

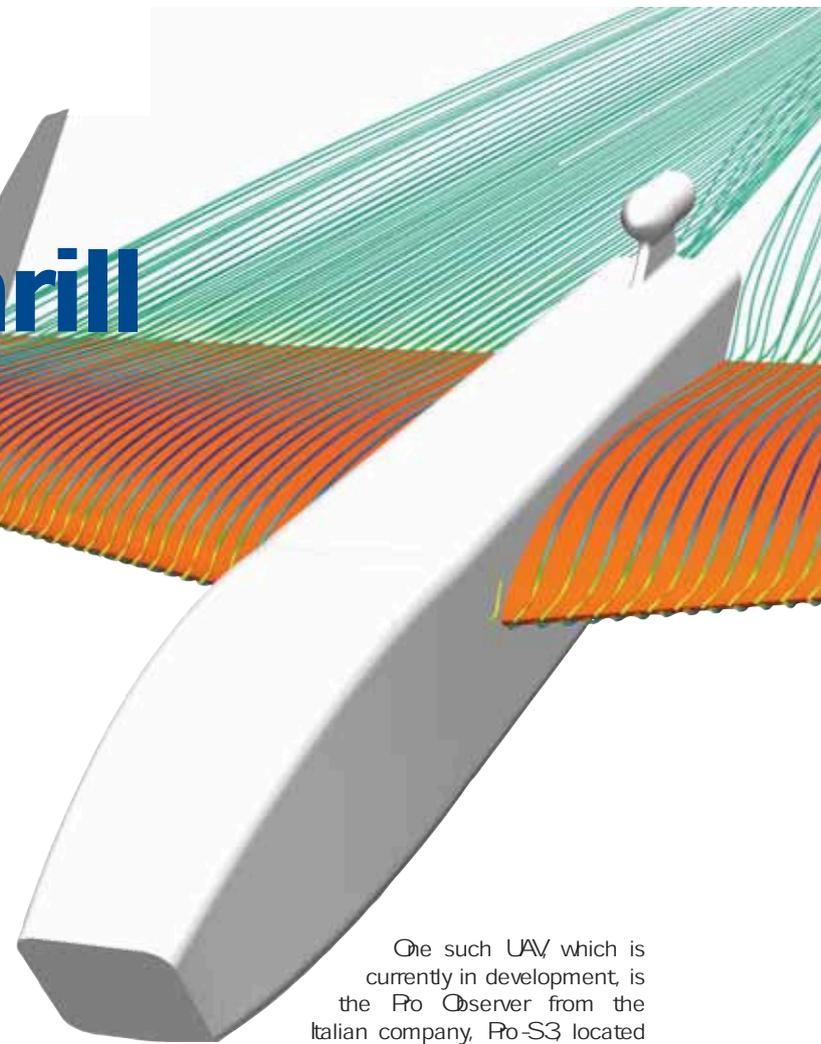
STAR-CCM+ : License to thrill

» Anthony Massobrio, CD-adapco and Daniele Camatti, Pro-S3 (Turin)

The Pro Observer Unmanned Aerial Vehicle (UAV) sounds like something straight from the pages of a James Bond story: a miniature aircraft, weighing less than a bag of a sugar that can be stored in a suitcase, ready to be launched on a "spying" mission within minutes of being unpacked. Proving that truth is sometimes stranger than fiction, the Pro Observer is now in flight-testing, after having been designed extensively using CFD. It seems somehow fitting that this seemingly futuristic technology is designed with the aid of the world's most futuristic CFD code: STAR-CCM+.

Although it is easy to associate UAVs with the covert world of international espionage, the truth is somewhat less glamorous. UAVs are really designed for work that is too "dull, dirty or dangerous" for the pilot of a manned aircraft.

Put simply, for this type of mission, a pilot is simply a superseded component, representing an unnecessary burden on the aircraft. A manned aircraft must carry not only the pilot, but between two and five times their weight in equipment required to support them. Critical systems need also to have multiple levels of built in redundancy which are required to bring the pilot home (hopefully alive) in cases of severe malfunction and failure. By removing the pilot, "pilot-error" can also be instantly eliminated as the most significant cause of aircraft failure.



One such UAV which is currently in development, is the Pro Observer from the Italian company, Pro-S3 located in Turin, delivering high level innovation services and products. The Pro Observer is a low-cost UAV developed specifically for short-range observation missions. With a wingspan of just 80cm and an overall length of 75cm, the aircraft can be stored inside a small suitcase and assembled and launched by a single person (whether a spy or not) in less than 10 minutes.

Powered by a 40W electric motor, the Pro Observer has a maximum speed of 27 kts (50 kph) and maximum flight time of around 40 minutes, ensuring a 10 to 12 km radius of action. The miniaturized avionics on-board Pro Observer ensures a totally automated flight, from launch to recovery. The missions are planned on a normal laptop computer and uploaded to the aircraft through the wireless link. The flight path can be modified during flight and the mission re-tasks. During the flight, a small tiltable high resolution camera is used to take live images of the ground that are immediately sent to the ground station.

Typical missions for the Pro Observer include the following, as well as any other situation where a cheap aerial point of view is necessary.

- over the hill view (military and civilian applications)
- traffic monitoring
- power lines monitoring
- surveillance of dangerous areas
- events monitoring
- agricultural monitoring

Pro Observer also has the distinction of being the first aircraft to be fully designed with the aid of STAR-CCM+, the next-generation CFD code from CD-adapco. For the tailless design of this UAV accurate calculation of the aerodynamic center was »



critical, influencing directly the flight performances and stability of the aircraft. In the words of **Daniele Camatti, CEO of Pro-S3 and designer of the Pro Observer**: "CFD analyses performed with STAR-CCM+ were critical in determining if the initial airframe designs were good enough to ensure the required flight performance. With STAR-CCM+ we were able to estimate with great precision the position of the aircraft's aerodynamic center, to such an extent that, from the first test flight onwards, we have completely avoided crashes."

The aircraft was modeled using STAR-Design, CDadapco's unique CADembedded design tool. STAR-Design is able to automatically create high quality polyhedral meshes, with enough extrusion layers around the aircraft to accurately predict the aerodynamic coefficients of the aircraft using a low-Reynolds number turbulence model. Through the power of associativity, changes to the CAD geometry in STAR-Design are reflected automatically in a revised CFD solution. This allows multiple design configurations to be tested both quickly and accurately. **Daniele explains the benefits**, "By using STAR-Design to run STAR-CCM+ we were able to quickly define the complete aircraft polar giving us a good starting point in choosing an appropriate power plant. Having completed a number of successful test flights, most of the flight parameters estimated with STAR-CCM+ have been confirmed by the test." ■

