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ISN'T SOCIETY NOW OVERPLAYING THE AIRCRAFT NOISE ISSUE?

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It is now some 17 years since the USA, UK and France debated the concept of aircraft noise certification in special conference in London, amid a sharply worsening airport noise climate. It is almost 15 years since the first certification scheme was launched in the USA to be followed hotly by International action through ICAO. Since then ICAO's Committee on Aircraft Noise (CAN) has met to revise and extend its rules 7 times, and FAR Part 36 has gone through 12 strengthening amendments. Even so, the breed of aircraft that originally caused the noise problem still dominates noise exposure patterns around airports. Consequently one is tempted to ask whether the regulatory system has failed society or whether perhaps it has laid the foundations of a progressively improving future situation.

Both are probably true in part, although the system must be accused of overreaction, and it behoves it to tread more cautiously in future. In particular it should seek to heal the wounds from which the industry is losing a disproportionate amount of its life-supporting cash flow.

Consider the strictures placed on the industry and the net benefit to the community. Noise certification, whereby almost every detailed change to an aircraft or its powerplant needs examining for its noise impact, costs the manufacturing industry over half its noise control budget. Airport measures, including flight scheduling, operational techniques, curfews and graded landing fees, cost the airlines as much as the manufacturing industry spends on noise control. Fuel burn alone is at least 1% above baseline. Taxpayers around the world support Government research and administration, consultants and lawyers. In all at least one billion US dollars flow annually in the cause of aircraft noise; enough dollar bills to stuff every ear cocked towards the skies around the world's airports!

And the payoff? Figure 1 displays the airline jet statistics. The world fleet has doubled since the late 1960's, most of the increase being taken up by inherently noisy low bypass powered aircraft. Only now, as they become uneconomic, are they beginning to reduce in absolute numbers, although they have been removed from fleets in developed nations at a faster rate than average. Even so, it will be the late 1980's before modern high bypass technology dominates fleet composition, and this in no way reflects the near hysteria promoting change after change to the noise regulations in less than a decade. The manufacturing industry had been working on noise reduction technology in great seriousness since the mid 1960's, and would never be allowed to lay the findings aside in selling to an airline industry constantly harangued on noise issues.

If it has achieved anything above the natural process, noise certification has guaranteed, at great cost, the

embodiment of a minimum standard of noise control technology. At the same time, it has probably slowed the rate of real improvement by diverting industry's effort from the engineeringly practical to the legislatively hypothetical, and stifled innovation from fear of enforced embodiment of encouraging findings. The time is well overdue for an objective review by industry and government together of the most effective route over the remainder of the Century.

THE TECHNOLOGY BASE

Industry's progress in noise control is indisputable. Figure 2 catalogues the 20 years decline in noise output at almost 1dB per year, at the same time as engine thrust and aircraft carrying capacity has increased fourfold, and these changes are well reflected in airport exposure levels. Figure 3 cites the situation around London's Heathrow Airport, where the area within the UK Noise and Number Index 35 contour (the value at which reaction to aircraft noise notably increases) has almost halved in a decade. This trend is completely in line with independent calculations from the substance of Figs. 1 and 2, represented by the solid line in Fig.3. Extrapolation to 1990 is most encouraging, indicating that exposure levels will be less than when jets started regular operations in the early 1960's.

Consequently, is there any purpose to be served in further stringency or wider applicability of aircraft noise regulations? Particularly since the industry is fast approaching a technological plateau, which can be eroded only by breakthrough or compromise in overall aircraft efficiency. One cannot legislate for the former without recognising the side effect on the latter, and in particular fuel consumption. Consider Fig. 4.

Engine noise is split between turbomachinery and jet exhaust sources. As bypass ratio increases turbomachinery power handling rises and jet exhaust velocities fall, with noise output varying accordingly. For any given cycle the turbomachinery sources assume greater significance at the low powers used for landing approach, due to the reduced jet exhaust velocities. Hence one can design for minimum noise at either full or reduced powers, or compromise between the two. However, as bypass ratio rises (or more accurately as thrust per unit of airflow falls) fuel consumption falls. More so with a "bare" engine, for installation and operational features erode efficiency by virtue of offtake losses, intake and duct losses, nacelle drag and interference effects between the nacelle and the airframe, in proportion to powerplant size. Even so, within the limits of sheer size and required cruise speed there are fuel savings to be made with increasing bypass ratio, and the optimum performance bypass ratio is invariably different from the optimum noise point, and it moves upwards year on year as technology advances improve component efficiencies.

With today's standard of noise technology, performance improvements associated with achieving fuel

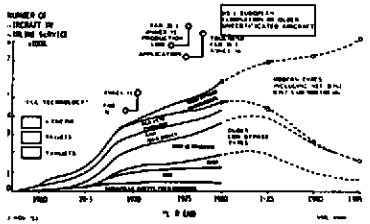

FIG.1 WORLD JET POWERED FLEET GROWTH - ASSOCIATED NOISE LEGISLATION

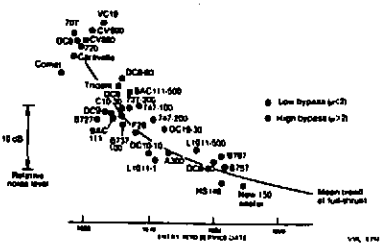

FIG.2 PROGRESS IN NOISE CONTROL

savings carry the challenge of counteracting a tendency to increase source noise. It must be accepted, therefore, that a noise "plateau" is with us, any small improvements possible being used to offset the underlying trend with bypass ratio. Already noise control is inbuilt into every relevant area of the engine (Fig. 5), increasing manufacturing costs by around 5%. Other avenues of reducing aircraft noise must be sought if the downward trend is noise exposure levels is to be maintained.

FUTURE ACTION

Certain clear actions are identifiable, most of which lie in the arena of government.

1. Internationally, ICAO nations must recognise the implications of their special 1981 report [1] and formally agree that Annex 16 standards be held at their current level throughout the 1980's. This will give time for high bypass technology to be implemented virtually fleetwide and its impact to register itself fully in airport exposure levels.
2. With some degree of urgency, the current provisions of Annex 16 must be reviewed with the objective of simplifying compliance procedures, to allow industry to offload its administrative burden and concentrate on real research. It follows that this can be achieved only if ICAO member states eliminate restrictive provisions from their national laws as quickly as ICAO can agree them.
3. With this achieved, say by 1986, ICAO can then be used as a forum to examine the divergence of methodologies apparent in Noise Certification and Airport Noise Control. A 1990's Annex 16, if necessary at all, should be linked more closely to everyday operation, and the data base that it generates on each aircraft made readily usable in the computation of airport noise exposure patterns. In this respect there will need to be changes to the format of Annex 16, to test procedures and to the unique noise unit used therein. Some suggestions for a modified rationale are contained in a previous paper to this body [2].
4. In the same period, ICAO should look closely at all possible operational techniques for reducing community noise, and encourage them in Annex 16. This would automatically demand that those rigid and often irrelevant certification flight procedures that currently feature be substituted by minimum noise operating techniques.
5. Throughout the above the manufacturing and operating industries must be united, and fully co-operative with government in seeking worthwile avenues of approach.

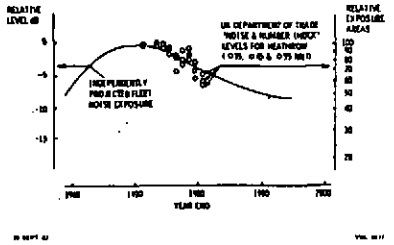

FIG.3 ENVIRONMENTAL SITUATION

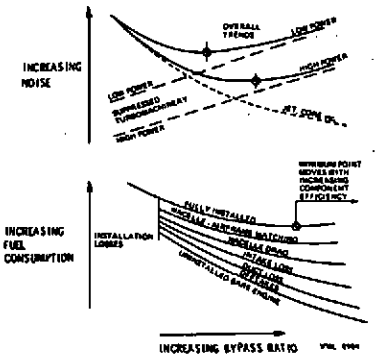

FIG.4 DESIGN CONSTRAINTS

Reference 1. International Civil Aviation Organisation. Assessment of Technological Progress Made in Reduction of Noise From Subsonic and Supersonic Jet Aeroplanes. 1981.

Reference 2. M.J.T. Smith: The Impact and Future Direction of Aircraft Noise Certification. InterNoise 80 pp1187-1190. (Synopsis of fuller paper of the same title published in Noise Control Engineering Vol. 18 No. 2, March-April 1982).

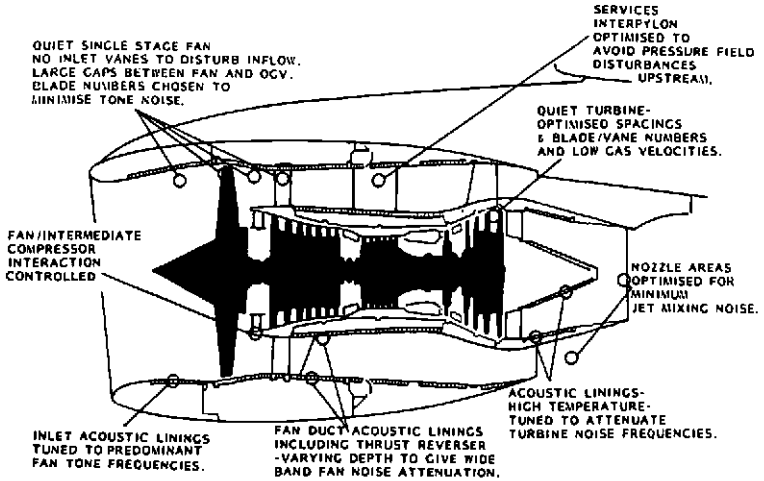

FIG.5 TYPICAL RB211 NOISE REDUCTION FEATURES