

middle” between experimental and certified aircraft. Dynon is the market leader for integrated cockpits for light-sport aircraft. While no standards today exist for light-sport avionics, Schofield says ASTM committees are in the process of developing equipment standards that would cover avionics.

Will those standards be one step closer to regulation? Schofield doesn't think so. “It's about finding a balance between a good product definition and helping the consumer know they're buying a competent product,” he explains.

Laminar Research's Austin Meyer, who developed the X-Plane simulator and Xavion, a cockpit safety aid that runs on Apple portables, believes a new product should be “locked down” first for the experimental market before attempting a certification effort.

“As soon as certification starts, a lot of the creativity stops,” he says. Meyer emphasizes this by noting that in one weekend, he developed and tested an automatic descent mode for an experimental avionics package for a Lanceair Evolution single-engine turboprop. “If it depressurizes, the aircraft automatically comes down to a lower altitude, maintaining separation from terrain,” he adds.

The certification process for all aircraft is purposefully slow in many cases to ensure product safety and durability. However, the FAA is studying moving to consensus standards for light aircraft (Part 23) structures and systems, a nod to bringing low-cost innovation back to the sector. ☺

Finding Focus

Texas company readies ‘augmented reality’ for general aviation cockpits

John Croft **Oshkosh**

Texas startup Aerocross Systems is confident it can succeed where others have failed in building a low-cost head-up display for the light aircraft market.

The company says it will be ready by late 2014 to begin selling a \$2,000, near-to-eye, head-mounted display that puts flight information in front of the pilot, enabling the pilot to keep looking outside for traffic or maneuvering the aircraft for takeoff or landing.

Previous attempts at low-cost, wearable head-up displays, also known as head-mounted displays (HMD), have resulted in failure either because the device was too expensive or bulky, the image was not collimated (focused at infinity) or the display did not have enough luminance to clearly present the information in bright sunlight. In the case of MicroVision, which went to market with a \$12,000 head-mounted, laser-based retinal raster scan display for light aircraft in 2002, the monochrome red image was focused at infinity but the bulky system did not sell and was discontinued.

Seeing Google and other companies racing to market with relatively low-cost “augmented reality,” full-color,



RENDERING: S

While Aerocross employed eye-glasses for its first prototype of its near-to-eye display, the second iteration will likely feature a strap arrangement for more stability.

normal-sized glasses in the very near future, however, changed the dynamic for Aerocross President Tam Pho.

Pho became interested in low-cost head-up displays for general aviation after he and his Aerocross partner, Henry Wyson, developed an unmanned aircraft called the Echo Hawk for a U.S. Air Force program to extend airborne

Mission Planning in a Paperless Cockpit

Improved Situational Awareness at Your Fingertips

Our **TacView®** Portable Mission Display facilitates airborne mission effectiveness.

- Rugged, compact NVIS compatible smart display
- Digital moving map, DOD charts, EFB, weather
- Data link display for network-centric communications

Esterline CMC Electronics

MONTREAL • OTTAWA • CHICAGO www.cmcelectronics.ca/tacview

Text

AVIONICS

communications at test ranges. In addition to the aircraft, Aerocross had to develop the means to fly the vehicle remotely. The solution was a synthetic display that overlaid real-time video taken from nose and tail cameras. After taxi tests, the project ran out of money in 2010 and Pho was not able to test the

A vendor whom Aerocross would not identify did agree to collaborate, and a first prototype was delivered in February. About the same time, the EAA announced it would offer free booth space in its Innovations Pavilion for companies "with something new to demonstrate" at AirVenture. "We applied and

type, optimized for mass production and including an image processor that accepts data through a wireless link to portable sensors or devices. What the pilot sees through the screen could be generated by a commercially available iPad application that takes input from a portable attitude and heading reference system (AHRS) with GPS and Automatic Dependent Surveillance-Broadcast (ADS-B) for attitude, position, traffic and weather. The pilot could select how much information to display.

Pilots using the near-to-eye display initially will see basic "six-pack" information, with traffic, weather, terrain and other features to come later.



AEROCROSS

display in flight. "They transitioned the project to the Army and we never heard back from them," he says.

The project whetted Pho's appetite for developing a head-up display for general aviation, though. At the Experimental Aircraft Association's AirVenture show in Oshkosh in July, he unveiled the Brilliant Eyes HMD.

"The biggest challenge we couldn't overcome was the optics. Everything has to be significantly cheaper than what the government is paying," says Pho, referring to the bulky helmet-mounted monocular displays used by Apache helicopter pilots for targeting.

But the monocular concept, in small, lighter and cheaper form, is the approach Pho and Wysong selected.

With Google and competitors developing glasses with a small LCD screen and close-in focus for under \$500, Aerocross began looking for an optics vendor who could instead collimate the light but keep the costs down.

"Focus at infinity turned out not to be a big deal; it's just not something the other people had thought they needed," notes Pho, describing the process in the optics as being similar to adjusting the focus of binoculars. "More of a challenge was finding somebody who would work with us on that." He says Google was not interested.

won a spot," says Pho. "It motivated us to get going on the prototype."

The prototype featured a micro-LCD with LED backlighting (similar to a flat-screen TV) housed on the right side of the glasses as the image source. Light from the image travels through an optical module that focuses the light at infinity and injects it into an optical wave guide built into the glass or polycarbonate right lens of the glasses.

"We think there's room in the future to build the entire system on a pair of Oakleys"

Pho says about 2,000 people tried the glasses at AirVenture, with "younger folks" having no problem seeing the display and older people "taking longer." He says "four or five" could not see the image at all. As with any product that interfaces with vision, he estimates there will be a portion of the pilot population that will not be able to adjust to the near-to-eye display or will become nauseated from eye fatigue.

Work is underway on a new proto-

type, he plans to launch initially with the traditional six-pack of information—altitude, heading, airspeed, vertical speed, horizontal direction and a magnetic compass. Brilliant Eyes "works in full sun," he explains, but could benefit from additional brightness through changes to the backlighting for the LCD. He is projecting an 8-hr. battery life for the device.

Making the data presentation conformal to the pilot's head position during flight remains an ongoing research area. Pho says he is testing an off-the-shelf AHRS, as well as an on-chip sensor for tracking the movements of the HMD. The pilot would have to calibrate the glasses at the start of the flight to align the device's AHRS with the aircraft attitude, after which certain functions—such as the horizon line—would remain in the correct location as the pilot's head moves.

"The calibration doesn't have to be that precise," notes Pho. "It is only intended to be an aid and doesn't have to be spot-on." As a situational awareness aid, Pho says the HMD will not require FAA certification.

Once calibrated though, Brilliant Eyes must stay in place for the calibration to remain valid, which may require the use of an elastic head band rather than glasses or a headset mount, at least in the near term. "We think there's room in the future to build the entire system on a pair of Oakleys," says Pho. ☺