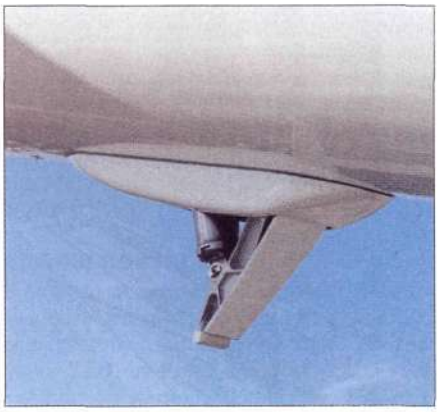

R-R Trent 892s powered the flight-test aircraft (top); a retractable tail skid prevents tail strikes during rotation (above left); all 777 versions are equipped with six-wheeled main landing gear

no need to retrim unless airspeed is changed.

FBW provides stall, bank and overspeed protection. "Load relief" prevents flap limiting speeds being exceeded by automatically retracting the flaps. As speed is decreased or increased beyond the normal flight envelope, pitch trim is automatically inhibited and the pilot has to apply a distinct and abnormal stick force to decelerate or accelerate further.

A similar philosophy applies to bank angle protection. When a bank angle of about 35° is exceeded, control wheel force tends to roll the aircraft back to 30° bank or less. This roll command can be overridden, but only by applying force to a distinct and abnormal extent.

The Airbus system, where the rate of roll is limited to 15°/s, differs from the Boeing system which always provides maximum control surface deflection for the most control wheel application. Another fundamental difference is that the Airbus pilot cannot, ultimately, override the envelope protection; in the 777 the envelope protection can be overridden – but only against opposing control forces.

Next, an approach to the stall was made with flaps at 5° and the auto-throttle off. Again stick force markedly increased as speed decreased. I persisted with this back pressure and provoked the stick shaker at 128kt, and a natural buffet at 124kt. Strong cues, therefore, warn the pilot that the aircraft was flying slow. If speed was further reduced, good artificial stall warning from the stick shaker and natural buffet at the brink of the stall itself would provide excellent situational awareness that no crew could conceivably fail to notice.

DIFFERING PHILOSOPHIES

Again, a fundamental difference between the Airbus and Boeing FBW philosophies lies in the engine failure case. With the 777-300, there is a thrust asymmetry compensation (TAC) system, while the A319, for instance, lacks any form of rudder boost. TAC monitors engine thrust and if there is a difference between engines of 10% or more, rudder is applied to minimise yaw. A fertile area for debate is whether the aircraft handling should reveal obvious cues of an engine failure, or should it relieve the pilot of the extra handling during a potentially demanding occurrence?

The 777 was then flown manually on one engine during which its handling was as thoroughbred as in any other phase of flight. The complete electronic checklist for an engine failure (automatically displayed on the MFD) was completed using one of the CCDs. This is much clearer than a paper checklist at points where there is a choice of action, such as 'Is the engine to be restarted? Yes or no'. This interaction clearly shows which choice has been made.

A coupled (autopilot) instrument approach to Moses Lake airport was prepared to culminate in a single engine, autoland touch and go. A 10kt crosswind blew from the left at Moses Lake but the coupled approach and single-engine autoland was flown faultlessly, and there were clear displays of mode (ie localiser and glidepath) and autoland status via legends on the PFD.

VISUAL CIRCUITS

I then flew two visual circuits at Moses Lake, and one simulated asymmetric pattern. Admittedly the aircraft was not anywhere near maximum AUW, but its nimble performance and ease of handling belied its considerable size. The 777-300 is, of course, sensitive to attitude in the flare and at touch down. The recommended technique is to fly at the threshold speed (V_{AT}/V_{REF}) until the audio alert of "20ft", then close the power levers to idle and check the sink rate by raising the nose by only a couple of degrees. I found the landings easy to fly well. The fuselage length leads to the nosewheel being high above the runway at mainwheel touchdown and it must be lowered using elevator before reverse thrust and brakes can be applied.

The 777-300's performance and flying qualities belie its size and the fly-by-wire flight control delivers excellent handling. The cockpit is a comfortable working environment with flight management systems and displays which promote excellent situational awareness and, consequently, the aircraft's safe and efficient operation. ❑