Handling the Big Jets

The book for which transport pilots, actual as well as prospective, and many others have been waiting—"Handling the Big Jets," by D. P. Davies, chief test pilot of the Air Registration Board—came out last week. During more than two years' appetites have been whetted occasionally by the publication of parts of the so-far-completed text in the Flight Safety Committee's Focus and, earlier, in Flight of March 18, 1965, when we discussed stalling, the super-stall and stick-pusher philosophy with the help of the original draft of the section of the book which dealt with these problems. These excerpts gave just a hint of what was to come; the finished book more than lives up to expectations. It is a tremendous, but notably readable, vade-mecum of jet transport flying qualities and design characteristics intended primarily for pilots who have yet to make the transition to jets, but which is packed with information of value to the most experienced of jet captains. And it is surprisingly low-priced at 30s.

An immediate comment might be that the book has arrived rather late in the life of the swept-wing jet and even of the second-generation rear-engined jet. So, inevitably, it has, but there are still very many hundreds of airline pilots who have yet to be converted to jets, as well as an infinite number of pilots of later generations who will be converted in the future. Furthermore, the book, in its immense scope, could not have been written without the experience of many years and of many different jet aircraft—and more individual types of jet transports have been flown and evaluated by Mr Davies than by anyone else in the world.

Why was the book written? Because there was an obvious need for it and because the ARB test pilots have test-flown a great many jet aircraft and have thus gained enormous experience. This, as a matter of moral obligation, should not remain locked up, so to speak, within the board and in the minds of its pilots and technicians. The RAF, for instance, has its general pilots notes as well as handling notes for individual aircraft—but there has been no such thing for civil aircraft. The need has been very obvious since the appearance of the big jet with its markedly different characteristics, such as those stemming from the swept wing, the speed, the high and varying weights (and, consequently, momentum), and the absence of the slipstream lift available in propeller aircraft. As Mr Davies says in his conclusions, jet transports (in the forms in which they have evolved) are not so much difficult for anyone else in the world.

Effective Vernacular

One of the pleasanter features of the book is that, though giving an immense amount of fact and experienced opinion, it is not in any way ponderous. In fact, the wording in places is vernacularly (and effectively) near-flippant: "Power was not reduced . . . because containment of the initial dive angle was so marginal that nothing, but nothing, was allowed to add any nose-down pitching moment . . . How this rather hairy maneuver will be regarded by an airline pilot is not known, but it must be of some comfort to know that there is a drill which will provide a recovery although at the expense of a large height loss . . ." These two sentences, in the section dealing with variable-incidence tailplanes, also serve to demonstrate that this is no dry textbook, and that it contains the results of practical personal experience.

Another attractive feature is the entirely logical way in which the different features of the jet are dealt with. The whole structure of the book is developed from a pictorial "table of differences" (between the jet and propeller aircraft), with an associated explanation and glossaries of terms, forms the introductory section. This table provides the effective means of the attack on the subject, which is under four main headings, or "first order differences." These are: (1) bigger and heavier; (2) turbine engines; (3) faster; and (4) higher. The consequences and effects of these differences are developed in the table and in the body of the book. Under headings (1), for instance, the effects of momentum and the features of powered control are covered; acceleration, the effects of the absence of slipstream and noise-abatement techniques come under (2); swept-wing characteristics, including stalling, high sink rates and the artificial devices such as yaw dampers come under (3); and high Mach number effects and emergency descents are under (4). Following these are sections on take-off and landing, flight through severe weather, followed by a final three pages addressed to airline pilots and training captains, illustrating the points being made are more than 80 three-colour diagrams and charts.

Super-stall causes

We hope to return in later issues of Flight to more of the many descriptive explanations in Mr Davies' book. Here, as an example, are some of his comments on the super-stall. After explaining the progress of a stall on the conventional pre-jet aeroplane and on the first-generation jets (which have, he says, excellent, but rarely credited, stall qualities), he turns to the second-generation jet with the words: "The tail which is in just about the right position to catch it. This..." Mr Davies writes, "Only two qualities which are different from those of the older aeroplanes and which lead to the super-stall; these are the pitching tendency of the aeroplane at the stall and the loss of tailplane effectiveness at the stall. From 14Vs down to the stall the handling qualities are much the same as on the old aeroplanes except that the high-set tail remains clear of the wing wake and retains its effectiveness during the speed reduction towards the stall. This is put to good effect when a stick-pusher is fitted, as the good elevator response produces a crisp nose-down pitch change following the stick push.) Continued speed reduction is, therefore, more likely because the wing wake has not yet degraded the tail.

"At the stall, again, two distinct things happen. The sophisticated-section swept wing suffers a marked nose-up pitch at the stall . . . and the wing wake, which has now become low-energy turbulent air, passes aft and immerses the high-set tail which is in just about the right position to catch it. This greatly reduces the tail effectiveness and a large increase of pitch results from the nose-up pitch of the wing and the aeroplane continues to pitch up. This pitch up just after the stall is worsened by greatly reduced lift and greatly increased drag which cause a rapidly increasing descent path, so compounding the rate of increase of incidence. The aeroplane is thus well on its way to extreme angles of incidence and a deep stall."