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the two programmes. It will incident-ally destroy commonality for all those carriers which already operate 727s, not all of which will want the 767 all-singing, all-dancing electronic flight-deck.
The A310/767 contest is nowhere hotter than in the cockpit and has been advancing the technology of commercial flight-deck design by leaps and bounds. Digital avionics, cathode-ray tube (CRT) instrument displays and flight-management systems (FMS) are being offered by each manufacturer. Boeing announced its plans earlier and has been less com-promising in its approach to the elec-tronic flight deck: the standard 767 cockpit will feature a CRT attitude direction indicator (AM) and hori-zontal situation display (HSI). The first replaces separate electro-mechanical ADI and radio altimeter displays, and the second combines direction and weather-radar informa-tion, as well as navigation data. Each pilot will have two CRTs to view, and there will be alphanumeric displays for a central warning panel and presentation of flight-management system information (the latter using a CRT). Boeing has already started

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to sign up suppliers. Collins will pro-vide displays for the electronic ADI and HSI, and Sperry has been chosen for the flight-management system. Collins was chosen because its dis-plays feature full three-colour shadow mask tubes (the same as in a domestic colour TV). While they are more complex than competing manu-facturers' Penetron tubes (which vary colour with electron-beam intensity), they do allow blue to be shown, which Boeing considers vital for the ADI display.
Airbus has started later, but is confident that it can match or im-prove on anything offered by the opposition. Digital avionics will be standard on the A310, but airlines will be able to choose between con-ventional and electronic displays. The production version of a digital auto-matic flight-control (AFCS) system now being developed will be flown in the Airbus A300 test aircraft, ship No 3, in October 1980, and a CRT cockpit will be installed in 1981. Air-
bus is taking advantage of A300/A310
commonality to test and certificate its
electronic flight deck well before the
A310's entry into service in early
1983. Boeing has not yet announced

The A3I0 is shorter and dumpier than Boeing's 767, an arrangement which increases drag but allows the use of and eight-abreast cabin and standard containers in the underfloor cargo hold. The 767 takes LD3s in a single row but makes best use of space with the purpose-built LD67

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plans for flight-testing the 767's cock-pit electronics before that type first takes to the air. Airbus is on the brink of selecting a supplier for
• A310/A300 CRT displays and has con-sidered presentations from Collins, Sperry, Thompson-CSF and Sfena. Collins seems to be the front runner, having already been chosen by Boe-ing, although there must be doubts about letting one supplier dominate such an important market. Airbus
' aims to use identical CRTs, not only for flight information but also for systems and warning displays; the latter two will show failure modes and suggested remedies (including references to pages in the manual!). They will also be capable of running through routine checklists, saving pilots some paperwork. Common dis-, plays will allow each one to present \ information from any of the others in the event of CRT failure.

Boeing was able to go for a standard 767 "take it or leave it" CRT cockpit because its US customer base is ready to accept these develop-ments. Airbus, because of the diverse circumstances of A300/A310 buyers, has had to allow more choice. Airbus senior vice-president in charge of flight-testing and support Henri Ziegler does however say that Euro-pean airlines are ahead of the rest of the world in specifying new cock-pit technology. A master warning CRT will be standard on KSSU A310s (Swissair and KLM have ordered the type) and possibly on those ordered by Atlas members (Lufthansa and Air France). A digital AFCS will be standard on A310s, and will be intro-duced first on the A300. Airbus has developed a push-button AFCS con-trol panel which uses half the area of the current A300 analogue system. The digital AFCS will have a mean time between failure of better than 600hr, compared with 150hr on the current system.
Airbus is extending push-button technology to other areas in the cock-pit. For instance, an A300/A310 elec-trical-systems overhead panel is being developed which will occupy one-fifth less area than the same panel on a Boeing 737 does now. The contest between Boeing and Airbus to apply the latest technology, including micro-processors, to their products has only just started. By the time the 767 and A310 are flying, the systems on offer to new customers, and for retrofit on existing aircraft, will be even more advanced.

Airframe technology is also being pushed ahead by Airbus and Boeing. The US company is using, or testing for use, graphite and Kevlar-covered graphite composite material for con-trol surfaces, engine fan cowlings and wing/body fairings which it claims will reduce structure weight by about one ton, compared with aluminium. Airbus will employ composites developed by the current A300 weight improvement programme. This in-