Gliders: Advancements in Collision Avoidance Technology

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The Transportation Safety Board of Canada (TSB) released its final report[3] into a tragic mid-air collision on June 29, 2013, near Pemberton, B.C., between a STEMME S10-VT motor glider and a Cessna 150F. Both aircraft were destroyed and all four people—two in each aircraft—perished.

In its analysis, the TSB said that the relative position of each of the occurrence aircraft just before the collision would have made visual acquisition difficult. The main TSB finding relating to cause and contributing factors was that "the converging 3-dimensional tracks of the 2 aircraft caused blind spots for the pilots. That factor, coupled with physiological vision limitations[4], reduced opportunities for collision detection. As a result, the available reaction time was reduced to a point at which a mid-air collision could not be avoided."

The TSB report discussed collision avoidance equipment at length, and it remarked that neither aircraft was fitted with any such device, nor were they required to be by regulation. However, from a risk perspective, the TSB concluded that "if the see-and-avoid principle is relied upon as the sole means of collision avoidance when operating in visual flight rules [VFR] conditions, then there is a continued risk of collision." It is easy to agree with that last statement; inconspicuously, this is a suggestion to install such a device where practical.

This subject is of critical importance to the glider community, considering that there was yet another fatal mid-air collision between two gliders on September 3, 2011, 7 NM southeast of Invermere Airport, B.C. The Pemberton report led me to submit this article for the *Aviation Safety Letter* (ASL), as a follow-up to the excellent article by Dan Cook on the PowerFLARM® collision avoidance system published in ASL Issue 3/2012. It is important to re-emphasize the value of collision avoidance systems such as PowerFLARM® and of its technological advancements and additional capabilities over the basic FLARM®.

FLARM®

The base functionality of a FLARM® consists of a global positioning system (GPS) receiver that is constantly calculating and transmitting both its current position and its projected positions. Other FLARM® units in other aircraft will receive these signals, show the target on either a dedicated display or a compatible moving-map navigational display, and algorithmically determine if there is a risk of collision. If a collision risk is projected, both pilots are notified. Simply alerting the pilot of nearby aircraft (as would happen with transponders, the traffic alert and collision avoidance system [TCAS] or a portable collision avoidance system [PCAS]) would lead to an unnecessary symphony of alarms, since light aircraft, and especially gliders, regularly fly in close proximity.

The greatest collision risk for a glider is from another glider, primarily when climbing in a thermal with many other gliders. The functionality of FLARM® has proven its usefulness to many pilots, and many Canadian gliders are already equipped. FLARM® has already been adopted as mandatory equipment for most competition flying, including for the Canadian National Soaring Championships. However, the risk of collision with powered aircraft remains a concern.

Gliders continue to maintain a transponder exemption in the *Canadian Aviation Regulations* (CARs), primarily due to power limitations. Transponders transmit over a much greater distance to ground stations at a power level that would too quickly drain the batteries in gliders, leaving them no radio (NORDO) and without their battery-powered instruments. FLARM® systems only transmit over about a 10-mi. range, putting much less of a strain on batteries.

[3] TSB Final Report A13P0127—text cited in this article comes from this final report.

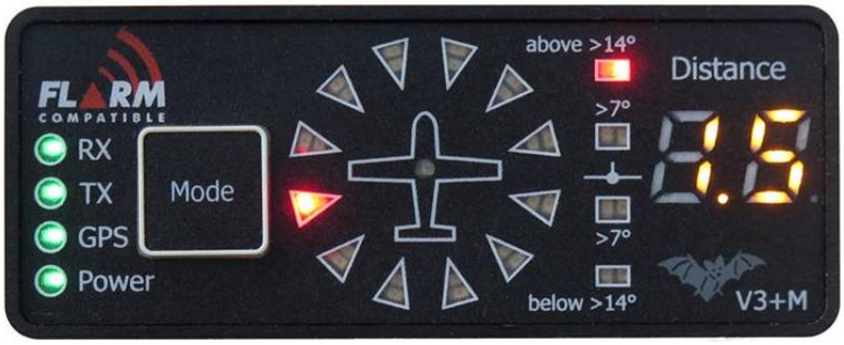
[4] Physiological factors linked to the limitations of the see-and-avoid principle. Read the complete TSB Final Report A13P0127 (see link above) for more details.

PowerFLARM®

PowerFLARM® devices are the next technological leap for pilots, receiving collision avoidance information not only from other FLARM® equipped aircraft but also from transponder-equipped aircraft and providing alarms for less than $1,700[5]. When a powered aircraft's transponder is queried by a ground station or by an overflying TCAS, the transponder's response will be received and analyzed by the PowerFLARM® device.

The position of an automatic dependent surveillance-broadcast (ADS-B) Mode-S transponder will be known to the PowerFLARM® device and used just like another FLARM® aircraft. For Mode-A/C transponders, only the range and altitude difference will be known. Instead of appearing as a point on the display, the Mode A/C will be shown as a ring. Several online videos provide examples of the PowerFLARM® alarms and displays in use.

This enhanced capability to detect and advise of powered aircraft is a key improvement to the pilot's ability to see-and-avoid. Even though the powered aircraft would also have to carry a FLARM® in order to see other aircraft, now a PowerFLARM®-equipped glider pilot will receive a warning and have the opportunity to react to a previously unseen threat.



Example of FLARM display provided by FLARM Technology Ltd.

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Because of the success of FLARM® in the gliding community, powered aircraft owners are since a few years also installing FLARM® at an unprecedented rate. Most new PowerFLARM® installations today are in fact in powered aircraft, including helicopters. Another segment where FLARM® is currently gaining tractions is in UAVs, or drones. Drone operators have started equipping their drones with FLARM®, both to see other aircraft but also for other aircraft to see them.

Another improvement in PowerFLARM® over the old classic FLARM® is the increased range. With PowerFLARM®, most installations have a range exceeding 10 km. With classic FLARM®, the range was usually 3-5 km. The difference can be life-saving in head-on situations, like the one in the Pemberton report.

Of course, technology is only an aid to collision avoidance, and pilots remain primarily reliant on the principle of see-and-avoid, which always requires vigilance and collaboration. Pilots are always welcome to visit glider operations to learn about them and share about themselves. Most Canadian glider fields require prior permission (PPR) for landing so make sure to call ahead. To find a glider field near you, go to www.sac.ca. △

[5] Note that costs quoted in the ASL are always provided by the author and are approximate. They can vary with time, location and other factors.