ACCIDENT

Aircraft Type and Registration:	1) Pierre Robin DR400/180R Remorqueur, G-LGCC 2) Schleicher ASK 21, G-CFYF
No & Type of Engines:	1) 1 Lycoming O-360-A4M piston engine 2) None
Year of Manufacture:	1) 1975 (Serial no: 1021) 2) 1990 (Serial no: 21470)
Date & Time (UTC):	8 June 2018 at 1502 hrs
Location:	Dunstable Airfield, Bedfordshire
Type of Flight:	1) Private 2) Training
Persons on Board:	1) Crew - 1 Passengers - None 2) Crew - 1 Passengers - 1
Injuries:	1) Crew - None Passengers - N/A 2) Crew - None Passengers - None
Nature of Damage:	1) Top of fin sliced off, rudder detached 2) Full depth gash in outboard section of right wing
Commander's Licence:	1) EASA Private Pilot's Licence (Aeroplanes) 2) BGA Glider Pilot's Licence with Full Instructor Rating
Commander's Age:	1) 62 years 2) 69 years
Commander's Flying Experience:	1) 2,825 hours (of which 1,238 were on type and 1,324 were in gliders) Last 90 days - 23 hours Last 28 days - 8 hours 2) 1,670 hours (of which 785 were on type) Last 90 days - 15 hours Last 28 days - 6 hours
Information Source:	Aircraft Accident Report Forms submitted by the pilots, gliding club investigation report and further AAIB enquiries

Synopsis

During the recovery to Dunstable Downs Airfield (DDA) after conducting a successful aero-tow launch, the pilot of the tug aircraft, G-LGCC, became aware of a glider ahead of him at close range. The pilot bunted to pass underneath the glider but had insufficient time to avoid a collision. The top of G-LGCC's fin struck the outboard leading edge of the glider's right wing. Despite suffering major damage, both aircraft remained controllable and landed without further incident.

History of the flight

G-LGCC, an aero-tow tug aircraft based at DDA and operated by the gliding club there, had conducted an aero-tow launch to the north of the field. Having released its towed glider at 2,000 ft, the tug was positioned for a right-hand downwind join to land on the north easterly grass strip (Figure 1).

G-CFYF, a 2-seater glider also operated by the gliding club, was conducting a training flight for the front-seat occupant. After winch launching to the north-east the glider followed a thermal southwards. On reaching the southern airspace boundary the pilots elected to reposition to the north over Dunstable Downs prior to joining the circuit for landing.

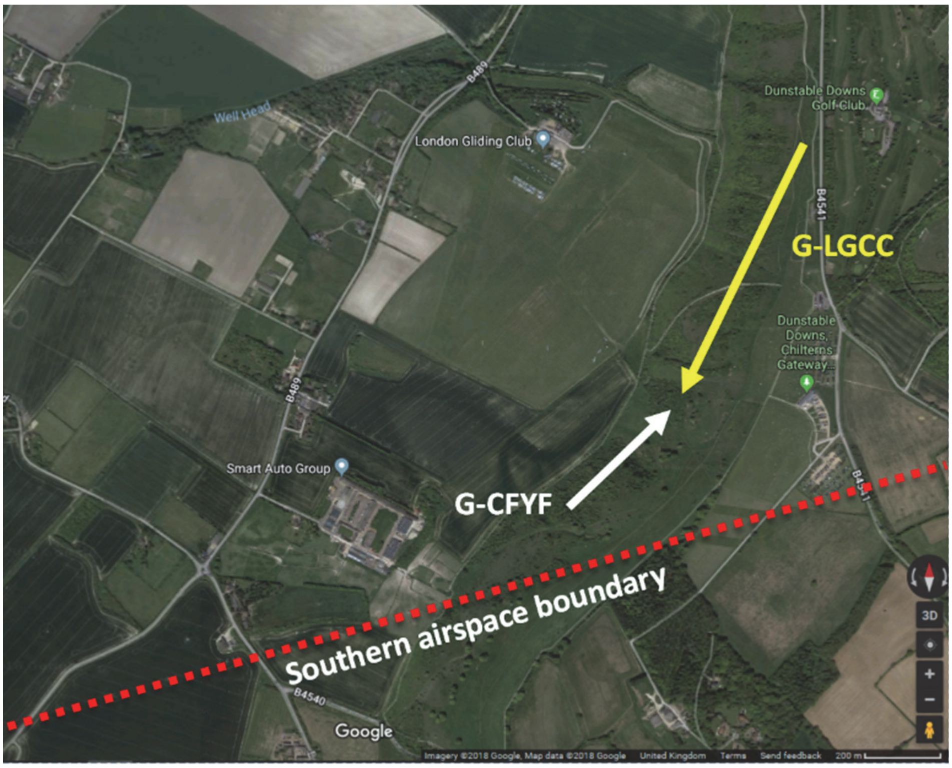

Figure 1
Tracks of G-LGCC and G-CFYF just prior to collision

The tug aircraft

As the tug pilot was descending southbound over Dunstable Downs[1] at approximately 100 kt, his attention was momentarily drawn to an airliner on his left on the approach to Luton Airport (LTN). On looking back to the front, the pilot saw a glider at very close range, directly ahead and slightly below him. With insufficient time available to turn away, he bunted to take his aircraft and its tow cable below the glider. As the aircraft passed one another, the top of G-LGCC's fin struck the outboard leading edge of the glider's right wing, penetrating the structure and slicing through to the spar. During the collision the top of the

Footnote

[1] National Trust owned heathlands on a north-south escarpment adjoining the eastern boundary of the gliding site.

tug's tail fin detached along with the rudder (Figures 2 and 3). Stress marks found on the tug's right wing were consistent with damage discovered on the inner lower surface of the gilder's right wing.

Figure 2

G-LGCC after the accident with rudder missing and damage to top edge of the fin

Following the collision, the tug pilot used gentle control inputs and flew a slack base turn onto final approach. Having lost the rudder, as its speed reduced the tug became less directionally stable. Increasing speed made the aircraft more controllable so the tug pilot elected to land faster than normal.

Figure 3

Damage to tail section of G-LGCC

The glider

Immediately prior to the accident the glider was tracking north easterly at 50 kt and approximately 900 ft agl[2]. Neither occupant saw the tug aircraft and the first they knew of the collision was a loud bang accompanied by the glider yawing violently to the right. The instructor in the rear-seat took control of G-CFYF to make an initial damage assessment. Looking to the right he could see significant disruption to the wing structure (Figures 4 and 5), but the wingtip angle looked normal, implying that the spar was intact.

Figure 4

Damage to the upper surface of G-CFYF's right wing

The glider was still flying and responding normally to control inputs. With members of the public below and the aircraft under control, the instructor elected to continue recovering to the field rather than risk a low-level abandonment. The glider landed without further incident.

Figure 5

Damage to the lower surface of G-CFYF's right wing

Footnote

2 Approximately 1,200 ft above the airfield.

Airfield information

DDA is an undulating grass airfield occupying approximately 110 acres and has been home to the gliding club since the early 1930s. Over time, the expansion of nearby LTN means that the airfield now sits within Class D airspace. A Letter of Agreement between NATS[3] and the operators of DDA provides for procedural separation between aircraft operating from LTN and Dunstable; the latter have restricted freedom of manoeuvre east and south of the field.

On the day of the accident, flight operations were taking place from the north-east run (Figure 6). In this configuration, aero-tow aircraft operate from the west side of the launch point and track northwards on departure, winch-launched gliders depart to the north-east. All aircraft aim to land to the right of, and parallel with, the winch launch track.

Figure 6

Satellite image of Dunstable Downs Airfield with north-east run depicted

While generic tug routings are known to the Dunstable gliding community, aero-tow aircraft returning to the field do not fly a set daily flightpath. Ground tracks are chosen to expedite recovery to the field and varied to distribute the tugs' noise nuisance footprint more evenly.

The airfield operates a single VHF radio frequency, primarily as a safety channel for control of the winch launching operation; it does not offer an air-to-ground radio service. To avoid

Footnote

3 The Air Navigation Service Provider at LTN.

winch safety calls being missed, transmissions for other than emergency situations are discouraged. Not all gliders carry a radio and for those that do, limited battery life can be an issue.

Meteorological information

At the time of the accident weather conditions were good, there was a gentle north-easterly breeze, very little cloud and visibility of more than 30 km.

Human factors

The tug pilot reported that there was a slight haze at height and that he was heading into sun. He believes that these factors, coupled with the distraction caused by the LTN inbound traffic, may have contributed to his difficulty in seeing the glider at range. The instructor in the glider reported that reflections in the canopy had compromised his lookout from the rear cockpit.

Other information

General collision avoidance procedures

The guiding principle for collision avoidance during VFR[4] flights, such as those undertaken at Dunstable, is 'see-and-avoid'. This concept places the onus on pilots to visually acquire conflicting traffic without third party assistance. Having detected a potential collision, pilots must then take appropriate avoiding action to prevent it. Pilot training, aircraft design and operational procedures are some of the passive measures designed to mitigate the risk of mid-air collision, but each has its limitations and cannot eliminate the risk entirely.

Avionics systems, such as TCAS[5] and FLARM[6], have been developed to further help pilots detect and avoid collisions. One of the limitations of FLARM is that it only works between aircraft fitted with the same system; unless both conflicting aircraft are using it, neither will receive an alert. Technological advancements such as PowerFLARM, with an improved display and the ability to detect FLARM, ADSB-Out[7] and transponder equipped aircraft, appear to offer enhanced capability over legacy electronic conspicuity (EC) systems.

Unlike with TCAS in commercial aviation, there is currently no agreed international standard for electronic collision avoidance or EC devices for General Aviation (GA) aircraft or gliders. The regulators of UK gliding operations do not specify a minimum level of collision avoidance equipment for participating aircraft.

Footnote

4 Visual Flight Rules, whereby pilots fly the aircraft using visual references and take responsibility for avoiding collisions with other aircraft.
5 Traffic Collision and Avoidance System.
6 A proprietary traffic awareness and collision avoidance system for General Aviation, light aircraft, and UAVs. FLARM uses audio cues coupled with a basic polar display to alert pilots to potential collisions with other FLARM-equipped aircraft.
7 Automatic Dependent Surveillance Broadcasting. A system that transmits information about the aircraft's location and flight parameters to other suitably equipped aircraft or ground systems.

UK Civil Aviation Authority Electronic Conspicuity Working Group

In response to safety recommendations made in a 2010 AAIB report[8] following a mid-air collision between a light aircraft and a glider, the UK Civil Aviation Authority (CAA) established the Electronic Conspicuity Working Group (ECWG). The remit of the ECWG was to examine how increased use of EC could improve safety in uncontrolled airspace. The ECWG published its findings in April 2018 (CAP 1391[9]), acknowledging the potential safety benefits of enhanced situational awareness through increased use of EC and stating:

> *'There is a perception that the use of EC could reduce the risk of mid-air collision (MAC) in Class G Airspace[10].'*

A target outcome for the ECWG was to define an industry standard for EC devices designed for the UK market. Their aspiration was that by standardising EC technology, equipment costs would reduce, leading to wider adoption of such systems across the GA and gliding communities.

Visual conspicuity

Fibreglass gliders are usually white and, with narrow cross-sections, it can be challenging for the human eye to detect them at distance, especially when head-on. Using darker colours could enhance visual conspicuity but would increase solar heating of the airframe which can adversely affect the aircraft's structural integrity. Solar heating does not affect the structural integrity of aircraft constructed of more traditional materials, such as wood and metal, to the same degree.

Gliding club investigation

The gliding club was authorised by the British Gliding Association (BGA) to conduct its own investigation into this accident and concluded that:

> *'The accident occurred because the pilots did not see each other's aircraft in sufficient time to take effective avoiding action.'*

As part of the investigation they also considered how electronic collision avoidance systems may have helped in this instance and reported that:

> *'FLARM fitment … may have helped to prevent this accident.'*

While acknowledging the potential benefits of FLARM, the Club's report expressed reservations about mandating it for all DDA-based aircraft. They were concerned that, with the high traffic density often encountered at the airfield, FLARM might generate high a level

Footnote

8 Formal Report AAR 5/2010. Report on the accident between Grob G115E (Tutor), G-BYXR and Standard Cirrus Glider, G-CKHT at Drayton, Oxfordshire on 14 June 2009 https://www.gov.uk/aaib-reports/5-2010-g-byxr-and-g-ckht-14-june-2009 (accessed 6 September 2018).

9 Civil Air Publication 1391. https://publicapps.caa.co.uk/modalapplication.aspx?appid=11&mode=detail&id=7275 (accessed 6 September, 2018.

10 Class G is the least restrictive of 8 airspace classifications described in ICAO Annex 11.

of nuisance alerts, leading to distraction rather than benefitting deconfliction. The Club had previously decided that mandating the use of high intensity LED landing lights on tug aircraft would be a more useful mitigation for tug-versus-glider collisions than FLARM. Due to increased radio interference on some tug aircraft when the LED lights were illuminated, not all tug pilots at Dunstable observed this policy.

The gliding club's investigation made safety recommendations related to the use of landing lights on tug aircraft as well as proposing reviews into the fitment of FLARM and improved battery technology on their aircraft.

The Club also instigated an informal review of tug operations to explore potential procedural changes which could enhance flight safety.

Further incident

On 4 August 2018 there was a further incident at DDA between an aero-tow aircraft and a glider. On this occasion the tug was recovering to the airfield when the free end of its tow cable struck, and broke the canopy of, the other aircraft. There were no reported injuries and this incident was referred to the BGA.

Analysis

Collision avoidance

With the airfield having been subsumed into Class D airspace, gliding at Dunstable is restricted on two sides. Limited freedom to operate east and south of the field leads to a higher traffic density in the remaining available airspace than might otherwise be the case. Concentrating a high level of activity into a smaller area inevitably increases the challenge of safely deconflicting flight operations using the see-and-avoid principle.

See-and-avoid is a long-established basis for collision avoidance that works satisfactorily provided at least one of the pilots involved sees the other aircraft sufficiently early to take effective avoiding action. On this occasion, and the subsequent incident on 4 August 2018, it did not provide an adequate safety margin. The limitations of see-and-avoid are well-documented and the residual risk of mid-air collision is a concern for the GA and gliding communities as well as for the BGA and CAA. Employing optional additional mitigation measures, such as EC systems and procedural deconfliction, invariably adds cost and is left to the discretion of pilots and operators. The CAP 1391 definition of an industry standard for EC devices could lead to reduced equipment costs and consequent wider deployment of the technology on GA and glider aircraft. (See report G-JAMM/G-WACG in this Bulletin.)

Tug operations

As highlighted by this accident and the subsequent incident, an aero-tow tug and its cable is a relatively un-manoeuvrable threat to other aircraft. Anything that enhances their conspicuity or increases others' situational awareness (SA) of their whereabouts would be a safety benefit. The gliding club's policy to fit high-intensity LED landing lights is extra mitigation for head-to-head collisions, although it did not prevent the second incident. The solar heating risk to structural integrity for fibreglass gliders means that painting them in more conspicuous colours is not an option, although this could be a course of action worthy of consideration for tug aircraft.

Full freedom for tug pilots to vary their recovery routings facilitates a more efficient aero-tow operation but does not help SA for other pilots. Adhering to more prescriptive routes, that could be briefed to those launching from DDA, would help glider pilots understand where the tug threat is greatest. Formalising daily tug routing would also allow for noise to be distributed in a planned, rather than arbitrary, manner. A downside, might be that tug efficiency would reduce leading to increased costs which would have to be balanced against the potential safety benefit.

Due to the risk of critical winch safety calls being missed, the DDA radio frequency is not routinely used for aircraft deconfliction. While not all gliders have radio capability, brief transmissions by tug aircraft recovering to the airfield could alert those on frequency to their presence. Timing their calls judiciously to avoid the critical phase of a winch launch, tug pilots could add to general SA by broadcasting their recovery intentions without compromising safety. Such a procedure would only benefit aircraft with functioning radios and would not have helped in this accident.

FLARM

The gliding club previously assessed that the benefits of FLARM are outweighed by the potential distraction of multiple alerts in a congested circuit area and, therefore, only fit it to their cross-country gliders. Ongoing technological advancements in the EC field appear to offer enhanced capabilities worthy of consideration when the gliding club conducts its review of its FLARM equipage policy. Other clubs use FLARM more extensively and lessons learnt from their operations could help inform the Club's deliberations.

Conclusion

Using see-and-avoid as the basis for collision avoidance is an accepted aviation risk which became a reality on this occasion. A late sighting gave insufficient time to avoid a collision and it was only through providence that there were no fatalities.

Gliding is a popular leisure pursuit that relies on participation for it to survive, anything that adds cost poses a threat to its viability. Visual deconfliction is a fundamental tenet of the sport but it has its limitations. Technological solutions are available to support see-and-avoid but, unless mandated by regulators, they can appear to be non-essential luxuries when money is tight.

Regulators can encourage operators to supplement see-and-avoid, but the lack of an international agreement on capability standards undermines this strategy; people are wary of investing in expensive equipment if it risks being made obsolescent by future regulatory change. While not directly addressing the lack of international agreement, CAP 1391 removes a degree of uncertainty and seeks to promote wider adoption of EC technology within the UK's GA and gliding communities.

Safety actions

To reduce the risk of mid-air collisions between aero-tugs and gliders, the gliding club decided to:

- Publicise and enforce the policy of using landing lights on their tug aircraft during normal towing operations.
- Resolve the issue of radio interference generated by LED landing lights on the Club's aero-tow aircraft.
- Review the policy on FLARM fitment for Club owned aircraft.
- Investigate the possibility of fitting extended life batteries to all Club aircraft with the aim of enabling radio use for all flights and supporting a growth path for wider use of electronic conspicuity systems.