

# A VISION IN GREEN

« A GTF ENGINE CAN DELIVER DOUBLE-DIGIT REDUCTION IN FUEL BURN, A 55% REDUCTION IN NO<sub>x</sub> EMISSIONS OVER PREVIOUS STANDARDS, AND A 20dB REDUCTION IN NOISE POLLUTION »



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Pratt & Whitney's environmental initiatives have historically been organized into three categories: green engine development, green services and green operations.

## GREEN ENGINES

The obvious way to lower the aviation industry's CO<sub>2</sub> emissions is by reducing fuel consumption, because each pound of fuel burned produces about 1.4kg of CO<sub>2</sub>. However, traditional engine architecture has reached a performance plateau.

Future performance improvement will provide only incremental increases at the engine level, although these are still important. A Pratt & Whitney engine upgrade provides significant benefits to the A330, including a 1% fuel consumption and CO<sub>2</sub> reduction. And the Airbus A320 family of aircraft benefits from a similar enhancement that reduces fuel burn and CO<sub>2</sub> emissions by another 1%.

But a new architecture is needed if the industry is to achieve significant efficiency gains and fuel burn reduction.

The strongest contender right now is the Geared Turbofan (GTF) engine. This revolutionary technology offers groundbreaking improvements in performance, fuel efficiency and overall operating costs. A GTF engine can deliver double-digit reduction in fuel burn, a 55% reduction in NO<sub>x</sub> emissions over previous standards, and a 20dB reduction in noise pollution.

It means CO<sub>2</sub> emissions from a 150-passenger aircraft can be reduced by up to 3,000 tonnes a year. The effect is equal to that of planting more than 700,000 trees, and surpasses the most stringent industry standards.

Investment in other new technologies will

further reduce industry gaseous emissions.

Reduction of gaseous emissions has also been achieved through the incorporation of the TALON (Technology for Advanced Low Nitrogen Oxide) family of combustors, and advanced coatings and materials that reduce combustor cooling requirements. TALON reduces nitrogen oxides (NO<sub>x</sub>), unburned hydrocarbons (UHC) and carbon monoxide (CO). These are all regulated pollutants that affect local air quality, and in the case of NO<sub>x</sub>, can have an impact on climate change.

## GREEN SERVICES

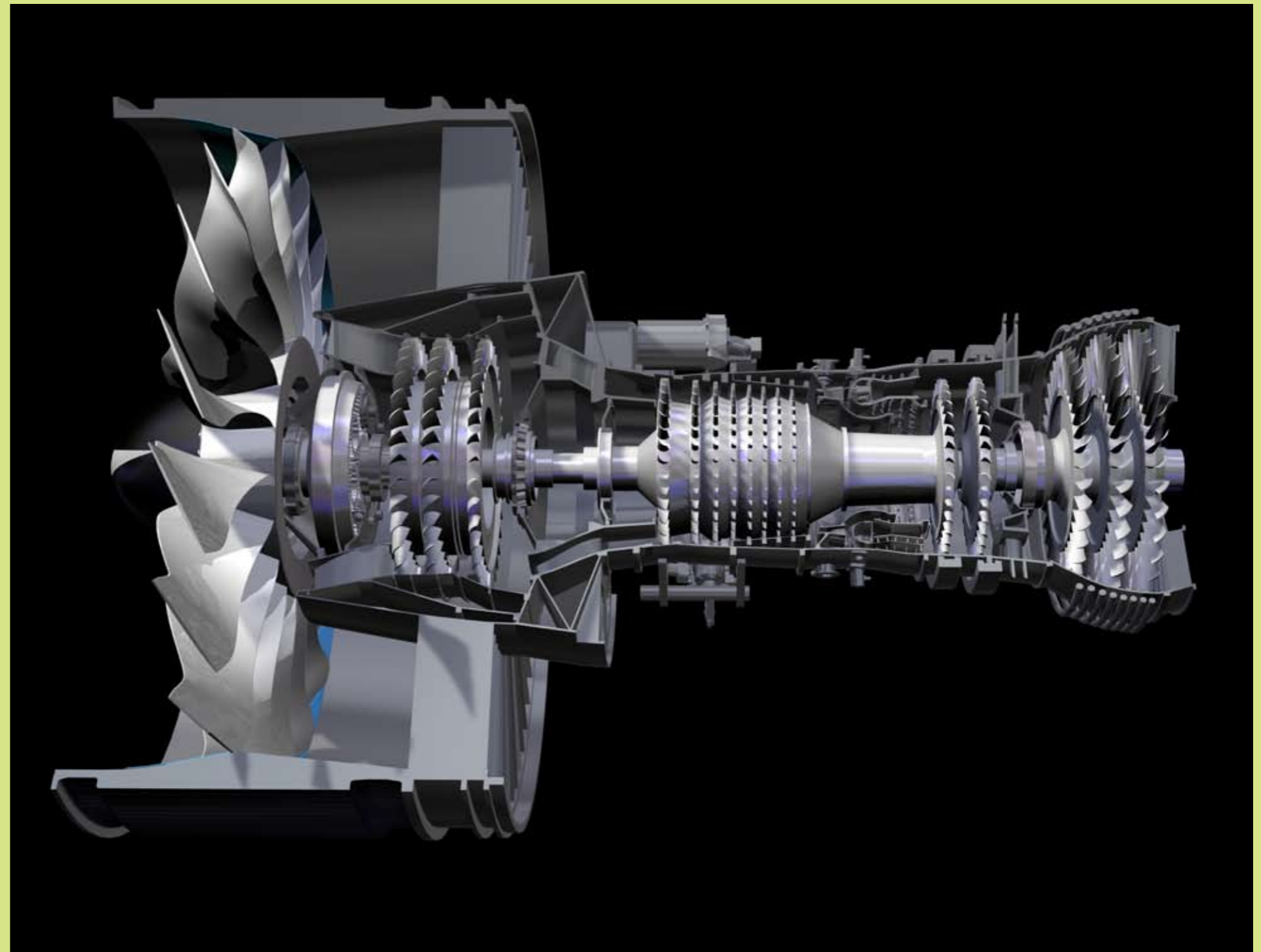
Several solutions also exist to improve in-service aircraft performance, including aircraft engine washes and aftermarket noise reduction systems.

Engines that become contaminated during normal operations naturally deteriorate in terms of green performance. Enhanced engine wash services such as EcoPower provide significant benefits while using an ultra eco-friendly process. No harsh chemicals, detergents or solvents are used, and excess effluent is captured in a closed-loop system, thereby preventing pollution of ground water.

And this closed-loop system can use purified, atomized water, which is collected during the wash process and repurified for re-use.

Fuel burn reductions of up to 1.2% are available. Engines washed twice a year lower a widebody aircraft's average CO<sub>2</sub> emissions by as much as 750 metric tonnes annually. An engine wash service takes about 90 minutes and can be done while the aircraft is parked at the gate.

Biofuels represent another way forward for aviation's environmental mitigation efforts. Pratt & Whitney has been exploring the potential





of synthetic jet fuels for more than 16 years, and the company collaborates with several international organizations to bring alternative fuels into field use. These organizations include the American Society of Testing and Materials, the Coordinating Research Council and the Commercial Aviation Alternative Fuels Initiative.

Biofuels could substantially reduce the CO<sub>2</sub> emissions associated with aviation. However, issues of sustainability, and the impact on ecology as well as the food supply must be addressed before they can be considered a truly practical option. The opportunity costs of biofuels including land use and commodity costs must also be considered in fuel source discussions.

### GREEN OPERATIONS

Alongside its parent company, United Technologies Corporation (UTC), Pratt & Whitney is equally committed to reducing the human impact on climate change through its business operations. These initiatives provide a template for industry best practice.

In 2007, UTC embarked on a four-year program to reduce greenhouse gas emissions by 12%, water consumption by 10%, and non-recyclable waste by 30%, compared to 2006. These metrics were not normalized for growing business volumes so that the per product emissions would drop even more as business increases.

The greenhouse gas reduction target is equivalent to taking more than 10,000 cars off

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the road. Several sites have also adopted cogeneration technology to harness unused heat, and also to process steam and electricity to further reduce CO<sub>2</sub> emissions.

In fact, on an absolute basis, Pratt & Whitney factories have reduced worldwide water usage by 42% and energy use by 11%. Furthermore, use of materials that could negatively affect the environment has been greatly reduced.

Today's products have achieved a "hazardous material index" value that is nearly 75% less than earlier jet engines. These reduction trends have been achieved in all engine models, both military and commercial.

As our knowledge of the interaction between these materials of concern and the environment increases, more environmentally friendly alternatives will become available.

Extensive validation testing is performed prior to releasing these green alternatives into production, ensuring that the alternatives have environmental benefits while not compromising performance, safety or durability.

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A GTF engine allows emissions from a 150-passenger aircraft to be reduced by up to 3,000 tonnes a year