Lightning strike

The AAIB's findings into last spring's devastating lightning strike on a London GC K-21, when two people parachuted to safety, are now public. *S&G* reports on what can be learned

THE LIGHTNING strike which last year destroyed a K-21 in mid-air has been described by the Air Accidents Investigation Branch as a "rare example of an extremely high-energy strike to a completely unprotected structure".

Although glider accidents are usually investigated by the BGA, the AAIB took an interest in this incident because a helicopter crash in 1995 had previously raised fears that international standards of lightning protection are inadequate.

The investigation into the mid-air destruction of the K-21, GBP, was carried out by the AAIB's Peter Claiden, who is also a Dunstable glider pilot. The report has led to two safety recommendations (see p7). The first, that manufacturers develop new ways of protecting gliders from lightning strikes is strongly backed by the BGA Technical Committee (see p29). The second asks the Civil Aviation Authority to give serious consideration to the findings as part of an international review of aircraft lightning standards. If the AAIB view prevails, what happened to GBP will make more aircraft safer across the world.

The significance of the GBP incident last April lies in the nature and severity of the strike and new research into how often such hits occur, as well as in changes to the construction of many modern aircraft.

Certificated fixed-wing aircraft and helicopters (not gliders) are required to survive lightning strikes without significant damage; the standard is meant to protect against 98 per cent of cloud-to-ground strikes, assuming that ten per cent of these are of positive polarity (ie, discharge positive current).

Positive strikes are often more damaging than negative ones; and recent research suggests that the proportion of positive strikes can be more than ten per cent. In the storm which hit GBP, 66 per cent of strikes were positive.

Furthermore, tests and calculations indicate that the energy level of the strike on the K-21 was eight or nine times higher than that tested for in the present international standards. The peak current was thought to be in excess of 300,000A. Such energy levels, the AAIB says, raise concerns about the ability of lightning-certificated aircraft to withstand such strikes without significant damage.

Key factor

K-21s are constructed almost entirely of glass reinforced plastic (GRP) with foam or honeycomb-filled sections bonded together – composite materials which do not conduct electricity. Elevator, aileron and airbrake control systems include metal levers, push/pull rods and bellcranks. In common with most sailplanes, there is no designed-in lightning protection.

The key factor in GBP's destruction was a high-energy strike on a metallic control system within a composite structure. In conventional "metal" aircraft, the lightning current is generally conducted through the metallic structure; the current density is generally low except near the lightning's entry point and the path of conduction does not usually fail, so lightning arcs do not form. Such arcs, where the current jumps creating light, heat and shock waves, led to the in-flight disintegration of GBP. But composite materials such as carbon fibre reinforced plastic (CFRP) are being increasingly used in other types of aircraft, including passenger jets, as well as gliders. Although CFRP conducts electricity, it is more resistive than an aluminium alloy push-rod believed to have conducted all of the strike's energy within the K-21 wing.

At the time of the accident, 15 strikes in 20 minutes were recorded within 25km of the main wreckage site. The first, at17.08hr 57.5sec, was a positive discharge in excess of 80,000A which is thought to have hit GBP.

The result was devastating (see *The final minutes of GBP*, bottom right). The charge entered the left wing and travelled through the aileron system before exiting the right wing (see diagram top right). Almost all the right wing, the outer section of the left wing and the

Airbrake mechanism sooted but unaffected — *Aileron system bellcrank distorted*

Fuselage side rib — *Cracked pushrod aperture* — *Fuselage side rib*