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JT8D ENGINE INTERNAL EXHAUST MIXER TECHNOLOGY PROGRAM.(U)
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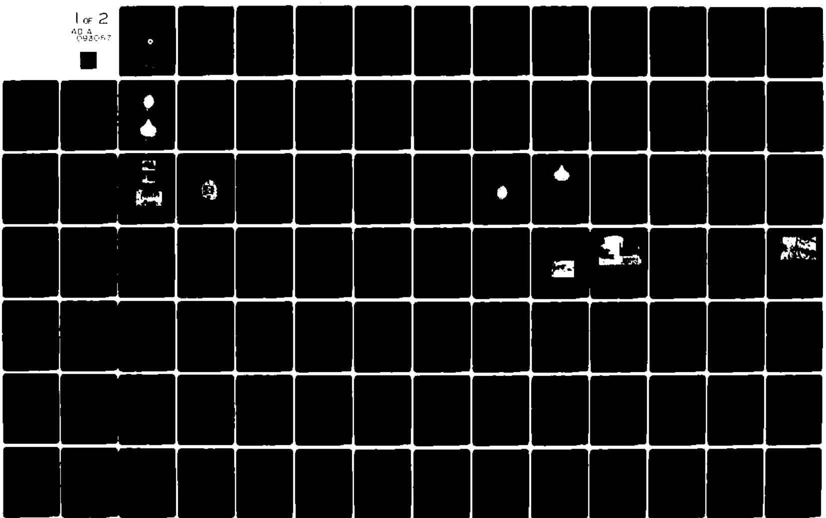

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JT8D ENGINE INTERNAL EXHAUST MIXER TECHNOLOGY PROGRAM

by

F.H. Pond and R.A. Heinz

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Final Report

April 1980

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16. Abstract

This technology program was directed towards demonstrating the reduction in jet noise achieved by the use of an internal exhaust mixer. The effort focused on static engine acoustic testing of different mixer configurations suitable for JT8D-powered commercial aircraft. A series of 12 lobe mixers with different lobe geometries was evaluated for performance and acoustic characteristics. On the basis of test results, the final mixer configuration selected for JT8D-17-powered DC-9 aircraft showed a reduction in jet noise of 2.0 PNdB at static takeoff power with an attendant 0.3 percent improvement in fuel consumption. A second mixer configuration, defined on a preliminary basis for JT8D-powered 727 aircraft, demonstrated a 4.7 PNdB reduction in jet noise at takeoff power. However, a penalty of 1.3 percent in fuel consumption was incurred, and this, combined with an incompatibility in the reverse thrust mode, indicated that significant additional development work is required to demonstrate a viable configuration for 727 aircraft. Testing was also successful in demonstrating the structural integrity of the mixer. In addition, the presence of the mixer did not impart any adverse interactive effects on the stress levels of other engine components.

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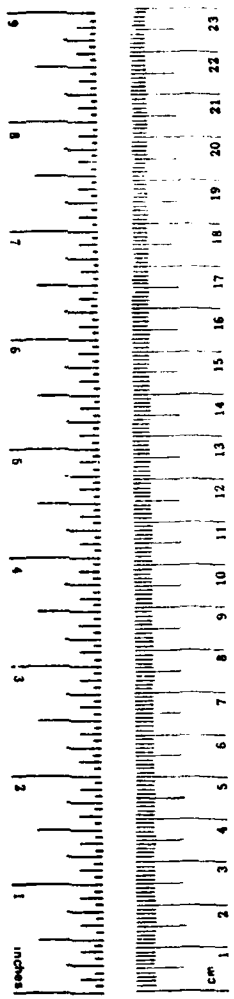
METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

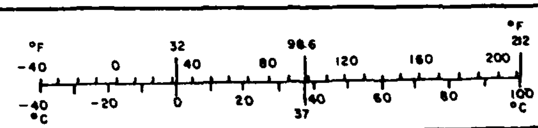
Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



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LIST OF ACRONYMS AND ABBREVIATIONS

A	Area
ALT	Altitude
ADR	Automatic data recording
B/M	Bill-of-material
C_D	Nozzle discharge coefficient
C_T	Nozzle thrust coefficient
dB	Decible, re .0002 dynes/CM^2
Deg	Degree
EPNdB	Effective perceived noise in decibels
EPNL	Effective perceived noise level
EPR	Engine pressure ratio
F	Thrust
Hz	Hertz
MIC	Microphone
Mn	Mach Number
OASPL	Overall sound pressure level
P	Pressure
PNdB	Perceived noise in decibels
PNL	Perceived noise level
PNLT	Total perceived noise level
psig	pounds per square inch gage
SPL	Sound pressure level
SSDS	Steady-state data system
T	Temperature
TEC	Turbine exit case
TSFC	Thrust specific fuel consumption
V	Velocity

Subscripts

AMB	Ambient
Corr	Corrected
F	Fan
N	Net
P	Primary
T	Total

PART I

JT8D ENGINE EXHAUST MIXER PROGRAM — EXECUTIVE SUMMARY

SECTION 1.0 -- INTRODUCTION

During the past seven years, Pratt & Whitney Aircraft has been actively involved in developing internal exhaust mixing technology as a method to suppress jet noise in turbofan engines. Internal exhaust mixing involves mixing the low velocity fan stream flow with the higher velocity core engine flow to produce a uniform exit velocity profile for low noise. Furthermore, if the mixing can be achieved efficiently, an improvement in propulsive efficiency may be attained.

The merit of exhaust mixing has been verified in previous technology programs. Noise reductions up to 3 PNdB have been demonstrated with scale models of mixer configurations under an earlier Federal Aviation Administration (FAA) sponsored program (contract DOT-FA76WA-3809).

To demonstrate that these benefits are translatable to a full scale mixer, Pratt & Whitney Aircraft completed a two-year program sponsored by the Federal Aviation Administration (FAA) and supplemented by an in-house mixer technology program. This effort focused on static engine acoustic testing of different mixer configurations suitable for JT8D-powered commercial aircraft. Most of the work centered on establishing a mixer configuration with a relatively flat exit velocity profile for DC-9 aircraft, although some testing at the end of the program was accomplished on a mixer for a 727 installation. The major goals defined for the program included:

- A reduction in static noise of 3 PNdB (peak percieved noise level)
- Minumum installation changes in JT8D engine-powered aircraft
- No loss in takeoff thrust
- No adverse engine effects
- No increase in cruise thrust specific fuel consumption.

SECTION 2.0 -- MIXER AEROMECHANICAL DESIGN

2.1 DESIGN CONSIDERATIONS AND INSTALLATION REQUIREMENTS

Major factors influencing the mixer aeromechanical design were experience gained in previous work, durability requirements, and compatibility with JT8D engine mounting and structural limitations.

The basic mixer design was predicated on the results from a preceding Federal Aviation Administration and Pratt & Whitney Aircraft-sponsored model test program. This work established the number of lobes and aerodynamic definition of the lobe convolution. In addition, results from ongoing programs funded by Pratt & Whitney Aircraft provided guidelines for the structural design.

Other factors affecting the mixer design were the installation constraints imposed by the different airframes. To coordinate the mixer design with the requirements unique to the DC-9 and 727 airframes, integration studies were conducted on a continuing basis throughout the program. This effort was aimed at assuring component/airframe compatibility with mimimun airframe modifications. Significant results from these studies that directed the mixer design are summarized below.

- The differences between the 727 and DC-9 airframes, in particular the thrust reverser system in the 727 aircraft, dictated a different mixer configuration for each airframe.

- A maximum temperature of approximately 500°F was established for the DC-9 tailpipe acoustic lining because of the potential deleterious effect on the bonding of the lining material. The implications of a 900°F temperature recorded on the 727 tailpipe could be potentially serious, but were not investigated because tailpipe considerations for this test were deleted by the FAA.

- The outer attachment flange and support system was revised to improve structural integrity characteristics.

2.2 FINAL MIXER DESIGNS

On the basis of airframe differences, separate designs were pursued for each installation. The final mixer configurations, as evolved through experimental testing, are shown in Figures 2.3-1 and 2.3-2 for the DC-9 and Boeing 727 installations, respectively. Each design was successful in reducing peak perceived noise levels and meeting physical installation requirements. However, although a determination of any operational problems between the 5Z mixer and 727 tailpipe while in the reverse thrust mode was beyond the scope of work in this program, testing in a related program has identified a mixer/reverser incompatibility in the reverse thrust mode.

The principal components of the mixer assembly are the (1) convoluted mixer geometry, (2) hardwall tailplug and (3) outer support ring. Both mixers are a 12-lobe configuration. In each design, the tailplug is supported by twelve inner struts and the entire mixer structure is supported by twelve outer struts. The outer support system is flexible to compensate for thermal expansion differences between the lobes and outer attachment ring. The main distinction in the two mixers, however, is the differences in the lobe geometry, particularly the discharge scarf angles.

Figure 2.3-1 Mixer Design for the DC-9 Airframe.

Figure 2.3-2 Mixer Design for the 727 Airframe.

A cross sectional view of the mixer design and installation hardware for the DC-9 airframe, designated configuration Mod. 5M, is shown in Figure 2.3-3. Because of the tailpipe temperature limit, the lobe shape and length is sufficient to direct the high temperature core gases away from the tailpipe outer wall. This design is characterized by nonuniform scarf cuts. Larger scarf angles are incorporated on the top lobes, relative to the bottom six lobes to accommodate the cant in the DC-9 tailpipe.

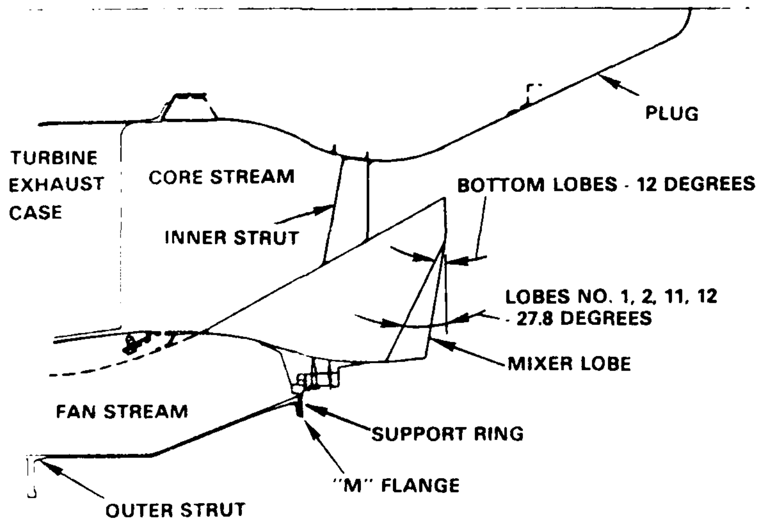


Figure 2.3-3 Cross Sectional View of Mod. 5M Configuration

A cross sectional view of the mixer for the 727 airframe, designated configuration Mod. 5Z, is shown in Figure 2.3-4. In contrast to the 5M configuration, the lobes have uniform scarfing of 36 degrees and extended lobe valleys. Since no tailpipe temperature restrictions were imposed with the 727 installation, the lobes were shorter and oriented for minimum protrusion into the reverser cascade area in order to prevent interference during operation in the reverse thrust mode. The tailplug has also been moved aft 6 inches to improve engine matching and reduce the mixer/plug gap.

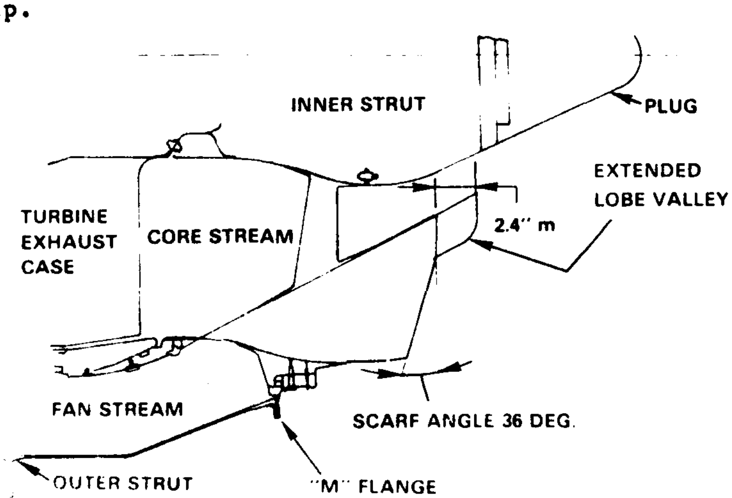


Figure 2.3-4 Cross Sectional View of Mod. 5Z Configuration

Both mixers are fabricated from conventional materials using standard manufacturing practices. Installation trials demonstrated that the mixer could be installed in an engine in an hour or less.

SECTION 3.0 — EXPERIMENTAL ENGINE TEST RESULTS

3.1 TEST PROGRAM SUMMARY

Substantiation and refinement of the mixer designs was accomplished through a series of performance and acoustic evaluations using a Pratt & Whitney Aircraft JT8D-17 experimental engine as the test vehicle. All testing was conducted at sea level static conditions. Special instrumentation was installed to monitor engine sensitivity to the presence of the mixer and to acquire key temperature and pressure data, including exit profile patterns. Acoustic testing was conducted at the Pratt & Whitney Aircraft outdoor acoustic facility, which is equipped to measure far field, near field and sideline noise levels.

In total, 11 mixer configurations were evaluated during the program, accounting for approximately 230 hours of development testing. Over 1100 performance data points and 360 acoustic points were acquired.

3.2 OVERALL PERFORMANCE EFFECTS

General engine component operating characteristics were essentially unaffected by the installation of the final mixer configurations. Fan surge margin, although sensitive to area ratio as demonstrated during the testing of earlier configurations, closely approached the characteristics of a standard JT8D engine with the final mixer configurations. The effects on operation in the reverse mode were not investigated in this program. Other key engine parameters such as net thrust, discharge pressures and temperatures, and flow showed only slight differences from standard engine levels. The effects on fuel consumption and noise levels are summarized in following sections.

The degree of radial and circumferential mixing was assessed by obtaining velocity profiles of the nozzle exit plane. Figure 3.1-1 illustrates the effectiveness of the final mixer configurations to disperse radially the higher temperature and higher velocity core gases. The dispersion of core gases to the outer portion of the fan stream is most pronounced with the Mod. 5Z mixer since the tailpipe wall temperature was not a constraint. In contrast, the degree of radial penetration of core gases in the DC-9 tailpipe is decreased because of the temperature limits.

3.3 ACOUSTIC CHARACTERISTICS

Experimental testing of the final mixer configurations demonstrated significant static jet noise reductions over the range of engine thrust settings, frequencies and angles. The peak static noise reduction attained with the Mod. 5M mixer with the DC-9 tailpipe was 2.3 PNdB, which approached the goal of 3 PNdB. However, the goal was surpassed by nearly 1.7 PNdB with the Mod. 5Z in the 727 tailpipe. The differences in noise suppression are attributed essentially to the differences in mixing associated with the mixer design modifications to limit the outer wall temperature in the DC-9 tailpipe.

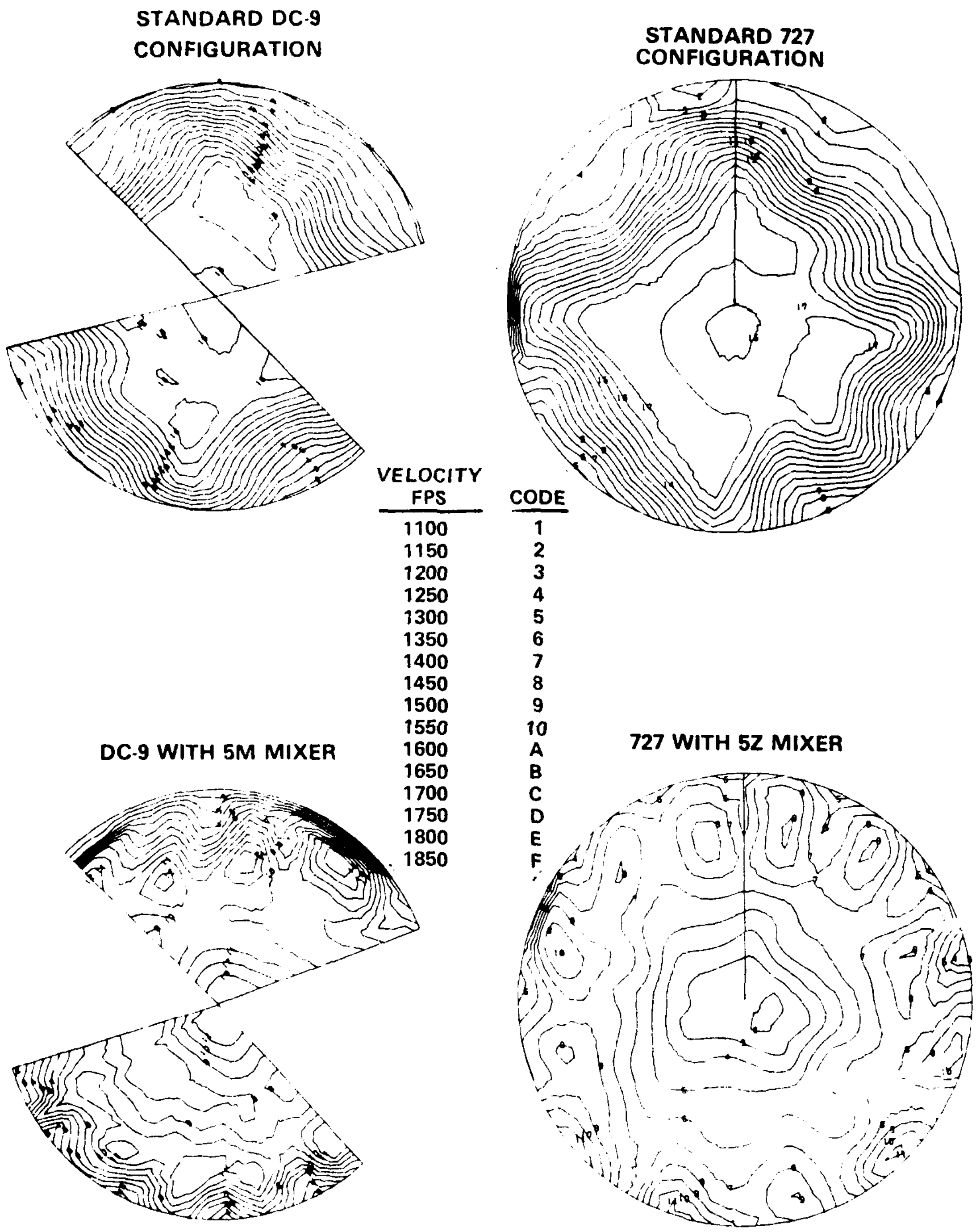


Figure 3.1-1 Exit Velocity Profiles

The trends of peak perceived noise level reduction as a function of thrust in Figure 3.2-1 exemplify the magnitude of noise suppression achieved with the two final mixers relative to standard JT8D noise levels. As indicated, the greatest reductions occur in the 12,000 to 16,000-pound range, which relate to cutback and takeoff flight operation. Similar trends were evident from the analysis of directivity patterns and noise spectra.

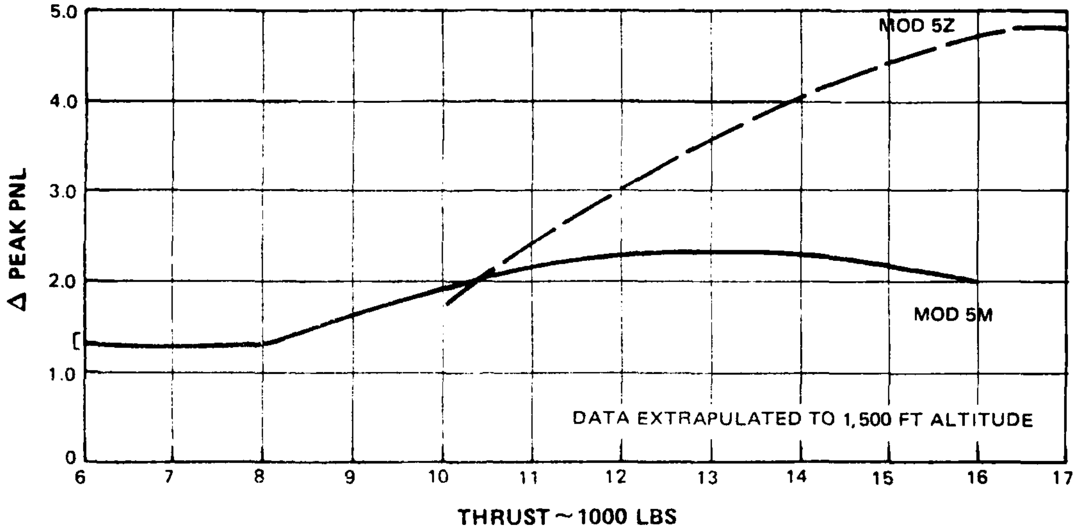


Figure 3.2-1 Noise Reduction Trends

Predictions of in-flight noise for a level flyover were analytically derived for three static gross thrust levels. The results, summarized in the Table 3.3-I, indicate that at JT8D-9 and JT8D-17 takeoff gross thrusts of 14,500 and 16,000 lbs., respectively, the large noise reduction advantage measured under static conditions of the 5Z/727 configuration relative to the 5M/DC9 configuration would be somewhat reduced in the flight situation.

3.4 FUEL CONSUMPTION EFFECTS

Installation of the Mod. 5M mixer with the DC-9 tailpipe produced a 0.3 percent reduction in fuel consumption at static takeoff thrust, thus achieving an important performance goal. However, fuel consumption was increased by 1.3 percent with the 5Z mixer/727 tailpipe configuration.

Predictions of fuel consumption at simulated altitude cruise conditions are shown in Figures 3.3-1. In comparison to a standard JT8D engine, the Mod. 5M mixer increases the propulsive efficiency at the maximum cruise thrust to reduce fuel consumption by 0.75 percent. At 80 percent of the cruise thrust, a 0.2 percent increase is estimated.

TABLE 3.3-I

STATIC AND SIMULATED LEVEL FLYOVER NOISE REDUCTIONS
(1500 ft. altitude)

	Mixer 5M (Flat Profile)	Mixer 5Z (Inverted Profile)
Static Test Results (Peak PNL Reduction)		
D-17 Takeoff Thrust (16,000 lb.)	2.0	4.7
D-9 Takeoff Thrust (14,500 lb.)	2.2	4.5
Takeoff Cutback (12,000 lb.)	2.3	3.0
Analytical Flyover Predictions (EPNL Reduction)		
D-17 Takeoff Thrust	2.7	4.3
D-9 Takeoff Thrust	2.6	4.2
Takeoff Cutback	2.4	3.2

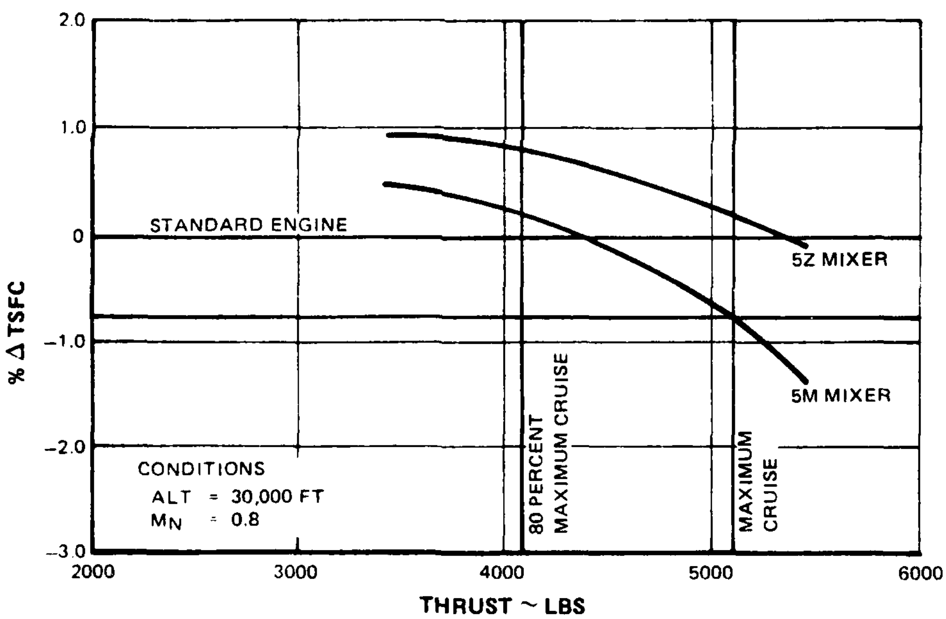


Figure 3.3-1 Predicted Fuel Consumption at Simulated Cruise

The estimated fuel efficiency with the 5Z mixer is much less favorable. An increase approaching 0.8 percent is predicted at 80 percent cruise, but the increase is reduced to 0.2 percent as thrust increases to the maximum cruise condition. This result, in combination with the takeoff fuel consumption characteristics, indicates that further refinements are required in the 5Z configuration.

3.5 STRUCTURAL INTEGRITY

Testing was successful in substantiating the structural integrity of the mixer component. Typically, thermal-mechanical stress levels were well below conservative analytically-derived limits. Also, surface metal temperatures were within established limits. Inspections of the different mixer configurations throughout the test program showed no evidence of cracking or other indications of thermal distress. On the basis of these results and observations, it is believed that the mixer has the structural capability to meet flight test requirements.

In addition, the presence of the mixer did not impart any adverse effects on the stress levels of other engine components. Comparative strain gage measurements, both with and without the mixer, showed essentially no differences in fan and low-pressure turbine vibratory stress characteristics, verifying that the mixer does not produce any aerodynamic excitation on uptream components.

SECTION 4.0 -- CONCLUSIONS AND CONCLUDING REMARKS

On the basis of the results obtained from the different series of performance and acoustic tests, the following conclusions have been made.

- A mixer geometry has been defined for JT8D-powered DC-9 aircraft. However, a configuration has been defined only on a preliminary basis for 727 aircraft.

- The testing accomplished under this program has been successful in demonstrating the acoustic benefits of internal exhaust mixing technology. Moreover, these benefits are attainable, particularly with the Mod. 5M configuration for the DC-9 aircraft, without serious compromises in engine performance. Further refinement of the 5Z mixer for the 727 installation is necessary to negate the demonstrated loss in engine performance.

- Installation of the 5M mixer does not impart any special problems or extensive modifications to either the airframe or JT8D mounting system. Further work is required with the 5Z design, however, to prevent an adverse flow interaction with the thrust reverser while operating in the reverse mode.

- Structural integrity of the mixer component has been demonstrated.

The technical achievements made in this program have contributed substantially towards furthering the state-of-the-art in noise reduction technology. Also, this effort has identified areas, particularly with the Mod. 5Z mixer configuration, where additional refinement or development is necessary. Such areas should be thoroughly investigated as part of a static engine test program. Configurations suitable for service engines should be then flight tested to verify structural and environmental performance under flight conditions.

PART II

MIXER DESIGN AND DEVELOPMENT TESTING

TECHNICAL DISCUSSION

SECTION 1.0
INTERNAL MIXER DESIGN AND FABRICATION

1.1 INTRODUCTION

Design and fabrication of the mixer was conducted under Task 1 of the program. The initial design effort was directed towards definition of a base mixer configuration. However, as the design evolved through experimental engine testing to a final configuration, design, design associated analyses and various fabrication operations were performed on a continuing basis.

In conjunction with the design process, Pratt & Whitney Aircraft conducted design coordination studies with the airframe manufacturers to ensure mixer compatibility with aircraft installation requirements. The studies were conducted under Task 2 of the program and focused on the requirements of the Boeing 727 and McDonnell Douglas DC-9 aircraft.

This section describes the aeromechanical design of the base mixer, including evolution of the design to the final configurations. Also discussed are the results of the airframe compatability studies and the fabrication of the mixer component.

1.2 DESIGN GOALS AND AIRFRAME INTEGRATION REQUIREMENTS

1.2.1 Mixer Design Goals

Design criteria for the internal mixer component were directed towards meeting several aero/acoustic performance and structural goals. In terms of performance, the goal was to achieve a noise reduction of at least 3 PNdB without any negative effects on engine performance such as an increase in cruise fuel consumption or a loss in takeoff thrust.

From a structural standpoint, goals were established for weight, durability, and installation effects. A definitive weight goal was not determined. However, the intent was to minimize component weight without compromising structural integrity.

Installation effects were a special area of concern. The goal was to minimize airframe changes and JT8D mounting requirements imposed by installing the mixer in DC-9 and 727 aircraft. In working towards this end, airframe compatibility studies and field surveys were conducted with the airframe manufacturers to ensure compatibility of the mixer design with the different aircraft installations. Results of these studies are discussed in the following section.

1.2.2 Airframe Integration Requirements

Key design information pertaining to installation requirements and constraints unique to the DC-9 and 727 airframes was acquired from field surveys and compatibility studies with the airframe manufacturers. This effort was conducted in parallel with the evolution of the mixer design. As design modifications evolved, detailed prints were reviewed by the airframe manufacturers to determine potential airframe integration problems.

One major result which had a profound impact on both the direction of the program and mixer design was the determination that one common design was not compatible with both the DC-9 and 727 installations. The thrust reverser in the DC-9 aircraft is external to the tailpipe and thus has little interaction with the mixer. In contrast, the thrust reverser in the 727 installation presents a special problem. This reverser incorporates blocker doors that redirect the flow through a series of cascades in the sides of the tailpipe. Consequently, the mixer discharge plane can actually protrude beyond the leading edge of the cascade passages and adversely affect the engine match in the reverse mode. These differences between the DC-9 and 727 reverser are depicted in Figure 1.2.2-1.

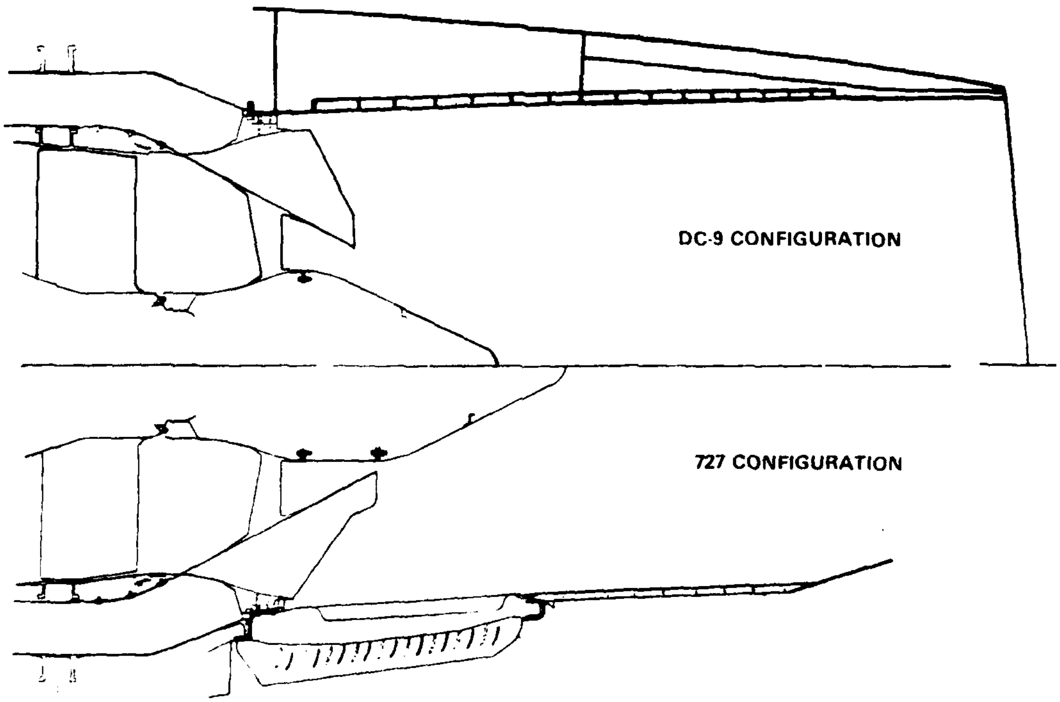


Figure 1.2.2-1 DC-9 and 727 Installations -- The major differences between the DC-9 and 727 installations, resulting primarily from the thrust reverser designs, are shown in this figure.

The method of eliminating lobe protrusion in the 727 installation involved incorporating a severe mixer lobe angle. This, however, produced unacceptably high tailpipe wall acoustic liner temperatures in the DC-9 installation. As a result, it was evident that a single mixer design would not meet the requirements of the different airframes, and separate designs were pursued for each airframe.

The occurrance of high temperatures on the outer wall of the DC-9 tailpipe introduced some additional design constraints. As identified through design coordination with the airframe manufacturers, the high temperatures adversely affected the bonding of the acoustic material lining, thus reducing service life. With increased mixing, elevated temperatures could be experienced along the tailpipe walls, and assuming fully mixed flow, temperatures up to 700°F were predicted at takeoff. For the type of bonding technique used in the DC-9 tailpipe, a temperature of 500°F was considered the limit to maintain current service life. This limit became a governing criterion in defining a design for the DC-9 installation. However, a temperature limit was not established for the 727 tailpipe. While temperature considerations were deleted by the FAA for the 727 tailpipe, subsequent integration efforts with the manufacturer may result in similar limitations.

The coordination effort was also instrumental in determining the final design of the outer attachment flange. The early designs incorporated a 0.500-inch flange welded to the outer struts, making the mixer an integral assembly. However, this configuration introduced a potentially high stress condition because of the thermal mismatch between the mixer and attachment ring. Also, The Boeing Company indicated that any flange over 0.160 inch thick was unacceptable because of a potential mismatch of the nacelle doors and door seals. On the basis of these requirements, the selected attachment scheme eliminated a high stress concentration and meets the thickness limit.

1.3 BASE MIXER DESIGN

Definition of the full scale base mixer design, in terms of basic configuration and aerodynamics, was predicated on results from the preceding one-seventh scale model test progam sponsored by the Federal Aviation Administration under Contract DOT-FA76WA-3809. In brief, three basic model configurations were reported in this program: a long flowpath design tested under the Federal Aviation Administration contract, a short flowpath design and a zero length design tested in a Pratt & Whitney Aircraft program. A summary of the pertinent performance and physical characteristics of each design is presented in Table 1.3-I. On the basis of these results and aircraft installation considerations, the zero length configuration was selected as the base design concept for the full scale JT8D mixer.

TABLE 1.3-I

MIXER SCALE MODEL TEST RESULTS
(Reported under FAA Contract DOT-FA76WA-3809)

	Long Flowpath	Short Flowpath	Zero Length Flowpath
Engine Length Extension (in)	16	7.6	0.15 to 0.25
Weight increase (lbs)	157	125	105
Takeoff Noise Reduction (dB)	3-4	3-4	3-4
Takeoff Thrust (%)	0	-0.25	-0.30
Cruise Fuel Consumption Improvement (%)	1.3	0.9	0.5

1.3.1 Aerodynamic Definition

The flowpath of the base mixer was defined by scaling key dimensions directly from the model points with one important exception. The final model evolved directly from the 7.6 in. M flange extension model through variations in scarfing and plug positioning. Therefore, the flowpath of the final mixer model was not considered optimum for the length of the extension desired. In defining the flowpath for the full scale mixer, the mixer and plug were translated 2.6 inches rearward to achieve less severe turning of fan stream flow as it enters the mixer. The flowpath of the final model is compared to the flowpath of the full scale mixer in Figure 1.3.1-1.

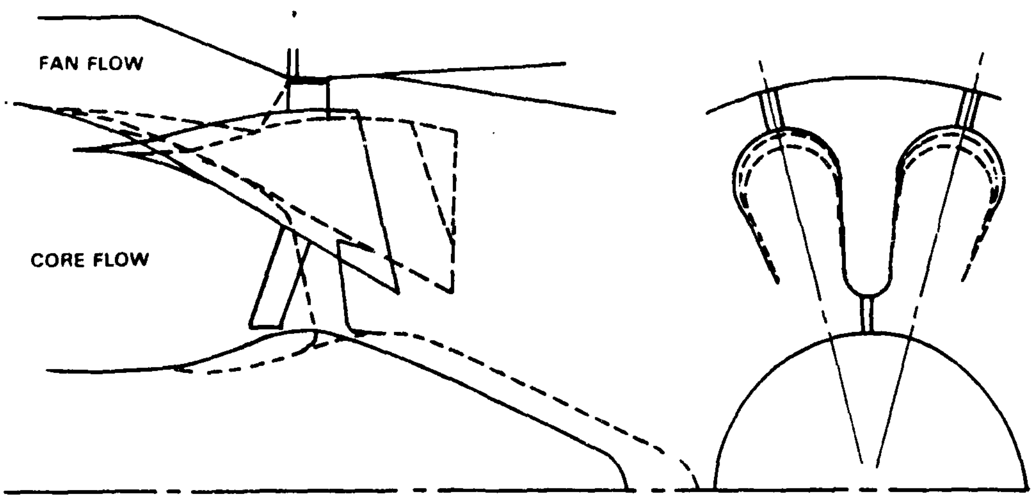


Figure 1.3.1-1 Mixer Aerodynamic Flowpath Definition -- This comparison shows the close resemblance of the flowpath of the zero length model to that of the base mixer.

The shape of the centerbody and side profiles of the full scale design are essentially the same as the model. An adjustment was made to the relative flow areas in the fan and core streams to reflect a shift in effective area ratio, a requirement recognized during a Pratt & Whitney Aircraft-sponsored mixer technology program. The revision consisted of a slightly larger fan stream area in order to maintain desired fan operation with the mixer installed.

1.3.2 Mechanical Definition

A cross sectional view of the base mixer mechanical design is shown in Figure 1.3.2-1. The main components of the mixer assembly are the 12-lobe convoluted mixer geometry, a hardwall tailplug with a slip joint front flange and an outer ring that supports the complete mixer system through twelve struts. The design is based on a modular construction so that installation or removal of the mixer can be easily accomplished and to negate any requirement for new engine cases.

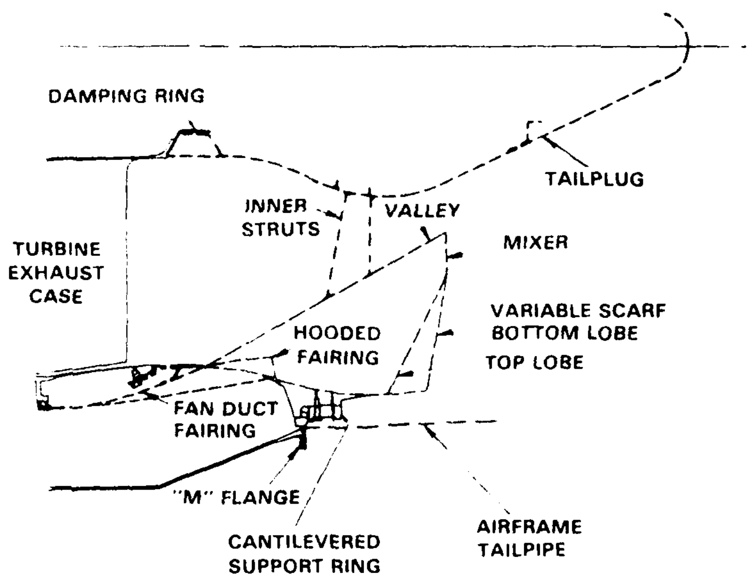


Figure 1.3.2-1 Mixer Mechanical Definition -- This figure identifies the various components that were designed and fabricated during the program.

Allowances for radial and axial thermal expansion were considered in the design of the slip joints. Also, the lobe walls are curved to minimize panel vibration and sensitivity to thermal and pressure gradients.

The support system consists of twelve inner struts to support the tailplug, along with twelve outer struts to support the entire mixer structure. In addition to structural support, the struts provide concentricity and circumferential pitch control to ensure the most acceptable mixing profile. The inner struts were fabricated from Inconel 625 nickel base alloy and the outer struts were fabricated from Inconel 718.

The inner struts are aerodynamically shaped and welded to the inner lobe, as shown in Figure 1.3.2-1. This method of support facilitates modular assembly and prevents loads on the tailplug from being applied to the inner flange of the turbine exhaust case. The sheet metal ring on the exhaust case inner flange provides a flexible interface with the tailplug as well as additional structural stability.

The outer support ring, sandwiched between the fan exhaust duct (M flange) and the aircraft tailpipe/reverser flange, was sized to absorb engine maneuver, blowoff and thermal loads. The ring is manufactured from Inconel 718 material, a nickel base alloy.

The mixer lobes and the tailplug are constructed from Inconel 625 material. The selection of this material was based on strength characteristics, fabricability and cost considerations. In addition, this material has excellent repairability properties for service usage.

The aluminum fan duct fairing is convoluted to serve as a fan flow filler piece. This fairing consists of three segments to facilitate installation. The segments are attached to the outer mixer crown and inner valleys. The fairing is slotted to allow optimizing the match of the flowpath at the lobe valley interface and crown forward of the outer struts.

1.4 MIXER FABRICATION

Fabrication of the base mixer subassembly, installation hardware and tooling was accomplished with conventional manufacturing practices and standards used at Pratt & Whitney Aircraft. Before machining operations were initiated, however, raw materials were examined as a quality assurance measure.

In fabricating the mixer subassembly, lobe sections were first stamped out of sheet metal and welded together to form the convoluted structure. A completed lobe section is shown in Figure 1.4-1. After individual sections were formed, each was welded together to construct the mixer subassembly. Slots to accommodate the inner and outer struts were then installed, as shown in Figure 1.4-2. Finally, finishing operations, such as final machining, polishing and smoothing the flowpath surface, were completed.

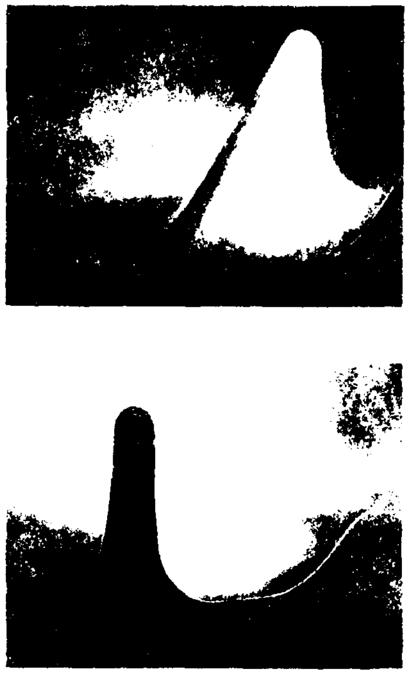


Figure 1.4-1 Mixer Lobe Sections

Figure 1.4-2 Mixer Subassembly in Final Stage of Rough Machining -- At this stage of the fabrication process, the slots for installing the inner and outer supports struts are being machined in the lobes.

Precautions were taken to minimize lobe distortion during welding. Also, various quality control checks were performed during the different phases of manufacturing. These consisted of dimensional inspections of critical tolerances and areas and detailed visual examinations for flaws such as welding deficiencies or cracking.

The inner and outer support struts were manufactured with numerical-controlled equipment because of the somewhat complex geometry. This necessitated developing a computer program for machining as well as conducting trials to verify the machining sequence and finished part.

After machining, the struts were installed to the inner and outer support rings. The finished base mixer is shown in Figure 1.4-3.

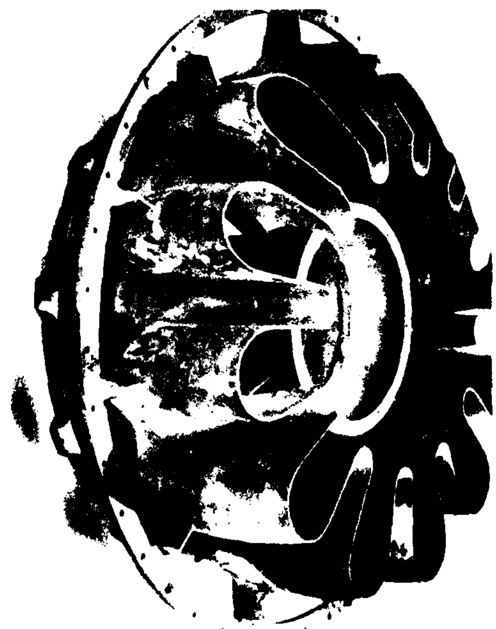
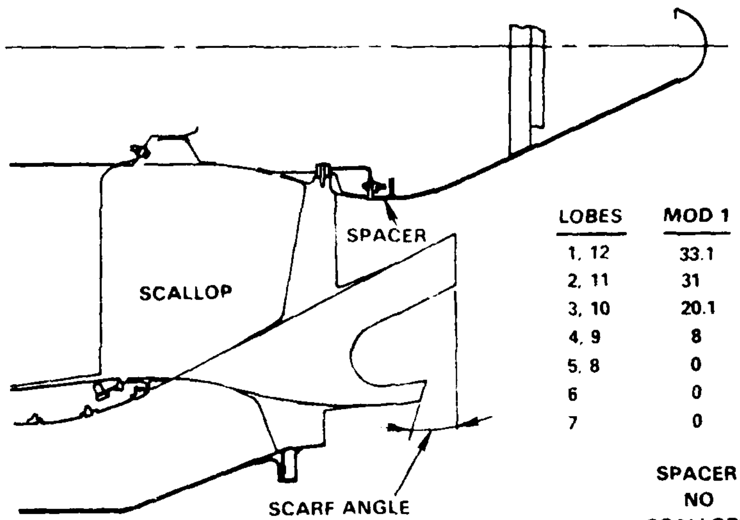


Figure 1.4-3 Finished Mixer Subassembly -- The fininshed component is shown with the support struts and rings welded in place.

1.5 SUMMARY OF MIXER DESIGN EVOLUTION

Several perturbations of the base mixer configuration were made based on the results of experimental engine testing and airframe compatibility studies. In total, five main generations evolved from the initial design. A performance summary of the different mixer designs is presented in Section 3.2 of Part II.

The base mixer (referred to as Mod. 1) was modified because of performance considerations. The modifications consisted of scallop cuts in each of the twelve lobes to move the mixing plane forward, thereby decreasing the effective area ratio. A cross sectional view of this configuration, designated Mod. 2, is shown in Figure 1.5-1 compared to the base design.

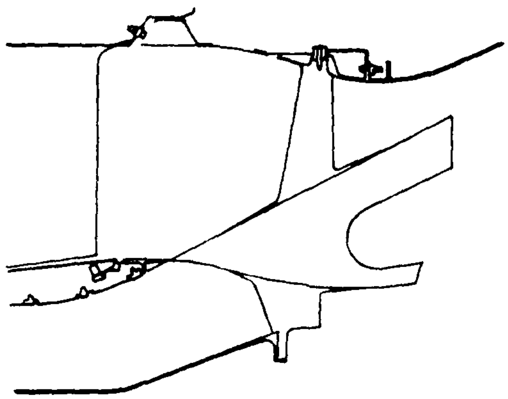


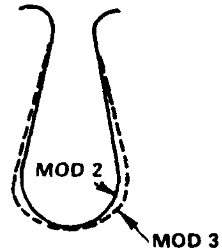
LOBES	MOD 1	MOD 2
1, 12	33.1	34.2
2, 11	31	32.5
3, 10	20.1	24.4
4, 9	8	17.2
5, 8	0	10.3
6	0	0
7	0	6.5
	SPACER NO SCALLOPS	NO SPACER SCALLOPS

Figure 1.5-1 Mixer Configuration Mod. 2 -- This design is characterized by the scallop cut lobes.

The scalloping was only partially successful in restoring nominal JT8D performance and further revisions were necessary. These changes defined the Mod. 3 configuration and are indicatad in Figure 1.5.-2. The changes included bulging the lobe sidewalls and increasing the scarf angles.

Configuration Mod. 4 represented a continued refinement of mixer aerodynamic and acoustic performance. The lobe sidewall bulge evident in Mod 3 was eliminated and the radial penetration of the mixer lobes was increased to improve engine matching. In the evolution of the Mod. 4 design, several variations were evaluated, including hooded fairings, hooded fairings with short fan exhaust fillers, straight fairings with long fan exhaust duct fillers, and scarf angle variations to reduce tailpipe wall temperatures.





SCARF ANGLE DEG.

LOBES	MOD 2	MOD 3
1,12	34.2	34.2
2,11	32.5	32.5
3,10	24.4	27.1
4,9	17.2	21.2
5,8	10.3	15.3
6	0	5.4
7	6.5	9.3

Figure 1.5-2 Mixer Configuration Mod. 3 -- The main feature of this design is bulged lobes and increased scarf angles.

The problem of excessively high tailpipe wall temperatures, which was detrimental to the bonding of the acoustic tailpipe lining in the DC-9 aircaft, was resolved by allowing a thin cooling layer of fan air to remain against the wall while mixing continued within the confines of this layer. This was achieved by modifying the scarf angles at the mixer discharge plane. Increasing the amount of radial inward turning of the core gases at the outer portion of the mixer discharge resulted in a lower wall temperature, although some loss in mixing efficiency was evident. Various scarf angles were tested to determine the angle that would provide a temperature within the airframe manufactures limits, while imparting a minimum effect on mixing performance. By varying the scarfing from lobe to lobe, an effect of tailpipe cant could also be reconciled.

Configuration Mod. 4A was successful in achieving acceptable performance, noise reduction, engine match and tailpipe temperatures. However, the outer support system became an area of concern and consequently necessitated redesign. A cross sectional view of the Mod. 4A design is shown in Figure 1.5-3, and Table 1.5-I lists the different combinations of changes tested, including scarf angles, in the Mod. 4 generation.

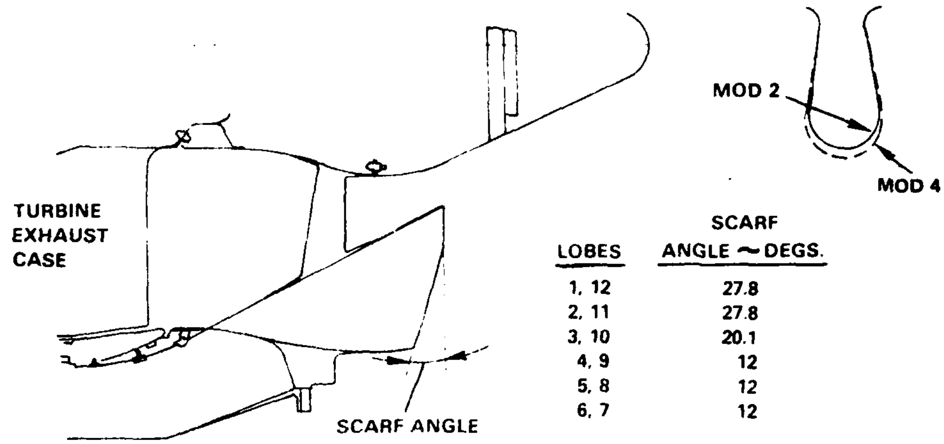


Figure 1.5-3 Mixer Configuration Mod. 4A -- The main feature of this design is increased penetration and modified scarf angles.

As in the base mixer design, all configurations evaluated through Mod. 4A incorporated a 0.500-inch attachment flange welded to the outer support struts, thereby making the mixer assembly one integral unit. A potential problem, however, was a high stress area resulting from the thermal growth mismatch of the mixer and the appreciably cooler outer ring. In addition, results of compatibility studies from The Boeing Company disclosed that an outer attachment flange thickness in excess of 0.160 inch would be unacceptable because of the potential mismatch of the nacelle door and door seals. After an analytical assessment of several attachment schemes, the approach shown in Figure 1.5-4 was adopted. This design allows a flexible retension/support system and complies with the thickness requirement dictated by the Boeing installation.

TABLE 1.5-I

SUMMARY OF DIFFERENT MOD. 4 DESIGNS

CONFIGURATION		SCARF ANGLE					
	Lobe #	1,12	2,11	3,10	4,9	5,8	6,7
Mod 4		27.8	27.8	20.1	8	0	0
Mod 4A		27.8	27.8	20.1	12	12	12
Mod 4B		27.8	27.8	20.1	20	20	16
Mod 4C		27.8	27.8	20.1	20	20	16
Mos 4D		27.8	27.8	20.,1	15	15	15

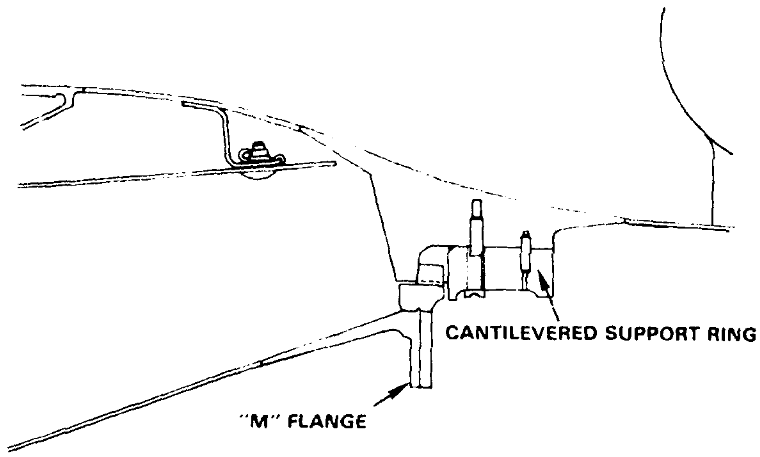


Figure 1.5-4 Revised Outer Strut Retension Scheme -- This flexible attachment scheme eliminates the potentially high stress condition in the earlier welded configuration.

The final generation, Mod. 5, combined the optimized Mod. 4A flowpath with the redesigned outer support system. The basic configuration produced unacceptablly high tailpipe wall temperatures. A series of configurations with revised scarf angles as well as other subtle changes was evaluated in the Pratt & Whitney Aircraft sponsored program. The configuration demonstrating acceptable performance, noise reduction and airframe compatability for the DC-9 installation was designated 5M. Because of the differences in the Boeing installation, however, additional refinements to the 5M design were necessary. The final configuration for the Boeing application was designated 5Z.

A cross sectional view of the basic Mod. 5 design is shown in Figure 1.5-5, and Table 1.5-II lists the different combinations of changes tested. Each of the final configurations is described fully in the next section.

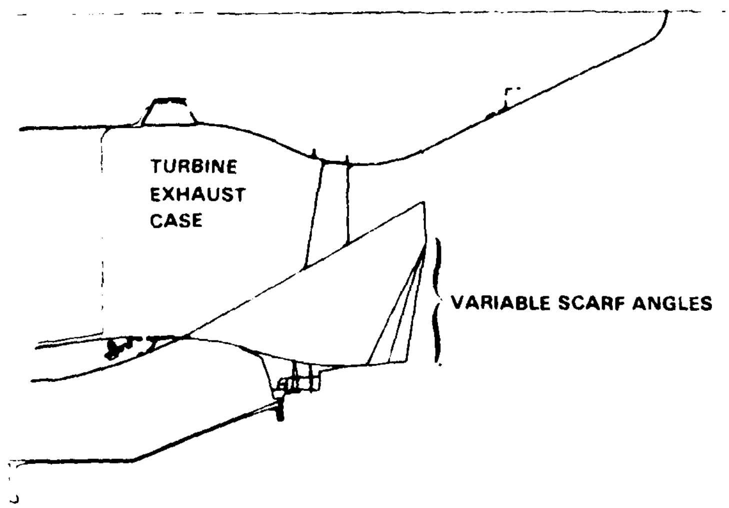


Figure 1.5-5 Basic Mod. 5 Mixer Configuration

TABLE 1.5-II

SUMMARY OF DIFFERENT MOD. 5 DESIGNS

CONFIGURATION		SCARF ANGLE					
	Lobe #	1,12	2,11	3,10	4,9	5,8	6,7
Mod 5M		27.8	27.8	20	12	12	12
Mod 5Z		36	36	36	36	36	36

1.6 FINAL MIXER DESIGNS

The final mixer configurations, Mods. 5M and 5Z, are illustrated in Figures 1.6-1 and 1.6-2, respectively. Figure 1.6-3 shows a cross sectional view of the 5M mixer and the relative positioning in conjunction with the DC-9 tailpipe exhaust/reverser system. A similar illustration is presented in Figure 1.6-4 for the 5Z/727 tailpipe configuration.

Figure 1.6-1 Final Mod 5M mixer for the DC-9 Installation

The main distinction between the two mixer configurations is the difference in lobe geometries. Figure 1.6-5 shows the flowpath definition of the 5M and 5Z mixers, along with a summary of the lobe scarf angles. As indicated, the scarf angles in the 5M configuration are nonuniform -- angles are higher at the top six lobes relative to the bottom six. The higher angles direct the high temperature core gases away from the outer wall of the canted tailpipe to maintain acceptable tailpipe liner temperatures in the DC-9 installation.

Figure 1.6.2 Final Mod. 5Z mixer for the 727 Installation

As stated previously, the thrust reverser in the 727 installation presented some unique design challenges. To minimize the impact of reverser/mixer interactions on operating stability in the reverse mode, lobe scarfing was more severe in comparison to the 5M mixer. As indicated in Figure 1.6-4, the mixer was scarfed to the point where the outer strut support pad joins the mixer skin. The lobe geometry of the 5Z mixer is characterized by an exaggerated scarf angle that is uniform in all twelve lobes at 36 degrees, as indicated in Figure 1.6-5. Since tailpipe temperature restrictions were eliminated by the FAA for the 727 application, the lobes were shorter and oriented for maximum mixing of high temperature core gasses. The extreme scarf angles do not guarantee satisfactory operation in the reverse thrust mode. Test results from a related program have shown that the operating line limit is exceeded by 1.5 percent with the 5Z mixer incorporated.

Because of the redesigned outer support, the Inconel 718 ring, which was selected initially for welding compatibility with the mixer subassembly, was replaced with AMS 5616 (Greek Ascoloy material). This material is less expensive and has a better thermal coefficient match with the existing fan exhaust duct.

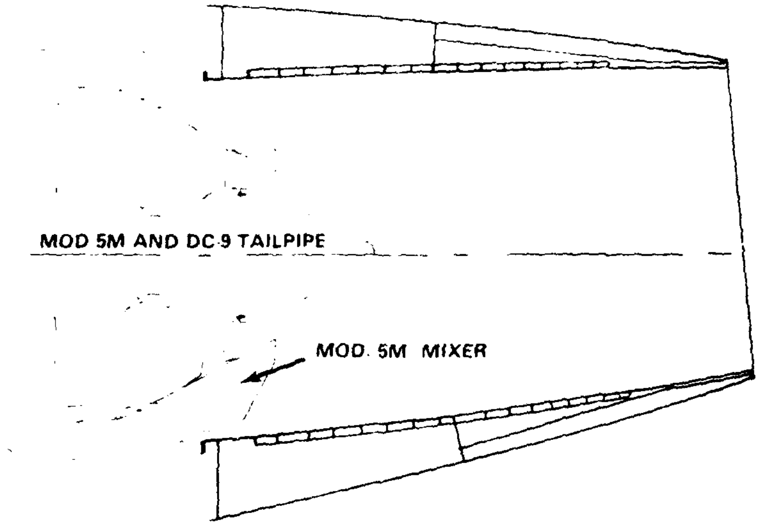


Figure 1.6-3 5M Mixer and DC-9 Tailpipe -- This cross sectional view depicts the orientation and interface of the mixer with the DC-9 tailpipe and reverser system.

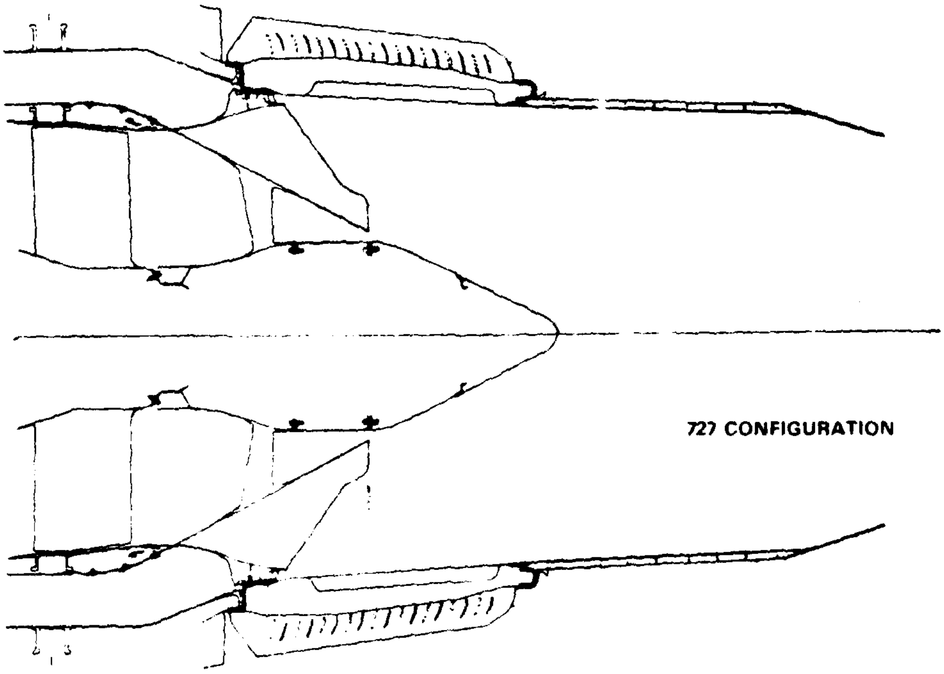
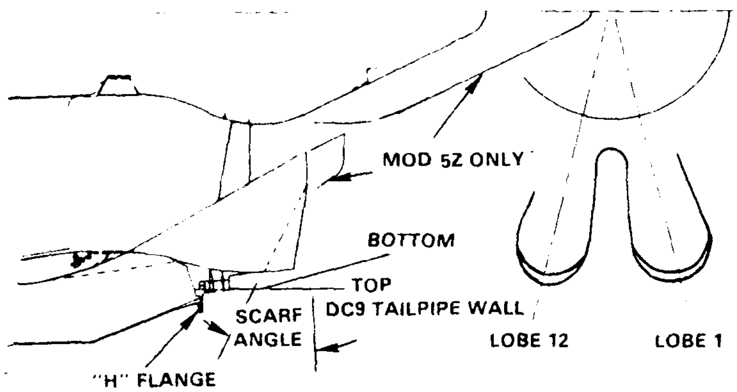


Figure 1.6-4 52 Mixer and 727 Tailpipe -- This figure shows the orientation and interface of the mixer with the 727 tailpipe and reverser system.



SCARF ANGLE~DEG.

LOBE	MOD 5M	MOD 5Z
1, 12	20	36
2, 11	28	36
3, 10	20	36
4, 9	12	36
5, 6	7.5	36
6, 7	6	36

Figure 1.6-5 Flowpath Definition of the Final Mixers -- The main difference is the nonuniformity in lobe scarf angles in the 5M configuration relative to the 5Z configuration.

Mixer axial, radial and tangential thermal-mechanical loads are taken at the 12 mixer strut locations and transferred into the ring. The ring is attached to the fan exhaust duct. Axial loading is transferred through a hardface wear surface on both the mixer struts and support ring. The tangential loading is transferred through anti-torque lugs that are integral with the mixer strut and fitted into grooves on the support ring. Radial loads are transferred from the strut base to the ring through a contact wear surface. The ring has a deeper groove at one location and a corresponding longer lug on the mixer strut to allow for proper orientation when the mixer system is installed into the engine.

An aerodynamic fairing is bolted to the mixer strut. This locks the component axially and radially to the support ring if an inward radial load and a forward axial load occurred. Once locked together, the mixer system can be installed as a module onto the engine.

SECTION 2.0

TEST PROGRAM AND PROCEDURES

2.1 INTRODUCTION

The test plan for demonstrating mixer performance and acoustic goals was organized under Task 3 of the program. This involved defining a matrix of operating conditions for acquiring meaningful performance and acoustic data and appropiate test procedures. In addition, it entailed preparing the test vehicle for testing, establishing instrumentation requirements and selecting the test facilities.

This section describes the test plan and technical approach for conducting the performance and acoustic evaluations. Also presented are descriptions of the test vehicle, instrumentation, special test equipment, and test facilities used during the program.

2.2 TEST OBJECTIVES AND METHODOLOGY

2.2.1 Test Objectives

The overall objective of the experimental test program was to demonstrate a mixer configuration that met or exceeded the goals for performance, noise suppression and durability. However, in addition to this objective, specific test objectives were defined for the different phases of performance and acoustic testing.

Objectives for the performance tests were to:

- o Determine the installed performance with the mixer in comparison to a standard JT8D engine.
- o Identify the necessary jet nozzle area changes required to optimize engine performance with the mixer installed.
- o Determine the performance impact of the mixer on other engine components.

The objectives for the acoustic tests were to:

- o Provide a complete characterization of engine noise levels under static conditions both with and without the mixer throughout the operating range.
- o Using the measured static data, estimate the noise reduction provided by the mixer under flight conditions.

2.2.2 Test Method and Procedures

The general test approach consisted of first conducting a performance calibration without the mixer installed to acquire baseline data pertaining to engine aerothermodynamic performance. The same operating conditions would then be repeated with the mixer installed for a direct comparison. A similar procedure was also employed for the acoustic tests. The test matrix of operating conditions as well as specific test procedures for both performance and acoustic evaluations are described in the following sections.

2.2.2.1 Performance Test Procedures

Performance tests were conducted at sea level static conditions. Before actual testing was initiated, a functional checkout of the test stand support systems and data acquisition equipment was conducted. After engine startup was accomplished and operation was stabilized at preselected steady-state conditions, checkouts of instrumentation, electrical and plumbing systems were made. With the satisfactory comple_ion of these checks, testing proceeded according to the planned program.

The performance calibration consisted of a total of ten operating conditions run in order of decreasing power. These power settings are tabulated in Table 2.2.2-I. Engine operation at each power setting was stabilized for at least three minutes before acquisition of data.

For data consistency and accuracy during the performance calibriation, the following general test procedures were followed.

- A thrust meter adjusted calibration was conducted prior to testing and after all remount or engine module changes. "As is" thrust meter calibrations were completed immediately after each performance calibration.

- Fuel samples were obtained before and immediately after each performance calibration. The samples were sent to the Pratt & Whitney Aircraft Materials Engineering and Research Laboratory for specific gravity amd lower heating value analyses.

- Instrumentation and data recording systems were checked both at idle and 10,000 pound thrust settings prior to the acquisition of performance data. Calibrations, however, were not conducted when critical instrumentation was inoperative.

- Fuel flow was measured using two 0.750-inch coxmeters calibrated prior to use and "as-is" calibrated after testing was completed.

TABLE 2.2.2-I
STEADY-STATE CALIBRATION POWER SETTINGS

Point No.	Corrected Net Thrust (lbs)
1	16,500*
2	16,000 (Takeoff)
3	15,000
4	13,000
5	11,000
6	10,000
7	9,000
8	6,000
9	3,000
10	Idle

* Observe all engine operating limits:
Maximum low-pressure rotor speed of 8600 rpm
Maximum high-pressure rotor speed of 11,950 rpm
Maximum exhaust gas temperature of 1202°F
Maximum burner pressure of 247 psig.

2.2.2.2 Acoustic Test Procedures

D ing the acoustic tests, a four-step procedure was followed to ensure accurate and consistent measurements of engine noise levels.

(1) The engine power setting was set at a preselected level. After operation was stabilized for approximately three minutes, noise levels were recorded for a period of 60 seconds, with all microphone signals being recorded simultaneously. During the recording period, the tape recorded playback signal was monitored to ensure that each microphone signal was being properly recorded as well as acceptable in quality.

(2) Engine performance data were recorded concurrently during the acoustic data acquisition. Engine low-pressure rotor speed was maintained to a $\pm$ 25 rpm tolerance during this period.

(3) Along with noise and performance, ambient air temperature, relative humidity, barometric pressure, and wind velocity were recorded at each test condition. Neither noise nor performance were recorded when the wind speed exceeded 8 knots or when the crosswind component exceeded 5 knots.

(4) Acoustic data tapes and respective data sheets were sent to the tape library to await data reduction.

Table 2.2.2-II presents typical operating conditions (pertinent to the analysis of acoustic data) at which noise measurements were obtained with both a standard engine configuration and with the Mod. 5M mixer using a DC-9 tailpipe. Similar information is presented in Table 2.2.2-III for the JT8D engine with a 727 tailpipe both with and without a Mod. 5Z mixer.

Constant Thrust Comparison Method for Baseline and Mixer Acoustic Data

Table 2.2.2-IV presents a sample of an acoustic data printout. Listed on this sheet are the ambient test conditions, reference values of observed and corrected low-pressure rotor speed, and one-third octave band sound pressure level (SPL) values at each one-third octave band center frequency for each microphone (denoted by angle relative to the upstream jet axis). At each angle, values of overall sound pressure level (OASPL) and perceived noise level (PNL) are also listed. All the acoustic data presented are corrected to a 77°F day at the measurement radius of 150 feet from the centerline of the tailpipe exit. A tabulation of acoustic data at a selection of operating conditions is included in Appendix A.

The goal of the noise measurements was to provide a direct assessment of the noise levels of both a standard JT8D engine and configurations with the internal mixer installed at the same values of engine thrust. Since installation of the mixer causes a slight change in engine match characteristics along with engine operating line and since the same value of thrust for both standard and mixed configurations could not be set during testing, the following procedure was employed for provide equal thrust noise comparisons.

(1) Noise data for each engine test configuration were extrapolated to a distance of 1500 feet, parallel to the tailpipe centerline, and perceived noise levels were calculated.

(2) At each angle, the 1500-foot perceived noise level was correlated to the core jet velocity, V_p 77° (expanded to ambient pressure and corrected to a 77°F day), using a least squares third order regression computer program. (Based on jet noise theory and Pratt & Whitney Aircraft experience, jet velocity has been shown to be a better correlating parameter for jet noise than the other available engine parameters.) As an example, Figure 2.2.2-1 shows regression curves for a perceived noise level at 140 degrees versus core jet velocity for a standard JT8D and mixer configuration. Regression curves at other angles were of similar quality.

(3) From the performance values in Tables 2.2.2-II and III, correlations of engine thrust and core jet velocity were developed for both the standard and mixer configurations. Table 2.2.2-V lists core jet velocity values for static gross thrusts, ranging from 6000 to 16,000 pounds for the engine with a DC-9 tailpipe.

TABLE 2.2.2-II
STANDARD ENGINE AND MIXER (MOD. 5M)
OPERATING CONDITIONS WITH DC-9 TAILPIPE

Corrected Thrust *	Corrected Low Rotor Speed **	Engine Pressure Ratio	Exhaust Gas Temp.***	Core Jet Velocity +	Corrected Low Rotor Speed (Ref) ++
		Standard Engine			
4561	5363	1.2585	1160	958	5335
7637	6470	1.4719	1258	1281	6447
10636	7172	1.7039	1348	1543	7151
5608	5789	1.3282	1190	1075	5775
8678	6750	1.5508	1289	1377	6730
7692	6479	1.4754	1257	1285	6467
13597	7756	1.9528	1434	1770	7741
4152	5159	1.2314	1147	908	5149
16041	8424	2.1829	1545	1968	8406
3585	4865	1.1958	1119	833	4858
14591	7990	2.0435	1467	1845	7972
9734	6987	1.6324	1326	1472	6964
11589	7325	1.7780	1385	1622	7304
16595	8576	2.2342	1578	2020	8566
15560	8262	2.1366	1508	1923	8242
		With Mixer			
7669	6579	1.4634	1265	1271	6557
12571	7590	1.8579	1405	1690	7565
5651	5889	1.3202	1185	1062	5889
4642	5504	1.2524	1153	945	5486
16551	8593	2.2429	1584	2028	8552
8720	6817	1.544	1287	1371	6817
4203	5285	1.2232	1138	890	5263
14709	8010	2.0565	1476	1860	8010
3616	4995	1.1884	1116	817	4976
10803	7258	1.7060	1357	1550	7231
15820	8362	2.1675	1532	1955	8337
4625	7023	1.6135	1319	1453	7023
7784	6582	1.4680	1255	1275	6554
13890	7829	1.9671	1444	1785	7800
16361	8512	2.2187	1567	2005	8489

* Engine thrust in pounds as measured by the thrust meter at the test stand and corrected to standard day barometric pressures.

** Rotor speed in revolutions per minute corrected to a 59°F day.

*** Temperature in °R corrected to 59°F

\+ Velocity in feet per second expanded to ambient pressure and corrected to a 77°F day.

++ An approximate value of corrected low-pressure rotor speed based on the test stand rpm meter. This value is used to identify the acoustic data printouts contained in Appendix A.

TABLE 2.2.2-III
STANDARD ENGINE AND MIXER (MOD. 5Z)
OPERATING CONDITIONS WITH 727 TAILPIPE

Corrected Thrust *	Corrected Low Rotor Speed **	Engine Pressure Ratio	Exhaust Gas Temp.***	Core Jet Velocity +	Corrected Low Rotor Speed (Ref) ++
			Standard Engine		
17,610	8894	2.336	1645	2113	8892
17,530	8880	2.326	1639	2104	8875
16,628	8616	2.327	1564	2011	8614
16,332	8521	2.217	1540	1985	8527
16,246	8497	2.205	1534	1975	8497
15,702	8337	2.156	1498	1926	8333
14,688	8053	2.057	1449	1840	8056
14,331	7965	2.022	1435	1811	7968
14,269	7942	2.015	1433	1806	7946
13,167	7668	1.913	1394	1719	7670
12,999	7647	1.896	1391	1706	7640
11,350	7298	1.757	1342	1580	7301
11,298	7280	1.751	1342	1576	7275
9,262	6922	1.599	1285	1419	6913
9,199	6915	1.593	1286	1414	6913
5,388	5562	1.289	1145	1068	5554
4,788	5556	1.286	1145	994	5557
			With Mixer		
17,447	8892	2.321	1648	2108	8892
17,428	8857	2.335	1635	2106	8853
15,946	8478	2.181	1527	1958	8474
15,840	8414	2.182	1510	1948	8417
15,472	8336	2.139	1493	1914	8333
15,440	8304	2.144	1485	1911	8300
15,031	8242	2.089	1473	1874	8245
14,956	8184	2.092	1461	1868	8183
14,569	8120	2.043	1450	1833	8123
14,455	8065	2.038	1439	1823	8063
14,007	7982	1.989	1423	1784	7977
13,634	7901	1.950	1410	1752	7893
13,541	7864	1.945	1402	1744	7861
12,417	7641	1.836	1363	1649	7631
10,713	7314	1.685	1311	1506	7310
10,618	7288	1.676	1309	1498	7288
8,773	6970	1.528	1260	1339	6970
6,784	6434	1.386	1198	1153	6441
6,744	6406	1.385	1193	1149	6403
4,789	5611	1.248	1127	927	5606
4,729	5589	1.244	1123	919	5588

* Thrust levels based on correlations of indoor and outdoor test stand thrust specific fuel consumption.

** Rotor speed in revolutions per minute corrected to a 59°F day.

*** Temperature in °R corrected to 59°F

\+ Velocity in feet per second expanded to ambient pressure and corrected to a 77°F day.

\+\+ An approximate value of corrected low-pressure rotor speed based on the test stand rpm meter. This value is used to identify the acoustic data printouts contained in Appendix A.

TABLE 2.2.2-IV

ACOUSTIC DATA PRINTOUT SAMPLE

2351 H 01923 JT8D-17 REF SPLITTER B/L,DC9 REV 5DEG CANT NORTH GP150RA150.1740

ENGINE MODEL	= JT8D -17			INLET TEMP	= 30.00 F
ENGINE NUMBER	= 000372	TEMPERATURE	= 30.0 F	TIME OF DAY	= 756
CAL LEVEL	= 124.0 DB.			BARM. PRESSURE	= 30.02 IN. HG.
STAND	= X-314	HUMIDITY	= 78.0 PER CT.	WIND DIRECTION	= S
DATE	= 02/28/79			WIND VELOCITY	= 1 MPH
		OBSERVED RPM	= 6265		
		CORRECTED RPM	= 6447		

FAA PART 36 REFERENCE DAY CORRECTED SPL IN DB - RADIUS = 150.0 FT.

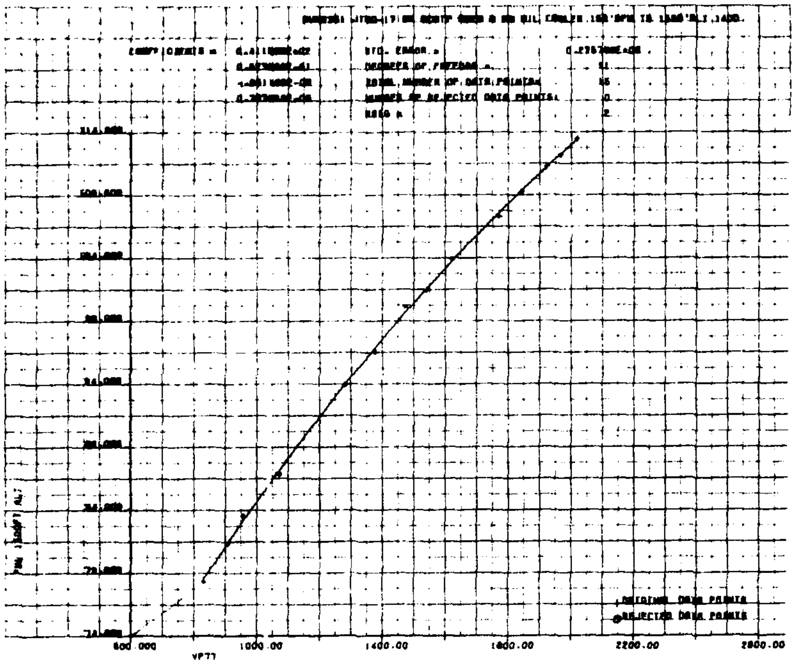
ANGLE IN DEGREES

CENTER FREQ. (KHZ)	90	100	110	120	130	135	140	145	150	155
.050	87.7	89.2	90.3	93.6	98.4	100.3	101.8	103.0	104.4	105.7
.063	89.8	91.1	91.8	95.3	100.0	102.6	104.1	105.8	106.2	107.3
.080	90.1	91.6	93.7	96.6	101.8	104.3	106.3	107.8	108.2	108.3
.100	91.8	94.1	95.7	98.5	103.2	105.5	107.0	108.7	109.2	109.6
.125	93.5	95.2	97.1	99.5	104.4	106.4	107.8	108.8	108.5	108.3
.160	94.6	96.0	98.1	100.9	105.0	106.6	107.2	108.1	108.4	104.1
.200	95.2	97.1	98.9	101.6	104.9	105.9	106.7	106.2	106.4	101.1
.250	95.0	97.5	99.5	101.6	104.4	105.0	105.0	104.2	104.3	98.5
.315	96.3	97.9	99.9	102.2	104.2	104.1	103.6	102.4	102.4	98.9
.400	96.8	98.3	100.0	101.9	103.6	103.1	102.5	101.5	100.5	98.7
.500	95.6	97.6	99.0	101.0	102.3	101.5	101.0	99.6	98.9	96.5
.630	94.7	97.2	98.3	100.3	101.3	100.5	99.5	98.2	97.9	94.6
.800	94.2	96.4	97.6	99.0	99.8	99.0	97.9	96.9	96.1	94.0
1.00	93.6	95.6	96.8	98.0	98.4	97.2	96.6	95.1	94.0	92.9
1.25	93.0	94.7	96.1	97.1	96.9	95.8	94.8	93.2	92.6	91.7
1.60	92.6	94.2	95.2	95.9	95.7	94.7	93.3	91.9	91.2	90.8
2.00	91.6	93.7	94.3	94.8	94.4	93.0	92.2	90.4	89.6	89.2
2.50	90.9	93.2	93.7	93.8	93.3	92.6	91.0	89.6	88.6	88.2
3.15	90.2	91.6	92.6	92.4	91.8	91.4	89.8	88.7	87.4	86.6
4.00	89.6	90.4	91.1	90.3	90.4	89.7	88.0	86.6	86.0	85.2
5.00	87.4	89.4	89.3	88.9	88.6	87.8	86.7	84.8	84.4	82.9
6.30	89.8	92.1	90.9	89.3	88.1	87.2	87.4	85.9	85.6	83.5
8.00	92.5	95.3	95.5	92.1	90.8	88.9	87.8	86.4	86.0	84.0
10.0	90.6	94.2	96.2	93.6	91.2	88.9	87.5	86.1	85.5	83.5
OASPL	107.0	108.9	110.3	112.0	114.6	115.5	116.1	116.7	116.9	116.0
PNLT	117.4	119.4	120.3	121.0	121.8	121.6	121.5	120.9	120.8	119.3
PNL	117.4	119.4	120.3	121.0	121.8	121.6	121.5	120.9	120.8	119.3
DBA	104.1	106.1	107.2	108.1	108.9	108.3	107.7	106.8	106.4	104.1
BAND	24	24	24	24	24	24	24	24	24	24
TCORR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

MAXIMUM OASPL	= 116.87	COMPOSITE SPL	= 117.75
MAXIMUM PNLT	= 121.82	COMPOSITE PNL	= 123.29
MAXIMUM PNL	= 121.82	PNLT (INTEGRATED)	= 130.57
MAXIMUM DBA	= 108.89		

THE FOLLOWING CONDITION HAS BEEN ADDED TO THE W601 DATA BASE

```
BASE ID  LD  DATE      ENG  MOD ENG NO STND C  OBS CORR TEMP HUM  TTI  TIME BARM  WD WV   RUN
 364 10  250 02/28/79 JT8D -17 000372 X314 3 6265 6447 77.0 70.0 30.0  756 30.02 S    1 2351 H 01923 JT8D-17 REF SPLITTER B/L,DC9 RE
                                                                                              V 5DEG CANT NORTH    GP150RA150.1740
```



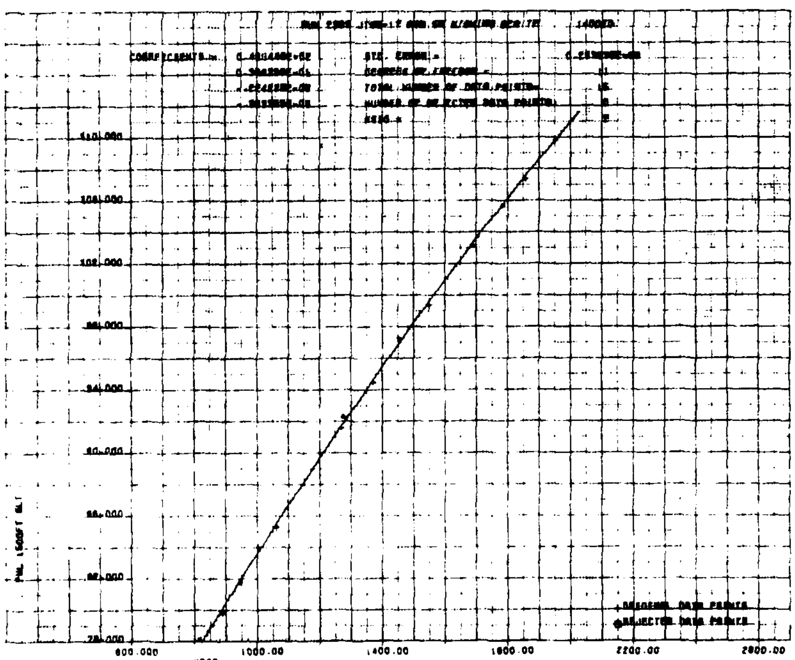


Figure 2.2.2-1 Typical Regression Curves -- These curves present the statistical correlation of perceived noise and corrected core jet velocity for a specific angle.

It is noteworthy to point out that at the same thrust settings, installation of a mixer produced a slightly higher core jet velocity at thrust setting above the 14,000 pound level and lower jet velocities at thrusts of 14,000 pounds and below.

Using the perceived noise level versus core jet velocity regression procedure as well as the thrust versus core velocity from Table 2.2.2-V, the perceived noise levels at angles for 90 to 155 degrees at a series of engine thrusts were tabulated, as shown by the examples in Tables 2.2.2-VI and VII for the standard JT8D engine and with the mixer installed, respectively. From data in these tables equal noise comparisons, including peak perceived noise levels versus thrust and perceived noise level directivity patterns, were made.

TABLE 2.2.2-V

ENGINE THRUST AND CORE JET VELOCITY VALUES
Standard Engine and Mixer Configurations
for DC-9 and 727 Tailpipes

	DC-9 Tailpipe		727 Tailpipe	
Thrust (lbs)	Standard	5M Mixer	Standard	5Z Mixer
6000	1130	1100	1135	1072
8000	1316	1302	1315	1270
10,000	1487	1476	1475	1445
12,000	1649	1642	1630	1613
13,000	1728	1724	1710	1700
14,000	1807	1806	1785	1785
15,000	1885	1889	1865	1872
16,000	1964	1973	1955	1965
16,600	2020	2030	2010	2020

TABLE 2.2.2-VI

PERCEIVED NOISE LEVELS AT CONSTANT THRUST
Standard JT8D Engine with DC-9 Tailpipe
1500 Ft Perceived Noise Level

Thrust (lbs)	6000	8000	10000	12000	13000	14000	15000	16000
Jet Vel. (ft/sec)	1130	1315	1437	1649	1728	1806	1885	1964
Angle (deg)								
90	89.4	93.2	96.4	99.2	100.6	101.9	103.3	104.7
100	90.7	94.7	98.2	101.2	102.6	104	105.4	106.8
110	91.5	95.5	99	102.1	103.6	105	106.5	108
120	91.7	96.2	100	103.5	105.1	106.6	108.1	109.5
130	91	96.3	100.6	104.5	106.3	108.1	109.9	111.7
135	90.5	95.9	100.5	104.6	106.5	108.5	110.4	112.3
140	89	94.9	100	104.4	106.5	108.5	110.3	112.2
145	87.5	93.5	98.7	103.3	105.4	107.4	109.3	111.1
150	85.3	91.8	97.4	102.1	104.2	106.1	107.7	109.4
155	82	88.4	93.5	97.7	99.6	101.4	103.1	104.8

TABLE 2.2.2-VII

PERCEIVED NOISE LEVELS AT CONSTANT THRUST
JT8D Engine with Mod. 5M Mixer and DC-9 Tailpipe
1500 Ft Perceived Noise Level

Thrust (lbs)	6000	8000	10000	12000	13000	14000	15000	16000
Jet Vel. (ft/sec)	1100	1301	1476	1642	1724	1806	1888	1973
Angle (deg)								
90	88.6	92.8	96.1	99	100.4	101.6	103	104
100	89.8	94	97.4	100.5	101.9	103.2	104.5	105.7
110	90.6	94.9	98.4	101.5	102.9	104.3	105.6	107
120	90.6	95	98.6	101.9	103.5	104.9	106.4	107.8
130	89.4	94.4	98.6	102.3	104.1	105.8	107.4	109.1
135	88	93.5	98	102.2	104.2	106.1	108	109.9
140	86.6	92.6	97.6	102	104.2	106.2	108.3	110.3
145	85	91.1	96.3	101	103.1	105.4	107.5	109.6
150	82.7	89.4	95	100	102.3	104.5	106.6	108.6
155	79.4	86 3	91.9	96.6	98.8	100.8	102.6	104.3

The PNL values at similar thrust levels for a standard JT8D engine and 5Z mizer configurations are tabulated in Tables 2.2.2-VIII and IX, respectively. However, the tests with the 727 tailpipe were conducted without fan duct acoustic treatment, in contrast to the DC-9 tailpipe, which incorporated a standard production fan duct double-wall acoustic treatment. Consequently, fan noise levels would be higher with the 727 tailpipe configuration. To provide noise results of the 5Z/727 configuration that would be more representative of this installation in a JT8D engine with fan duct treatment as well as to permit a direct comparison with 5M/DC-9 data, the extra fan noise in the 5Z data was analytically removed from the noise spectra and the perceived noise levels were recalculated. A discussion of the additional data processing procedures to account for the absence of the fan duct treatment is presented in Appendix B.

TABLE 2.2.2-VIII

PERCEIVED NOISE LEVELS AT CONSTANT THRUST
Standard JT8D Engine with 727 Tailpipe
1500 ft Perceived Noise Level

Thrust (lbs)	6000	8000	10000	12000	13000	14000	15000	16000
Jet Vel. (ft/sec)	1135	1398	1475	1630	1710	1785	1865	1955
Angle (deg)								
90	89.4	95.1	96.6	99.6	101.1	102.4	103.7	105.2
100	89.9	95.7	97.2	101.3	101.8	103.2	104.7	106.4
110	91.8	97.5	99	102.1	103.7	105	106.5	108.2
120	91.4	97.9	99.6	103.1	104.8	106.4	107.9	109.5
130	90.7	98.1	100.2	104.3	106.3	108.1	110	111.8
135	89.8	97.7	100	104.5	106.7	108.6	110.3	112.5
140	88.6	97	99.4	104.1	106.3	108.2	110.1	112
145	87.4	96.1	98.7	103.3	105.5	107.4	109.2	111
150	84.6	93.8	96.4	101.3	103.6	105.6	107.2	108.8
155	81.6	91.1	93.9	99	101.4	103.4	105.1	106.6

TABLE 2.2.2-IX

PERCEIVED NOISE LEVELS AT CONSTANT THRUST
JT8D Engine with 5Z Mixer and 727 Tailpipe
1500 ft Perceived Noise Level

Thrust (lbs)	6000	8000	10000	12000	13000	14000	15000	16000
Jet Vel. (ft/sec)	1072	1360	1445	1613	1700	1785	1872	1965
Angle (deg)								
90	88.1	94.2	95.8	98.6	100	101.3	012.5	103.7
100	89.5	95.6	97.1	100	101.4	102.7	104	105.6
110	91.8	97.4	98.8	101.5	102.9	104.2	105.6	107
120	90.9	96.7	98.2	101.4	102.9	104.3	105.7	107
130	88.7	95.5	97.4	100.9	102.7	104.2	105.7	107.3
135	87.5	94.4	96.4	100.1	102	105.7	105.4	107.1
140	85.8	93.5	95.5	99.5	101.5	103.4	105.4	107.4
145	84.4	92.1	94.3	98.7	101	103.2	105.4	107.8
150	80.8	89.4	91.9	96.8	99.2	101.6	104	106.4
155	----	85.8	88.6	94.1	96.9	99.6	102.1	104.7

2.3 TEST VEHICLE DESCRIPTION AND INSTRUMENTATION

2.3.1 Test Vehicle — General Description

All testing, both performance and acoustic, was conducted with a Pratt & Whitney Aircraft JT8D-17 development engine. During parts of the program, testing was augmented with the use of two JT8D-17 engines.

The JT8D-17 is a dual spool, axial flow turbofan engine with a rating of 16,000 pounds of net takeoff thrust at sea level static conditions. In brief, the low-pressure spool consists of a two-stage fan and four stage low-pressure compressor driven by a two-stage low-pressure turbine unit. In the high-pressure spool, a seven-stage compressor is driven by a two-stage uncooled turbine. The combustion system is a multi-can annular system. Table 2.3.1-I lists key engine operating parameters.

Before testing, the engine was disassembled and thoroughly inspected. Worn or damaged parts were either repaired or replaced. Instrumentation, such as strain gages and thermocouples, was also installed on selected components while the engine was disassembled.

Figure 2.3.1-1 shows the JT8D test engine installed in the a sea level static performance test facility (stand X-16) prior to testing a mixer configuration. The engine incorporated an inlet bellmouth to ensure undistorted inlet flow conditions. During noise evaluations at the Pratt & Whitney Aircraft outdoor acoustic facility (stand X-314) an inlet noise suppressor tube was installed to minimize contamination of jet noise measurements by inlet radiated fan and compressor noise. In addition, an exhaust system, consisting of an acoustically-lined tailpipe, was used in this program. Tailpipes of the respective airframes, the DC-9 and 727, were used during selective performance and acoustic tests. For the acoustic tests, the tailpipes were canted away from the ground microphones (DC-9, 5 degress and 727, 3.3 degrees) to simulate the engine/tailpipe orientation during an overhead flyover. Figure 2.3.1-2 shows a JT8D engine installed in the outdoor facility with the inlet noise suppression tube and a DC-9 tailpipe.

TABLE 2.3.1-I

STANDARD JT8D-17 OPERATING PARAMETERS
(Takeoff Sea Level Static Conditions)

Fan Pressure ratio	2.06
Bypass Ratio	1.02
Overall Compressor Ratio	16.93
Turbine Stator Inlet Temperature (°F)	1990
Turbine Discharge Temperature (°F)	1108

Figure 2.3.1-1 JT8D-17 Test Engine -- The engine is shown installed in stand X-16 prior to performance testing of the 5M mixer configuration.

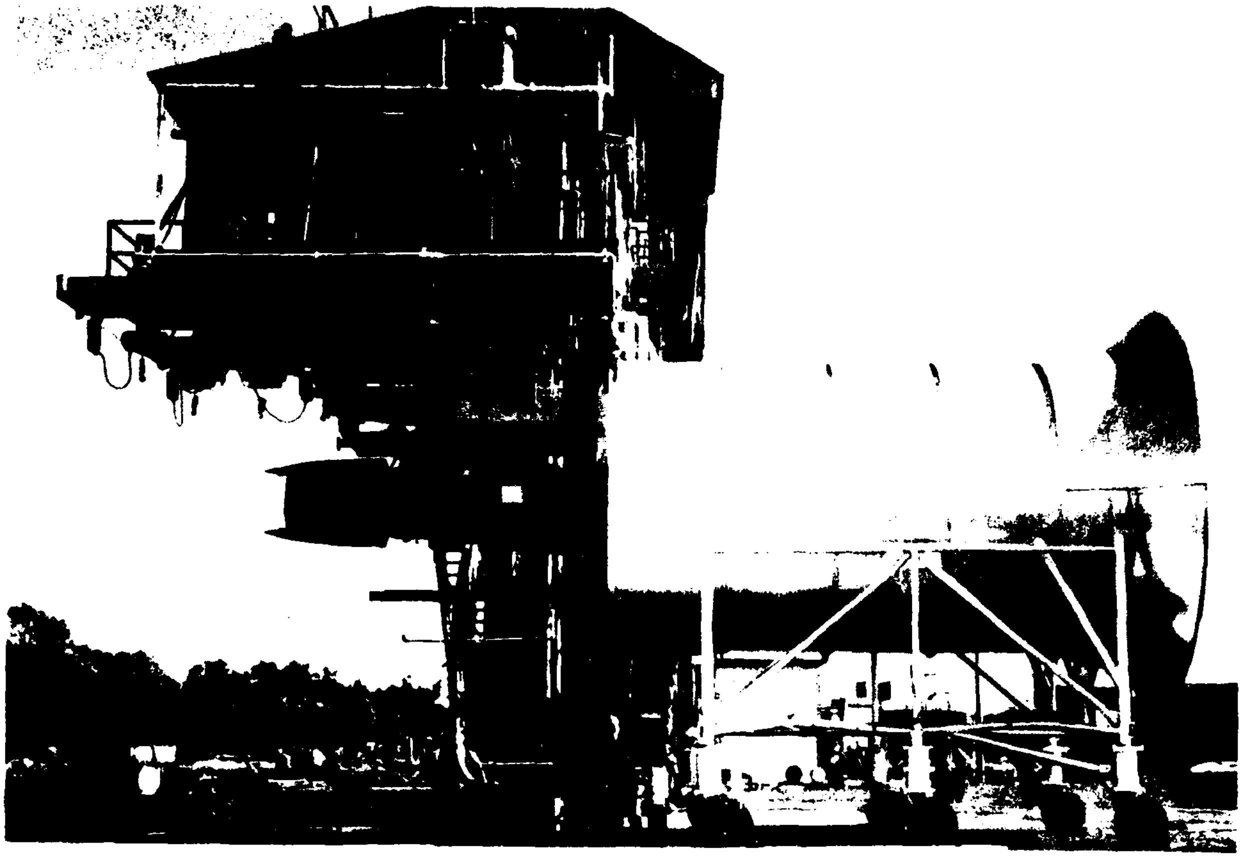


Figure 2.3.1-2 JT8D-17 Test Engine -- The engine is shown installed at the outdoor acoustic facility with an inlet noise suppression tube and a DC-9 tailpipe.

In test conducted with the DC-9 tailpipe, the standard double-wall fan duct acoustic treatment was used. This treatment, however, was not installed during the test with the 727 tailpipe.

2.3.2 Instrumentation

The engine was equipped with sufficient instrumentation to measure key performance parameters as well as ensure the structural integrity of the engine and mixer component. Pressure and temperature sensors were installed at standard measurement locations. The JT8D-17 development engine typically has instrumentation installed at these locations. This previous experience provided reliability, accuracy, pressure and temperature circumferential variations and absolute levels as a basis for comparison to baseline testing. A listing of the different types of pressure and temperature instrumentation is presented in Table 2.3.2-I, and the installation locations are depicted in Figure 2.3.2-1.

TABLE 2.3.2-I
PERFORMANCE INSTRUMENTATION

ARP* Station	Engine Location	Description
2.0	Forward of inlet Guide Vane	Total Temperature Sensors 6 Pitot Total and Static Pressure Probes
13.0	Fan Exit Guide Vane Discharge	4 Total Pressure Pole Rakes with 5 Sensing Elements per Rake 16 Individual Total Temperature Probes **
2.2	Low-Pressure Com pressor Discharge	4 Total Pressure Pole Rakes with 5 Sensing Elements per Rake 2 Static Pressure Bleed Cavity Sensors 4 Total Temperature Pole Rakes with 5 Sensing Elements per Rake**
3.0	High-Pressure Com-ressor Discharge	3 Total Pressure Rakes with 4 Sensing Elements per Rake 2 Static Pressure Bleed Cavity Sensors 1 Fuel Control Static Pressure Sensor 2 Total Temperature Rakes with 4 Sensing Elements per Rake **
4.0	Turbine Cooling Air	1 Bleed Cavity Static Pressure Sensor
7.0	Low-Pressure Turbine Discharge	6 Total Pressure Probes with 6 Sensing Elements per Rake (1 Manifolded Average Sensor) 1 Outer Static Pressure Sensor at Each Turbine Exit Location 8 Total Temperature Rakes with 1 Average Sensor per Rake**
16	Fan Duct Exit	6 Total Pressure Probes with 6 Sensing Elements per Probe (1 Manifolded Average Sensor) 1 Outer Static Pressure Sensor at Each Fan Duct Exit Location

Notes: *Aerospace Recommended Practices
** Calibrated Thermocouples

The instrumentation was calibrated before testing and periodic calibration checks were conducted during the test sequence to ensure data validity.

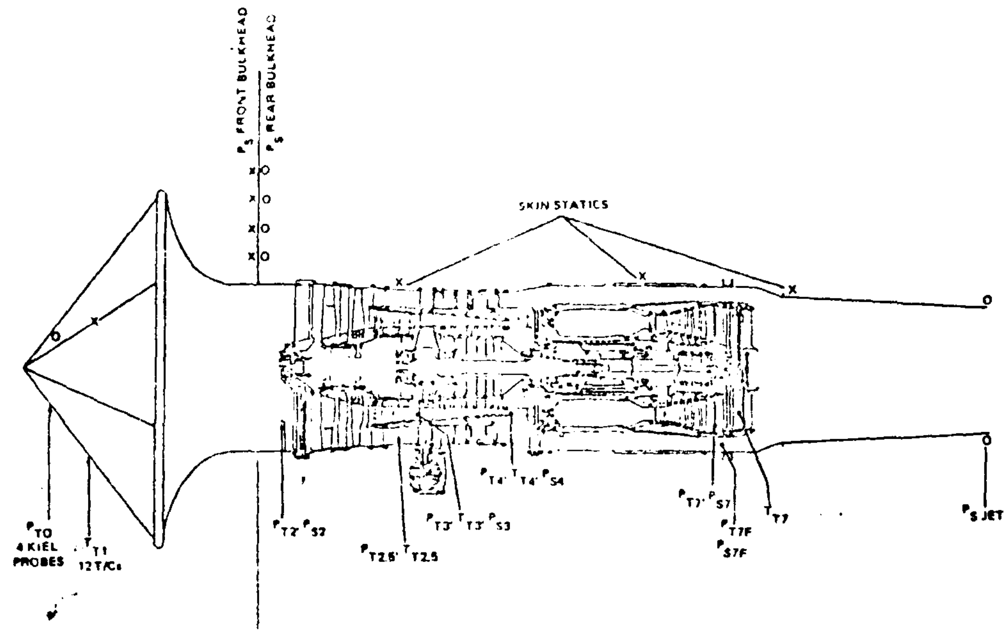


Figure 2.3.2-1 Schematic of JT8D Engine Showing Instrumentation Locations -- The basic test configuration is equipped with a full complement of calibration type instrumentation.

Strain gages were installed on selective fan and turbine blades to verify that the presence of the exhaust mixer did not impart any high stress levels on these components.'Strain gages and thermocouples were also installed at predetermined locations on the mixer and, in some cases, on the tailpipe to monitor thermal response.

During selected tests, a traverse instrumentation system was used as a diagnostic tool to determine the amount of radial and circumferential mixing in the exhaust plume. The temperature and pressure data acquired with this system were used to generate velocity profiles, which served as a basis to guide geometric modifications to the mixer.

A schematic of the traverse system is shown in Figure 2.3.2-2. The system is installed directly behind the nozzle discharge. The traverse gear consists of a traverse rake attached along a diameter of a circular ring which in turn rests on four idler wheels. A chain drive attached to the ring is driven by a stepper motor to rotate the ring. Twelve total temperature probes alternating with eleven total pressure probes are contained along one half of the rake length. This system was used to acquire data at 5 degree increments for the entire nozzle exhaust plume of the 727 tailpipe. However, when used with the DC-9 tailpipe, the system could not be traversed at the 4:00 and 10:00 o'clock locations because of an interference with the reverser support stangs.

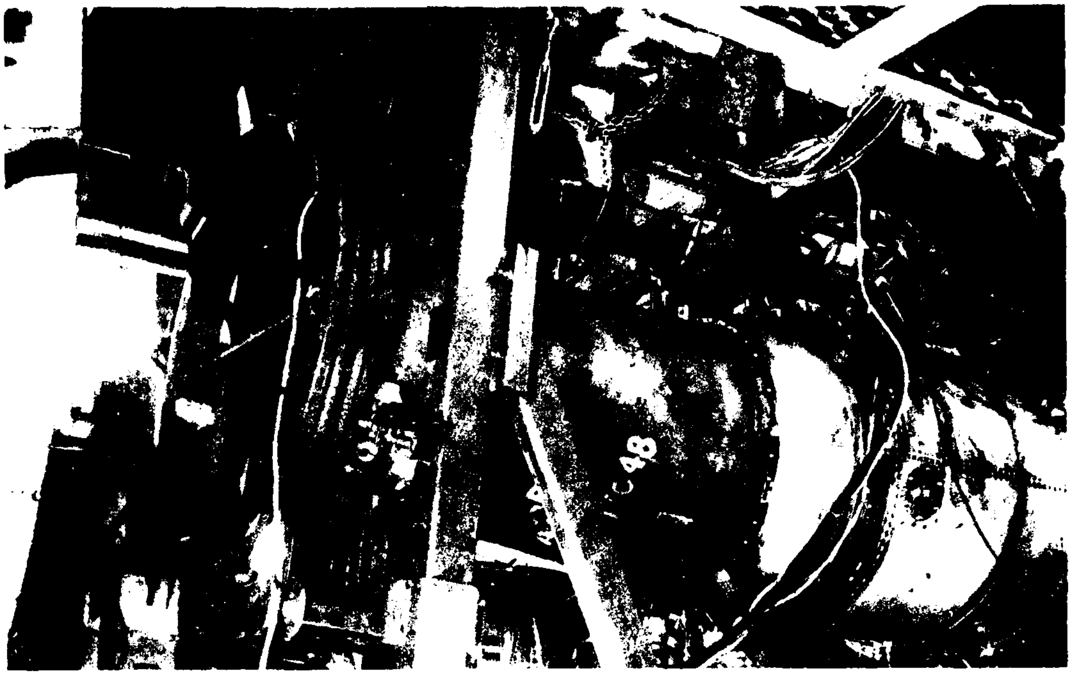


Figure 2.3.2-2 Traversing System -- The system consists of a series of alternating pressure and temperature probes from which velocity profiles can be generated to show mixing efficiency.

Pressure and temperature data were recorded on magnetic tape by a portable, high accuracy pressure and temperature system (HAPTS). The HAPTS signal is converted to engineering units which are recorded on punch cards. These cards are loaded into the IBM 370 computer and displayed on an interactive scope for data editing. The edited data are processed by another computer program that uses the input temperatures and pressures to calculate velocities. The program also generates information used to create contour plots of pressure, temperature and velocity on an automatic plotting system.

2.4 TEST FACILITIES

All experimental engine testing was conducted at the Pratt & Whitney Aircraft Commercial Products Division in East Hartford, Connecticut. Performance testing was conducted in a sea level test stand (stand X-16) and acoustic testing was conducted in an outdoor facility (stand X-314). A description of these facilities is presented in the following sections.

2.4.1 Sea Level Test Facility

The sea level test facility, stand X-16, is designed to develop both afterburning and nonafterburning turbojet and turbofan engines. Total airflow in the stand is limited by the inlet sound treatment to 1800 lbs/sec. Testing can be conducted at static sea level inlet and exhaust conditions.

The stand is constructed or reinforced concrete in the form of an enlongated "ELL". A horizontal inlet and resonant chamber exhaust silencer with a vertical discharge stack are located at the extreme ends. Extended sound-stream type acoustical panels with 42 percent open area are installed in the inlet. The engine is mounted to a suspended overhead-type thrust measurement platform. Ambient air is supplied to the inlet, which is isolated from the afterpart of the engine by a partial bulkhead. Exhaust gases are ejected into a collector tube where they are mixed with and cooled by atmospheric air aspirated over the inlet bulkhead vane. Additional cooling of exhaust is accomplished by injecting water into the air stream by means of spray nozzles in the exhaust duct. The mixed gases are then dispersed through an exhaust silencer.

The controls and instrumentation to operate the engine and monitor performance are located in the control room. This room is located at an intermediate elevation, and an observation window allows visual inspection of the test cell interior testing. Support equipment and services are located beneath the control room.

Test parameters are recorded automatically by the steady-state data system (SSDS). This system consists of a central computer area and four remote subsystems. There are also four seven-track 556 BPI tape units for recording stand data, one card punch, one card reader, one printer and computer-subsystem interface log.

When data acquisition is initiated, the data are processed first through the central computer that converts the electrical signals to engineering units. The conversion is accomplished by a preprocessor program with information pertaining to the engine configuration supplied by input in the long term and pretest. The engineering units can then be printed at the stand and at the central computer area. In addition to printed output, the engineering units are recorded on magnetic tape and/or cards in the automatic data recording (ADR) card image format. Within the central computer, a "quick-look" program receives the engineering units and calculates, for printout at the stand or on the central printer, the measured data, selected answers and selected gas stream radial pressure and temperature profiles.

Special cabling is provided from the test cell to the control room and to an outside mobile van panel. This enables connecting special instrumentation such as vibration meters, pressure transducers, strain gages, closed-circuit televisions, fuel flows and communications.

2.4.2 Acoustic Test Facility

Stand X-314 was the outdoor facility used for evaluating noise and performance characteristics of the JT8D-17 test engine with various mixer configurations. The engine was mounted on the stand supported by two large "I" beams cantilevered from a vertical open truss structure in a manner to provide noise radiation free of acoustical shadow zones around the engine. The engine was installed at a height of approximately 16 feet above the ground.

The test pad area is directly under and adjacent to the test stand consisted of paved asphalt and concrete. A cleared and carefully graded controlled ground surface with uniform reflective characteristics extended for the test pad in a semicircle around the right side of the engine in an area enclosed by an arc of an approximately 200-foot radius. The controlled surface consisted of a 12-inch deep layer of 1 to 1.5-inch size trap rock, with a drainage system to maintain a water table of at least 18 inches below the finished surface. On the left side of the engine on an arc from 90 to approximately 170 degrees, the ground surface consisted of sealed asphalt to a radius of approxixmately 160 feet. Figure 2.4.2-1 shows the surface arrangement with the microphone locations.

Engine noise levels were measured over the trap rock surface by an array of pole microphones permanently located along a nominal 150-foot radius arc with diaphragms placed to receive noise at grazing incidence at a height approximately in the same horizontal plane as the engine centerline. The array consisted of 19 microphones. The microphone distances and angles relative to the jet exit plane centerline are listed in Table 2.4.2-I. A hard, smooth-sealed asphalt surface exists on the opposite side of the engine covering the area from 90 to 160 degrees within a 150-foot arc. A portable array of ground level microphones, spaced at no greater than 10-degree intervals along the arc, was used to obtain a clear definition of low frequency noise. These microphones were also placed relative to the centerline of the exhaust plane of the engine tailpipe.

The acoustic data recording system was contained in a mobile van located adjacent to the test area. The signal conditioning and recording console provided calibration and monitoring instrumentation, switching capability, variable gain signal conditioning amplifiers, and full analog magnetic tape recording capability. Calibrations were completed both before and after testing to ensure system measurement reliability, provide appropiate microphone, cable and system responses, and provide a known sound pressure level to the system for an acoustic reference point.

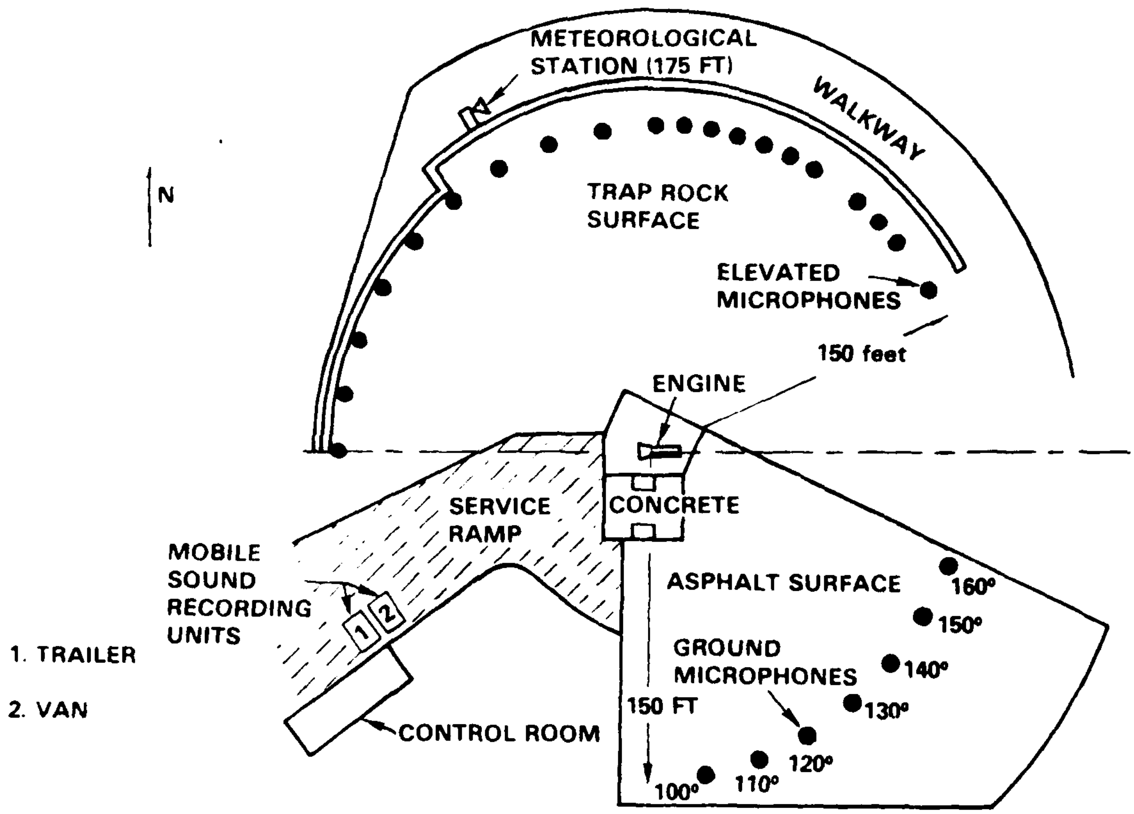
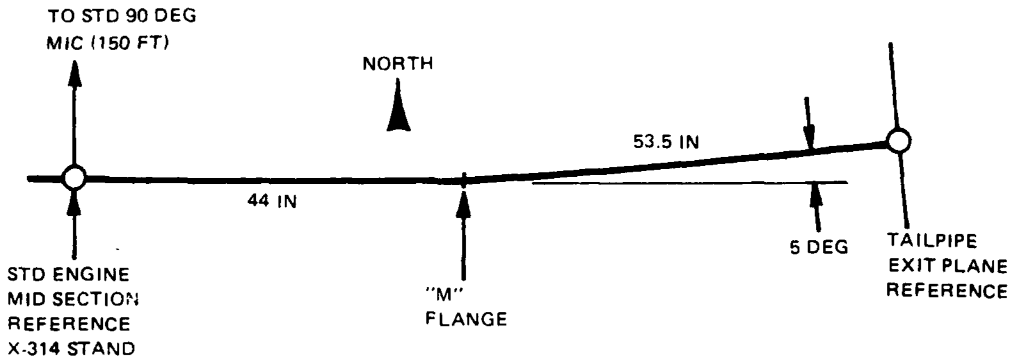


Figure 2.4.2-1 Schematic Representation of the Arrangement of the Pratt & Whitney Aircraft Acoustic Test Facility Stand X-314 -- The test stand configuration together with the sound field and microphone system are of the highest quality, and the facility has been used previously to produce data used by the Federal Aviation Administration to approve acoustic changes in engine hardware.

TABLE 2.4.2-I

POLE MICOPHONE ANGLES AND DISTANCES
DC-9 AND 727 TAILPIPE TEST ARRANGEMENTS
REFERENCED TO A STANDARD ANGLE



Pole No.	Standard Ang. (deg)	DC-9 Tailpipe Ang.(deg)	DC-9 Tailpipe Dist.(ft)	727 Tailpipe Ang.(deg)	727 Tailpipe Dist.(ft)
4	30	33	157	32	157
5	40	43	156	41	156
6	50	53	155	51	155
7	60	62	154	61	154
8	70	72	153	70	153
9	80	82	151	80	151
---Portable---		90	150	---	---
10	90	92	150	90	150
11	95	97	149	95	149
12	100	102	148	100	149
13	105	107	148	105	148
14	110	112	147	110	147
15	115	117	146	116	146
16	120	122	146	121	146
--- Portable ---		127	145	126	145
17	130	132	144	131	145
18	135	138	144	136	144
19	140	143	143	141	144
20	150	155	143	152	143

Each analog tape containing noise data was reduced to yield one-third octave band sound pressure levels from each microphone at each measured condition. The analysis system consisted of a playback tape recorded from which signals were directed through an amplifier to a contiguous filter set. The filter covered one-third band center frequencies from 50 Hz to 80 kHz and provided outputs to a multi-output detector. The detector sensed the filtered values and provided input to the computer.

The computer controls the analysis sequence, stores interim data sets, reads and stores manually-entered information, and transfers data to a digital tape ready for computer processing. Data output was selected for an averaging time of two seconds and accumulated sixteen times in the computer, then averaged to yield one-third octave band data integrated over the 32-second time period.

Upon completion of one-third octave band data reduction, the results of the reduction process were stored on incremental magnetic tape. The incremental magnetic tape information was input to the large IBM 370/168 computer where the data were processed through computer programs to apply calibration and weather corrections to the data. The results were then made available in the form of plots/curves, hard copy printout, and storage in the computer disk file. Other programs then assessed the data and provided additional output such as plots, power levels, perceived noise levels, data extrapolations and flight predictions.

SECTION 3.0

TEST RESULTS AND ANALYSIS

3.1 INTRODUCTION

The analysis of performance and acoustic data was a continuing process throughout the test program, and results served as the basis for selecting design modifications. During the test program, a total of 11 mixer configurations was evaluated, accounting for approximately 230 hours of development testing. Over 1100 performance data points and 360 acoustic points were obtained.

The different types of tests and data analysis were accomplished under Tasks 4 through 7. Task 4 was associated with performance and acoustic testing of earlier mixer configurations, and Task 5 was concerned with the analysis and correlation of test results. Testing and analysis of the final mixer configurations was accomplished under Task 6 of the program.

In this section, the general performance and acoustic trends of the different test configurations are first presented in a comparison with the baseline nonmixed JT8D configuration. The final mixer configurations are then discussed in detail in terms of overall performance effects, including the impact on thrust specific fuel consumption, acoustic characteristics and structural integrity.

3.2 MIXER AERO/ACOUSTIC PERFORMANCE SUMMARY

As discussed in Section 1.4, Summary of Mixer Design Evolution, the base mixer design underwent several generations of changes before the final configurations were established. The performance results that influenced these modifications are summarized in the following paragraphs. A complete discussion of the performance and acoustic characteristics of the two final mixer designs is presented in the next section.

Testing of the base mixer design (configuration Mod. 1) indicated that exhaust system efficiency was essentially equal to that demonstrated in previous model tests. However, the fan operating line was substantially below the operating line of the standard JT8D engine, thereby producing a penalty of 30°F in exhaust gas temperature at takeoff thrust. The operating line shift and attendant exhaust gas temperature penalty was attributed to a mismatch of the mixer area ratio (A_{fan}/A_{engine}). Because of the performance decrement, no acoustic testing was conducted with this configuration.

To improve performance, the mixer was modified by scalloping each of the twelve lobes. This configuration (Mod. 2) demonstrated a reduction of 15°F in the exhaust gas temperature penalty as well as a reduction in

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area mismatch from +26 percent to +14.5 percent. However, performance remained unacceptable and further modifications were incorporated to improve system performance.

The third generation (Mod. 3) was successful in demonstrating acceptable exhaust gas temperatures, indicating that the area mismatch was further reduced. Acoustic testing was conducted with this configuration installed in a DC-9 tailpipe, but results showed no significant improvement in noise suppression compared to a standard JT8D engine. In addition, nozzle system performance was reduced by one percent in nozzle thrust coefficient (C_T) relative to the preceding design. Measurements of internal pressures at the mixer discharge plane and velocity surveys suggested (1) the occurrence of flow separation on the lobe sidewall and (2) a reduction in the degree of mixing which was associated with the flow separation and/or the presence of scallops on the lobe sidewalls.

To eliminate the condition of flow separation, the mixer design (Mod. 4) was changed to increase lobe outer penetration, thereby achieving an increased core engine area without the necessity of diffusing sidewalls or scallops. Testing of an optimized version of the Mod. 4 configuration (Mod. 4A) demonstrated acceptable performance, along with a significant reduction in noise level and an exhaust gas temperature that was only 5°F higher than a standard JT8D engine.

Although the Mod. 4A configuration was acceptable in performance and noise reduction, structural considerations indicated the requirement for a flexible outer support system. This design characterized the Mod. 5 mixer. Initial tests with this mixer showed a penalty in thrust specific fuel consumption of 0.2 percent and an exhaust gas temperature increase of 8°F at sea level static thrust relative to the Mod. 4A configuration. This was caused by an increase of 6.4 percent in mixer area ratio. In addition, tailpipe wall temperatures exceeded levels defined for the DC-9 installation. Variations of the Mod. 5 mixer, involving a reduction in the scarf angles, resulted in the 5M configuration which met the the temperature limit of 500°F for the DC-9 tailpipe. The Mod. 5M mixer reduced the peak percieved static noise level by 2.3 PNdB. Also, general engine operating characteristics, including fuel consumption, were unaffected by the mixer.

The final mixer configuration for the 727 installation was designated Mod. 5Z. In terms of acoustic performance, this mixer was superior to the 5M design, demonstrating a maximum noise reduction of 4.7 PNdB. However, this had a counterproductive effect on engine performance. Fuel consumption was increased appreciably and other engine operating characteristics deviated from standard engine levels.

3.3 COMPARATIVE ANALYSIS OF SELECTED CONFIGURATIONS

The presentation of detailed results focuses mainly on the final mixer configurations by comparing and contrasting test data to the levels of a standard JT8D-17 engine. Where appropiate, comparisons are made between the final configurations and earlier designs.

3.3.1 Overall Performance Effects

3.3.1.1 General Engine Performance

Effects produced by the 5M configuration on parameters such as thrust, rotor speeds and pressure ratios are shown in Figure 3.3.1-1 compared to a standard JT8D-17 engine at a constant pressure ratio. The slight differences with the mixer are indicative of a +1.0 percent effective area ratio (A_{fan}/A_{engine}) change. In essence, these results suggest that the 5M configuration does not compromise static performance to any measurable degree at takeoff, since the exhaust gas temperature and fuel consumption at the 16,000-pound thrust rating are improved compared to a standard JT8D-17 engine. The slight deficiency in thrust at engine pressure ratios of 2.17 and above could be overcome by a minor adjustment to inflight power setting curves in order to ensure rated thrust at power setting engine pressure ratios. It should be pointed out, however, that this would not be detrimental to engine service life, since data indicate no penalty in exit temperature at a given thrust over the full range of power settings. Revision to power setting curves, would only result in achieving the same rated thrust as demonstrated with the standard engine configuration with no degradation in exit temperature.

Figure 3.3.1-2 shows the similar effects on thrust, rotor speeds and pressure ratios resulting from the Mod. 5Z mixer. As indicated by these trends, engine thrust and pressure ratio are somewhat more sensitive to the presence of the 5Z mixer than the 5M configuration. Low- and high-pressure spool speeds, however, are consistent with the 5M mixer trends.

These results indicate that the presence of an internal exhaust mixer does have an influence on engine component operating characteristics, although the overall influence is slight. The difference in operating trends between the 5M and 5Z is apparently related to geometry differences.

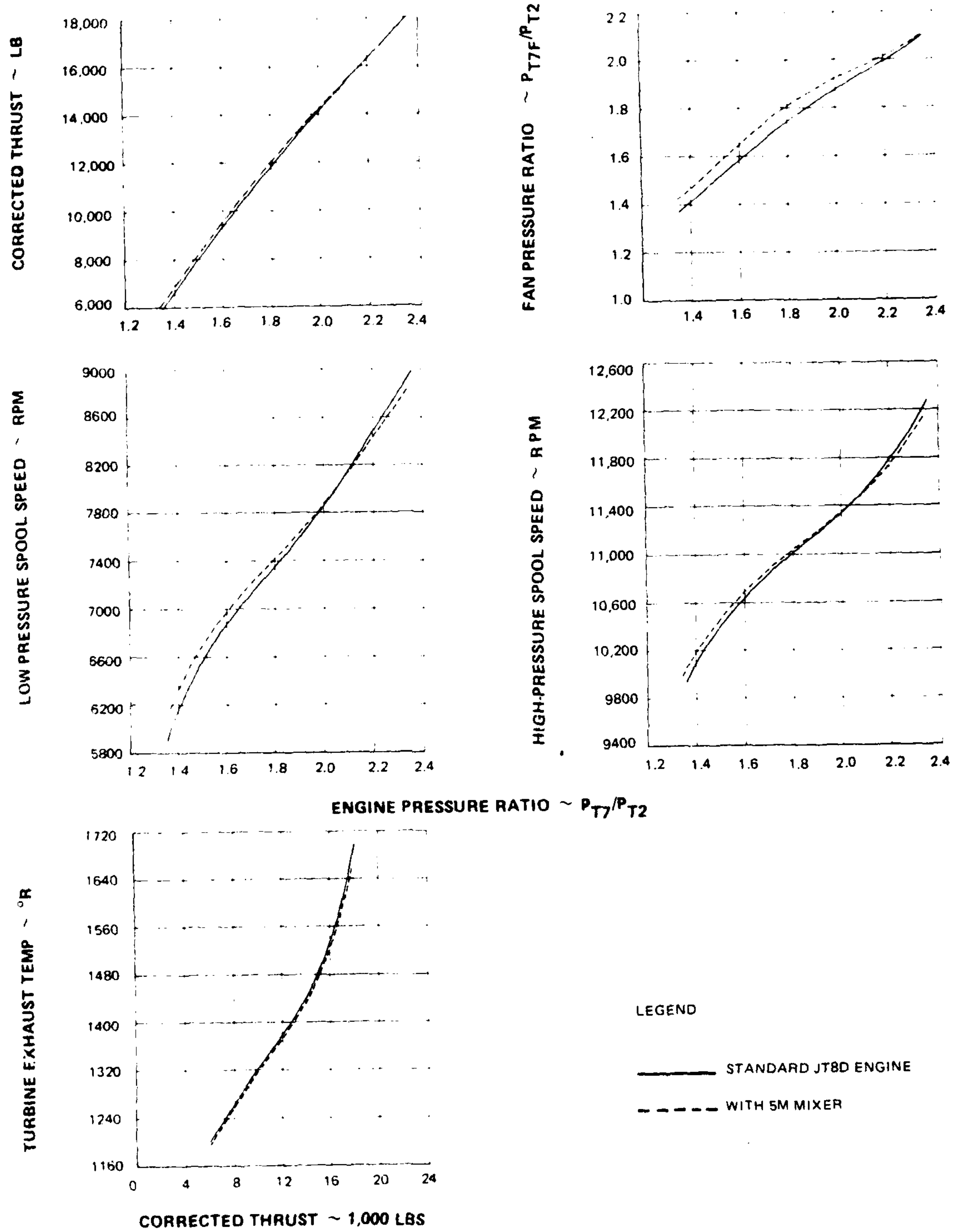


Figure 3.3.1-1 Engine Performance Trends with Mod. 5M Mixer -- This mixer has a negligable effect on thrust, low- and high-pressure rotor speeds, and pressure ratio in relation to standard JT8D levels.

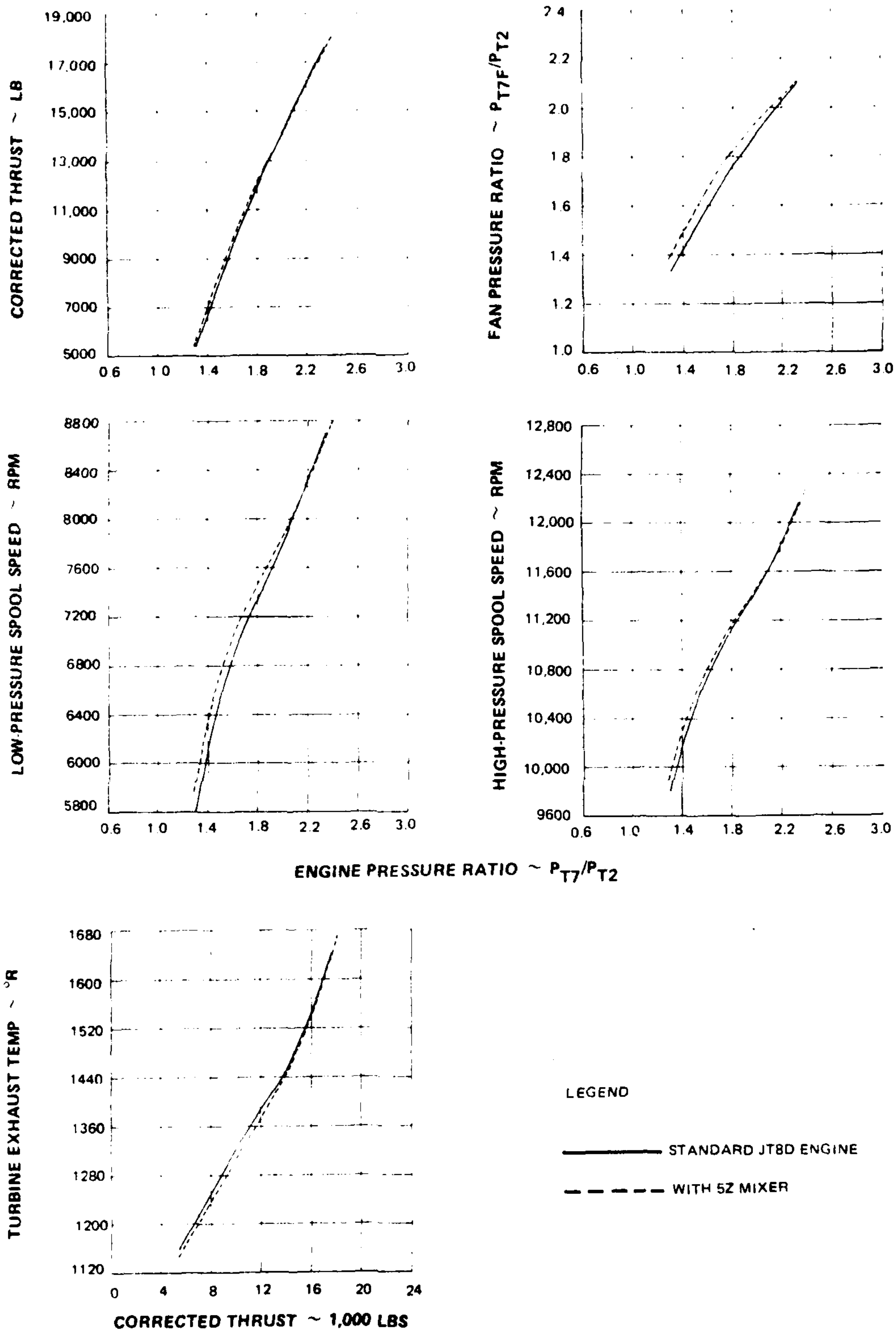


Figure 3.3.1-2 Engine Performance Trends with Mod. 5Z Mixer -- The presence of the 5Z mixer, compared to the 5M, has more of an effect on thrust and pressure ratio.

3.3.1.2 Exhaust System Performance

In general, mixer performance and its interaction with the engine can be assessed in terms of three parameters. These are nozzle thrust coefficient (C_T), nozzle discharge coefficient (C_D) and area ratio. The nozzle thrust coefficient represents the combined effects of mixing and pressure loss on exhaust system efficiency. Similarly, the nozzle discharge coefficient provides an indication of the effect of mixing and pressure loss on the amount of airflow exiting the tailpipe per unit of nozzle area. A change in this parameter corresponds to the amount of increase in jet nozzle area required with the mixer to maintain the same operating line as a standard JT8D engine. Finally, the ratio of calculated flow areas in the fan and core streams at the mixer discharge reflects the flow split between these streams. This parameter is determined on the basis of measured total pressures, temperatures and flows on each side of the mixer. A change in shape or level of this parameter will indicate a change in the engine bypass ratio. In using these parameters as indicators of exhaust system performance, the influence of the Mod. 5M and 5Z mixers is discussed.

The effect on exhaust system performance with the 5M mixer is shown in Figure 3.3.1-3 as the performance differences between the mixer calibrations and corresponding standard engine configurations. These incremental differences are compared as a function of nozzle expansion ratio.

At the takeoff nozzle expansion ratio (2.15 at 16,000 pounds thrust), the nozzle discharge coefficient was 3.4 percent below a standard engine level. To compensate for this reduction in flow coefficient, the DC-9 jet nozzle area was increased by removing a section of the conical nozzle. The physical area achieved was 2.8 percent larger than the standard configuration and within 0.6 percent of the desired nominal area.

Area ratio, the other indicator of gas generator matching, was 2.9 percent below a standard engine at takeoff power. This would tend to raise the fan operating line slightly at this condition. At low nozzle expansion ratios, however, the area ratio differs significantly from a standard engine configuration. Early in the program it was determined that the total area at the mixer discharge plane can have a major affect on the shape of the engine operating line. The JT8D mixer design incorporates a bulbous plug which contributes to a reduction in flow area at the mixer discharge. The corresponding reduction in flow results in a flattening of the fan operating line. Since it is desirable to duplicate the standard engine match at the takeoff, the mixer area ratio was sized for this condition. The reduction in mixer discharge total area, therefore, resulted in a higher operating line at low power conditions.

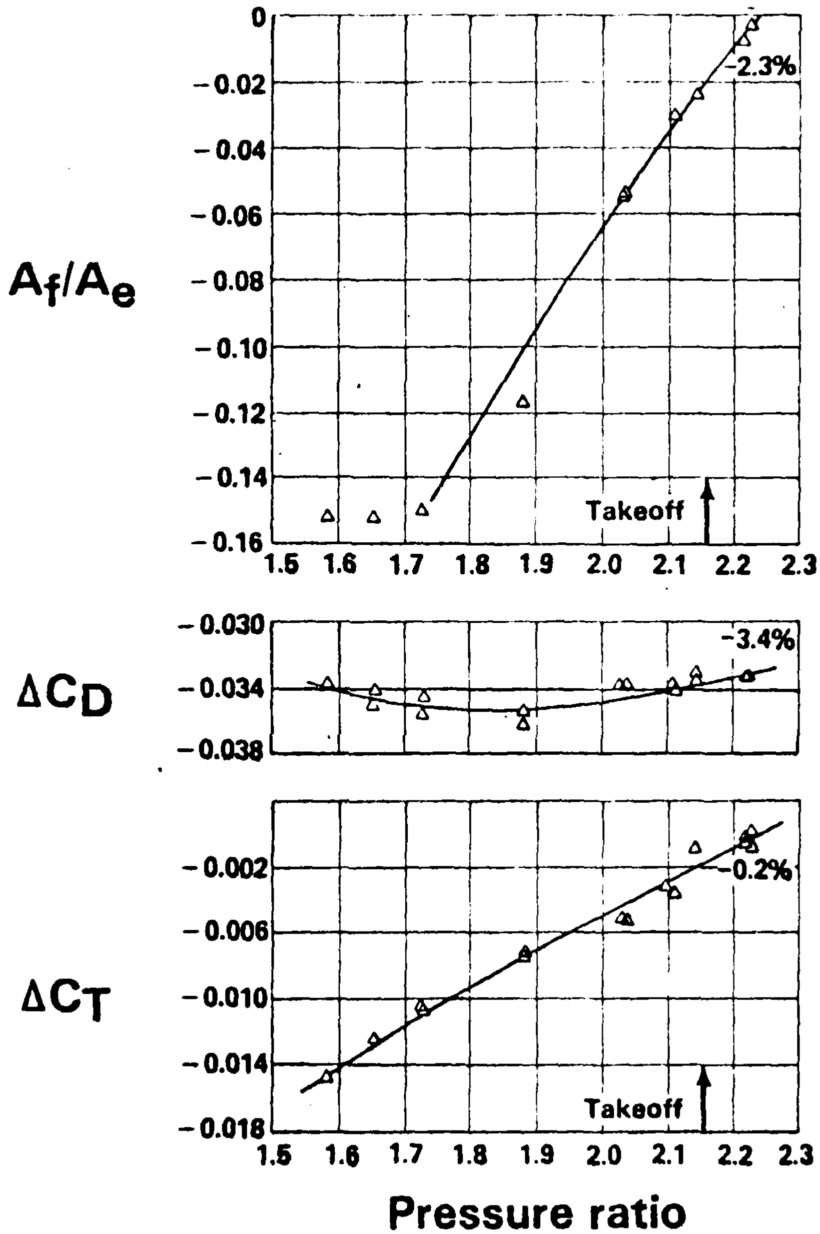


Figure 3.3.1-3 Exhaust System Performance Trends -- The figure shows the effect the 5M mixer produced on nozzle discharge coefficient, nozzle thrust coefficient and area ratio.

Nozzle thrust coefficient at takeoff is 0.2 percent below a JT8D-17 level. This, in turn, results in a 0.35 percent increase in static fuel consumption, which must be added to the effects of engine cycle efficiency because of the slight mismatch in jet nozzle area and mixer area ratio. As expansion ratio is reduced, exhaust system efficiency continues to decrease as pressure loss effects become dominant.

It is important to understand the contributions of increased mixing and increased pressure loss on exhaust system performance. Since the potential gain in thrust from mixing is a function of engine power setting and the effect of pressure loss is dependent on nozzle expansion ratio, which is a function of engine power and flight Mach numbers, both effects must be separated to predict engine performance over the range of flight conditions. This is possible through an analysis of shifts in thrust and discharge coefficients. Both parameters are reduced by increases in pressure loss, but increased mixing will improve the thrust coefficient while reducing the discharge coefficient. Only one combination of increased mixing and increased pressure loss will explain the shifts in mixer nozzle coefficients in relation to a standard JT8D engine. Analysis of test data using this method resulted in the estimates of mixing and increases in pressure loss shown in Figure 3.3.1-4.

Exhaust system performance trends with the Mod. 5Z/727 tailpipe configuration are summarized in Figure 3.3.1-5. At an expansion ratio of 2.15, the nozzle discharge coefficient is 0.6 percent below a standard engine and equivalent to a 1 percent increase in takeoff fuel consumption. Also, this is a 0.4 percent reduction in nozzle thrust coefficient relative to results with the Mod. 5M mixer. The decrease in nozzle thrust coefficient is suspected the result of a combination of two factors. The first is an increase in pressure loss, probably associated with the high velocity core air impinging on and scrubbing the tailpipe. Second, traverse results of the nozzle exit properties indicated an increase in mixing. This is also associated with the outward penetration of core gases that displace the fan discharge air around the tailpipe wall and thus promote mixing.

The contention of increased mixing and pressure loss is supported by the nozzle discharge coefficient trends in Figure 3.3.1-5. Both mixing and pressure loss tend to reduce the flow coefficient. Test data with the 5Z mixer indicate substantial reductions in flow coefficient in relation to both a standard JT8D engine and Mod. 5M configuration of 4.3 percent and 1.1 percent, respectively. Calculations of mixing and pressure losses based on the nozzle coefficient closure technique discussed previously further support this contention.

For testing the 5Z mixer, the jet nozzle area of the 727 tailpipe was increased by 3.8 percent. Since the discharge coefficient was reduced by 4.3 percent at takeoff, the nozzle matching at takeoff required a 0.5 percent larger nozzle increase to attain the desired match. The net effects of mixing and pressure loss result in a decrease in the discharge coefficient, which varies as a function of engine power setting.

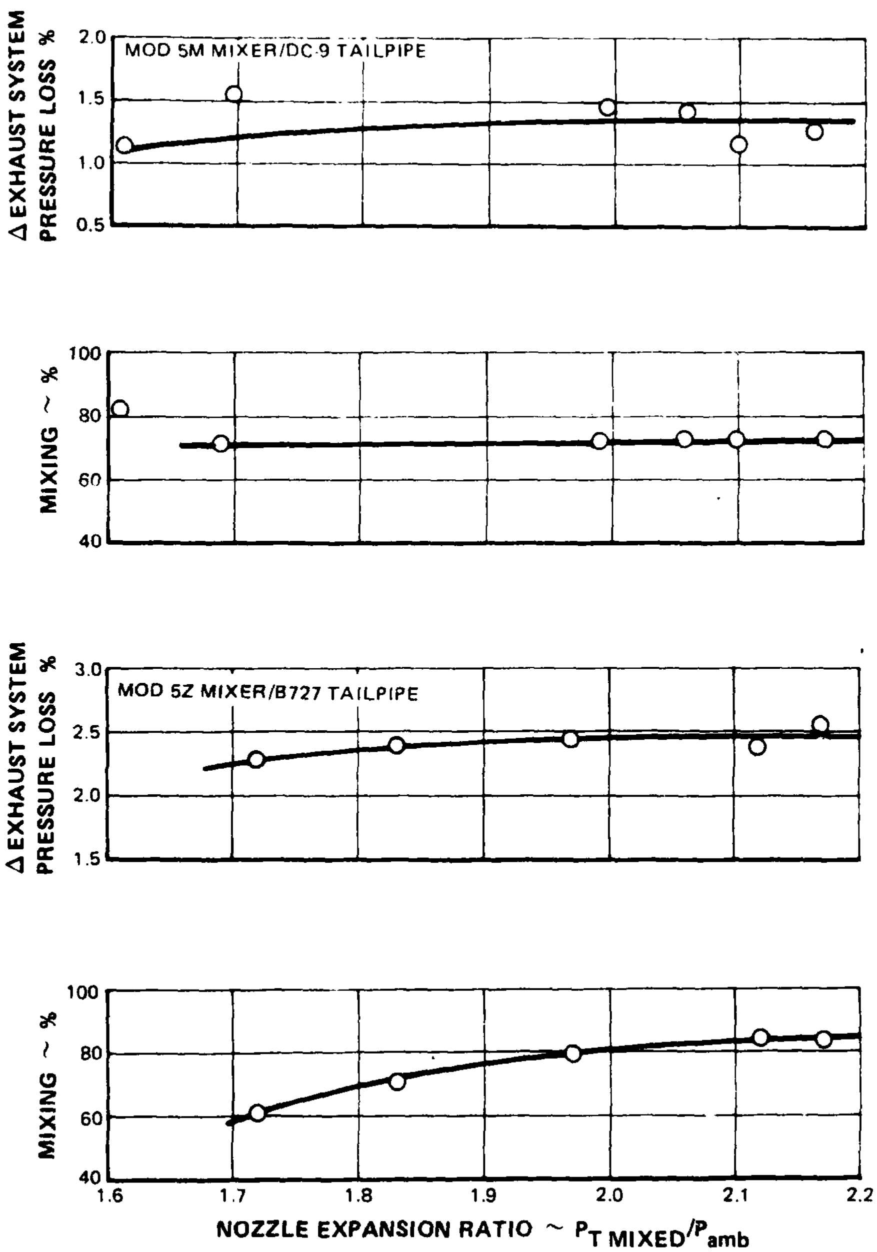


Figure 3.3.1-4 Analytical Projection of Mixer Performance in Relation to Standard Exhaust System Performance -- Estimates in mixing and pressure loss can be derived from the analysis of shifts in nozzle thrust and discharge coefficients.

Therefore, correct nozzle sizing could only be achieved at a single point. An area increase of 3.8 percent was selected to avoid excessive compromises in operating line shift at very high or very low power setting.

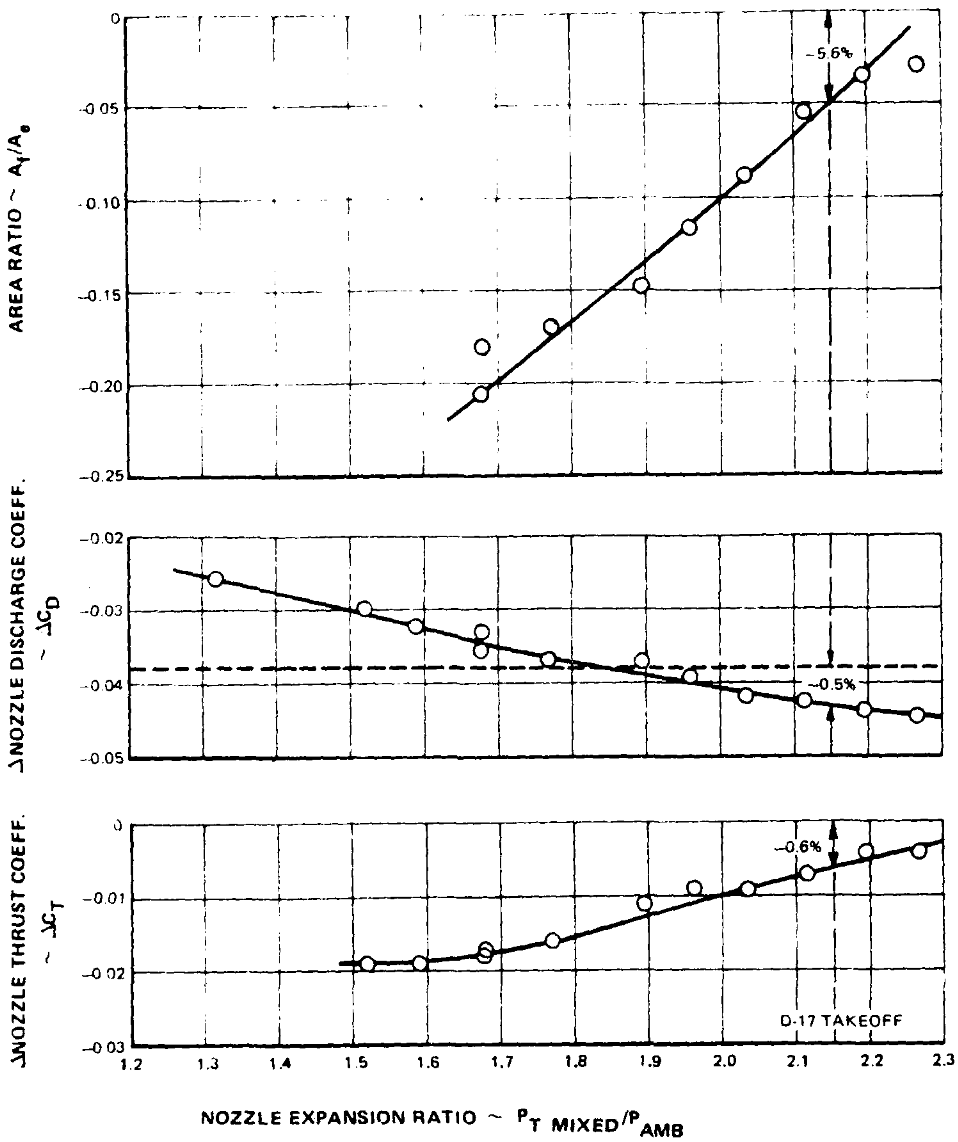


Figure 3.3.1-5 Exhaust System Performance Trends -- The figure shows the effect the 5Z mixer produced on nozzle discharge coefficient, nozzle thrust coefficient and area ratio.

Area ratio, as shown in Figure 3.3.1-5, is 5.6 percent below a standard engine at takeoff with a much larger variation at low power. As with the 5M configuration, the reduction in area at the mixer discharge plane results in a variation in calculated area ratio as a function of power.

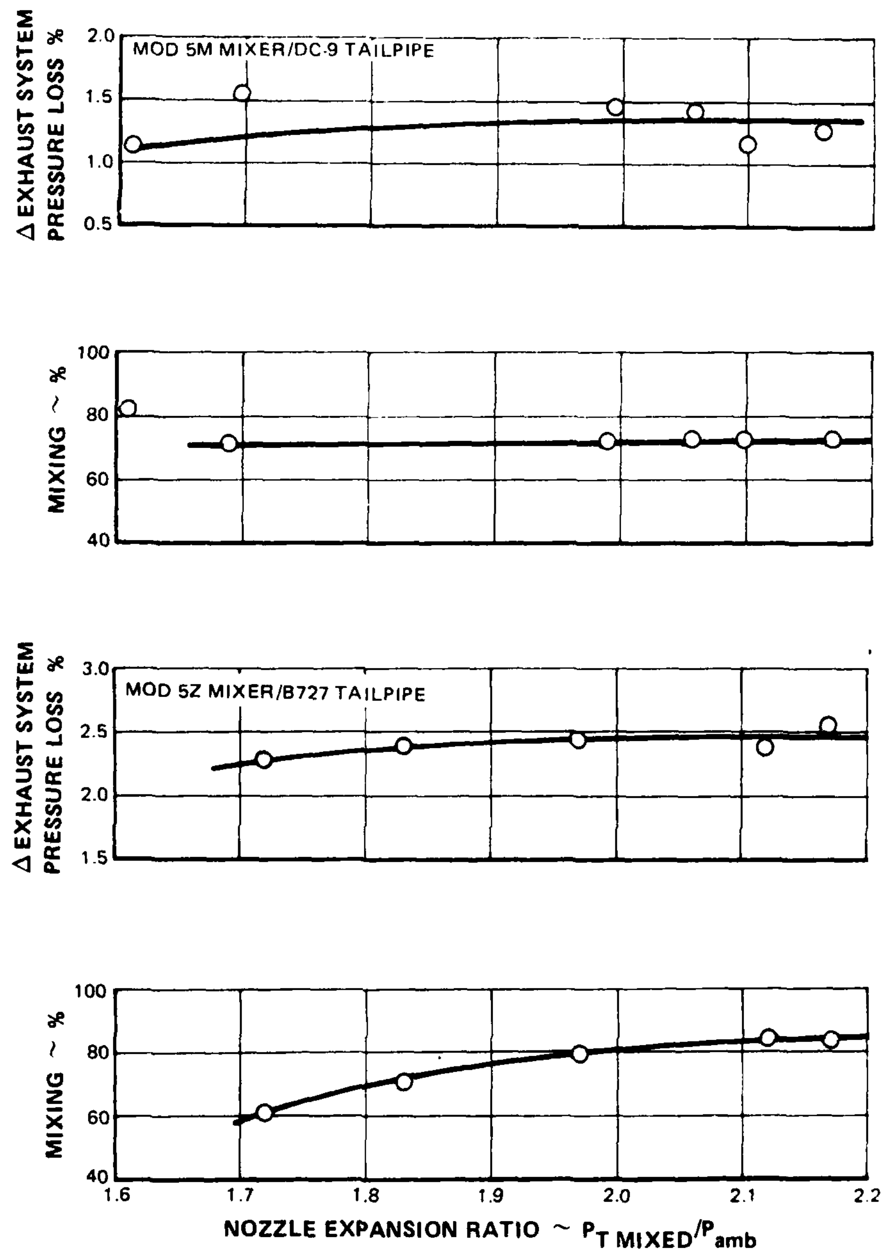


Figure 3.3.1-4 Analytical Projection of Mixer Performance in Relation to Standard Exhaust System Performance -- Estimates in mixing and pressure loss can be derived from the analysis of shifts in nozzle thrust and discharge coefficients.

Therefore, correct nozzle sizing could only be achieved at a single point. An area increase of 3.8 percent was selected to avoid excessive compromises in operating line shift at very high or very low power setting.

3.3.1.3 Mixer Aerodynamic Performance

Nozzle exit velocity profiles were used to assess the degree of radial and circumferential mixing of selected mixer configurations. Data to generate the profiles were acquired with traversing pressure and temperature instrumentation in a plane approximately 2 inches from the nozzle exit. By assuming that static pressure is constant across the face of the nozzle and that this pressure is equivalent to the static pressure measured on the external surface of the nozzle, velocities could be calculated from the traverse data and isopleths of constant velocity could be generated. All traverse data were obtained at maximum continuous power and velocities corrected to ambient conditions were used for correlating noise data (77°F ambient temperature).

The exit velocity pattern of a standard JT8D-17 engine with a DC-9 tailpipe is shown in Figure 3.3.1-6 and a profile with a 727 tailpipe is shown in Figure 3.3.1-7. Figures 3.3.1-8 through 3.3.1-12 show the exit profiles of selected mixer configurations. The missing sectors at the 4:00 and 10:00 o'clock positions correspond to the locations where the gear on the traverse instrumentation equipment interferred with the stangs that support the DC-9 reverser linkage.

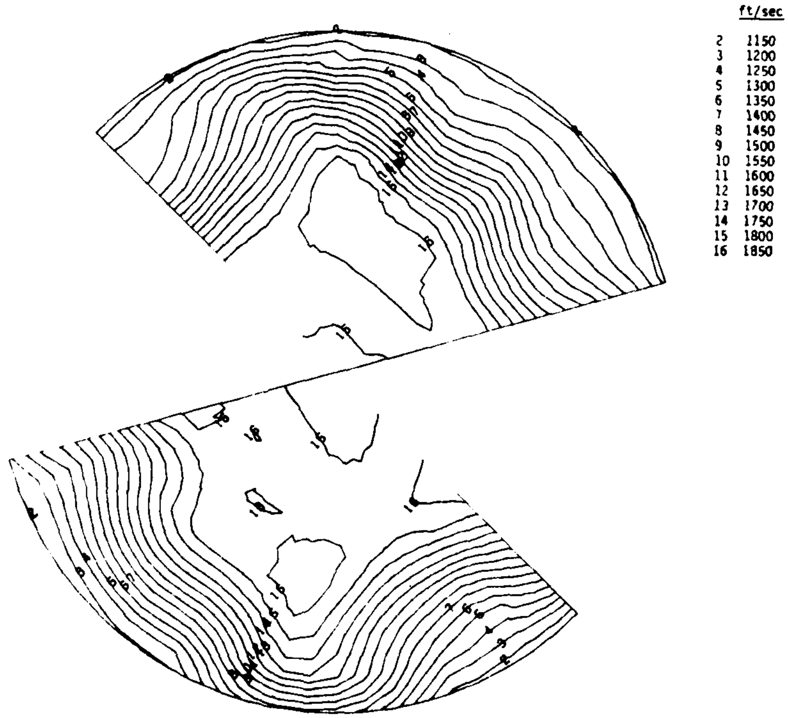


Figure 3.3.1-6 Exit Velocity Profile of Standard JT8D-17 Engine with DC-9 Tailpipe — The higher temperature and higher velocity flow is concentrated in the central region.

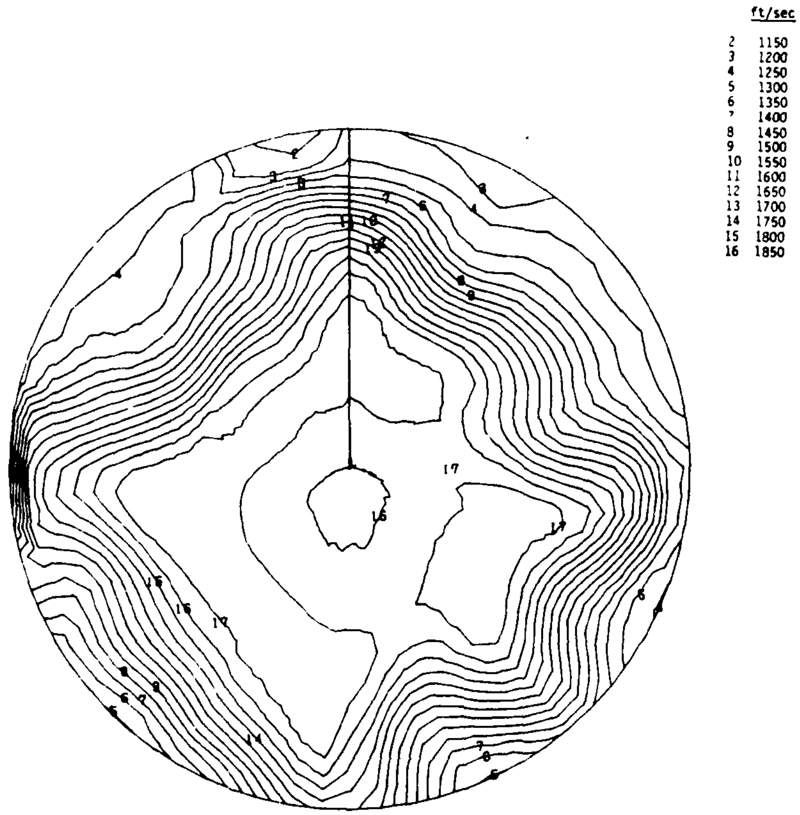


Figure 3.3.1-7 Exit Velocity Profile of Standard JT8D-17 Engine with 727 Tailpipe — The exit flow pattern is essentially the same as that with the DC-9 tailpipe.

As indicated in Figure 3.3.1-6, the higher temperature, higher velocity gases exiting the turbine in a standard JT8D engine are concentrated in the center of the DC-9 tailpipe. Peak velocities in excess of 1850 ft/sec are exhibited in the flow. Cooler, low velocity gases tend to accumulate near the tailpipe walls, and a fair degree of mixing as a result of viscous shear is evident from the lack of a distinct boundary between the two streams. The diamond shape of the velocity contour is typical of a JT8D engine and is attributed to an interaction of gases with the tangential struts in the fan stream and the turbine exhaust case struts in the core stream. Overall, the exit porfile of the JT8D with the 727 tailpipe is very similar, as indicated in Figure 3.3.1-7.

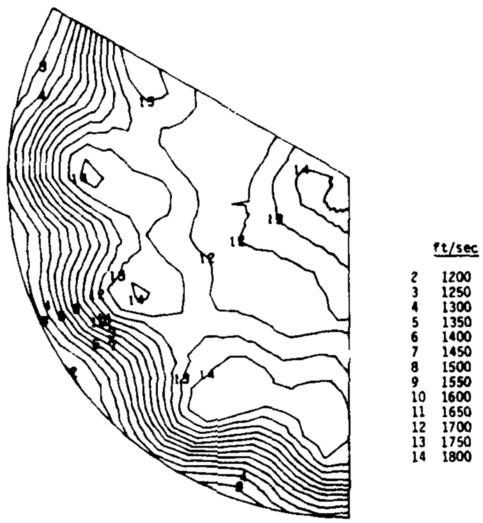


Figure 3.3.1-8 Exit Velocity Profile with Mod. 3 Mixer -- This profile exhibits appreciable mixing of core and fan stream gases.

Figure 3.3.1-8 shows the velocity pattern with the Mod. 3 configuration, the first mixer evaluated for acoustic performance. The position of the mixer lobes is clearly visible as high velocity islands at the mid span location. In contrast to the profile in Figure 3.3.1-6, the region of high velocity gas diminished considerably, although some moderately high velocity regions up to 1800 ft/sec are still present.

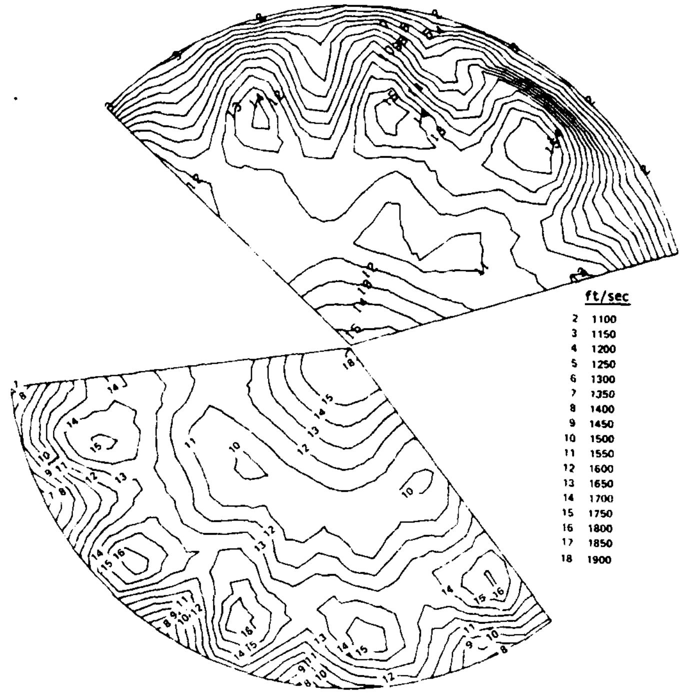


Figure 3.3.1-9 Exit Velocity Profile with Mod. 4A Mixer -- Increased mixing, representative of a substantial noise reduction, is indicative of the greater penetration of core cases to the outer area.

The design changes in the Mod. 4A mixer successfully increased mixing, as indicated in Figure 3.3.1-9. The higher velocity gases penetrated further towards the outer tailpipe wall and a region of low velocity gases displaced the hotter gases at the 30 to 60 percent span location. These changes in exit characteristics are significant since the Mod. 3 configuration produced essentially no reduction in noise, while the Mod. 4A design demonstrated a substantial noise reduction.

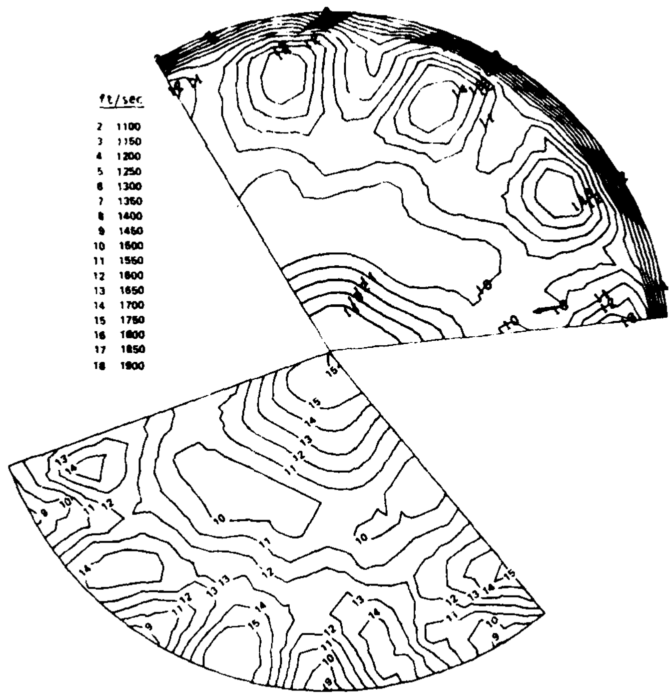


Figure 3.3.1-10 Exit Velocity Profile with the Mod. 5 Mixer -- The higher rate of mixing with the attendant higher temperature gas flow in the outer region produced high tailpipe wall temperatures.

Traverse results with the basic Mod. 5 configuration are shown in Figure 3.3.1-10. The effect of increased deflection of the mixer lobes is apparent in the radial movement of high velocity regions. Although this outward dispersement of high temperature gases appeared to increase the rate of mixing, it also produced unacceptably high tailpipe wall temperatures for the DC-9 installation. The effect of configurational changes to alleviate this condition (Mod. 5M) is shown in Figure 3.3.1-11. Exit velocity characteristics indicate a similar degree of mixing and the position of the lobe centers as achieved with the Mod. 4A design. Also, a coolant film of fan air protects the outer wall from the direct impingement of high temperature core gases.

The profile with the Mod. 5Z mixer/727 tailpipe in Figure 3.3.1-12 shows the apparent increase in the displacement of the core flow with the fan stream flow. The absence of a tailpipe temperature limit and thus elimination of a cooling film on the outer wall, permitted the penetration of the higher temperature core flow to the outer wall. The displacement of fan and core stream flows is so thorough that the central region is dominated by fan flow while the outer region is dominated by core flow.

In other words, the flow distribution has been inverted, thereby forming an inverted velocity profile — a characteristic evident only with the 5Z mixer. Further discussion of the inverted velocity profile and the influence on acoustic characteristics is presented in Section 3.3.2.4.

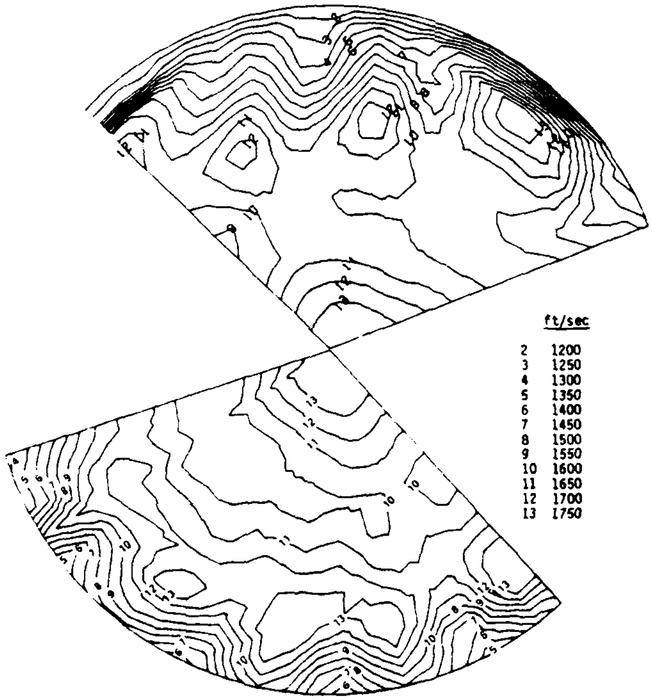


Figure 3.3.1-11 Exit Velocity Profile with the Mod. 5M Mixer -- As evident by this profile, the 5M configuration was successful in optimizing mixing properties while maintaining acceptable outer wall temperature levels. Note the similarity to the Mod 4A profile.

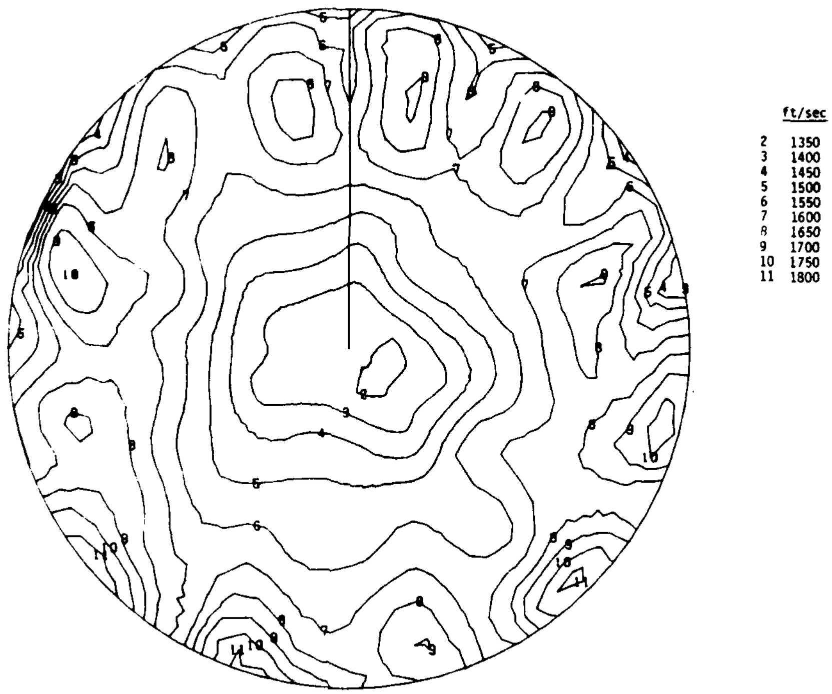


Figure 3.3.1-12 Exit Velocity Profile with Mod. 5Z Mixer -- This profile is characterized by an displacement of fan and core - inverted velocity profile.

3.3.2 Acoustic Characteristics

3.3.2.1 Acoustic Comparisons with 5M Mixer/DC-9 Tailpipe

In this section, representative noise reduction trends demonstrated with the 5M mixer are compared to a standard JT8D engine and discussed in terms of peak perceived noise level (PLN), directivity and noise spectra. These comparisons show that the Mod. 5M mixer provided significant static jet noise reductions over the range of frequencies and angles necessary to obtain meaningful reductions in airplane takeoff noise. Noise levels presented in this section are based on static data.

Estimates of inflight levels are contained in Section 3.3.2.3.

To illustrate the effect on peak PNL, Figure 3.3.2-1 shows a comparison of peak PNL at 1500 feet versus thrust for both standard JT8D-17 engine and 5M mixer configurations based on the data regression procedure outlined in Section 2.2.2.2. At the bottom of the figure, the reduction in peak perceived noise level from the mixer is shown as a function of thrust. As indicated, the mixer provided a reduction in peak PNL over the entire thrust range. The maximum reduction was 2.3 PNdB at 13,000 pounds, which is the thrust range typical of reduced thrust "cutback operation" used during takeoff. The minimum reduction was 1.4 PNdB, occurring at the 6000 pound thrust level.

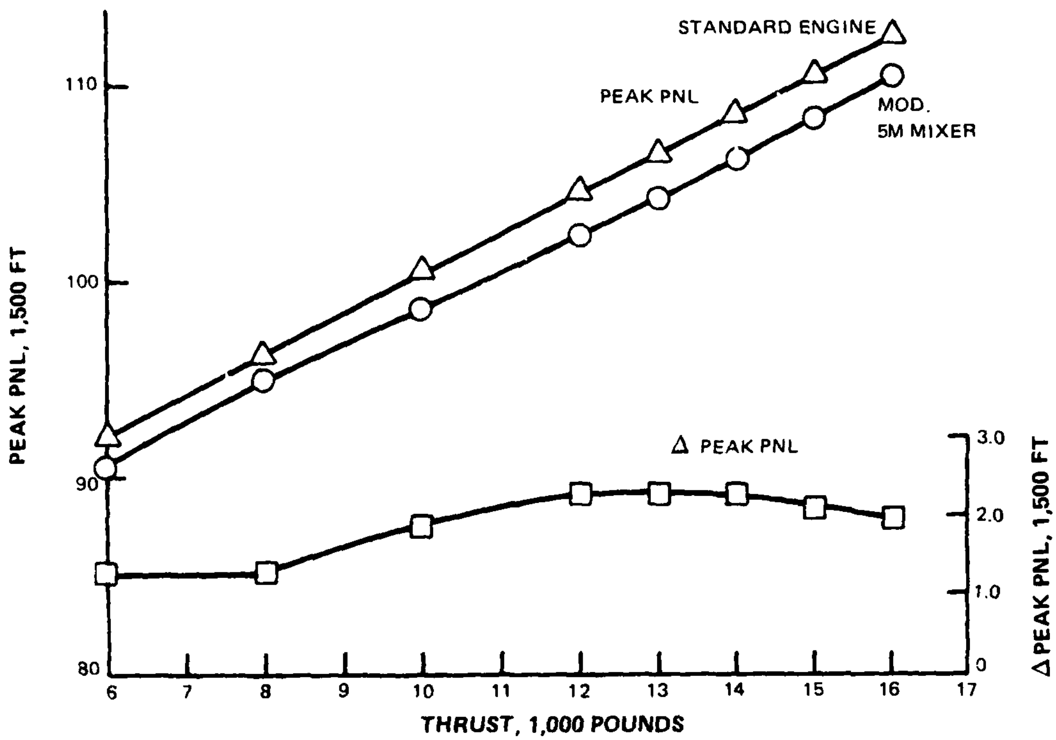


Figure 3.3.2-1 Perceived Noise Level Trends -- Compared to a standard JT8D engine configuration, the mixer provides a maximum noise reduction of 2.3 PNdB, occurring at a thrust setting of 13,000 pounds.

Comparisons of PNL directivity patterns (PNL versus radiation angle,) for the same test configurations are shown at three thrust conditions in Figure 3.2.2-2. Radiation angle is defined as the angle relative to the upstream jet axis and centered at the tailpipe exit plane. The operating conditions shown are a takeoff static gross thrust rating of 16,000 pounds, a typical cutback thrust level of 12,000 pounds, and a low power level of 6000 pounds which is within the thrust range used during landing approach. As indicated by this figure, the maximum reductions in PNL from the mixer occurred in the mid-angle range for all thrust levels. Figure 3.3.2-3 shows the reduction in PNL also as a function of radiation angle for the same thrust conditions. The peak reduction angle ranged from 130 to 150 degrees, depending on the thrust level. At angles less than 110 degrees, the noise reduction was less than 1 PNdB and there was no distinct trend with thrust level. However, at 130 degrees, the reduction in noise increased with thrust, reaching a maximum value of 2.5 PNdB at 16,000 pounds thrust. Above 135 degrees, noise suppression decreased with thrust. The maximum reduction at any one angle was 2.7 PNdB, occurring at 150 degrees and 6000 pounds thrust.

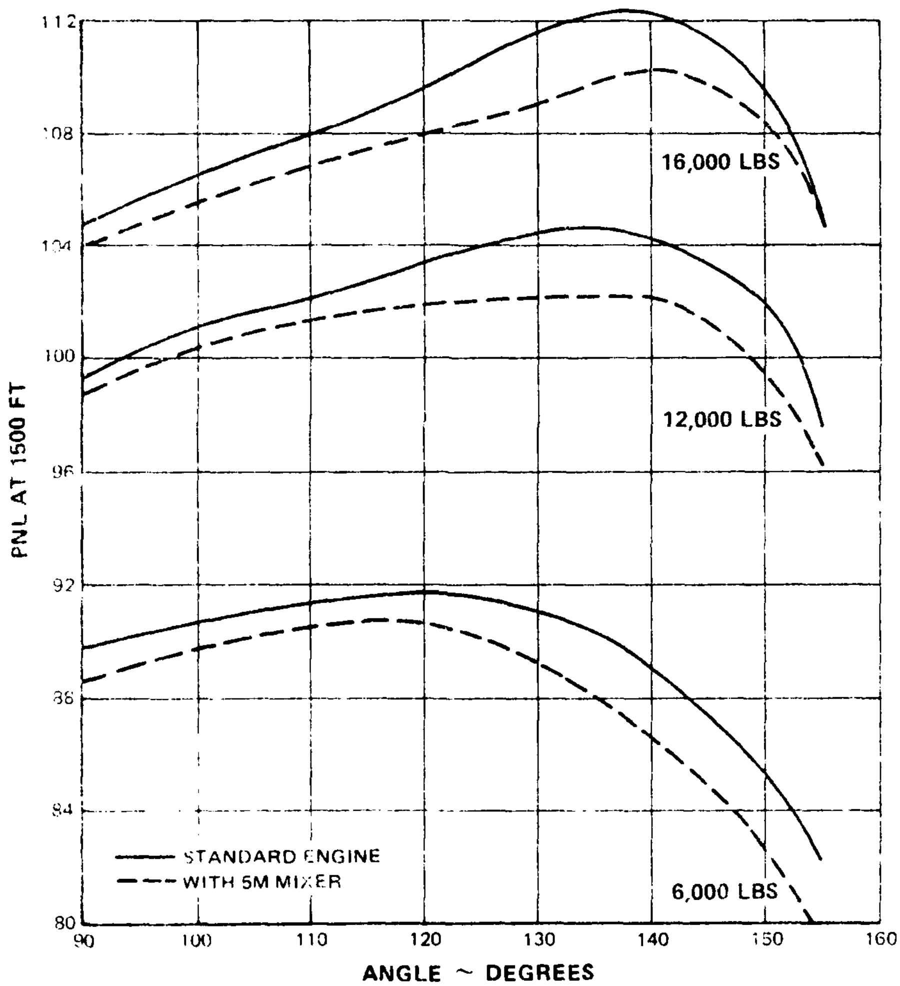


Figure 3.3.2-2 Perceived Noise Level Directivity Trends -- At all thrust conditions and angles, the mixer demonstrated a reduction in noise.

A special procedure was employed to compare noise spectra at equal thrust values. One-third octave band data were processed with the Pratt & Whitney Aircraft computer program for one-third octave band averaging. The program provides a high order polynominal least squares regression for each one-third octave band sound pressure level versus a selected parameter — in this case, the core stream jet velocity in feet per second, expanded to ambient pressure and corrected to a 77°F day.

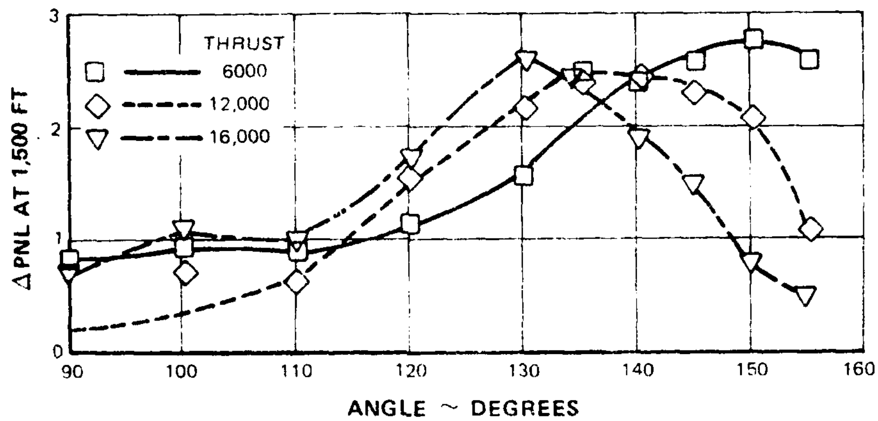


Figure 3.3.2-3 Perceived Noise Level Reduction Directivity Trends -- As indicated, the maximum noise reduction at any single angle is 2.7 PNdB, occurring at 150 degrees and 6000 pound thrust.

Figures 3.3.2-4 through 3.3.2-6 present a comparison of one-third octave band averaged free-field spectra extrapolated to a 1500-foot sideline distance for a 77°F FAA day. In these figures, spectral data for both standard and mixed configurations are shown for three angles at each of the three thrust settings.

Figure 3.3.2-4(a) shows the spectra at an angle of 90 degrees for a thrust level of 16,600 pounds. Significant reductions in sound pressure level (SPL), up to 1.6 dB, resulting from the mixer occur at frequencies from 200 to 2000 Hz, with essentially no reduction at frequencies outside this range. The small noise peak in the mixer spectra at 400 Hz is attributed to combustion noise, described in detail in FAA report "Combustion Noise Investigation" (FAA RD-77-3). This noise is not in the standard engine spectra because of the higher level of jet noise. At an angle of 120 degrees (Figure 3.3.2-4(b)), noise reductions up to 3 PNdB were obtained. However, as indicated in Figure 3.3.2-4(c), only a 1 PNdB reduction was attained at an angle of 140 degrees.

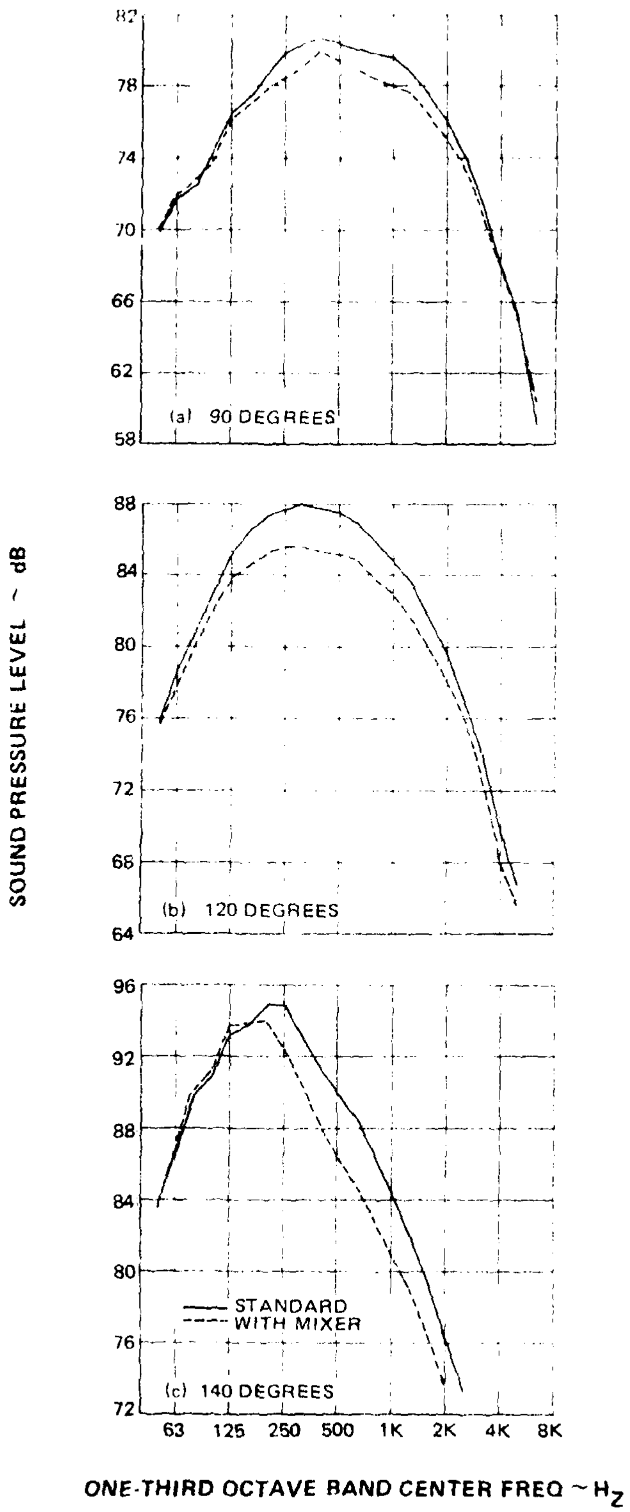


Figure 3.3.2-4 Noise Spectra Trends at Takeoff Thrust Setting -- This series of curves shows that the most significant reductions in sound pressure level resulting from the mixer occur at frequencies from 200 to 2000 Hz.

Spectra at a 12,000-pound thrust level are presented in the series of curves in Figure 3.3.2-5. At 90 degrees, the peak at 400 Hz is more pronounced in the mixer spectra than at 16,600 pounds (Figure 3.3.2-4(a)). The results at 120 degrees are similar to trends at the higher thrust level. At 140 degrees, however, the peak SPL noise reduction is 2 PNdB, compared to only 1 PNdB at 16,000 pounds thrust.

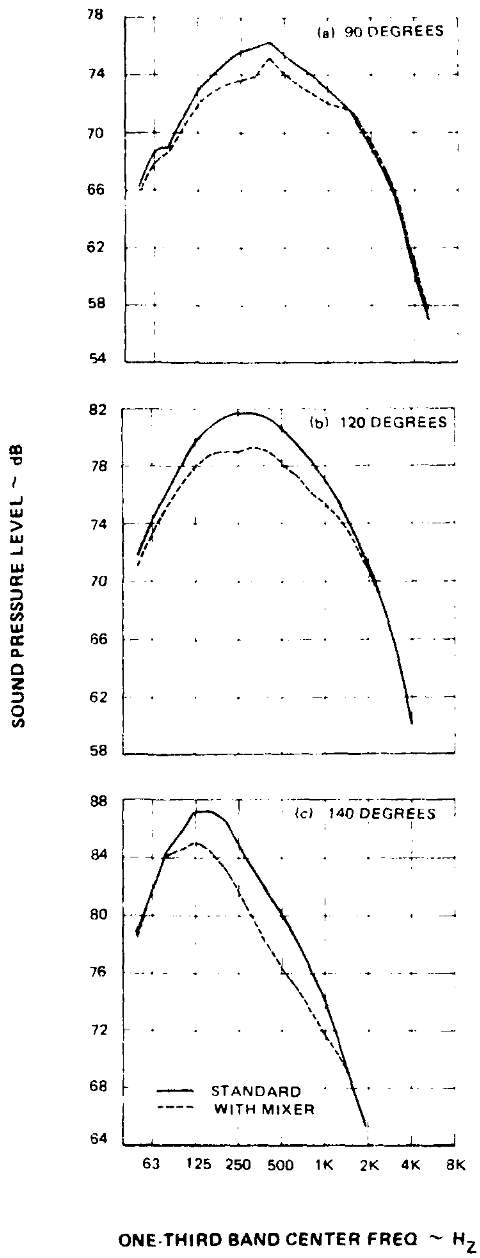
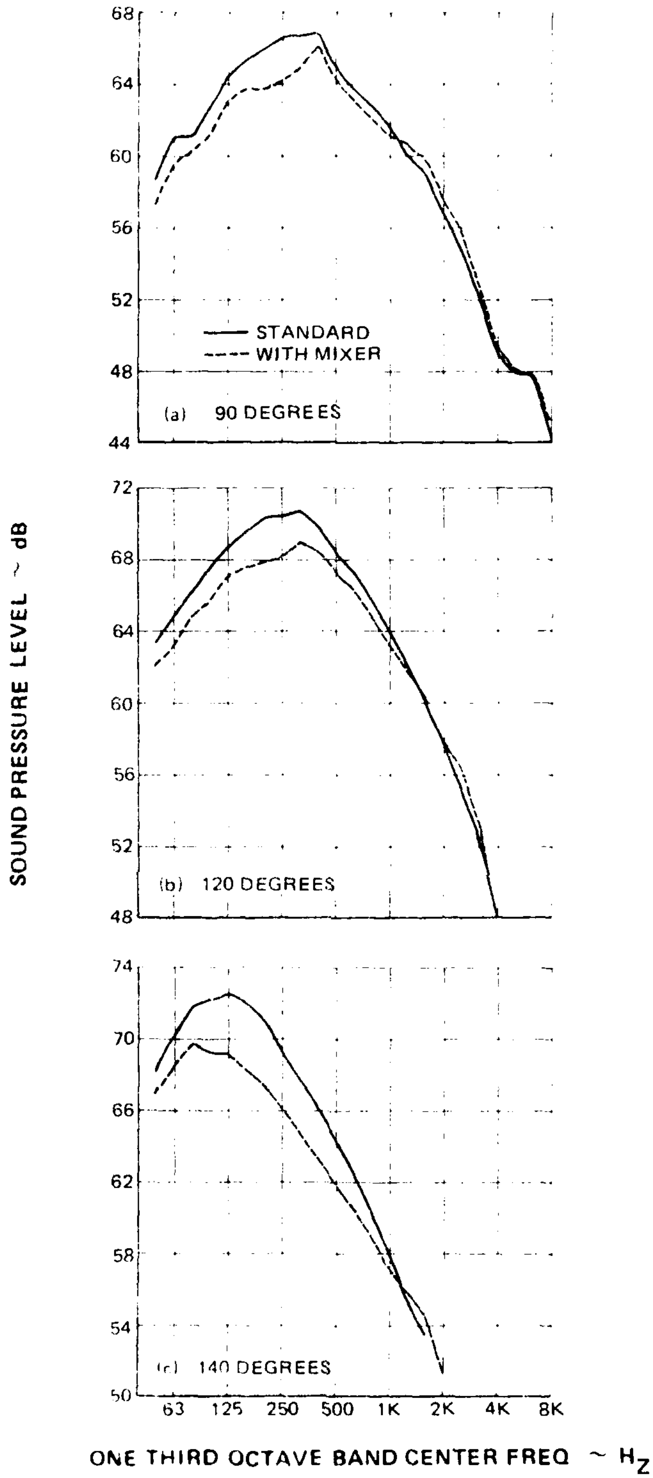


Figure 3.3.2-5 Noise Spectra Trends at Cutback Thrust Setting -- Noise reduction trends are similar to results at takeoff power.



[illegible] Spectra Trends at Approach Thrust Setting --
[illegible] reduction trends are similar to results at
[illegible] power

Figure 3.3.2-6 shows spectra at the 5000-pound thrust level. Results at a 90-degree angle show the noise peak occurring at 400 Hz in the mixer spectra is more prominant than at either of the higher thrust levels. Also, the 400 Hz noise is apparent in the standard JT8D engine spectra, a result not evident at higher thrust levels. Moreover, as indicated in Figure 3.3.2-6(b), the 400 Hz noise is present in both spectra at 120 degrees. These results, in terms of frequency and level, are consistent with core combustion noise predictions published in the aforementioned FAA report (RD-17-3) for the JT8D engine. In the standard engine configuration, core noise is present at low thrust levels because jet noise diminishes at a faster rate with decreasing thrust. The core noise is evident in the spectra at all thrust settings with the mixer since the mixer produces significant reductions only in the jet noise component.

A comparison of noise spectra at 90 and 120-degree angles in Figure 3.3.2-6 indicates that reductions in jet noise were achieved at frequencies up to approximately 1600 Hz. However, above 1600 Hz, the mixer produces SPL levels up to 1 PNdB higher than a standard JT8D. This is believed to be the influence of fan-generated noise, which would be expected to increase with the mixer installed because of a small increase in low-pressure rotor speed at low thrust settings. At an angle of 140 degrees, as shown in Figure 3.3.2-6(c), a significant reduction in noise at most frequencies was demonstrated with the mixer.

3.3.2.2 Inflight Noise Estimates -- Mod. 5M Mixer/DC-9 Tailpipe

Noise data obtained from the static tests were used to estimate effective perceived noise levels (EPNL) reductions for a mixer-equipped engine relative to a standard JT8D engine when both are operating under forward flight conditions at equal thrust levels. For these estimates, airplane altitude and airspeed were defined at 1500 feet and 300 feet per second, respectively, which are typical operating conditions for JT8D-powered aircraft. Since the static data used in the inflight estimates were measured by ground plane microphones, the EPNL estimates have been made for ground plane measurements. It was assumed that noise from the engine exhaust was not contaminated by other noise sources such as the fan. Possible effects on noise propagation from aircraft shielding were not considered and extra ground attenuation was ignored.

The analytical procedure employed to establish the estimates consisted of the following:

(1) Static noise levels from each configuration measured by the ground plane microphone (90 to 155 degrees) were extrapolated to an altitude of 1500 feet. Perceived noise levels at angles forward of 90 degrees were established by assuming that the ground microphone perceived noise level versus angle shapes for angles less than 90 degrees were the same as those measured by the pole microphones.

(2) The static PNL at each angle was corrected to provide flight PNLs by accounting for the effect of airplane

forward speed the procedure described in NASA TM 79155 (An Improved Method for Predicting the Effects of Flight on Jet Mixing Noise: J. R. Stone; June 1979).

(3) Flyover time histories (flight PNL versus time) were plotted by assuming a level flyover at an altitude of 1500 feet and an airplane speed of 300 feet per second.

(4) Effective perceived noise levels were calculated by interpolating the PNL time history plots at 0.5-second intervals, and using the formula below over a duration corresponding to that specified by the 10 dB down point.

$$\text{EPNL} = -13 + 10 \log \quad [10 \text{ Exp } (\text{PNL}/10)]$$

The estimated inflight perceived noise level time histories for a standard JT8D engine and an engine incorporating a Mod. 5M mixer are presented in Figure 3.3.2-7 for the static gross thrusts of 16,000 and 12,000 pounds, which correspond to the engine power setting at maximum and cutback thrusts, respectively. The reduction in EPNL produced by the mixer at the 16,000 pound thrust power setting was calculated at 2.7 dB. This estimate is greater than the reduction in peak static PNL by 0.7 dB. The estimated reduction in EPNL at the 12,000-pound thrust level is 2.4 dB, which is 0.1 dB greater that the peak static PNL reduction.

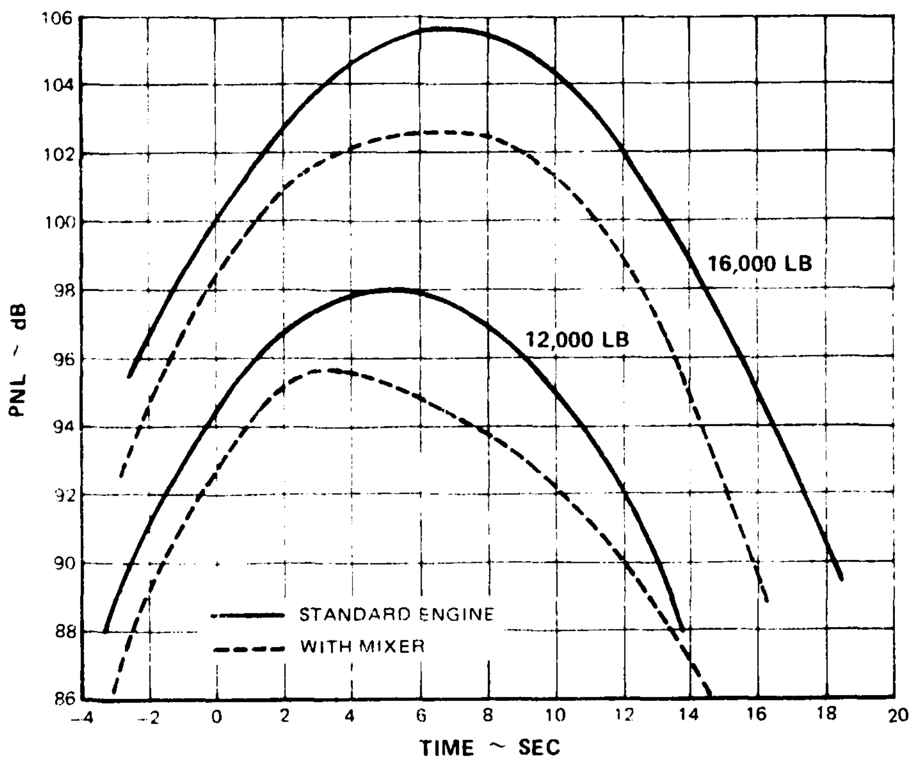


Figure 3.3.2-7 Estimated Inflight PNL Time Histories for Takeoff and Cutback Thrust Settings — Estimates of inflight EPNL noise reduction are higher than measured static peak PNL reduction.

It would be also desirable to estimate the inflight noise reduction with the mixer during the landing approach condition. However, actual approach flyovers of airplanes powered by JT8D engines clearly show that fan-generated noise dominates the overall noise signature at this low thrust condition, as illustrated by the noise spectrum in Figure 3.3.2-8. This spectrum, occurring at the angle of peak PNL (between 70 and 80 degrees) during the approach flyover of a JT8D-powered DC-9 airplane, contains a large amplitude discrete tone at 3300 Hz generated by the fan. The static data measured during this program does not show the presence of this tone since the use of an inlet suppression tube eliminated the inlet-radiated noise. Thus, although the mixer produced significant reductions in jet noise at low thrust levels, as discussed earlier, the dominance of fan noise precludes estimating mixer noise reductions at this operating condition.

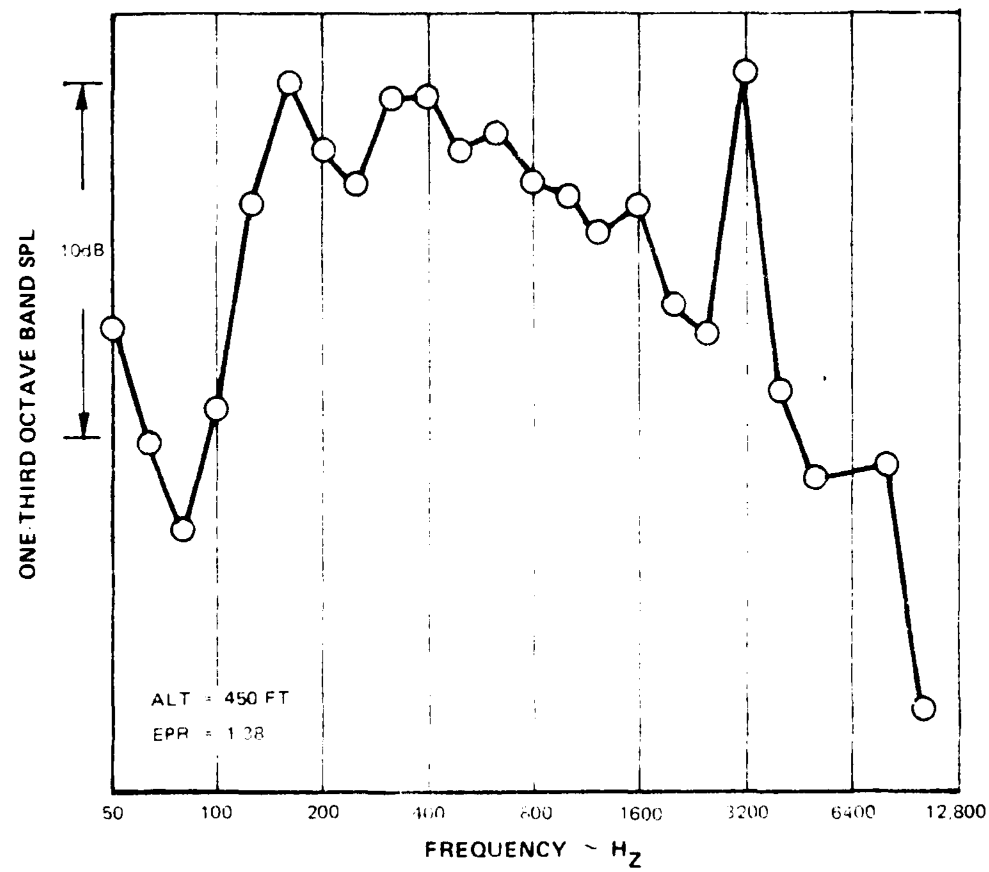


Figure 3.3.2-8 Inflight Noise Spectrum at Time of Peak PNL for JT8D Engines -- Fan-generated noise dominates the noise signature at this low power setting.

3.3.2.3 Acoustic Comparisons with 5Z Mixer/727 Tailpipe

Static acoustic test results acquired with the 5Z mixer and 727 tailpipe are discussed in terms of peak perceived noise level (PNL), directivity and noise spectra. These results demonstrate that the variations in mixer geometry produced significant differences in noise reductions compared to the Mod. 5M/DC-9 configuration. Estimates of inflight levels are contained in Section 3.3.2.4.

Figure 3.3.2-9 shows a comparison of peak PNL at 1500 feet versus thrust for both standard exhaust and 5Z mixer configurations based on the data regression procedure outlined in Section 2.2.2.2. Noise characteristics of a standard JT8D engine were essentially the same with the 727 tailpipe as the DC-9 tailpipe, indicating that a change in tailpipe had a negligible effect on peak perceived noise level. However, in comparison to the Mod. 5M mixer, the 5Z/727 configuration produced substantially lower values of peak PNL at thrusts above 10,000 pounds. The reduction in peak PNL was 4.7 PNdB at 16,000 pounds thrust, which is 2.7 PNdB greater than that exhibited with the 5M mixer. At a thrust of 12,000 pounds, the peak noise reduction was 3.0 PNdB, compared to 2.3 with the 5M mixer.

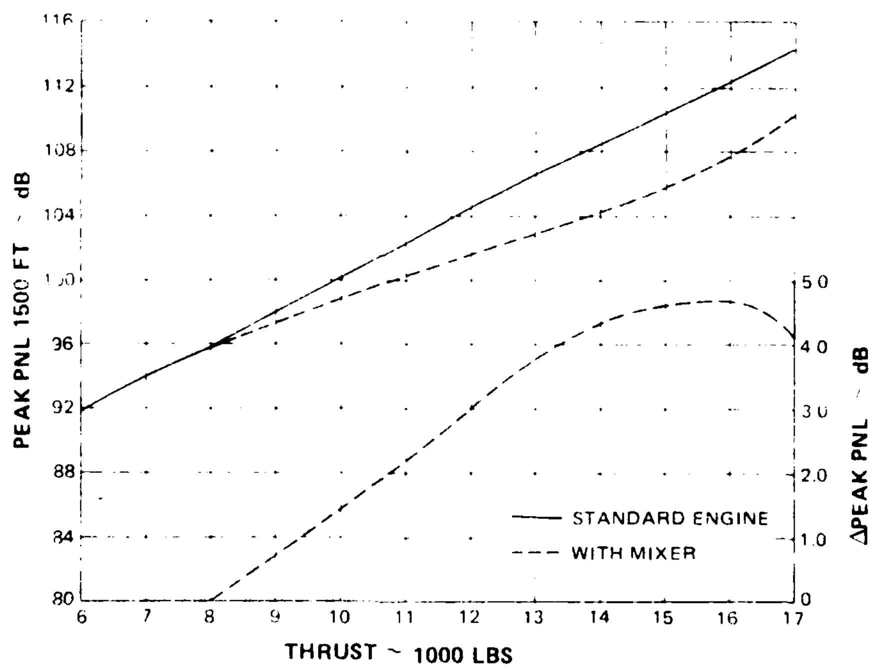


Figure 3.3.2-9 Perceived Noise Level Trends -- The demonstrated noise reduction at high power settings is 4.7 PNdB with the 5Z mixer.

Comparisons of PNL directivity patterns are shown in Figure 3.3.2-10 at both 16,000 and 12,000 pounds thrust. In comparing these results with data acquired with the Mod. 5M mixer in Figure 3.3.2-2, it is apparent that the 5Z configuration produced significantly greater noise reductions at angles beyond 110 degrees. It is also noted that the directivity pattern of a standard JT8D engine with either a DC-9 or 727 tailpipe is quite similar, except at a 155-degree angle where noise levels with the 727 tailpipe are higher. This indicates that differences in tailpipe geometry had a negligible effect on noise directivity.

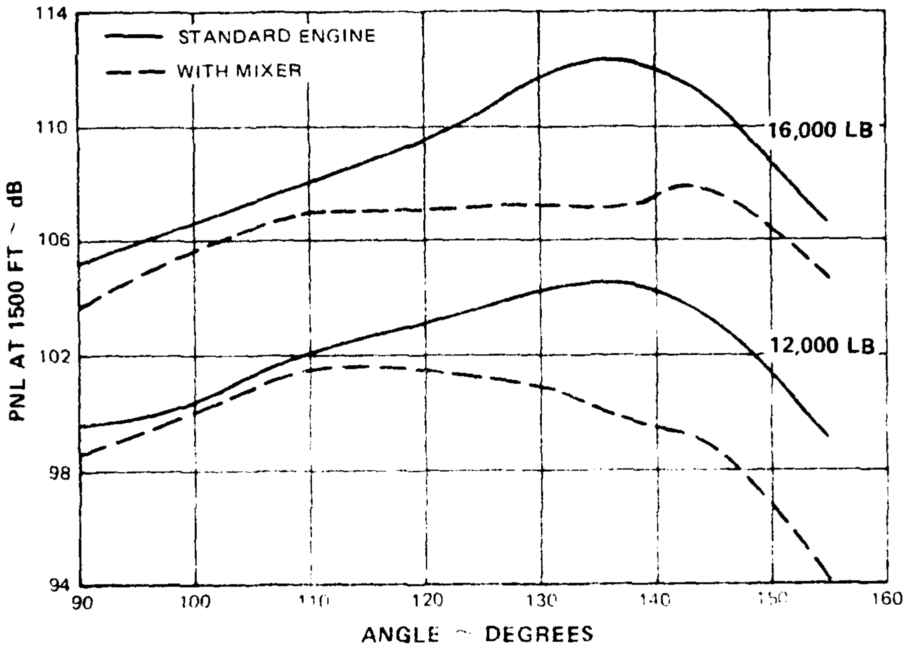


Figure 3.3.2-10 Perceived Noise Level Directivity Trends -- At all thrust conditions and angles, especially beyond an angle of 110 degrees, the 5Z mixer demonstrated a reduction in noise.

Noise spectra data are presented by the series of curves in Figure 3.3.2-11. In comparison spectra data with the Mod. 5M mixer, the 5Z mixer again produced more suppression over most of the frequency range. For example, at 140 degrees and at 16,000 pound thrust, the 5M configuration reduced the peak sound pressure level by 1 PNdB, in contrast to the reduction of 4 PNdB demonstrated by the 5Z mixer.

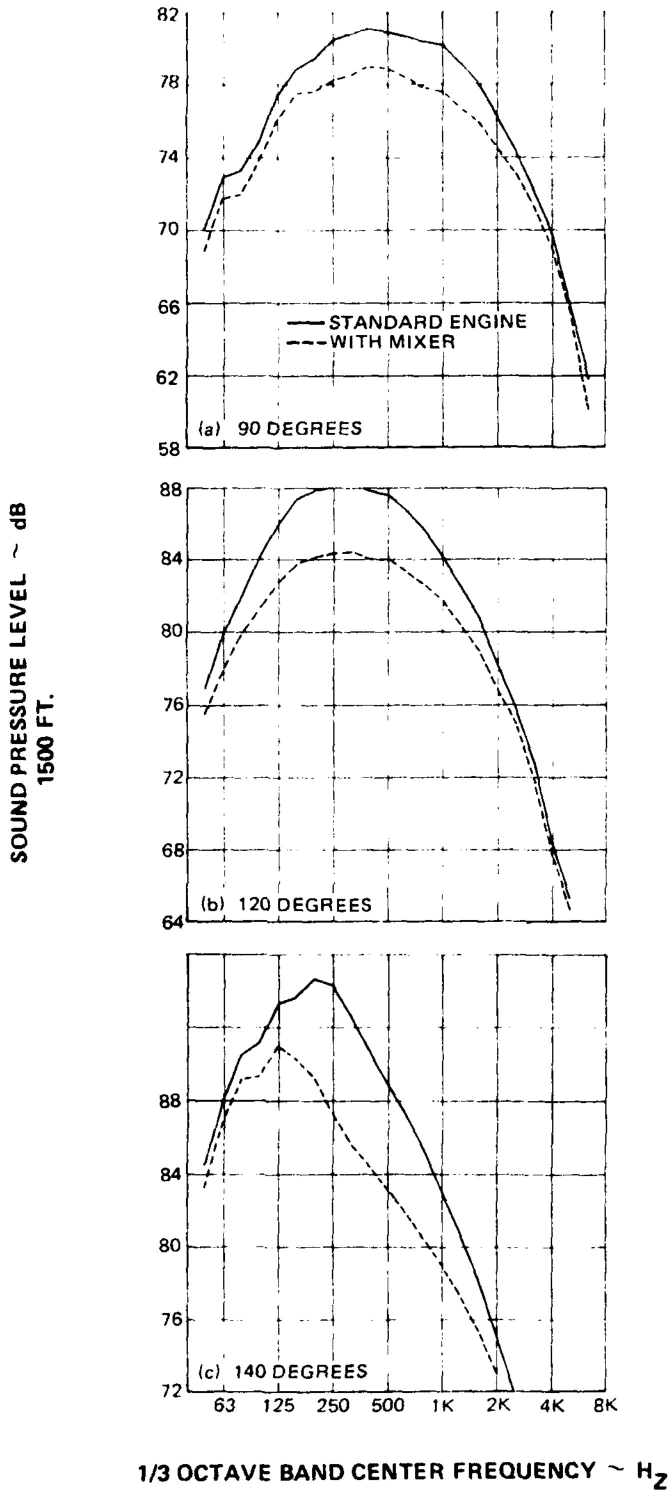


Figure 3.3.2-11 Noise Spectra Trends at Takeoff Thrust Setting -- These results show the most significant noise reductions in sound pressure level with the mixer occur at frequencies from 125 to 2000 Hz.

The data in Figure 3.3.2-12 quantify the differences in sound pressure level versus frequency at a thrust of 16,000 pounds. In this figure, the differential sound pressure levels of each of the two mixers are shown in relation to a standard engine. At each of the three angles presented, the 5Z mixer/727 configuration produced greater noise reductions at frequencies below 2000 Hz than the 5M/DC-9 configuration.

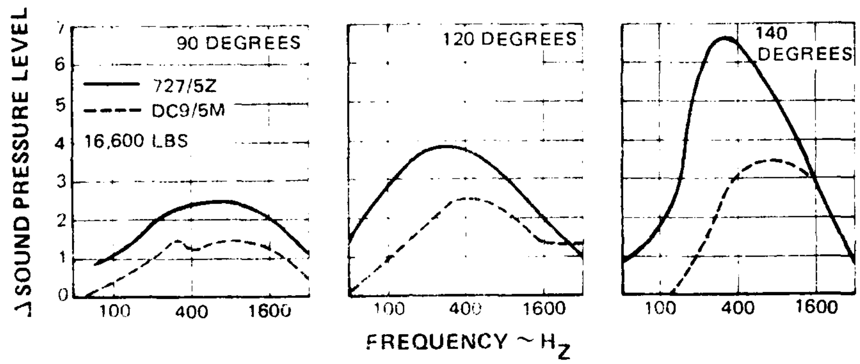


Figure 3.3.2-12 Sound Pressure Level Reduction -- The superior noise reduction capability of the 5Z mixer is clearly indicated -- this capability can be related to differences in tailpipe exit velocity profiles developed by each mixer configuration.

The differences in noise reduction capability between the 5Z and 5M mixers can be related to the differences in tailpipe exit velocity profiles developed by each mixer configuration. Figures 3.3.2-13 and 3.3.2-14 show the exit velocity characteristics with the 5M and 5Z mixers, respectively. Each profile is distinguished by lines of constant velocity (iso-velocity contours), the values of which are indicated on each iso-velocity line. In examining these profiles, there are several major differences. First, the 5M/DC-9 configuration shows very high velocities, in excess of 1750 ft/sec, in the central region, while this same region in the 5Z/727 configuration exhibits low velocity levels -- on the order of less than 1400 ft/sec. Secondly, maximum velocities (greater than 1800 ft/sec) with the 5Z/727 tailpipe were located at the outer edge of the bottom tailpipe cross section, while in the other the maximum velocities were located at about 80 percent of the radius with slightly lower values.

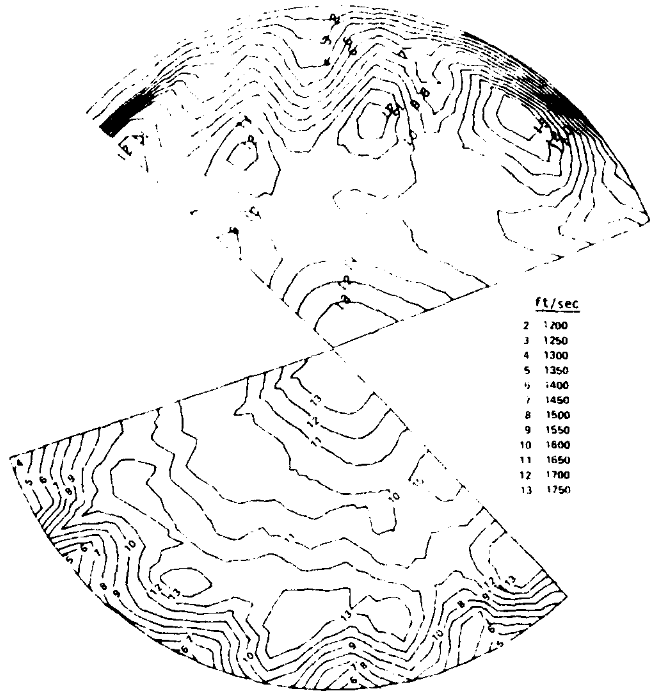


Figure 3.3.2-13 Exit Velocity Profile with 5M/DC-9 Configuration -- The central region exhibits higher velocity levels compared to the 5Z/727 configuration.

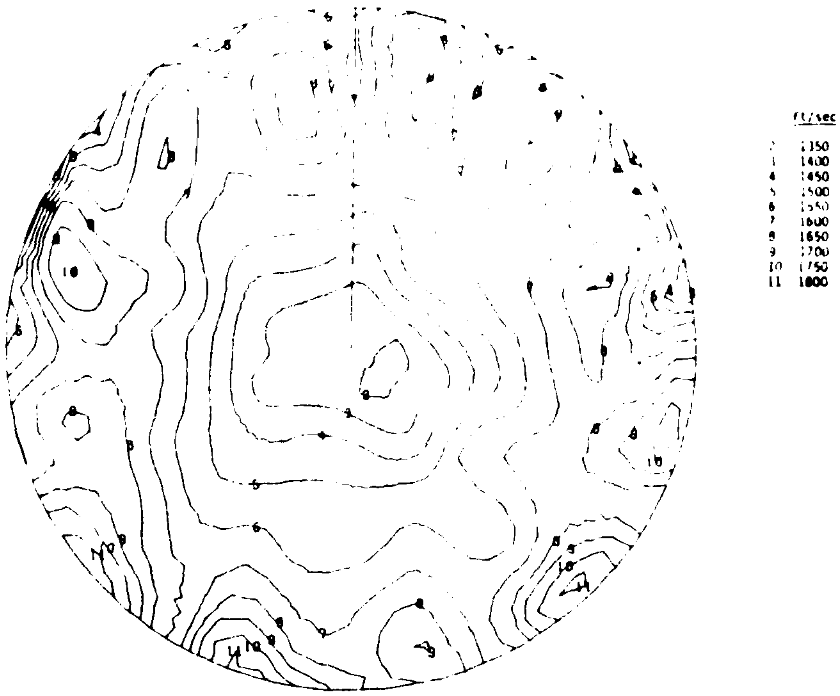


Figure 3.3.2-14 Exit Velocity Profile with 5Z/727 Configuration -- The central region of this profile is dominated by lower velocity fan stream flow and the outer region is dominated by the higher velocity core flow.

Figure 3.3.2-15 further illustrates the differences in these profiles. In this figure, the velocity along a radial line at approximately 190 degrees clockwise from the top of the engine is shown as a function of radial location. The 5M profile, although reasonably well mixed in this region, contains higher than average velocities in the central and 80 percent span regions. In contrast, the 5Z profile has an inverted characteristic -- the lower temperature fan flow is dominant in the central region while the higher velocity, higher temperature core flow dominates the outer radial region. The inverted nature of this flow is believed responsible for the appreciable noise reduction by the 5Z mixer.

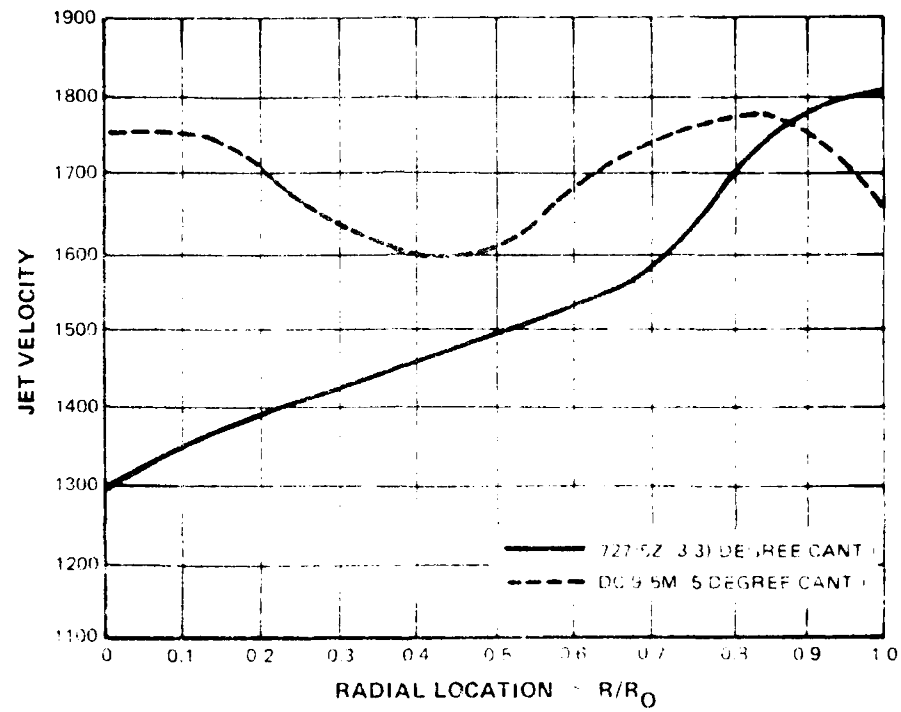


Figure 3.3.2-15 Velocity as a Function of Radial Location -- The inverted velocity characteristics produced by the 5Z mixer, compared to the 5M configuration, is apparent by the data.

3.3.2.4 Inflight Noise Estimates -- Mod. 5Z Mixer/727 Tailpipe

The same procedure described in Section 3.3.2.2 was also employed to estimate the inflight noise reduction characteristics. In using this procedure, estimated flight PNL time history curves were determined for both a standard engine and with the 5Z mixer at static thrusts of 16,000 and 12,000 pounds. The estimates of noise reduction are presented in Figure 3.3.2-16.

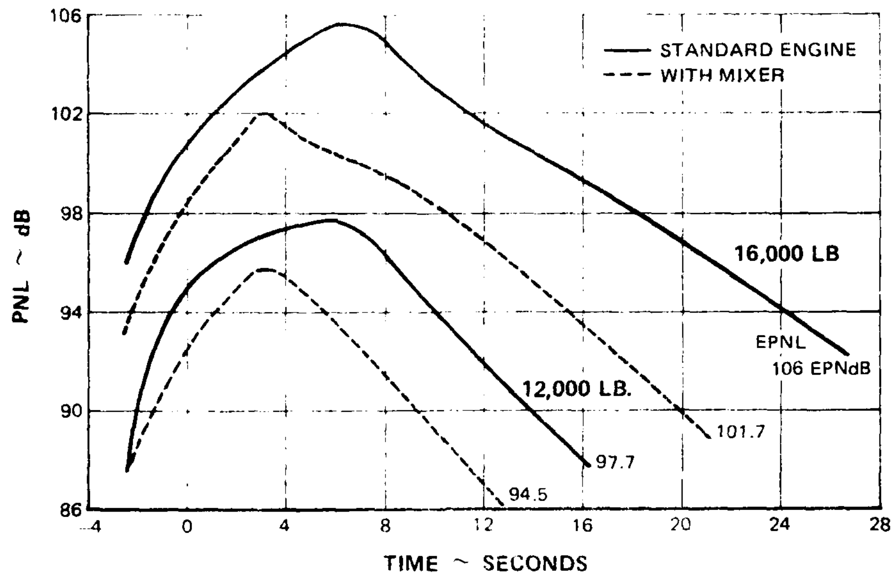


Figure 3.3.2-16 Estimated Inflight PNL Time Histories -- The estimated noise suppression levels with the 5Z mixer are significant at both thrust settings relative to a standard JT8D engine.

The reduction in EPNL produced by the 5Z mixer relative to a standard engine at 16,000 pounds thrust was estimated at 4.3 EPNdB. This value is 1.6 EPNdB greater than the 2.7 EPNdB estimated for the 5M/DC-9 configuration. However, although the differential EPNL reduction for the 5M/DC-9 configuration was 0.7 dB greater than the static differential peak PNL, the differential reduction for the 5Z/727 configuration was less than the static differential peak PNL by 0.4 dB.

Table 3.3.2-I summarizes the static peak PNL reduction as well as the estimated in-flight EPNL reduction for the 5M/DC9 and the 5Z/727 configurations relative to their respective baselines at three gross thrust levels: 16,000 and 14,500 pounds, JT8D-17 and -9 full takeoff power, respectively; and 12,000 pounds, a typical value of takeoff cutback thrust. The table shows that the large reduction in peak PNL at static full power takeoff conditions is somewhat reduced in terms of EPNL reduction under flight conditions.

The explanation for the dissimilarity in static-to-flight effectiveness of the two mixer configurations is related to the large differences in the static PNL directivity patterns and the result of applying the jet effects corrections to these directivity patterns to arrive at inflight PNL time histories. Static and flight PNL characteristics at 16,000 pounds thrust for both mixers are shown in Figure 3.3.2-17. The static data in this figure show that the differences in peak PNL is 2.5 PNdB between the two mixer configurations. In flight, however, the difference is predicted to be 0.5 PNdB.

TABLE 3.3.2-I
STATIC AND SIMULATED LEVEL FLYOVER NOISE REDUCTIONS
- 1500 FT. ALTITUDE-

	Mixer 5M (Flat Profile)	Mixer (Inverted Profile)
Static Test Results (Peak PNL Reduction)		
D-17 Takeoff Thrust (16,000 lb.)	2.0	4.7
D-9 Takeoff Thrust (14,500 lb.)	2.2	4.5
Takeoff Cutback (12,000 lb.)	2.3	3.0
Analytical Flyover Predictions (EPNL Reduction)		
D-17 Takeoff Thrust	2.7	4.3
D-9 Takeoff Thrust	2.6	4.2
Takeoff Cutback	2.4	3.2

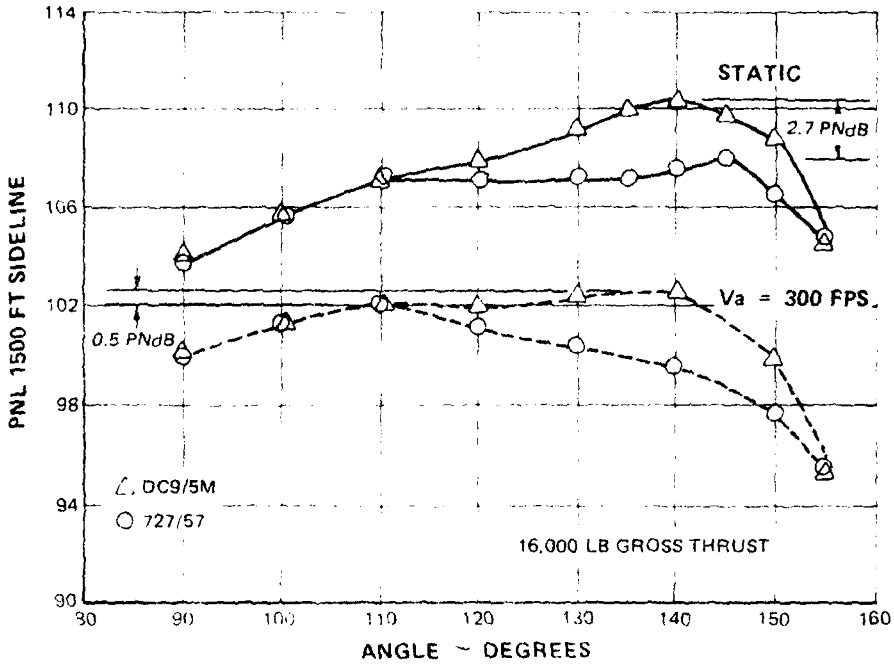


Figure 3.3.2-17 Static and Estimated Inflight PNL Versus Noise Radiation Angle — Static results indicate a difference in peak PNL of 2.7 PNdB with the two mixer configurations, while the inflight difference is predicted to be 0.5 PNdB.

This change in noise characteristics from static to flight resulted because the application of flight effects reduced the peak PNL of the 5M mixer more than the 5Z. This results because (1) the flight correction increases with increasing angle (up to angles of about 150 degrees), which is beyond the peak in the static PNL directivity pattern of both mixers and (2) the 5M mixer had more of a pronounced peak occuring at approximately 140 degrees in comparison to the 5Z configuration which had a relatively flat directivity pattern. Since the peak PNL in flight is the dominant factor in the determination of EPNL, the differential EPNL reflect the peak inflight PNL differences.

At a thrust of 12,000 pounds, it was estimated that the 5Z mixer reduced the EPNL by 3.2 PNdB in relation to a standard engine, compared to a reduction of 2.4 PNdB estimated with the 5M mixer.

The estimates for the 5M and 5Z configurations must be viewed with a certain degree of caution since the static-to-flight corrections for the mixers were assumed to be a function only of jet velocity and air speed. Exit velocity profile shape differences are not accounted for in the flight correction procedure. In addition, although a limited amount of data on fully inverted velocity profiles were obtained in simulated flight testing in wind tunnels, there are no data available for the partially inverted profile characteristic of the 5Z/727 configuration.

3.3.2.5 Jet Crackle Observations

The introduction of the increased thrust JT8D-15 and -17 models also introduced an aspect of jet noise not easily discernable on earlier lower thrust versions of the engine. This noise called "crackle" is characterized by a rapid and irregular series of cracks and bangs.

The presence of crackle has been noticed preivously on high jet velocity turbojets, and a thorough study on the subject can be found in: J.E. Ffowcs Williams et. al. "'Crackle': An Annoying Component of Jet Noise", J. Fluid Mechanics (1975) Volume 71, Part 2, Pages 251-271.

Although audibly important in high velocity jets, crackle does not influence the spectral character of jet noise and its presence can only be discerned by ear.

During the testing of the JT8D engines at jet velocities equal to the net in-flight jet velocity of the JT8D-17 engine, a significant decrease in the crackle was observed when the mixers were installed.

Thus, in addition to the sizable reductions in measured jet mixing noise from the mixer in terms of the perceived noise level and spectra, an additional benefit was obtained by the significant reduction in crackle.

3.3.3 Fuel Consumption Characteristics

In comparison to a standard JT8D-17 engine, testing with the Mod. 5M/DC-9 tailpipe mixer resulted in a 0.3 percent improvement in thrust specific fuel consumption (TSFC). Figure 3.3.3-1 shows a comparison of engine fuel consumption characteristics throughout the operating range. As indicated, fuel consumption with the mixer is higher at lower power settings than a standard engine configuration. At takeoff power, however, there is a 0.3 percent improvement between a mixer and a standard engine.

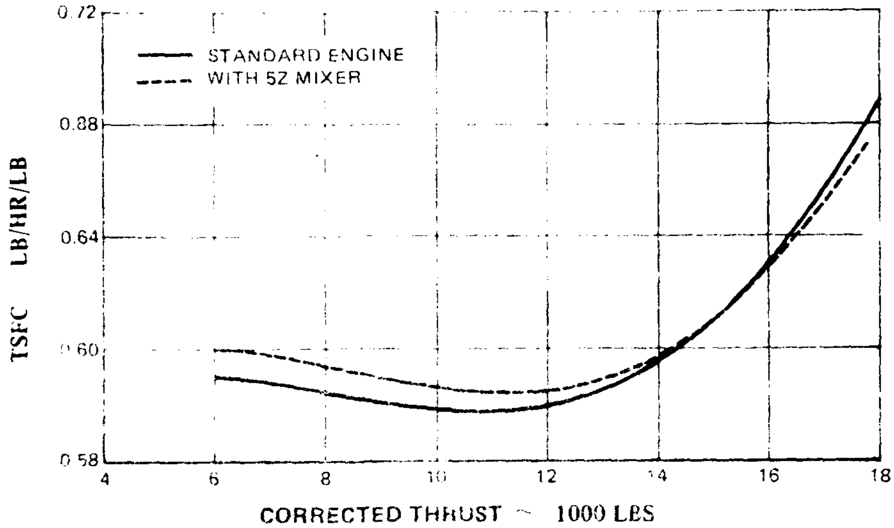


Figure 3.3.3-1 Comparative Fuel Consumption Characteristics -- At sea level static takeoff thrust, the presence of the 5M mixer produces a negligible affect on fuel consumption.

Test results with the Mod. 5Z mixer/727 tailpipe configuration show a TSFC penalty of 1.3 percent at sea level static takeoff thrust with no change in exhaust gas temperature. Figure 3.3.3-2 shows the fuel consumption characteristics with the Mod. 5Z mixer compared to a standard engine configuration. Typically, fuel consumption levels with the mixer are higher throughout the operating range.

The comparison of other measured engine parameters such as thrust, pressure ratios and rotor speeds showed that changes in these operating parameters relative to a standard JT8D engine imparted a negligible fan to primary area ratio change. Consequently, the penalty associated with the mixer is probably attributable to an increase in pressure loss resulting from the hot gases scrubbing on the internal surface of the tailpipe. Results acquired in other acoustic and performance testing support the high fuel consumption levels with the Mod. 5Z mixer/727 tailpipe configuration. However, because of a problem with the test facility, it was not possible to confirm the magnitude of increase.

Predictions of altitude performance with both mixer configurations were made using trade factors generated for computer simulation of related mixers in which test data were available. The flight conditions consis-

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ted of an altitude of 30,000 feet and a flight Mach number of 0.8. Comparative predicted fuel consumption trends of the 5M and 5Z mixers are presented in Figure 3.3.3-3.

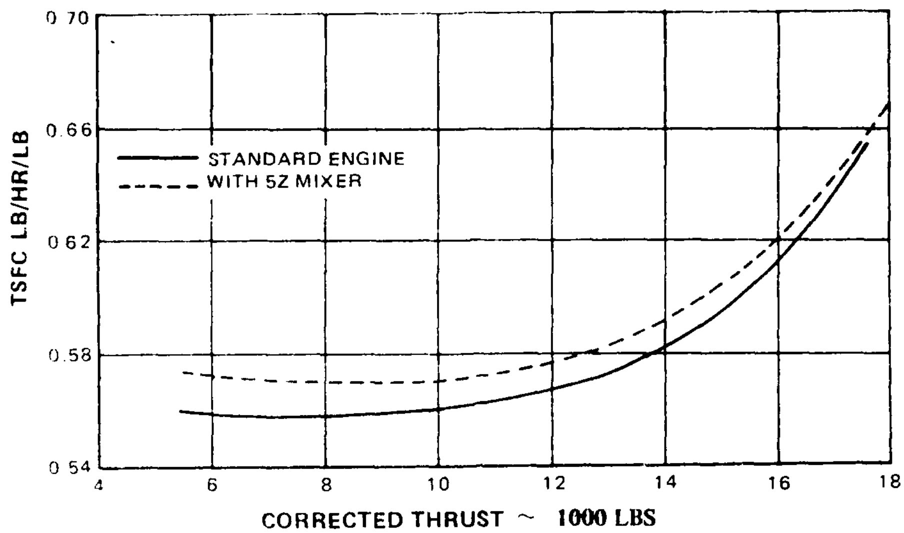

Figure 3.3.3-2 Comparative Fuel Consumption Characteristics -- Incorporation of the 5Z mixer configuration results in a fuel consumption penalty of 1.3 percent at sea level static takeoff thrust.

As shown, altitude performance predictions for the 5M mixer indicate a 0.75 percent improvement in fuel consumption at the maximum cruise condition, but a 0.2 percent penalty at 80 percent of the maximum cruise condition. With the 5Z configuration, fuel consumption increases are predicted at both the maximum cruise condition (0.2 percent) and 80 percent of maximum cruise (0.8 percent). These results are based on the fact that the pressure loss at altitude is reduced at high nozzle expansion ratios, while mixing gains are essentially the same relative to sea level static operation.

3.3.4 STRUCTURAL INTEGRITY

Testing was successful in substantiating the structural integrity of the mixer component as well as verifying that the mixer does not impart any adverse effects on the interactive behavior of other engine components. Steady stress levels measured on the mixer were below the defined limit for an acceptable low cycle fatigue life. The combination of measured vibratory stress levels of ± 5000 psi or less and measured steady stress levels falls within the allowable high frequency fatigue limits.

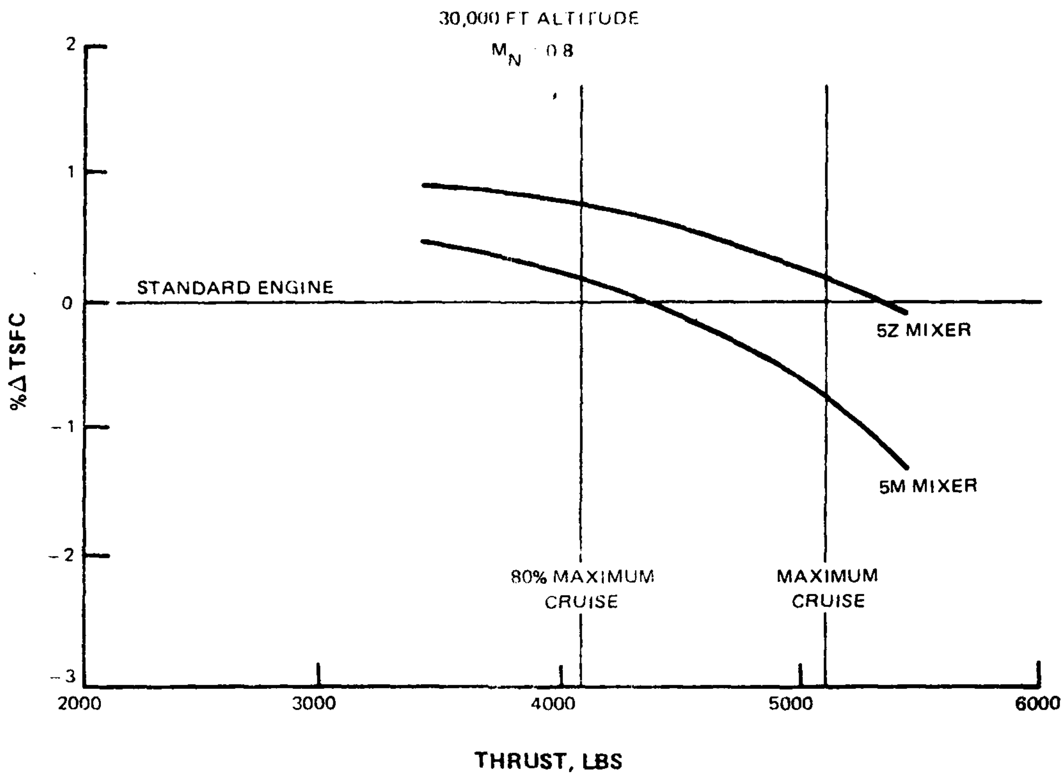

Figure 3.3.3-3 Predicted Fuel Consumption Characteristics at Altitude -- The 5M mixer improves fuel consumption at the maximum cruise condition, while the 5Z configuration shows an estimated performance deficit.

Surface metal temperatures were also within limits established for this type of construction, materials and service expectations. Post test visual inspections of the different mixer configurations throughout the test program showed no evidence of cracking or other indications of thermal distress such as lobe distortion or buckling. On the basis of these results and observations, it is con- cluded that the mixer has the structural capability to meet requirements for flight test.

The presence of the mixer did not impart any adverse effects on the stress levels of other engine components, although tailpipe wall temperature levels with the DC-9 installation presented an unique situation. Comparative strain gage measurement, both with and without the mixer, showed essentially no differences in fan and low-pressure turbine vibratory stress characteristics, verifying that the presence of the mixer produces no aerodynamic excitations to upstream components.

Tailpipe wall temperature levels in the DC-9 application were a particular concern because of the potential reduction in the durability of the acoustic material lining the tailpipe when temperatures exceeded approximately 500°F. To monitor temperatures behind the centerline of the mixer lobes and valleys, thermocouples were installed at the trailing edge of the honeycomb-preforated sheet panels lining the tailpipe. Since the cant of the tailpipe was not considered in the placement of the thermocouples, the locations of actual peak temperatures, as determined by metal discoloration, were slightly displaced from the expected locations.

Figure 3.3.4-1 presents a circumferential profile of tailpipe wall temperatures of standard JT8D engine and with the incorporation of several different mixer configurations. Profile shapes for the circumferential temperature graident were based on measured temperatures and the locations of the discolored regions of the tailpipe wall. Data were acquired at takeoff conditions and all temperatures were corrected to standard day conditions.

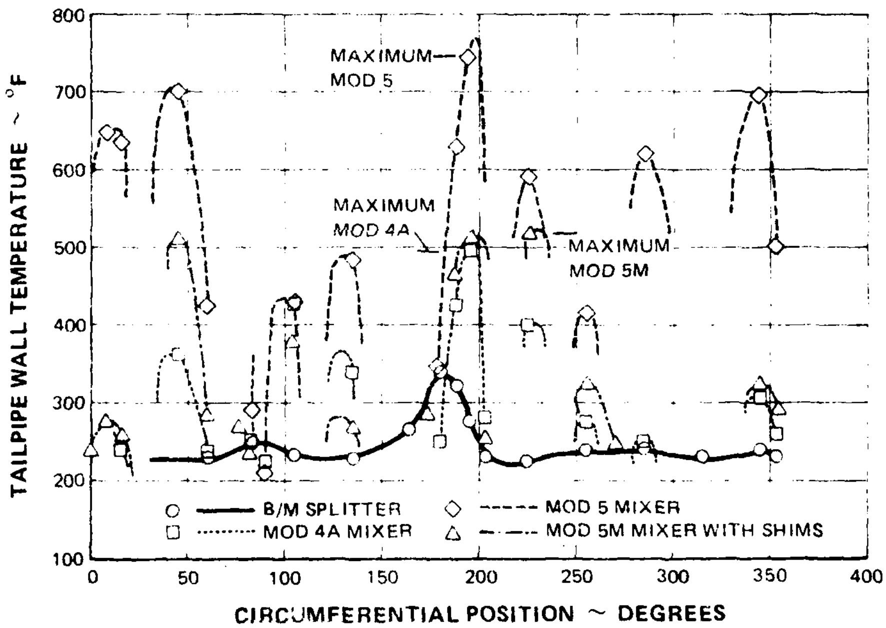

Figure 3.3.4-1 Circumferential Profile of Tailpipe Temperatures -- As shown, the maximum tailpipe wall temperatures with the Mod. 5M mixer are maintained within acceptable levels.

As shown in Figure 3.3.4-1, tailpipe temperatures with the standard engine configuration were essentially at the fan stream temperature level, except for an approximate 40-degree segment between the 160 to 200-degree circumferential position. The elevated temperature level in this area is believed related to the upward cant of the tailpipe which allows core gases to penetrate through the lower temperature fan stream air, thus heating the tailpipe.

The peak temperature measured with the Mod.4A configuraition was 495°F and occurred behind one of the bottom mixer lobes. Mixer lobe deflections associated with the the basic Mod. 5 configuration, which incorporated a different retension scheme, resulted in a higher peak temperature of 745°F -- a level well above the defined limit. The configurational changes made to the Mod. 5M design were successful in reducing the peak temperature to an acceptable level.

SECTION 4.0

CONCLUSIONS AND CONCLUDING REMARKS

4.1 CONCLUSIONS

The overall conclusion derived from this program is that noise reduction benefits associated with internal exhaust mixing technology have been substantiated by full scale engine tests. Specific conlcusions with respect to the aero/acoustic performance of the different mixer configurations are presented below.

- On the basis of static engine performance and acoustic tests with the Mod. 5M mixer/DC-9 configuration, the following conclusions have been made:

  (1) The Mod. 5M configuration is a viable design for the DC-9 installation.

  (2) An appreciable reduction in static jet noise has been demonstrated (over 2 PNdB at takeoff power) throughout the operating range with no serious compromises in engine performance. Predictions of inflight noise levels indicate that reductions in EPNL will be larger than the reductions in static peak PNL.

  (3) The design meets the installation requirements and wall temperature limits unique to the DC-9 tailpipe. Also, major modifications are not necessary to install the mixer.

  (4) The structural integrity of the mixer has been demonstrated.

- Conclusions made for the Mod. 5Z/727 configuration include the following:

  (1) The Mod. 5Z mixer represents a preliminary design configuration for the 727 installation.

  (2) A reduction in jet noise of 4.7 PNdB at takeoff power has been attained. However, the presence of the mixer produces undesirable performance effects, indicating that compromises are necessary between acoustic and aero-thermodynamic performance. Predictions of inflight noise levels, like with the Mod. 5M configuration, show reductions in EPNL will be larger than the reductions in static peak PNL.

(3) The design meets the installation requirements, although operation in the thrust reverse mode has not been demonstrated.

(4) The structural integrity of the mixer has been demonstrated.

4.2 CONCLUDING REMARKS

The emphasis on jet noise reduction has presented new demands for the next generation of gas turbine engines and technical challenges for current aircraft engines. In dealing with current service engines, the challenge of suppressing exhaust noise is complicated by the effects imposed on performance, system weight and life cycle cost.

The results acquired from this program have demonstrated the feasibility of internal exhaust mixing for current JT8D-powered aircraft. In addition, this work has identified areas where additional refinement or development is necessary. Such areas should be thoroughly investigated as part of a similar experimental engine test program. Mixer configurations considered suitable for introduction into service should be flight tested to verify structural and environmental performance under flight conditions.

This program has made a substantial contribution in furthering the technology readiness of exhaust mixing. As a result, it will be possible to capitalize on the benefits that this technology offers within the near future.

ACKNOWLEDGEMENTS

The authors wish to express appreciation to Donald Eiler, Melvin Feldman, and Allen Packman for their constructive suggestions and guidance during the performance of this contract.

APPENDIX A

TABULATED ACOUSTIC DATA

2351 H 01923 JT8D-17 REF SPLITTER B/L,DC9 REV 5DEG CANT NORTH GP150RA150.1740

ENGINE MODEL = JT8D -17				INLET TEMP	= 30.00 F
ENGINE NUMBER = 000372	TEMPERATURE	=	30.0 F	TIME OF DAY	= 756
CAL LEVEL = 124.0 DB.				BARM. PRESSURE	= 30.02 IN. HG.
STAND = X-314	HUMIDITY	=	78.0 PER CT.	WIND DIRECTION	= S
DATE = 02/28/79				WIND VELOCITY	= 1 MPH
	OBSERVED RPM	=	6265		
	CORRECTED RPM	=	6447		

FAA PART 36 REFERENCE DAY CORRECTED SPL IN DB - RADIUS = 150.0 FT.

ANGLE IN DEGREES

CENTER FREQ. (KHZ)	90	100	110	120	130	135	140	145	150	155
.050	87.7	89.2	90.3	93.6	98.4	100.3	101.8	103.0	104.4	105.7
.063	89.8	91.1	91.8	95.3	100.0	102.6	104.1	105.8	106.2	107.3
.080	90.1	91.6	93.7	96.6	101.8	104.3	106.3	107.8	108.2	108.3
.100	91.8	94.1	95.7	98.5	103.2	105.5	107.0	108.7	109.2	109.6
.125	93.5	95.2	97.1	99.5	104.4	106.4	107.8	108.8	108.5	108.3
.160	94.6	96.0	98.1	100.9	105.0	106.6	107.2	108.1	108.4	104.1
.200	95.2	97.1	98.9	101.6	104.9	105.9	106.7	106.2	106.4	101.1
.250	96.0	97.5	99.5	101.6	104.4	105.0	105.0	104.2	104.3	98.5
.315	96.3	97.9	99.9	102.2	104.2	104.1	103.6	102.4	102.4	98.9
.400	96.8	98.3	100.0	101.9	103.6	103.1	102.5	101.5	100.5	98.7
.500	95.6	97.6	99.0	101.0	102.3	101.5	101.0	99.6	98.9	96.5
.630	94.7	97.2	98.3	100.3	101.3	100.5	99.5	98.2	97.9	94.6
.800	94.2	96.4	97.6	99.0	99.8	99.0	97.9	96.9	96.1	94.0
1.00	93.6	95.6	96.8	98.0	98.4	97.2	96.6	95.1	94.0	92.9
1.25	93.0	94.7	96.1	97.1	96.9	95.8	94.8	93.2	92.6	91.7
1.60	92.6	94.2	95.2	95.9	95.7	94.7	93.3	91.9	91.2	90.8
2.00	91.6	93.7	94.3	94.8	94.4	93.0	92.2	90.4	89.6	89.2
2.50	90.9	93.2	93.7	93.8	93.3	92.6	91.0	89.6	88.6	88.2
3.15	90.2	91.6	92.6	92.4	91.8	91.4	89.8	88.7	87.4	86.6
4.00	89.6	90.4	91.1	90.3	90.4	89.7	88.0	86.6	86.0	85.2
5.00	87.4	89.4	89.3	88.9	88.6	87.8	86.7	84.8	84.4	82.9
6.30	89.8	92.1	90.9	89.3	88.1	87.2	87.4	85.9	85.6	83.5
8.00	92.5	95.3	95.5	92.1	90.8	88.9	87.8	86.4	86.0	84.0
10.0	90.6	94.2	96.2	93.6	91.2	88.9	87.5	86.1	85.5	83.5
OASPL	107.0	108.9	110.3	112.0	114.6	115.5	116.1	116.7	116.9	116.0
PNLT	117.4	119.4	120.3	121.0	121.8	121.6	121.5	120.9	120.8	119.3
PNL	117.4	119.4	120.3	121.0	121.8	121.6	121.5	120.9	120.8	119.3
DBA	104.1	106.1	107.2	108.1	108.9	108.3	107.7	106.8	106.4	104.1
BAND	24	24	24	24	24	24	24	24	24	24
TCORR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

MAXIMUM OASPL	= 116.87	COMPOSITE SPL	= 117.75
MAXIMUM PNLT	= 121.82	COMPOSITE PNL	= 123.29
MAXIMUM PNL	= 121.82	PNLT (INTEGRATED)	= 130.57
MAXIMUM DBA	= 108.89		

THE FOLLOWING CONDITION HAS BEEN ADDED TO THE W601 DATA BASE

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BASE ID  LD  DATE      ENG  MOD ENG NO STND C  OBS CORR TEMP HUM  TTI  TIME BARM  WD WV   RUN
 364 10  250 02/28/79 JT8D -17 000372 X314 3 6265 6447 77.0 70.0 30.0  756 30.02 S   1 2351 H 01923 JT8D-17 REF SPLITTER B/L,DC9 RE
                                                                                         V 5DEG CANT NORTH    GP150RA150.1740
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2351 H Q1923 JT8D-17 REF SPLITTER B/L,DC9 REV 5DEG CANT NORTH   GP150RA150.1740

ENGINE MODEL	= JT8D -17				INLET TEMP	=	30.00 F
ENGINE NUMBER	= 000372	TEMPERATURE	=	30.0 F	TIME OF DAY	=	820
CAL LEVEL	= 124.0 DB.				BARM. PRESSURE	=	30.02 IN. HG.
STAND	= X-314	HUMIDITY	=	78.0 PER CT.	WIND DIRECTION	=	S
DATE	= 02/28/79				WIND VELOCITY	=	1 MPH
		OBSERVED RPM	=	6284			
		CORRECTED RPM	=	6467			

FAA PART 36 REFERENCE DAY CORRECTED SPL IN DB - RADIUS = 150.0 FT.

ANGLE IN DEGREES

CENTER FREQ. (KHZ)	90	100	110	120	130	135	140	145	150	155
.050	87.3	89.4	90.5	93.2	98.3	100.4	102.0	103.4	105.0	105.6
.063	90.0	90.9	92.1	95.4	100.2	102.7	104.3	105.9	105.7	107.0
.080	90.4	92.0	93.8	97.3	101.9	105.1	106.7	108.3	108.4	108.5
.100	92.4	94.2	95.6	98.7	103.7	105.8	107.3	108.8	109.7	109.6
.125	93.9	95.6	97.0	100.1	104.6	106.7	107.8	109.0	108.5	108.7
.160	95.0	96.4	98.6	101.2	105.1	106.6	107.3	108.2	108.2	104.1
.200	95.8	97.5	99.1	101.8	104.5	106.2	106.4	106.4	106.3	101.4
.250	96.5	97.5	99.7	101.9	104.4	105.5	105.1	104.5	104.3	98.7
.315	96.8	98.1	100.0	102.3	104.3	104.5	103.6	102.9	102.4	99.2
.400	97.3	98.6	100.2	102.3	103.6	103.3	102.4	101.7	100.5	98.4
.500	96.1	97.9	99.5	101.1	102.3	101.8	100.9	99.9	99.0	96.5
.630	95.2	97.2	98.8	100.3	101.3	100.7	99.7	98.6	98.0	94.8
.800	94.7	96.7	98.1	99.3	100.1	99.4	98.0	97.1	96.2	94.1
1.00	94.1	95.8	97.2	98.4	98.6	97.6	96.5	95.4	94.2	93.4
1.25	93.3	95.0	96.6	97.5	96.9	96.1	94.9	93.7	92.8	92.0
1.60	93.1	94.6	95.8	96.4	96.0	95.1	93.7	92.2	91.5	90.9
2.00	91.9	94.1	94.9	95.3	94.6	93.5	92.0	90.7	89.8	89.3
2.50	91.2	93.9	94.2	94.3	93.6	93.2	91.5	89.6	88.6	88.6
3.15	90.6	92.7	93.1	92.9	92.5	92.4	90.3	88.4	87.5	87.3
4.00	89.0	91.0	91.6	91.3	90.8	89.9	88.1	86.9	85.9	84.9
5.00	87.7	89.9	89.4	89.5	88.7	88.1	86.5	84.7	84.3	82.4
6.30	89.8	92.5	91.1	89.6	88.7	87.6	87.7	85.5	85.3	83.3
8.00	92.4	95.9	95.9	92.6	90.7	89.0	87.9	86.2	85.7	83.7
10.0	96.6	94.7	96.6	94.0	91.4	89.5	87.3	86.1	85.2	83.1
OASPL	107.4	109.2	110.6	112.3	114.7	115.8	116.2	116.9	116.9	116.0
PNLT	117.8	119.9	120.7	121.4	121.9	122.0	121.5	121.1	120.7	119.4
PNL	117.8	119.9	120.7	121.4	121.9	122.0	121.5	121.1	120.7	119.4
DBA	104.5	106.5	107.6	108.4	109.0	108.7	107.8	107.0	106.4	104.2
BAND	24	24	24	24	24	24	24	24	24	24
TCORR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

MAXIMUM OASPL	= 116.93	COMPOSITE	SPL	= 117.80
MAXIMUM PNLT	= 121.97	COMPOSITE	PNL	= 123.54
MAXIMUM PNL	= 121.97	PNLT (INTEGRATED)		= 130.80
MAXIMUM DBA	= 109.00			

THE FOLLOWING CONDITION HAS BEEN ADDED TO THE W601 DATA BASE

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BASE ID  LD  DATE      ENG  MOD ENG NO STND C  OBS CORR TEMP HUM  TTI  TIME BARM  WD WV   RUN
 364 14  250 02/28/79 JT8D -17 000372 X314 3 6284 6467 77.0 70.0 30.0  820 30.02 S   1 2351 H Q1923 JT8D-17 REF SPLITTER B/L,DC9 RE
                                                                                          V 5DEG CANT NORTH    GP150RA150.1740
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2351 H Q1923 JT8D-17 REF SPLITTER H/L,DC9 REV 5DEG CANT NORTH GP150RA150.1740

CONDITION = 6467

ALTITUDE = 1500. FT SIDELINE

ANGLE IN DEGREES

CENTER FREQ. (KHZ)	90	100	110	120	130	135	140	145	150	155
.050	67.2	69.2	69.9	71.8	75.9	77.2	77.9	78.4	78.7	77.9
.063	69.9	70.6	71.4	74.0	77.7	79.4	80.2	80.8	79.4	79.1
.080	70.2	71.7	73.0	75.8	79.4	81.8	82.6	83.1	81.9	80.5
.100	72.2	73.8	74.8	77.2	81.0	82.5	83.1	83.6	83.1	81.5
.125	73.6	75.1	76.1	78.5	81.9	83.3	83.5	83.6	81.8	80.5
.160	74.6	75.9	77.7	79.5	82.3	83.0	82.8	82.7	81.4	75.7
.200	75.3	76.9	78.1	80.0	81.6	82.5	81.8	80.7	79.3	72.8
.250	75.9	76.8	78.6	80.0	81.3	81.6	80.4	78.5	77.1	69.7
.315	76.1	77.2	79.7	80.2	81.0	80.4	78.6	76.7	74.8	69.9
.400	76.4	77.5	78.6	79.9	80.0	78.9	77.0	75.1	72.5	68.6
.500	74.9	76.6	77.6	78.4	78.4	77.1	75.1	72.9	70.4	66.0
.630	73.7	75.5	76.7	77.3	77.0	75.5	73.4	71.0	68.8	63.5
.800	72.8	74.6	75.5	75.8	75.2	73.6	71.1	68.8	66.2	61.8
1.00	71.7	73.2	74.1	74.4	73.1	71.1	68.8	66.2	63.1	59.8
1.25	70.3	71.8	72.9	72.7	70.6	68.7	66.2	63.4	60.4	56.9
1.60	69.2	70.5	71.1	70.6	68.4	66.4	63.6	60.3	57.2	53.6
2.00	67.0	69.0	69.1	68.3	65.7	63.4	60.3	56.9	53.4	49.5
2.50	65.0	67.4	67.0	65.8	63.0	61.2	57.6	53.4	49.5	45.5
3.15	62.6	64.5	64.0	62.3	59.5	57.7	53.6	49.1	44.6	39.8
4.00	58.7	60.4	60.1	58.0	54.7	51.8	47.6	43.3	38.1	31.5
5.00	55.9	57.9	56.3	54.5	50.7	48.0	43.7	38.5	33.5	25.4
6.30	54.8	57.2	54.5	50.8	45.9	42.7	39.7	33.4	27.7	18.1
8.00	52.4	55.3	53.8	47.8	41.5	36.7	31.6	24.8	17.3	5.7
10.0	42.8	46.2	46.2	40.2	31.8	25.9	18.5	10.4	0.4	0.0
OASPL	85.7	87.1	88.3	89.7	91.3	91.9	91.6	91.3	90.1	87.8
PNLT	92.7	94.2	95.0	95.7	95.6	95.1	93.9	92.4	90.6	87.3
PNL	92.7	94.2	95.0	95.7	95.6	95.1	93.9	92.4	90.6	87.3
DBA	81.2	82.8	83.7	84.2	84.0	83.0	81.3	79.6	77.7	73.2
BAND	24	24	24	24	24	24	24	24	24	24
TCORR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

PNLT (INTEGRATED) = 103.83

2351 H Q1924 JT8D-17 REF SPLITTER B/L,DC9 REV 5DEG CANT NORTH GP150RA150.1740

ENGINE MODEL = JT8D -17				INLET TEMP	= 36.00 F
ENGINE NUMBER = 372-69	TEMPERATURE	=	36.0 F	TIME OF DAY	= 921
CAL LEVEL = 124.0 DB.				BARM. PRESSURE	= 30.04 IN. HG.
STAND = X-314	HUMIDITY	=	64.0 PER CT.	WIND DIRECTION	= SW
DATE = 02/28/79				WIND VELOCITY	= 1 MPH
	OBSERVED RPM	=	6808		
	CORRECTED RPM	=	6964		

FAA PART 36 REFERENCE DAY CORRECTED SPL IN DB - RADIUS = 150.0 FT.

ANGLE IN DEGREES

CENTER FREQ. (KHZ)	90	100	110	120	130	135	140	145	150	155
.050	90.3	91.4	93.2	96.6	101.9	103.9	106.3	107.1	109.0	109.9
.063	92.4	93.6	95.0	98.4	103.7	105.8	108.5	109.8	110.2	110.5
.080	92.3	94.6	96.9	100.8	105.6	108.8	110.9	112.5	112.5	112.0
.100	94.6	96.7	98.7	102.[illegible]	107.5	109.6	112.4	113.8	114.0	113.6
.125	96.6	98.2	100.3	103.8	108.8	111.3	113.9	114.1	113.4	114.1
.160	97.7	99.3	101.7	104.6	109.7	112.1	114.2	114.6	114.4	110.5
.200	93.8	100.4	102.6	105.6	104.8	111.2	113.3	112.7	113.8	108.9
.250	99.5	100.9	103.4	106.2	109.1	110.3	111.2	110.6	111.7	106.1
.315	99.9	101.3	103.6	106.2	108.7	109.0	109.4	108.5	109.2	106.3
.400	100.4	101.7	103.9	106.1	108.0	108.1	108.3	107.4	107.4	105.4
.500	99.4	101.6	103.3	105.4	107.1	106.6	107.3	106.0	106.4	103.4
.630	98.6	101.3	102.9	104.7	105.8	105.4	105.8	104.9	105.9	101.9
.800	98.6	100.8	102.2	104.0	104.5	104.3	104.5	103.7	104.1	101.2
1.00	97.8	100.1	101.4	103.0	103.1	102.8	103.0	102.0	101.9	100.0
1.25	97.4	99.5	101.0	102.3	101.7	101.4	101.2	100.0	100.4	98.5
1.60	97.3	99.2	100.2	101.1	100.0	99.8	99.7	98.4	98.6	97.0
2.00	96.0	98.6	99.5	100.2	98.6	98.4	98.0	96.9	96.7	95.5
2.50	95.4	98.0	98.5	99.0	97.0	97.2	96.7	95.5	95.2	94.4
3.15	94.9	96.9	97.5	98.0	96.3	99.1	96.8	96.0	94.1	93.4
4.00	92.9	95.3	95.4	95.6	94.2	94.4	93.0	92.0	91.2	90.1
5.00	91.3	94.2	93.3	93.8	92.3	92.6	91.1	89.7	89.4	87.8
6.30	91.0	94.1	93.2	93.1	90.8	91.0	90.5	88.3	88.4	86.4
8.00	92.8	95.8	95.3	93.3	90.9	90.2	89.6	88.4	87.7	86.1
10.0	91.2	95.8	96.2	93.8	91.1	89.6	89.0	87.4	88.0	85.7
OASPL	110.6	112.6	114.2	116.4	119.1	120.4	122.1	122.3	122.5	121.0
PNLT	121.5	123.6	124.5	125.7	126.1	128.0	127.8	127.3	127.4	125.3
PNL	121.3	123.5	124.4	125.6	126.0	126.9	127.4	126.8	127.2	125.0
DBA	108.0	110.3	111.4	112.8	113.3	113.5	113.9	113.1	113.5	110.7
BAND	23	23	19	19	19	19	19	19	19	19
TCOPR	0.2	0.1	0.1	0.1	0.1	1.1	0.4	0.5	0.2	0.2

MAXIMUM OASPL	= 122.55		COMPOSITE SPL	= 122.90
MAXIMUM PNLT	= 128.02		COMPOSITE PNL	= 128.61
MAXIMUM PNL	= 127.42		PNLT (INTEGRATED)	= 136.14
MAXIMUM DBA	= 113.91			

THE FOLLOWING CONDITION HAS BEEN ADDED TO THE W601 DATA BASE

BASE	ID	LD	DATE	ENG	MOD	ENG NO	STND	C	OBS	CORR	TEMP	HUM	TTI	TIME	BARM	WD	WV	RUN
534	9	250	02/28/79	JT8D	-17	372-69	X314	3	6808	6964	77.0	70.0	36.0	921	30.04	SW	1	2351 H Q1924 JT8D-17 REF SPLITTER B/L,DC9 REV 5DEG CANT NORTH GP150RA150.1740

2351 H Q1924 JT8D-17 REF SPLITTER B/L,DC9 REV 5DEG CANT NORTH GP150RA150.174C

CONDITION = 6964

ALTITUDE = 1500. FT SIDELINE

ANGLE IN DEGREES

CENTER FREQ. (KHZ)	90	100	110	120	130	135	140	145	150	155
.050	70.2	71.2	72.6	75.4	79.5	80.7	82.3	82.1	82.8	82.2
.063	72.3	73.3	74.3	77.0	81.2	92.6	94.5	84.7	83.9	82.7
.080	72.1	74.3	76.2	79.4	83.1	85.5	86.8	87.4	86.1	84.1
.100	74.4	76.4	77.9	80.7	84.9	86.3	88.2	88.6	87.5	85.6
.125	76.3	77.8	79.5	82.2	86.1	87.9	89.6	88.8	86.8	85.9
.160	77.3	78.8	90.8	83.1	86.9	88.6	89.8	89.1	87.6	82.1
.200	78.3	79.9	91.6	84.0	86.9	87.5	88.7	87.0	86.8	80.2
.250	78.9	80.2	82.2	84.3	86.0	86.4	86.4	84.7	84.4	77.1
.315	79.2	80.4	82.3	84.1	85.4	84.9	84.4	82.3	81.6	77.0
.400	79.5	80.6	92.3	93.7	84.4	83.7	82.9	80.8	79.4	75.5
.500	78.2	80.3	81.5	82.8	83.2	81.9	81.5	79.0	77.9	72.9
.630	77.3	79.6	80.8	81.7	91.5	80.2	79.5	77.3	76.7	70.6
.800	76.7	78.7	79.6	80.5	79.6	78.5	77.6	75.4	74.1	68.9
1.00	75.4	77.6	78.3	79.0	77.6	76.3	75.3	72.8	70.8	66.5
1.25	74.4	76.3	77.2	77.5	75.3	74.0	72.5	69.6	68.0	63.4
1.60	73.4	75.1	75.4	75.2	72.4	71.1	69.5	66.4	64.3	59.7
2.00	71.1	73.4	73.7	73.2	69.7	68.2	66.2	63.1	60.3	55.6
2.50	69.2	71.6	71.3	70.5	66.4	65.2	62.9	59.4	56.1	51.3
3.15	67.0	68.7	68.5	67.5	63.4	64.5	60.1	56.7	51.3	45.9
4.00	62.6	64.7	63.9	62.3	58.1	56.4	52.5	48.4	43.5	36.7
5.00	59.6	62.2	60.2	58.8	54.3	52.5	48.3	43.5	38.7	30.8
6.30	56.0	58.7	56.6	54.3	48.4	46.1	42.5	36.1	30.8	21.2
8.00	52.8	55.3	53.3	48.6	41.7	37.9	33.3	26.9	19.3	8.1
10.0	43.3	47.3	45.8	39.9	31.5	25.9	20.1	11.7	3.2	0.0
OASPL	88.8	90.5	91.9	93.7	95.7	96.4	97.4	96.6	95.6	92.6
PNLT	96.4	98.2	99.0	100.0	100.3	100.8	100.7	99.1	97.7	93.6
PNL	96.1	98.0	98.8	99.8	100.0	100.0	100.1	98.4	97.4	93.2
DBA	84.8	86.8	87.7	88.6	88.5	87.9	87.6	85.7	84.6	79.7
BAND	23	23	23	19	19	19	19	19	21	19
TCURR	0.3	0.2	0.2	0.2	0.2	0.8	0.5	0.6	0.3	0.4

PNLT (INTEGRATED) = 109.02

2351 H Q1924 JT8D-17 REF SPLITTER B/L,DC9 REV 5DEG CANT NORTH   GP150RA150.1740

ENGINE MODEL = JT8D -17
ENGINE NUMBER = 372-69
CAL LEVEL = 124.0 DB.
STAND = X-314
DATE = 02/29/79

TEMPERATURE = 36.0 F
HUMIDITY = 64.0 PER CT.
OBSERVED RPM = 7141
CORRECTED RPM = 7304

INLET TEMP = 36.00 F
TIME OF DAY = 937
BARM. PRESSURE = 30.04 IN. HG.
WIND DIRECTION = SW
WIND VELOCITY = 1 MPH

FAA PART 36 REFERENCE DAY CORRECTED SPL IN DB - RADIUS = 150.0 FT.

ANGLE IN DEGREES

CENTER FREQ. (KHZ)	90	100	110	120	130	135	140	145	150	155
.050	91.7	92.9	95.1	98.6	103.6	106.3	108.4	109.7	111.0	112.5
.063	94.2	95.3	97.1	100.9	106.0	108.7	111.2	112.3	113.0	113.1
.080	94.7	96.2	98.9	102.9	108.4	111.3	113.9	115.0	115.4	113.7
.100	96.6	98.8	101.0	104.8	110.6	113.1	115.1	116.6	117.0	116.2
.125	98.5	100.0	102.7	106.5	112.4	115.1	117.0	117.1	116.1	117.2
.160	99.7	101.2	103.8	107.7	113.6	115.7	117.6	118.3	117.7	113.6
.200	100.6	102.5	105.3	108.8	113.3	115.2	116.9	117.2	119.1	113.7
.250	101.8	103.1	106.1	109.1	112.6	114.0	115.0	115.7	116.8	112.2
.315	102.1	103.7	106.3	109.1	112.1	112.8	113.3	113.1	114.1	111.5
.400	102.5	103.9	106.4	109.2	111.4	111.7	112.1	112.3	112.0	110.2
.500	101.8	104.0	106.4	108.4	110.8	110.6	111.3	111.2	110.7	108.3
.630	101.1	103.9	105.8	108.0	109.6	109.6	110.0	109.7	109.9	106.3
.800	101.0	103.5	105.5	107.2	108.3	108.6	108.9	108.5	107.7	105.0
1.00	100.7	102.6	104.9	106.5	107.2	107.2	107.6	106.7	105.5	103.8
1.25	100.4	102.2	104.3	105.8	105.7	105.7	105.9	104.7	104.0	102.4
1.60	100.0	101.7	103.6	104.5	104.4	104.3	104.3	103.0	102.1	100.8
2.00	99.2	101.2	103.0	103.8	103.1	102.7	102.7	101.5	100.4	99.4
2.50	98.5	100.7	101.9	102.4	101.7	101.5	101.4	100.1	99.1	98.1
3.15	97.6	99.5	101.0	101.1	100.4	100.3	99.9	99.1	97.5	96.5
4.00	96.1	98.1	99.0	99.1	98.6	98.3	97.3	96.4	95.0	93.8
5.00	94.3	96.8	96.9	96.9	96.5	96.2	95.2	94.1	92.6	90.4
6.30	92.7	96.1	95.9	95.9	94.7	94.5	94.0	91.8	91.2	88.5
8.00	93.3	96.3	96.2	94.9	94.0	93.4	92.3	90.8	89.9	87.7
10.0	91.9	96.1	96.5	94.1	93.3	92.3	91.3	89.8	90.0	87.0
OASPL	112.9	114.9	117.0	119.4	122.6	124.0	125.5	126.0	126.1	124.3
PNLT	123.9	126.0	127.6	128.7	129.7	130.4	131.3	131.2	131.2	128.8
PNL	123.8	125.9	127.5	128.7	129.6	130.3	131.1	131.0	131.1	128.6
DBA	110.7	112.8	114.6	116.1	117.2	117.5	118.0	117.7	117.5	115.0
BAND	23	18	19	19	6	19	19	19	12	5
TCORR	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.3

MAXIMUM OASPL = 126.14
MAXIMUM PNLT = 131.27
MAXIMUM PNL = 131.15
MAXIMUM DBA = 117.99

COMPOSITE SPL = 126.55
COMPOSITE PNL = 132.26
PNLT (INTEGRATED) = 139.42

THE FOLLOWING CONDITION HAS BEEN ADDED TO THE W601 DATA BASE

BASE ID	LD	DATE	ENG	MOD	ENG NO	STND	C	OBS	CORR	TEMP	HUM	TTI	TIME	BARM	WD	WV	RUN
534	10	250 02/28/79	JT8D	-17	372-69	X314	3	7141	7304	77.0	70.0	36.0	937	30.04	SW	1	2351 H Q1924 JT8D-17 REF SPLITTER B/L,DC9 REV 5DEG CANT NORTH GP150RA150.1740

2351 H Q1924 JT8D-17 REF SPLITTER B/L,DC9 REV 5DEG CANT NORTH GP150RA150.1740

CONDITION = 7304

ALTITUDE = 1500. FT SIDELINE

CENTER FREQ. (KHZ)	ANGLE IN DEGREES 90	100	110	120	130	135	140	145	150	155
.050	71.6	72.7	74.5	77.2	81.2	83.1	84.4	84.7	84.8	84.9
.063	74.1	75.0	76.4	79.5	83.5	85.5	87.2	87.2	86.7	85.3
.080	74.5	75.9	78.2	81.5	85.9	86.0	89.8	89.9	89.0	85.8
.100	76.4	78.5	80.2	83.3	88.0	89.8	90.9	91.4	90.5	88.2
.125	78.2	79.6	81.9	84.9	89.7	91.7	92.7	91.8	89.5	89.0
.160	79.3	80.7	82.9	86.0	90.8	92.2	93.2	92.8	90.9	85.2
.200	80.1	81.9	84.3	87.0	90.4	91.5	92.3	91.5	91.1	85.0
.250	81.2	82.4	84.9	87.2	89.5	90.1	90.2	89.8	89.5	83.2
.315	81.4	82.8	85.0	87.0	88.8	88.7	88.3	86.9	86.5	82.2
.400	81.6	82.8	84.8	86.8	87.8	87.3	86.7	85.7	84.0	80.3
.500	80.6	82.7	84.6	85.8	86.9	85.9	85.5	84.2	82.2	77.8
.630	79.6	82.2	83.7	85.0	85.3	84.4	83.7	82.1	80.7	75.0
.800	79.1	81.4	82.9	83.7	83.4	82.8	82.0	80.2	77.7	72.7
1.00	78.3	80.1	81.8	82.5	81.7	80.7	79.9	77.5	74.4	70.3
1.25	77.4	79.0	80.5	81.0	79.3	78.3	77.2	74.3	71.6	67.3
1.60	76.1	77.6	78.8	78.6	76.8	75.6	74.1	71.0	67.8	63.5
2.00	74.3	76.0	77.2	76.8	74.2	72.5	70.9	67.7	64.0	59.5
2.50	72.3	74.3	74.7	73.9	71.1	69.5	67.6	64.0	60.0	55.0
3.15	69.7	71.3	72.0	70.6	67.5	65.7	63.2	59.8	54.7	49.0
4.00	65.8	67.5	67.5	65.8	62.5	60.3	56.8	52.8	47.3	40.4
5.00	62.6	64.8	63.8	61.9	58.5	56.1	52.4	47.9	41.9	33.4
6.30	57.7	60.7	59.3	57.1	52.3	49.6	46.0	39.6	33.6	23.3
8.00	53.3	55.8	54.2	50.2	44.8	41.1	36.0	29.3	21.5	9.7
10.0	44.0	47.6	46.1	40.2	33.7	28.6	22.4	14.1	5.2	0.0
OASPL	91.1	92.8	94.7	96.6	99.2	100.0	100.7	100.2	99.1	95.7
PNLT	98.9	100.6	101.9	103.1	103.9	104.1	104.1	103.1	101.7	97.2
PNL	98.6	100.5	101.7	102.9	103.7	103.8	103.9	102.7	101.4	96.9
DBA	87.4	89.3	90.9	91.8	92.2	91.8	91.5	90.3	88.9	84.1
BAND	23	23	19	23	21	21	21	21	21	21
TCORR	0.3	0.2	0.2	0.2	0.2	0.3	0.2	0.4	0.3	0.3

PNLT (INTEGRATED) = 112.34

2351 H Q1923 JT8D-17 REF SPLITTER B/L,DC9 REV 5DEG CANT NORTH GP150RA150.1740

ENGINE MODEL	= JT8D -17	TEMPERATURE	= 31.0 F	INLET TEMP	= 31.00 F
ENGINE NUMBER	= 000372			TIME OF DAY	= 827
CAL LEVEL	= 124.0 DB.	HUMIDITY	= 82.0 PER CT.	BARM. PRESSURE	= 30.02 IN. HG
STAND	= X-314			WIND DIRECTION	= S
DATE	= 02/28/79	OBSERVED RPM	= 7530	WIND VELOCITY	= 1 MPH
		CORRECTED RPM	= 7741		

FAA PART 36 REFERENCE DAY CORRECTED SPL IN DB - RADIUS = 150.0 FT.

ANGLE IN DEGREES

CENTER FREQ. (KHZ)	90	100	110	120	130	135	140	145	150	155
.050	93.8	95.5	97.0	101.0	106.6	109.3	110.8	112.4	113.2	115.1
.063	95.6	97.2	98.7	103.5	109.5	111.9	113.9	114.7	114.9	114.6
.080	96.5	98.4	100.5	105.3	111.6	114.3	116.3	117.4	117.4	115.7
.100	98.5	100.9	102.7	107.4	114.2	116.0	117.8	118.7	119.2	118.3
.125	100.7	102.2	104.6	109.2	116.0	118.5	119.8	119.3	118.1	119.0
.160	101.5	103.4	106.0	110.6	116.9	119.6	120.0	121.0	120.3	115.5
.200	102.9	104.9	107.3	111.5	117.0	119.3	120.3	120.6	121.3	117.1
.250	104.0	105.7	108.3	111.7	116.2	118.2	119.0	120.2	121.8	116.7
.315	104.1	105.9	108.3	112.1	115.9	116.7	117.2	117.8	119.0	116.9
.400	104.7	106.5	108.6	111.9	115.0	115.9	116.4	116.6	116.3	114.2
.500	104.3	106.8	109.0	111.6	114.4	114.9	115.2	115.3	115.1	112.3
.630	103.8	106.7	108.3	111.0	113.5	114.3	114.3	113.9	113.5	110.3
.800	103.8	106.2	108.0	110.3	112.4	113.3	112.6	112.1	111.4	108.9
1.00	103.5	105.5	107.4	109.7	111.1	111.6	110.9	110.0	109.2	107.5
1.25	102.9	105.2	106.9	108.8	109.7	110.0	109.1	108.2	107.8	106.3
1.60	102.9	104.9	106.3	107.6	108.5	108.6	107.6	106.5	105.9	104.6
2.00	102.1	104.6	105.6	106.7	107.2	107.4	106.1	105.1	104.4	103.0
2.50	101.5	103.9	104.5	105.4	105.6	106.3	104.8	103.8	103.3	101.7
3.15	100.5	102.6	103.2	103.8	103.9	104.9	103.3	102.4	101.7	99.2
4.00	99.0	101.4	101.7	101.7	102.5	102.8	101.2	100.4	99.3	96.2
5.00	97.2	100.0	99.5	100.1	100.7	100.6	99.3	98.3	97.0	93.6
6.30	95.4	98.9	98.4	98.7	99.0	98.6	98.2	96.5	95.6	92.5
8.00	95.1	97.5	97.6	97.1	98.3	97.5	96.3	94.9	93.9	90.7
10.0	93.7	96.8	96.8	95.9	96.6	96.7	95.7	94.5	93.2	89.6
OASPL	115.4	117.5	119.3	122.3	126.2	127.9	128.7	129.1	129.4	127.1
PNLT	126.4	128.8	129.8	131.5	133.4	134.4	134.6	134.7	135.0	132.3
PNL	126.4	128.8	129.8	131.5	133.4	134.4	134.6	134.7	135.0	132.3
DBA	113.4	115.7	117.1	119.1	121.0	121.8	121.7	121.5	121.6	118.9
BAND	24	24	24	24	24	24	24	24	24	24
TCORR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

MAXIMUM OASPL	= 129.37	COMPOSITE SPL	= 129.85
MAXIMUM PNLT	= 135.03	COMPOSITE PNL	= 136.11
MAXIMUM PNL	= 135.03	PNLT (INTEGRATED)	= 142.85
MAXIMUM DBA	= 121.84		

THE FOLLOWING CONDITION HAS BEEN ADDED TO THE W601 DATA BASE

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BASE ID  LD  DATE      ENG  MOD ENG NO STND C  OBS CORR TEMP HUM  TTI  TIME BARM  WD WV   RUN
 364 15  250 02/28/79 JT8D -17 000372 X314 3 7530 7741 77.0 70.0 31.0  827 30.02 S   1 2351 H Q1923 JT8D-17 REF SPLITTER B/L,DC9 R
                                                                                             V 5DEG CANT NORTH   GP150RA150.174
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2351 H Q1923 JT8D-17 REF SPLITTER B/L,DC9 REV 5DEG CANT NORTH   GP150RA150.1740

CONDITION = 7741

ALTITUDE = 1500. FT SIDELINE

ANGLE IN DEGREES

CENTER FREQ. (KHZ)	90	100	110	120	130	135	140	145	150	155
.050	73.7	75.3	76.3	79.6	84.1	86.1	86.7	87.3	86.9	87.3
.063	75.5	76.9	78.0	82.0	86.9	88.7	89.8	89.6	88.6	86.8
.080	76.3	78.1	79.8	83.8	89.0	91.0	92.2	92.3	90.9	87.7
.100	78.3	80.5	81.9	85.9	91.5	92.6	93.6	93.4	92.7	90.2
.125	80.4	81.7	83.8	87.6	93.3	95.1	95.5	93.9	91.4	90.8
.160	81.1	82.9	85.0	88.9	94.1	96.1	95.6	95.4	93.5	87.0
.200	82.4	84.3	86.3	89.7	94.0	95.6	95.7	94.9	94.3	88.5
.250	83.4	85.0	87.1	89.8	93.1	94.3	94.2	94.3	94.5	87.7
.315	83.4	85.0	87.0	89.9	92.6	92.6	92.2	91.6	91.4	87.5
.400	83.8	85.4	87.1	89.6	91.4	91.5	91.0	90.1	88.3	84.4
.500	83.1	85.4	87.1	89.0	90.5	90.2	89.4	88.3	86.5	81.8
.630	82.3	85.0	86.2	88.0	89.2	89.1	88.0	86.4	84.3	79.0
.800	81.8	84.2	85.4	86.9	87.5	87.5	85.6	83.8	81.3	76.6
1.00	81.1	83.0	84.3	85.6	85.6	85.1	83.1	80.8	78.2	74.0
1.25	79.9	82.0	83.2	84.0	83.4	82.6	80.4	77.8	75.5	71.3
1.60	79.0	80.8	81.6	81.7	81.0	79.9	77.5	74.6	71.7	67.3
2.00	77.1	79.4	79.8	79.6	78.3	77.2	74.3	71.3	68.0	63.1
2.50	75.2	77.5	77.3	76.9	75.0	74.3	70.9	67.6	64.2	58.6
3.15	72.5	74.4	74.2	73.2	71.0	70.3	66.6	63.0	58.9	51.7
4.00	68.7	70.8	70.1	68.4	66.4	64.7	60.7	56.7	51.6	42.8
5.00	65.5	68.0	66.4	65.1	62.7	60.5	56.5	52.1	46.2	36.6
6.30	60.5	63.5	61.8	59.9	56.6	53.8	50.1	44.3	38.0	27.4
8.00	55.1	56.9	55.6	52.4	49.1	45.2	40.0	33.4	25.5	12.7
10.0	45.9	48.3	46.4	42.0	37.0	33.0	26.8	18.9	8.5	0.0
OASPL	93.4	95.4	97.0	99.5	102.7	103.8	103.8	103.3	102.2	98.3
PNLT	101.3	103.4	104.1	105.8	107.4	107.9	107.3	106.3	105.2	100.3
PNL	101.3	103.4	104.1	105.8	107.4	107.9	107.3	106.3	105.2	100.3
DBA	90.0	92.1	93.3	94.8	96.0	96.1	95.2	94.1	92.9	88.0
BAND	24	24	24	24	24	24	24	24	24	24
TCORR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

PNLT (INTEGRATED) = 115.52

2351 H Q1923 JT8D-17 REF SPLITTER B/L,DC9 REV 5DEG CANT NORTH GP150RA150.1740

ENGINE MODEL	= JT8D -17	TEMPERATURE	= 33.0 F	INLET TEMP	= 33.00 F
ENGINE NUMBER	= 000372			TIME OF DAY	= 848
CAL LEVEL	= 124.0 DB.			BARM. PRESSURE	= 30.02 IN. HG.
STAND	= X-314	HUMIDITY	= 75.0 PER CT.	WIND DIRECTION	= S
DATE	= 02/28/79			WIND VELOCITY	= 1 MPH
		OBSERVED RPM	= 8193		
		CORRECTED RPM	= 8406		

FAA PART 36 REFERENCE DAY CORRECTED SPL IN DB - RADIUS = 150.0 FT.

ANGLE IN DEGREES

CENTER FREQ. (KHZ)	90	100	110	120	130	135	140	145	150	155
.050	95.7	97.2	99.2	102.8	109.3	111.5	113.4	115.0	115.8	117.8
.063	97.5	99.1	100.9	105.5	112.1	114.7	116.3	117.7	117.4	117.9
.080	98.3	100.3	102.6	107.7	114.1	117.2	119.3	120.5	120.1	118.2
.100	100.4	102.7	105.2	109.6	116.9	118.9	120.5	121.4	121.9	120.6
.125	102.5	104.1	106.6	111.8	118.9	121.5	122.6	122.0	120.3	121.7
.160	103.4	105.5	108.4	113.6	120.5	122.9	122.9	123.6	122.4	118.8
.200	104.8	107.0	110.0	114.3	120.9	123.2	124.4	123.9	124.2	119.6
.250	106.1	108.3	111.2	114.7	120.4	122.8	124.3	124.7	125.9	120.8
.315	106.6	108.7	111.5	115.1	119.8	121.6	123.1	123.9	124.3	121.7
.400	107.3	109.0	111.8	115.1	119.1	120.7	121.2	121.8	121.4	119.6
.500	107.2	109.5	112.2	115.0	118.3	119.9	120.3	120.2	119.8	117.2
.630	106.8	109.6	111.7	114.8	117.8	119.3	119.6	119.0	118.3	115.1
.800	106.9	109.6	111.6	114.3	117.0	118.2	117.9	117.4	116.5	114.1
1.00	107.0	109.2	111.3	113.8	115.9	116.9	116.5	116.0	114.4	113.1
1.25	106.9	109.0	111.0	113.2	114.5	115.4	115.0	114.3	113.1	112.1
1.60	106.8	109.2	110.4	112.1	113.5	114.3	113.9	112.9	111.5	110.6
2.00	106.1	109.0	109.9	111.4	112.3	113.3	112.6	111.6	110.3	109.5
2.50	105.6	108.6	109.3	110.5	111.1	112.5	111.5	110.6	109.0	108.5
3.15	104.7	107.5	108.0	109.2	109.6	111.4	110.1	109.3	107.9	106.6
4.00	103.2	106.2	106.4	107.5	108.4	109.8	108.3	108.0	106.2	104.0
5.00	101.3	104.9	104.1	105.7	106.9	108.0	106.7	106.2	104.4	101.3
6.30	99.0	103.9	103.0	104.7	105.8	106.7	106.1	105.1	103.7	100.9
8.00	97.9	101.6	101.9	103.3	105.2	106.1	104.7	104.3	102.6	100.4
10.0	96.4	100.4	100.3	101.6	103.9	104.5	104.1	103.6	102.3	98.8
OASPL	118.4	120.9	122.8	125.8	130.1	132.1	132.9	133.1	133.0	130.7
PNLT	130.0	132.8	133.9	136.0	138.3	139.8	139.9	139.9	139.7	137.3
PNL	130.0	132.8	133.9	136.0	138.3	139.8	139.9	139.9	139.7	137.3
DBA	117.0	119.6	121.0	123.3	125.6	127.0	127.1	126.9	126.4	124.0
BAND	24	24	24	24	24	24	24	24	24	24
TCORR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

MAXIMUM OASPL	= 133.11	COMPOSITE SPL	= 133.69
MAXIMUM PNLT	= 139.94	COMPOSITE PNL	= 140.92
MAXIMUM PNL	= 139.94	PNLT (INTEGRATED)	= 147.77
MAXIMUM DBA	= 127.11		

THE FOLLOWING CONDITION HAS BEEN ADDED TO THE W601 DATA BASE

BASE ID	LD	DATE	ENG	MOD	ENG NO	STND	C	OBS	CORR	TEMP	HUM	TTI	TIME	BARM	WD	WV	RUN
365	4	250 02/28/79	JT8D	-17	000372	X314	3	8193	8406	77.0	70.0	33.0	848	30.02	S	1	2351 H Q1923 JT8D-17 REF SPLITTER B/L,DC9 REV 5DEG CANT NORTH GP150RA150.1740

2351 H Q1923 JT8D-17 REF SPLITTER B/L,DC9 REV 5DEG CANT NORTH GP150RA150.1740

CONDITION = 8406

ALTITUDE = 1500. FT SIDELINE

ANGLE IN DEGREES

CENTER FREQ. (KHZ)	90	100	110	120	130	135	140	145	150	155
.050	75.6	76.9	78.5	81.4	86.8	88.3	89.4	89.9	89.5	90.0
.063	77.3	78.8	80.2	84.0	89.6	91.5	92.2	92.6	91.0	90.0
.080	78.1	80.0	81.9	86.3	91.5	93.9	95.1	95.3	93.7	90.3
.100	80.2	82.3	84.4	88.1	94.2	95.6	96.3	96.2	95.4	92.5
.125	82.2	83.6	85.8	90.2	96.2	98.0	98.3	96.6	93.7	93.5
.160	83.0	84.9	87.5	91.9	97.7	99.3	98.5	98.1	95.6	90.3
.200	84.3	86.4	89.0	92.5	98.0	99.5	99.8	98.2	97.2	91.0
.250	85.5	87.5	90.0	92.8	97.3	98.9	99.5	98.8	98.6	91.9
.315	85.9	87.8	90.2	93.0	96.5	97.5	98.0	97.8	96.7	92.3
.400	86.3	87.9	90.2	92.8	95.5	96.3	95.8	95.3	93.4	89.8
.500	86.0	88.1	90.4	92.3	94.4	95.2	94.6	93.2	91.3	86.7
.630	85.3	87.9	89.6	91.8	93.5	94.1	93.3	91.5	89.1	83.9
.800	85.0	87.6	89.0	90.8	92.1	92.4	90.9	89.1	86.4	81.8
1.00	84.6	86.6	88.2	89.7	90.3	90.4	88.8	86.8	83.3	79.5
1.25	83.9	85.8	87.2	88.5	88.2	88.0	86.3	84.0	80.7	77.0
1.60	82.9	85.1	85.7	86.3	85.9	85.6	83.8	81.0	77.3	73.3
2.00	81.2	83.9	84.1	84.4	83.4	83.1	80.9	77.8	74.0	69.7
2.50	79.4	82.2	82.1	81.9	80.5	80.4	77.6	74.4	69.9	65.3
3.15	76.7	79.3	78.9	78.7	76.6	76.8	73.4	69.9	65.1	59.1
4.00	72.9	75.6	74.8	74.2	72.3	71.7	67.8	64.3	58.4	50.6
5.00	69.5	72.9	71.0	70.8	68.9	67.9	63.9	60.0	53.6	44.3
6.30	64.1	68.6	66.5	65.9	63.4	61.9	58.1	53.0	46.1	35.7
8.00	57.9	61.1	59.8	58.5	56.1	53.8	48.4	42.8	34.2	22.4
10.0	48.5	52.0	49.9	47.7	44.3	40.9	35.2	27.9	17.5	1.3
OASPL	96.2	98.3	100.1	102.7	106.5	107.7	107.8	107.0	105.6	101.7
PNLT	104.7	107.2	108.0	109.5	111.7	112.5	112.2	111.0	109.4	104.8
PNL	104.7	107.2	108.0	109.5	111.7	112.5	112.2	111.0	109.4	104.8
DBA	93.4	95.7	97.0	98.7	100.3	101.0	100.3	99.1	97.4	92.6
BAND	24	24	24	24	24	24	24	24	24	24
TCORR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

PNLT (INTEGRATED) = 119.86

2359 H Q2075 JT8D-17 5M MXR W/ SHIMS, DC9 REV 5DEG. CANT NORTH GP150RA150.1740

ENGINE MODEL = JT8D -17
ENGINE NUMBER = 372-69
CAL LEVEL = 124.2 DB.
STAND = X-314
DATE = 03/17/79

TEMPERATURE = 33.0 F
HUMIDITY = 55.0 PER CT.
OBSERVED RPM = 6388
CORRECTED RPM = 6554

INLET TEMP = 33.00 F
TIME OF DAY = 953
BARM. PRESSURE = 30.45 IN. HG.
WIND DIRECTION = NW
WIND VELOCITY = 6 MPH

FAA PART 36 REFERENCE DAY CORRECTED SPL IN DB - RADIUS = 150.0 FT.

ANGLE IN DEGREES

CENTER FREQ. (KHZ)	90	100	110	120	130	135	140	145	150	155
.050	87.2	88.1	90.3	92.9	97.3	99.6	102.0	103.0	105.1	106.1
.063	89.0	89.8	91.6	94.7	99.1	101.8	104.1	105.5	106.3	107.0
.080	90.1	91.3	93.3	96.3	99.9	102.9	105.8	107.5	107.5	106.9
.100	91.2	92.8	95.0	97.4	100.9	102.9	105.4	107.5	108.2	107.5
.125	92.9	94.3	96.2	98.8	101.6	103.4	104.9	106.2	106.3	106.4
.160	94.0	95.3	96.9	99.5	102.0	103.3	104.3	105.3	104.1	102.2
.200	93.7	95.2	97.1	99.7	102.1	102.8	103.6	102.9	102.8	98.4
.250	94.2	95.2	97.8	100.2	101.7	101.8	102.4	101.6	100.8	96.6
.315	95.0	96.1	98.4	101.0	101.7	101.2	101.3	100.3	99.0	96.1
.400	96.4	96.8	99.0	101.0	101.0	100.5	100.2	99.3	97.6	95.9
.500	94.9	96.5	98.3	99.7	99.9	99.2	99.0	98.0	97.3	95.7
.630	94.4	96.1	97.9	99.1	99.0	98.5	98.2	97.4	96.2	95.1
.800	93.9	96.1	97.1	98.1	98.3	97.6	97.3	96.5	94.8	93.9
1.00	93.5	95.4	96.4	97.4	97.5	97.0	96.4	95.5	94.0	93.2
1.25	93.9	95.2	96.1	96.9	96.9	96.0	95.9	94.9	93.9	93.1
1.60	94.4	95.1	95.9	96.3	96.3	95.4	95.4	94.6	93.7	93.0
2.00	93.1	94.3	95.3	95.3	95.2	94.1	94.0	93.0	92.0	91.7
2.50	92.7	94.0	95.1	94.5	94.5	93.4	92.7	92.1	90.9	90.9
3.15	91.7	93.8	93.8	94.1	94.1	93.5	92.4	91.4	90.1	90.8
4.00	90.3	91.8	93.1	91.7	91.0	90.1	90.3	89.3	88.3	88.0
5.00	88.8	90.7	90.8	90.1	89.3	88.5	88.1	87.0	86.1	85.7
6.30	90.7	93.2	91.8	90.7	89.5	87.9	88.8	88.4	87.0	86.1
8.00	93.9	96.5	95.7	92.8	91.3	90.0	90.3	89.9	88.4	87.7
10.0	92.8	96.3	97.1	93.9	91.8	89.8	89.5	88.7	87.2	86.9
OASPL	106.9	108.5	109.9	111.2	112.5	113.3	114.5	115.2	115.3	114.8
PNLT	118.5	120.2	121.8	121.4	121.8	121.6	121.4	120.8	120.1	119.5
PNL	118.2	120.0	121.4	121.2	121.5	121.2	121.2	120.7	119.9	119.3
DBA	104.8	106.5	107.5	107.8	107.9	107.2	107.1	106.4	105.3	104.3
BAND	23	19	19	19	19	19	19	19	16	19
TCORR	0.2	0.2	0.4	0.2	0.3	0.4	0.2	0.2	0.2	0.3

MAXIMUM OASPL = 115.31
MAXIMUM PNLT = 121.83
MAXIMUM PNL = 121.52
MAXIMUM DBA = 107.86

COMPOSITE SPL = 116.30
COMPOSITE PNL = 123.56
PNLT (INTEGRATED) = 130.84

THE FOLLOWING CONDITION HAS BEEN ADDED TO THE W601 DATA BASE

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BASE ID  LD  DATE      ENG  MOD ENG NO STND C  OBS CORR TEMP HUM  TTI  TIME BARM  WD WV   RUN
 189 14  250 03/17/79 JT8D -17 372-69 X314 3 6388 6554 77.0 70.0 33.0  953 30.45 NW  6 2359 H Q2075 JT8D-17 5M MXR W/ SHIMS, DC9 RE
                                                                                        V 5DEG. CANT NORTH   GP150RA150.1740
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2359 H Q2075 JT8D-17 5M MXR W/ SHIMS, DC9 REV 5DEG. CANT NORTH GP150RA150.1740

CONDITION = 6554

ALTITUDE = 1500. FT SIDELINE

ANGLE IN DEGREES

CENTER FREQ. (KHZ)	90	100	110	120	130	135	140	145	150	155
.050	67.1	67.9	69.7	71.6	74.9	76.5	78.0	78.0	78.9	78.4
.063	68.9	69.6	70.9	73.3	76.6	78.6	80.1	80.4	80.0	79.2
.080	70.0	71.0	72.6	74.9	77.4	79.7	81.7	82.4	81.1	79.0
.100	71.0	72.5	74.3	75.9	78.3	79.6	81.2	82.3	81.7	79.5
.125	72.6	73.9	75.4	77.2	78.9	80.0	80.6	80.9	79.7	78.2
.160	73.7	74.6	76.0	77.8	79.2	79.8	79.9	79.8	77.3	73.8
.200	73.3	74.6	76.1	77.9	79.2	79.1	79.0	77.2	75.8	69.8
.250	73.6	74.5	76.7	78.3	78.6	78.0	77.6	75.7	73.6	67.7
.315	74.3	75.2	77.1	78.9	78.4	77.1	76.3	74.1	71.4	66.8
.400	75.5	75.7	77.5	78.7	77.4	76.1	74.9	72.8	69.6	66.1
.500	73.8	75.2	76.5	77.1	76.0	74.5	73.3	71.0	68.8	65.3
.630	72.9	74.4	75.7	76.0	74.6	73.3	71.9	69.8	67.0	63.8
.800	72.0	74.0	74.5	74.6	73.4	71.8	70.4	68.2	64.7	61.6
1.00	71.1	72.9	73.3	73.4	72.0	70.5	68.7	66.3	62.9	59.7
1.25	70.9	72.0	72.3	72.1	70.5	68.6	67.2	64.6	61.5	58.0
1.60	70.5	71.0	71.2	70.5	68.8	66.7	65.3	62.7	59.5	55.7
2.00	68.2	69.2	69.5	68.3	66.3	63.9	62.2	59.2	55.6	51.8
2.50	66.4	67.5	67.9	65.9	63.8	61.3	58.8	55.9	51.7	47.7
3.15	63.8	65.6	66.8	63.6	61.2	58.9	55.7	52.1	47.3	43.3
4.00	60.0	61.2	61.6	58.4	54.9	52.1	49.8	45.7	40.6	34.6
5.00	57.1	58.6	57.7	55.1	51.3	48.4	45.3	40.8	35.3	28.7
6.30	55.7	57.8	55.2	51.9	47.1	43.0	40.7	36.2	29.4	20.9
8.00	53.8	55.9	53.6	48.0	42.1	37.7	34.0	28.4	20.0	9.7
10.0	45.0	47.9	46.8	40.1	32.2	26.2	20.7	13.1	2.5	0.0
OASPL	84.7	85.8	87.2	88.4	88.9	89.2	89.7	89.6	88.5	86.5
PNLT	93.0	94.1	94.9	95.0	94.3	93.3	92.7	91.4	89.6	86.4
PNL	92.6	93.8	94.5	94.7	93.9	92.8	92.3	90.9	89.1	86.0
DBA	80.9	82.1	83.0	83.2	82.1	80.8	79.8	77.9	75.4	71.8
BAND	23	23	19	19	19	19	23	23	23	19
TCORR	0.4	0.3	0.5	0.3	0.4	0.5	0.4	0.4	0.5	0.5

PNLT (INTEGRATED) = 103.06

2359 H Q2074 JT8D-17 5M MXR W/ SHIMS, DC9 REV 5DEG. CANT NORTH GP150RA150.1740

ENGINE MODEL = JT8D -17				INLET TEMP	= 31.00 F
ENGINE NUMBER = 372-69	TEMPERATURE	=	31.0 F	TIME OF DAY	= 843
CAL LEVEL = 124.1 DB.				BARM. PRESSURE	= 30.44 IN. HG.
STAND = X-314	HUMIDITY	=	61.0 PER CT.	WIND DIRECTION	= N
DATE = 03/17/79				WIND VELOCITY	= 4 MPH
	OBSERVED RPM	=	6631		
	CORRECTED RPM	=	6817		

FAA PART 36 REFERENCE DAY CORRECTED SPL IN DB - RADIUS = 150.0 FT.

ANGLE IN DEGREES

CENTER FREQ. (KHZ)	90	100	110	120	130	135	140	145	150	155
.050	88.1	89.5	91.5	94.3	99.3	101.8	103.4	104.9	106.7	108.3
.063	90.1	90.8	93.0	95.9	100.7	103.5	105.7	107.1	108.1	108.2
.080	91.4	93.0	94.6	97.6	102.4	105.7	107.5	109.5	109.9	108.7
.100	92.4	94.3	96.5	99.1	103.4	105.6	107.5	109.8	110.8	109.6
.125	94.2	95.5	97.8	100.5	104.1	106.1	107.6	108.7	109.0	109.6
.160	95.2	96.6	98.4	101.2	104.5	106.0	106.9	108.0	107.9	105.4
.200	95.2	96.6	98.8	101.2	104.5	105.6	105.8	105.6	105.9	101.4
.250	95.9	97.0	99.2	101.2	103.9	104.6	104.5	104.0	103.9	98.7
.315	96.2	97.5	100.1	102.0	103.6	103.6	103.4	102.7	102.0	98.5
.400	97.9	98.3	100.5	102.2	103.2	102.8	102.2	101.2	100.2	98.1
.500	96.4	97.7	99.9	101.1	102.4	101.7	101.2	100.1	99.7	97.9
.630	95.9	97.5	99.3	100.7	101.7	100.9	100.4	99.2	98.6	97.1
.800	95.6	97.4	98.5	99.8	100.9	100.4	99.4	98.6	97.6	96.5
1.00	95.3	96.7	98.0	99.3	99.9	99.5	98.5	97.6	96.9	95.5
1.25	95.6	96.7	97.8	98.9	99.3	98.9	98.1	97.0	96.5	95.6
1.60	96.1	96.8	97.6	98.3	98.7	98.4	97.6	96.6	96.4	95.2
2.00	95.2	96.3	96.9	97.4	97.6	97.1	96.4	95.5	94.9	93.9
2.50	94.1	95.4	96.3	96.4	96.4	96.1	95.0	94.2	93.5	92.5
3.15	93.4	95.6	96.9	95.9	96.9	97.5	95.1	94.7	93.6	92.3
4.00	91.7	93.6	94.8	93.4	93.5	93.3	91.7	90.6	90.1	89.0
5.00	90.1	92.4	92.5	91.8	91.6	91.3	89.9	88.6	88.4	87.2
6.30	90.9	93.7	92.6	91.7	91.2	90.0	89.7	88.9	87.9	86.5
8.00	93.7	95.9	95.2	92.4	91.8	90.8	89.9	89.6	88.2	86.7
10.0	92.9	96.2	96.2	93.2	92.0	90.6	89.4	88.6	87.7	86.4
OASPL	108.3	109.7	111.2	112.7	114.8	115.8	116.6	117.5	117.9	117.0
PNLT	119.9	121.7	122.9	123.0	124.3	125.1	123.7	123.5	122.9	121.6
PNL	119.7	121.5	122.6	122.7	123.9	124.2	123.3	123.0	122.5	121.2
DBA	106.3	107.8	108.8	109.4	110.2	110.0	109.2	108.5	108.0	106.4
BAND	23	19	19	19	19	19	19	19	19	19
TCORR	0.2	0.3	0.3	0.2	0.4	0.9	0.4	0.5	0.4	0.4

MAXIMUM OASPL	= 117.87	COMPOSITE SPL	= 118.60
MAXIMUM PNLT	= 125.14	COMPOSITE PNL	= 125.41
MAXIMUM PNL	= 124.20	PNLT (INTEGRATED)	= 133.09
MAXIMUM DBA	= 110.20		

THE FOLLOWING CONDITION HAS BEEN ADDED TO THE W601 DATA BASE

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BASE ID  LD  DATE      ENG  MOD ENG NO STND C  OBS CORR TEMP HUM  TTI  TIME BARM  WD WV   RUN
 544  3  250 03/17/79 JT8D -17 372-69 X314 3 6631 6817 77.0 70.0 31.0  843 30.44 N   4 2359 H Q2074 JT8D-17 5M MXR W/ SHIMS, DC9 RE
                                                                                        V 5DEG. CANT NORTH   GP150RA150.1740
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2359 H Q2074 JT8D-17 SM MXR W/ SHIMS, DC9 REV 5DEG. CANT NORTH GP150RA150.1740

CONDITION = 6817

ALTITUDE = 1500. FT SIDELINE

ANGLE IN DEGREES

CENTER FREQ. (KHZ)	90	100	110	120	130	135	140	145	150	155
.050	68.0	69.3	70.9	73.0	76.9	78.7	79.4	79.9	80.5	80.6
.063	70.0	70.6	72.3	74.5	78.2	80.3	81.7	82.0	81.8	80.4
.080	71.3	72.7	73.9	76.2	79.9	82.5	83.4	84.4	83.5	80.8
.100	72.2	74.0	75.7	77.6	80.8	82.3	83.3	84.6	84.3	81.6
.125	73.9	75.1	77.0	78.9	81.4	82.7	83.3	83.4	82.4	81.4
.160	74.9	76.1	77.5	79.5	81.7	82.5	82.5	82.5	81.1	77.0
.200	74.8	76.0	77.8	79.4	81.6	81.9	81.2	79.9	78.9	72.8
.250	75.3	76.3	78.1	79.3	80.8	80.8	79.7	78.1	76.7	69.8
.315	75.5	76.6	78.8	79.9	80.3	79.5	78.4	76.5	74.4	69.2
.400	77.0	77.2	79.0	79.9	79.6	78.4	76.9	74.7	72.2	68.3
.500	75.2	76.4	78.1	78.5	78.5	77.0	75.5	73.1	71.2	67.5
.630	74.4	75.9	77.2	77.7	77.4	75.7	74.2	71.7	69.5	65.9
.800	73.7	75.3	75.9	76.3	76.0	74.6	72.4	70.3	67.5	64.2
1.00	72.9	74.1	74.9	75.2	74.4	73.0	70.8	68.4	65.8	62.0
1.25	72.6	73.5	74.0	74.1	72.9	71.5	69.4	66.6	64.1	60.5
1.60	72.2	72.7	72.9	72.5	71.2	69.7	67.5	64.7	62.2	57.9
2.00	70.2	71.1	71.1	70.3	68.7	66.9	64.6	61.7	58.5	54.0
2.50	67.9	68.9	69.1	67.9	65.8	64.0	61.1	58.0	54.4	49.4
3.15	65.5	67.4	67.9	65.4	64.0	62.9	58.4	55.4	50.8	44.8
4.00	61.4	63.0	63.3	60.1	57.4	55.3	51.2	47.0	42.4	35.6
5.00	58.3	60.3	59.4	56.8	53.6	51.1	47.1	42.3	37.6	30.2
6.30	55.9	58.4	56.0	52.9	48.9	45.1	41.7	36.8	30.3	21.4
8.00	53.7	55.4	53.2	47.7	42.6	38.5	33.6	28.1	19.8	8.7
10.0	45.1	47.8	45.8	39.3	32.4	26.9	20.5	12.9	2.9	0.0
OASPL	86.2	87.3	88.7	89.8	91.2	91.7	91.8	91.8	91.0	88.7
PNLT	94.5	95.6	96.3	96.5	96.7	96.3	95.0	93.9	92.4	89.1
PNL	94.1	95.3	95.9	96.2	96.2	95.6	94.5	93.2	91.8	88.6
DBA	82.5	83.6	84.5	84.8	84.5	83.4	81.9	80.1	78.2	74.3
BAND	23	19	19	19	19	19	19	19	19	19
TCORR	0.4	0.3	0.4	0.3	0.5	0.7	0.5	0.6	0.5	0.5

PNLT (INTEGRATED) = 105.10

2359 H Q2074 JT8D-17 5M MXR W/ SHIMS, DC9 REV 5DEG. CANT NORTH GP150RA150.1740

ENGINE MODEL	= JT8D -17	TEMPERATURE	= 32.0 F	INLET TEMP	= 32.00 F
ENGINE NUMBER	= 372-69			TIME OF DAY	= 919
CAL LEVEL	= 124.1 DB.	HUMIDITY	= 57.0 PER CT.	BARM. PRESSURE	= 30.44 IN. HG.
STAND	= X-314			WIND DIRECTION	= N
DATE	= 03/17/79	OBSERVED RPM	= 7041	WIND VELOCITY	= 4 MPH
		CORRECTED RPM	= 7231		

FAA PART 36 REFERENCE DAY CORRECTED SPL IN DB - RADIUS = 150.0 FT.

ANGLE IN DEGREES

CENTER FREQ. (KHZ)	90	100	110	120	130	135	140	145	150	155
.050	90.5	91.4	94.0	96.7	102.1	105.2	106.6	108.5	109.7	111.5
.063	92.5	93.5	95.3	99.1	104.3	107.4	109.5	110.9	111.3	111.9
.080	93.4	95.5	97.0	101.3	106.2	109.6	112.0	113.5	113.3	112.2
.100	94.8	96.8	99.2	102.5	107.7	110.0	112.8	114.0	115.3	113.5
.125	96.7	98.2	100.9	103.8	108.5	111.2	113.2	114.3	114.7	115.0
.160	97.7	96.9	101.5	104.7	108.9	110.7	112.5	113.4	113.6	111.9
.200	98.3	99.4	102.2	105.0	108.6	109.8	111.3	110.9	112.6	108.3
.250	98.9	99.9	102.7	105.4	107.9	108.9	109.2	108.7	109.5	105.3
.315	99.2	100.3	103.2	105.8	107.6	107.7	107.7	107.2	107.0	104.4
.400	101.1	101.3	104.3	106.0	107.0	106.8	106.3	105.3	104.5	103.2
.500	99.7	101.0	104.1	105.3	106.5	105.6	105.2	104.3	103.7	102.4
.630	99.1	100.9	103.5	104.7	105.7	104.9	104.3	103.3	102.4	101.5
.800	98.8	100.8	102.8	104.0	104.9	104.0	103.6	102.5	101.3	100.7
1.00	98.6	100.5	102.5	103.8	104.0	103.3	102.6	101.6	100.9	99.9
1.25	99.0	100.4	102.1	103.4	103.4	102.9	102.6	101.4	100.8	99.8
1.60	99.3	100.4	101.9	102.7	102.7	102.6	102.1	101.2	100.2	99.2
2.00	98.6	100.1	101.3	102.1	101.5	101.8	101.4	100.5	99.0	98.0
2.50	97.7	99.2	100.6	101.2	100.1	100.6	100.1	99.2	97.6	96.7
3.15	97.1	98.7	100.2	100.2	99.3	99.6	98.8	97.9	96.4	95.3
4.00	95.8	97.3	98.9	98.0	97.5	97.5	96.2	94.9	93.8	92.9
5.00	94.2	96.2	96.8	96.3	95.6	95.7	94.2	92.9	92.2	90.8
6.30	93.7	96.6	96.0	95.8	94.7	94.0	93.4	92.2	91.3	89.2
8.00	95.1	97.0	96.3	95.1	94.3	93.6	92.8	91.7	90.7	88.8
10.0	94.7	97.2	97.0	94.9	93.7	92.4	91.4	90.4	89.6	88.0
OASPL	111.4	112.8	114.9	116.6	118.9	120.1	121.4	122.0	122.5	121.5
PNLT	123.1	124.6	126.2	127.0	127.4	127.8	127.8	127.3	127.2	126.1
PNL	123.0	124.5	126.1	126.9	127.3	127.7	127.6	127.1	127.0	125.9
DBA	109.5	111.1	112.8	113.7	114.1	113.9	113.7	112.9	112.5	111.0
BAND	10	19	20	19	19	19	19	19	19	5
TCORR	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.3

MAXIMUM OASPL	= 122.51	COMPOSITE SPL	= 123.11
MAXIMUM PNLT	= 127.78	COMPOSITE PNL	= 129.13
MAXIMUM PNL	= 127.66	PNLT (INTEGRATED)	= 136.65
MAXIMUM DBA	= 114.10		

THE FOLLOWING CONDITION HAS BEEN ADDED TO THE W601 DATA BASE

BASE ID	LD	DATE	ENG	MOD	ENG NO	STND	C	OBS	CORR	TEMP	HUM	TTI	TIME	BARM	WD	WV	RUN
544	10	250	03/17/79	JT8D	-17	372-69	X314 3	7041	7231	77.0	70.0	32.0	919	30.44	N	4	2359 H Q2074 JT8D-17 5M MXR W/ SHIMS, DC9 REV 5DEG. CANT NORTH GP150RA150.1740

2359 H 02074 JT8D-17 SM MXR W/ SHIMS, DC9 REV 5DEG. CANT NORTH   GP150RA150.1740

CONDITION = 7231

ALTITUDE = 1500. FT SIDELINE

CENTER FREQ. (KHZ)	ANGLE IN DEGREES 90	100	110	120	130	135	140	145	150	155
.050	70.4	71.2	73.4	75.4	79.7	82.1	82.6	83.5	83.5	83.8
.063	72.4	73.3	74.6	77.7	81.8	84.2	85.5	85.8	85.0	84.1
.080	73.3	75.2	76.3	79.9	83.7	86.4	87.9	88.4	86.9	84.3
.100	74.6	76.5	78.4	81.0	85.1	86.7	88.6	88.8	88.8	85.5
.125	76.4	77.8	80.1	82.2	85.8	87.8	88.9	89.0	88.1	86.8
.160	77.4	78.4	80.6	83.0	86.1	87.2	88.1	87.9	86.8	83.5
.200	77.9	78.8	81.2	83.2	85.7	86.1	86.7	85.2	85.6	79.7
.250	78.2	79.2	81.6	83.5	84.8	85.1	84.4	82.8	82.3	76.4
.315	76.5	79.4	81.9	83.7	84.3	83.6	82.7	81.0	79.4	75.1
.400	80.2	80.2	82.8	83.7	83.4	82.4	81.0	78.8	76.5	73.4
.500	78.5	79.7	82.3	82.7	82.6	80.9	79.5	77.3	75.2	72.0
.630	77.6	79.3	81.4	81.7	81.4	79.7	78.1	75.8	73.3	70.3
.800	75.9	78.7	80.2	80.5	80.0	78.2	76.6	74.2	71.2	68.4
1.00	76.2	77.9	79.4	79.8	78.5	76.8	74.9	72.4	69.8	66.4
1.25	76.0	77.2	76.3	78.6	77.0	75.5	73.9	71.1	68.4	64.7
1.60	75.4	76.3	77.2	76.9	75.2	73.9	72.0	69.3	66.0	61.9
2.00	73.7	75.0	75.5	75.1	72.6	71.6	69.6	66.7	62.6	58.1
2.50	71.5	72.8	73.4	72.7	69.5	68.6	66.2	63.1	58.5	53.6
3.15	69.2	70.5	71.1	69.6	66.3	65.0	62.1	58.6	53.6	47.8
4.00	65.5	66.7	67.3	64.7	61.4	59.5	55.7	51.3	46.1	39.5
5.00	62.4	64.1	63.7	61.3	57.6	55.5	51.4	46.6	41.4	33.8
6.30	58.8	61.3	59.5	57.1	52.4	49.2	45.4	40.1	33.7	24.1
8.00	55.0	56.5	54.3	50.3	45.1	41.3	36.5	30.2	22.3	10.8
10.0	46.9	48.8	46.7	41.1	34.2	28.8	22.6	14.8	4.9	0.0
UASPL	89.2	90.3	92.3	93.6	95.3	96.0	96.7	96.4	95.7	93.1
PNLT	97.7	98.9	100.0	100.5	100.4	100.1	99.7	98.4	97.1	94.2
PNL	97.4	98.7	99.9	100.3	100.2	99.8	99.4	98.1	96.7	93.7
DBA	85.8	87.1	88.6	89.0	88.5	87.5	86.5	84.7	83.1	79.4
BAND	23	19	19	19	23	21	23	23	23	21
TCORR	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.4

PNLT (INTEGRATED) = 109.02

2359 H Q2075 JT8D-17 5M MXR W/ SHIMS, DC9 REV 5DEG. CANT NORTH GP150RA150.1740

ENGINE MODEL	= JT8D -17			INLET TEMP	= 33.00 F
ENGINE NUMBER	= 372-69	TEMPERATURE	= 33.0 F	TIME OF DAY	= 1003
CAL LEVEL	= 124.2 DB.			BARM. PRESSURE	= 30.45 IN. HG.
STAND	= X-314	HUMIDITY	= 55.0 PER CT.	WIND DIRECTION	= NW
DATE	= 03/17/79			WIND VELOCITY	= 6 MPH
		OBSERVED RPM	= 7603		
		CORRECTED RPM	= 7800		

FAA PART 36 REFERENCE DAY CORRECTED SPL IN DB - RADIUS = 150.0 FT.

ANGLE IN DEGREES

CENTER FREQ. (KHZ)	90	100	110	120	130	135	140	145	150	155
.050	93.4	94.7	96.7	100.4	105.7	109.1	110.9	112.5	114.1	115.5
.063	96.0	97.0	98.7	102.8	108.6	112.0	113.9	115.5	115.4	115.5
.080	96.7	98.2	100.5	104.6	110.5	114.1	116.5	118.0	117.4	115.4
.100	98.2	100.0	102.5	106.5	112.4	115.6	117.7	119.4	119.9	118.3
.125	100.2	101.5	104.1	107.8	113.7	117.2	119.1	119.7	119.2	120.2
.160	100.9	102.7	105.3	108.8	114.1	117.0	118.8	120.6	120.0	117.7
.200	101.8	103.5	106.3	109.3	113.8	116.2	118.3	118.6	120.9	116.3
.250	102.2	103.7	106.8	109.5	113.1	114.2	116.5	117.2	118.9	115.1
.315	102.8	104.5	107.2	109.9	112.4	113.2	114.2	115.3	116.2	114.4
.400	104.1	105.4	108.0	109.7	111.8	111.7	112.6	113.0	113.9	113.1
.500	103.5	105.5	107.9	109.5	111.0	110.7	111.4	111	112.9	111.8
.630	103.0	105.5	107.7	109.4	110.3	109.9	110.6	110.7	111.4	110.4
.800	102.8	105.1	107.0	108.4	109.5	108.9	109.6	109.5	109.8	108.7
1.00	102.6	104.5	106.9	108.4	108.6	108.3	108.5	108.3	108.6	107.0
1.25	102.8	104.4	106.9	107.9	108.0	107.8	108.2	107.5	107.5	105.8
1.60	102.9	104.6	106.6	107.2	107.4	107.2	107.6	106.5	105.2	104.2
2.00	102.4	104.3	106.4	106.8	106.9	106.4	106.5	105.7	105.0	103.0
2.50	102.1	104.1	105.7	106.1	105.9	105.6	105.5	104.2	104.0	102.0
3.15	101.2	103.3	104.6	104.6	104.3	104.2	103.9	102.4	102.3	100.1
4.00	100.2	102.2	103.4	102.8	102.4	102.4	102.3	100.4	100.5	98.2
5.00	98.6	101.0	101.4	101.7	100.9	100.5	100.3	98.3	98.4	96.4
6.30	97.4	101.0	100.5	101.1	100.2	98.8	99.6	97.6	97.4	94.8
8.00	97.8	100.0	100.1	100.1	99.8	98.5	98.8	97.3	96.9	94.3
10.0	96.8	99.6	99.5	99.0	98.5	97.1	97.2	95.7	95.3	93.1
OASPL	115.0	116.9	119.0	120.9	123.7	125.5	127.2	128.2	128.7	127.1
PNLT	126.9	128.9	130.5	131.5	132.4	132.8	133.5	133.5	134.4	132.2
PNL	126.8	128.8	130.4	131.4	132.4	132.7	133.4	133.4	134.2	132.0
DBA	113.4	115.4	117.2	118.2	118.9	119.0	119.7	119.6	120.2	118.4
BAND	10	16	20	12	17	5	5	6	4	5
TCORR	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2

MAXIMUM OASPL	= 128.69	COMPOSITE SPL	= 129.06
MAXIMUM PNLT	= 134.42	COMPOSITE PNL	= 135.02
MAXIMUM PNL	= 134.24	PNLT (INTEGRATED)	= 142.14
MAXIMUM DBA	= 120.20		

THE FOLLOWING CONDITION HAS BEEN ADDED TO THE W601 DATA BASE

BASE ID	LD	DATE	ENG	MOD	ENG NO	STND	C	OBS	CORR	TEMP	HUM	TTI	TIME	BARM	WD	WV	RUN
543	4	250	03/17/79	JT8D -17	372-69	X314	3	7603	7800	77.0	70.0	33.0	1003	30.45	NW	6	2359 H Q2075 JT8D-17 5M MXR W/ SHIMS, DC9 REV 5DEG. CANT NORTH GP150RA150.1740

2359 H Q2075 JT8D-17 5M MXR W/ SHIMS, DC9 REV 5DEG. CANT NORTH   GP150RA150.1740

CONDITION = 7800

ALTITUDE = 1500. FT SIDELINE

ANGLE IN DEGREES

CENTER FREQ. (KHZ)	90	100	110	120	130	135	140	145	150	155
.050	73.3	74.5	76.1	79.1	83.3	86.0	86.9	87.5	87.9	87.8
.063	75.9	76.8	78.0	81.4	86.1	88.8	89.9	90.4	89.1	87.7
.080	76.6	77.9	79.8	83.2	88.0	90.9	92.4	92.9	91.0	87.5
.100	78.0	79.7	81.8	85.0	89.8	92.3	93.5	94.2	93.4	90.3
.125	79.9	81.1	83.3	86.2	91.0	93.8	94.8	94.4	92.6	92.0
.160	80.6	82.2	84.4	87.1	91.3	93.5	94.4	95.1	93.2	89.3
.200	81.4	82.9	85.3	87.5	90.9	92.5	93.7	92.9	93.9	87.7
.250	81.6	83.0	85.7	87.6	90.0	90.4	91.7	91.3	91.7	86.2
.315	82.1	83.6	85.9	87.8	89.1	89.1	89.2	89.1	88.6	85.1
.400	83.2	84.3	86.5	87.4	88.2	87.3	87.3	86.5	85.9	83.3
.500	82.4	84.2	86.1	86.9	87.1	86.0	85.7	84.6	84.4	81.4
.630	81.5	83.8	85.5	86.3	85.9	84.7	84.3	83.1	82.2	79.1
.800	80.9	83.0	84.4	84.9	84.6	83.1	82.7	81.2	79.7	76.4
1.00	80.2	82.0	83.8	84.4	83.1	81.8	80.8	79.1	77.5	73.5
1.25	79.8	81.2	83.1	83.1	81.6	80.4	79.5	77.2	75.1	70.7
1.60	79.0	80.5	81.9	81.4	79.9	78.5	77.5	74.6	72.0	66.9
2.00	77.5	79.2	80.6	79.8	78.0	76.2	74.7	71.4	68.6	63.1
2.50	75.8	77.6	78.5	77.5	75.2	73.5	71.6	68.0	64.8	58.8
3.15	73.3	75.1	75.6	74.1	71.4	69.6	67.2	63.1	59.5	52.6
4.00	69.9	71.6	71.9	69.5	66.3	64.4	61.8	56.8	52.8	44.8
5.00	66.9	68.9	68.3	66.7	62.9	60.4	57.5	52.1	47.6	39.4
6.30	62.4	65.6	63.9	62.3	57.8	53.9	51.5	45.4	39.8	29.6
8.00	57.7	59.4	58.0	55.3	50.6	46.2	42.5	35.8	28.5	16.3
10.0	49.0	51.2	49.2	45.2	38.9	33.5	28.4	20.1	10.6	0.0
OASPL	92.7	94.4	96.3	97.8	100.1	101.5	102.5	102.5	101.6	98.5
PNLT	101.5	103.2	104.5	104.7	105.3	105.7	106.0	105.1	104.6	100.5
PNL	101.3	103.1	104.4	104.5	105.1	105.4	105.7	104.7	104.2	100.0
DBA	89.6	91.3	93.0	93.4	93.3	92.7	92.7	91.8	91.2	87.3
BAND	23	22	23	21	23	23	23	23	23	21
TCORR	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.5

PNLT (INTEGRATED) = 114.41

2359 H Q2075 JT8D-17 5M MXR W/ SHIMS, DC9 REV 5DEG. CANT NORTH GP150RA150.1740

ENGINE MODEL	= JT8D -17				INLET TEMP	= 33.00 F
ENGINE NUMBER	= 372-69	TEMPERATURE	=	33.0 F	TIME OF DAY	= 1020
CAL LEVEL	= 124.2 DB.				BARM. PRESSURE	= 30.45 IN. HG.
STAND	= X-314	HUMIDITY	=	55.0 PER CT.	WIND DIRECTION	= NW
DATE	= 03/17/79				WIND VELOCITY	= 6 MPH
		OBSERVED RPM	=	8274		
		CORRECTED RPM	=	8489		

FAA PART 36 REFERENCE DAY CORRECTED SPL IN DB - RADIUS = 150.0 FT.

ANGLE IN DEGREES

CENTER FREQ. (KHZ)	90	100	110	120	130	135	140	145	150	155
.050	95.8	97.2	99.0	102.6	108.2	111.8	113.3	115.6	116.1	118.5
.063	98.0	98.9	100.8	105.2	111.2	114.4	116.7	118.0	118.1	118.1
.080	98.9	100.9	102.6	107.5	114.1	117.5	120.2	121.4	120.9	118.8
.100	100.0	102.2	104.8	109.8	116.3	118.9	121.4	122.8	122.9	121.6
.125	102.3	104.1	106.4	111.1	118.2	121.5	123.5	123.4	122.5	123.7
.160	103.2	104.9	107.9	112.0	119.1	121.8	123.8	124.8	123.9	121.1
.200	104.1	105.9	108.9	112.7	119.0	121.8	124.0	124.3	125.6	121.2
.250	104.9	106.6	[illegible]	113.2	118.2	120.6	122.7	123.8	125.3	120.7
.315	105.5	107.1	110.2	113.3	117.4	118.9	120.9	122.9	123.5	121.1
.400	106.6	107.9	110.8	113.6	116.5	117.4	119.3	120.8	121.4	120.0
.500	106.2	108.4	111.3	113.5	115.5	116.0	118.1	119.1	120.6	119.0
.630	106.2	108.3	110.9	113.5	114.8	115.1	117.2	118.1	119.0	117.8
.800	106.1	108.3	110.4	112.3	113.7	114.4	116.0	116.7	117.0	115.8
1.00	106.3	107.8	110.3	112.6	113.1	113.6	114.6	115.0	115.5	114.0
1.25	106.5	107.9	110.2	112.2	112.5	112.9	113.9	113.7	114.3	113.0
1.60	106.3	107.9	109.8	111.5	111.9	111.9	112.4	112.1	112.3	111.2
2.00	105.8	107.8	109.7	111.0	111.2	110.9	111.3	110.9	111.1	109.9
2.50	105.7	107.6	109.2	110.5	110.3	110.2	110.1	109.9	109.9	108.9
3.15	105.0	106.6	108.0	109.1	109.2	108.9	109.1	108.6	108.8	107.4
4.00	104.1	105.6	106.6	107.3	107.5	107.3	107.5	106.9	107.1	106.1
5.00	102.4	104.5	104.9	105.8	105.9	105.6	105.8	104.6	105.4	103.9
6.30	101.0	104.4	103.8	105.5	105.5	104.0	105.4	104.2	104.9	102.5
8.00	100.8	102.8	103.2	104.6	105.1	103.7	104.7	104.1	104.6	102.3
10.0	99.5	101.4	102.1	102.9	103.8	102.5	103.3	102.7	103.3	101.2
OASPL	118.1	119.9	122.1	124.7	128.3	130.3	132.3	133.2	133.6	131.7
PNLT	130.3	132.0	133.7	135.6	137.0	137.6	138.9	139.5	140.2	138.3
PNL	130.2	131.9	133.6	135.5	136.9	137.5	138.8	139.4	140.1	138.0
DBA	116.8	118.6	120.5	122.4	123.5	124.2	125.5	126.2	126.8	125.0
BAND	20	22	11	18	19	5	5	6	4	5
TCORR	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.3

MAXIMUM OASPL = 133.61		COMPOSITE SPL	= 133.91
MAXIMUM PNLT = 140.19		COMPOSITE PNL	= 140.28
MAXIMUM PNL = 140.06		PNLT (INTEGRATED)	= 147.27
MAXIMUM DBA = 126.85			

THE FOLLOWING CONDITION HAS BEEN ADDED TO THE W601 DATA BASE

BASE ID	LD	DATE	ENG MOD	ENG NO	STND	C	OBS	CORR	TEMP	HUM	TTI	TIME	BARM	WD	WV	RUN
543	5	250 03/17/79	JT8D -17	372-69	X314	3	8274	8489	77.0	70.0	33.0	1020	30.45	NW	6	2359 H Q2075 JT8D-17 5M MXR W/ SHIMS, DC9 REV 5DEG. CANT NORTH GP150RA150.1740

2359 H Q2075 JT8D-17 5M MXR W/ SHIMS, DC9 REV 5DEG. CANT NORTH   GP150RA150.1740

CONDITION = 8489

ALTITUDE = 1500. FT SIDELINE

ANGLE IN DEGREES

CENTER FREQ. (KHZ)	90	100	110	120	130	135	140	145	150	155
.050	75.7	77.0	78.4	81.3	85.8	88.7	89.3	90.6	89.9	90.8
.063	77.9	78.7	80.1	83.8	88.7	91.2	92.7	92.9	91.8	90.3
.080	78.8	80.6	82.1	86.1	91.6	94.3	96.1	96.3	94.5	90.9
.100	79.8	81.9	84.1	88.3	93.7	95.6	97.2	97.6	96.4	93.6
.125	82.0	83.7	85.6	89.5	95.5	98.1	99.2	98.1	95.9	95.5
.160	82.9	84.4	87.0	90.3	96.3	98.3	99.4	99.3	97.1	92.7
.200	83.7	85.3	87.9	90.9	96.1	98.1	99.4	98.6	98.6	92.6
.250	84.3	85.9	88.6	91.3	95.1	96.8	97.9	97.9	98.1	91.8
.315	84.6	86.2	88.9	91.2	94.1	94.8	95.9	96.7	95.9	91.8
.400	85.7	86.8	89.3	91.3	92.9	93.0	94.0	94.3	93.4	90.2
.500	85.1	87.1	89.3	90.9	91.6	91.3	92.4	92.1	92.1	88.6
.630	84.7	86.6	88.7	90.4	90.4	89.9	90.9	90.5	89.8	86.5
.800	84.2	86.2	87.8	89.3	88.8	88.6	89.1	88.4	86.9	83.5
1.00	83.9	85.3	87.2	88.6	87.6	87.1	86.9	85.8	84.4	80.5
1.25	83.5	84.7	86.4	87.4	86.1	85.5	85.1	83.4	81.9	77.9
1.60	82.4	83.8	85.1	85.7	84.4	83.2	82.3	80.2	78.1	73.9
2.00	80.9	82.7	83.9	84.0	82.3	80.7	79.5	77.1	74.7	70.0
2.50	79.4	81.1	82.0	81.9	79.6	78.1	76.2	73.7	70.7	65.7
3.15	77.1	78.4	79.0	78.6	76.3	74.3	72.4	69.3	66.0	59.9
4.00	73.8	75.0	75.1	74.0	71.4	69.3	67.0	63.3	59.4	52.7
5.00	70.7	72.4	71.8	70.8	67.9	65.5	63.0	58.4	54.6	46.9
6.30	65.0	69.0	67.2	66.7	63.1	59.1	57.3	52.0	47.3	37.3
8.00	60.7	62.2	61.1	59.8	55.9	51.4	48.4	42.6	36.2	24.3
10.0	51.7	53.0	51.8	49.1	44.2	38.9	34.5	27.1	18.6	3.7
OASPL	95.6	97.2	99.3	101.5	104.7	106.2	107.4	107.3	106.2	102.7
PNLT	104.8	106.4	107.7	108.8	110.0	110.8	111.5	110.9	110.1	105.8
PNL	104.6	106.2	107.5	108.6	109.8	110.5	111.2	110.5	109.7	105.3
DBA	92.9	94.5	96.2	97.5	97.9	98.1	98.8	98.4	97.7	93.6
BAND	23	22	23	23	23	21	23	23	23	23
TCORR	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.4

PNLT (INTEGRATED) = 119.19

2360 H Q3034 JT8D-17,REF SPLTR B/L,B727 T/P,3.5DEG CANT NORTH   GP150RA

ENGINE MODEL	= JT8D -17			INLET TEMP	= 24.00 F
ENGINE NUMBER	= 370-05	TEMPERATURE	= 24.0 F	TIME OF DAY	= 838
CAL LEVEL	= 124.1 DB.			BARM. PRESSURE	= 30.25 IN. HG.
STAND	= X-314	HUMIDITY	= 74.0 PER CT.	WIND DIRECTION	= NW
DATE	= 01/09/80			WIND VELOCITY	= 7 MPH
		CONDITION	= 6354		

FAA PART 36 REFERENCE DAY CORRECTED SPL IN DB - RADIUS = 150.0 FT.

ANGLE IN DEGREES

CENTER FREQ. (KHZ)	90	100	110	120	130	135	140	145	150	155
.050	86.5	88.0	90.7	93.4	97.9	100.3	101.7	103.3	103.8	104.9
.063	89.4	89.8	91.9	95.3	99.6	102.1	103.9	105.3	105.5	106.5
.080	89.5	91.5	93.6	96.4	100.5	103.1	105.2	107.3	107.6	107.8
.100	90.5	92.7	95.4	97.9	102.2	104.4	106.0	108.0	108.5	108.5
.125	93.0	94.4	96.9	99.3	103.1	[illegible]	[illegible]	105.3	108.3	107.3
.160	94.3	94.9	97.8	100.4	103.7	[illegible]	[illegible]	107.1	107.3	104.4
.200	94.6	95.9	97.9	100.3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	102.8
.250	94.8	96.5	98.5	100.8	102.9	[illegible]	[illegible]	[illegible]	101.9	101.5
.315	95.5	96.6	99.3	101.1	102.5	[illegible]	[illegible]	[illegible]	100.2	100.6
.400	95.6	96.5	98.9	100.5	[illegible]	[illegible]	[illegible]	99.8	98.5	98.6
.500	94.9	95.7	97.9	99.5	100.2	[illegible]	[illegible]	98.2	96.7	96.9
.630	93.9	95.0	97.5	98.5	99.3	[illegible]	[illegible]	95.9	95.4	94.9
.800	93.6	94.2	96.8	97.7	97.7	97.3	[illegible]	95.3	93.9	93.0
1.00	[illegible]	93.5	96.1	96.5	96.2	95.7	[illegible]	93.6	92.3	91.7
1.25	93.3	93.5	95.5	95.3	94.9	94.2	93.0	92.6	91.8	90.6
1.60	91.9	92.0	94.5	94.5	93.5	92.9	91.8	91.0	89.7	89.1
2.00	91.6	92.2	93.9	92.8	92.0	91.4	90.2	89.5	88.1	87.2
2.50	93.7	94.7	94.1	94.8	93.5	93.7	93.1	91.2	89.7	90.8
3.15	92.2	93.3	93.3	92.1	90.8	91.0	90.0	88.9	87.2	87.4
4.00	91.5	93.8	96.4	90.6	91.3	90.4	86.5	85.9	87.6	87.3
5.00	91.8	92.7	94.4	91.8	89.4	89.4	88.3	88.6	87.0	87.0
6.30	94.9	97.3	96.8	94.4	91.1	90.6	90.0	89.9	88.3	89.1
8.00	97.2	99.3	99.7	97.5	94.0	92.7	91.6	90.9	89.6	89.6
10.0	96.6	98.2	99.8	97.8	94.1	93.2	91.8	90.4	89.1	88.9
OASPL	107.5	108.8	110.6	111.4	113.1	114.3	115.0	116.0	115.9	115.5
PNLT	119.5	121.1	123.0	121.8	121.5	121.9	121.9	121.1	120.4	120.8
PNL	119.1	120.7	122.1	122.3	121.1	121.3	120.9	120.7	120.0	119.6
DBA	105.4	106.6	108.1	107.6	107.4	107.3	106.6	106.1	105.0	104.5
BAND	18	18	20	18	18	18	18	18	18	18
TCORR	0.4	0.4	0.9	0.5	0.5	0.5	1.0	0.4	0.4	1.2

MAXIMUM OASPL	= 115.97	COMPOSITE SPL	= 116.92
MAXIMUM PNLT	= 122.99	COMPOSITE PNL	= 124.29
MAXIMUM PNL	= 122.13	PNLT (INTEGRATED)	= 131.39
MAXIMUM DBA	= 108.06		

2360 H Q3034 JT8D-17,REF SPLTR B/L,B727 T/P,3.5DEG CANT NORTH GP150RA150.1740

CONDITION = 6354

ALTITUDE = 1500. FT SIDELINE

CENTER FREQ. (KHZ)	ANGLE IN DEGREES 90	100	110	120	130	135	140	145	150	155
.050	66.4	67.7	70.0	72.0	75.4	77.1	77.7	78.2	77.5	77.1
.063	69.2	69.5	71.2	73.9	77.1	78.9	79.8	80.2	79.2	78.6
.080	69.3	71.1	72.8	74.9	77.9	79.8	81.0	82.1	81.2	79.8
.100	70.2	72.3	74.6	76.4	79.6	81.0	81.8	82.7	82.0	80.4
.125	72.7	73.9	76.0	77.7	80.4	81.7	82.4	82.9	81.6	79.1
.160	73.9	74.3	76.8	78.7	80.9	81.9	81.7	81.6	80.5	75.9
.200	74.1	75.2	76.8	78.5	80.0	80.8	80.4	79.5	77.2	74.1
.250	74.2	75.7	77.3	78.8	79.8	79.9	78.8	77.3	74.6	72.5
.315	74.7	75.8	77.9	78.9	79.2	79.0	77.3	75.5	72.6	71.2
.400	74.6	75.5	77.3	78.1	77.9	76.9	75.5	73.2	70.5	68.7
.500	73.7	74.3	76.1	76.8	76.3	75.3	73.5	71.2	68.2	66.4
.630	72.4	73.3	75.3	75.5	75.0	73.5	71.4	69.3	66.2	63.6
.800	71.7	72.1	74.2	74.2	72.8	71.5	69.3	67.0	63.9	60.7
1.00	71.0	70.9	73.0	72.4	70.6	69.2	67.2	64.4	61.2	58.1
1.25	70.3	70.3	71.8	70.6	68.6	66.8	64.3	62.3	59.4	55.6
1.60	68.0	67.9	69.7	68.6	65.9	64.2	61.6	59.0	55.4	51.8
2.00	66.7	67.1	68.1	65.8	63.1	61.2	58.4	55.7	51.7	47.4
2.50	67.4	68.3	66.9	66.2	62.8	61.6	59.2	55.0	50.5	47.6
3.15	64.2	65.1	64.2	61.5	57.8	57.4	53.3	49.5	44.4	39.9
4.00	61.2	63.2	64.8	57.3	55.2	52.4	48.0	45.3	39.8	33.9
5.00	60.0	60.7	61.3	56.8	51.3	49.2	45.5	42.3	36.2	30.0
6.30	59.9	61.9	60.2	55.6	48.7	45.7	42.0	37.7	30.7	23.9
8.00	57.1	58.8	57.7	52.7	44.8	40.4	35.3	29.4	21.2	11.6
10.0	48.8	49.8	49.5	44.0	34.5	29.6	23.0	14.8	4.3	0.0
OASPL	84.6	85.5	87.3	88.4	89.7	90.4	90.3	90.4	89.1	87.2
PNLT	93.4	94.4	95.0	95.3	94.5	94.6	93.7	92.0	89.9	88.3
PNL	93.0	93.9	94.6	94.4	94.0	93.6	92.6	91.5	89.4	86.9
DBA	80.5	81.1	82.7	82.6	82.0	81.3	79.8	78.3	75.8	73.4
BAND	18	18	20	18	18	18	18	18	18	18
TCORR	0.4	0.5	0.5	0.9	0.5	0.9	1.7	0.5	0.5	1.3

PNLT (INTEGRATED) = 103.57

2360 H Q3034 JT8D-17,REF SPLTR B/L,B727 T/P,3.5DEG CANT NORTH   6P150RA150.1740

ENGINE MODEL	= JT8D -17			INLET TEMP	= 28.00 F
ENGINE NUMBER	= 378-05	TEMPERATURE	= 28.0 F	TIME OF DAY	= 1012
CAL LEVEL	= 124.1 DB.			BARM. PRESSURE	= 30.25 IN. HG.
STAND	= X-314	HUMIDITY	= 55.0 PER CT.	WIND DIRECTION	= NW
DATE	= 01/09/80			WIND VELOCITY	= 7 MPH
		CONDITION	= 6913		

FAA PART 36 REFERENCE DAY CORRECTED SPL IN DB - RADIUS = 150.0 FT.

ANGLE IN DEGREES

CENTER FREQ. (KHZ)	90	100	110	120	130	135	140	145	150	155
.050	89.5	90.6	92.8	95.3	101.4	104.0	105.9	107.4	107.8	109.3
.063	92.0	92.3	94.8	98.7	104.0	106.6	108.5	109.8	109.8	110.3
.080	92.4	94.1	96.6	100.2	105.4	108.2	110.0	112.0	111.8	110.6
.100	93.9	95.5	98.0	102.0	107.3	109.5	111.3	113.2	113.7	112.9
.125	96.2	97.2	99.9	103.4	108.6	111.3	112.8	113.7	112.8	113.2
.160	97.8	98.1	101.3	104.4	108.8	111.2	112.0	113.4	113.2	109.7
.200	98.2	99.5	101.6	104.9	108.4	110.2	111.1	111.4	111.1	110.5
.250	98.9	100.1	102.1	105.3	108.0	109.0	108.9	108.7	108.1	107.8
.315	99.3	100.4	102.7	105.4	107.4	108.1	107.5	107.4	105.9	107.2
.400	99.3	100.4	102.6	104.7	106.6	106.5	106.0	105.5	104.4	104.8
.500	98.8	99.9	101.9	104.2	105.7	105.3	104.3	104.2	102.9	103.0
.630	98.1	99.3	101.4	103.2	104.8	103.9	103.0	103.0	102.1	101.2
.800	97.6	98.5	100.9	102.5	103.2	102.5	101.6	101.5	100.5	99.4
1.00	97.0	97.6	100.3	101.3	101.6	100.7	99.7	99.7	98.5	97.6
1.25	96.6	97.1	99.4	100.2	100.2	99.0	98.0	97.7	96.6	95.8
1.60	96.0	96.6	98.9	99.0	98.7	97.5	96.4	96.2	95.0	94.1
2.00	95.3	96.1	97.8	97.3	97.1	96.0	94.7	94.5	92.8	91.9
2.50	95.6	96.7	96.9	96.2	95.7	94.9	93.4	92.9	91.8	90.8
3.15	96.8	97.6	97.1	95.7	95.5	95.5	93.5	93.7	91.7	91.3
4.00	95.0	96.5	95.6	93.7	93.6	92.7	91.2	91.0	89.8	89.5
5.00	93.8	95.3	95.7	93.7	92.8	91.9	90.5	90.2	89.0	88.8
6.30	95.0	96.4	96.1	94.3	93.2	92.3	91.4	90.8	89.4	89.4
8.00	97.6	99.3	98.2	96.3	94.4	93.9	93.2	91.8	90.5	90.4
10.0	98.0	99.2	99.5	98.4	95.4	94.6	94.0	92.0	90.7	90.7
OASPL	110.6	111.6	113.4	115.4	118.1	119.6	120.4	121.3	121.0	120.5
PNLT	122.7	123.5	124.3	124.4	125.4	125.9	125.7	126.1	125.2	124.7
PNL	122.3	123.3	124.1	124.2	125.2	125.5	125.5	125.7	125.0	124.5
DBA	108.3	109.3	110.6	111.3	112.2	112.0	111.4	111.4	110.5	110.0
BAND	19	19	19	19	19	19	19	19	19	19
TCORR	0.3	0.2	0.2	0.2	0.2	0.4	0.3	0.4	0.2	0.3

MAXIMUM OASPL	= 121.34	COMPOSITE SPL	= 121.84
MAXIMUM PNLT	= 126.08	COMPOSITE PNL	= 127.40
MAXIMUM PNL	= 125.69	PNLT (INTEGRATED)	= 134.90
MAXIMUM DBA	= 112.19		

2360 H Q3034 JT8D-17,REF SPLTR B/L,B727 T/P,3.5DEG CANT NORTH   6P150RA150.1740

CONDITION = 6913

ALTITUDE = 1500. FT SIDELINE

ANGLE IN DEGREES

CENTER FREQ. (KHZ)	90	100	110	120	130	135	140	145	150	155
.050	69.4	70.3	72.1	74.9	78.9	80.8	81.9	82.3	81.5	81.5
.063	71.8	72.0	74.1	77.3	81.5	83.4	84.4	84.7	83.5	82.4
.080	72.2	73.7	75.8	78.7	82.8	84.9	85.8	86.8	85.4	82.6
.100	73.6	75.1	77.2	80.5	84.7	86.1	87.1	87.9	87.2	84.8
.125	75.9	76.7	79.0	81.8	85.9	87.8	88.5	88.3	86.1	85.0
.160	77.4	77.5	80.3	82.7	86.0	87.6	87.5	87.9	86.4	81.3
.200	77.7	78.8	80.5	83.1	85.4	86.5	86.5	85.7	84.1	81.8
.250	78.3	79.3	80.9	83.3	84.9	85.1	84.1	82.8	80.8	78.8
.315	78.5	79.5	81.3	83.3	84.1	84.0	82.4	81.2	78.3	77.8
.400	78.3	79.3	81.0	82.3	83.0	82.1	80.6	78.9	76.4	74.9
.500	77.6	78.5	80.1	81.6	81.8	80.6	78.5	77.2	74.4	72.5
.630	76.6	77.6	79.3	80.2	80.5	78.7	76.8	75.5	72.9	70.0
.800	75.7	76.4	78.3	79.0	78.3	76.7	74.6	73.2	70.4	67.1
1.00	74.6	75.0	77.2	77.3	76.1	74.2	72.0	70.5	67.4	64.1
1.25	73.6	73.9	75.7	75.4	73.9	71.6	69.3	67.4	64.2	60.7
1.60	72.1	72.5	74.2	73.2	71.2	68.8	66.2	64.2	60.7	56.8
2.00	70.4	70.9	72.0	70.3	68.2	65.8	62.9	60.7	56.4	52.0
2.50	69.4	70.2	69.7	67.6	65.0	62.8	59.5	56.7	52.6	47.6
3.15	68.8	69.3	68.0	65.1	62.5	60.9	56.8	54.3	48.9	43.8
4.00	64.7	65.9	64.1	60.4	57.5	54.7	50.7	47.4	42.1	36.1
5.00	62.1	63.2	62.7	58.8	54.8	51.8	47.7	44.0	38.3	31.9
6.30	60.1	61.0	59.6	55.5	50.9	47.5	43.4	38.7	31.8	24.3
8.00	57.6	58.7	56.2	51.6	45.2	41.6	36.9	30.4	22.1	12.4
10.0	50.1	50.8	49.1	44.5	35.8	30.9	25.1	16.3	5.9	0.0
OASPL	88.2	89.1	90.9	92.7	94.8	95.7	95.8	95.7	94.2	92.1
PNLT	96.5	97.2	98.1	98.7	99.2	99.3	98.3	97.6	95.4	92.9
PNL	96.1	96.9	97.9	98.5	98.9	98.8	98.0	97.1	95.0	92.5
DBA	84.2	84.9	86.4	87.1	87.2	86.5	85.1	84.1	81.8	79.5
BAND	19	23	19	19	19	19	19	19	23	19
TCORR	0.4	0.3	0.3	0.2	0.3	0.5	0.4	0.5	0.4	0.4

PNLT (INTEGRATED) = 107.67

2360 H Q3032 JT8D-17,REF SPLTR B/L,B727 T/P,3.5DEG CANT NORTH   GP150RA150.1740

ENGINE MODEL	= JT8D -17			INLET TEMP	= 28.00 F
ENGINE NUMBER	= 378-05	TEMPERATURE	= 26.0 F	TIME OF DAY	= 1419
CAL LEVEL	= 124.1 DB.			BARM. PRESSURE	= 30.21 IN. HG.
STAND	= X-314	HUMIDITY	= 46.0 PER CT.	WIND DIRECTION	= NW
DATE	= 01/04/80			WIND VELOCITY	= 6 MPH
		CONDITION	= 7301		

FAA PART 36 REFERENCE DAY CORRECTED SPL IN DB - RADIUS = 150.0 FT.

ANGLE IN DEGREES

CENTER FREQ. (KHZ)	90	100	110	120	130	135	140	145	150	155
.050	91.4	92.7	95.5	98.3	103.7	106.2	107.8	109.7	110.1	111.3
.063	94.1	94.6	96.8	101.1	106.4	109.4	111.4	112.5	112.0	112.2
.080	94.4	96.2	98.9	102.5	108.7	111.2	113.7	115.7	114.3	111.3
.100	96.2	97.9	101.1	104.7	110.5	112.8	114.2	116.6	116.5	113.4
.125	98.5	99.6	102.9	106.5	112.3	114.9	116.4	116.5	115.5	115.6
.160	100.0	100.8	104.4	107.5	112.6	115.2	116.2	117.8	116.7	113.7
.200	100.6	102.0	105.2	108.0	112.4	114.2	115.6	116.4	116.9	115.0
.250	101.5	103.1	105.9	107.8	111.8	112.8	113.4	114.5	114.4	115.0
.315	101.9	102.6	106.0	108.2	111.3	111.9	112.0	112.5	111.6	112.2
.400	102.2	103.6	106.5	107.8	110.0	110.2	110.6	111.2	110.4	110.7
.500	101.7	103.2	106.0	107.3	108.9	109.1	109.3	109.4	108.1	108.7
.630	101.5	103.2	105.8	106.5	107.8	107.8	108.2	108.5	107.0	106.9
.800	101.0	102.3	105.1	105.7	106.2	106.6	106.3	106.5	104.8	104.4
1.00	100.6	101.4	104.4	104.9	104.7	105.0	104.4	104.2	102.5	102.4
1.25	100.0	100.8	103.8	103.4	103.3	103.4	102.8	102.4	100.9	100.5
1.60	99.7	100.1	103.0	102.5	102.0	101.4	100.8	100.6	99.1	98.4
2.00	98.8	99.7	102.1	100.9	100.1	99.8	99.5	98.8	97.2	96.4
2.50	98.7	99.7	101.3	99.9	99.2	98.7	98.1	97.6	95.7	94.9
3.15	99.3	100.3	100.9	99.0	98.0	97.7	97.2	96.8	94.4	94.4
4.00	96.8	98.0	98.6	97.2	96.4	95.6	95.0	94.8	92.1	91.9
5.00	96.0	97.4	98.1	96.6	95.6	94.8	93.7	93.8	91.9	91.3
6.30	96.1	97.4	97.6	96.3	95.1	94.7	93.7	93.0	91.5	91.0
8.00	98.2	99.6	98.4	96.7	94.9	94.6	94.7	93.2	91.4	91.2
10.0	99.1	101.0	101.1	98.0	95.9	95.1	94.6	93.1	92.1	91.6
OASPL	113.2	114.4	116.9	118.3	121.6	123.2	124.3	125.4	124.8	123.7
PNLT	125.2	126.3	127.8	127.3	128.5	129.1	129.7	130.2	129.6	129.0
PNL	124.9	126.0	127.5	127.2	128.4	129.0	129.6	130.1	129.4	128.7
DBA	111.1	112.2	114.4	114.5	115.4	115.8	115.9	116.3	115.3	115.0
BAND	19	19	19	19	5	19	19	6	4	19
TCORR	0.4	0.3	0.2	0.1	0.1	0.1	0.2	0.1	0.2	0.2

MAXIMUM OASPL	= 125.38	COMPOSITE SPL	= 125.63
MAXIMUM PNLT	= 130.22	COMPOSITE PNL	= 131.37
MAXIMUM PNL	= 130.07	PNLT (INTEGRATED)	= 138.51
MAXIMUM DBA	= 116.27		

2360 H Q3032 JT8D-17,REF SPLTR B/L,B727 T/P,3.5DEG CANT NORTH   GP150RA150.1740

CONDITION = 7301

ALTITUDE = 1500. FT SIDELINE

ANGLE IN DEGREES

CENTER FREQ. (KHZ)	90	100	110	120	130	135	140	145	150	155
.050	71.3	72.4	74.8	76.9	81.2	83.0	83.7	84.6	83.8	83.5
.063	73.9	74.3	76.1	79.7	83.9	86.2	87.3	87.4	85.6	84.3
.080	74.2	75.8	78.1	81.0	86.1	87.9	89.5	90.5	87.9	83.3
.100	75.9	77.5	80.3	83.1	87.8	89.4	90.0	91.3	90.0	85.3
.125	78.2	79.1	82.0	84.9	89.6	91.4	92.1	91.1	88.8	87.4
.160	79.6	80.2	83.4	85.8	89.8	91.6	91.7	92.3	89.9	85.2
.200	80.1	81.3	84.1	86.2	89.4	90.5	91.0	90.7	89.9	86.3
.250	80.9	82.3	84.7	85.8	88.7	88.9	88.6	88.6	87.1	86.0
.315	81.1	81.9	84.7	86.1	88.0	87.8	86.9	86.3	84.0	82.8
.400	81.3	62.5	85.0	85.4	86.4	85.8	85.2	84.6	82.4	80.8
.500	80.5	81.9	84.2	84.7	85.0	84.4	83.6	82.4	79.6	78.3
.630	80.0	81.6	83.6	83.5	83.5	82.6	81.9	80.9	77.8	75.6
.800	79.1	80.2	82.6	82.2	81.4	80.8	79.4	78.2	74.8	72.1
1.00	78.2	78.8	81.3	80.9	79.2	78.5	76.7	75.0	71.4	68.9
1.25	76.9	77.6	80.0	78.6	76.9	75.9	74.0	72.0	68.5	65.4
1.60	75.8	76.0	78.2	76.6	74.4	72.7	70.6	68.6	64.8	61.1
2.00	73.9	74.5	76.3	73.9	71.2	69.6	67.7	65.0	60.8	56.6
2.50	72.5	73.2	74.1	71.3	68.5	66.6	64.2	61.4	56.5	51.7
3.15	71.4	72.0	71.9	68.5	65.1	63.1	60.5	57.5	51.6	46.9
4.00	66.5	67.4	67.0	63.9	60.3	57.6	54.5	51.2	44.3	38.5
5.00	64.3	65.4	65.0	61.6	57.6	54.7	50.9	47.6	41.1	34.3
6.30	61.1	62.1	61.0	57.5	52.7	49.8	45.6	40.8	33.9	25.8
8.00	58.2	59.1	56.4	52.0	45.7	42.3	38.4	31.8	23.0	13.2
10.0	51.3	52.6	50.8	44.2	36.3	31.5	25.8	17.5	7.4	0.0
OASPL	91.0	92.1	94.6	95.7	98.3	99.3	99.6	99.7	97.8	95.1
PNLT	99.3	100.2	101.9	101.8	102.7	102.8	102.6	102.0	100.2	97.4
PNL	98.9	99.8	101.6	101.6	102.4	102.6	102.3	101.7	99.7	96.9
DBA	87.4	88.3	90.5	90.3	90.6	90.3	89.7	89.0	86.8	84.6
BAND	19	19	19	21	21	19	23	21	21	21
TCORR	0.4	0.4	0.3	0.2	0.2	0.2	0.3	0.3	0.5	0.5

PNLT (INTEGRATED) = 111.38

2360 H Q3034 JT8D-17,REF SPLTR B/L,B727 T/P,3.5DEG CANT NORTH   6P150RA150.1740

ENGINE MODEL	= JT8D -17			INLET TEMP	= 28.00 F
ENGINE NUMBER	= 378-05	TEMPERATURE	= 28.0 F	TIME OF DAY	= 1033
CAL LEVEL	= 124.1 DB.			BARM. PRESSURE	= 30.25 IN. HG.
STAND	= X-314	HUMIDITY	= 55.0 PER CT.	WIND DIRECTION	= NW
DATE	= 01/09/80			WIND VELOCITY	= 7 MPH
		CONDITION	= 7946		

FAA PART 36 REFERENCE DAY CORRECTED SPL IN DB - RADIUS = 150.0 FT.

ANGLE IN DEGREES

CENTER FREQ. (KHZ)	90	100	110	120	130	135	140	145	150	155
.050	94.2	95.8	98.2	101.6	108.3	111.0	112.5	114.0	114.5	115.9
.063	97.0	97.4	99.5	104.3	111.0	114.0	115.8	116.7	116.1	116.3
.080	97.5	99.1	101.5	106.4	112.8	116.1	117.9	119.5	118.4	116.3
.100	99.0	101.1	103.8	108.5	115.2	117.8	119.1	120.6	120.5	119.0
.125	101.7	102.9	105.8	110.0	117.2	120.1	121.2	120.9	119.5	120.5
.160	103.5	104.1	107.5	111.5	118.4	121.0	121.5	122.3	121.4	117.9
.200	104.3	105.6	108.4	112.3	118.3	120.9	122.0	122.3	122.6	121.3
.250	105.0	106.6	109.3	112.7	117.6	119.7	120.7	121.8	122.4	122.9
.315	105.3	106.6	109.5	112.8	117.2	118.5	118.8	119.6	119.0	121.0
.400	105.9	107.3	109.9	112.8	116.3	117.5	118.0	117.8	117.0	117.9
.500	105.5	107.3	109.5	112.6	115.6	116.8	116.9	116.2	115.1	115.5
.630	105.1	106.8	109.3	111.9	115.0	116.1	115.7	114.7	113.8	112.9
.800	105.0	106.2	108.8	111.2	113.7	114.9	114.1	113.2	112.1	110.7
1.00	104.7	105.5	108.2	110.3	112.3	113.0	112.2	111.4	110.2	108.6
1.25	104.2	105.2	107.5	109.5	111.1	111.3	110.7	109.4	108.4	106.9
1.60	104.1	104.7	107.1	108.6	109.5	109.9	109.6	107.9	106.8	105.0
2.00	103.4	104.4	106.0	107.3	108.5	108.4	108.0	106.1	105.0	103.3
2.50	102.7	103.8	105.0	106.3	106.8	107.1	106.4	104.8	103.7	102.2
3.15	102.9	103.6	104.1	105.1	105.4	105.4	105.3	103.2	102.1	100.8
4.00	101.2	102.1	102.4	103.3	104.0	103.7	103.6	101.7	100.2	99.1
5.00	99.6	100.9	100.9	102.2	102.6	102.3	103.0	100.2	98.4	97.1
6.30	98.6	100.4	100.3	101.3	101.8	101.3	102.1	98.7	96.9	95.8
8.00	99.4	100.4	99.7	100.7	100.6	100.7	103.2	97.9	96.1	95.1
10.0	100.3	100.6	99.8	100.4	99.6	101.3	104.8	97.3	95.7	96.5
OASPL	116.8	118.0	120.3	123.2	127.5	129.5	130.2	130.7	130.3	129.9
PNLT	128.6	129.5	130.8	132.7	134.9	136.1	136.7	136.3	136.0	135.7
PNL	128.4	129.4	130.7	132.6	134.8	136.0	136.6	136.2	135.8	135.5
DBA	114.9	116.0	117.9	120.0	122.4	123.4	123.4	122.8	122.2	122.0
BAND	19	19	19	19	12	5	5	8	8	8
TCORR	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2

MAXIMUM OASPL	= 130.69	COMPOSITE SPL	= 131.28
MAXIMUM PNLT	= 136.69	COMPOSITE PNL	= 137.62
MAXIMUM PNL	= 136.59	PNLT (INTEGRATED)	= 144.54
MAXIMUM DBA	= 123.37		

2360 H Q3034 JT8D-17,REF SPLTR B/L,B727 T/P,3.5DEG CANT NORTH GP150RA150.1740

CONDITION = 7946

ALTITUDE = 1500. FT SIDELINE

CENTER FREQ. (KHZ)	ANGLE IN DEGREES 90	100	110	120	130	135	140	145	150	155
.050	74.1	75.5	77.5	80.2	85.8	87.8	88.5	88.9	88.2	88.1
.063	76.8	77.1	78.8	82.9	88.5	90.8	91.7	91.6	89.8	88.4
.080	77.3	78.7	80.7	84.9	90.2	92.8	93.7	94.3	92.0	88.3
.100	78.7	80.7	83.0	87.0	92.6	94.4	94.9	95.3	94.0	90.9
.125	81.4	82.4	84.9	88.4	94.5	96.6	96.9	95.5	92.8	92.3
.160	83.1	83.5	86.5	89.8	95.6	97.4	97.0	96.8	94.6	89.5
.200	83.8	84.9	87.3	90.5	95.3	97.2	97.4	96.6	95.6	92.6
.250	84.4	85.8	88.1	90.7	94.5	95.8	95.9	95.9	95.1	93.9
.315	84.5	85.7	88.1	90.7	93.9	94.4	93.7	93.4	91.4	91.6
.400	84.9	86.2	88.3	90.4	92.7	93.1	92.6	91.2	89.0	88.0
.500	84.3	85.9	87.7	90.0	91.7	92.1	91.1	89.2	86.6	85.0
.630	83.6	85.1	87.2	88.9	90.7	90.9	89.5	87.2	84.6	81.7
.800	83.1	84.1	86.2	87.7	88.8	89.1	87.1	84.9	82.0	78.4
1.00	82.3	82.9	85.1	86.3	86.8	86.5	84.5	82.2	79.1	75.1
1.25	81.2	82.0	83.8	84.7	84.8	83.9	82.0	79.1	76.0	71.8
1.60	80.2	80.6	82.4	82.8	82.0	81.2	79.4	75.9	72.5	67.7
2.00	78.5	79.2	80.2	80.3	79.6	78.2	76.2	72.3	68.6	63.4
2.50	76.5	77.3	77.8	77.7	76.1	75.0	72.5	68.6	64.5	59.0
3.15	74.9	75.3	75.0	74.5	72.4	70.8	68.6	63.8	59.3	53.3
4.00	70.9	71.5	70.9	70.0	67.9	65.7	63.1	58.1	52.5	45.7
5.00	67.9	68.8	67.9	67.3	64.6	62.2	60.2	54.0	47.7	40.2
6.30	63.7	65.0	63.8	62.5	59.5	56.5	54.1	46.6	39.3	30.7
8.00	59.4	59.8	57.7	56.0	51.4	48.4	46.9	36.5	27.7	17.1
10.0	52.4	52.2	49.4	46.5	40.0	37.6	35.9	21.6	10.9	0.0
OASPL	94.7	95.8	97.9	100.3	104.0	105.4	105.4	104.9	103.1	101.1
PNLT	103.0	103.9	105.2	107.0	109.0	109.7	109.4	108.1	106.4	104.3
PNL	102.7	103.6	105.0	106.7	108.8	109.5	109.0	107.8	106.0	103.9
DBA	91.3	92.3	94.1	95.7	97.3	97.7	96.8	95.5	93.5	91.7
BAND	19	19	19	21	21	21	21	21	21	21
TCORR	0.3	0.2	0.2	0.2	0.2	0.3	0.4	0.4	0.4	0.4

PNLT (INTEGRATED) = 117.18

2360 H Q3034 JT8D-17,REF SPLTR B/L,B727 T/P,3.5DEG CANT NORTH GP15CRA150.1740

ENGINE MODEL	= JT8D -17			INLET TEMP	= 24.00 F
ENGINE NUMBER	= 378-05	TEMPERATURE	= 25.0 F	TIME OF DAY	= 907
CAL LEVEL	= 124.1 DB.			BARM. PRESSURE	= 30.25 IN. HG.
STAND	= X-314	HUMIDITY	= 75.0 PER CT.	WIND DIRECTION	= NW
DATE	= 01/09/80			WIND VELOCITY	= 7 MPH
		CONDITION	= 8333		

FAA PART 36 REFERENCE DAY CORRECTED SPL IN DB - RADIUS = 150.0 FT.

ANGLE IN DEGREES

CENTER FREQ. (KHZ)	90	100	110	120	130	135	140	145	150	155
.050	95.8	97.1	99.9	103.2	108.7	111.5	113.2	114.9	115.4	117.2
.063	98.1	98.7	101.2	105.7	111.9	115.0	116.8	118.0	117.8	118.0
.080	98.7	100.6	103.6	108.1	114.4	117.4	119.3	120.9	120.5	119.7
.100	100.3	102.6	105.7	110.4	117.2	119.5	120.8	121.9	121.8	121.9
.125	102.9	104.5	107.5	112.0	118.6	121.4	122.4	123.0	121.2	121.2
.160	104.3	105.4	109.4	113.6	120.4	122.8	123.2	123.4	123.6	119.5
.200	105.2	106.9	110.3	114.3	120.7	123.3	124.2	124.9	123.6	123.8
.250	106.3	108.2	111.1	114.8	120.1	122.3	123.7	124.8	124.9	124.5
.315	106.8	108.0	111.8	115.3	119.5	121.1	122.2	123.2	122.9	124.9
.400	107.4	108.7	112.1	115.0	118.7	120.2	120.7	121.1	120.9	121.9
.500	107.3	108.9	112.3	115.1	118.1	119.3	119.6	119.6	118.7	119.7
.630	107.1	108.9	112.2	114.5	117.5	118.5	118.4	118.2	117.3	117.5
.800	107.1	108.6	111.8	113.9	116.3	117.2	117.0	116.9	115.9	115.3
1.00	107.1	107.9	111.1	113.0	115.1	115.7	115.6	115.2	114.1	113.7
1.25	106.8	107.7	110.5	112.2	113.9	114.2	114.0	113.8	112.8	112.4
1.60	106.6	107.1	110.3	111.4	112.5	112.9	112.9	112.4	111.4	110.8
2.00	105.9	107.2	109.6	110.1	111.4	111.9	111.9	111.0	109.9	109.1
2.50	105.3	106.9	109.0	109.2	110.3	110.7	111.0	110.1	109.1	108.2
3.15	104.7	106.3	107.8	107.9	108.7	109.4	109.9	109.0	107.7	106.9
4.00	103.7	104.9	106.0	106.1	107.0	107.6	108.2	107.5	106.3	105.3
5.00	101.7	103.5	104.6	104.7	105.7	106.1	107.1	105.8	104.5	103.5
6.30	100.2	103.0	104.0	104.0	105.1	105.5	107.7	104.4	103.3	102.5
8.00	100.0	102.8	103.2	103.1	104.4	105.2	107.8	103.8	102.6	101.8
10.0	100.2	102.0	102.6	102.0	102.9	105.7	108.8	102.5	101.7	101.4
OASPL	118.6	120.0	122.9	125.5	129.8	131.7	132.5	133.1	132.6	132.6
PNLT	130.3	131.9	134.0	135.3	137.7	138.8	139.7	139.8	139.3	139.5
PNL	130.2	131.8	134.0	135.2	137.6	138.7	139.6	139.7	139.1	139.2
DBA	117.1	118.4	121.0	122.6	125.1	126.1	126.5	126.4	125.7	125.9
BAND	20	19	19	11	6	7	7	7	8	7
TCORR	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.3

MAXIMUM OASPL	= 133.13	COMPOSITE SPL	= 133.55
MAXIMUM PNLT	= 139.77	COMPOSITE PNL	= 140.61
MAXIMUM PNL	= 139.68	PNLT (INTEGRATED)	= 147.67
MAXIMUM DBA	= 126.47		

2360 H Q3034 JT8D-17,REF SPLTR B/L,B727 T/P,3.5DEG CANT NORTH   GP150RA150.1740

CONDITION = 8333

ALTITUDE = 1500. FT SIDELINE

ANGLE IN DEGREES

CENTER FREQ. (KHZ)	90	100	110	120	130	135	140	145	150	155
.050	75.7	76.8	79.2	81.8	86.2	88.3	89.2	89.8	89.1	89.4
.063	77.9	78.4	80.5	84.3	89.4	91.8	92.7	92.9	91.5	90.1
.080	78.5	80.2	82.8	86.6	91.8	94.1	95.1	95.7	94.1	91.7
.100	80.0	82.2	84.9	88.9	94.6	96.1	96.6	96.6	95.3	93.8
.125	82.6	84.0	86.6	90.4	95.9	97.9	98.1	97.6	94.5	93.0
.160	83.9	84.8	88.4	91.9	97.6	99.2	98.7	97.9	96.8	91.0
.200	84.7	86.2	89.2	92.5	97.7	99.6	99.6	99.2	96.6	95.1
.250	85.7	87.4	89.9	92.8	97.0	98.4	98.9	98.9	97.6	95.5
.315	86.0	87.2	90.4	93.1	96.2	97.0	97.1	97.0	95.3	95.5
.400	86.4	87.6	90.5	92.6	95.1	95.8	95.3	94.5	92.8	92.0
.500	86.1	87.6	90.5	92.4	94.2	94.5	93.8	92.6	90.1	89.2
.630	85.6	87.2	90.0	91.5	93.2	93.3	92.1	90.6	88.1	86.2
.800	85.2	86.5	89.2	90.4	91.4	91.4	90.1	88.6	85.9	83.0
1.00	84.7	85.3	88.0	89.0	89.6	89.2	87.9	86.0	83.1	80.2
1.25	83.6	84.5	86.7	87.4	87.6	86.8	85.3	83.5	80.4	77.3
1.60	82.7	63.1	85.6	85.6	85.0	84.2	82.8	80.5	77.2	73.5
2.00	81.0	82.0	83.8	83.1	82.5	81.7	80.1	77.2	73.5	69.2
2.50	79.1	80.4	81.8	80.7	79.7	78.6	77.1	73.9	70.0	65.1
3.15	76.8	78.1	78.8	77.4	75.8	74.8	73.2	69.7	64.9	59.4
4.00	73.4	74.3	74.4	72.8	70.9	69.6	67.7	63.9	58.6	51.9
5.00	70.0	71.5	71.5	69.7	67.7	66.0	64.3	59.6	53.8	46.5
6.30	65.3	67.6	67.5	65.2	62.8	60.7	59.7	52.3	45.7	37.4
8.00	59.9	62.2	61.1	58.3	55.2	52.8	51.5	42.3	34.2	23.7
10.0	52.3	53.6	52.2	48.1	43.3	42.0	39.9	26.8	16.9	3.8
OASPL	96.4	97.6	100.4	102.6	106.2	107.5	107.5	107.1	105.3	103.5
PNLT	104.9	106.2	108.1	109.3	111.5	112.2	111.9	111.2	109.2	107.4
PNL	104.8	106.1	108.0	109.1	111.2	112.0	111.7	110.9	108.8	107.0
DBA	93.5	94.5	97.0	98.2	99.9	100.3	99.6	98.7	96.6	95.1
BAND	21	23	19	23	23	21	22	21	21	21
TCORR	0.1	0.2	0.1	0.2	0.2	0.2	0.2	0.3	0.4	0.4

PNLT (INTEGRATED) = 119.79

2361 H Q3036 JT8D-17,MOD 5Z MXR,B727 T/P,3.5 DEG CANT NORTH GP150RA150.1740

ENGINE MODEL	= JT8D -17			INLET TEMP	= 35.00 F
ENGINE NUMBER	= 378-05	TEMPERATURE	= 35.0 F	TIME OF DAY	= 1114
CAL LEVEL	= 124.1 DB.			BARM. PRESSURE	= 30.22 IN. HG.
STAND	= X-314	HUMIDITY	= 75.0 PER CT.	WIND DIRECTION	= N
DATE	= 01/14/80			WIND VELOCITY	= 6 MPH
		CONDITION	= 6403		

FAA PART 36 REFERENCE DAY CORRECTED SPL IN DB - RADIUS = 150.0 FT.

ANGLE IN DEGREES

CENTER FREQ. (KHZ)	90	100	110	120	130	135	140	145	150	155
.050	84.1	85.9	88.0	90.4	94.2	95.9	97.9	99.8	100.7	101.9
.063	86.6	88.0	89.9	92.3	95.5	97.4	99.5	100.9	101.1	102.1
.080	86.8	89.3	91.1	93.3	96.0	97.9	100.4	102.1	101.4	100.4
.100	87.0	90.6	92.3	94.2	97.0	98.4	100.1	102.0	101.7	99.1
.125	90.2	91.9	93.7	95.5	98.2	99.1	100.1	100.9	99.9	97.9
.160	91.4	92.3	94.5	96.5	98.4	99.0	99.6	100.1	98.5	94.8
.200	91.2	92.9	94.9	96.6	98.5	98.6	99.0	98.4	96.9	93.3
.250	91.8	93.8	95.5	97.4	98.0	98.0	97.6	97.0	95.0	93.7
.315	92.5	94.5	97.0	98.5	98.0	97.1	96.5	96.0	93.9	93.5
.400	92.8	94.6	96.6	97.9	97.1	96.3	95.9	94.9	92.8	92.3
.500	92.4	94.4	96.4	97.7	96.2	95.3	94.6	93.3	91.6	92.1
.630	92.5	94.2	96.3	97.0	95.9	94.7	93.8	93.0	91.2	90.9
.800	91.3	93.1	95.6	96.0	95.0	94.1	93.0	91.9	90.3	89.7
1.00	91.3	92.8	95.2	95.6	94.6	93.4	92.2	91.0	89.7	88.8
1.25	91.1	92.4	95.2	[illegible]	94.0	93.0	91.8	90.9	89.4	88.8
1.60	90.7	92.6	95.2	94.7	93.1	92.2	91.2	90.5	89.0	88.3
2.00	91.0	93.2	94.6	93.8	92.3	91.1	90.2	89.3	88.0	87.3
2.50	94.8	96.2	99.9	94.9	93.0	92.9	92.1	90.7	89.8	89.4
3.15	93.4	95.1	98.8	94.9	92.5	91.4	90.7	89.6	88.7	88.3
4.00	93.9	96.3	99.3	95.7	92.2	91.0	89.5	89.9	87.7	87.6
5.00	92.6	94.6	96.3	93.9	90.6	89.2	87.8	88.2	86.5	86.1
6.30	93.5	96.8	97.5	95.1	91.3	90.0	90.1	89.2	88.0	87.3
8.00	95.0	98.6	98.6	96.7	92.3	90.8	90.1	89.1	87.3	87.3
10.0	93.4	96.7	96.6	95.5	91.1	89.0	88.0	87.3	85.1	84.9
OASPL	105.8	108.0	110.0	109.5	109.3	109.3	109.9	110.5	109.7	109.0
PNLT	119.5	121.3	124.3	121.7	119.7	119.2	118.8	118.1	116.9	116.2
PNL	118.6	120.8	123.2	121.4	119.5	118.9	118.4	117.9	116.6	115.9
DBA	104.5	106.8	109.0	107.3	105.4	104.5	103.7	102.9	101.4	100.8
BAND	18	18	18	20	20	18	18	18	18	18
TCORR	0.9	0.5	1.1	0.3	0.2	0.4	0.4	0.3	0.3	0.3

MAXIMUM OASPL	= 110.46	COMPOSITE SPL	= 112.77
MAXIMUM PNLT	= 124.28	COMPOSITE PNL	= 124.25
MAXIMUM PNL	= 123.23	PNLT (INTEGRATED)	= 130.20
MAXIMUM DBA	= 108.98		

THE FOLLOWING CONDITION HAS BEEN ADDED TO THE W601 DATA BASE

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BASE ID  LD  DATE      ENG  MOD ENG NO STND C  OBS CORR TEMP HUM  TTI  TIME BARM  WD WV  RUN
  92  8  250 01/14/80 JT8D -17 378-05 X314 0 6403 6403 77.0 70.0 35.0 1114 30.22 N   6 2361 H Q3036 JT8D-17,MOD 5Z MXR,B727 T/P,3.5
                                                                                         DEG  CANT NORTH     GP150RA150.1740
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2361 H Q3036 JT8D-17,MOD 5Z MXR,B727 T/P,3.5 DEG CANT NORTH   6P150RA150.1740

CONDITION = 6403

ALTITUDE = 1500. FT SIDELINE

CENTER FREQ. (KHZ)	ANGLE IN DEGREES 90	100	110	120	130	135	140	145	150	155
.050	64.0	65.6	67.3	69.0	71.7	72.7	73.9	74.7	74.4	74.1
.063	66.4	67.7	69.2	70.9	73.0	74.2	75.4	75.8	74.7	74.2
.080	66.6	68.9	70.3	71.8	73.4	74.6	76.2	76.9	75.0	72.4
.100	67.5	70.2	71.5	72.7	74.3	75.0	75.9	76.7	75.2	71.0
.125	69.9	71.4	72.8	73.9	75.5	75.6	75.8	75.5	73.2	69.7
.160	71.0	71.7	73.5	74.8	75.6	75.4	75.1	74.6	71.7	66.3
.200	70.7	72.3	73.8	74.8	75.5	74.9	74.4	72.7	69.9	64.6
.250	71.2	73.1	74.3	75.4	74.9	74.1	72.8	71.1	67.7	64.7
.315	71.7	73.6	75.6	73.3	74.6	73.0	71.4	69.8	66.3	64.1
.400	71.9	73.5	75.1	75.6	73.6	72.0	70.6	68.4	64.8	62.5
.500	71.3	73.1	74.6	75.1	72.3	70.6	68.9	66.3	63.1	61.7
.630	71.0	72.6	74.2	74.0	71.6	69.5	67.6	65.5	62.1	59.7
.800	69.4	71.0	73.1	72.6	70.2	68.3	66.1	63.6	60.3	57.4
1.00	68.9	70.2	72.1	71.6	69.1	66.9	64.5	61.8	58.7	55.3
1.25	68.1	69.2	71.4	70.5	67.6	65.6	63.1	60.5	57.0	53.7
1.60	66.8	68.5	70.5	68.9	65.6	63.5	61.1	58.6	54.8	51.0
2.00	66.1	68.1	68.8	66.8	63.4	60.9	58.4	55.5	51.6	47.5
2.50	68.5	69.8	72.7	66.3	62.3	60.8	58.2	54.5	50.6	46.2
3.15	65.4	66.9	69.7	64.3	59.5	56.8	54.0	50.2	45.9	40.8
4.00	63.6	65.7	67.8	62.4	55.1	53.0	49.0	46.3	40.0	34.2
5.00	60.8	62.6	63.2	58.9	52.6	49.0	45.0	41.9	35.7	29.1
6.30	58.5	61.5	60.9	56.3	48.9	45.1	42.0	37.0	30.3	22.1
8.00	54.9	58.1	56.7	51.9	43.1	38.5	33.8	27.6	18.9	9.3
10.0	45.6	48.2	46.3	41.7	31.6	25.4	19.2	11.7	0.4	0.0
OASPL	82.2	83.9	85.6	85.8	85.3	84.9	84.9	84.6	82.7	80.4
PNLT	93.2	94.4	97.1	93.5	91.0	89.6	88.4	86.5	83.5	79.7
PNL	92.3	93.9	96.0	93.0	90.6	89.2	87.9	86.1	83.1	79.2
DBA	79.0	80.6	82.5	81.3	78.9	77.1	75.4	73.4	70.2	67.2
BAND	18	18	18	23	23	18	18	23	18	18
TCORR	0.9	0.5	1.1	0.3	0.3	0.4	0.4	0.4	0.4	0.5

PNLT (INTEGRATED) = 101.98

2361 H Q3036 JT8D-17,MOD 5Z MXR,B727 T/P,3.5 DEG CANT NORTH GP150RA150.1740

ENGINE MODEL	= JT8D -17	TEMPEPATURE	= 39.0 F	INLET TEMP	= 40.00 F
ENGINE NUMBER	= 378-05	HUMIDITY	= 72.0 PER CT.	TIME OF DAY	= 1504
CAL LEVEL	= 124.1 DB.	CONDITION	= 6970	BARM. PRESSURE	= 30.22 IN. HG.
STAND	= X-314			WIND DIRECTION	= N
DATE	= 01/14/80			WIND VELOCITY	= 6 MPH

FAA PART 36 REFERENCE DAY CORRECTED SPL IN DB - RADIUS = 150.0 FT.

ANGLE IN DEGREES

CENTER FREQ. (KHZ)	90	100	110	120	130	135	140	145	150	155
.050	87.3	89.3	91.5	93.7	97.7	99.6	102.1	103.7	104.4	105.8
.063	89.7	90.9	92.7	95.1	99.7	102.1	104.4	105.9	106.1	107.0
.080	90.2	92.5	94.6	97.0	100.5	102.8	105.4	107.4	106.9	105.7
.100	91.4	93.7	96.2	98.2	101.4	102.9	104.8	107.4	107.5	105.1
.125	93.7	95.0	97.2	99.4	102.3	103.4	104.[illegible]	105.7	105.4	104.2
.160	95.1	95.8	93.4	100.3	102.7	103.4	104.5	104.7	103.5	100.7
.200	94.9	96.4	99.1	100.4	102.8	103.3	103.7	103.2	102.0	98.5
.250	95.0	97.2	99.3	100.9	102.2	102.3	102.3	101.9	99.9	98.7
.315	95.7	97.7	100.6	101.6	101.7	101.5	101.4	100.8	98.7	98.3
.400	96.7	98.3	100.9	101.9	101.5	100.8	100.8	99.8	97.9	97.0
.500	96.1	98.3	100.3	101.2	100.8	99.8	99.4	98.5	96.6	96.4
.630	96.4	98.0	100.4	101.1	100.4	99.5	99.1	98.2	96.4	95.4
.800	95.3	97.0	99.4	100.2	99.6	98.6	98.0	97.1	95.4	93.9
1.00	95.3	96.9	99.3	99.7	99.1	98.2	97.4	96.2	94.9	93.5
1.25	95.1	96.5	99.2	99.6	98.7	97.8	96.8	95.8	94.3	92.9
1.60	95.1	96.9	99.5	99.0	98.0	97.2	96.3	95.5	94.0	92.3
2.00	94.8	96.9	99.0	98.2	97.2	96.4	95.2	94.5	93.0	91.7
2.50	95.9	98.1	99.4	98.0	96.9	96.0	94.4	93.9	92.5	91.4
3.15	98.5	99.7	102.6	98.8	97.1	96.8	95.1	95.2	93.8	93.4
4.00	95.9	97.8	99.7	96.5	95.1	94.0	92.4	92.6	90.7	90.0
5.00	97.5	97.7	99.9	96.7	94.4	93.1	92.0	92.0	90.3	89.8
6.30	94.8	97.8	99.6	96.2	93.7	92.3	91.6	91.1	89.9	89.1
8.00	96.1	98.7	99.5	96.0	93.3	92.2	91.4	90.6	88.9	87.9
10.0	95.1	97.3	97.8	95.1	92.2	90.6	89.6	88.8	87.0	86.0
OASPL	109.1	110.8	112.9	112.9	113.4	113.7	114.5	115.3	114.8	113.9
PNLT	122.8	124.3	127.2	124.7	123.8	123.6	122.9	122.9	121.6	121.1
PNL	122.3	123.9	126.2	124.4	123.6	123.2	122.5	122.4	121.1	120.2
DBA	107.9	109.5	111.6	110.5	109.6	108.8	108.1	107.5	105.9	104.8
BAND	19	19	19	19	19	19	19	19	19	19
TCORR	0.5	0.4	1.0	0.3	0.2	0.4	0.4	0.4	0.5	0.9

MAXIMUM OASPL	= 115.33	COMPOSITE SPL	= 116.79
MAXIMUM PNLT	= 127.23	COMPOSITE PNL	= 127.43
MAXIMUM PNL	= 126.21	PNLT (INTEGRATED)	= 133.83
MAXIMUM DBA	= 111.64		

THE FOLLOWING CONDITION HAS BEEN ADDED TO THE W601 DATA BASE

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BASE ID  LD  DATE      ENG   MOD ENG NO STND C  OBS CORR TEMP HUM  TTI  TIME BARM  WD WV   RUN
  93  2  250 01/14/80 JT8D -17 378-05 X314 0 6970 6970 77.0 70.0 40.0 1504 30.22 N   6 2361 H Q3036 JT8D-17,MOD 5Z MXR,B727 T/P,3.5
                                                                                              DEG  CANT NORTH    GP150RA150.1740
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2361 H Q3036 JT8D-17,MOD 5Z MXR,B727 T/P,3.5 DEG CANT NORTH GP150RA150.1740

CONDITION = 6970

ALTITUDE = 1500. FT SIDELINE

CENTER FREQ. (KHZ)	ANGLE IN DEGREES 90	100	110	120	130	135	140	145	150	155
.050	67.2	69.0	70.8	72.3	75.2	76.4	78.1	78.6	78.1	78.0
.063	69.5	70.6	72.0	73.7	77.2	78.9	80.3	80.8	79.7	79.1
.080	70.0	72.1	73.8	75.5	77.9	79.5	81.2	82.2	80.5	77.7
.100	71.1	73.3	75.4	76.7	78.7	79.5	80.6	82.1	81.0	77.0
.125	73.4	74.5	76.3	77.8	79.6	79.9	80.3	80.3	78.7	76.0
.160	74.7	75.2	77.4	78.6	79.9	77.8	80.0	79.2	76.7	72.2
.200	74.4	75.7	78.0	78.6	79.3	79.6	79.1	77.5	75.0	69.8
.250	74.4	76.5	78.1	78.9	79.1	78.4	77.5	76.0	72.6	69.7
.315	74.9	76.8	79.2	79.4	78.3	77.4	76.3	74.6	71.1	68.9
.400	75.7	77.2	79.3	79.5	77.9	76.4	75.4	73.2	69.8	67.1
.500	75.0	77.0	78.5	78.6	76.9	75.1	73.7	71.5	68.1	66.0
.630	74.9	76.4	78.3	78.1	76.1	74.3	72.9	70.7	67.3	64.2
.800	73.4	74.9	76.8	76.7	74.3	72.8	71.1	68.8	65.4	61.6
1.00	72.9	74.3	76.2	75.7	73.6	71.7	69.7	67.0	63.8	60.0
1.25	72.0	73.3	75.4	74.8	72.3	70.3	68.0	65.4	61.9	57.8
1.60	71.2	72.8	74.8	73.2	70.5	68.5	66.2	63.6	59.7	55.0
2.00	69.9	71.8	73.2	71.2	68.3	66.2	63.4	60.7	56.6	51.8
2.50	69.7	71.6	72.2	69.5	66.2	63.9	60.5	57.7	53.3	48.3
3.15	70.5	71.5	73.5	68.2	64.1	62.2	58.4	55.8	51.0	45.9
4.00	66.6	67.2	68.1	63.2	59.0	55.9	51.9	49.0	42.9	36.6
5.00	65.8	65.6	66.8	61.7	56.4	53.0	49.2	45.8	39.5	32.8
6.30	59.9	62.5	63.1	57.5	51.4	47.5	43.6	39.0	32.3	24.0
8.00	56.1	58.1	57.5	51.3	44.1	39.9	35.1	29.2	20.5	9.9
10.0	47.2	48.9	47.4	41.2	32.6	26.9	20.7	13.1	2.2	0.0
OASPL	85.9	87.4	89.3	89.5	89.5	89.4	89.6	89.6	87.8	85.5
PNLT	96.3	97.5	99.9	96.9	95.3	94.3	93.2	91.9	89.5	85.7
PNL	95.7	97.1	98.8	96.5	95.0	93.8	92.7	91.4	88.8	84.9
DBA	82.7	84.2	86.0	85.1	83.3	81.7	80.3	78.4	75.2	71.9
BAND	21	19	19	19	19	19	19	19	19	19
TCORR	0.6	0.5	1.1	0.4	0.3	0.5	0.5	0.6	0.6	0.8

PNLT (INTEGRATED) = 105.53

2361 H Q3036 JT8D-17,MOD 5Z MXR,B727 T/P,3.5 DEG CANT NORTH GP150RA150.1740

ENGINE MODEL	= JT8D -17	TEMPERATURE	= 37.0 F	INLET TEMP	= 38.00 F
ENGINE NUMBER	= 378-05	HUMIDITY	= 73.0 PER CT.	TIME OF DAY	= 1308
CAL LEVEL	= 124.1 DB.	CONDITION	= 7310	BARM. PRESSURE	= 30.22 IN. HG.
STAND	= X-314			WIND DIRECTION	= N
DATE	= 01/14/80			WIND VELOCITY	= 6 MPH

FAA PART 36 REFERENCE DAY CORRECTED SPL IN DB - RADIUS = 150.0 FT.

ANGLE IN DEGREES

CENTER FREQ. (KHZ)	90	100	110	120	130	135	140	145	150	155
.050	89.4	91.2	93.4	95.9	100.4	102.7	105.4	107.1	108.0	109.4
.063	91.7	93.2	95.0	98.1	103.1	105.7	108.2	109.8	109.9	110.7
.080	92.4	94.9	97.0	100.1	104.5	107.3	110.1	112.3	111.8	110.4
.100	93.8	96.1	98.4	101.4	105.5	107.4	109.8	112.5	112.8	111.1
.125	96.0	97.6	100.0	102.5	106.3	107.9	109.6	111.1	111.3	111.0
.160	97.5	98.2	101.2	103.8	106.9	106.0	109.3	110.3	109.4	107.4
.200	97.5	99.0	101.4	103.9	106.8	107.6	108.2	107.9	107.3	104.6
.250	97.9	99.6	101.8	104.0	106.6	106.8	106.9	106.4	104.9	103.9
.315	98.1	99.6	102.7	104.6	106.2	106.2	106.2	105.5	103.4	103.1
.400	99.2	100.7	103.2	105.1	105.8	105.4	105.3	104.4	102.2	101.6
.500	98.7	100.4	102.5	104.5	104.8	104.7	104.4	103.3	100.8	100.5
.630	98.9	100.3	102.9	103.9	104.6	104.4	104.2	103.0	100.4	99.1
.800	98.3	99.4	102.2	103.2	104.0	103.7	103.3	102.4	99.7	97.8
1.00	98.4	99.3	102.3	102.7	103.8	103.3	102.8	101.9	99.1	97.2
1.25	98.2	99.0	102.1	102.5	103.3	102.8	102.4	101.7	98.7	96.9
1.60	98.2	99.4	102.4	102.1	102.6	102.1	102.4	101.2	98.2	96.3
2.00	98.0	99.3	102.1	101.2	102.0	101.4	101.6	100.5	97.5	95.6
2.50	98.1	99.7	101.9	100.7	101.4	100.8	100.9	100.0	96.7	94.9
3.15	99.8	101.7	103.0	100.3	100.4	100.1	100.2	99.6	96.7	95.1
4.00	97.3	99.1	100.7	98.7	98.8	98.5	98.0	97.9	94.0	92.7
5.00	97.0	98.1	99.5	97.8	97.3	95.9	96.2	96.5	93.0	91.8
6.30	94.5	97.5	99.0	96.7	96.4	95.1	95.2	95.0	91.8	90.1
8.00	95.6	98.1	98.7	95.8	95.0	94.3	94.1	93.4	90.2	89.1
10.0	94.8	97.2	97.6	94.8	93.3	92.8	92.6	92.0	88.5	87.3
OASPL	111.0	112.6	114.9	115.7	117.6	118.2	119.3	120.2	119.6	118.8
PNLT	124.4	126.1	127.8	126.7	127.4	127.4	127.7	127.4	125.2	123.9
PNL	123.9	125.6	127.4	126.5	127.3	127.3	127.5	127.2	124.9	123.6
DBA	109.7	111.2	113.4	113.1	113.8	113.5	113.4	112.7	110.1	108.7
BAND	19	19	19	19	19	19	19	19	19	19
TCORR	0.5	0.5	0.4	0.1	0.1	0.1	0.2	0.2	0.3	0.3

MAXIMUM OASPL	= 120.19	COMPOSITE SPL	= 120.93
MAXIMUM PNLT	= 127.83	COMPOSITE PNL	= 129.47
MAXIMUM PNL	= 127.51	PNLT (INTEGRATED)	= 136.60
MAXIMUM DBA	= 113.79		

THE FOLLOWING CONDITION HAS BEEN ADDED TO THE W601 DATA BASE

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BASE ID  LD  DATE      ENG  MOD ENG NO STND C  OBS CORR TEMP HUM  TTI  TIME BARM  WD WV   RUN
  92 13  250 01/14/80 JT8D -17 378-05 X314 0  7319 7310 77.0 70.0 38.0 1308 30.22 N    6 2361 H Q3036 JT8D-17,MOD 5Z MXR,B727 T/P,3.5
                                                                                           DEG  CANT NORTH    GP150RA150.1740
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2361 H Q3036 JT8D-17,MOD 5Z MXR,B727 T/P,3.5 DEG CANT NORTH 6P150RA150.1740

CONDITION = 7310

ALTITUDE = 1500. FT SIDELINE

ANGLE IN DEGREES

CENTER FREQ. (KHZ)	90	100	110	120	130	135	140	145	150	155
.050	69.3	70.9	72.7	74.5	77.9	79.5	81.4	82.0	81.7	81.6
.063	71.5	72.9	74.3	76.7	80.6	82.5	84.1	84.7	83.5	82.8
.080	72.2	74.5	76.2	78.6	81.9	84.0	85.9	87.1	85.4	82.4
.100	73.5	75.7	77.6	79.9	82.8	84.0	85.6	87.2	86.3	83.0
.125	75.7	77.1	79.1	80.9	83.6	84.4	85.3	85.7	84.6	82.8
.160	77.1	77.6	80.2	82.1	84.1	84.4	84.8	84.8	82.6	78.9
.200	77.0	78.4	80.3	82.0	83.8	83.9	83.6	82.2	80.3	75.9
.250	77.3	78.9	80.6	82.0	83.5	82.9	82.1	80.5	77.6	74.9
.315	77.3	78.7	81.3	82.4	82.8	82.1	81.1	79.3	75.8	73.7
.400	78.2	79.6	81.6	82.7	82.2	81.0	79.9	77.8	74.1	71.7
.500	77.6	79.1	80.7	81.9	80.9	80.0	78.7	76.3	72.3	70.1
.630	77.4	78.7	80.8	80.9	80.3	79.2	78.0	75.5	71.3	67.9
.800	76.4	77.3	79.6	79.7	79.2	77.9	76.4	74.1	69.7	65.5
1.00	76.0	76.7	79.2	78.7	78.3	76.8	75.1	72.7	68.1	63.7
1.25	75.1	75.8	78.3	77.7	76.9	75.3	73.6	71.3	66.3	61.8
1.60	74.3	75.3	77.7	76.3	75.1	73.4	72.3	69.3	64.0	59.0
2.00	73.1	74.2	76.3	74.2	73.1	71.2	69.8	66.7	61.1	55.7
2.50	71.9	73.3	74.7	72.2	70.8	68.7	67.0	63.8	57.6	51.8
3.15	71.9	73.5	74.0	69.8	67.5	65.5	63.5	60.3	53.9	47.6
4.00	67.0	68.5	69.1	65.4	62.7	60.4	57.5	54.2	46.2	39.3
5.00	65.3	66.0	66.4	62.8	59.3	56.8	53.4	50.3	42.2	34.8
6.30	59.5	62.2	62.4	57.9	54.0	50.2	47.1	42.8	34.2	24.9
8.00	55.5	57.6	56.6	51.0	45.8	42.0	37.8	31.9	21.8	11.1
10.0	47.0	48.7	47.3	41.0	34.2	29.2	23.8	16.4	3.8	0.0
OASPL	89.4	89.7	91.7	92.6	93.7	93.8	94.3	94.4	92.8	90.5
PNLT	98.2	99.9	100.9	99.7	99.5	98.7	98.0	96.9	94.3	91.3
PNL	97.6	99.1	100.4	99.5	99.2	98.3	97.7	96.5	93.8	90.7
DBA	85.3	86.4	88.5	88.1	87.7	86.5	85.4	83.5	79.9	76.8
BAND	19	19	19	21	21	21	19	21	21	21
TCORR	0.5	0.9	0.5	0.3	0.2	0.3	0.3	0.4	0.5	0.6

PNLT (INTEGRATED) = 108.42

2361 H Q3036 JT8D-17,MOD 5Z MXR,B727 T/P,3.5 DEG CANT NORTH GP150RA150.1740

ENGINE MODEL	= JT8D -17	TEMPERATURE	= 37.0 F	INLET TEMP	= 38.00 F
ENGINE NUMBER	= 378-05			TIME OF DAY	= 1243
CAL LEVEL	= 124.1 DB.	HUMIDITY	= 73.0 PER CT.	BARM. PRESSURE	= 30.22 IN. HG.
STAND	= X-314			WIND DIRECTION	= N
DATE	= 01/14/80	CONDITION	= 7977	WIND VELOCITY	= 6 MPH

FAA PART 36 REFERENCE DAY CORRECTED SPL IN DB - RADIUS = 150.0 FT.

ANGLE IN DEGREES

CENTER FREQ. (KHZ)	90	100	110	120	130	135	140	145	150	155
.050	93.2	95.3	97.5	100.1	105.5	108.1	110.5	112.6	113.2	114.6
.063	95.7	96.8	98.8	102.7	108.4	111.1	113.5	114.7	114.5	115.0
.080	96.1	98.4	101.1	104.9	110.1	113.1	116.0	117.9	117.1	114.8
.100	97.6	99.6	102.6	105.3	110.9	113.3	116.0	118.7	119.1	116.8
.125	100.1	101.7	104.3	107.4	112.0	114.2	116.6	118.1	118.2	118.6
.160	101.6	102.3	105.5	108.5	112.5	114.0	115.8	118.2	118.1	116.8
.200	101.6	103.0	106.1	108.9	112.1	112.9	114.2	115.6	117.3	115.8
.250	102.0	104.2	106.6	109.3	111.7	112.0	112.4	113.7	114.3	115.7
.315	102.5	104.1	107.3	109.7	111.3	111.2	111.4	112.0	111.8	114.0
.400	103.2	104.7	107.6	109.5	110.9	110.5	110.3	110.5	110.6	112.6
.500	103.0	104.8	107.3	109.6	110.3	109.8	109.3	109.2	108.5	111.0
.630	103.0	104.8	107.8	109.3	110.1	109.3	108.5	108.3	107.9	108.9
.800	102.7	104.3	107.1	109.0	109.4	108.7	107.7	107.3	106.8	107.3
1.00	102.7	103.9	106.9	108.7	108.8	108.3	107.0	106.3	106.0	106.3
1.25	102.7	103.8	106.8	108.2	108.5	108.1	106.8	105.8	105.2	105.5
1.60	102.8	104.1	106.8	107.7	108.0	107.6	106.4	105.2	104.4	104.8
2.00	102.6	103.9	106.1	106.7	107.3	107.0	105.8	104.6	103.9	103.7
2.50	102.4	103.8	105.4	105.8	106.6	106.3	105.3	104.1	103.0	103.2
3.15	103.2	104.8	105.7	105.0	105.6	105.3	104.3	103.6	102.4	102.6
4.00	102.3	103.6	104.2	103.6	104.2	104.3	102.8	102.6	100.6	101.3
5.00	100.5	101.9	102.9	102.4	102.6	102.7	101.1	101.2	99.2	99.6
6.30	98.3	100.8	101.6	101.3	101.4	101.1	100.3	99.3	97.5	97.8
8.00	97.9	99.9	100.4	99.9	99.6	99.8	99.0	98.0	95.6	96.1
10.0	97.4	98.3	98.2	97.7	97.8	97.7	97.2	96.1	93.9	93.9
OASPL	115.1	116.7	119.1	120.8	122.9	123.7	125.0	126.5	126.6	126.2
PNLT	127.9	129.5	131.1	131.5	132.6	132.7	132.3	132.4	132.0	132.1
PNL	127.7	129.2	130.9	131.4	132.5	132.6	132.3	132.2	131.8	131.9
DBA	113.8	115.3	117.4	118.4	119.1	118.7	118.0	117.8	117.4	118.1
BAND	19	19	19	19	12	5	5	6	4	5
TCORR	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.2

MAXIMUM OASPL	= 126.58	COMPOSITE SPL	= 127.38
MAXIMUM PNLT	= 132.68	COMPOSITE PNL	= 134.07
MAXIMUM PNL	= 132.62	PNLT (INTEGRATED)	= 141.63
MAXIMUM DBA	= 119.05		

THE FOLLOWING CONDITION HAS BEEN ADDED TO THE W601 DATA BASE

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BASE ID  LD  DATE       ENG  MOD ENG NO STND C  OBS CORR TEMP HUM  TTI  TIME BARM  WD WV   RUN
  92 12  250 01/14/80 JT8D -17 378-05 X314 0 7977 7977 77.0 70.0 38.0 1243 30.22 N   6 2361 H Q3036 JT8D-17,MOD 5Z MXR,B727 T/P,3.5
                                                                                     DEG  CANT NORTH    GP150RA150.1740
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2351 H Q3036 JT8D-17,MOD 5Z MXR,B727 T/P,3.5 DEG CANT NORTH GP150RA150.1740

CONDITION = 7977

ALTITUDE = 1500. FT SIDELINE

ANGLE IN DEGREES

CENTER FREQ. (KHZ)	90	100	110	120	130	135	140	145	150	155
.050	73.1	75.0	76.8	78.7	83.0	84.9	86.5	87.5	86.9	86.8
.063	75.5	76.5	78.1	81.3	85.9	87.9	89.4	89.6	88.1	87.1
.080	75.9	78.0	80.3	83.4	87.5	89.8	91.8	92.7	90.7	86.8
.100	77.3	79.2	81.8	84.3	88.2	89.9	91.8	93.4	92.6	88.7
.125	79.8	81.2	83.4	85.8	89.3	90.7	92.3	92.7	91.5	90.4
.160	81.2	81.7	84.5	86.8	89.7	90.4	91.3	92.7	91.3	88.3
.200	81.1	82.4	85.0	87.1	89.1	89.2	89.6	89.9	90.3	87.1
.250	81.4	83.5	85.4	87.3	88.6	88.1	87.6	87.8	87.0	86.7
.315	81.7	83.2	85.9	87.5	87.9	87.1	86.3	85.8	84.2	84.6
.400	82.2	83.6	86.0	87.1	87.3	66.1	84.9	83.9	82.5	82.7
.500	81.9	83.5	85.5	87.0	86.4	85.1	83.6	82.2	80.0	80.6
.630	81.5	83.2	85.7	86.3	85.8	84.1	82.3	80.8	78.8	77.7
.800	80.8	82.2	84.5	85.5	84.6	82.9	80.8	79.0	76.8	75.0
1.00	80.3	81.3	83.8	84.7	83.3	81.8	79.3	77.1	75.0	72.8
1.25	79.6	80.6	83.0	83.4	82.1	80.6	78.0	75.4	72.8	70.4
1.60	78.9	80.0	82.1	81.9	80.5	78.9	76.3	73.3	70.2	67.5
2.00	77.7	78.8	80.3	79.7	78.4	76.8	74.0	70.8	67.5	63.8
2.50	76.2	77.4	78.2	77.3	76.0	74.2	71.4	67.9	63.9	60.1
3.15	75.3	76.6	76.7	74.5	72.7	70.7	67.6	64.3	59.6	55.1
4.00	72.0	73.0	72.6	70.3	68.1	66.2	62.3	58.9	52.8	47.9
5.00	68.6	69.8	69.8	67.4	64.6	62.6	58.3	55.0	48.4	42.6
6.30	63.3	65.5	65.0	62.5	59.0	56.2	52.2	47.1	39.9	32.6
8.00	57.8	59.4	58.3	55.1	50.4	47.5	42.7	36.5	27.2	18.1
10.0	49.6	49.8	47.9	43.9	38.2	34.1	28.4	20.5	9.2	0.0
OASPL	92.6	94.0	96.2	97.7	99.0	99.4	100.1	100.8	99.6	97.5
PNLT	101.9	103.3	104.6	104.8	104.8	104.1	103.4	103.3	101.9	99.8
PNL	101.6	103.0	104.4	104.6	104.5	103.8	103.2	102.8	101.4	99.3
DBA	89.6	90.9	92.9	93.5	92.9	91.7	90.3	89.4	87.9	86.7
BAND	19	19	19	21	21	21	23	21	21	21
TCORR	0.3	0.3	0.3	0.2	0.2	0.3	0.3	0.4	0.5	0.5

PNLT (INTEGRATED) = 113.43

2361 H Q3036 JT8D-17,MOD 5Z MXR,B727 T/P,3.5 DEG CANT NORTH GP150RA150.1740

ENGINE MODEL	= JT8D -17			INLET TEMP	= 38.00 F
ENGINE NUMBER	= 378-05	TEMPERATURE	= 38.0 F	TIME OF DAY	= 1330
CAL LEVEL	= 124.1 DB.			BARM. PRESSURE	= 30.22 IN. HG.
STAND	= X-314	HUMIDITY	= 73.0 PER CT.	WIND DIRECTION	= N
DATE	= 01/14/80			WIND VELOCITY	= 6 MPH
		CONDITION	= 8474		

FAA PART 36 REFERENCE DAY CORRECTED SPL IN DB - RADIUS = 150.0 FT.

ANGLE IN DEGREES

CENTER FREQ. (KHZ)	90	100	110	120	130	135	140	145	150	155
.050	94.7	96.7	98.9	102.0	107.4	110.1	112.6	114.4	115.3	116.7
.063	97.2	98.3	100.5	104.7	110.9	113.8	116.4	117.7	117.4	117.5
.080	97.3	99.8	102.8	106.7	112.3	115.5	118.6	120.5	119.8	117.4
.100	99.3	101.8	104.7	108.3	113.7	116.5	118.9	121.5	121.7	119.9
.125	101.6	103.5	106.2	109.7	115.0	117.6	120.3	121.3	120.8	121.9
.160	103.0	104.3	107.5	110.8	115.6	117.7	120.0	122.5	122.2	120.0
.200	103.3	105.6	108.2	111.1	115.2	116.9	119.3	121.2	122.7	121.2
.250	103.9	106.3	108.9	111.5	114.7	115.8	117.4	119.8	120.9	121.7
.315	104.4	106.5	109.7	112.1	114.6	114.8	116.0	118.3	118.8	121.2
.400	105.1	107.0	109.9	112.0	114.0	114.2	114.9	116.9	118.0	120.0
.500	105.0	107.3	109.8	112.2	113.3	113.3	114.2	116.0	116.5	118.6
.630	104.9	107.3	110.5	111.9	113.2	112.9	113.6	115.2	115.6	116.5
.800	104.6	107.1	110.0	111.6	112.3	112.5	112.9	114.4	114.4	114.3
1.00	104.8	106.8	109.8	111.3	111.8	111.9	112.2	113.3	113.3	113.0
1.25	104.9	106.6	109.7	111.1	111.4	111.5	111.8	112.8	112.4	112.1
1.60	105.0	106.7	109.6	110.6	110.7	110.9	111.6	112.0	111.5	111.0
2.00	104.6	106.9	109.0	109.6	110.3	110.4	110.9	111.2	110.5	110.0
2.50	104.4	106.8	108.4	109.0	109.6	109.9	109.9	110.6	109.6	109.0
3.15	104.5	107.1	107.9	108.1	108.4	108.8	109.0	109.5	108.9	108.1
4.00	104.1	106.7	106.7	106.5	106.8	107.5	107.5	108.3	107.3	106.7
5.00	102.4	104.7	104.5	105.3	105.7	105.9	105.7	106.5	105.8	105.2
6.30	100.4	104.1	104.0	104.6	104.7	104.6	105.2	105.0	105.0	104.0
8.00	99.3	102.7	102.8	103.0	103.2	103.7	104.1	103.8	103.5	103.0
10.0	98.4	100.6	100.0	100.9	101.2	101.7	102.6	102.6	101.8	101.4
OASPL	117.0	119.2	121.5	123.4	125.8	127.1	129.0	130.8	131.0	131.0
PNLT	129.5	131.9	133.4	134.3	135.6	136.2	136.9	138.0	137.9	138.0
PNL	129.3	131.8	133.2	134.3	135.5	136.1	136.8	137.9	137.7	137.8
DBA	115.7	118.0	120.0	121.2	122.0	122.3	122.9	124.1	124.2	124.6
BAND	20	20	12	19	12	18	5	6	4	5
TCORR	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2

MAXIMUM OASPL	= 131.02	COMPOSITE SPL	= 131.79
MAXIMUM PNLT	= 138.05	COMPOSITE PNL	= 138.47
MAXIMUM PNL	= 137.91	PNLT (INTEGRATED)	= 145.90
MAXIMUM DBA	= 124.63		

THE FOLLOWING CONDITION HAS BEEN ADDED TO THE W601 DATA BASE

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BASE ID  LD  DATE      ENG   MOD ENG NO STND C  OBS CORR TEMP HUM  TTI  TIME BARM  WD WV   RUN
  92 14  250 01/14/80 JT8D -17 378-05 X314 0 8474 8474 77.0 70.0 38.0 1330 30.22 N    6 2361 H Q3036 JT8D-17,MOD 5Z MXR,B727 T/P,3.5
                                                                                        DEG  CANT NORTH    GP150RA150.1740
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2361 H Q3036 JT8D-17,MOD 5Z MXR,B727 T/P,3.5 DEG CANT NORTH GP150RA150.1740

CONDITION = 8474

ALTITUDE = 1500. FT SIDELINE

CENTER FREQ. (KHZ)	ANGLE IN DEGREES 90	100	110	120	130	135	140	145	150	155
.050	74.6	76.4	78.2	80.6	84.9	86.9	88.6	89.3	89.0	88.9
.063	77.0	78.0	79.8	83.3	88.4	90.6	92.3	92.6	91.0	89.6
.080	77.1	79.4	82.0	85.2	89.7	92.2	94.4	95.3	93.4	89.4
.100	79.0	81.4	83.9	86.8	91.0	93.1	94.7	96.2	95.2	91.8
.125	81.3	83.0	85.3	88.1	92.3	94.1	96.0	95.9	94.1	93.7
.160	82.6	83.7	86.5	89.1	92.8	94.1	95.5	97.0	95.4	91.5
.200	82.8	84.9	87.1	89.3	92.2	93.2	94.7	95.5	95.7	92.5
.250	83.3	85.6	87.7	89.5	91.6	91.9	92.6	93.9	93.6	92.7
.315	83.6	85.6	88.3	89.9	91.2	90.7	90.9	92.1	91.2	91.8
.400	84.1	85.9	88.3	89.6	90.4	89.8	89.5	90.3	89.9	90.1
.500	83.9	86.0	89.0	89.6	89.4	88.6	88.5	89.0	88.0	88.2
.630	83.4	85.7	88.4	88.9	88.9	87.7	87.4	87.7	86.5	85.3
.800	82.7	85.0	87.4	88.1	87.5	86.7	86.0	86.1	84.4	82.0
1.00	82.4	84.2	86.7	87.3	86.3	85.4	84.5	84.1	82.3	79.5
1.25	81.8	83.4	85.9	86.3	85.0	84.0	83.0	82.4	80.0	77.0
1.60	81.1	82.6	84.9	84.8	83.2	82.2	81.5	80.1	77.3	73.7
2.00	79.7	81.8	83.2	82.6	81.4	80.2	79.0	77.4	74.1	70.1
2.50	78.2	80.3	81.2	80.5	79.0	77.8	76.0	74.4	70.5	65.9
3.15	76.5	78.8	78.8	77.5	75.4	74.2	72.3	70.2	66.1	60.6
4.00	73.8	76.1	75.1	73.2	70.7	69.5	67.0	64.7	59.6	53.3
5.00	70.7	72.6	71.4	70.4	67.7	65.8	62.9	60.3	55.1	48.2
6.30	65.4	68.8	67.4	65.8	62.3	59.7	57.1	52.8	47.4	38.8
8.00	59.2	62.2	60.7	58.2	54.0	51.4	47.8	42.3	35.1	25.0
10.0	50.6	52.2	49.7	47.0	41.6	38.1	33.8	27.0	17.0	3.9
OASPL	94.4	96.4	98.7	100.1	102.0	102.8	104.0	104.8	103.7	101.9
PNLT	103.7	105.8	107.2	107.5	107.8	107.7	108.1	108.4	107.3	105.4
PNL	103.5	105.6	107.0	107.3	107.6	107.4	107.8	108.1	107.0	104.9
DBA	91.6	93.6	95.6	96.2	95.9	95.3	95.1	95.5	94.4	93.2
BAND	21	23	23	23	21	23	23	21	21	21
TCORR	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.4	0.5

PNLT (INTEGRATED) = 117.09

APPENDIX B

ACOUSTIC CORRECTION PROCEDURE TO ACCOUNT FOR ABSENCE OF FAN DUCT ACOUSTIC TREATMENT IN 727 TAILPIPE

Tests involving the DC-9 tailpipe were conducted with an engine having the standard production double-wall fan duct acoustic treatment. This duct treatment provides a significant reduction in the aft radiated fan noise. However, when tests were performed with the 727 tailpipe the engine used did not incorporate the duct treatment. This allowed fan noise to have higher levels than would be the case if the acoustic treatment was present.

To provide 727/5Z mixer results more representative of this installation on JT8D engine with fan duct treatment as well as to allow direct comparison data acquired with the DC-9/5M mixer, the extra fan noise resulting from the absence of the treatment was analytically removed from the noise spectra and the perceived noise levels were recalculated.

The magnitude of the corrections are shown in Figure B-1, plotted against thrust level for each angle from 90 degrees to 140 degrees. The correction was negligible at high thrusts, and increased in a fairly regular manner as the thrust decreased. Figure B-2 shows the measured and corrected peak PNL versus thrust curves for the tests of the standard engine configuration and with the 5Z mixer installed. It is noted that the correction at the peak PNL angles does not reach 0.2 PNdB until the thrust decreased to 9000 pounds for the standard configuration and to about 13,000 pounds with the mixer installed.

The noise data, corrected as described above, were used to define the PNLs at a series of constant thrust settings for the 727 tailpipe in the standard and 5Z mixer configurations for a JT8D engine having the BG-19 duct acoustic treatment. These PNL values are listed in Tables VIII and IX in Section 2.2.2.2.

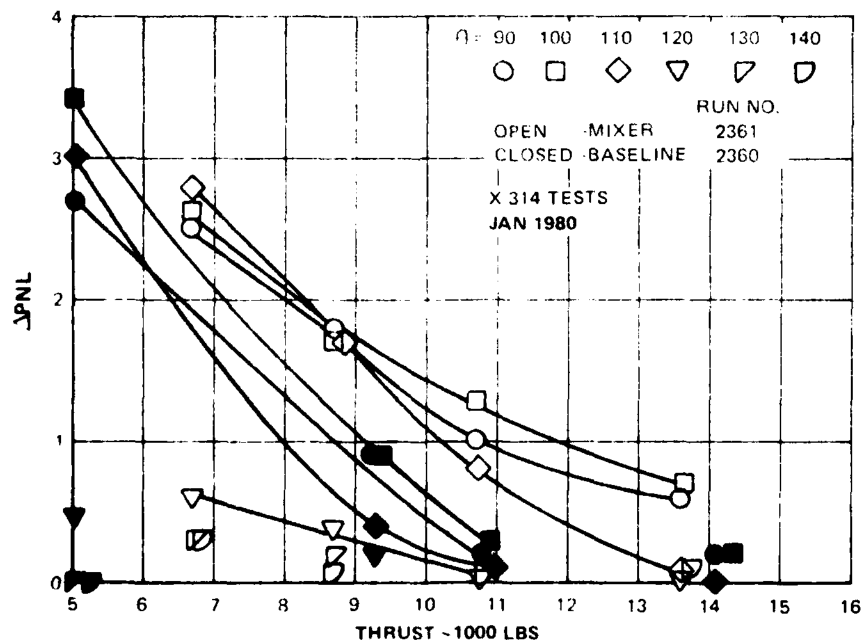

Figure B-1 PNL Corrections for Fan Duct Acoustic Treatment

136. Blank

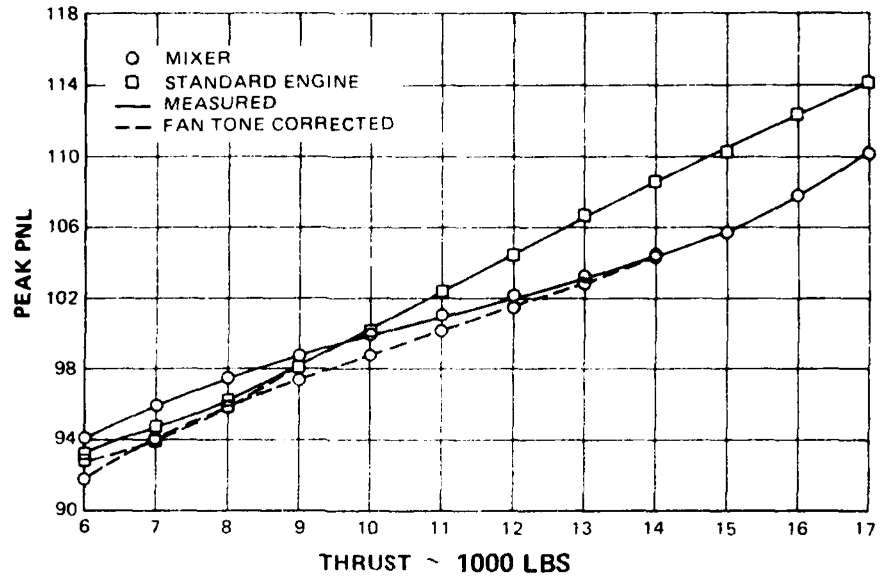

Figure B-2 Effect of Fan Tone Correction on Peak PNL Versus Thrust for Standard and Mixed Engines, 727 Tailpipe