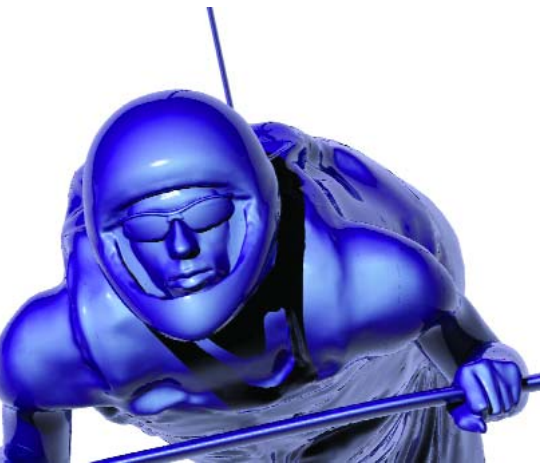


High-Flying Design

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In the niche sport of hang gliding, a number of small manufacturers worldwide service the needs of about 10,000 pilots. While elite competition hang gliders can cost up to \$10,000 each, second-hand and intermediate gliders can be acquired at more reasonable prices, allowing novices to participate in the thrill of flying as well. Most gliding clubs exist in North America, Europe, and Australasia. Europe, particularly Austria with its many world class pilots, is a major center for the sport. There are a number of hang glider manufacturers in Europe, and many elite pilots are allied to, or even work for, one of them.

Avian Gliders, based near Sheffield in the UK, is a three-man company run by Steve Elkins, its founder, chief designer, and a top 20 competitor in the world with over 20 years experience in the sport. Established in 1988, the company is currently the only hang glider manufacturer in the UK. Avian produces a wide range of hang gliders and has developed a reputation over the years for user-friendly wings with good handling and weight characteristics. They make and sell “Rio” intermediates, “Java” sports, and “Cheetah” performance and competition wings.

Constantly under price competition pressure from Eastern European hang glider manufacturers, Elkins turned to Sheffield Hallam University’s Sports Engineering department at the Center for Sport and Exercise Science (CSES) to carry out CFD simulations of

a typical glider and pilot, in order to look for enhancements to his designs. Although hang gliders have been tested in wind tunnels in the past to understand their aerodynamics, wind tunnels are an expensive alternative for research and development, especially for a small company like Avian.

Under the auspices of the SportsPulse initiative in South Yorkshire, Avian got computer-aided engineering, and in particular, CFD support to do some sophisticated aerodynamic research on their hang gliders. SportsPulse is funded by the European Union Objective 1 program, which is aimed at improving the competitiveness of small and medium-sized sports and leisure enterprises in the region. Sheffield Hallam’s CFD team has applied CFD to Olympic sports such as sailing, cycling, and bob skeleton. This project was the first



The geometry of the hang glider, pilot, and harness bag
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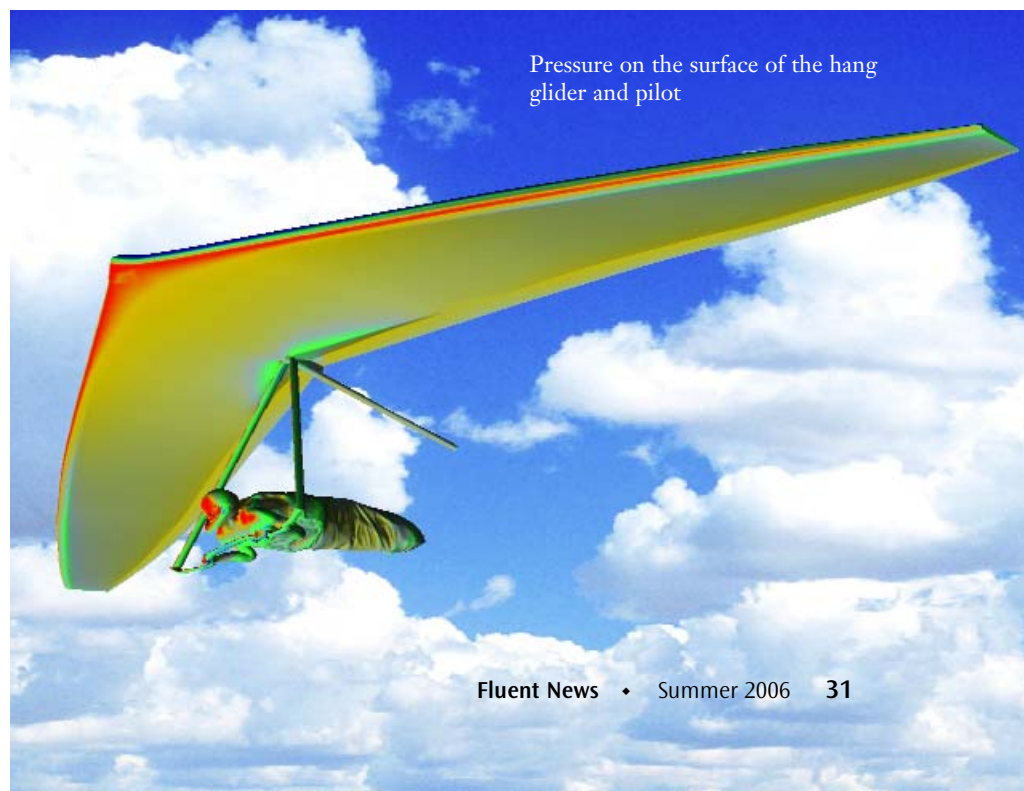
time ever that CFD had been used to elucidate the air flows over glider wings.

Elkins notes that hang gliding is similar to Formula 1 motor racing in that small aerodynamic variations can have a large impact on performance. The lift versus drag efficiency is the key to a good design. Indeed, any small design change that increases performance will always show up in competition.

The CFD team at Sheffield Hallam worked with Elkins to define a detailed CAD geometry of an Avian hang glider, which included details of the pilot and harness bag. A computational mesh was constructed from this geometry, and a FLUENT simulation was performed to capture the aerodynamic flow field around the glider. The team validated the computer model using lift and drag data from flight tests and found excellent

agreement. This gave them the confidence to examine the fine details in the flow patterns over the pilot and wings in particular.

As a result of the considerable knowledge of airflow phenomena that has been unearthed using CFD, Elkins foresees the day when this technology can be used to help design more customizable elite hang gliders. This should lead to incremental design enhancements for Avian, helping them to stay ahead of the competition. Computer aided engineering is clearly helping this small company further the design envelope for performance enhancement in the sport. Avian hopes that some patentable innovations might come out of the analysis work as well, especially when coupled with other research into modern, high performance materials. CFD has been able to show aerodynamic results in fine detail, especially for a small change to a glider's design. The flow vectors, surface pressure data, and detailed flow separations would be difficult and costly to observe by any other method. ■



Pressure on the surface of the hang glider and pilot