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ANALYZED

CF-105 NOISE

Report on Jet Noise Symposium

June 23, 1956

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1. A visit was made on Saturday, June 23 to the Massachusetts Institute of Technology, Cambridge, Mass., to attend a symposium on Jet Noise. This meeting was sponsored by the Acoustical Society of America and the Internation Commission on Acoustics and was part of a one week session on acoustic problems.

2. The significant papers from the meeting were:

(a) Jet Engine Noise Reduction Research at NACA.
Sanders & E. Callaghan (Lewis Labs., N.A.C.A.)

(b) Panel Discussion on Jet Aircraft Noise.

F.B. Greatrex	(Rolls-Royce)
K. Young	(Boeing A/C Co.)
A. Powell	(Southampton University)
J. Tyler	(Pratt & Whitney)
M. Miller	(Douglas A/C Co.)

(c) A Method for Determining the Radiation Characteristics of Aircraft in Flight.

J. Cole	(W.A.D.C.)
D. Kyrazis	(W.A.D.C.)

(d) The Noise Radiation from Jet Aircraft in Flight.

H. von Gierke J. Cole K. Eldred M. Fass L. Hoeft D. Kyrazis	Wright Aeronautical Development Centre, U.S.A.F.

No preprints of the papers were available, so a copy of the Proceedings of the meeting was ordered for the Aircraft Library. This should be delivered around the end of August.

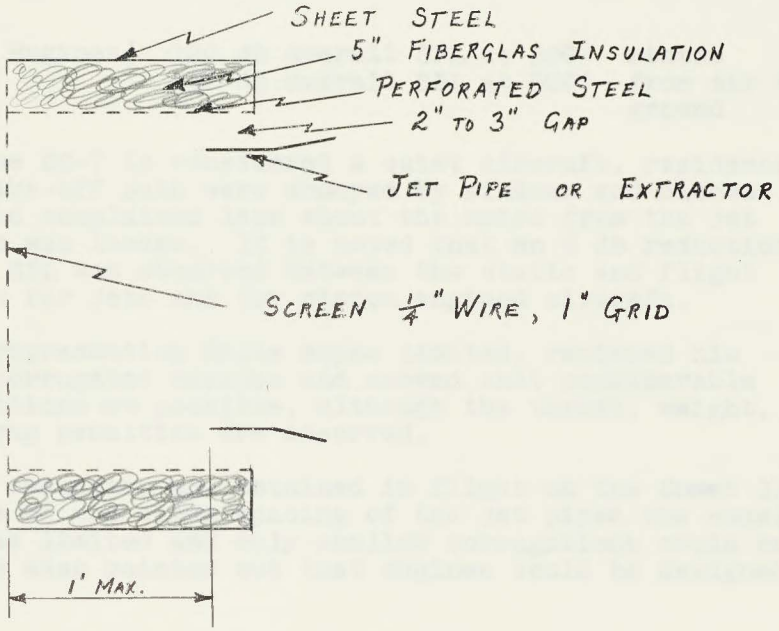
3. N.A.C.A. WORK

To date, N.A.C.A. Lewis Laboratories have been studying the jet noise problem using an engine mounted on a thrust stand in an open field. They have designed and tested various

3. (cont'd)

nozzles, retaining the RPM/JPT characteristics of the engine, and have measured the total Sound Pressure Levels (SPL), frequency spectrum, and thrust loss. Total SPL values 3 to 10 db below those of the basic nozzle have been obtained with some nozzle shapes, but so far these nozzles have given thrust losses from 1-1/2 to 4% at maximum engine R.P.M., and would also increase the base drag if fitted to an aircraft for flight. No flight tests have been conducted.

For static engine runs, they have made cheap, simple screen silencers which can reduce the total SPL by 15 db if located close to the nozzle. If placed too far back, resonance or howling is set up, and this may be worse than the noise from the unsilenced engine. These screens will absorb about 50 - 60% of the engine thrust and are constructed as shown in the sketch below. It is recommended that one be built and tested for CF-100 engine runs with and without afterburner.



N.A.C.A. SILENCER FOR GROUND RUNNING

4. PANEL DISCUSSION

The discussion was concerned primarily with jet transport aircraft for civil use, and it was emphasized that jet silencers for flight would, at their best, cause a weight increment of 100 lb. per engine, and a thrust loss of 1%. These could penalize the payload by about 5% and the airline operators and aircraft manufacturers alike doubt that the noise reduction is worth this penalty. However, their first concern is the lack of adequate standards and objectives on which to base noise reduction programs. In this regard, they have found that the noise from jets, although louder, may be less objectionable in many cases. Also, whereas noise suppressors will probably be specified on the basis of the noise reduction under static conditions, they will be assessed by the communities on the basis of noise reduction during take-off and climb. Douglas Aircraft Co., quotes the following figures:

DC-7	113 db overall SPL at 500'	static
	105 db overall SPL at 500'	from air to ground
RB-66 (2 J-71 Engines)	120 db overall SPL at 500'	static
	112 db overall SPL at 500'	from air to ground

Although the DC-7 is considered a quiet aircraft, residents near the take-off path were annoyed by windows and dishes rattling and complained less about the noise from the jet although it was louder. It is noted that an 8 db reduction in overall SPL was observed between the static and flight cases, both for jets and for piston engined aircraft.

Greatrex, representing Rolls Royce Limited, reviewed his work with corrugated nozzles and showed that considerable noise reductions are possible, although the thrust, weight, and base drag penalties are incurred.

Some noise reduction was obtained in flight on the Comet II, but because of the close spacing of the jet pipes, the nozzle diameter was limited and only shallow corrugations could be tested. He also pointed out that engines could be designed

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to be quieter by using a higher ratio of air mass flow to thrust. Rolls Royce has done this with the Conway by-pass engine.

It is generally felt that considerable theoretical work and much fundamental research work must be done before lasting cures can be found to the noise problems. However, because of the time required for this, aircraft and engine manufacturers have tackled the problem on a trial and error basis to try to make the Douglas DC-8 and Boeing 707 aircraft tolerable when they are introduced.

5. W.A.D.C. PAPERS

The U.S.A.F. work at Wright Aeronautical Development Centre had indicated that the noise levels from aircraft in flight could not be predicted accurately from measurements around a static aircraft in a field. Therefore, they were working on methods of calculating the noise intensity of the source from measurements of noise recorded at points on the ground as aircraft were flown overhead at various heights and speeds. The accuracy seemed little better than that obtained by calculation from static measurements, but some interesting aspects were pointed out.

It was found that on an F-100 aircraft at high speed (M.8), there was little difference in noise level with engine on and off. Their figures were 103 db overall SPL at 500' power on
101 db overall SPL at 500' power off

They conclude that considerable noise is generated by turbulence within the boundary layers and are investigating this in more detail because of possible effects on aircraft structures and on equipment mounted within the aircraft.

Also, they have found that, with aircraft flying at high speeds and low altitudes, the sudden build-up of noise without warning is a greater cause of annoyance and concern than the noise level. Supersonic flying is being restricted to higher altitudes at the present time.

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