Uneven surfaces conserve fuel

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Tiny regular bumps on a surface, such as the wing of an airplane, can substantially reduce total air resistance, and thereby the consumption of fuel. Wind tunnel tests at the Royal Institute of Technology in Stockholm, Sweden, show that small cylindrical bumps on a surface delay the transition from laminar flow (well-ordered) to turbulent (chaotic) when air flows over a surface-a crucial factor in total air resistance.

If this finding, made by an international research team at KTH, holds up in tests outside the laboratory, huge savings may be in store for the aviation industry.

Many other technological applications may see major yet simple cost reductions and save energy as a result of reduced air resistance. The findings are being published in the prestigious journal *Physical Review Letters* and are making waves around the world.

“The discovery is revolutionary for physicists working with fluid mechanics, since it goes against the conventional thinking that an uneven surface could only speed up the transition to turbulence,” says Jens Fransson, one of the scientists in the research group.

A further benefit the newly discovered method might offer is that it is passive-it requires no more input than properly placed bumps on the surface to prevent unnecessary turbulence. Many earlier methods for reducing total air resistance have involved the elimination of turbulence that has already occurred.

In wind tunnel experiments at the Department of Mechanics at KTH, the scientists have created velocity variations against the direction of the flow by placing tiny cylindrical elements on a surface. This hampers the occurrence of instabilities and delays the transition of laminar flow to turbulence.

Plasma physics, laser technology, and magnetohydrodynamics are further examples of fields where the underlying physical mechanism should be of interest.

Other participating scientists: Prof. Alessandro Talamelli, Il Facoltà di Ingegneria, Universitetà di Bologna, Italy; Luca Brandt, Ph.D., KTH Mechanics, Stockholm; Assoc. Prof. Carlo Cossu, LadHyX, CNRS École Polytechnique, France.

Source: The Swedish Research Council