COLLISION WARNING SYSTEM

Despite “See and avoid”, mid-air collisions represent the second most frequent fatal accident cause in gliding.

Commercial aviation requires large aircraft to be equipped with collision avoidance systems (ACAS). These systems are based on powerful onboard primary radar interrogating nearby transponders (XPDR), similar to ground based radars. XPDR answers are then localized relative to the interrogating airliner, resulting in a traffic display. Conflicting targets result in warnings issued to the pilot. If both aircraft are equipped with ACAS, a vertical only conflict resolution is mutually agreed.

ACAS does indeed prevent aircraft to collide with other XPDR equipped aircraft, but it fails if used in a glider-populated area with many XPDR working. French authorities have conducted such tests. In addition ACAS does not work if - as often the case in gliding - the glider is not XPDR equipped or the XPDR is switched off. ACAS will never be useful to prevent gliders colliding with other small aircraft: Too expensive, too big, too much power consumption and not designed for the glider specific movement pattern and aircraft density.

Using GPS, each aircraft can broadcast its own position and velocity vectors to ATC and nearby aircraft. This generic concept – known for decades – is called ADS-B (Automatic Dependent Surveillance - Broadcast).

That’s what FLARM does,
optimized for small aircraft's needs.

FLARM utilizes position and movement information obtained form an integrated precision GPS and an embedded barometric sensor. The future flight path of the aircraft is predicted and transmitted over low-power short-range radio as a brief digital message once a second. These messages are received by all other compatible units within range and then compared with their own predicted flight path. Furthermore the own flight path is compared with the stored fixed obstacles in the area (e.g. cables, antennas, aerial railways, power lines). If in either of the cases a dangerous approximation is detected, FLARM warns the pilot of the current most dangerous object. Warnings are shown via a buzzing sound and on a bright multi coloured-LED display indicating the direction of the threat and the time to impact. Directional indication is given in the horizontal and vertical plane. The first alarm level is typically issued 18 seconds prior to possible impact. Furthermore the pilot is informed of other aircraft even when not posing any danger. This improves general situation awareness.

FLARM’s range is around 2-5 km, subject to antenna installation. This is by far sufficient for glider and small aircraft operation. FLARM can handle over 50 aircraft inside the range.

FLARM supports a VFR-pilot but it cannot take over the pilot’s duties. If an alarm is issued, the pilot must visually check the approaching aircraft in the indicated direction and further intensify airspace scanning. FLARM does not issue collision avoidance advise. The use of FLARM does not allow a change of flight tactics or pilot behaviour. FLARM does not recognise other aircraft if not equipped with a compatible device. FLARM is not a XPDR, is no alternative to any XPDR and can not process XPDR signals.

FLARM is designed only to warn if there is a real danger. Otherwise the system remains silent. In order to achieve this, FLARM assesses every second the actual flight mode, e.g. cruising is handled differently to circling. When thermalling, other algorithms are used for the flight path prediction as well as the danger level assessment. This allows to handle gaggles of gliders in the same thermal and not to constantly distract the pilot on aircraft nearby. Nevertheless the pilot can always adjust the buzzing volume, temporarily suppress all alarms or even display all traffic in addition to threads.

Alarms do not need to be confirmed. Several features are implemented to avoid repeated alarms regarding a friendly aircraft when team flying. Other features are designed to limit mutual data exchange to suppress lead and follow in a competition if not wished by the pilot or forbidden by FAI Sporting Code rules.

GPS and collision data are transmitted over a serial data output to be used in 3rd party applications (e.g. PDA). Most manufacturers of PDA software and glider avionics now offer FLARM functionality. See reverse page for additional information.

FLARM also includes a flight recorder. The log data is available in the common IGC-format for subsequent analysis in any IGC viewing PC-software or submission to OLC (Online Contest). FLARM is not an IGC homologated flight recorder.

An SD memory card slot allows easy data transfer of flight logs and updates to obstacle data and firmware.

Original size

www.flarm.com

„FLARM works superbly, the indication usually appears before you see the other aircraft. FLARM supports the imperfect human vision. For me, FLARM represents the only available option to reduce one of the biggest dangers in flying. I assume FLARM will save more lives than parachutes do, despite being much less expensive and quite unspectacular."
Wolfgang Janowitsch (World- and European champion, Austria)

Technical Data

FLARM is a small (75 x 25 x 110 mm), light (120g), thermoplastic box which can be mounted by either two M5-screw threads or by Velcro™ tape. The user interface comprises a three color LED display, a button and a buzzer. The box includes in internal radio antenna and a 16-channel high-performance GPS-engine. The GPS-antenna is provided and must be externally mounted. FLARM draws 55 mA at 12 VDC which must be provided from the onboard system. Voltages between 8-28 VDC can be used.

If necessary or convenient, a tiny external user interface offering the same functionality as the main unit can be added. It only requires an area of 50 x 25 mm, is 5 mm thick and needs a 16 x 16 mm mounting hole. You won't have anything smaller and better in your glider except the yaw string. It is self-adhesive for easy installation. For the main FLARM unit, an external radio-antenna is available when needed.

FLARM's digital radio emits during less than 1% of every second at 10 mW ERP - orders of magnitude less than a mobile phone. FLARM can be operated without a radio license in most countries.

FLARM includes an RJ45 power- and data-connector as defined by the FAI / IGC as the standard connector for flight recorders. You can therefore use the same cables to upload new firmware and obstacle data to FLARM and to download flight logs.

A SD card slot is integrated for easiest data transfer of flight records or updates to obstacle data and firmware.

Market Penetration

FLARM was introduced in early 2004. Within months, half of the Swiss glider aircraft were equipped with FLARM. In spring 2007 there are more than 8'000 FLARM or compatible devices in use; primarily in Germany, France, Italy, Switzerland, Austria, BeNeLux, Australia, New Zealand and South Africa.

Pricing and Availablility

FLARM currently sells for EUR 570 per unit plus VAT and shipping. Ask for mass order rebates. Consult **www.flarm.com** for your nearest dealer and further information. In the UK, please contact **LX avionics Ltd** at **www.lxavionics.co.uk**

Other FLARM compatible devices

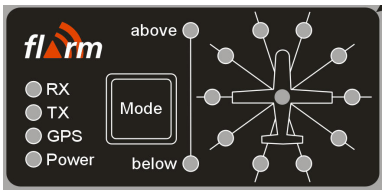
Flarm has licensed its technology to other avionics manufacturers to ensure a range of products and integration into existing systems.

Please visit www.flarm.com for a list of compatible devices.

Selected 3rd Party Devices

External user interface including button, display and buzzing sound. Updates directly via FLARM. No external power needed. Available through www.ediatec.ch and www.artronic.ch

Original size



Voice and Intercom interface TR-DVS including SD-Card flight recorder readout. Size 24x50x116 mm, weight 105g. Available through www.triadis.ch

Reduced size

3rd Party Applications

Most PocketPC- and PalmOS-based Flight Software manufacturers have integrated FLARM collision data in their software.

Furthermore new applications are being developed.

„I had many opportunities to test FLARM in the extreme conditions of record mountain wave flying in Argentina. FLARM's performance was impressive in all flying situations: thermalling, lateral approaches and high-speed opposite traffic. Warnings issued were clear and intuitive. I hope most aircraft will soon be fitted with FLARM, and I expect the number of collision events to dramatically fall."
Klaus Ohlmann (World record holder, Germany)