

SUMMARY OF NASA QCGAT PROGRAM

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As was stated in the program overview, the QCGAT program objectives were to demonstrate that the application of large turbofan engine technology to small general aviation turbofan engines can achieve low noise, low emissions, and acceptable fuel consumption.

NOISE GOALS

Figure 1 shows the takeoff noise goal. This is the same figure that was shown in the overview, except that the results predicted from ground static testing are shown. Avco is quieter than the goal while AiResearch is meeting the goal. For the sideline and approach conditions (figs. 2 and 3), both engines are quieter than the goals. By meeting or bettering these stringent NASA noise goals, we believe that QCGAT has demonstrated that noise need not be a major constraint on the future growth of the general aviation turbofan fleet.

EMISSION GOALS

The measured emission results for the AiResearch QCGAT engine are shown in figure 4. For each pollutant, the bar at the left shows the published level of the production TFE-731-2 engine. The bar in the center shows the QCGAT goal and the bar at the right, the measured QCGAT results. As can be seen, the carbon monoxide emissions were lower than the goal; the goal for the unburned hydrocarbons was met; and, while the NO_x goal was not met, QCGAT NO_x emissions are lower than those of the production TFE-731-2. Also, engine smoke was not visible.

The measured emission results for the AVCO QCGAT engine are shown in figure 5. No comparisons with production engines are made because there are no comparable production engines. However, it can be seen that measured emissions for carbon monoxide and unburned hydrocarbons are lower than the stringent goals and that NO_x is right at the goal. Again, this engine does not produce visible smoke.

PERFORMANCE GOALS

A comparison of the AiResearch QCGAT engine measured performance with the performance goals is given in table I. The AiResearch QCGAT engine met its

thrust goals both at sea level takeoff and at design cruise. The sea level takeoff SFC is about 2 percent higher than the goal, but at design cruise, where it really counts, the SFC is lower than the goal and is approximately 9 or 10 percent lower than the current production TFE-731-3.

A comparison of the AVCO QCGAT engine measured performance with the goals is given in table II. The AVCO QCGAT engine did not meet the sea level takeoff or design cruise goals for either thrust or SFC. However, the measured numbers are quite respectable. It must be remembered that this engine did not evolve from a mature production engine as did the AiResearch QCGAT engine. It is believed that the AVCO QCGAT engine is one iteration away from meeting the goals.

CONCLUSIONS

The major goals for the QCGAT project were met and the project was completed on schedule and within the NASA budget. We consider this to have been a very successful NASA joint effort with industry.

TABLE I. - AIRESEARCH QCGAT PERFORMANCE

[Standard day; installed]

		Goal	Measured
Sea level takeoff	Thrust, N(lb)	17312 (3892)	17312 (3892)
	SFC, kg/hr-N (lb/hr-lb)	0.0431 (0.423)	0.0440 (0.431)
Design cruise M = 0.8 12 200 km (40 000 ft)	Thrust, N(lb)	4017 (903)	4017 (903)
	SFC, kg/hr-N (lb/hr-lb)	0.0759 (0.744)	0.0756 (0.741)

TABLE II. - AVCO QCGAT PERFORMANCE

[Standard day; installed]

		Goal	Measured
Sea level takeoff	Thrust, N(lb)	7166 (1611)	6485 (1458)
	SFC, kg/hr-N (lb/hr-lb)	0.0370 (0.363)	0.040 (0.392)
Design cruise M = 0.6 7600 km (25 000 ft)	Thrust, N(lb)	2157 (485)	1850 (416)
	SFC, kg/hr-N (lb/hr-lb)	0.0640 (0.628)	0.0737 (0.723)

TAKEOFF NOISE LEVELS

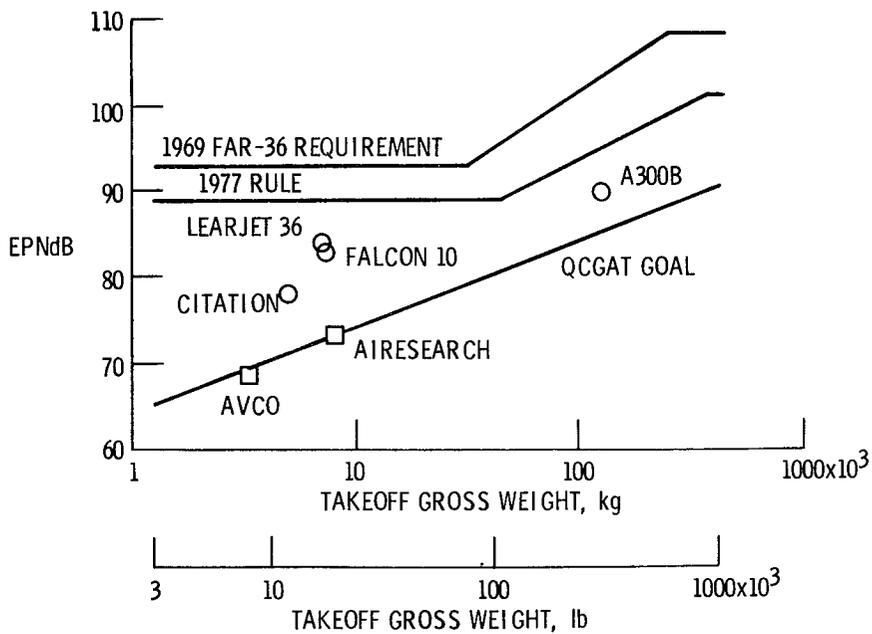


Figure 1

SIDELINE NOISE LEVELS

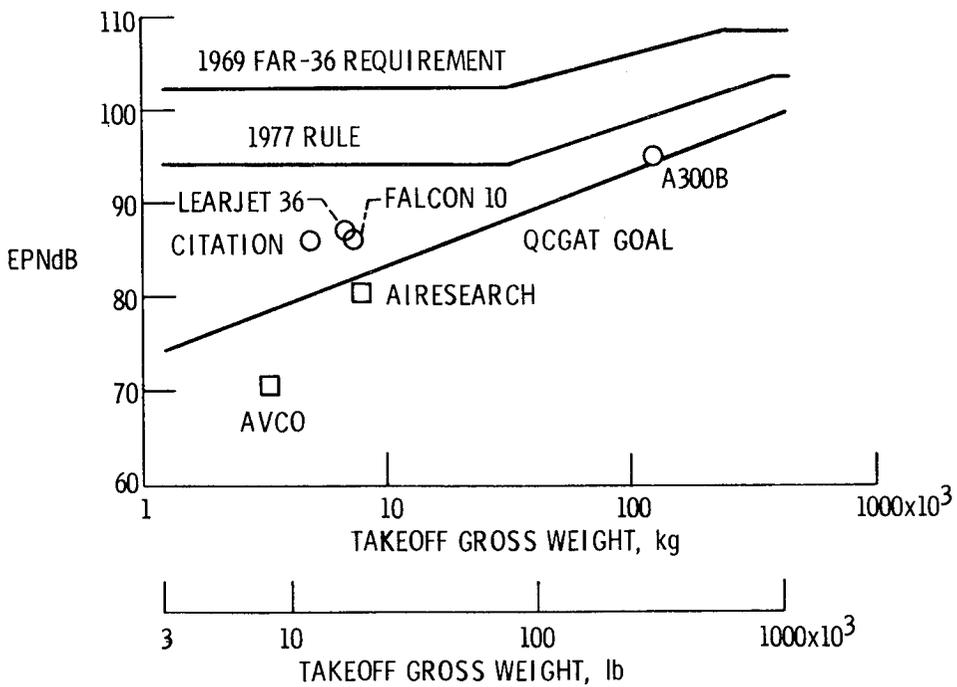


Figure 2

APPROACH NOISE LEVELS

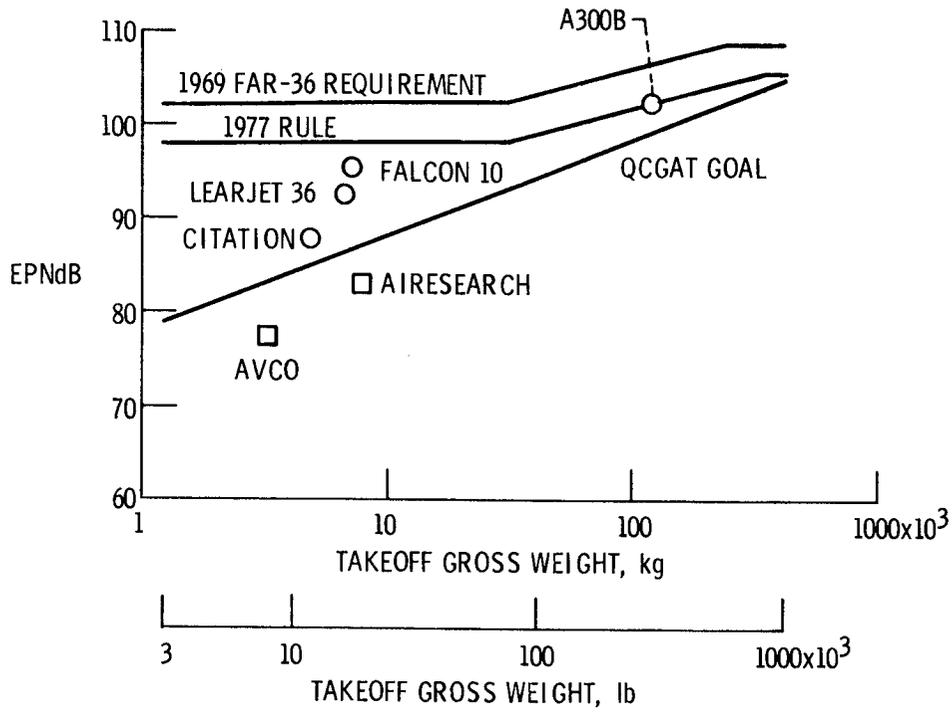
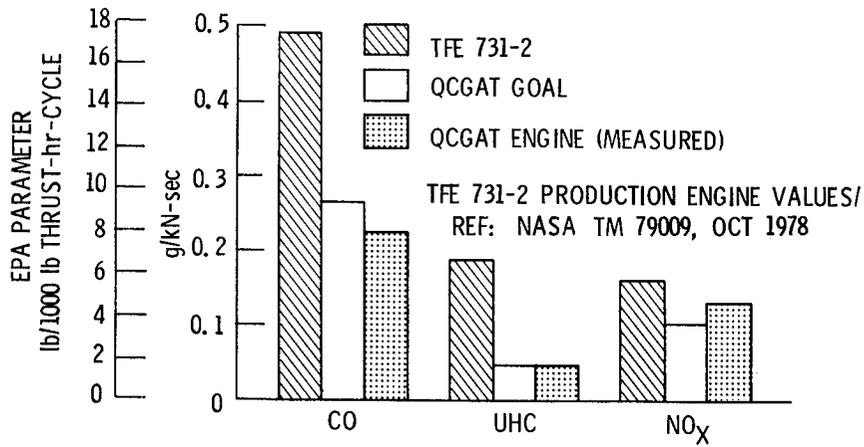


Figure 3

AIRESEARCH QCGAT EMISSIONS



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Figure 4

AVCO QCGAT EMISSIONS

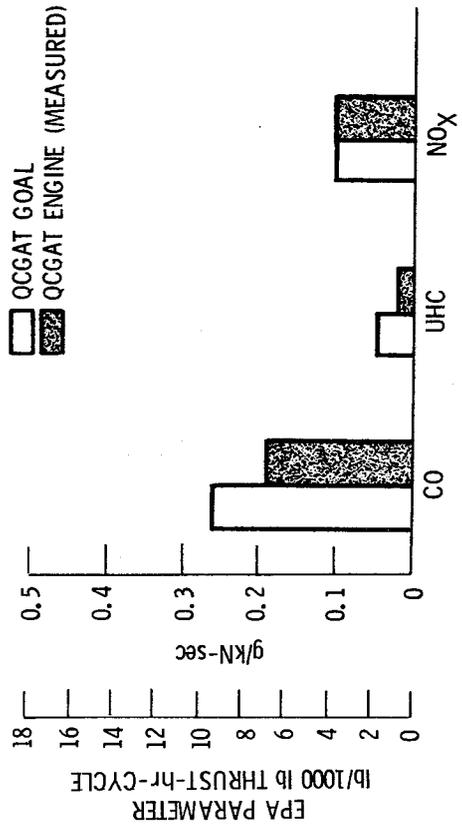


Figure 5

