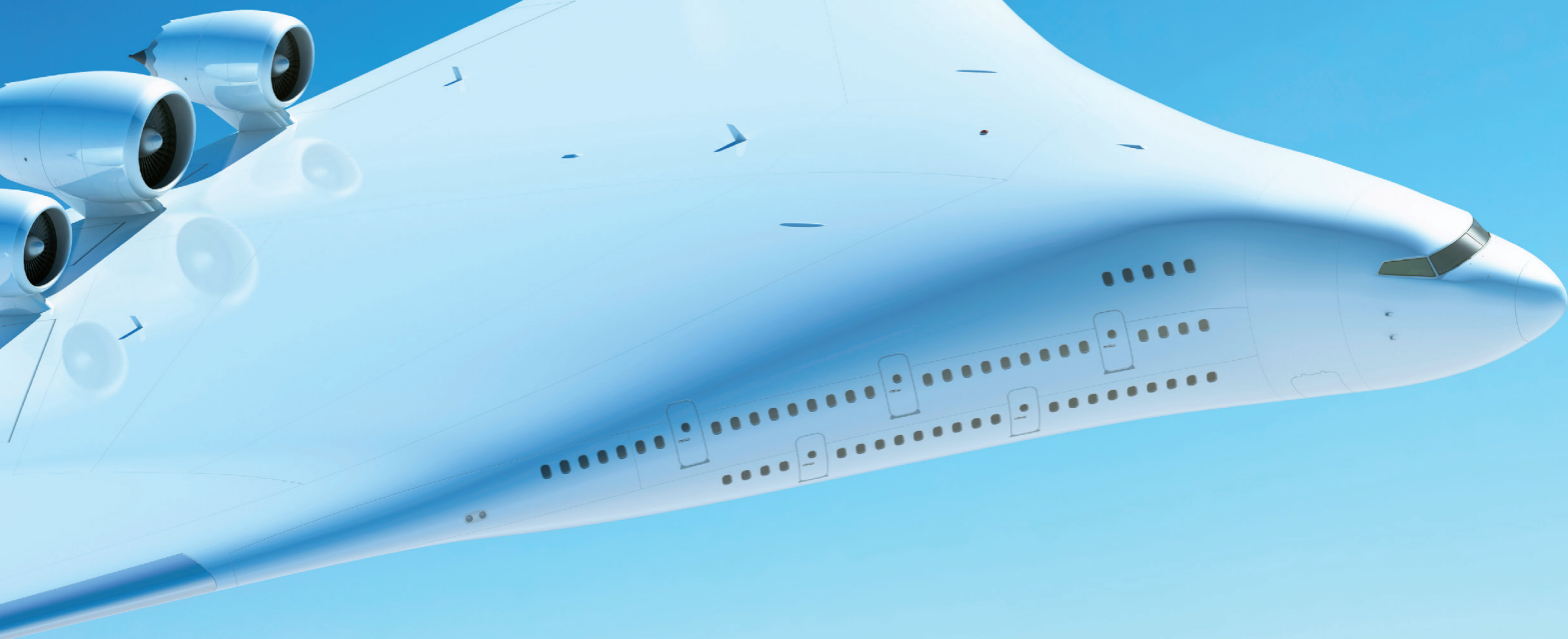


MICHELIN SUPPORTS THE FUTURE OF AVIATION



“ Air transport, a century-old industry which Michelin helped create and develop, is going through an unprecedented crisis. This global pandemic has dramatic economic consequences for the sector. Fear of the virus, border closures, economic recessions, have left traffic sluggish and scores of planes on the ground. Like the entire aeronautical community, the men and women of Michelin stand in solidarity with the sector and stand alongside their partners.

Aviation connects people, unites cultures, and contributes to the economic dynamism of businesses and territories. In doing so, it is a vector of progress and prosperity, making possible large-scale innovation, as well as sustainable transformation.

Michelin thus intends to support changes in the sector in order to make it more sustainable. Like the rest of its products, Michelin innovates to make its products for aviation safer, more efficient and as always, respectful of the environment”

Mauro Sponza, *Michelin Aeronautical Activities Director*



MICHELIN SUPPORTS THE TRANSFORMATION OF AVIATION TO MAKE IT MORE SUSTAINABLE

Innovation in aircraft tires continue to make them safe, more efficient and thus environmentally friendly.

Innovation is the DNA of Michelin aircraft products. The technical challenges are many, but Michelin always offers breakthrough innovations in aircraft tires.

Michelin invented the Radial tire in 1946 for passenger cars and then gradually extended its use to other industries. The first radial aircraft tire saw the light of day in 1981 in military aircraft today it is used on more than half of all commercial aircraft.

Michelin also introduced a new revolution in the field of aircraft tires in 2001 with the NZG (Near Zero Growth). This radial tire uses innovative reinforcements to reduce tire mass while increasing the number of landings and improving safety at the same time. The NZG MICHELIN has been adopted on many commercial aircraft, and in particular on new generation aircraft, such as the Airbus A350.

Using an NZG tire compared to an older generation tire saves an average of 20 kg per tire* and more, for a total gain of 85 to 150 kg depending on the aircraft type.

This can therefore represent a reduction in emissions of 9 to 16 kg of CO₂ per flight hour**.

The reduction is extremely important in terms of the number of daily flights.

In addition, with a rate of between 40% to 50% natural rubber, aircraft tires are the ones that incorporate the most bio-sourced materials.

MICHELIN® NZG RADIAL TECHNOLOGY

The NZG tire is based on radial technology but uses crown reinforcement plies made of a high modulus aramid/nylon hybrid cord.

- Reduction in fuel burn due to weight saving.
- Reduction of maintenance cost due to the improved landings per tread.
- Reduction of early/unscheduled removals due to the resistance to tear and cuts.

MORE LANDINGS
Extra strong radial casing design Flexible radial casing reduces tread rubber tension.

LABOR SAVINGS
Fewer tire changes due to more landings.

FUEL SAVINGS
Lightweight radial design = measurable savings and increased range.

WEATHER PROTECTION
Special sidewall compounds for longterm ozone and UV light protection.

RESISTANCE TO FOREIGN OBJECT DAMAGE (FOD)
Ultra-strong NZG technology.

* Example on a main train of short / medium haul aircraft)

** Assumption of consumption of 3.5% of kg of kerosene per kg transported, per hour of flight, and with a ratio of 3.1 kg of CO₂ released per kg of kerosene consumed

THE AIRCRAFT TIRE, A LITTLE-KNOWN HIGH-TECH OBJECT

A long-haul aircraft, of the Boeing 777 type, has 14 tires total, 12 main (six under each wing) and two under the nose of the aircraft. Each main gear tire under the fenders is 52" in diameter exterior (1.32 meters) and is capable of carrying approximately 30 tons with an inflation pressure of 227 psi (16 bar). It is capable of operating at speeds up to 395 km/h.

This aircraft tire thus combines the ability to carry a massive truck crane at the speed of a super sports car.



When performing a flight, this same tire will be able to withstand temperatures internal to its structure in the order of 120 degrees Celsius at the end of the take-off run.

It is able to stay at -55 degrees Celsius during long-haul flights of more than 10 hours and then be heated on the surface to more than 200 ° C during landing, when the tire will go from 0 to 250 km/h in a fraction of a second.

During homologation tests, this tire must demonstrate that it is capable of being inflated to 4 times the normal pressure without bursting (64 bars) to demonstrate the resistance of its internal structure.

LEADERSHIP MORE CURRENT THAN EVER

THANKS TO ITS R&D, MICHELIN IS PERFORMING ON THE TECHNICAL AND ENVIRONMENTAL PLAYGROUND.

Today, Michelin is the world leader in the airline industry

In 2019, Michelin and Safran successfully tested the first connected aircraft tire, which simplifies and reduces the time of maintenance operations.

Beyond tires, Michelin offers innovative service offers like predictive maintenance that is developed with the most advanced MRO* partners.

Metal 3D printing, with Add Up, also represents a major potential for innovation in aircraft construction, both for manufacturers and for equipment manufacturers.

A result made possible by our cutting-edge R&D:

- Michelin R&D: 6,000 researchers worldwide and a budget of 700 million.
- A necessary investment to meet the demands of the airline industry.

*maintenance, repair and overhaul

87

COUNTRIES WHERE MICHELIN OPERATES

50%

OF COMMERCIAL AIRCRAFT IN THE WORLD ARE EQUIPPED BY MICHELIN

250

CUSTOMERS INCLUDING THE BIGGEST MANUFACTURERS / AIRLINES IN THE WORLD

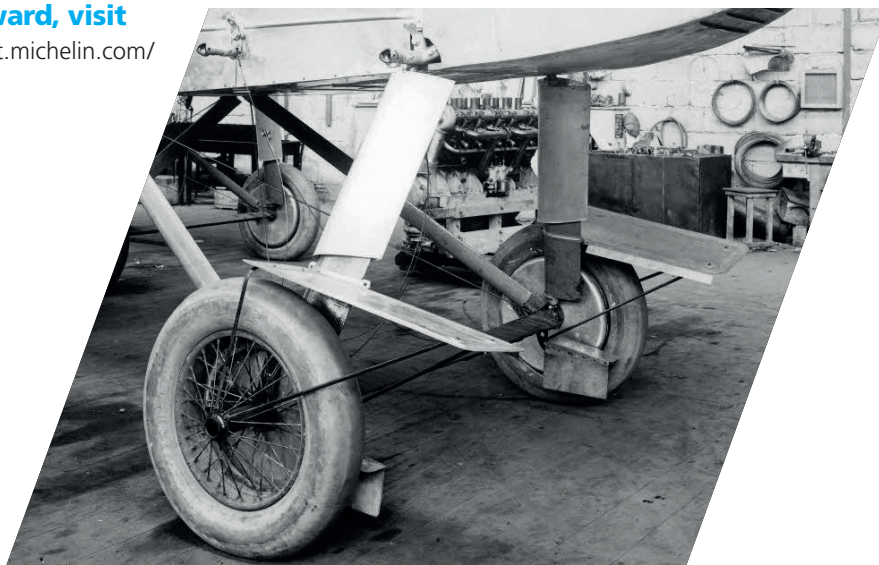
TO GO FURTHER: *DID YOU KNOW?*



For more than a century, Michelin has been advancing the aviation sector:

- 1898** | André Michelin co-founder of the Aéro-club de France.
- 1908** | Michelin creates a prize for the 1st aviator capable of making Paris-Puy de Dôme in less than 6 hours.
- 1912** | "Our future is in the air" communication campaign.
- 1914** | Because of its involvement in the development of aviation, Michelin offered to participate in the war effort
- 1918** | by transforming its Clermont factories to produce planes for the army. Between 1915 and 1919, Michelin built nearly 2,000 planes in partnership with Breguet, for the French and American armies. Michelin also created a driving school for this occasion.
- 1916** | Michelin builds the world's 1st hard landing strip.
- 1981** | Michelin invents the radial airplane tire.
- 2001** | Michelin tires allow the Concorde to regain its airworthiness certificate and fly again.
- 2019** | Michelin and Safran successfully test the first connected aircraft tire, which simplifies and reduces maintenance time.

➤ **To go forward, visit**
<https://aircraft.michelin.com/>



*The final 20 years of NASA's
Space Shuttle missions were flown
on Michelin tires.*



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