Flight research center to test shape-changing wing idea

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(Phys.org) —Conventional wing designs in the form of hinged flaps are in for a re-think. The Aircraft Owners and Pilots Association has noted how hinged flight control surfaces came along shortly after wing-warping technology developed by the Wright Brothers, and still remain the usual method of construction for flight control surfaces. Something different is being proposed, however. At this year's American Institute of Aeronautics and Astronautics (AIAA) SciTech January event in Washington, new wing technology was introduced by an Ann Arbor,

Michigan company. Wing "morphing" may emerge as a technology approach. The company behind the technology is FlexSys, which showcased their FlexFoil, a variable geometry airfoil system. The idea is to use seamless, flexible wings which can operate like flaps but without the extra baggage of inefficiency. The system is designed to optimize wing aerodynamics. FlexFoil is a deformable, seamless surface that changes shape for better performance throughout the flight. The company says it uses aerospace-grade materials and actuators.

The foils are just as stiff and strong as a conventional flap; they are optimized to resist deflection under significant aerodynamic loading. They can tolerate over 10,000 pounds of air loads.

FlexFoil has been in development since 2001; the inventor is mechanical engineer Dr. Sridhar Kota, who is also the founder of FlexSys. In starting the company, Dr, Kota, who is a University of Michigan professor of mechanical engineering, sought to develop and commercialize his patented design of a shape-morphing adaptive control surface.

A key principle pertinent to the work as stated on the company site: "Conventionally engineered mechanisms connected by various joints are designed to be strong and stiff. Nature prefers strength combined with compliance." Strong and flexible can beat strong and rigid in many instances. His bio-inspired research has led to a technology known as "distributed compliance. This term refers to "a form of structural load sharing by exploiting elasticity to design monolithic compliant structures or joint-less mechanisms."

According to the company, "Changing the shape of a modern aircraft's wing in flight has been an elusive goal. Unlike the earlier iterations, which suffered from complexities with the actuators and problems of heavyweight componentry, the FlexFoil technology employed a new approach, called distributed compliance."

The results are wings that can be reliable and cost-effective. How cost effective?. FlexFoil, which can be retrofitted into existing wings or work on new builds, reduces fuel consumption. When retrofitted, FlexFoil can reduce fuel consumption by a claimed three to five percent, and eight to 12 percent on a "clean sheet" build. These numbers were presented in a promotional video about FlexFoil.

Jet fuel savings may prove to be a significant reason for FlexFoil. "Given the United States' aviation community's $54 billion yearly fuel bill," said a company press release, "the savings could be viewed enthusiastically by industry insiders in both the manufacturing and operations spheres. Successful flight tests of the new FlexFoil technology are expected to gain the attention of designers and accountants." Also, with less strain in any one area, reduced wing loads may lead to lowered maintenance costs; other benefits include a significant reduction in noise while landing.

The company's variable geometry technology could have other applications, such as helicopter rotor blades, wind turbine blades, and boat rudders.

In July, FlexSys in partnership with the Air Force and NASA will be flight-testing a Gulfstream business jet with FlexFoil seamless control surfaces at the Dryden Flight Research Center.

More information: www.flxsys.com/pdf/flexsys.com … ss-release011314.pdf
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