

Hypergravity helping aircraft fly further

November 6 2012



Aircraft turbine in flight. ESA research has helped to develop an aircraft-grade alloy that is twice as light as conventional nickel superalloys while offering equally good properties. Credit: Creative Commons–A. Rueda

(Phys.org)—ESA research has helped to develop an aircraft-grade alloy that is twice as light as conventional nickel superalloys while offering equally good properties. The path to creating this alloy required research under all types of gravity.

Airlines are always looking for ways to save fuel by cutting down on weight without sacrificing safety. Generally, cutting weight by 1% will

save up to 1.5% in fuel.

For [commercial airlines](#), this saving quickly adds up, offering cheaper flights and fewer stopovers while reducing the overall impact on the environment.

For years, engineers have known that titanium aluminide alloys offer great weight benefits over the nickel superalloys used today in conventional [jet engines](#).

Since the newer alloy can withstand [extreme temperatures](#) up to 800°C, it is of particular interest to engine manufacturers.

Although it is possible to make the alloy in a laboratory, casting it in the shapes required by industry, such as a turbine blade, is not simple.

ESA scientists working in the Impress project looked into the problem. To understand natural processes, scientists often remove as many external variables as possible, concentrating their observations on core interactions.

The Impress project needed to 'switch-off' a factor that hampers observations: [gravity](#).



Aircraft turbine. ESA research has helped to develop an aircraft-grade alloy that is twice as light as conventional nickel superalloys while offering equally good properties. Credit: Creative Commons–Bleuchoi

Switching off gravity

Aluminium samples were heated in a small [furnace](#) carried in a [sounding rocket](#) launched from Kiruna, Sweden. During six minutes of free fall, they were heated to over 700°C and then monitored by X-rays as they cooled.

Looking at the results, the researchers realised that casting titanium

aluminides might require looking in the opposite direction: hypergravity.

ESA is the only organisation that offers all levels of gravity, so the Impress team turned to the agency's centrifuge in the ESTEC research and technology centre, the Netherlands to test their theory.



The Large Diameter Centrifuge (LDC) at ESA's European Space Research and Technology Centre (ESTEC) at Noordwijk in the Netherlands.

Casting the metals in a [centrifuge](#) creating up to 20 times normal gravity helps the liquid metals to fill every part of a mould, producing a perfectly cast alloy, even with complex shapes.

Analysing metal casting in as many ways as possible produced building blocks of knowledge that allowed the industrial process to be refined and

commercialised.

Over a million jet turbine blades will be made over the next eight years, and using titanium aluminide would reduce their weight by 45% over traditional components.

The alloy's benefits are also of interest to the car industry – before long, cars will run on engines using space-based knowledge.

Provided by European Space Agency

Citation: Hypergravity helping aircraft fly further (2012, November 6) retrieved 26 April 2024 from <https://phys.org/news/2012-11-hypergravity-aircraft.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.