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## **Aircraft structural weight, cost and fatigue reductions via pressure adaptive honeycomb**

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A new form of structural engineered material called “Pressure Adaptive Honeycomb” (PAH) was recently invented. This material has the ability to change shape and stiffness and thereby manipulate the lift characteristics of wings. Recent experiments and analytical models show that as PAH is integrated into lifting surfaces, camber-active solid state flaps made from PAH can be made to exactly tailor the lifting properties of wings as the aircraft moves from takeoff through climb, cruise, descent and landing. As the aircraft transitions through a number of flight regimes, the basic levels of camber and therefore lift is manipulated. The net effect of these changes is to create a lifting surface which flies a “commanded lift profile” rather than a “commanded angle of attack profile” which is the norm today. Wind tunnel testing on PAH sections shows very clearly that it is possible to fly commanded lift through a wide range of angles of attack. What is more is that aeromechanics modeling also shows that as the airfoil is hit by gusts, the PAH trailing edge simply relieves, allowing it to pass harmlessly over the airfoil. From fundamental aeromechanics models, it is also shown that dangerous atmospheric structures such as microbursts can be transited with properly designed PAH wings. The presentation concludes with an analysis of the implications for aircraft structural weight demonstrating that new aircraft which employ such flaps can experience a 9-22% decrement in total structural weight.

### **Biography**

Ronald M Barrett holds BS, MS and PhD degrees in Aerospace Engineering from the University of Kansas, Lawrence and the University of Maryland, College Park. He is one of the first adaptive structures technologists to design, build and fly adaptive aircraft and munitions. He holds a number of patents including the first US patent on adaptive aerostructures, a patent on a dragless wing section, a guided munition flight control mechanism and has generated more than 300 other technical publications. He currently teaches and does research on adaptive aerostructures and aircraft design at the University of Kansas in Lawrence, Kansas USA.

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