Future Flight

Flair Seminars challenge the status quo on propulsion and aerodynamics

Contributed by Graeme Porter

THERE WAS a high level of attendance at Flair seminars in October 2011, where cutting edge US general aviation experts delivered a report for the future showing that conventional ideas on aircraft propulsion systems and aerodynamic theory are able to be questioned and alternatives are within grasp.

Sid Siddiqi debated current ideas related to emerging technologies within the aviation industry. "It is important for general aviation to move away from being a craft industry and truly address volume production", he said.

The Lean Personal Aircraft

Citing examples in the Light Sport Aircraft (LSA) arena where Europe had arrived at sustainable volume production but the US was yet to achieve that goal, he said there were grounds for keeping aviation 'non elite' and developing the 'Lean Personal Aircraft' (LPA) where owners would have ease of access and affordability through shared ownership, have increasingly reliable airframes and associated systems and have an aircraft that was easy to fly.

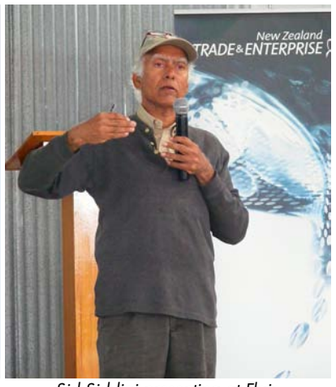
Sid explained how technology can deliver to these requirements by making increased use of:

- Laminar flow structures on fuselages and wings
- Precision manufacturing techniques
- Transferring existing technology from the automotive industry
- Creating intuitive cockpits with technology from the computer industry

Sid noted that these base requirements to a large extent are already delivered by the New Zealand aviation industry. Aviation within New Zealand has a strong existing DNA where innovation and a green customer culture are already established with exportable technologies. Having a bi-lateral agreement with the FAA is a feather in the New Zealand cap.

While the LSA approach is attractive using either reciprocal internal combustion engines or embracing electric propulsion what about an LSA turbofan? Here enters the Lean Private Jet which Sid envisages as a two seat aircraft with cruise of 200kts plus and powered by a high bypass ratio turbofan of about 200 thermo HP offering 500 lb thrust. Currently small turbofan engines are expensive to manufacture but options exist for precision machining from aluminium alloys to lower costs and Sid says that compression moulded fibreglass techniques are cheaper still, adding that a whole range of LPJs with 2, 4 or 6 seats has the potential to be developed with the concept marketed as safe, speedy and affordable. He noted that; "General aviation grew in a depression environment and developed innovative products through great teams. It's time to rekindle that spirit."

The Synergy Aircraft: A quarter scale RC model is flying and a full scale prototype is under construction.



Sid Siddiqi presenting at Flair.

Synergy - A catalyst for efficiency in aircraft design

In a separate address John McGinnis furthered the concepts that Sid Siddiqi initiated with his seminar on the aerodynamic challenges just waiting to be explored.

To progress general aviation from its status today, incremental steps are needed. The recent NASA Green Flight Challenge result featuring electric powered aircraft, however general aviation will include more incremental steps along the path to full electric flight. The path envisaged by McGinnis follows transitions from aviation fuels to automotive fuel, diesel, hybrid and finally electric power. He says the public needs to be energised towards general aviation as they are towards their car or personal computer, and that to achieve this goal, existing technology and efficiencies need to be incorporated to produce a safe SUV style of aircraft.

"Costs must be reduced and the key is to 'productionise' the format from the start. Let's do away with direct manufacture of complicated parts." McGinnis told his audience.

His unveiling through a media presentation, of the Synergy proof of concept aircraft showed what he considers possible. Synergy is a double box tail aircraft designed for five to seven passengers. By harmonising six proven technologies for drag reduction at low cost, including Laminar Flow, Wake Propulsion, Open Thermodynamics, and Subsonic Area Ruling, Synergy achieves both high speed and low induced drag in a structurally robust, lightweight form. Pressurisation is also a feature from the outset.

McGinnis promoted reduced drag through laminar flow and wake immersed propulsion as key functions of Synergy. He spoke of reducing drag beyond zero and then using it as thrust, adding that stability and control could be enhanced through induced drag reduction.

The concept Synergy aircraft currently flies as a quarter scale RC model. A full scale prototype is presently under construction and the design is intended to be available as a kit. "We're going to need a lot of help in getting this concept into the hands of the new flying public. New Zealand is recognised as a leader world-wide in innovative production techniques and that's why we have brought this concept to Flair," he said.

More information is available from www.synergyaircraft.com

A next-generation Aircraft Propeller

AT FLAIR in October 2011, John McGinnis of Synergy Aircraft introduced attendees to KiwiProps, their next-generation aircraft propeller. With a view that most aircraft propellers are a legacy item with few fundamental design improvements over the last 50 years, the concept to build a fully blended aerofoil was too challenging for them to resist.

"A fully blended aerofoil is our ultimate goal," said McGinnis. "Initially KiwiProps will serve the experimental market. The popular Vans RV series of aircraft exemplify the kind of aircraft that will use these designs initially. The first model and that on display at FLAIR was designed specifically for the RV-6 and RV-7 variants with the propeller intended to be an option for this series of aircraft. We think it is clear that the performance and efficiency of next-generation props will cause rapid development across the entire spectrum of general aviation applications."

KiwiProps intends to become an advocate for future aircraft offering quieter, lightweight, multi-bladed systems that are fully optimised for their engine and airframe. McGinnis said they will be particularly well suited to the birth of electric and hybrid electric powerplants, both for tractor configurations and most notably, pushers.

"Immersing a prop blade in the wake of a body offers many unrealised opportunities and Kiwiprops will lead the way by showcasing the world's most efficient wake props on the Synergy aircraft and its derivatives", he said. "Most props fly at radically different speeds from hub to tip and do all their work in the outer one third of their length, causing high drag and noise. If a typical prop were drawn as a wing at its actual operating condition of airfoil angles and Reynolds number, few pilots would consider it flightworthy, let alone efficient. KiwiProps use a constant relationship between chord length and speed and this allows a prop blade to be designed as if it were a proper, high efficiency wing."

McGinnis says it has taken the power of computer solid modelling to set aside the geometry problem enough to focus on true aerodynamic issues. For KiwiProps, every station of each blade has an airfoil that is designed for its exact speed, Mach number, and precise, true angle of attack range. Creating a seamless, constantly changing airfoil designed for the exact environment the blade experiences at that point results in more than double the usual L/D of a propeller airfoil. High camber, low camber, rounded, sharp, thick, thin... all these conflicting attributes are found where they belong on a KiwiProp blade. A high degree of laminar flow is even maintained over most of the propeller surface. Custom spinners help maintain these advantages while reducing drag near to the blade hub.

The team behind KiwiProps. Flair Organiser Shaun Mitchell and John McGinnis are centre left and right respectively.

McGinnis believes New Zealand offers an ideal development centre for this type of high precision composite work, saying that; "As the commercial opportunity advances, more and better ways to improve processes will constantly be needed. It's clear that Kiwis think differently, and the systematic application of lean manufacturing principles drives innovation that can keep pace with the needs of a coming revolution in the aeronautical sciences. Working with NZ industry, we intend to explore a full range of manufacturing methods as we refine each line of products in a long term, four-phase deployment of advanced propeller technologies with a global audience."

John McGinnis can be contacted via: info@synergyaircraft.com