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PILOTING OLD AIRCRAFT AND THEIR REPLICAS

1 Many aeroplanes on the British Register have been around for more than a quarter of a century and may properly be regarded as old in design, as well as in material fact. These include a growing number of old jet powered aircraft as well as aircraft with unusual design features. These may be light aircraft designs being recreated as replicas or simply the older twin aircraft with more demanding asymmetric handling qualities than their modern counterpart. There is also an increasing number of old light aircraft designs being recreated as replicas, sometimes with original engines, often with modern engines. It is fair to say that every old aeroplane flying today is a replica to some degree. The result is that some recent accidents and incidents reveal that not all pilots are aware that old aeroplanes do not necessarily achieve the airworthiness standards of more modern designs, particularly with respect to flying qualities. They also reveal a lack of knowledge of older technological practices needed to get the best out of such aeroplanes. The purpose of this Circular is to emphasise these points.

2 Many airworthiness requirements applicable to light aeroplanes have not changed greatly over the years. For example, the general strength requirements have altered only in matters of detail. Moreover, if experience has shown dangerous weaknesses in a particular design, mandatory action will have been taken to put matters right.

3 So far as flying qualities are concerned, these have improved with time and advancing knowledge. But, retrospective changes to earlier aircraft cannot be made simply because it is often impossible to alter the qualities in any substantial way without major redesign. Such aeroplanes are usually not as 'forgiving' as more recent types and they must be are flown with care and understanding of their characteristics.

4 For single-engine piston aircraft the two most important areas in which older designs sometimes compare unfavourably with more recent ones are:

Low speed stability, controllability and stall qualities, specifically:

(a) The generally lower levels of stability about the pitch and yaw axes;

(b) Control forces. Light elevator forces may allow inadvertently large excursions in pitch attitude and speed; light and possibly non-linear rudder forces (ie not increasing progressively with rudder angle) may make accurate directional control difficult on types which require careful attention to directional control;

(c) limited stall warning, even a total absence on some very old types;

(d) tendency to drop a wing at the stall unless care is taken to avoid yaw or sideslip.

These four together could lead to inadvertent stalling for the uninitiated or unwary and any stall may result in considerable height loss and even a spin. It must also be remembered that there are other factors not exclusive to old designs, which if present will further degrade stall qualities. These include CG positions further aft than usual, angle of bank, rate of approach to the stall, general degradation of longitudinal and directional stability, all of which can be exacerbated with replicas of old designs by:

(i) Use of lighter weight modern engines with inadequate ballast;

(ii) replacement of original aerofoil sections of wings and tails with more modern sections;

(iii) altering the design of, or introducing separate control surfaces, eg ailerons in place of wing warping.

Such modifications must never be carried out without seeking advice.

Landing

In the case of aeroplanes with a tailwheel undercarriage, prudence in landing is needed because of:

(a) Relatively poor directional control relying solely on rudder effectiveness and often erratic differential braking;

(b) the critical effect of even small crosswind components and degradation of directional control as the tail is lowered into the wake of an often bluff fuselage and engine combination.

There is good reason to believe that pilots trained on modern nosegear aeroplanes are more likely to get into difficulties from these causes, because the required tailwheel/skid experience cannot now be gained so easily.

5 Older jet aircraft and multi-engine aircraft have design features that require detailed thought and understanding if they are to be flown safely. They may also be operating outside their original intended envelope; for example, limited to below 10,000 ft because of inoperative oxygen systems or to 250 kts for ATC reasons. These limitations may have an impact on safety procedures and drills. The two most important areas to consider about aircraft designs are:

(a) **General aircraft systems and emergency systems**

(i) Control and cockpit layouts may be very complex;

(ii) Aircraft systems can be very complicated with back-up systems that offer a 'get you home' mode only with reduced handling qualities;

(iii) Faster transit speed can produce workload problems, particularly is the aircraft is a single or two-seater;

(iv) The emergency escape systems could be very complex and even include ejection seats, which need a through understanding, technically and philosophically, before any flight is made;

(v) Emergency escape procedures must be considered during the conversion period to ensure an early and correct abandonment decision should the worst happen.

(b) **Safety Speed**

The older multi-engine aircraft may have very different asymmetric handling qualities than any modern equivalent. Some areas that should be considered and fully understood before first flight are;

(i) The emergency Safety Speed of an aircraft, in the case of an engine failure at that speed, is the minimum speed at which control should be maintainable with the 'live' engine at full power.

(ii) For older aircraft designs it is possible for the lift-off speed to be below Safety Speed.

(iii) If control is in doubt, it may possibly be assured by reducing power slightly.

(iv) If control is lost, a reduction in power of the live engine must be made to reduce the destabilizing influence.

(v) In extreme cases throttles may have to be reduced to idle and the aircraft landed straight ahead or abandoned.

A thorough conversion concentrating on asymmetric handling, emergency procedures and associated problems is essential for this class of aircraft.

6 Before you start to fly any aeroplane with which you are not familiar, and especially when the design is that of an earlier generation than the one on which you were trained, find out all that you can about it. The flying qualities, the feel of the controls, the unusual cockpit arrangement and unexpected operation of the systems, all conspire to unnerve and reduce the effectiveness of an unfamiliar pilot. Talk first to someone who is used to flying the aeroplane. Finally do not be too proud to arrange, whenever possible, a proper flight demonstration and check by someone who is competent on a strange type. Such aeroplanes can be unforgiving towards pilots who are insensitive to their peculiarities.

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This Circular is issued for information, guidance and necessary action.

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