

ENVIRONMENT MICHAEL PHELAN / ARCAHON

Boeing tests more sound ideas in bid to cut noise

Airbus and CFMI also move to quieten A321 to meet ICAO Chapter 4 regulations

Boeing is expanding its engine noise reduction programme to test scarfed inlets and treated lips following 777 Quiet Technology Demonstrator (QTD) flight tests last year, which have resulted in design changes being incorporated on the 777 production line.

Boeing technical fellow, environmental performance strategy Belur Shivashankara told the Association Aeronautique et Astronautique de France aircraft noise reduction conference in Arcachon, France, earlier this month that the scarfed inlet proposal would extend the lower lip of the engine inlet, deflecting more sound upwards and shielding the ground from direct fan noise. Boeing hopes to test the inlet on a Pratt & Whitney PW4098-powered 777 next year.

The second concept involves pumping hot bleed air through micro-perforated titanium panels on the inlet lip, and is also due for flight tests next year. Shivashankara says ground tests predict a forward-radiated noise reduction of 3-5dB using the scarf, with a further reduction of up to 10dB promised by inlet lip treatment.

The QTD tests last year involved an American Airlines 777-200ER

fitted with a modified Rolls-Royce Trent 800 flying over a phased array of 187 microphones in Glasgow, Montana. The modifications resulted in significant jet and inlet fan noise reductions (*Flight International*, 20-26 November, 2001). During the programme Boeing engineers noticed a distinct 2kHz tone emanating from the 777's wing leading edge. Shivashankara said: "By taping over de-icing holes on subsequent tests, the tones were eliminated, and Boeing has since incorporated redesigned non-whistling holes on production 777s."

Meanwhile, Airbus and CFM International aim to reduce A321

aircraft and engine noise to comply fully with International Civil Aviation Organisation Chapter 4 noise regulations, and London Heathrow's Quota Count 2 (QC2) noise levels.

The A321's sideline noise levels currently fall outside the limits imposed by these regulations (ICAO Chapter 3 minus 10dB). Airbus and CFMI are to begin flight testing an A321 early next year featuring with a CFM56-5 engine fitted with a chevron nozzle and other noise reducing components from CFMI's wider TECH56 programme. Testing was due to begin this year, but the programme has been pushed back by Airbus.



Boeing 777 QTD tests last year have resulted in design changes

FUEL

UAV engine to be altered for kerosene

A gasoline automotive engine is to be modified to burn kerosene-based fuel under a US Defense Advanced Research Projects Agency (DARPA) programme to develop a lightweight "heavy fuel" engine for the A160 Hummingbird rotary-wing unmanned air vehicle (UAV). A prototype engine will be ground tested next year.

Sonex Research has been awarded a \$744,250 contract to apply stratified charge radical ignition (SCRI) technology to the 225kW (300hp) four-stroke engine powering the A160 technology demonstrator. Using less-volatile kerosene-based fuels such as JP5 and JP8 will reduce the hazards and logistics burden associated with gasoline. Converted gasoline engines are lighter than diesels, says Sonex.

Sonex has previously converted a small two-stroke gasoline engine to heavy fuel for the US Marine Corps' Dragon Drone UAV. The company will convert the engine from spark ignition to radical, or chemical, ignition using specially designed pistons. These feature micro-chambers around the combustion bowl that trap fuel and slow oxidation, forming highly reactive chemicals that act as catalysts for auto-ignition.

FLYING CAR

ZAP joins Moller to boost Skycar programme

Moller International has signed an agreement with electrical vehicle developer ZAP to pursue jointly advanced transport, including the Moller M400 Skycar. Separately, Moller has reopened its orderbook for the M400 "flying car", after a three-year programme delay. An M400X prototype recently completed tethered hover tests at the company's Davis, California, plant, and three more vehicles are to be completed by the middle of 2003.

ZAP will help market the M400 and some of the technologies

developed for it. Moller has developed a version of the Wankel rotary engine that ZAP is looking to incorporate in other environmentally friendly transport concepts.

Moller president Paul Moller believes the four-seat Skycar will revolutionise personal transport. The vertical take-off and landing (VTOL) machine, about the same size as a car, would have a maximum speed of 330kt (610km/h) and a range of 1,450km (780nm). The 1,090kg (2,400lb) M400 Skycar would lift 340kg to an operational

ceiling of 29,000ft (8,850m). It would also be qualified to travel short distances on the ground as an automobile. Moller claims the M400 can achieve 12km/litre (28 miles/USgal) fuel consumption.

Moller is aiming for M400 certification within three years. So far 100 customers have paid refundable \$5,000 deposits for the M400 and, following the suspension of order taking as the programme slipped, the books were reopened this month. "Initial examples will cost about \$1 million," says Moller,

but volume production could cut the price to around \$200,000. Moller also sees potential markets in border patrol, police work and search and rescue activities.

The airframe is constructed of carbonfibre composites, and the aircraft uses eight 200kW (150hp) aluminium rotary engines, driving four lift fans fitted with thrust-directing vanes, which can be tilted to transition the aircraft from horizontal to vertical flight. Moller is also investigating single-seat and six-seat designs.