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Report No. FAA-SS-73-11-3

SST Technology
Follow-On Program—Phase II
NOISE SUPPRESSOR/NOZZLE DEVELOPMENT
VOLUME III

NOISE TECHNOLOGY—BACKUP DATA REPORT

AD B004730

AD No. _____
DDC FILE COPY

J. Atvars., J. D. Nuhse, C. P. Wright,
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Boeing Commercial Airplane Company
P.O. Box 3707
Seattle, Washington 98124

D6-42444

March 1975

FINAL REPORT

Task III

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Prepared for
FEDERAL AVIATION ADMINISTRATION
Supersonic Transport Office
800 Independence Avenue, S.W.
Washington, D.C. 20590

Volume III

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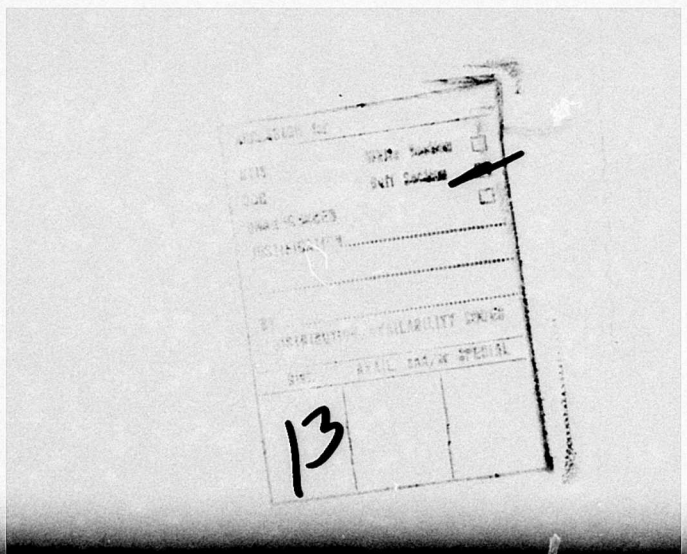

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15. Supplementary Notes
S. Blatt, DOT/SST Technical Monitor

16. Abstract

Jet noise suppression technology was studied in this program and reported in Volume II of this document. The data base for the technology studies consisted of static far field noise signatures and jet noise source location measurements for a systematic set of multitube nozzles, with and without ejectors. Acoustic results were complemented by flow profile data to better understand the noise generation and suppression mechanisms. A representative set of test configurations were chosen for which the basic data has been compiled in this report in a standardized format to be readily available to those researchers who may desire to study the data behind the discussions in Volume II. Because of limitations of space not all of the available data could be included. The data presented in this report consists of sound power spectra, sound pressure spectra, directivity patterns, extrapolated perceived noise level characteristics, jet noise source location data and jet flow profiles.

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17. Key Words	18. Distribution Statement
JET NOISE MULTITUBE JETS EJECTORS EJECTOR/SUPPRESSORS FLOW PROFILES	Approved for U.S. Government only. This document is exempted from public availability because of restrictions imposed by the Export Control Act. Transmittal of this document outside the U.S. Government must have prior approval of the Supersonic Transport Office.

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390145

PREFACE

This is one of a series of final reports on noise and propulsion technology submitted by the Boeing Commercial Airplane Company, Seattle, Washington, 98124, in fulfillment of Task III of Department of Transportation Contract DOT-FA-72WA-2893, dated 1 February 1972.

To benefit utilization of technical data developed by the noise suppressor and nozzle development program, the final report is divided into 10 volumes covering key technology areas and a summary of total program results. The 10 volumes are issued under the master title, "Noise Suppressor/Nozzle Development." Detailed volume breakdown is as follows:

			Report No.
Volume I	–	Program Summary	FAA-SS-73-11-1
Volume II	–	Noise Technology	FAA-SS-73-11-2
Volume III	–	Noise Technology–Backup Data Report	FAA-SS-73-11-3
Volume IV	–	Performance Technology Summary	FAA-SS-73-11-4
Volume V	–	Performance Technology–The Effect of Initial Jet Conditions on a 2-D Constant Area Ejector	FAA-SS-73-11-5
Volume VI	–	Performance Technology–Thrust and Flow Characteristics of a Reference Multitube Nozzle With Ejector	FAA-SS-73-11-6
Volume VII	–	Performance Technology–A Guide to Multitube Suppressor Nozzle Static Performance: Trends and Trades	FAA-SS-73-11-7
Volume VIII	–	Performance Technology–Multitube Suppressor/ Ejector Interaction Effects on Static Performance (Ambient and 1150° F Jet Temperature)	FAA-SS-73-11-8
Volume IX	–	Performance Technology–Analysis of the Low-Speed Performance of Multitube Suppressor/ Ejector Nozzles (0-167 kn)	FAA-SS-73-11-9
Volume X	–	Advanced Suppressor Concepts and Full-Scale Tests	FAA-SS-73-11-10

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CONTENTS

	PAGE
1.0 INTRODUCTION	1
2.0 TEST DATA	2

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SYMBOLS AND ABBREVIATIONS

A_8	Nozzle exit area
D_E	Equivalent flow area conical nozzle diameter
Hz	Hertz (frequency)
HNTF	Hot Nozzle Test Facility
NPR	Nozzle pressure ratio
OASPL	Overall sound pressure level
P_{amb}	Ambient pressure
PNL	Perceived noise level
PNdB	Perceived noise in units of decibels
PWL	Sound power level
R.H.	Relative humidity
SPL	Sound pressure level
T_{amb}	Ambient temperature
T_T	Total temperature
V_J	Jet velocity
μ Bar	micro-Bar (pressure)
x	distance

1.0 INTRODUCTION

The model scale jet noise technology results were analyzed and discussed in Volume II of this report. The large quantity of test data that was acquired for the purpose of the technology studies could not be documented adequately together with the final analysis in one book. Therefore, a separate test data report has been prepared to preserve a representative cross-section of test data for those investigators that require to examine in more detail the information that formed the foundation for Volume II. Even with this approach 100% documentation of test data is beyond the scope of this report.

It was decided to arrange the test data in order of nozzle configurations. For each nozzle configuration a hardware and test parameter description is given, followed by key examples of PWL, SPL and PNL spectra, beam patterns, "normalized" noise levels, and noise suppression values. SPL and PNL spectra are presented for only two angles, 110° and 130°, which are representative of peak premerged and postmerged noise respectively. This data is then followed by noise source location results and flow profile curves for those configurations where such data was acquired.

2.0 TEST DATA

Test data for the following model scale nozzle configurations appears in this data report.

Nozzle	Description	Page
4.16" RC	4.16 Inch Diameter, Round Convergent Nozzle	6
6" RC	6 Inch Diameter, Round Convergent Nozzle	27
37T-3.3AR-CPA-RT/RC	37 Tubes, 3.3 Area Ratio, Close-Packed Array, Round Tubes with Round Convergent Ends	34
7T-3.3AR-CPA-ET/RC	7 Tubes, 3.3 Area Ratio, Close-Packed Array, Elliptical Tubes with Round Convergent Ends	58
19T-3.3AR-CPA-ET/RC	19 Tubes, 3.3 Area Ratio, Close-Packed Array, Elliptical Tubes with Round Convergent Ends	83
37T-3.3AR-CPA-ET/RC	37 Tubes, 3.3 Area Ratio, Close-Packed Array, Elliptical Tubes with Round Convergent Ends	108
37T-3.3AR-CPA-ET/RC w/3.1AR EJECTOR	37 Tubes, 3.3 Area Ratio, Close-Packed Array, Elliptical Tubes with Round Convergent Ends with 3.1 Area Ratio Ejector, $L/D_E = 2$ Long	121
61T-3.3AR-CPA-ET/RC	61 Tubes, 3.3 Area Ratio, Close-Packed Array, Elliptical Tubes with Round Convergent Ends	143
37T-2.75AR-CPA-ET/RC	37 Tubes, 2.75 Area Ratio, Close-Packed Array, Elliptical Tubes with Round Convergent Ends	168
37T-4.5AR-CPA-ET/RC	37 Tubes, 4.5 Area Ratio, Close-Packed Array, Elliptical Tubes with Round Convergent Ends	194
37T-6.0AR-CPA-ET/RC	37 Tubes, 6.0 Area Ratio, Close-Packed Array, Elliptical Tubes with Round Convergent Ends	218
37T-3.3AR-RA-RT/NC	37 Tubes, 3.3 Area Ratio, Radial Arrangement, Round Tubes with Non-Convergent Ends	243

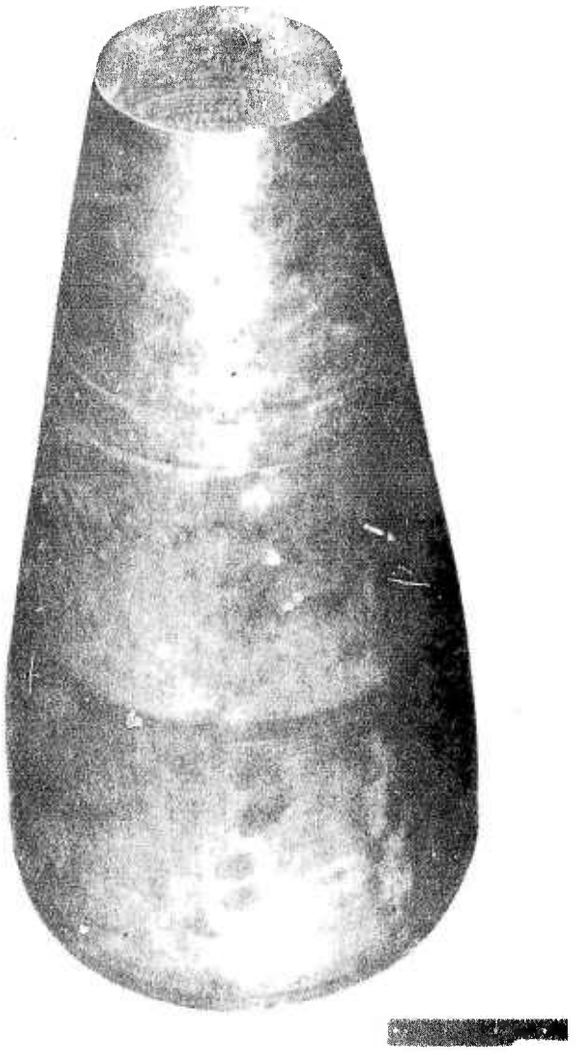
Nozzle	Description	Page
37T-4.5AR-RA-ET/RC	37 Tubes, 4.5 Area Ratio, Radial Arrangement, Elliptical Tubes with Round Convergent Ends	268
31T-2.75AR-RA-ET/RC	31 Tubes, 2.75 Area Ratio, Radial Arrangement, Elliptical Tubes with Round Convergent Ends	287
31T-2.75AR-RA-ET/RC w/2.6AR-EJECTOR	31 Tubes, 2.75 Area Ratio, Radial Arrangement, Elliptical Tubes with Round Convergent Ends with 2.6 Area Ratio Ejector, $L/D_E = 2$ Long	299
31T-2.75AR-RA-ET/RC w/3.1AR-EJECTOR	31 Tubes, 2.75 Area Ratio, Radial Arrangement, Elliptical Tubes with Round Convergend Ends with 3.1 Area Ratio Ejector, $L/D_E = 2$ Long	309
31T-2.75AR-RA-ET/RC w/3.7AR-EJECTOR	31 Tubes, 2.75 Area Ratio, Radial Arrangement, Elliptical Tubes with Round Convergent Ends with 3.7 Area Ratio Ejector, $L/D_E = 2$ Long	319
42T/Annulus-3.3AR-CPA-ET/RC	42 Tubes with Annulus and Plug, 3.3 Area Ratio, Close-Packed Array, Elliptical Tubes with Round Convergent Ends, 0.383" Wide Annulus	329
42T/Annulus-3.0AR-CPA-ET/RC	42 Tubes with Annulus and Plug, 3.0 Area Ratio, Close-Packed Array, Elliptical Tubes with Round Convergent Ends, 0.533" Wide Annulus	352
42T/Annulus-2.6AR-CPA-ET/RC	42 Tubes with Annulus and Plug, 2.6 Area Ratio, Close-Packed Array, Elliptical Tubes with Round Convergent Ends, 0.8" Wide Annulus	362
42T/Annulus-2.4AR-CPA-ET/RC	42 Tubes with Annulus and Plug, 2.4 Area Ratio, Close-Packed Array, Elliptical Tubes with Round Convergent Ends, 1.067" Wide Annulus	372

Nozzle	Description	Page
61T-3.1AR-CPA-RT/NC	61 Tubes, 3.1 Area Ratio, Close-Packed Array, Round Tubes with Non-Convergent Ends	392
61T(Canted)-3.1AR-CPA-RT/NC	61 Tubes with the Outer Row of 24 Tubes Canted Outwards, 3.1 Area Ratio, Close-Packed Array, Round Tubes with Non-Convergent Ends	401
85T-3.1AR-CPA-RT/NC	85 Tubes, 3.1 Area Ratio, Close-Packed Array, Round Tubes with Non-Convergent Ends	410

Typically the noise data for each test configuration is arranged in the following order. For some test configurations, however, not all of these pages or data formats were available and hence do not appear in this report.

Page Order	Description
1	Test Hardware Photograph
2	Test Hardware Schematic
3	Table of Test Conditions
4	1/3 Octave Band PWL Spectrum
5	1/3 Octave Band SPL Spectrum at 110° from Nozzle Inlet Axis
6	1/3 Octave Band SPL Spectrum at 130° from Nozzle Inlet Axis
7	Overall SPL Beam Patterns
8	2128 Ft. Sideline PNL versus Ideal Jet Velocity
9	2128 Ft. Sideline PNL Suppression versus Ideal Jet velocity
10	2128 Ft. Sideline PNL Beam Patterns
11	2128 Ft. Sideline, 1/3 Octave Band SPL Spectrum at 110° from Nozzle Inlet Axis
' '	2128 Ft. Sideline, 1/3 Octave Band SPL Spectrum at 130° from Nozzle Inlet Axis
	Table of Jet Noise Source Location Test Conditions
15	1/3 Octave Band "Space Averaged" SPL Spectra versus Jet Length

Page Order	Description
16	Jet Noise Source Intensity Distributions
17	Peak Jet Noise Source Locations
18	Total Pressure Profile @ $x/D_E = 1$
19	Total Pressure Profile @ $x/D_E = 5$
20	Total Temperature Profile @ $x/D_E = 1$
21	Total Temperature Profile @ $x/D_E = 5$
22	Static Pressure Profile @ $x/D_E = 1$
23	Static Pressure Profile @ $x/D_E = 5$



4.16 IN. DIA. REFERENCE NOZZLE

TEST CONDITIONS

NOZZLE: 4.16 IN. DIA., ROUND CONVERGENT

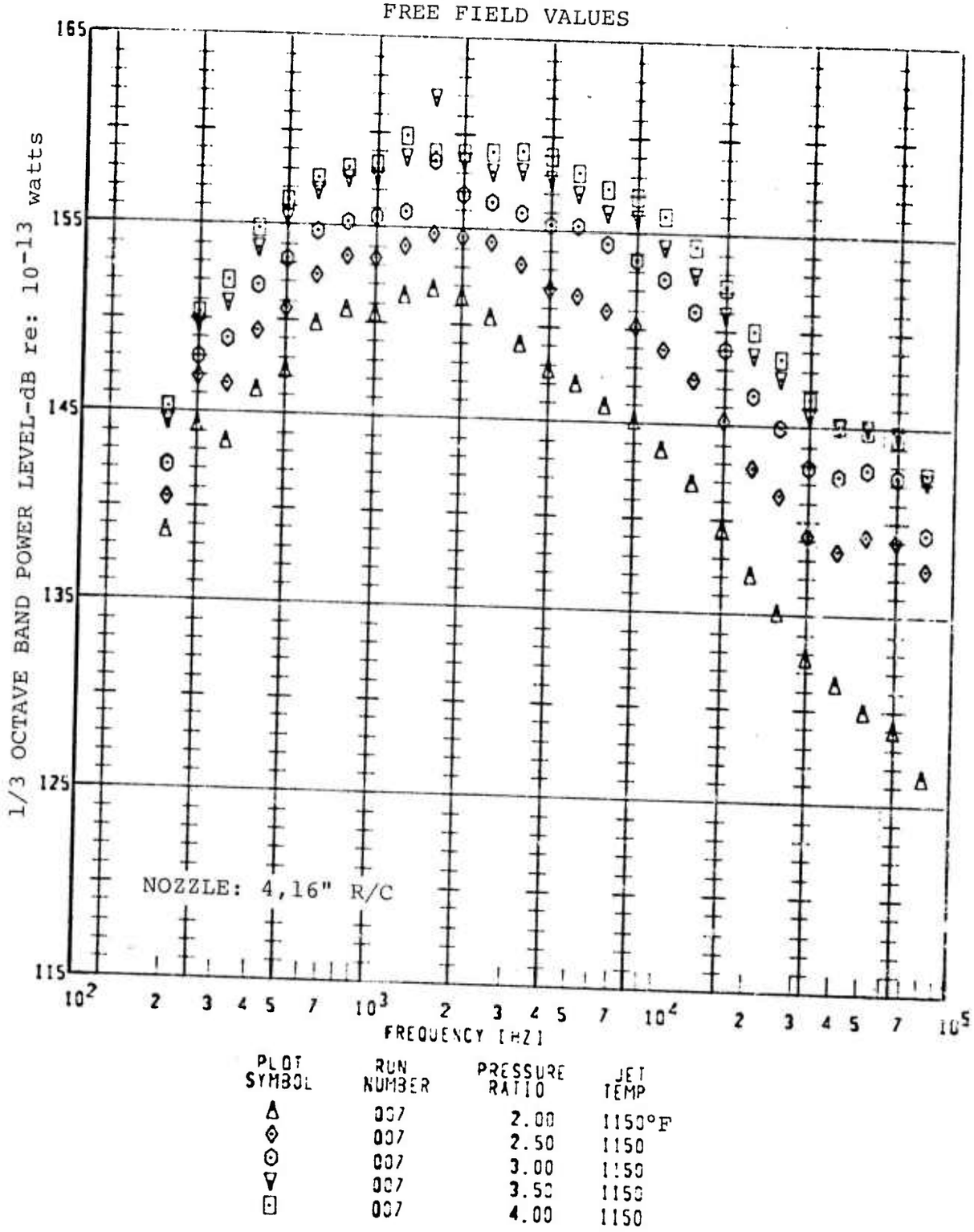
FACILITY: HNTF

DATE: 6-11-73 T_{AMB} = 65°F **R.H.** = 55.5%

SCALE MODEL A_8 = 13.6 in.^{2}

RUN NO.	NPR	T_T	V_J (IDEAL)	REMARKS	REF
007	2.0	1150°F	1875 fps		
"	2.5		2126		
"	3.0		2303		
"	3.5		2437		
"	4.0		2544		

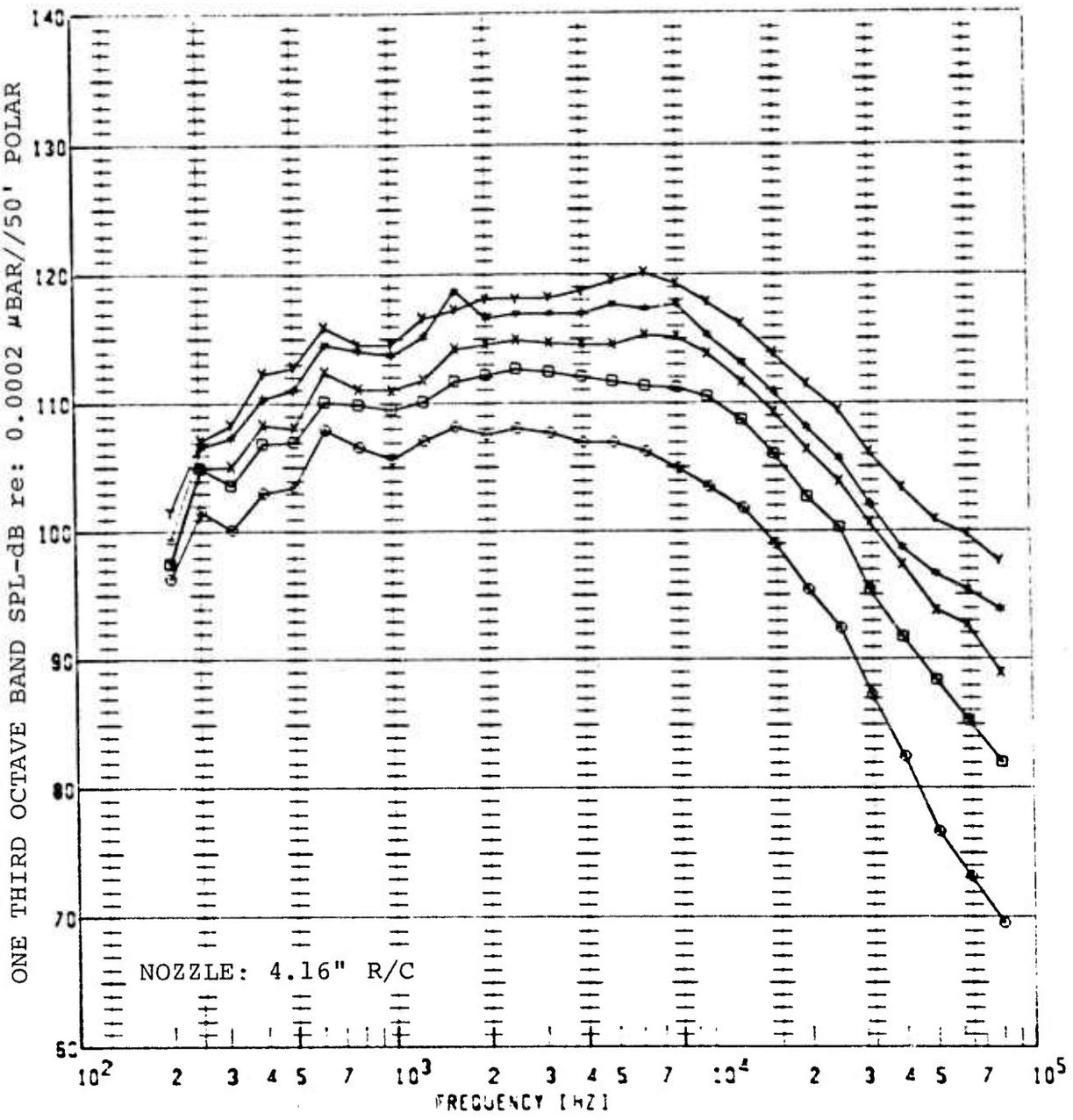
MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH CONCRETE GROUND SURFACE. MEASURED ACOUSTIC DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.



PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	007	2.00	1150°F
◇	007	2.50	1150
○	007	3.00	1150
▽	007	3.50	1150
□	007	4.00	1150

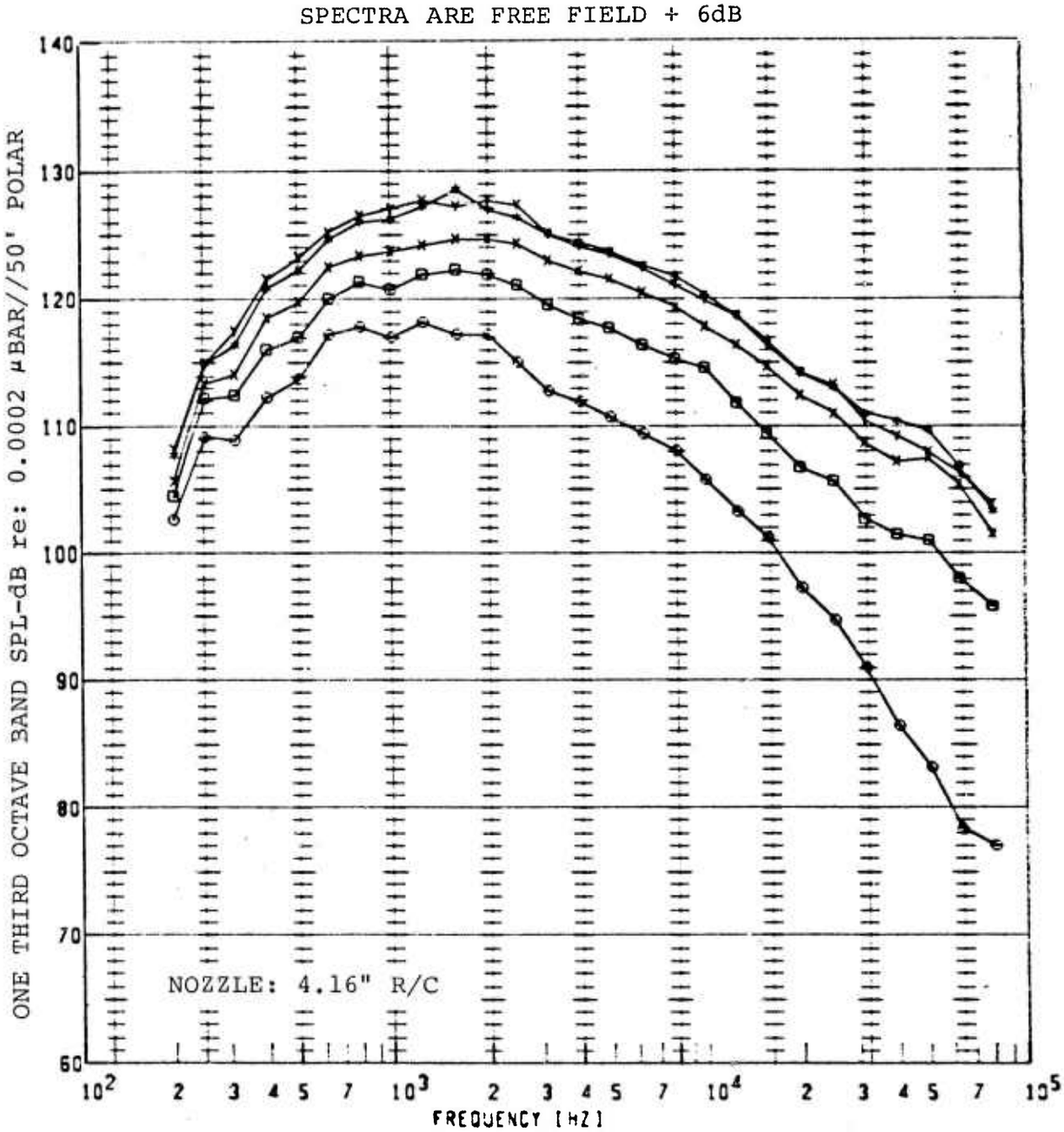
JET NOISE POWER SPECTRA

SPECTRA ARE FREE FIELD + 6dB



PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL [DB]
⊕	0076	1150°F	2.000	110°	50FP	118.7
⊡	0076	1150	2.500		50FP	123.1
x	0076	1150	3.000		50FP	125.7
*	0076	1150	3.500		50FP	128.2
Y	0076	1150	4.000		50FP	129.7

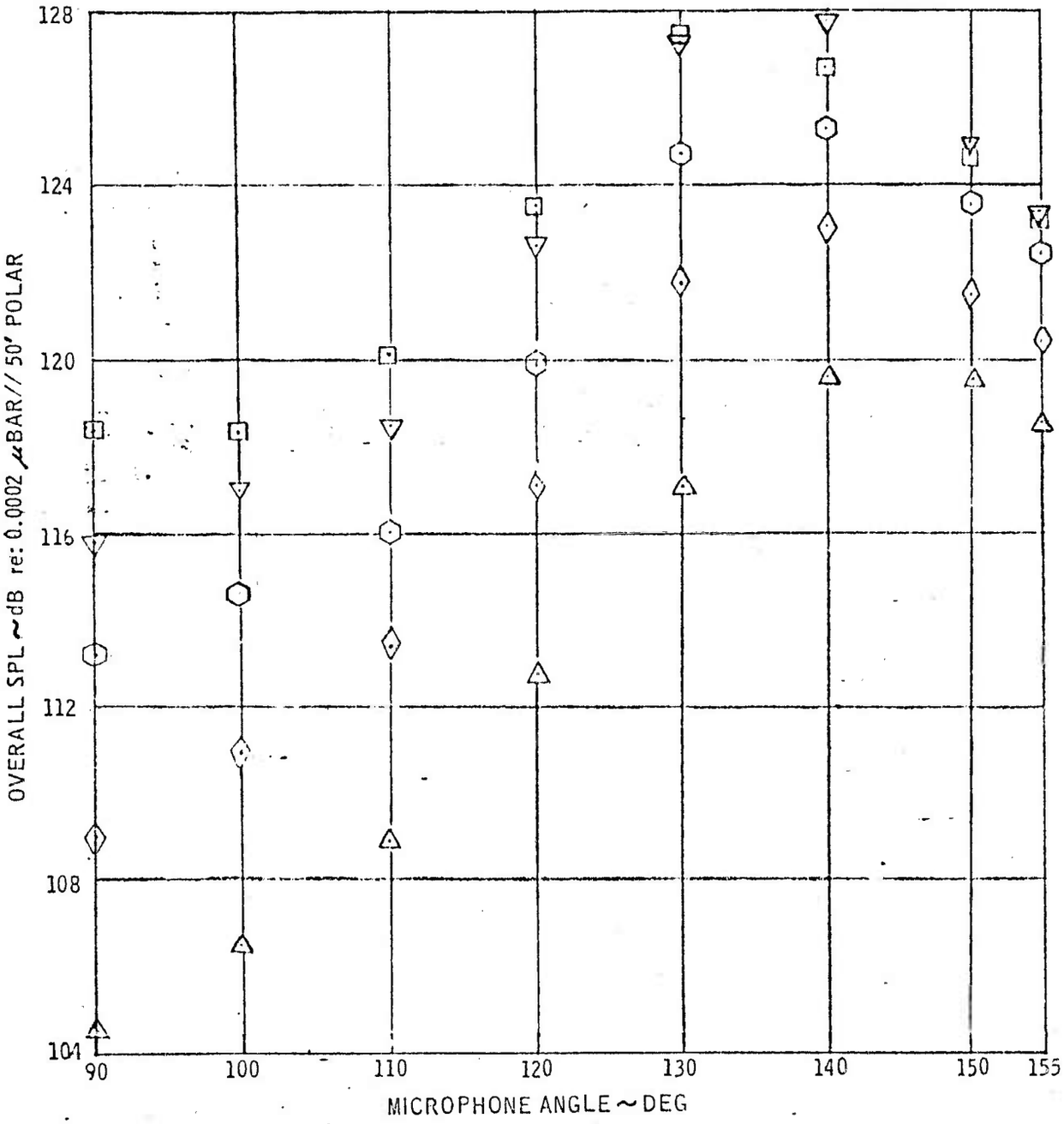
MEASURED NOISE SPECTRA AT 110° re: NOZZLE INLET AXIS



PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL [DB]
⊙	007G	1150°F	2.000	130°	50FP	126.9
⊡	007G	1150	2.500	↓	50FP	131.6
x	007G	1150	3.000	↓	50FP	134.5
*	007G	1150	3.500	↓	50FP	137.1
Y	007G	1150	4.000	↓	50FP	137.3

MEASURED NOISE SPECTRA AT 130° re: NOZZLE INLET AXIS

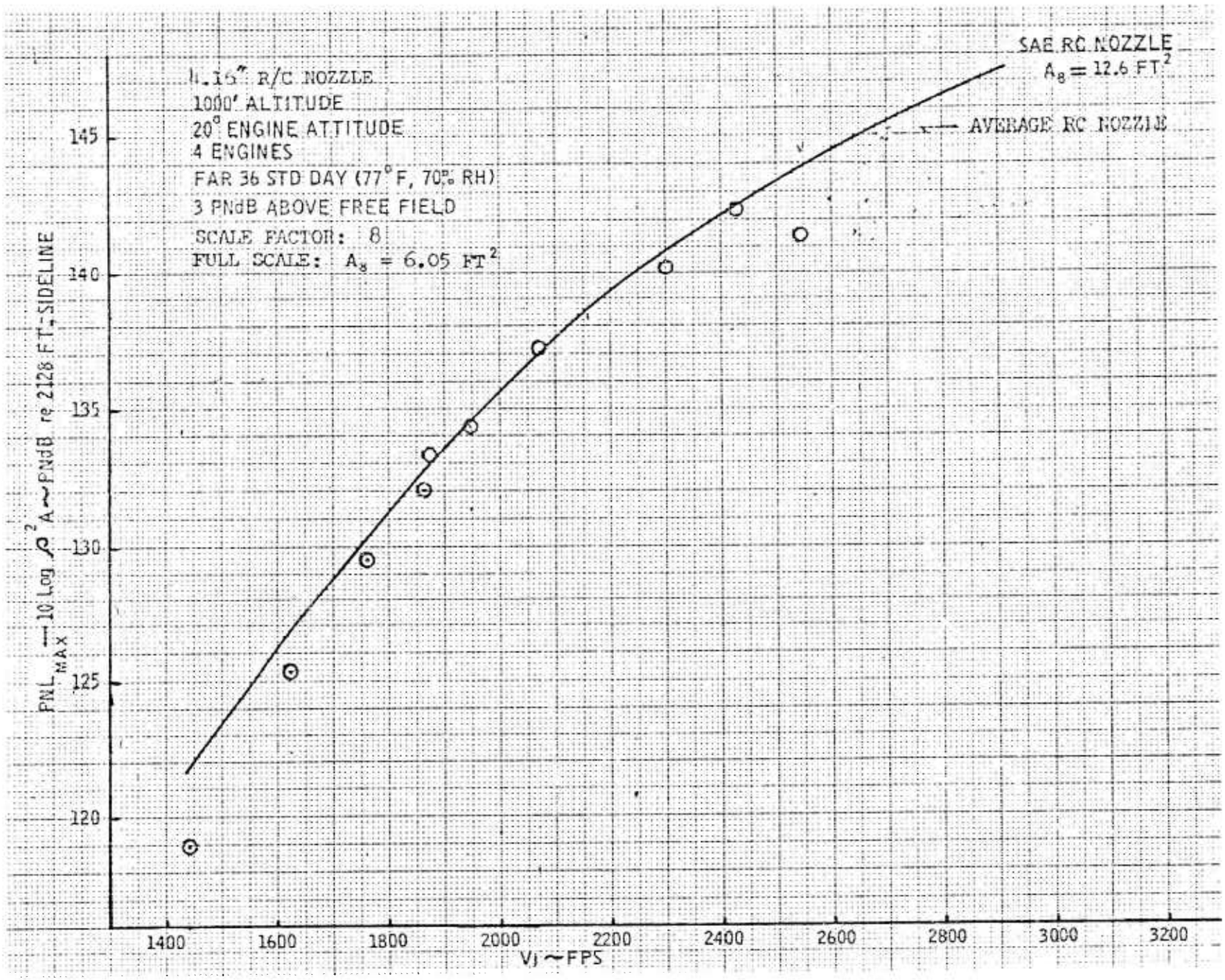
FREE FIELD VALUES



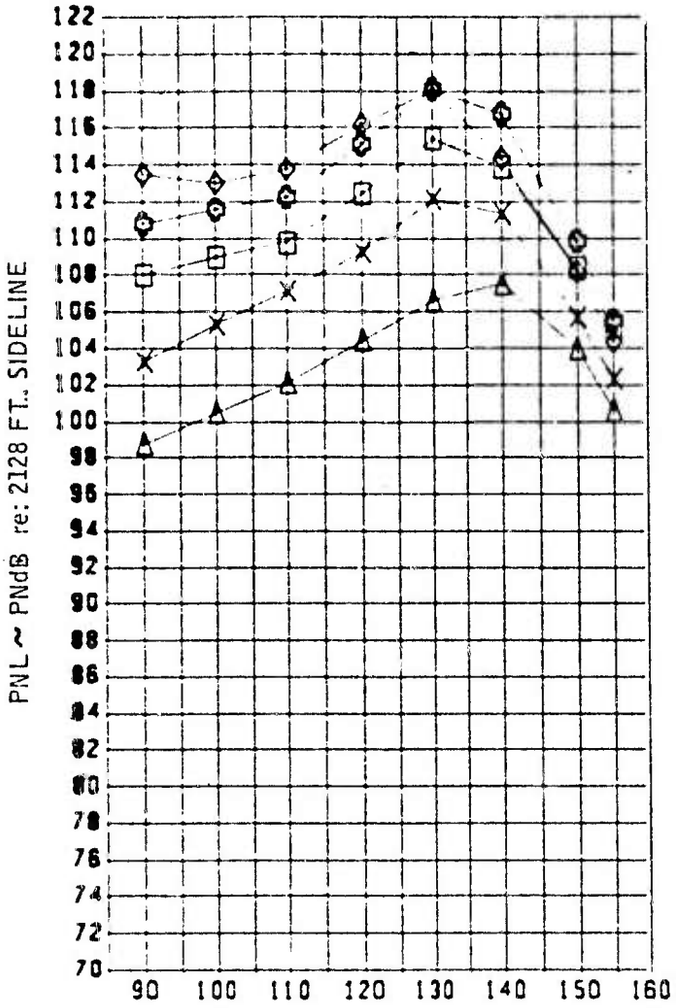
NOZZLE: 4.16" R/C

PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	007	2.00	1150°F
◇	007	2.50	1150
○	007	3.00	1150
▽	007	3.50	1150
□	007	4.00	1150

OASPL BEAM PATTERNS


4.15" R/C NOZZLE
1000' ALTITUDE
20° ENGINE ATTITUDE
4 ENGINES
FAR 36 STD DAY (77° F, 70% RH)
3 PNdB ABOVE FREE FIELD
SCALE FACTOR: 8
FULL SCALE: A_8 = 6.05 FT^2
SAE RC NOZZLE
A_8 = 12.6 FT^2
AVERAGE RC NOZZLE
PNL_{MAX} — 10 Log ρ^2 A ~ PNdB re 2128 FT, SIDELINE
145
140
135
130
125
120
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
V_j ~ FPS

NOZZLE: 4.1" R/C



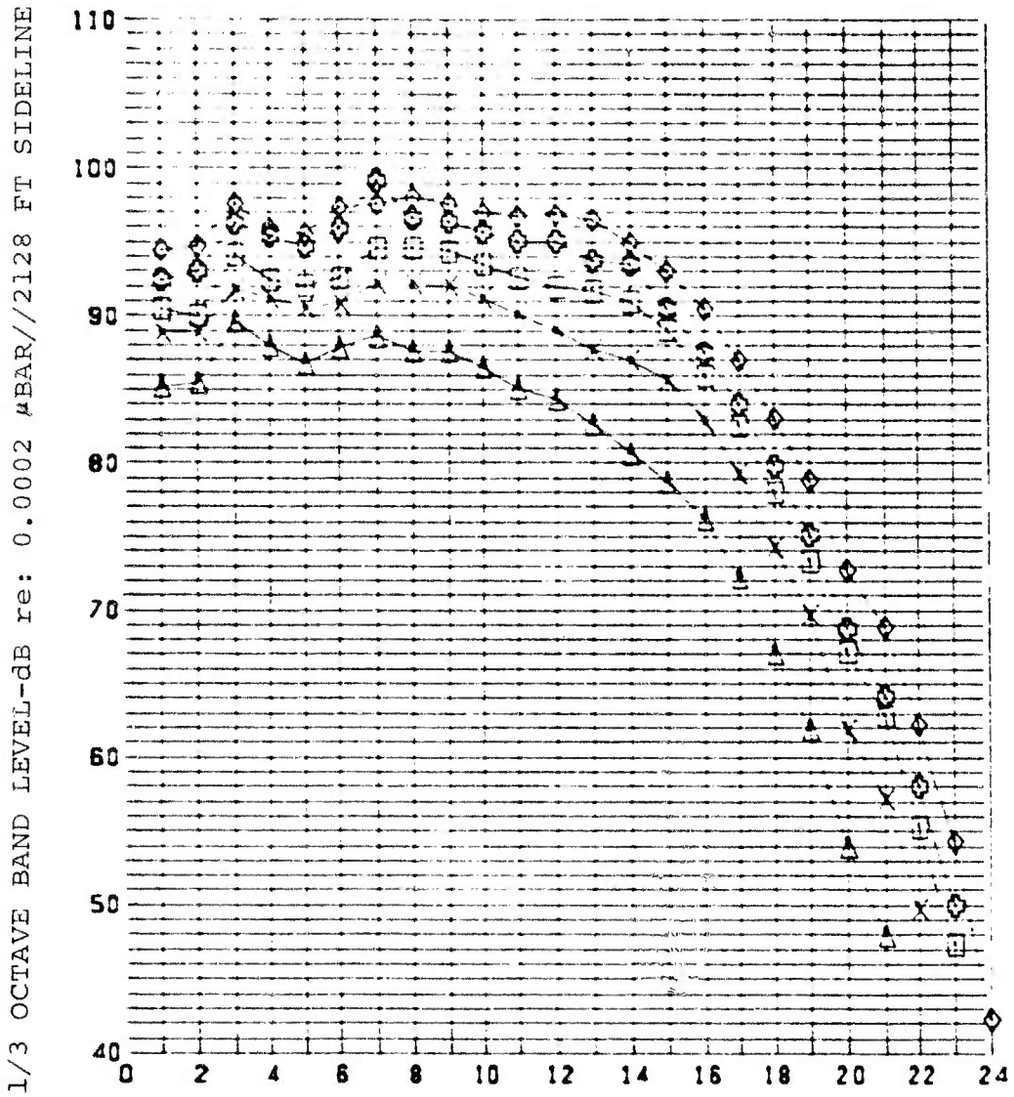
T_T = 1150°F A_8 = 6.05 FT^2 RUN:007

PR = △ 2.0, X 2.5, □ 3.0, ✣ 3.5, ◇ 4.0

PNL BEAM PATTERNS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 110 DEG TEMP = 77 DEG R.H. = 70 PER CENT



T_T = 1150°F A_8 = 6.05 FT^2 RUN:007

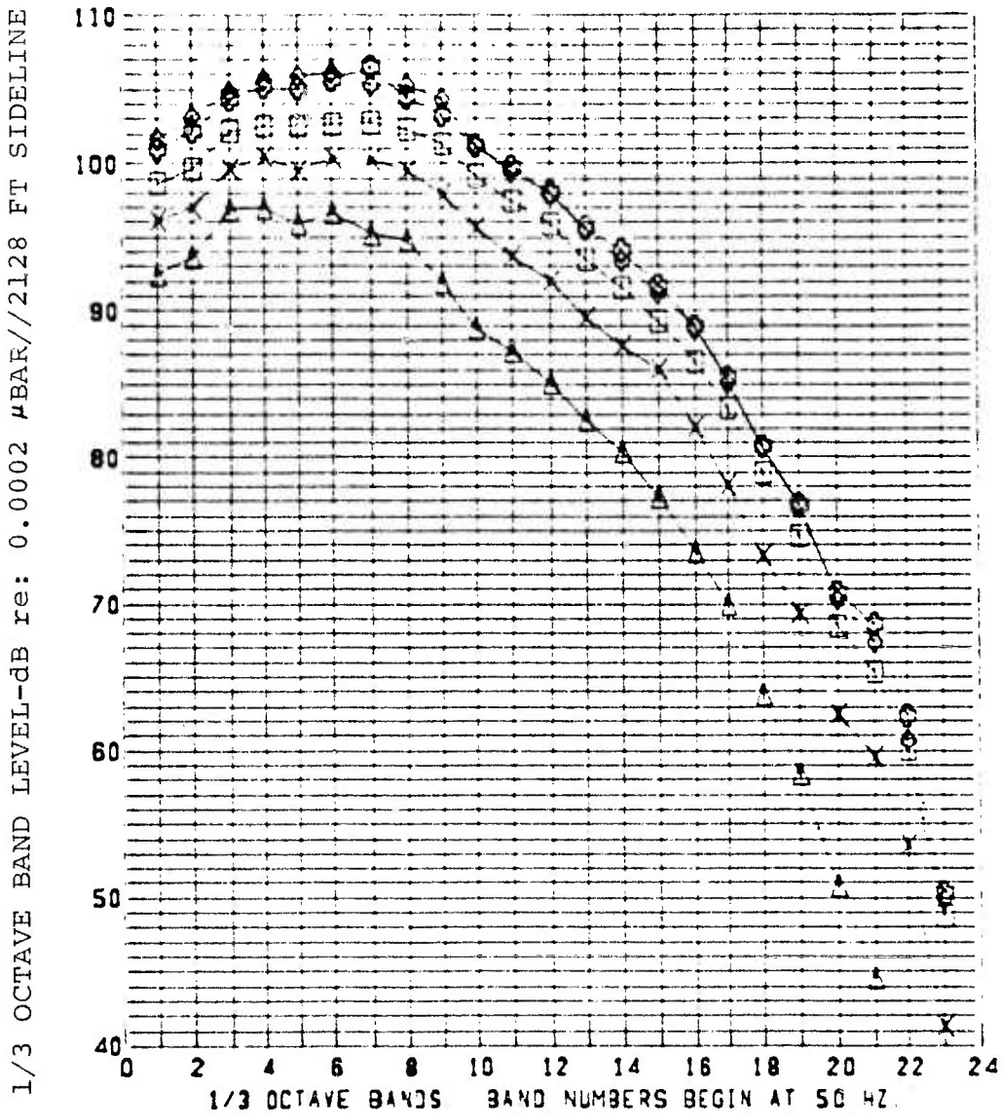
PR = △ 2.0, X 2.5, □ 3.0, ✣ 3.5, ◇ 4.0

NOZZLE: 4.16 " R/C

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 110° re: NOZZLE INLET AXIS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 130 DEG TEMP = 77 DEG R.H. = 70 PER CENT



T_T = 1150°F A_8 = 6.05 FT^2 RUN: 007

PR = △ 2.0, X 2.5, □ 3.0, ✣ 3.5, ◇ 4.0

NOZZLE: 4.16 R/C

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 130°
re: NOZZLE INLET AXIS

TEST CONDITIONS

NOZZLE: 4.16" R/C

FACILITY: WALL ISOLATION FACILITY

DATE: August 11, 1972

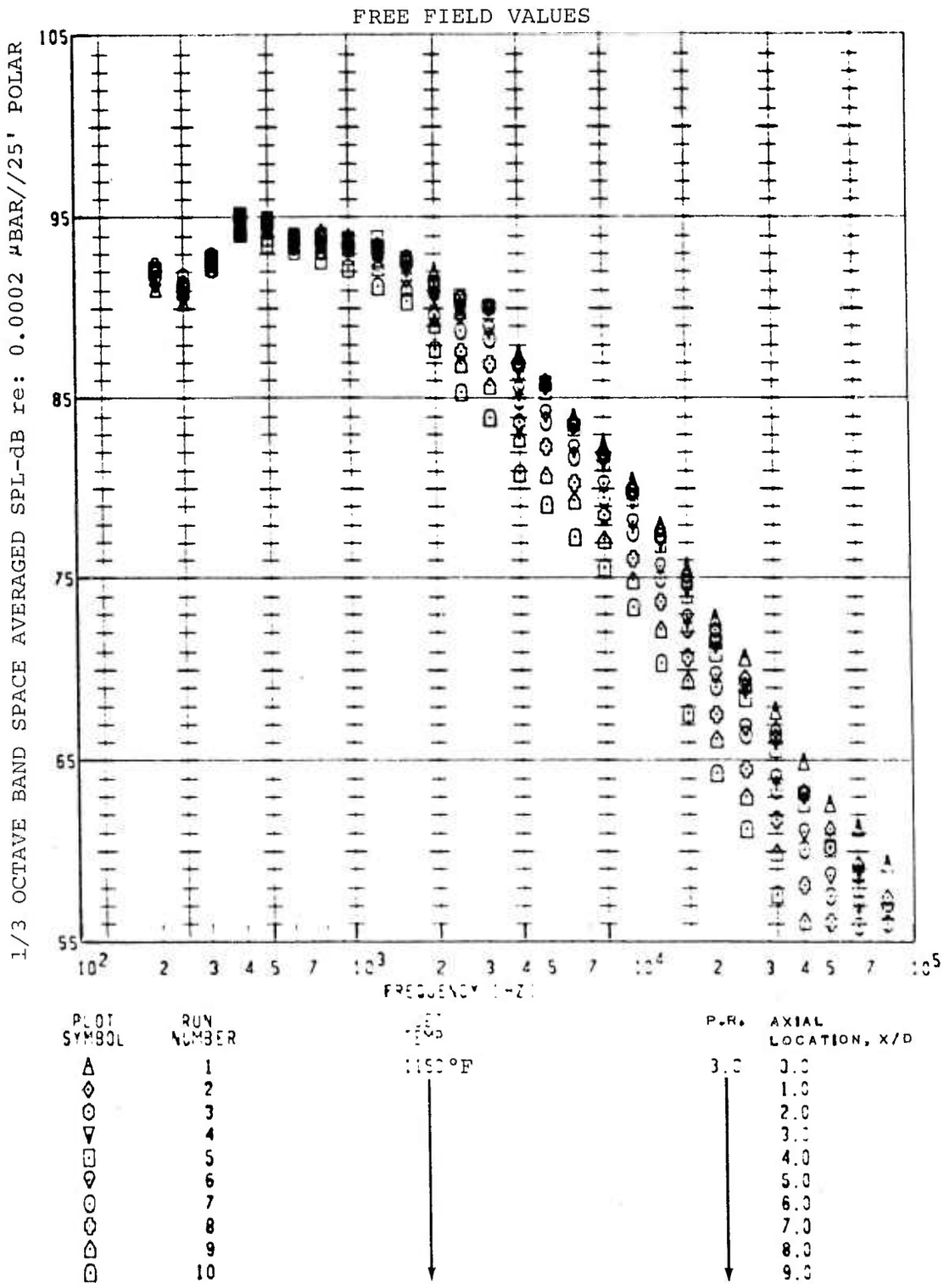
P_{AMB} = 30.3 in Hg T_{AMB} = 71°F **R.H.** = 49%

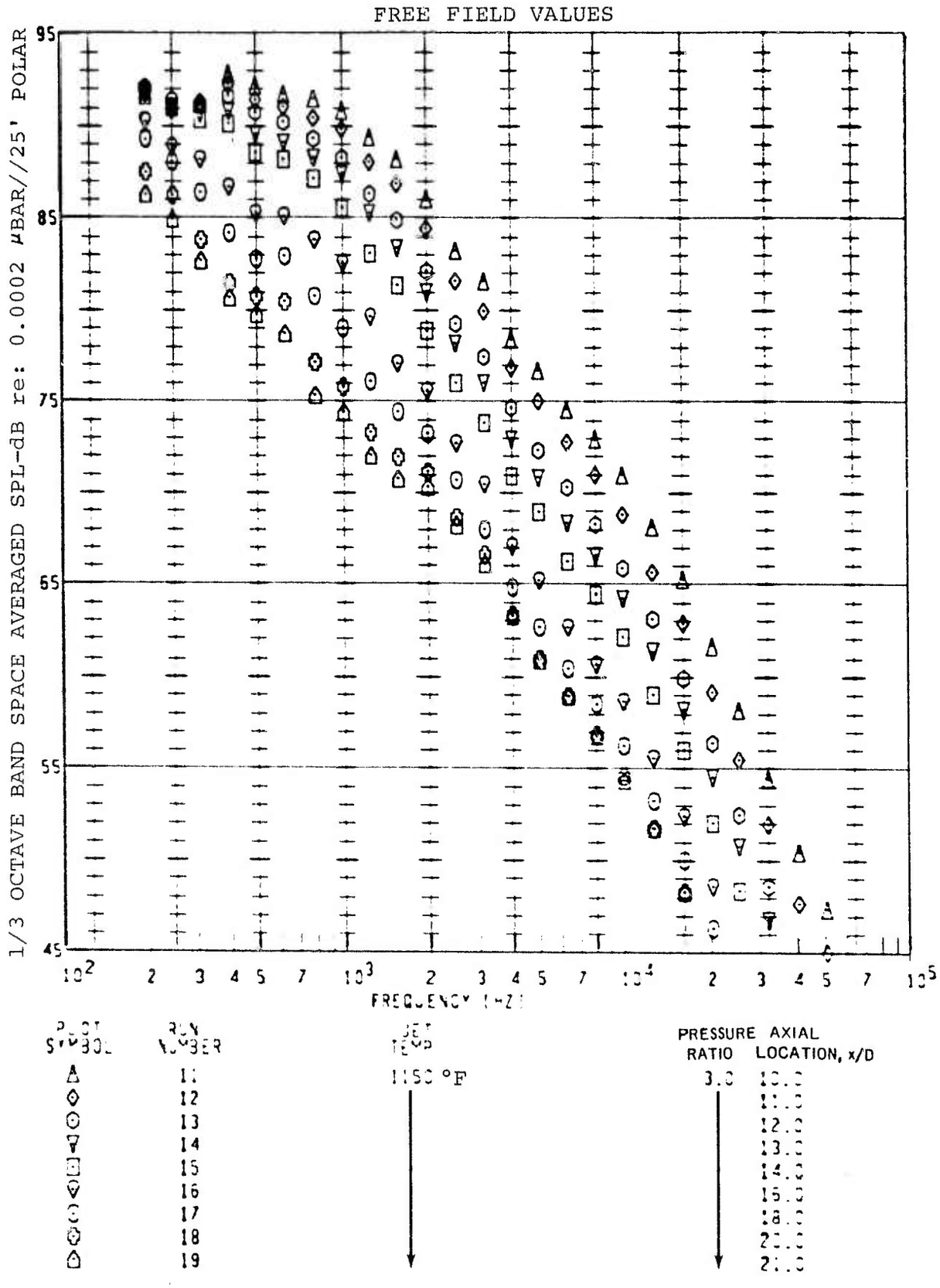
NPR = 3.0 T_T = 1150°F V_J **(IDEAL)** = 2300 FPS

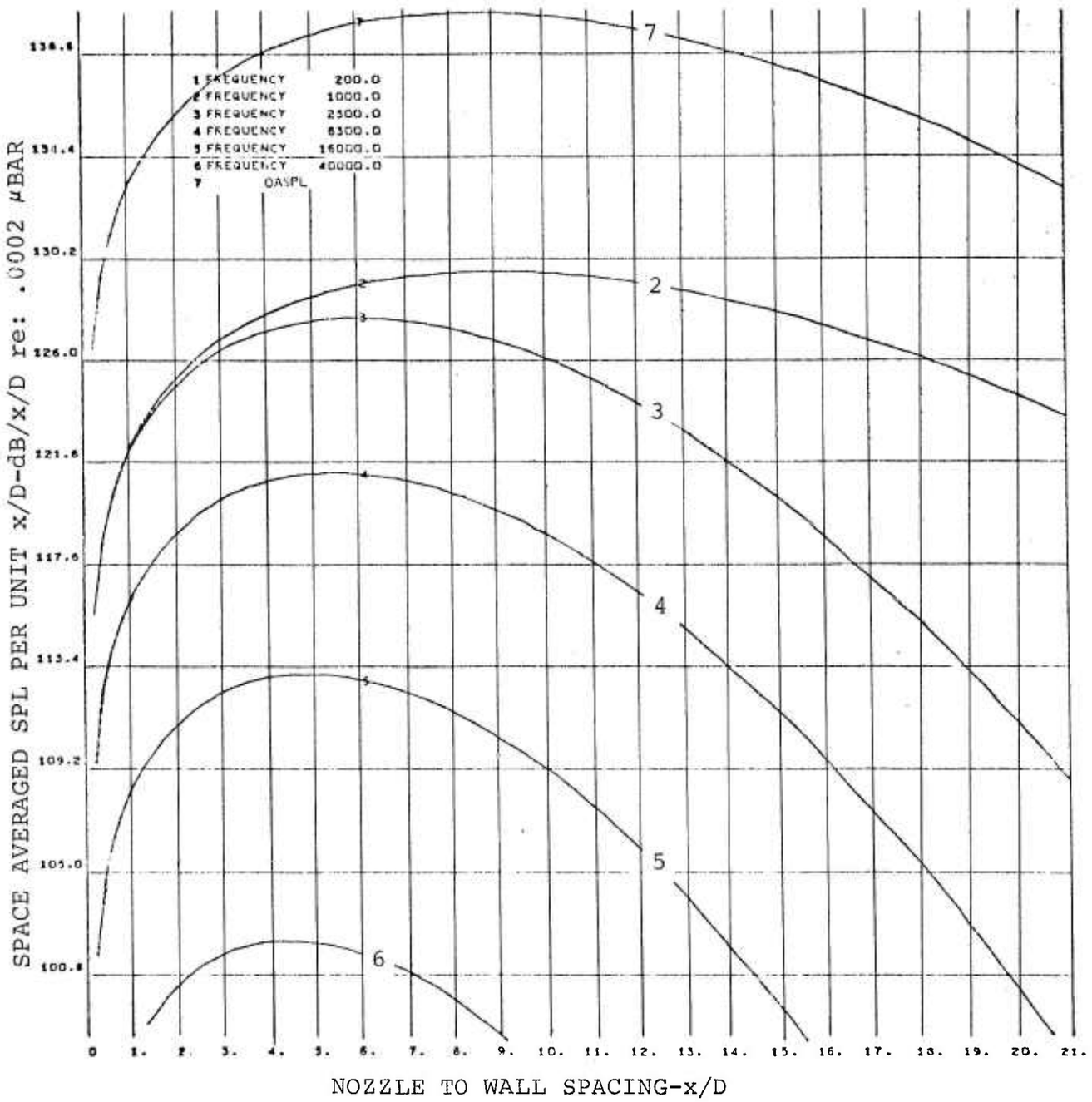
SCALE MODEL A_8 = 13.6 $in.^2$

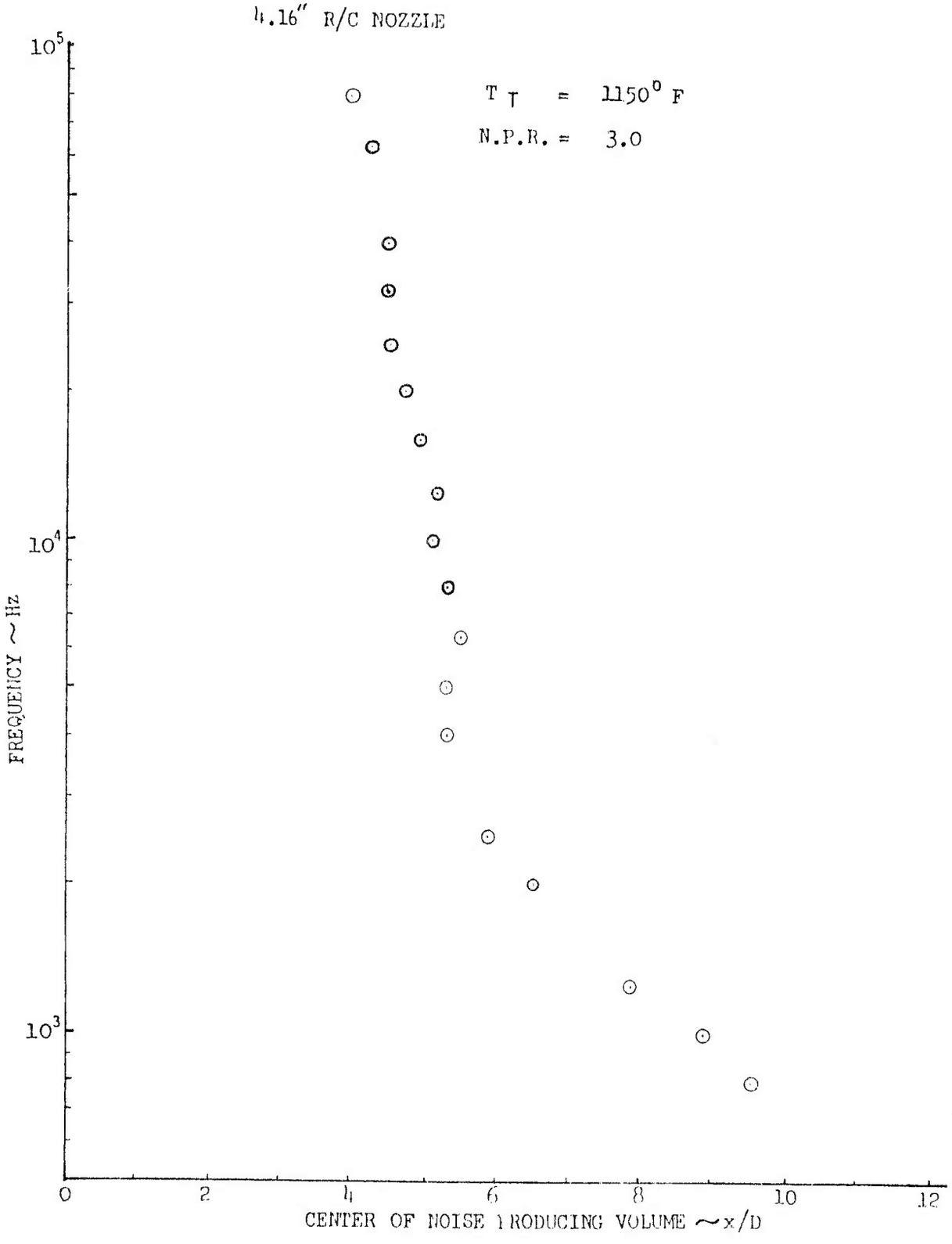
RUN NO.	AXIAL LOCATION	IRIS DIA.	REMARKS	REF.
1	0.0 x/D	6.0 in.		
2	1.0	6.0		
3	2.0	7.4		
4	3.0	8.4		
5	4.0	9.4		
6	5.0	10.4		
7	6.0	11.4		
8	7.0	12.4		
9	8.0	13.6		
10	9.0	14.4		
11	10.0	15.6		
12	11.0	16.0		
13	12.0	16.4		
14	13.0	17.0		
15	14.0	17.4		
16	16.0	22.4		
17	18.0	24.4		
18	20.0	26.4		
19	21.0	28.4		

MICROPHONE LAYOUT: 25 FOOT VERTICAL POLAR ARC

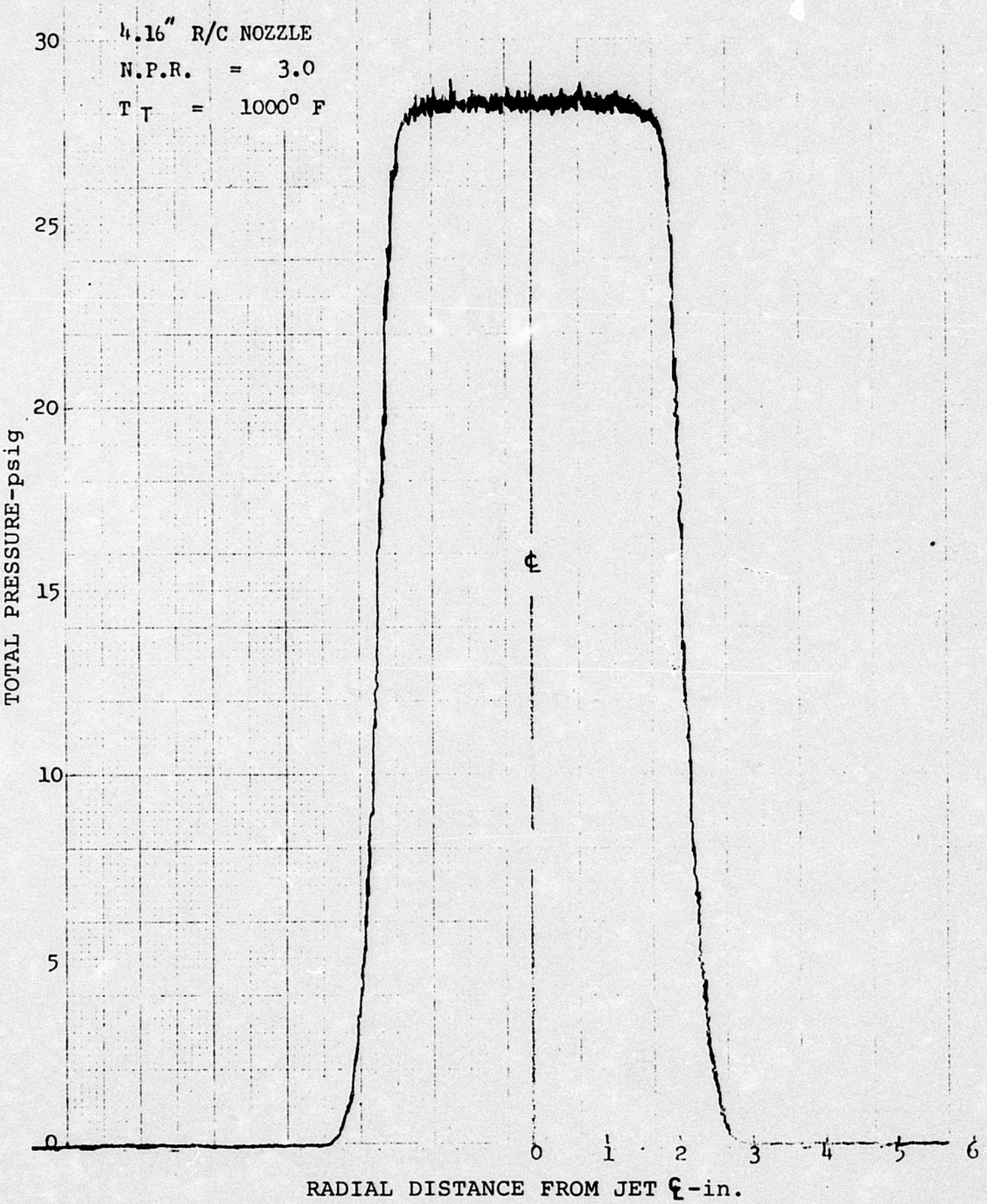

FREE FIELD VALUES
1/3 OCTAVE BAND SPACE AVERAGED SPL-dB re: 0.0002 μBAR//25' POLAR
105
95
85
75
65
55
10^2 2 3 4 5 7 10^3 2 3 4 5 7 10^4 2 3 4 5 7 10^5
FREQUENCY (HZ)
PLOT SYMBOL
RUN NUMBER
1150°F
P.R.
3.0
AXIAL LOCATION, X/D
1 3.0
2 1.0
3 2.0
4 3.0
5 4.0
6 5.0
7 6.0
8 7.0
9 8.0
10 9.0

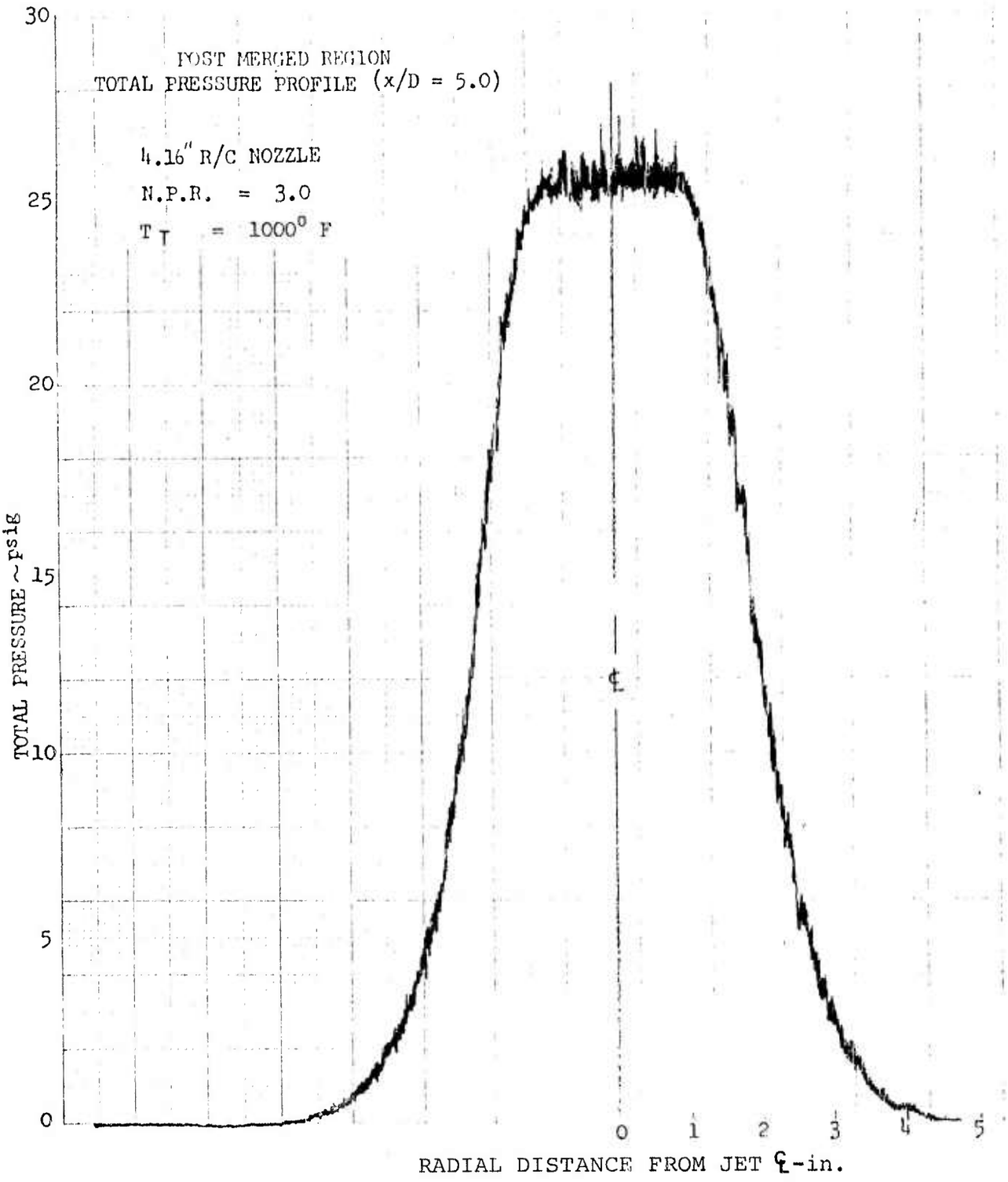

FREE FIELD VALUES
1/3 OCTAVE BAND SPACE AVERAGED SPL-dB re: 0.0002 μBAR//25' POLAR
95
85
75
65
55
45
10²
2
3
4
5
7
10³
2
3
4
5
7
10⁴
2
3
4
5
7
10⁵
FREQUENCY (HZ)
PLOT SYMBOL
RUN NUMBER
JET TEMP
1150 °F
PRESSURE RATIO
3.0
AXIAL LOCATION, x/D
11
12
13
14
15
16
17
18
19
12.0
13.0
14.0
15.0
18.0
21.0

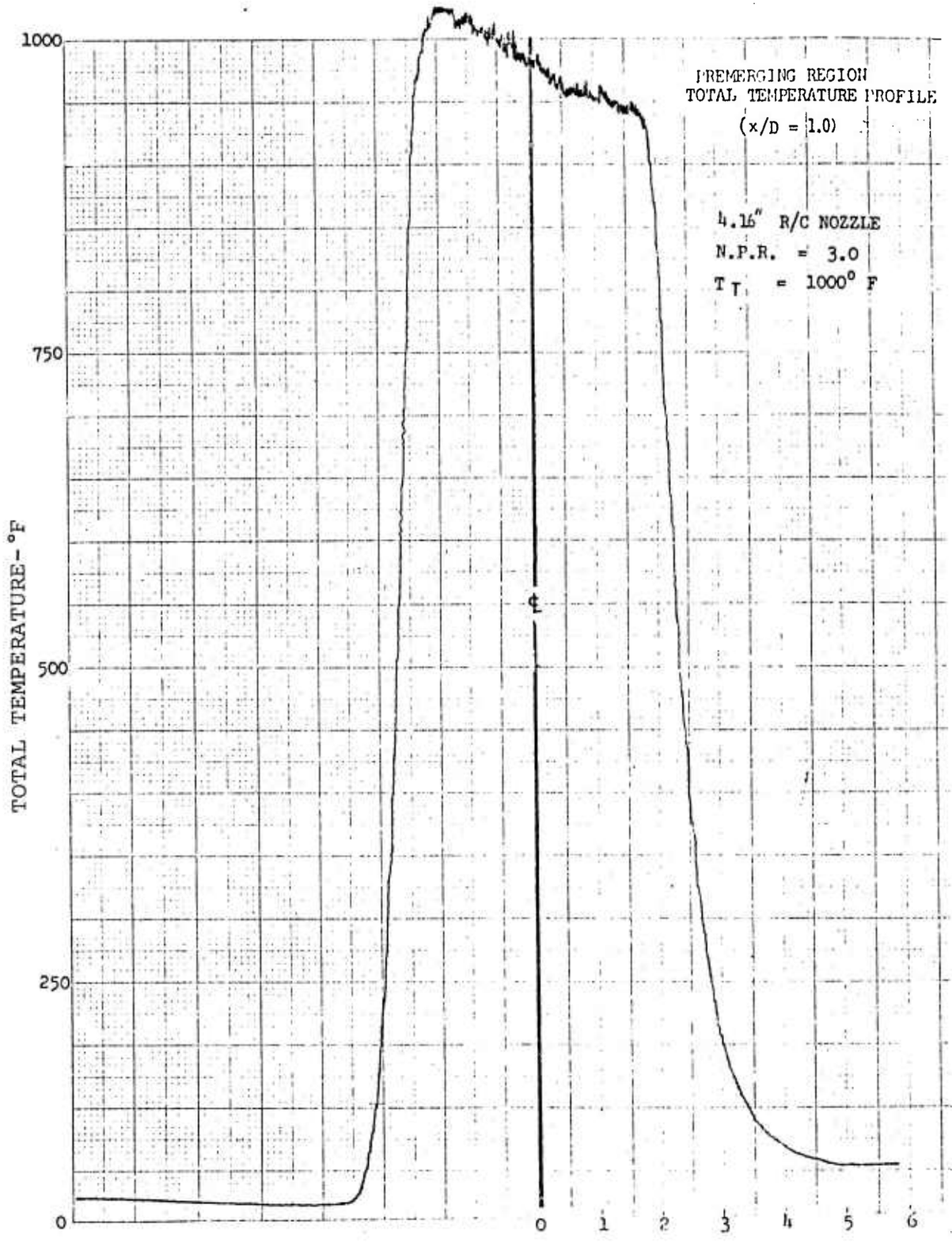

1 FREQUENCY 200.0
2 FREQUENCY 1000.0
3 FREQUENCY 2500.0
4 FREQUENCY 6300.0
5 FREQUENCY 16000.0
6 FREQUENCY 40000.0
7 OASPL
SPACE AVERAGED SPL PER UNIT x/D-dB/x/D re: .0002 μBAR
NOZZLE TO WALL SPACING-x/D

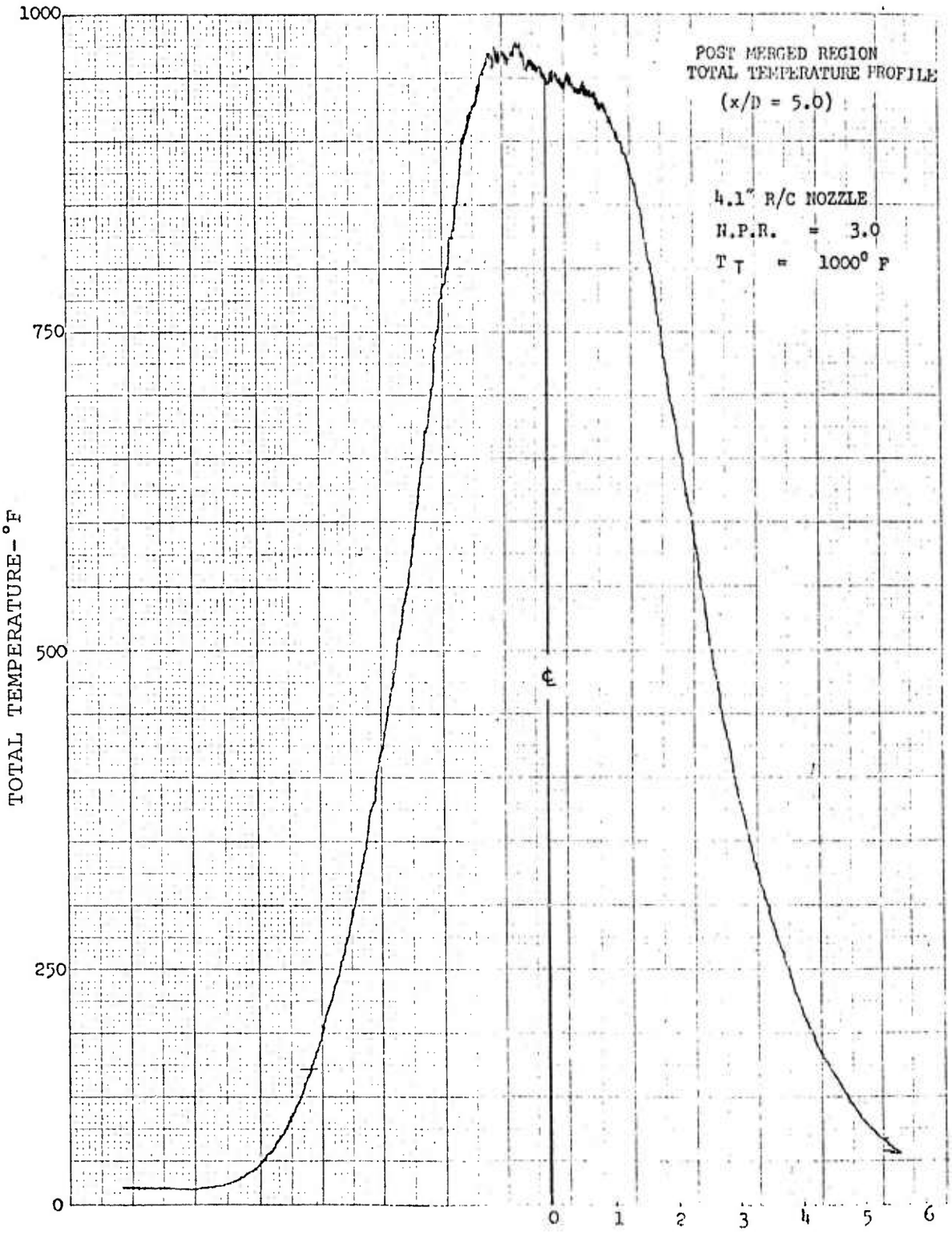

4.16" R/C NOZZLE
T_T = 1150° F
N.P.R. = 3.0
10^5
10^4
10^3
FREQUENCY ~ Hz
0
2
4
6
8
10
12
CENTER OF NOISE PRODUCING VOLUME ~x/D

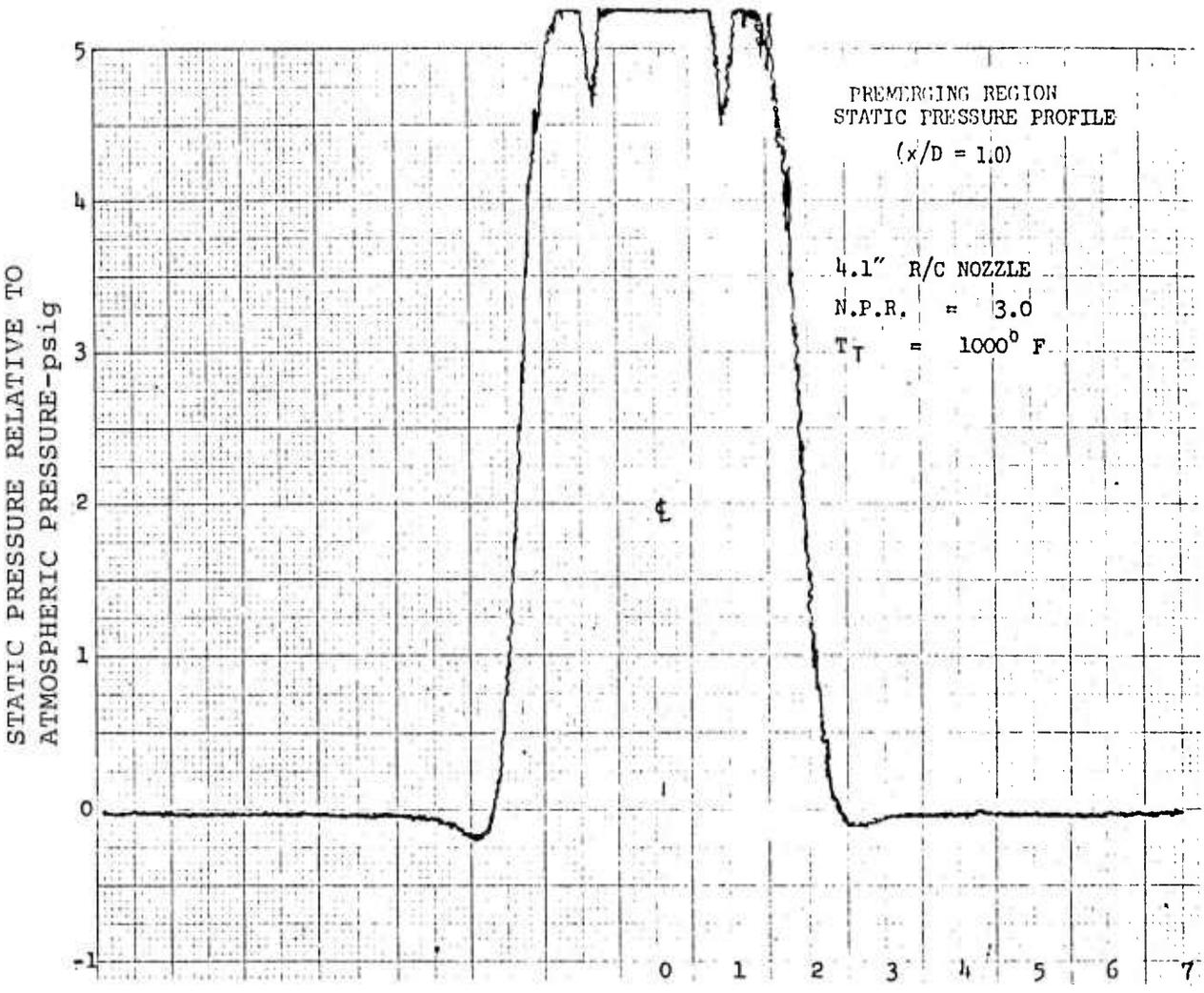
PREMERGING REGION
TOTAL PRESSURE PROFILE (x/D = 1.0)

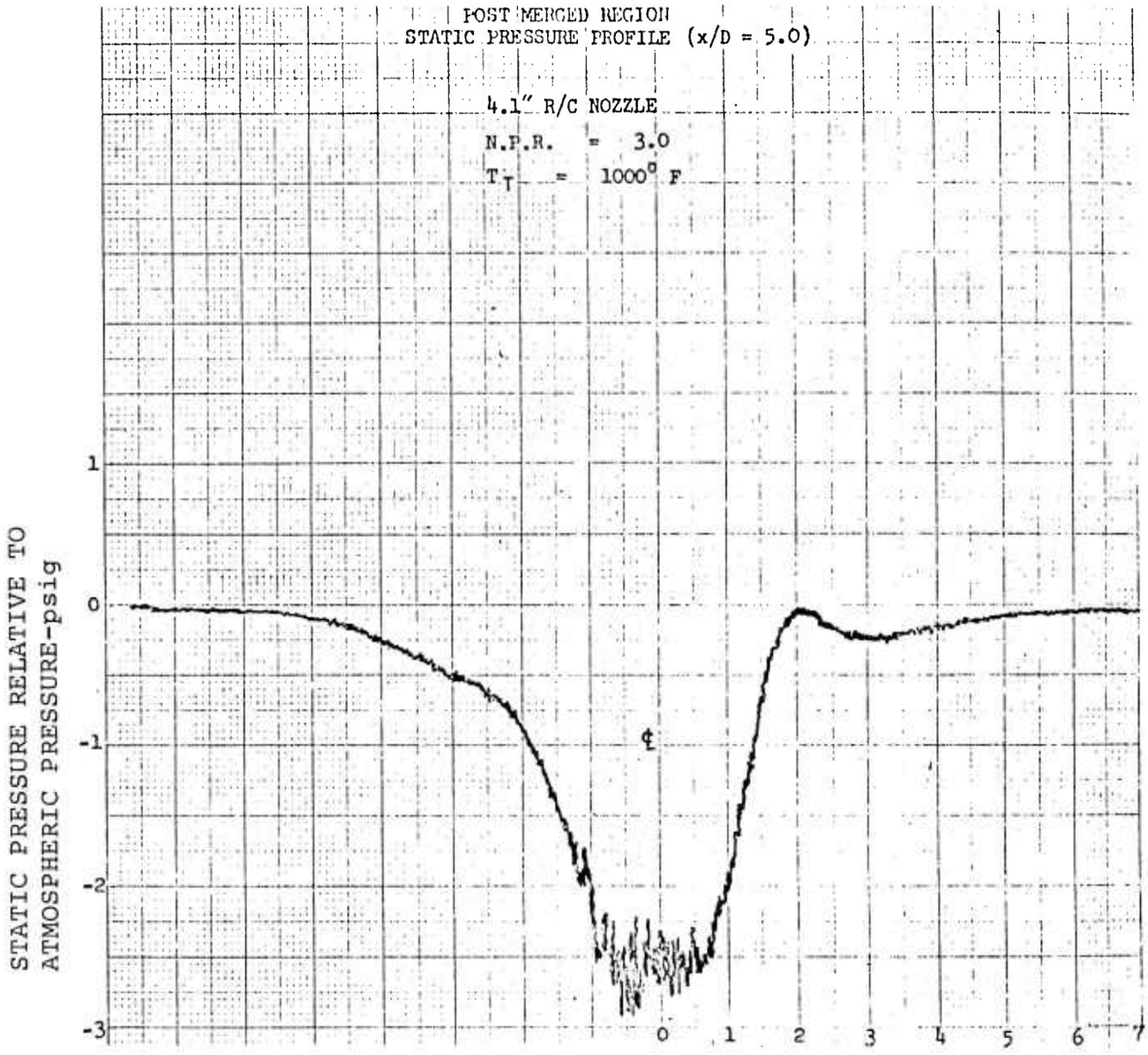



POST MERGED REGION
TOTAL PRESSURE PROFILE (x/D = 5.0)
4.16" R/C NOZZLE
N.P.R. = 3.0
T_T = 1000° F
TOTAL PRESSURE ~ psig
30
25
20
15
10
5
0
℄
0
1
2
3
4
5
RADIAL DISTANCE FROM JET ℄-in.


PREMERGING REGION
TOTAL TEMPERATURE PROFILE
(x/D = 1.0)
4.16" R/C NOZZLE
N.P.R. = 3.0
T_T = 1000° F
TOTAL TEMPERATURE - °F
1000
750
500
250
0
0
1
2
3
4
5
6
RADIAL DISTANCE FROM JET ℄-in.


POST MERGED REGION
TOTAL TEMPERATURE PROFILE
(x/D = 5.0)
4.1" R/C NOZZLE
N.P.R. = 3.0
T_T = 1000° F
TOTAL TEMPERATURE-°F
1000
750
500
250
0
℄
0
1
2
3
4
5
6
RADIAL DISTANCE FROM JET ℄-in.


PREMERGING REGION
STATIC PRESSURE PROFILE
(x/D = 1.0)
4.1" R/C NOZZLE
N.P.R. = 3.0
T_T = 1000° F
STATIC PRESSURE RELATIVE TO ATMOSPHERIC PRESSURE-psig
5
4
3
2
1
0
-1
0
1
2
3
4
5
6
7
RADIAL DISTANCE FROM JET ℄-in.


POST MERGED REGION
STATIC PRESSURE PROFILE (x/D = 5.0)
4.1" R/C NOZZLE
N.P.R. = 3.0
T_T = 1000° F
STATIC PRESSURE RELATIVE TO ATMOSPHERIC PRESSURE-psig
1
0
-1
-2
-3
℄
0
1
2
3
4
5
6
7
RADIAL DISTANCE FROM JET ℄-in.

TEST CONDITIONS

NOZZLE: 6 IN. DIA. ROUND CONVERGENT

FACILITY: HNTF

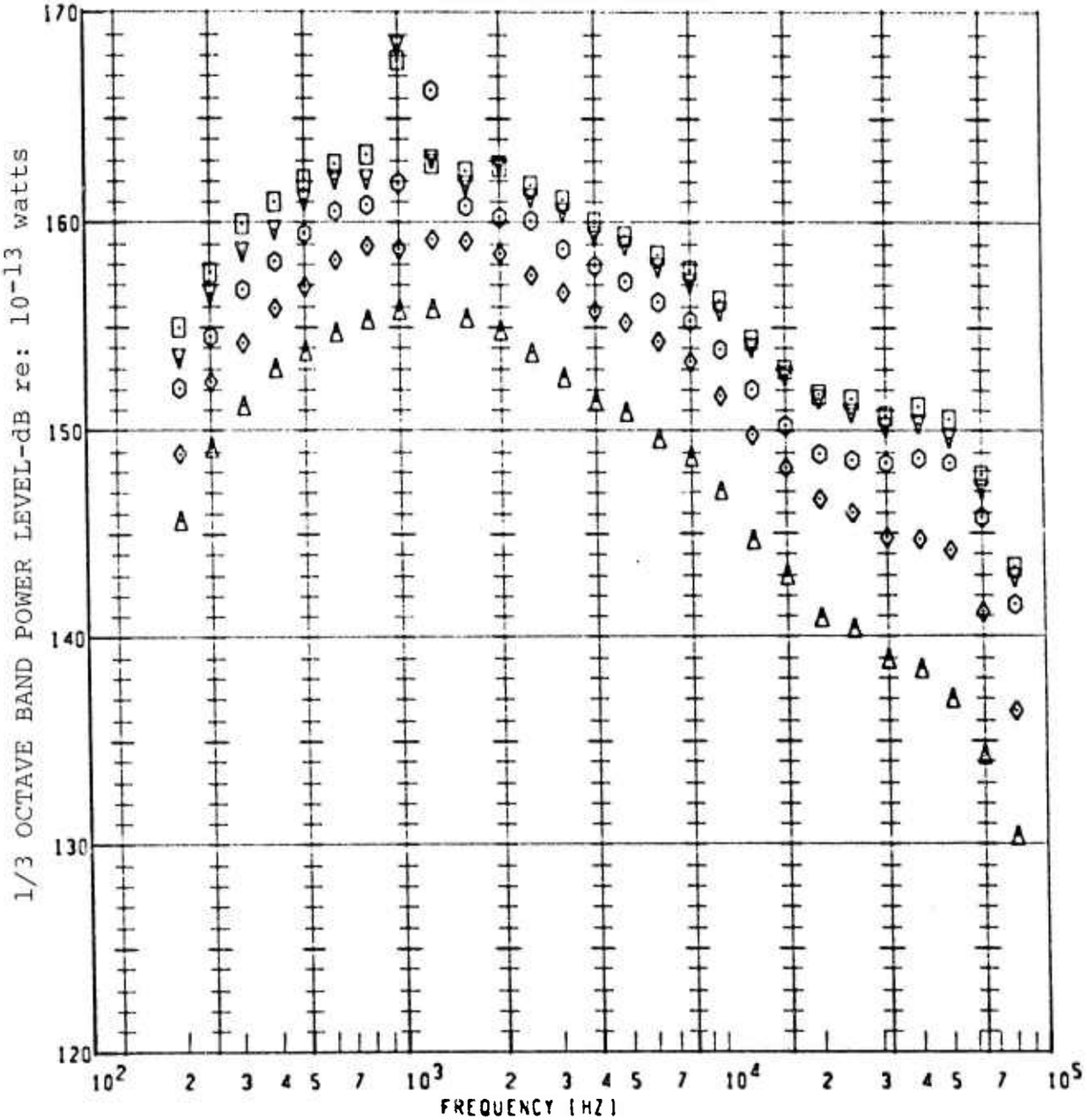
DATE: 11-21-73 T_{AMB} = **R.H.** =

SCALE MODEL A_8 =

RUN NO.	NPR	T_T	V_J (IDEAL)	REMARKS	REF
03	2.0	1500°F	2072 fps	11-21-73	
"	2.5	"	2351	"	
"	3.0	"	2548	"	
"	3.5	"	2697	"	
"	3.8	"	2771	"	

MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH CONCRETE GROUND SURFACE. MEASURED ACOUSTIC DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.

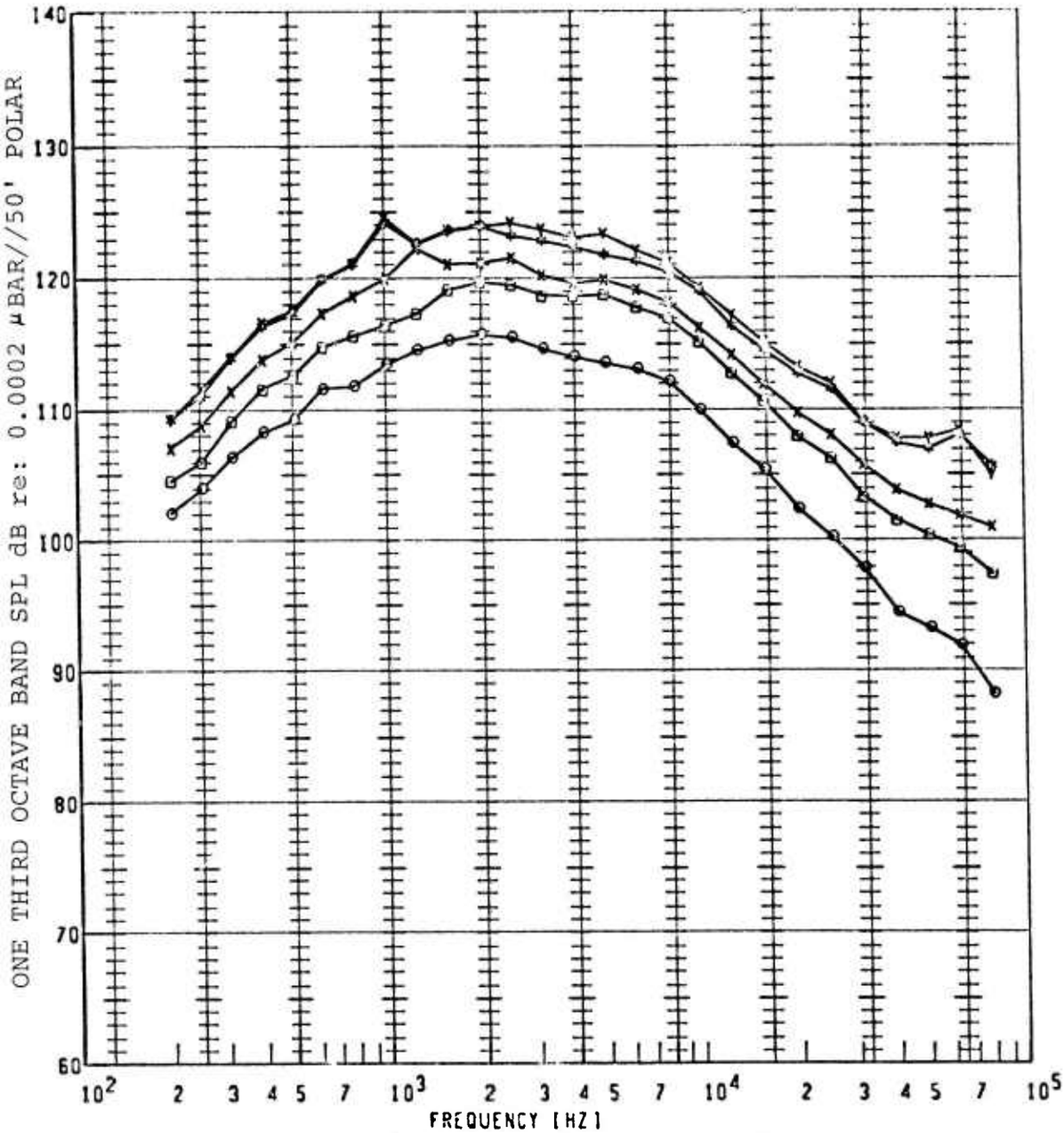
FREE FIELD VALUES



PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	3	2.00	1500°F
◇	3	2.50	1500
⊙	3	3.00	1500
▽	3	3.50	1500
⊡	3	3.80	1500

NOZZLE: 6" R/C

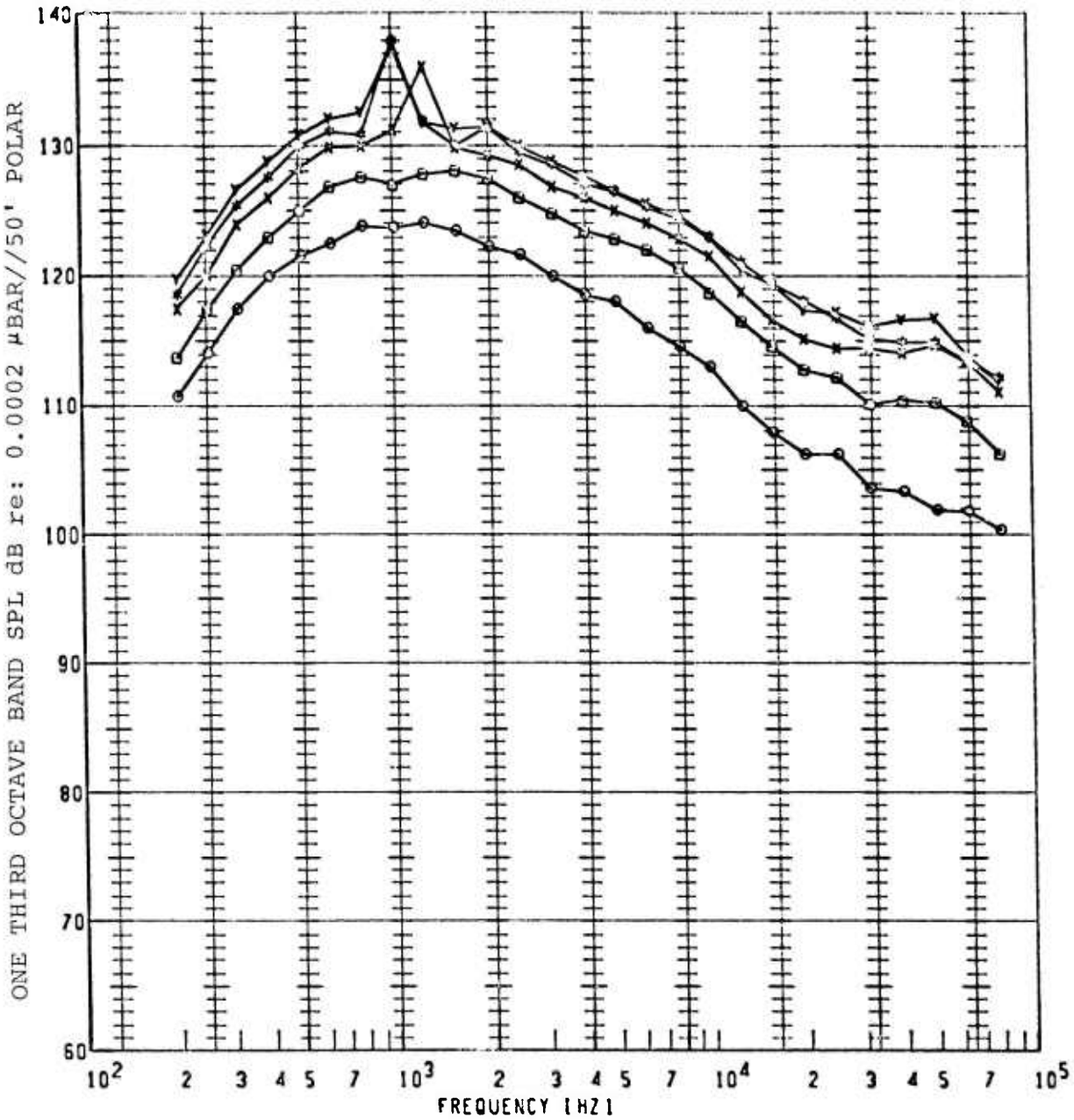
SPECTRA ARE FREE FIELD + 6dB



PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL [DB]
⊖	36	1500°F	2.000	110	50FP	125.4
⊟	36	1500	2.500	110	50FP	129.5
x	36	1500	3.000	110	50FP	131.6
*	36	1500	3.500	110	50FP	133.9
Y	36	1500	3.800	110	50FP	134.4

NOZZLE: 6" R/C

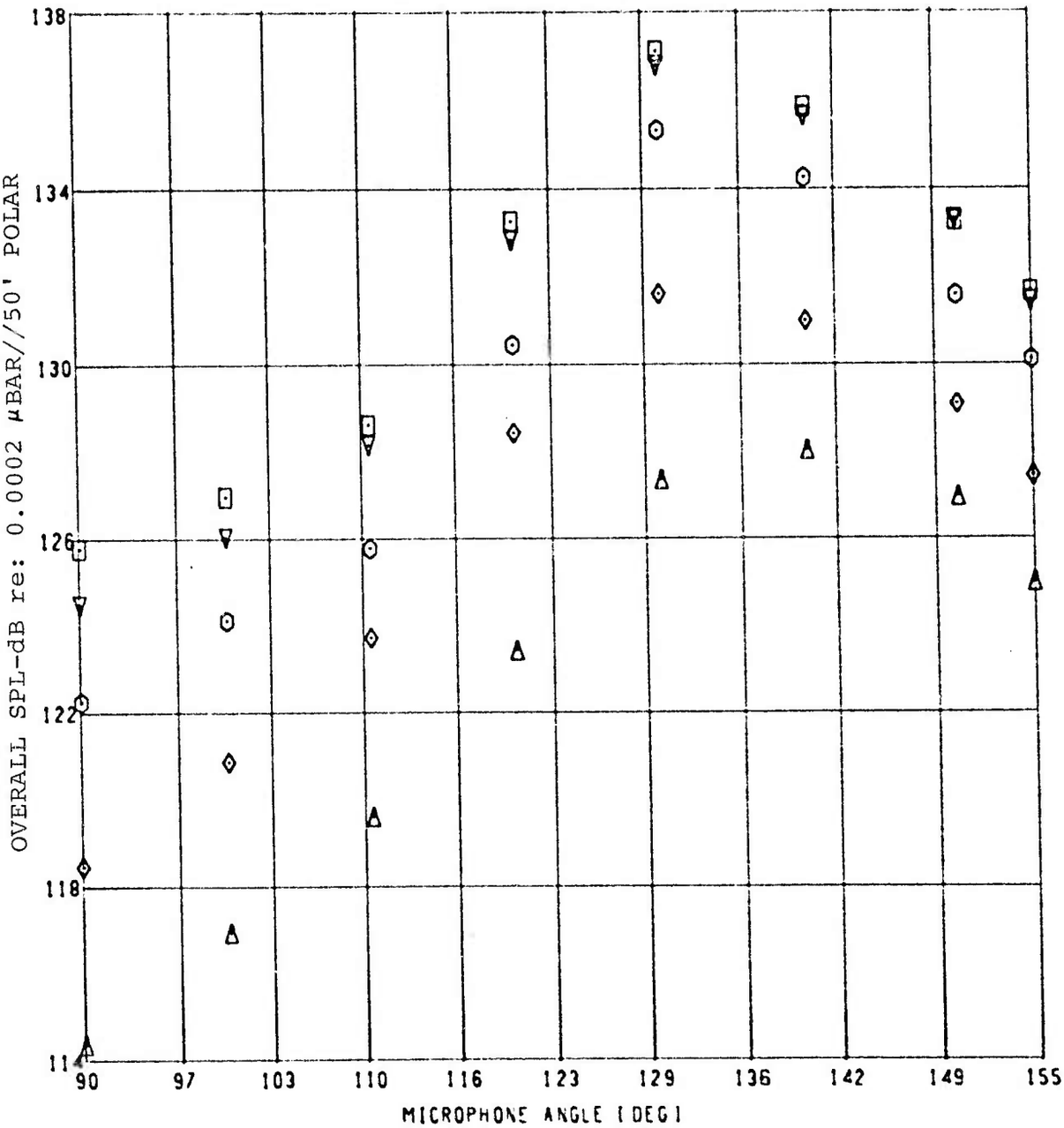
SPECTRA ARE FREE FIELD + 6dB



PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL (DB)
⊙	36	1500°F	2.000	130	50FP	133.3
⊡	36	1500	2.500	130	50FP	137.5
x	36	1500	3.000	130	50FP	141.2
*	36	1500	3.500	130	50FP	142.7
Y	36	1500	3.800	130	50FP	143.0

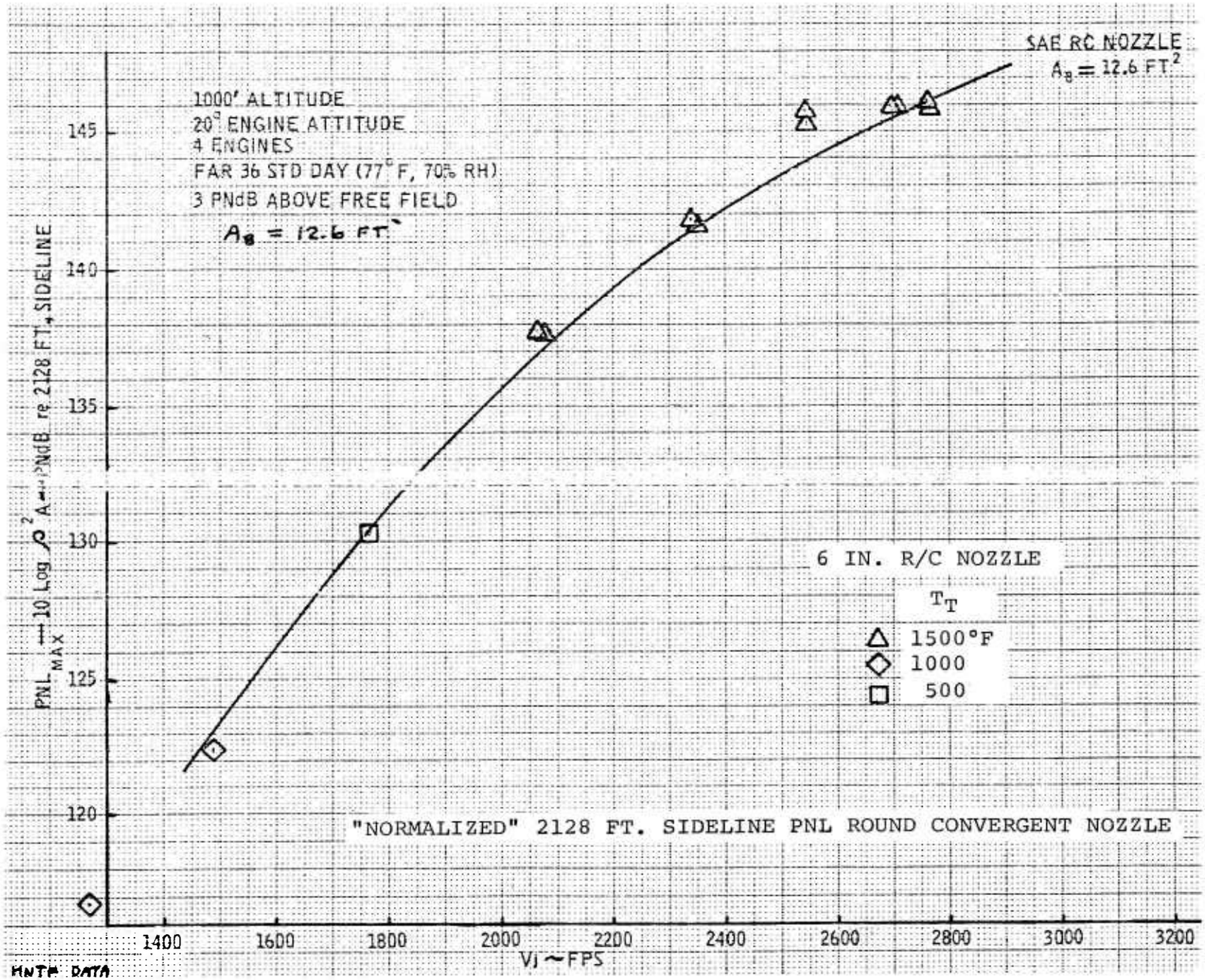
NOZZLE: 6" R/C

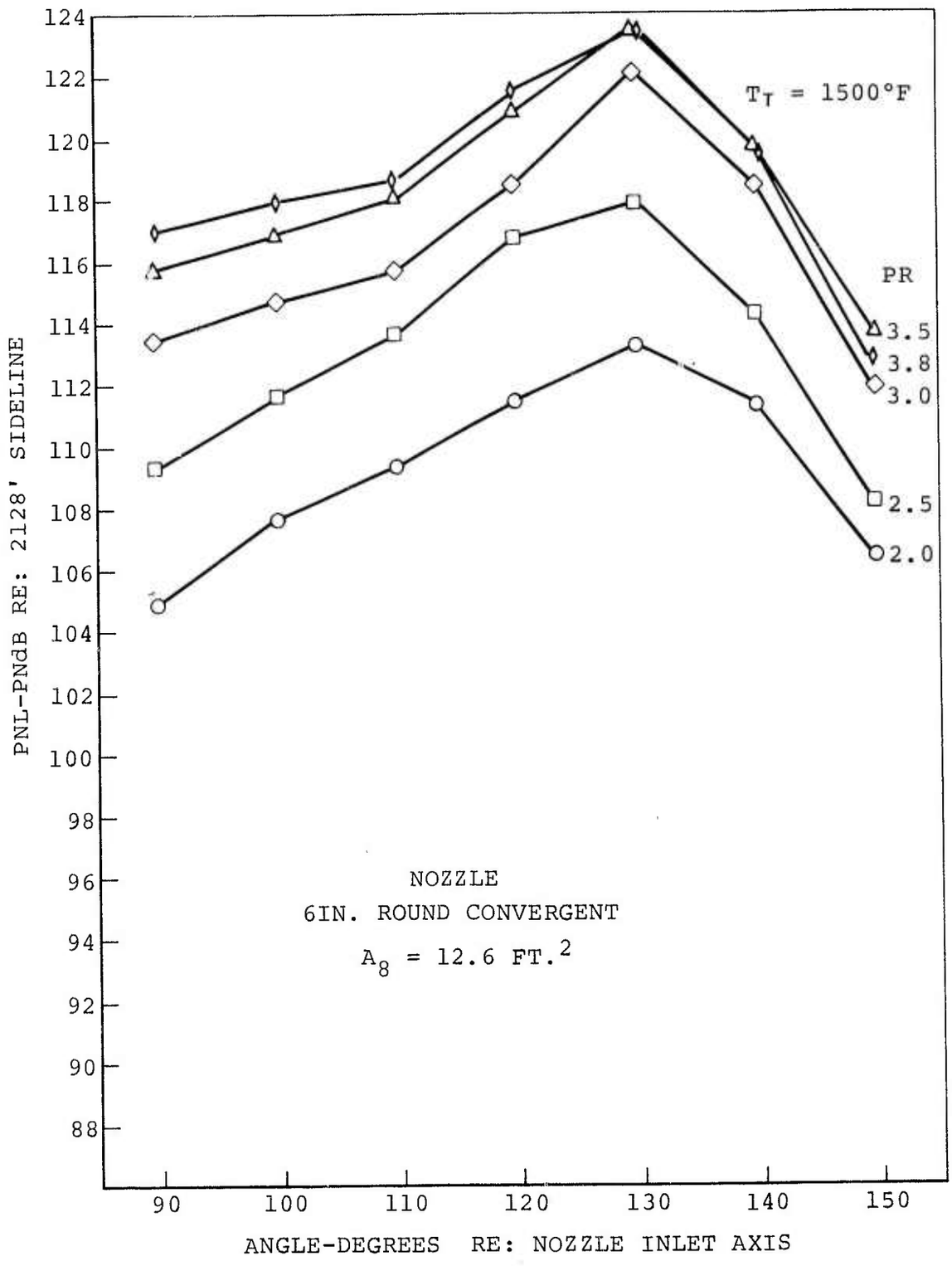
FREE FIELD VALUES



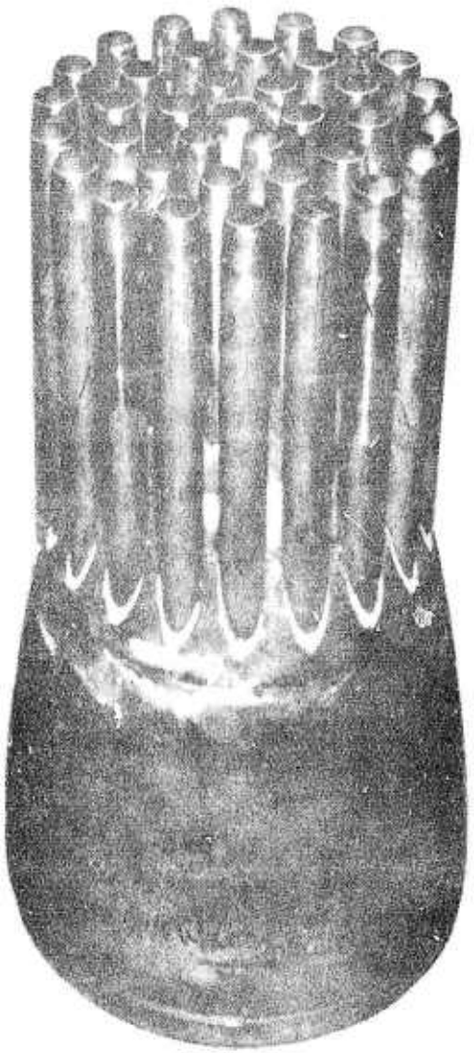
PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	3	2.00	1500°F
◇	3	2.50	1500
⊙	3	3.00	1500
▽	3	3.50	1500
⊡	3	3.80	1500

NOZZLE: 6" R/C


SAE RC NOZZLE
$A_8 = 12.6\ FT^2$
1000' ALTITUDE
20° ENGINE ATTITUDE
4 ENGINES
FAR 36 STD DAY (77° F, 70% RH)
3 PNdB ABOVE FREE FIELD
$A_8 = 12.6\ FT^2$
6 IN. R/C NOZZLE
T_T
1500°F
1000
500
"NORMALIZED" 2128 FT. SIDELINE PNL ROUND CONVERGENT NOZZLE
PNL_{MAX} — 10 Log ρ^2 A — PNdB re 2128 FT. SIDELINE
145
140
135
130
125
120
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
V_j ~ FPS
NNTP DATA



ROUND CONVERGENT NOZZLE PERCEIVED NOISE LEVEL BEAM PATTERN



37TUBE, 3.3 AREA RATIO REFERENCE NOZZLE

NO
SCHEMATIC
AVAILABLE

NOZZLE EXIT PATTERN SIMILAR TO THAT SHOWN ON PAGE 109

37T-3.3AR-CPA-RT/RC NOZZLE

TEST CONDITIONS

NOZZLE: 37T-3.3AR-CPA-RT/RC

FACILITY: HNTF

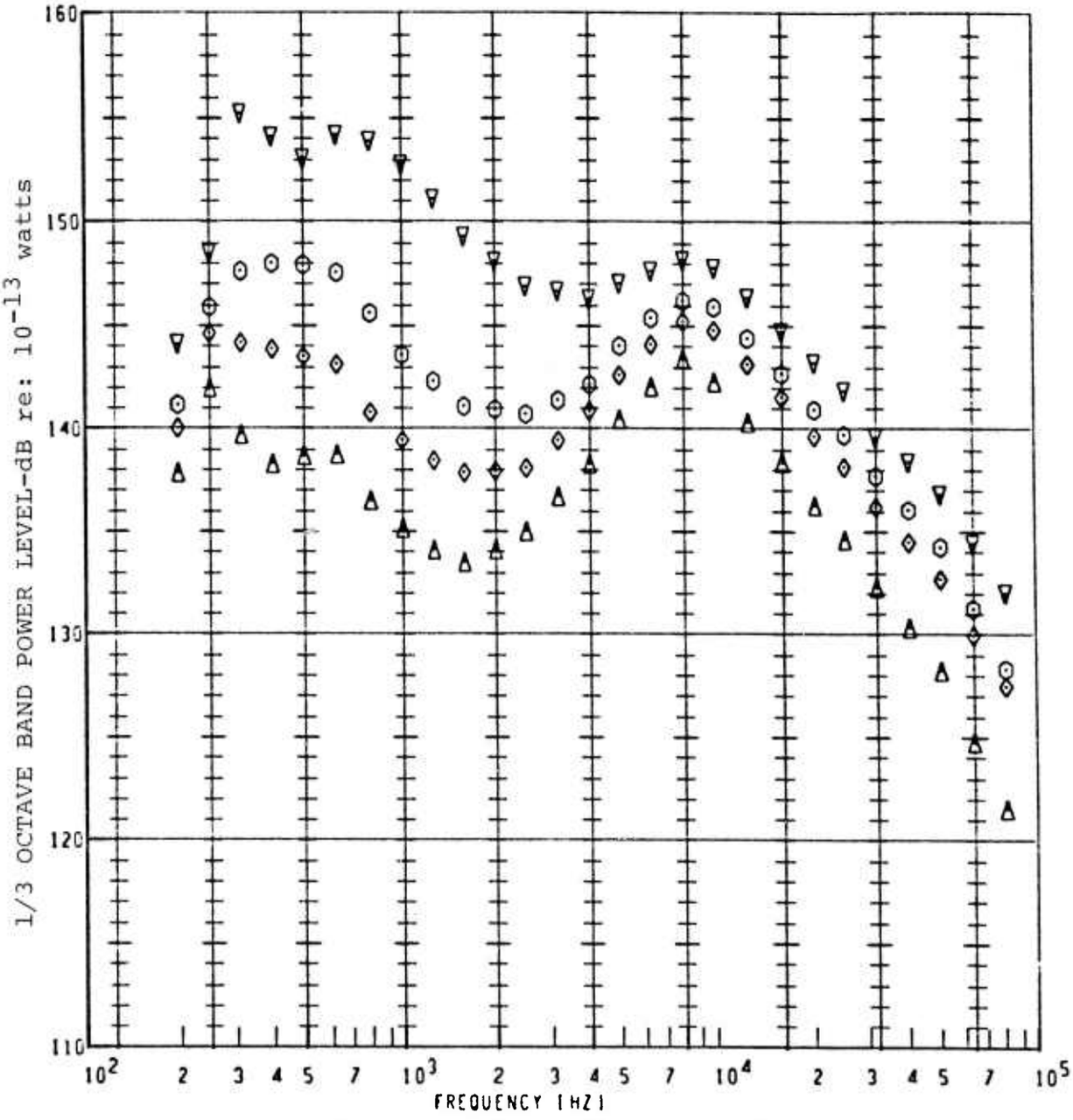
DATE: T_{AMB} = **R.H.** =

SCALE MODEL A_8 = 13.6 $in.^2$

RUN NO.	NPR	T_T	V_J (IDEAL)	REMARKS	REF
66	2.0	1150°F	1875 fps		
"	2.5	"	2126		
"	3.0	"	2303		
"	4.0	"	2544		

MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH CONCRETE GROUND SURFACE. MEASURED ACOUSTIC DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.

FREE FIELD VALUES

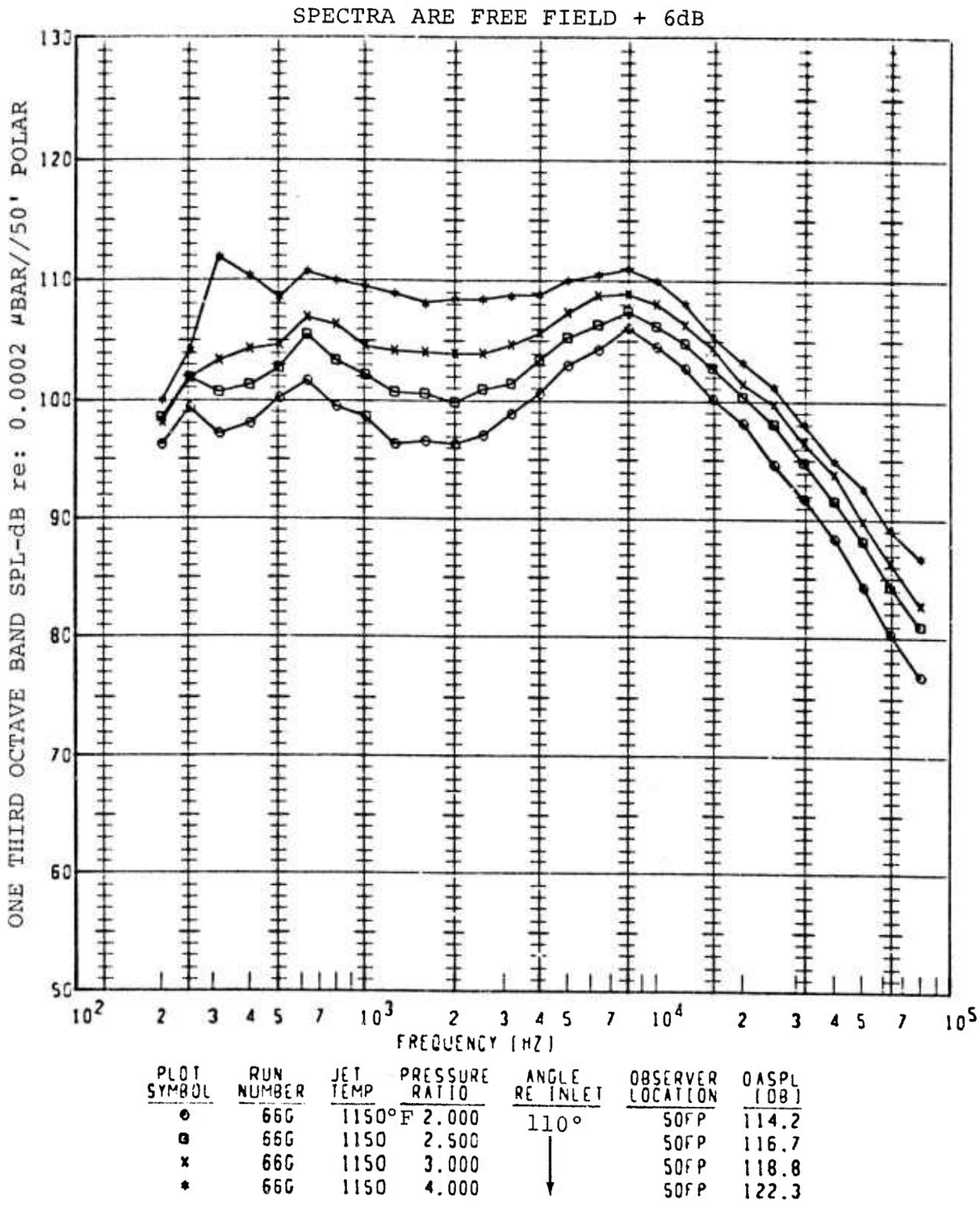


PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	66	2.00	1150°F
◇	66	2.50	1150
⊙	66	3.00	1150
▽	66	4.00	1150

A = 13.6 IN.^{2}

NOZZLE: 37T-3.3AR-CPA-RT/RC

JET NOISE POWER SPECTRA

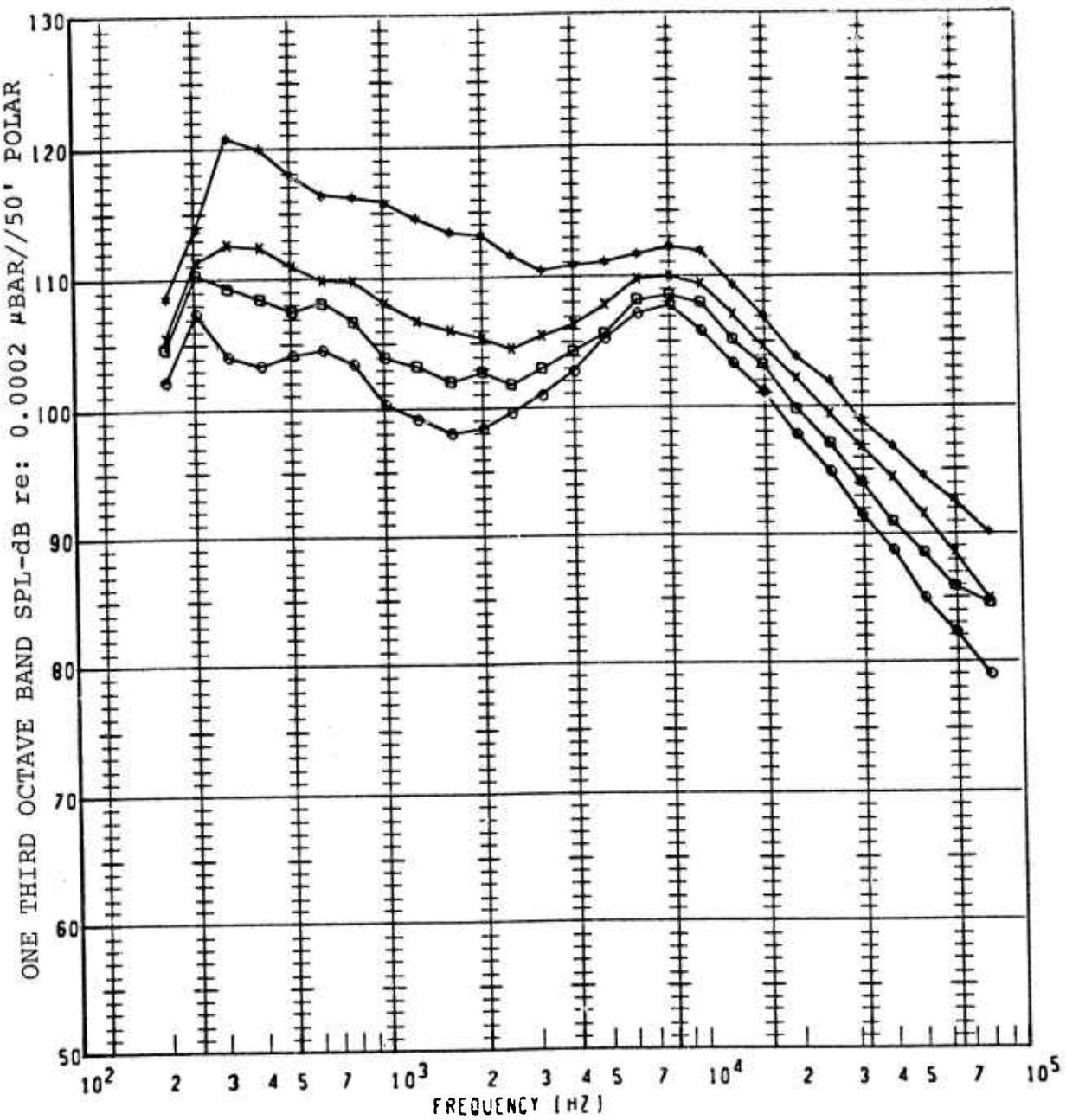


PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL (DB)
●	660	1150°F	2.000	110°	50FP	114.2
■	660	1150	2.500	↓	50FP	116.7
×	660	1150	3.000		50FP	118.8
*	660	1150	4.000		50FP	122.3

NOZZLE: 37T-3.3AR-CPA-RT/RC

MEASURED NOISE SPECTRA AT 110° re: NOZZLE INLET AXIS

SPECTRA ARE FREE FIELD + 6dB

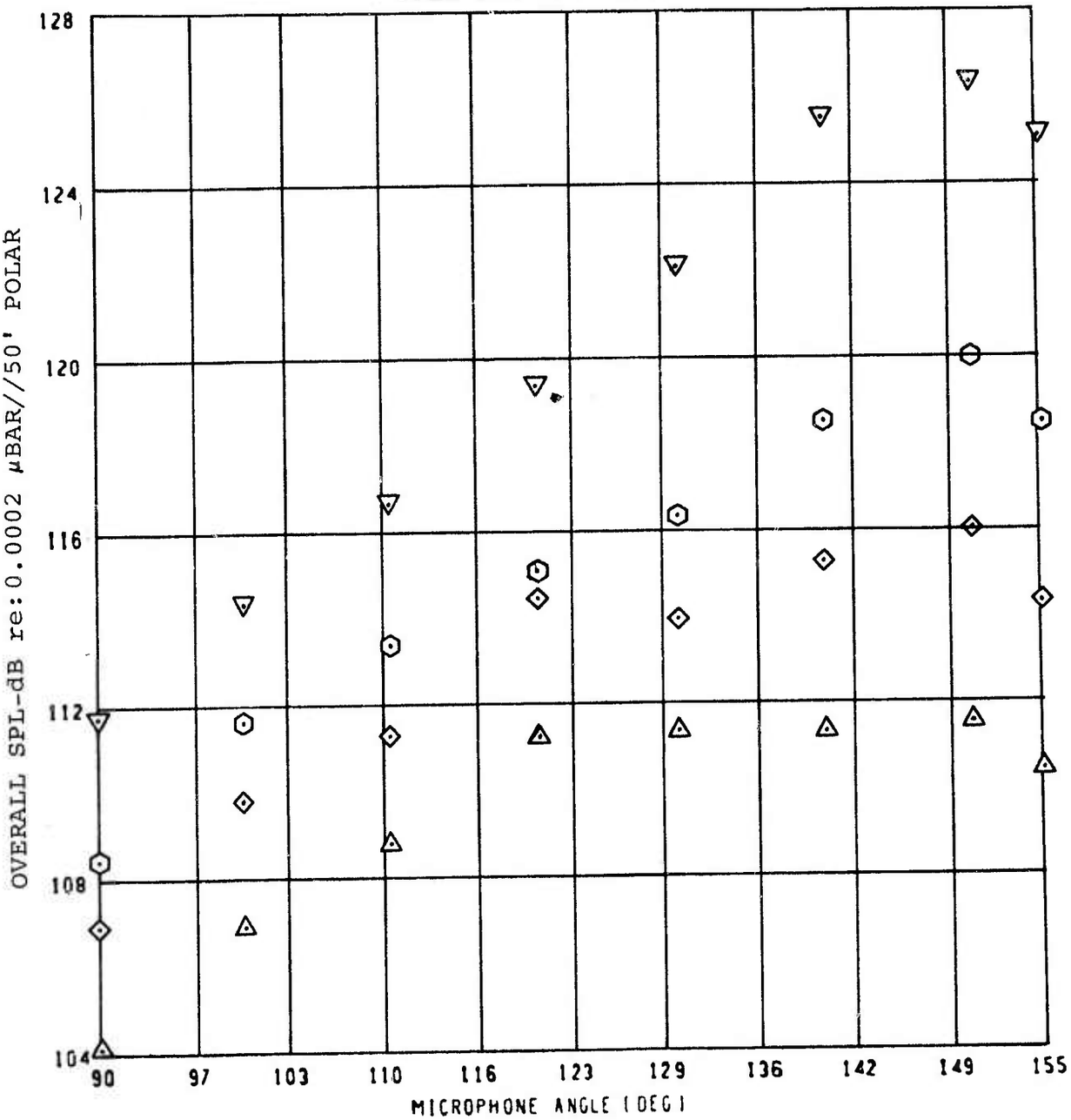


PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL (OB)
●	660	1150°F	2.000	130°	50FP	117.0
■	660	1150	2.500	↓	50FP	119.6
x	660	1150	3.000	↓	50FP	122.0
*	660	1150	4.000	↓	50FP	127.9

NOZZLE: 37T-3.3AR-CPA-RT/RC

MEASURED NOISE SPECTRA AT 130° re: NOZZLE INLET AXIS

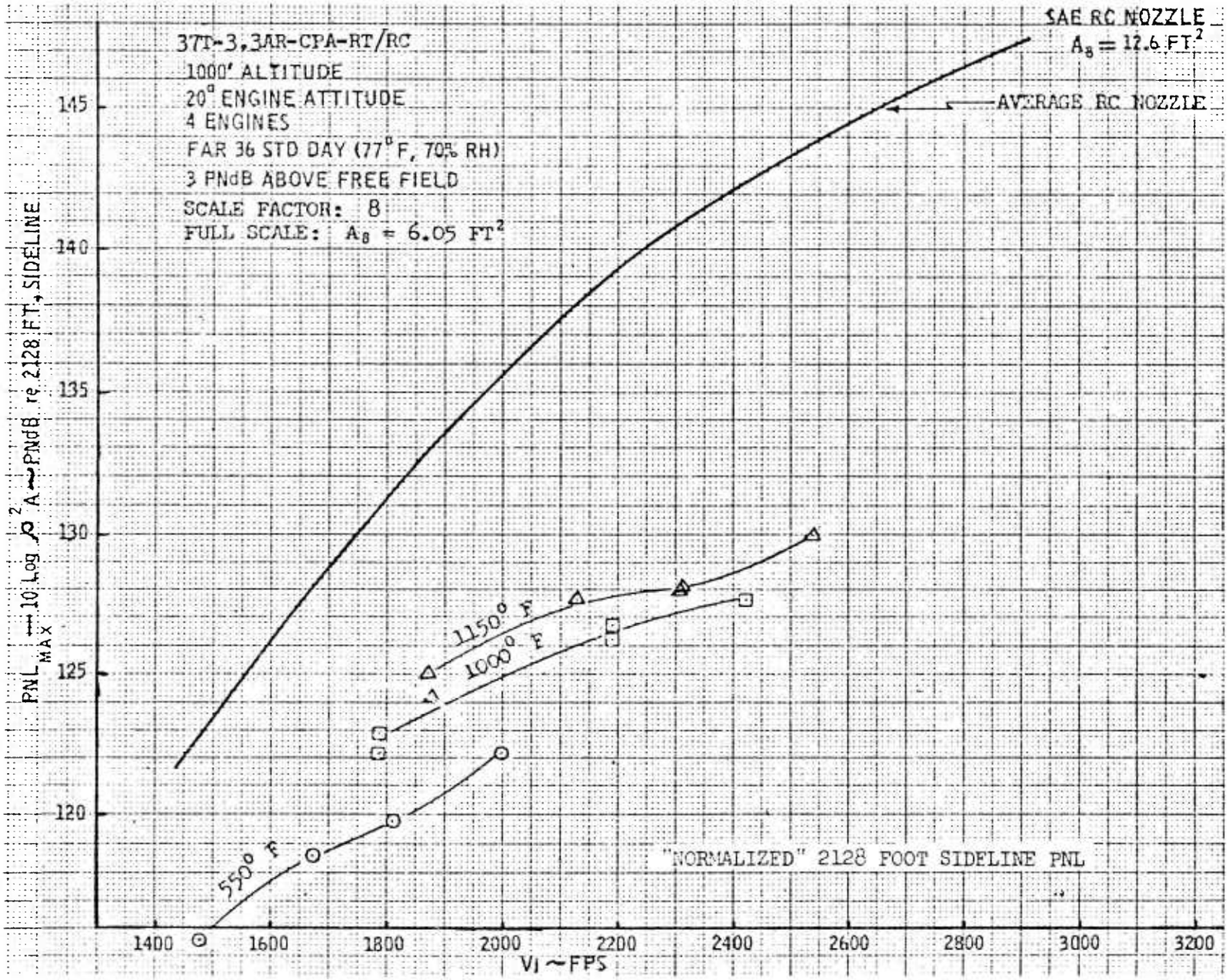
FREE FIELD VALUES



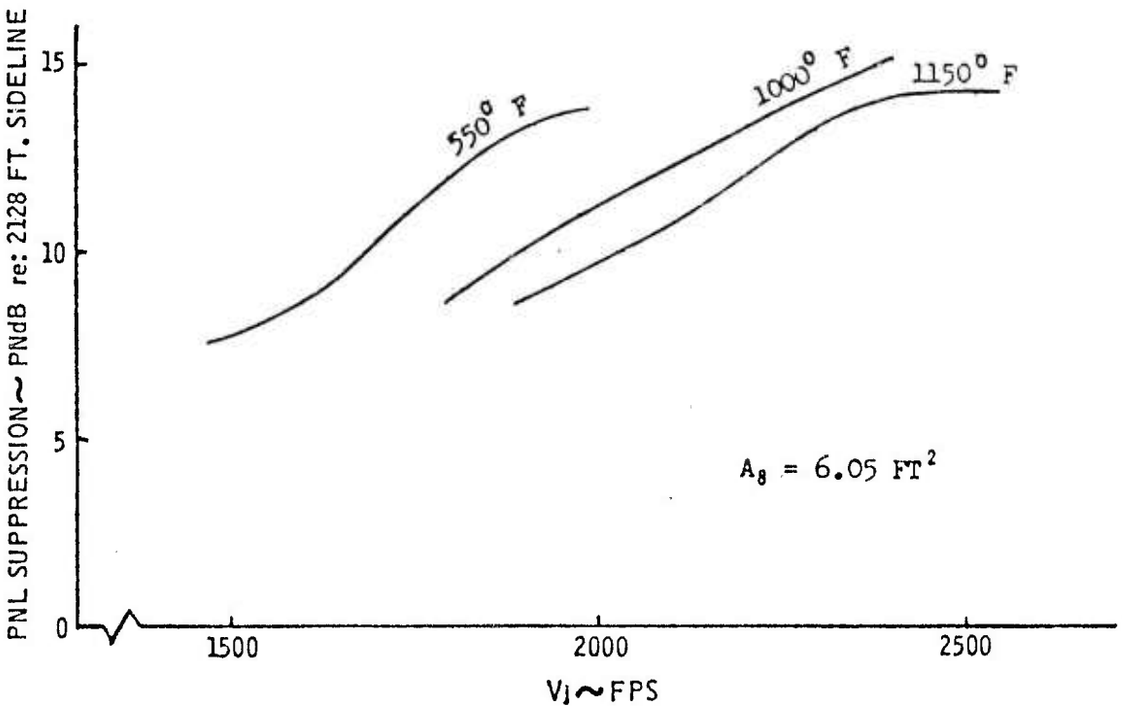
PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	66	2.00	1150°F
◇	66	2.50	1150
○	66	3.00	1150
▽	66	4.00	1150

NOZZLE: 37T-3.3AR-CPA-RT/RC

OASPL BEAM PATTERNS

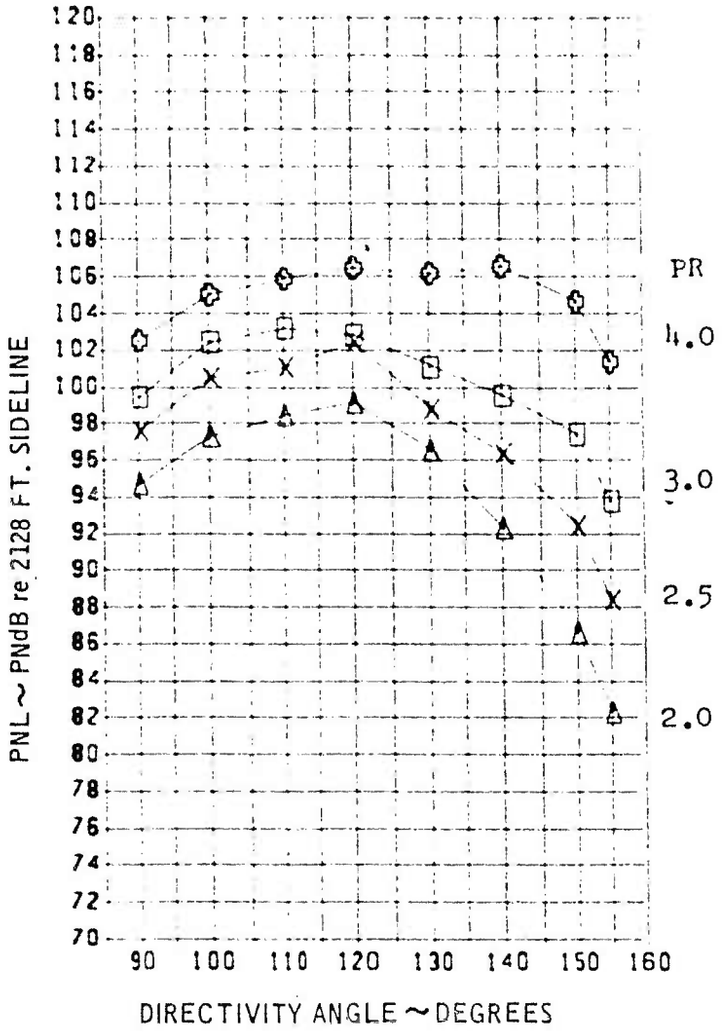

37D-3,3AR-CPA-RT/RC
1000' ALTITUDE
20° ENGINE ATTITUDE
4 ENGINES
FAR 36 STD DAY (77° F, 70% RH)
3 PNdB ABOVE FREE FIELD
SCALE FACTOR: 8
FULL SCALE: A_8 = 6.05 FT²
SAE RC NOZZLE
A_8 = 12.6 FT²
AVERAGE RC NOZZLE
1150° F
1000° F
550° F
"NORMALIZED" 2128 FOOT SIDELINE PNL
PNL MAX — 10 Log A² ~PNdB re 2128 FT, SIDELINE
Vj ~FPS
145
140
135
130
125
120
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200

37T-3.3AR-CPA-RT/RC



PEAK PNL SUPPRESSION VALUES

NOZZLE: 37T-3.3AR-CPA-RT/RC

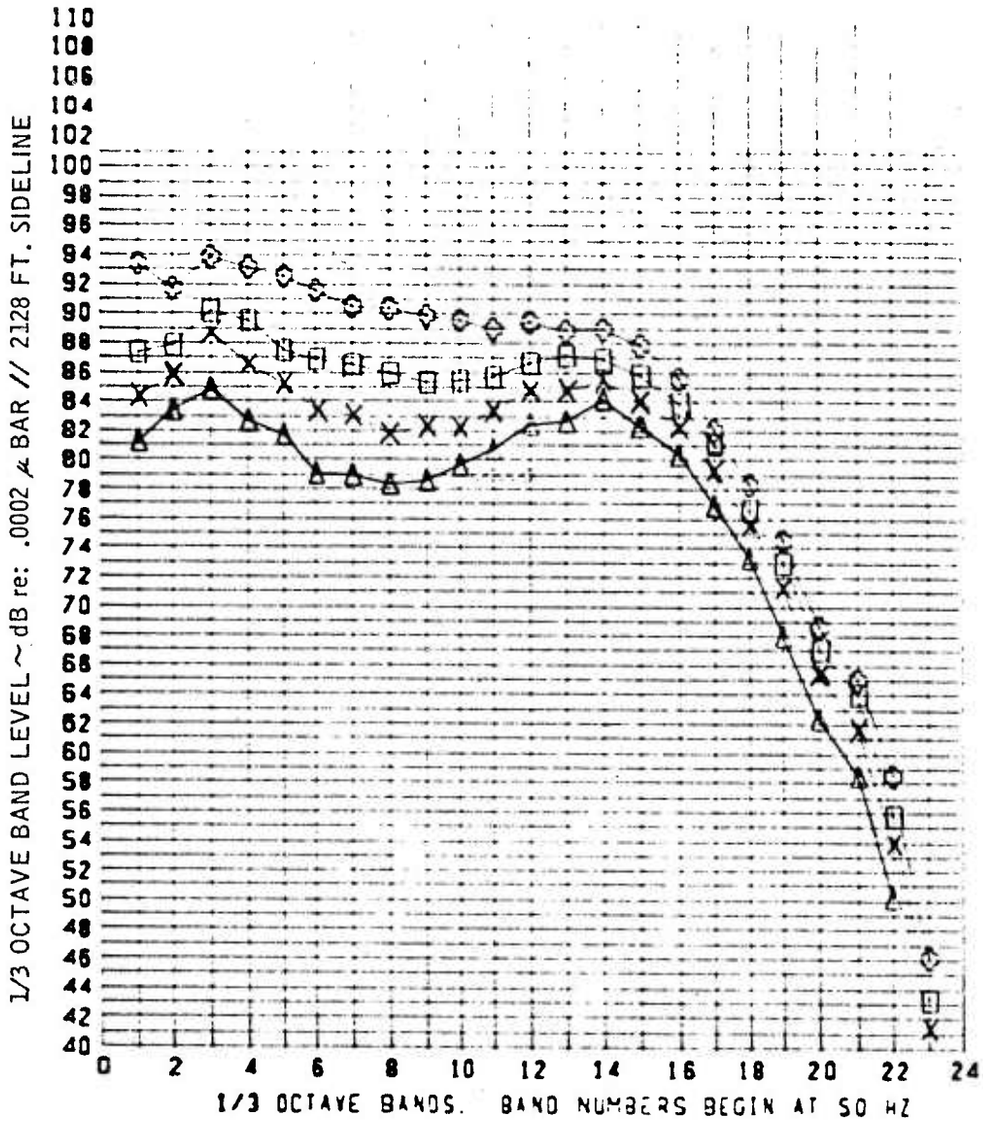


T_T = 1150°F A_8 = 6.05 FT^2 RUN: 66

PNL BEAM PATTERNS

ALT = 1000 FT, VEL = 0 FPS, SIDELINE = 2128 FT, 4 ENGINES

ANGLE: 110 DEG TEMP = 77 DEG R.H. = 70 PER CENT



T_T = 1150° F A_8 = 6.05 FT^2 RUN: 66

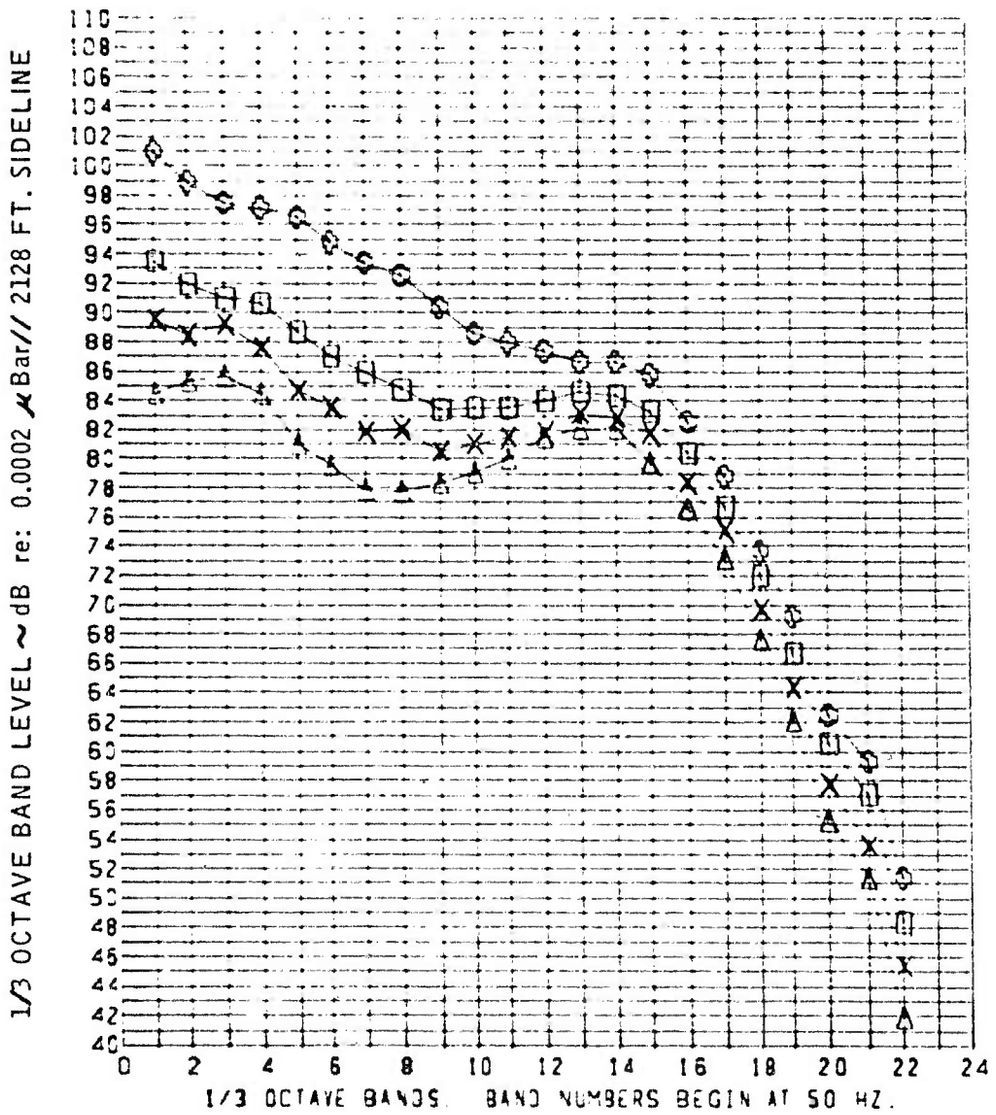
PR △ 2.0, ✕ 2.5, □ 3.0, ✣ 4.0

NOZZLE: 37T-3.3AR-CPA-RT/RC

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 110° re: NOZZLE INLET AXIS

ALT = 1000FT, VEL = 0 FPS, S.L. = 2128 FT., 4 ENGINES

ANGLE = 130 DEG TEMP = 77 DEG R.H.= 70 PER CENT



T_T = 1150° F A_8 = 6.05 FT^2 RUN: 66

PR = △ 2.0, ✕ 2.5, □ 3.0, ✠ 4.0

NOZZLE: 37T-3.3AR-CPA-RT/RC

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 130° re: NOZZLE INLET AXIS

TEST CONDITIONS

NOZZLE: 37T-3.3AR-CPA-RT/RC

FACILITY: WALL ISOLATION FACILITY

DATE: August 25, 1972

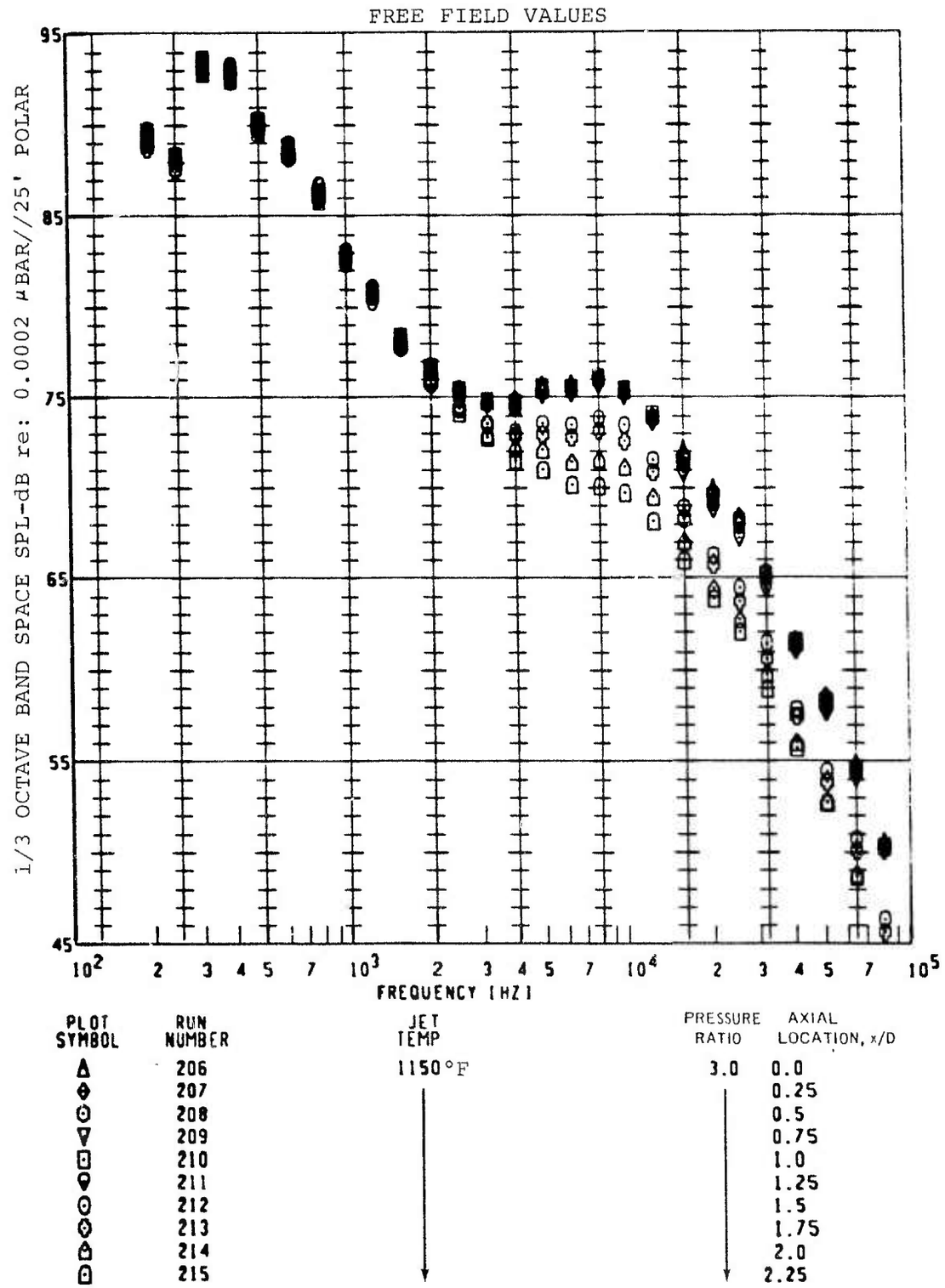
P_{AMB} = 30.05 in Hg T_{AMB} = 61°F R.H. = 82%

NPR = 3.0 T_T = 1150°F V_J (IDEAL) = 2300 FPS

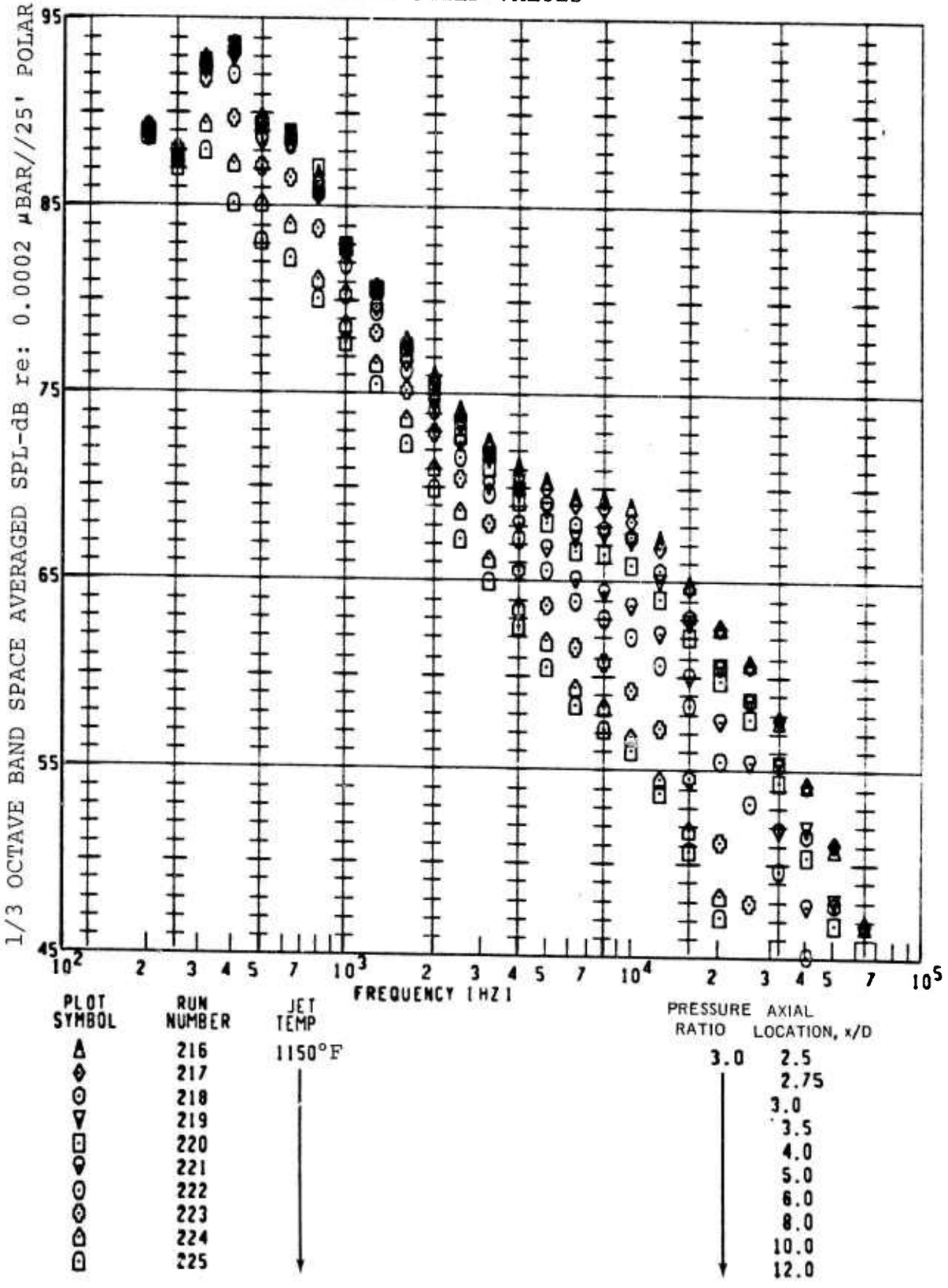
SCALE MODEL A_8 = 13.6 in.^{2}

RUN NO.	AXIAL LOCATION	IRIS DIA.	REMARKS	REF.
206	0.0 x/D	14.3 in.		
207	0.25	11.3		
208	0.50	11.8		
209	0.75	11.8		
210	1.0	12.3		
211	1.25	11.5		
212	1.50	11.8		
213	1.75	12.0		
214	2.0	12.3		
215	2.25	12.5		
216	2.5	12.8		
217	2.75	13.0		
218	3.0	13.3		
219	3.5	13.5		
220	4.0	14.0		
221	5.0	15.0		
222	6.0	16.0		
223	8.0	18.0		
224	10.0	20.0		
225	12.0	22.0		
226	14.0	23.0		
227	16.0	25.0		

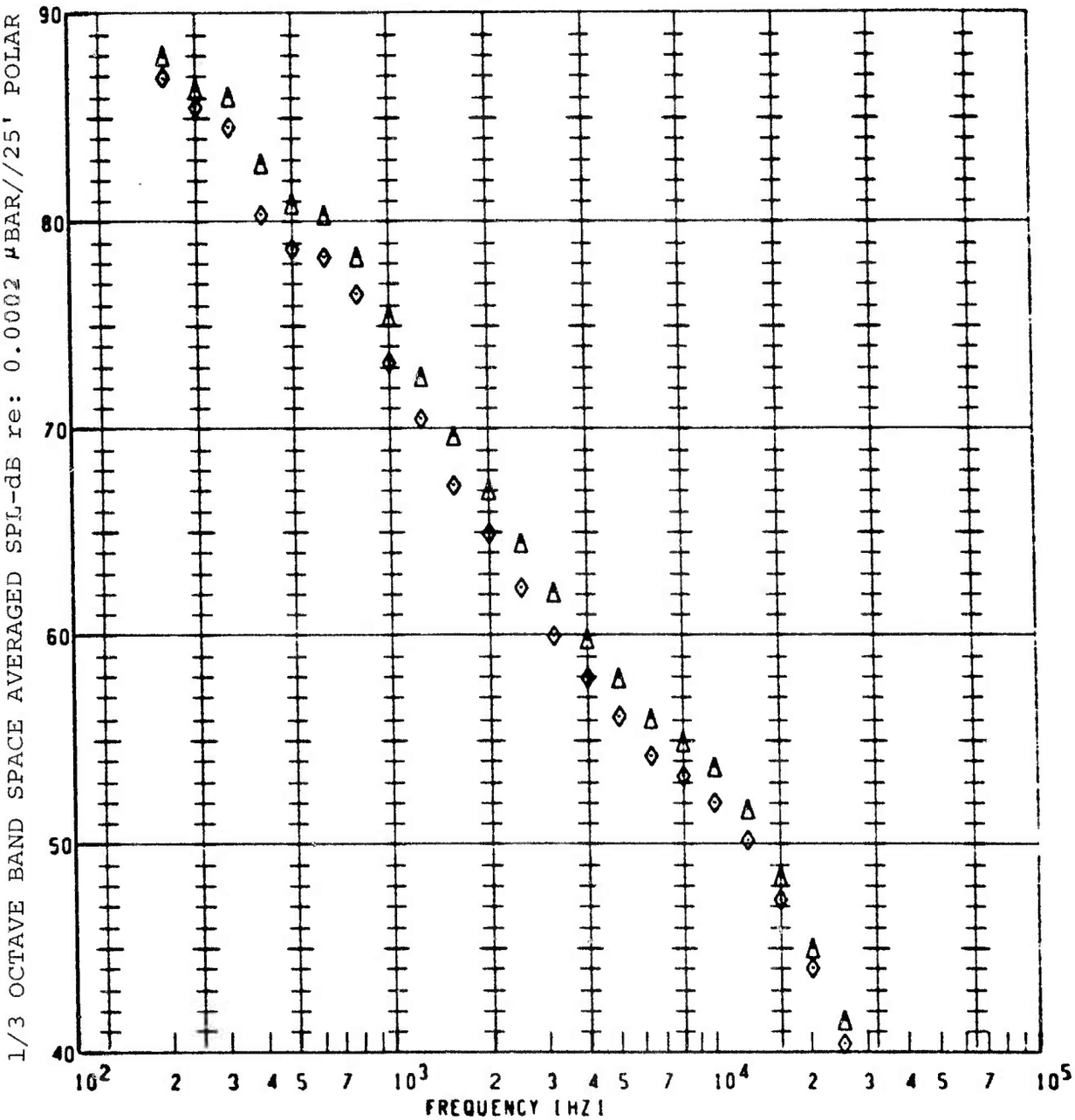
MICROPHONE LAYOUT: 25 FOOT VERTICAL POLAR ARC


FREE FIELD VALUES
1/3 OCTAVE BAND SPACE SPL-dB re: 0.0002 μBAR//25' POLAR
95
85
75
65
55
45
10²
2
3
4
5
7
10³
2
3
4
5
7
10⁴
2
3
4
5
7
10⁵
FREQUENCY (HZ)
PLOT SYMBOL
RUN NUMBER
JET TEMP
PRESSURE RATIO
AXIAL LOCATION, x/D
206
207
208
209
210
211
212
213
214
215
1150°F
3.0
0.0
0.25
0.5
0.75
1.0
1.25
1.5
1.75
2.0
2.25

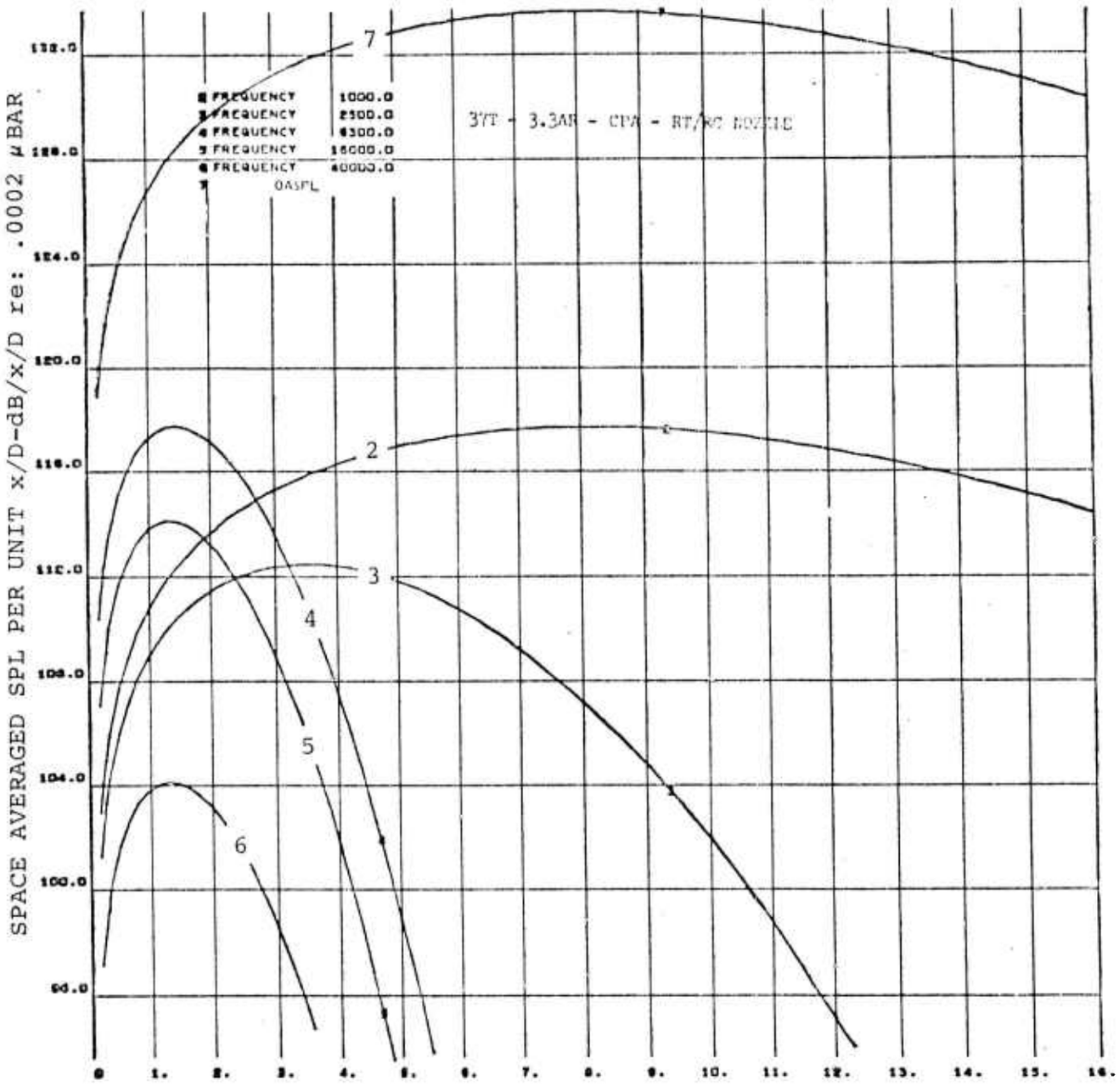
FREE FIELD VALUES

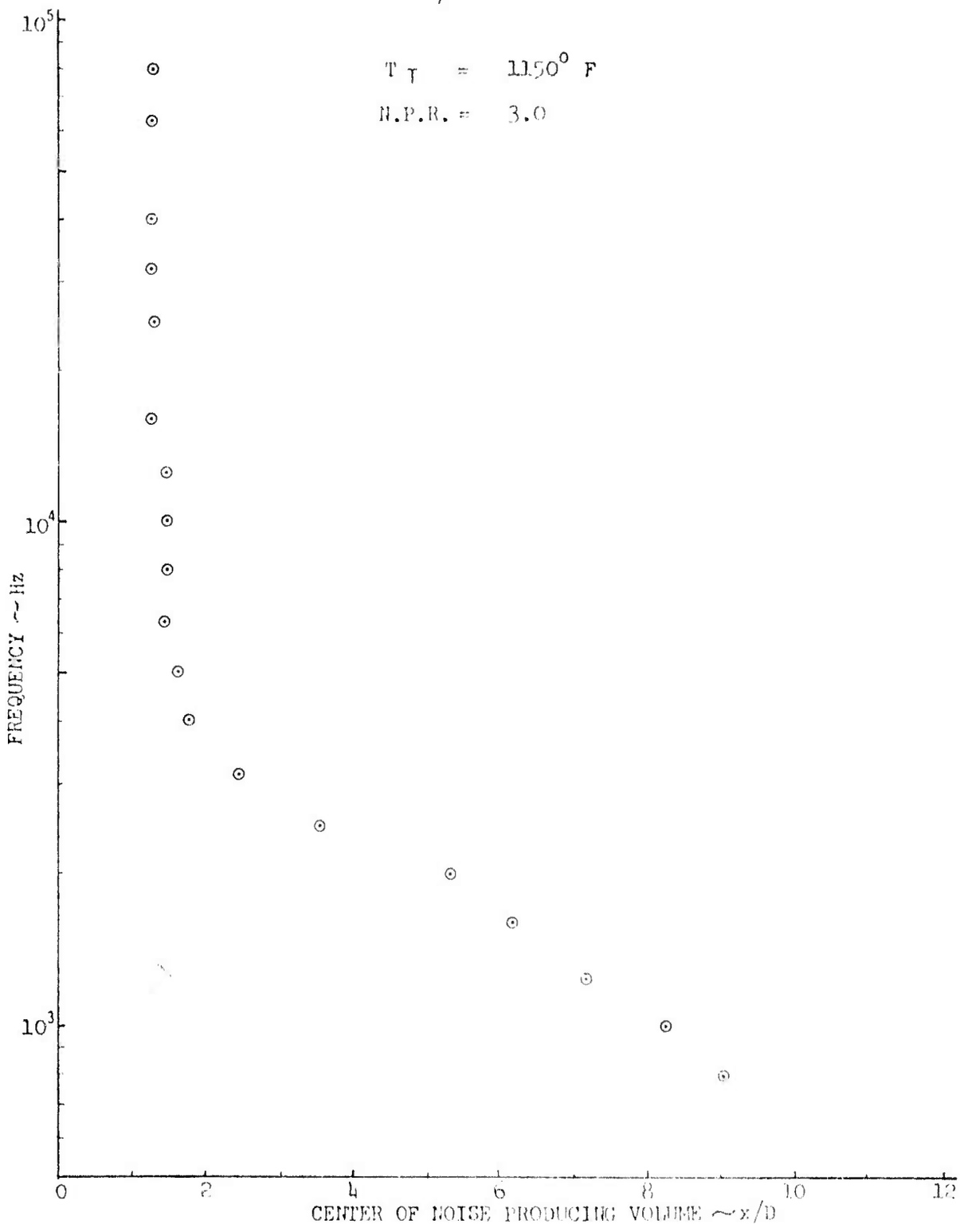


FREE FIELD VALUES

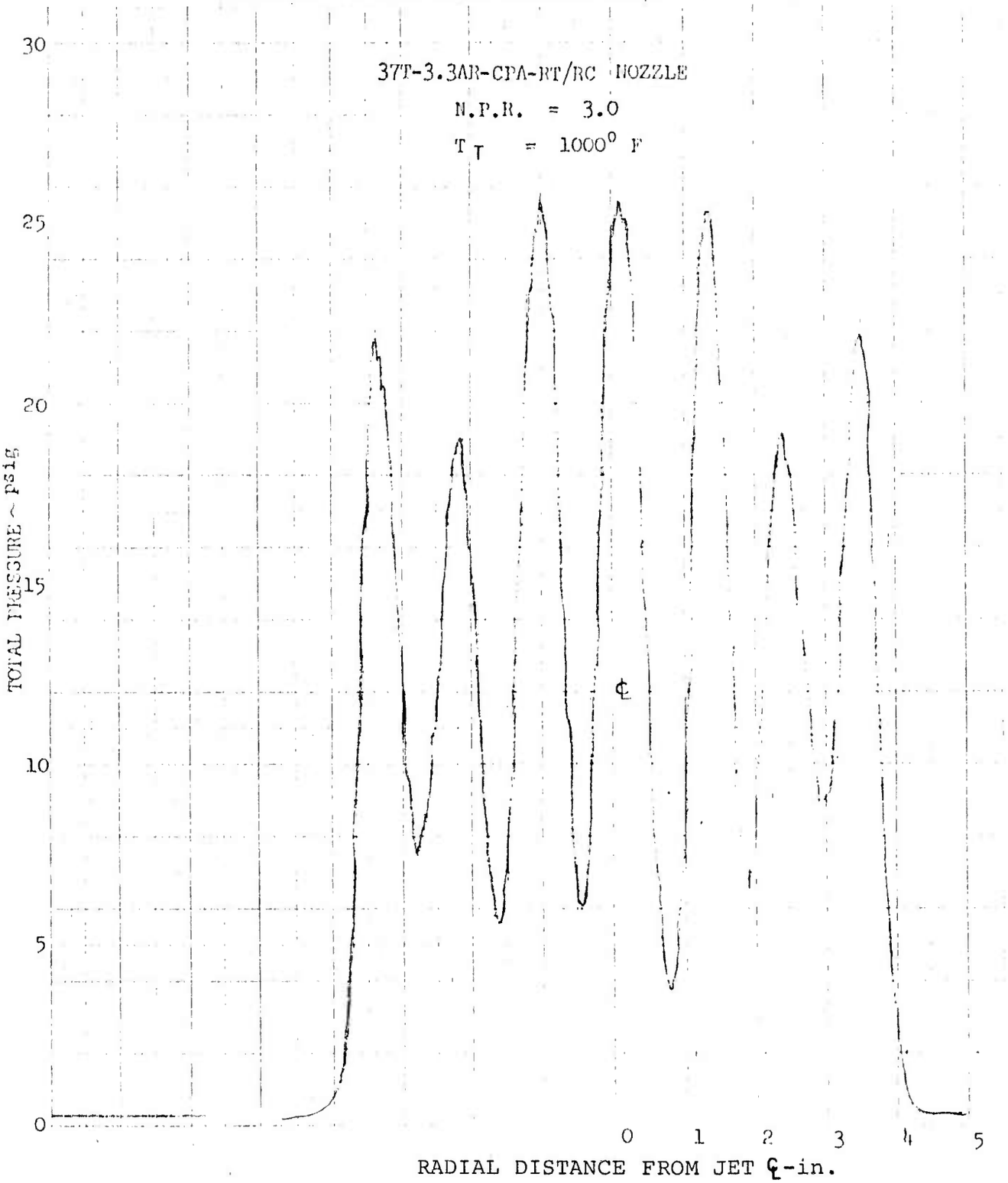


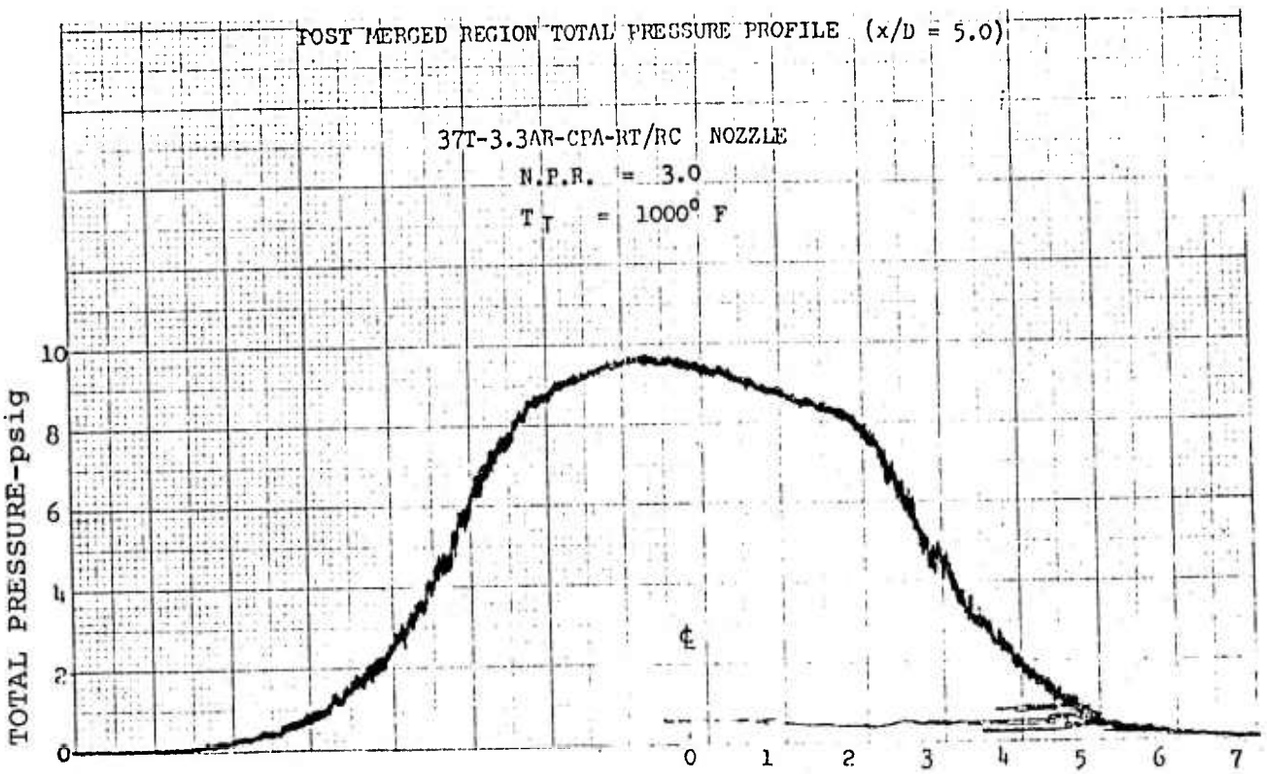
PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	AXIAL LOCATION, x/D
△	226	1150°F	3.0	14.0
◇	227	1150	3.0	16.0

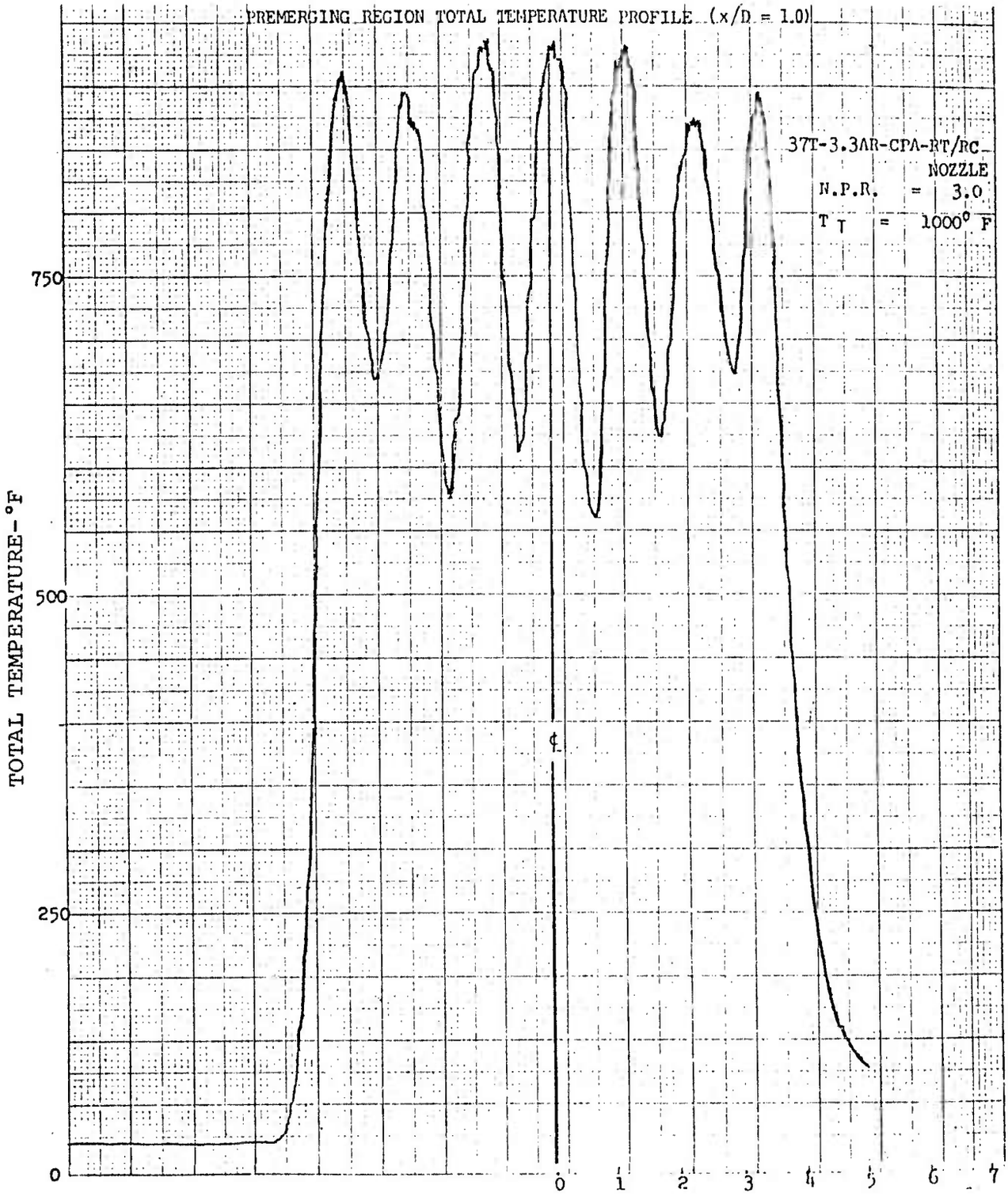

SPACE AVERAGED SPL PER UNIT x/D-dB/x/D re: .0002 μBAR
NOZZLE TO WALL SPACING-x/D
7
2
3
4
5
6
OASPL
FREQUENCY 1000.0
FREQUENCY 2500.0
FREQUENCY 6300.0
FREQUENCY 16000.0
FREQUENCY 40000.0
3YT - 3.3AR - CPA - RT/AC NOZZLE
0. 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14. 15. 16.

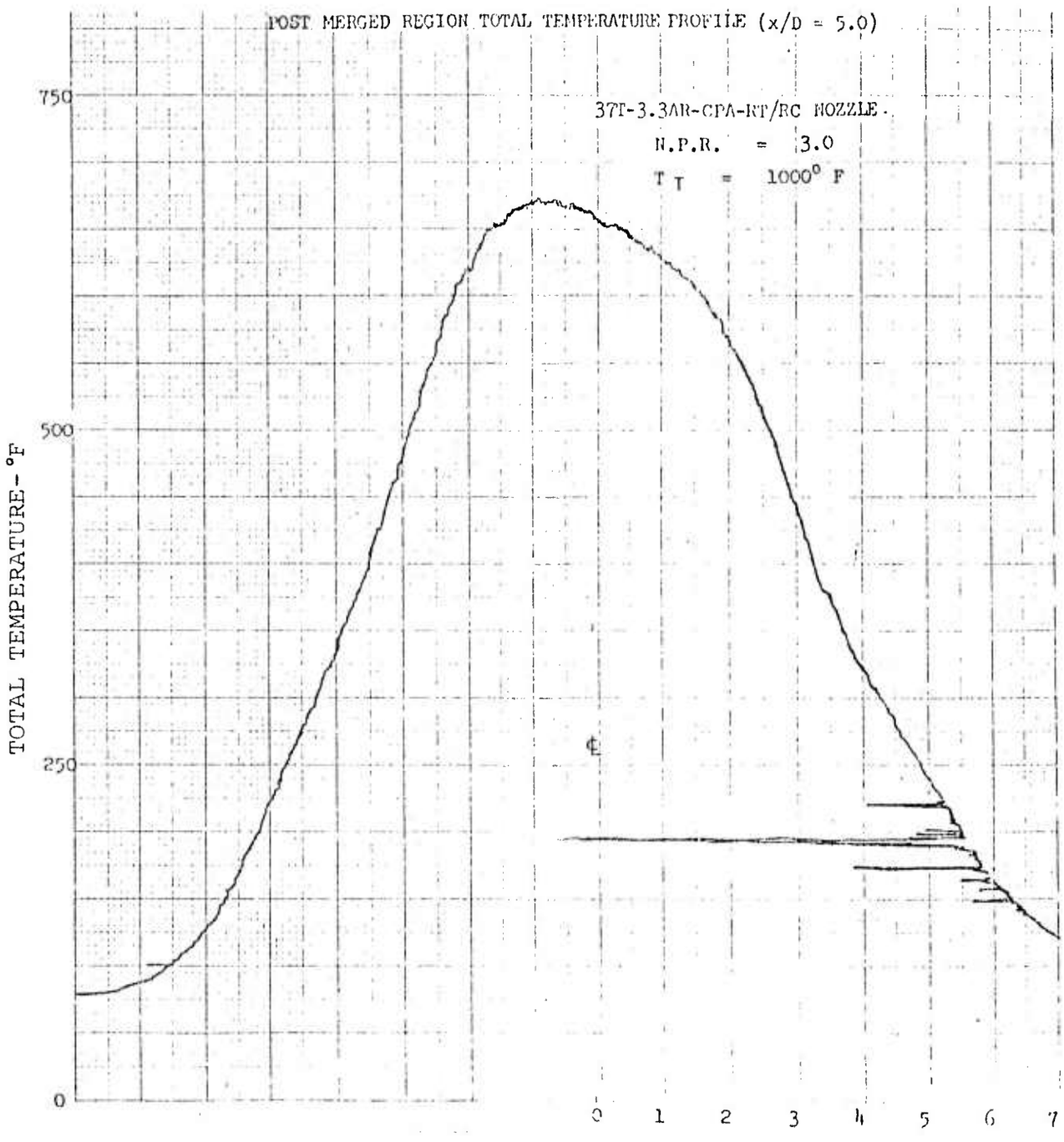

37T-3.3AR-CPA-RT/RC NOZZLE
T_T = 1150° F
N.P.R. = 3.0
10^5
10^4
10^3
FREQUENCY ~ Hz
0
2
4
6
8
10
12
CENTER OF NOISE PRODUCING VOLUME ~ x/D

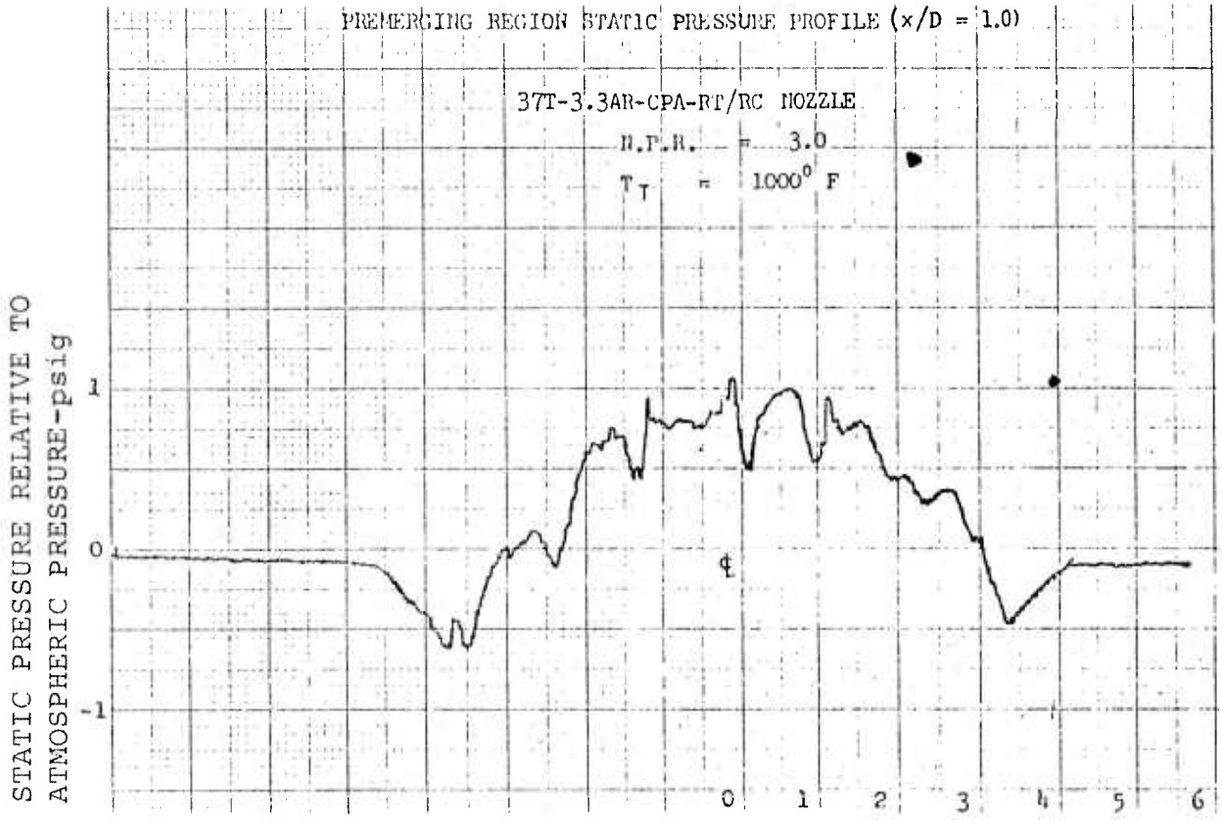
PREMERGING REGION TOTAL PRESSURE PROFILE (x/D = 1.0)

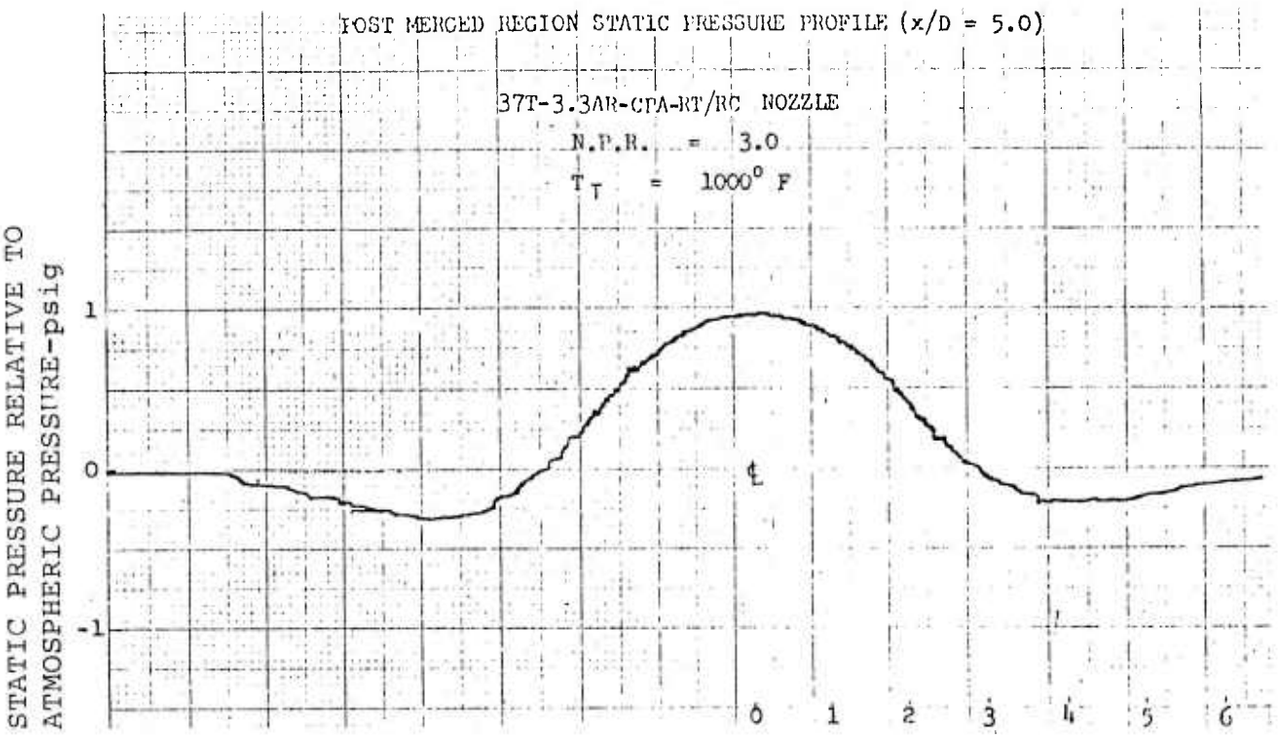


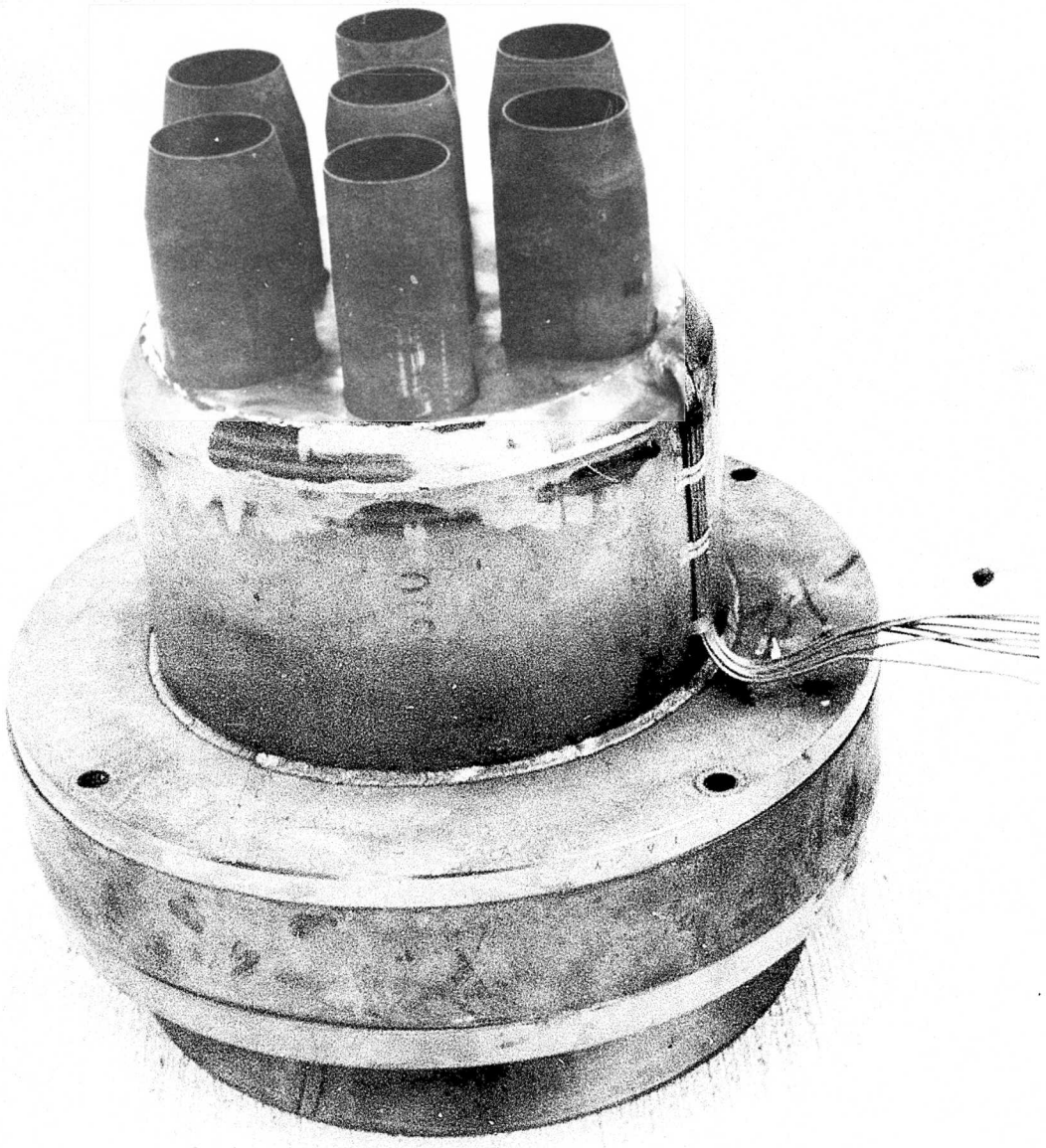

POST MERGED REGION TOTAL PRESSURE PROFILE (x/D = 5.0)
37T-3.3AR-CPA-RT/RC NOZZLE
N.P.R. = 3.0
T_T = 1000° F
TOTAL PRESSURE-psig
0
2
4
6
8
10
0
1
2
3
4
5
6
7
℄
RADIAL DISTANCE FROM JET ℄-in.


PREMERGING REGION TOTAL TEMPERATURE PROFILE (x/D = 1.0)
37T-3.3AR-CPA-RT/RC
NOZZLE
N.P.R. = 3.0
T_T = 1000° F
TOTAL TEMPERATURE-°F
0
250
500
750
0
1
2
3
4
5
6
7
RADIAL DISTANCE FROM JET ℄-in.

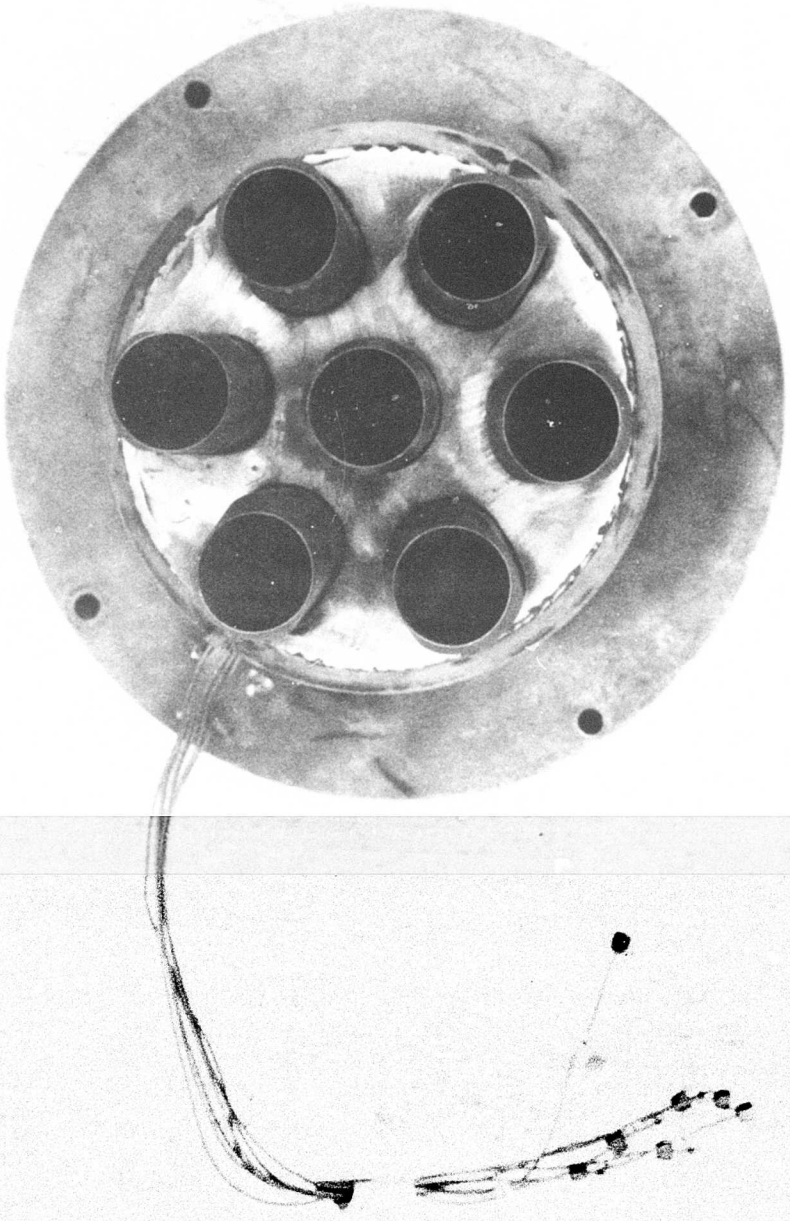

POST MERGED REGION TOTAL TEMPERATURE PROFILE (x/D = 5.0)
37T-3.3AR-CPA-RT/RC NOZZLE
N.P.R. = 3.0
T_T = 1000° F
TOTAL TEMPERATURE- °F
750
500
250
0
0
1
2
3
4
5
6
7
RADIAL DISTANCE FROM JET ℄-in.


PREMERGING REGION STATIC PRESSURE PROFILE (x/D = 1.0)
37T-3.3AR-CPA-RT/RC NOZZLE
N.P.R. = 3.0
T_T = 1000° F
STATIC PRESSURE RELATIVE TO ATMOSPHERIC PRESSURE-psig
1
0
-1
℄
0
1
2
3
4
5
6
RADIAL DISTANCE FROM JET ℄-in.


POST MERGED REGION STATIC PRESSURE PROFILE (x/D = 5.0)
37T-3.3AR-CPA-RT/RC NOZZLE
N.P.R. = 3.0
T_T = 1000° F
STATIC PRESSURE RELATIVE TO ATMOSPHERIC PRESSURE-psig
1
0
-1
℄
0 1 2 3 4 5 6
RADIAL DISTANCE FROM JET ℄-in.



7T-3.3AR-CPA-ET/RC NOZZLE

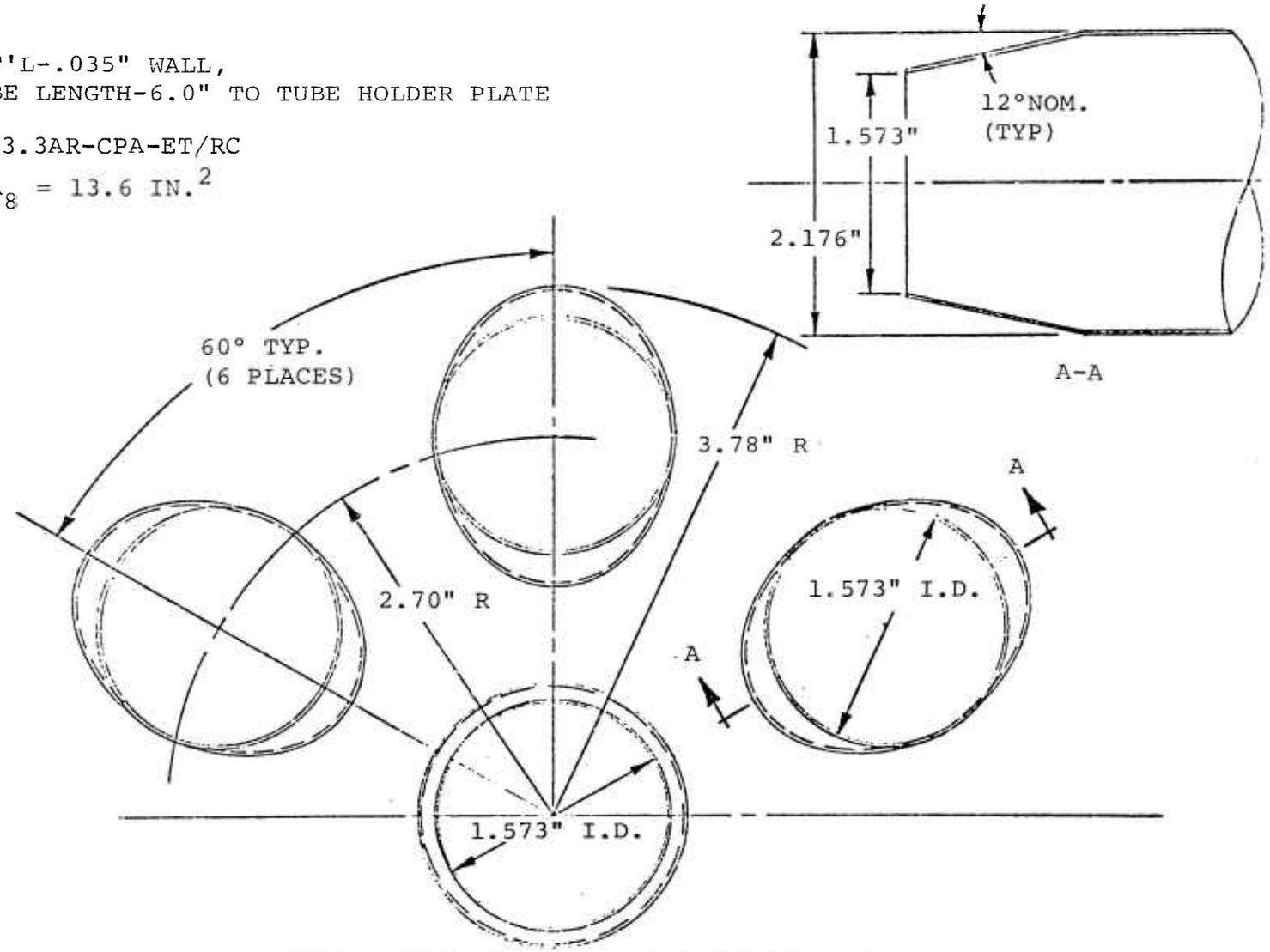


7T-3.3AR-CPA-ET/RC NOZZLE

MAT'L-.035" WALL,
TUBE LENGTH-6.0" TO TUBE HOLDER PLATE

7T-3.3AR-CPA-ET/RC

A_8 = 13.6 IN.^{2}



7 TUBE - AREA RATIO 3.3 ELLIPTICAL TUBES

TEST CONDITIONS

NOZZLE: 7T-3.3AR-CPA-ET/RC

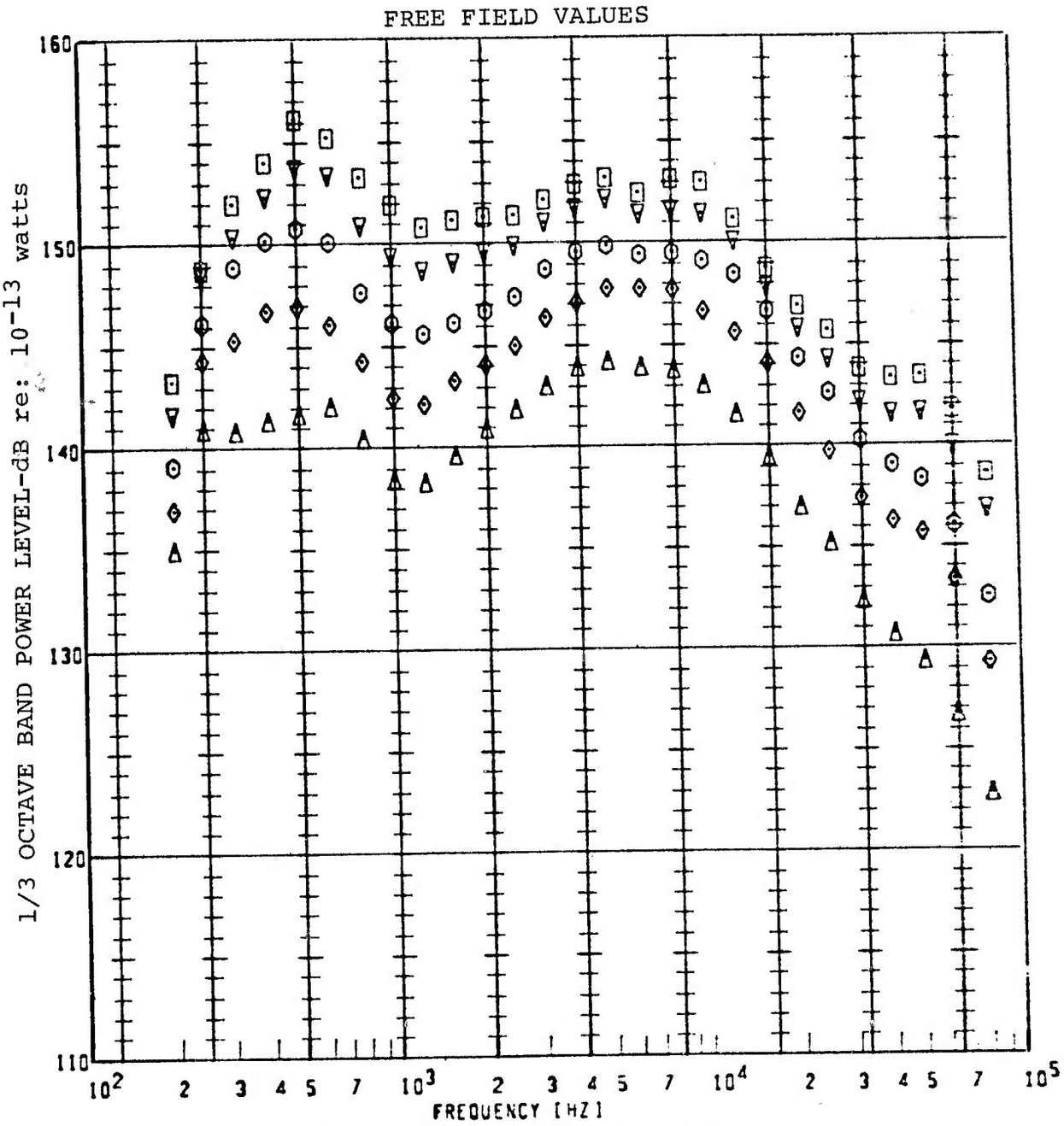
FACILITY: HNTF

DATE: 6-11-73 T_{AMB} = 73°F **R.H.** = 36%

SCALE MODEL A_8 = 13.6 in.^{2}

RUN NO.	NPR	T_T	V_J (IDEAL)	REMARKS	REF
8	2.0	1150°F	1875 fps	6" tube lengths	
"	2.5	"	2126		
"	3.0	"	2303		
"	3.5	"	2437		
"	4.0	"	2544		

MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH CONCRETE GROUND SURFACE. MEASURED ACOUSTIC DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.

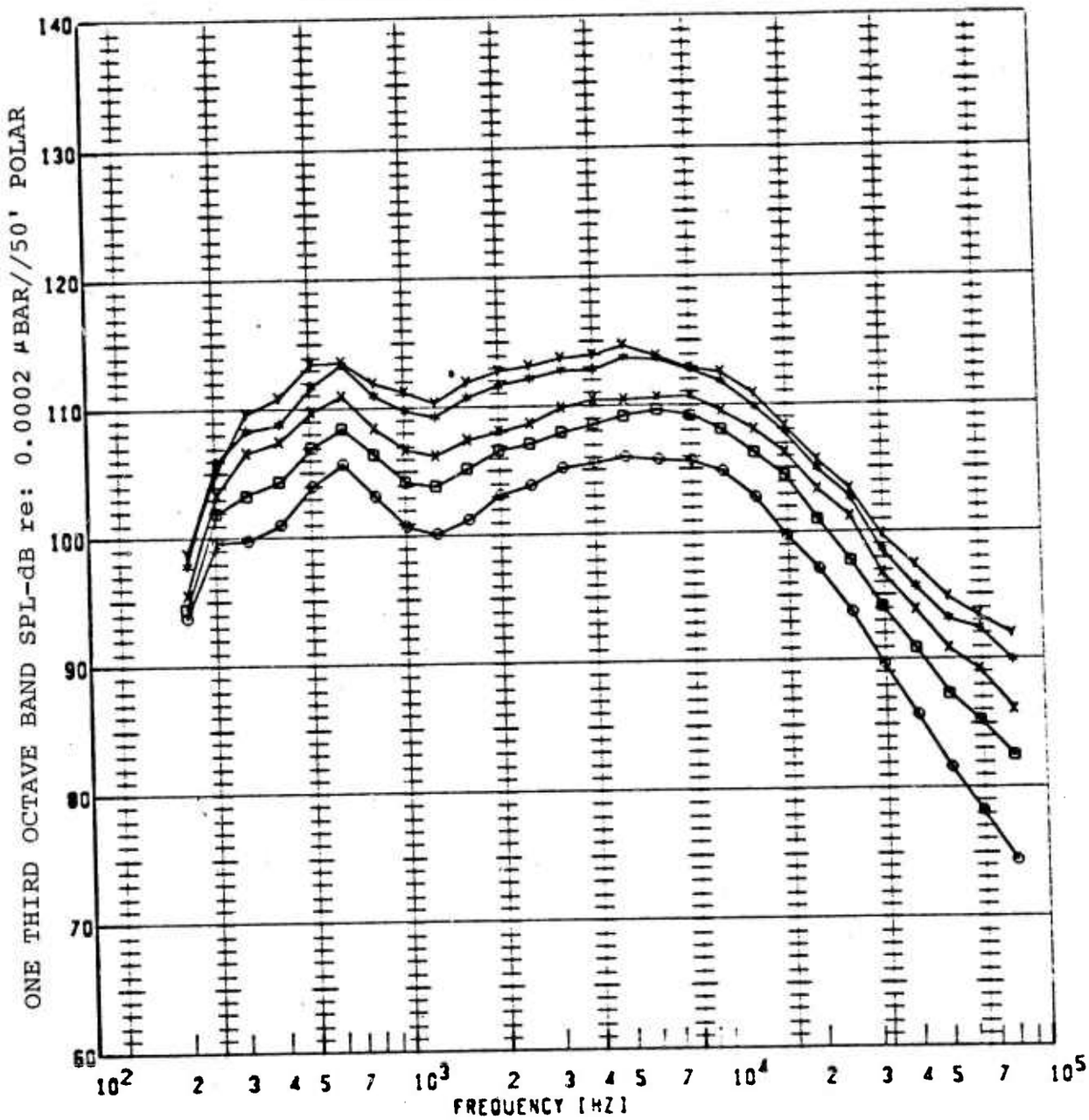


PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	008	2.00	1150 °F
◇	008	2.50	1150
○	008	3.00	1150
▽	008	3.50	1150
□	008	4.00	1150

NOZZLE: 7T-3.3AR-CPA-ET/RC

JET NOISE POWER SPECTRA

SPECTRA ARE FREE FIELD + 6dB

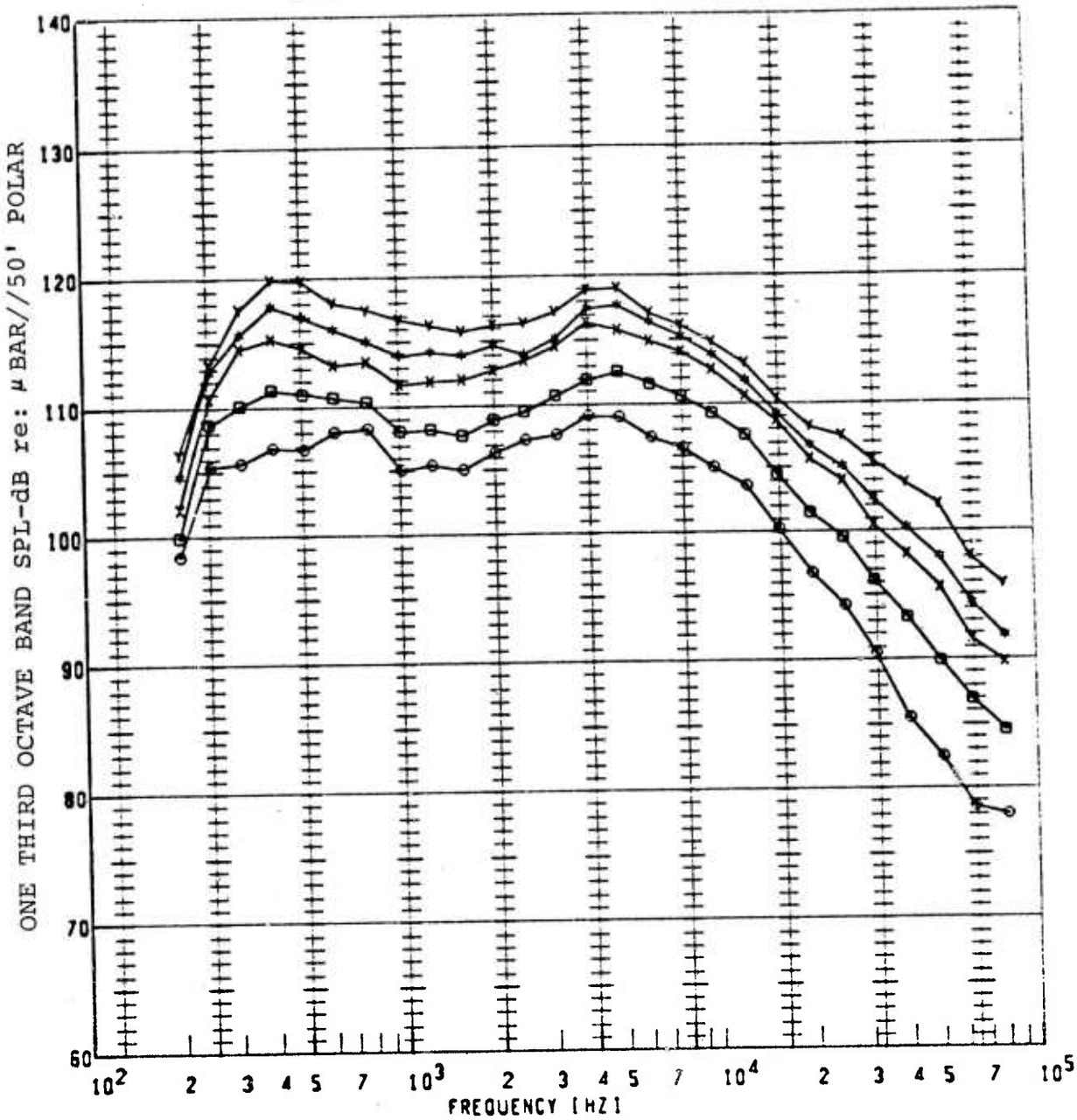


PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL [DB]
⊙	008G	1150°F	2.000	110°	50FP	116.5
⊡	008G	1150	2.500	↓	50FP	119.8
x	008G	1150	3.000	↓	50FP	121.7
*	008G	1150	3.500	↓	50FP	124.3
Y	008G	1150	4.000	↓	50FP	125.2

NOZZLE: 7T-3.3AR-CPA-ET/RC

MEASURED NOISE SPECTRA AT 110° re: NOZZLE INLET AXIS

SPECTRA ARE FREE FIELD + 6dB

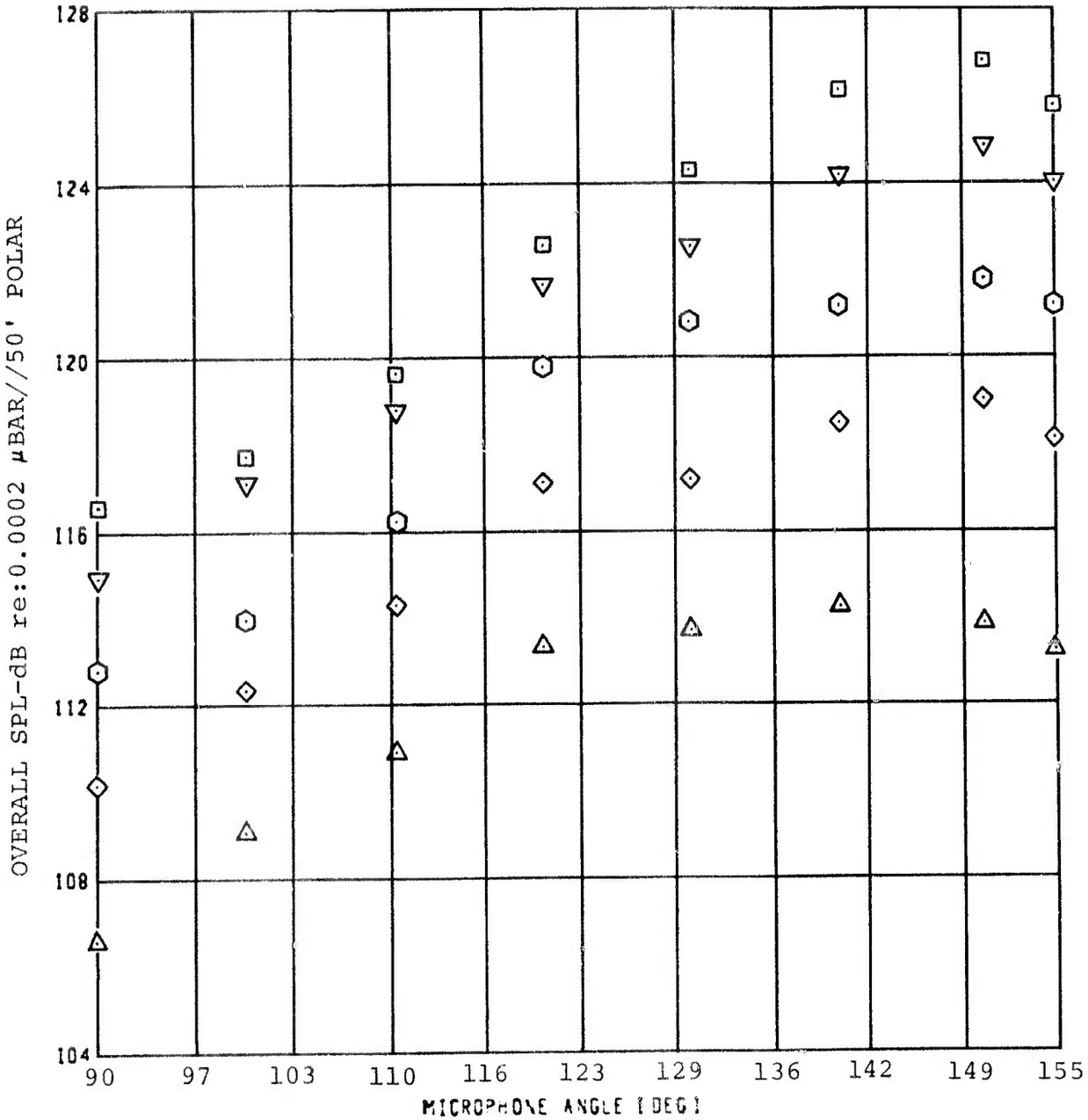


PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL [DB]
⊙	0086	1150°F	2.000	130°	50FP	119.5
⊡	0086	1150	2.500	↓	50FP	122.9
x	0086	1150	3.000		50FP	126.5
*	0086	1150	3.500		50FP	128.2
Y	0086	1150	4.000		50FP	129.9

NOZZLE: 7T-3.3AR-CPA-ET/RC

MEASURED NOISE SPECTRA AT 130° re: NOZZLE INLET AXIS

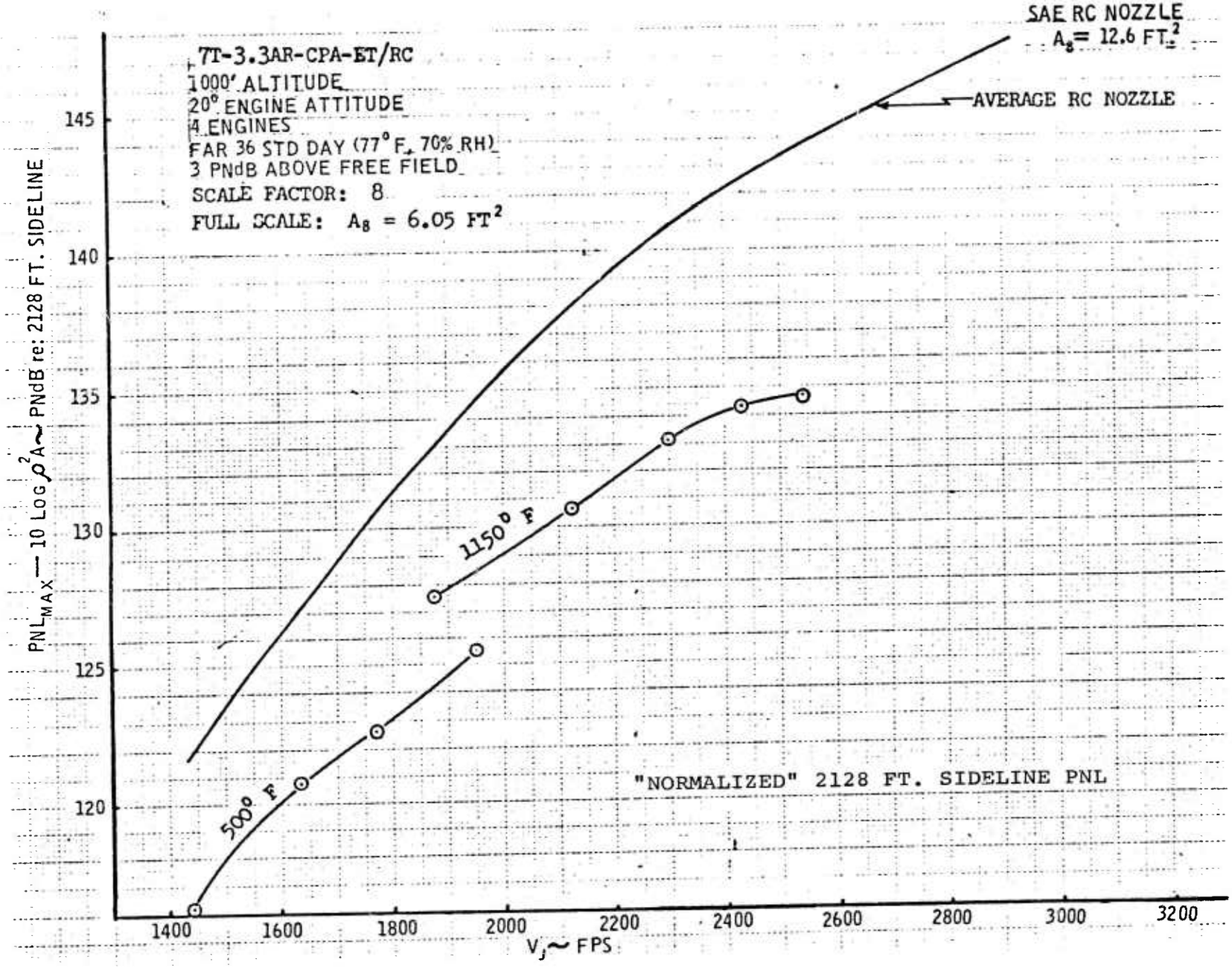
FREE FIELD VALUES



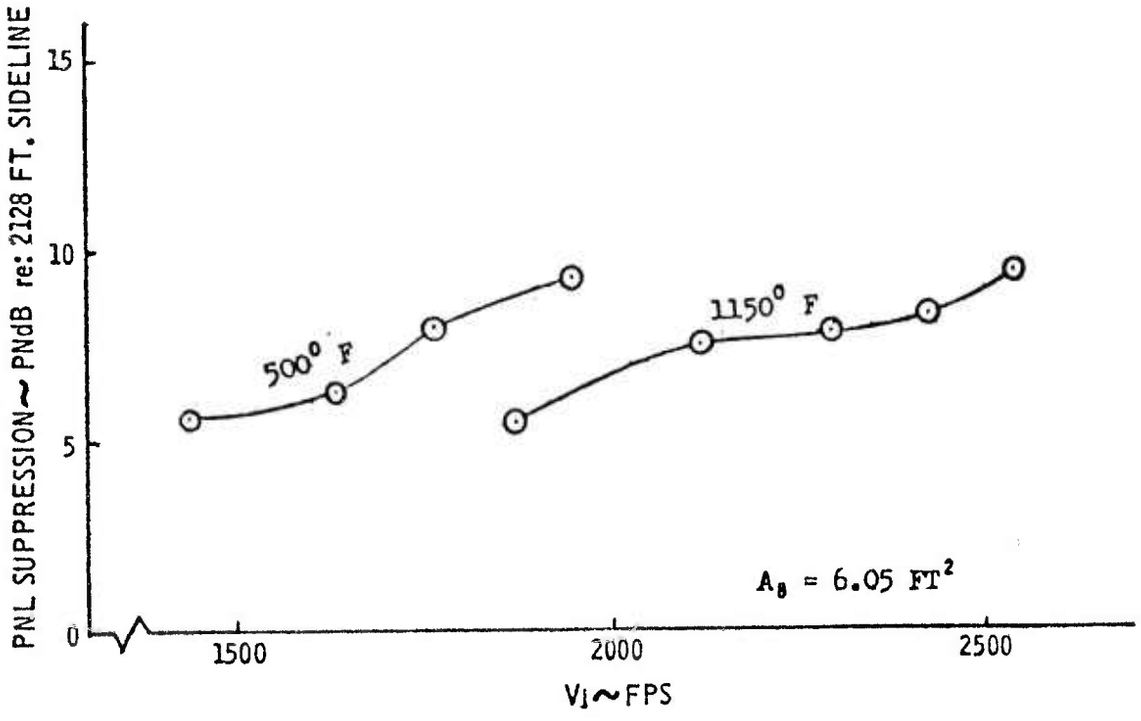
PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	008	2.00	1150°F
◇	008	2.50	1150
○	008	3.00	1150
▽	008	3.50	1150
□	008	4.00	1150

NOZZLE: 7T-3.3AR-CPA-ET/RC

OASPL BEAM PATTERNS

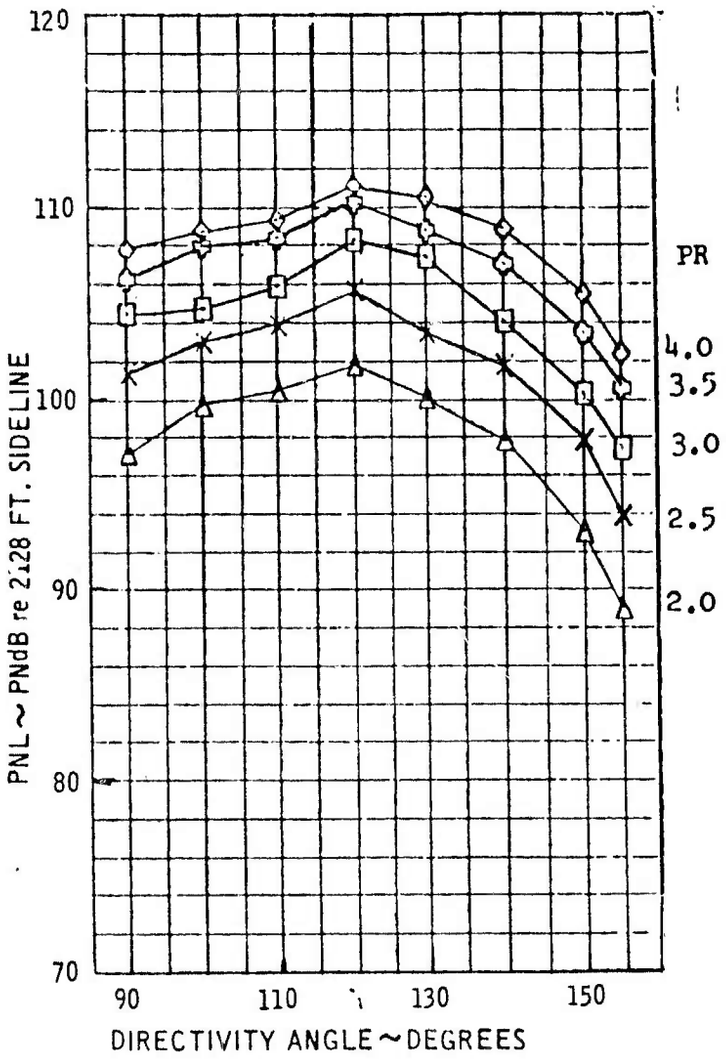

7T-3.3AR-CPA-ET/RC
1000' ALTITUDE
20° ENGINE ATTITUDE
4 ENGINES
FAR 36 STD DAY (77° F, 70% RH)
3 PNdB ABOVE FREE FIELD
SCALE FACTOR: 8
FULL SCALE: A_8 = 6.05 FT^2
SAE RC NOZZLE
A_8 = 12.6 FT^2
AVERAGE RC NOZZLE
1150° F
500° F
"NORMALIZED" 2128 FT. SIDELINE PNL
PNL_{MAX} — 10 LOG $\rho^2 A$ ~ PNdB re: 2128 FT. SIDELINE
145
140
135
130
125
120
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
V_j ~ FPS

7T-3.3AR-CPA-ET/RC



PEAK PNL SUPPRESSION VALUES

NOZZLE: 7T-3.3AR-CPA-RT/RC



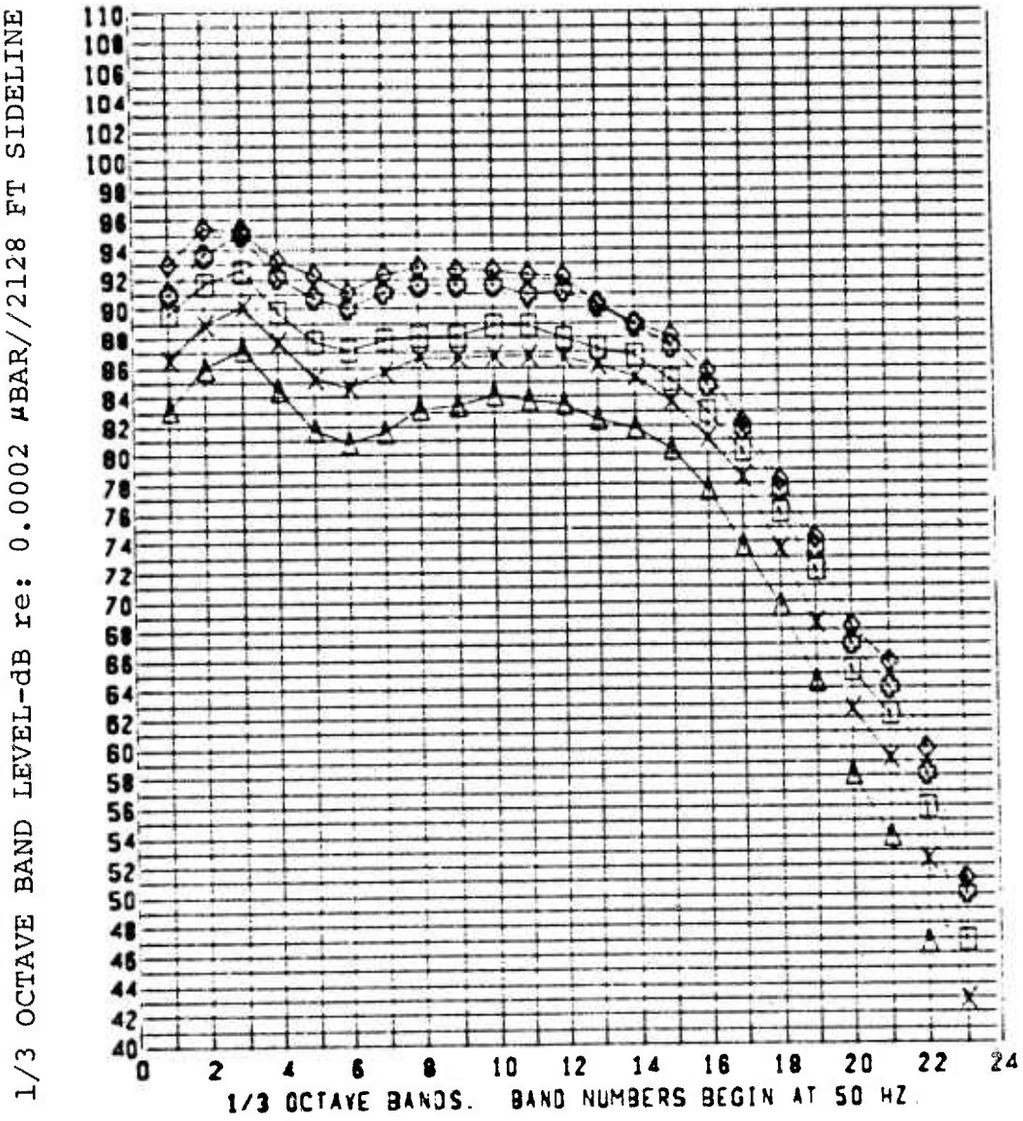
RUN 008

T_T = 1150° F A_8 = 6.05 FT^2

PNL BEAM PATTERNS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 110 DEG TEMP = 77 DEG R.H. = 70 PER CENT



T_T = 1150°F A_8 = 6.05 FT^2 RUN: 008

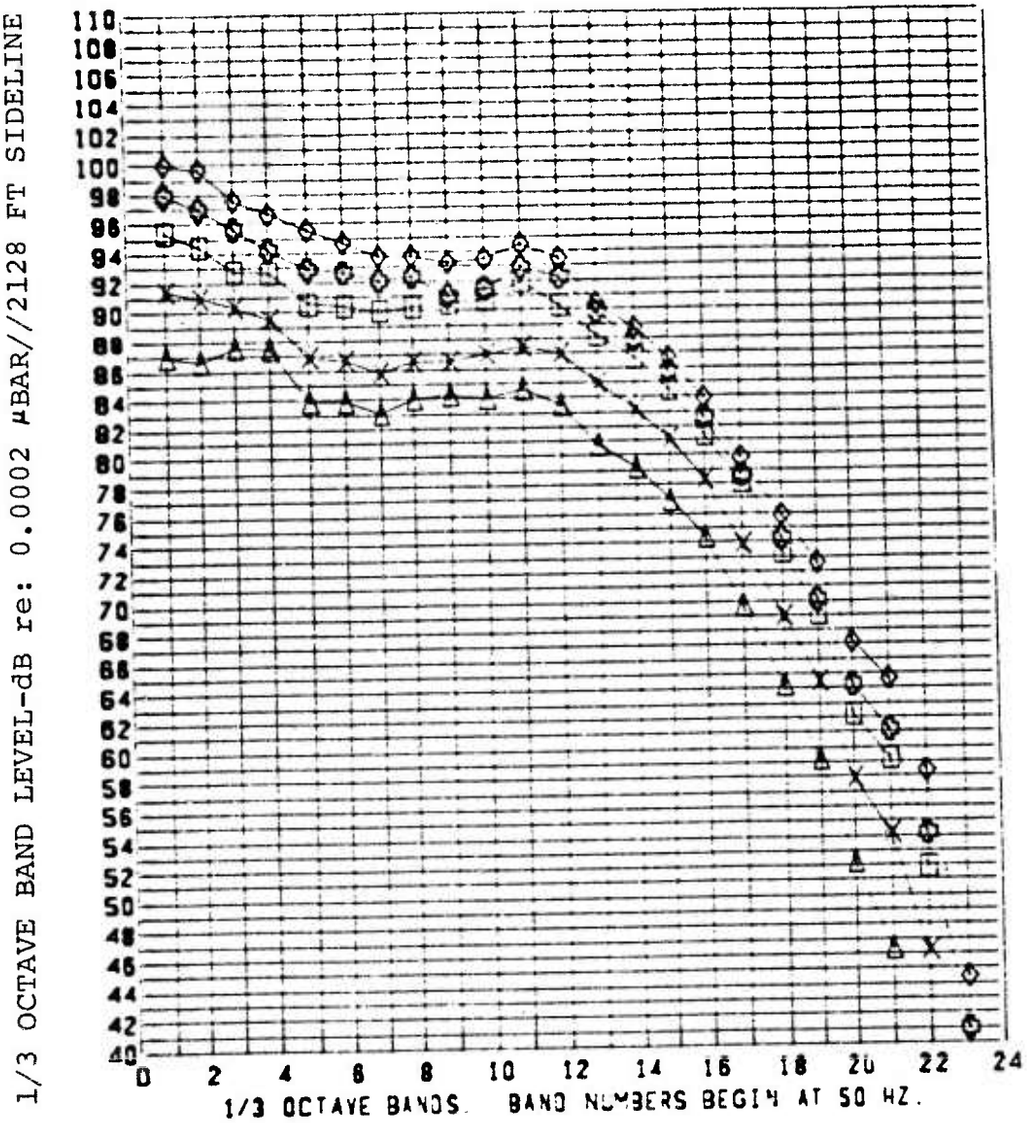
PR = △ 2.0, X 2.5, □ 3.0, ✣ 3.5, ◇ 4.0

NOZZLE: 7T-3.3AR-CPA-ET/RC

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 110°
re: NOZZLE INLET AXIS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 130 DEG TEMP = 77 DEG R.H. = 70 PER CENT



T_T = 1150°F A_8 = 6.05 FT^2 RUN: 008

PR = △ 2.0, X 2.5, □ 3.0, ✣ 3.5, ◇ 4.0

NOZZLE: 7T-3.3AR-CPA-ET/RC

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 130°

re: NOZZLE INLET AXIS

TEST CONDITIONS

NOZZLE: 7T-3.3AR-CPA-ET/RC

FACILITY: WALL ISOLATION FACILITY

DATE: January 18, 1973

P_{AMB} = 29.43 in Hg T_{AMB} = 47°F R.H. = 66%

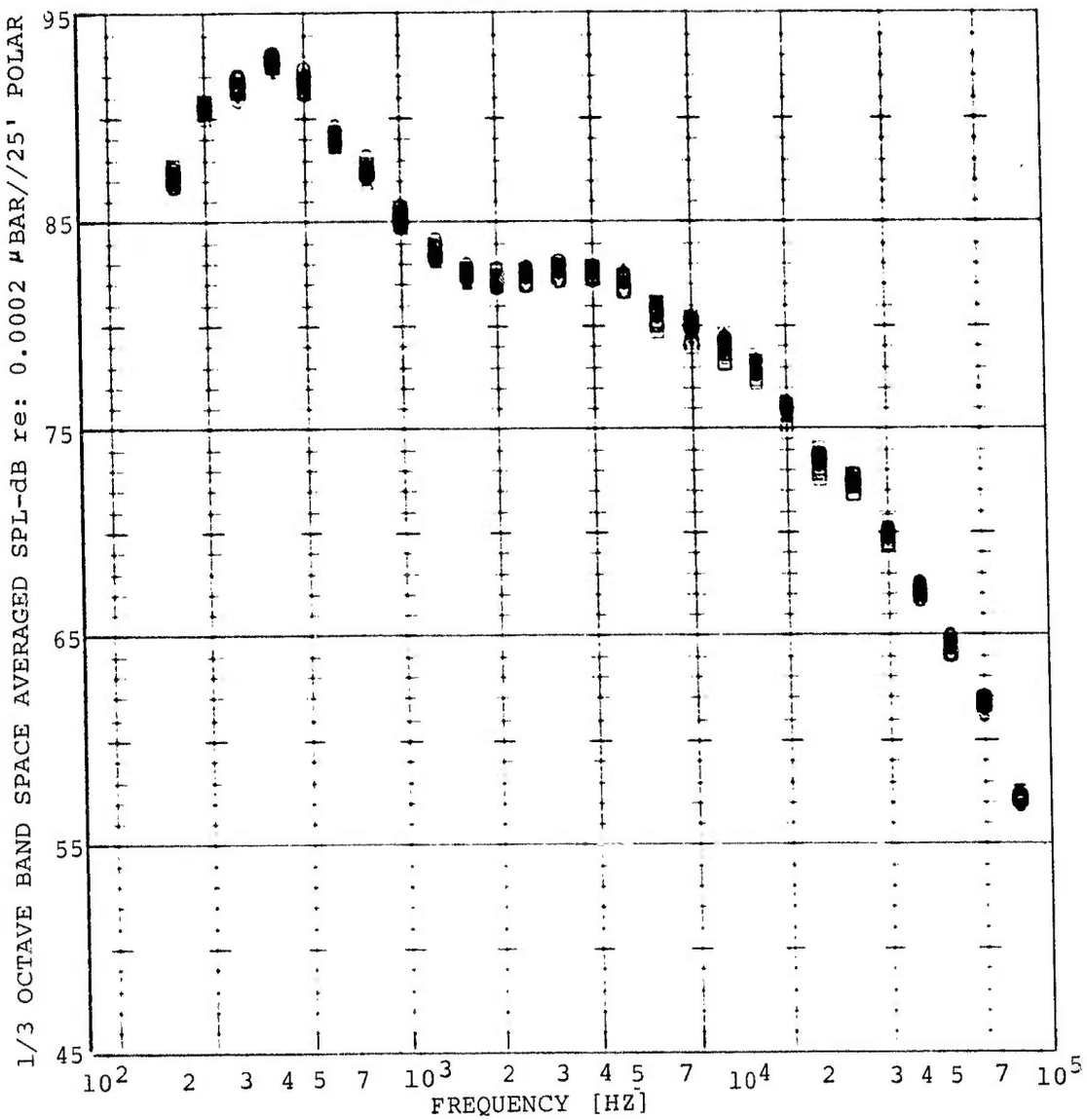
NPR = 3.0 T_T = 1150°F V_J (IDEAL) = 2300 FPS

SCALE MODEL A_8 = 13.6 in.^{2}

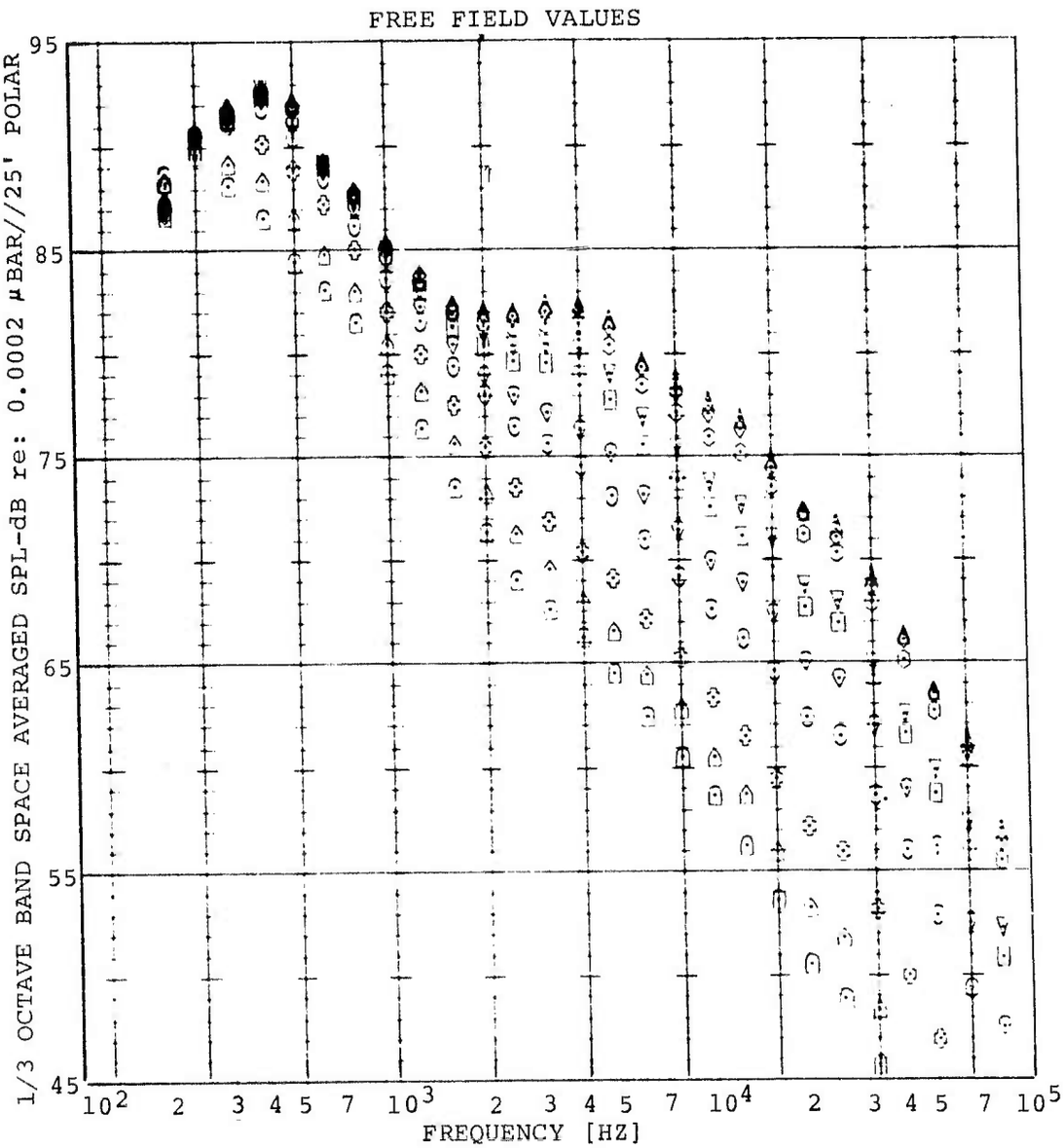
RUN NO.	AXIAL LOCATION	IRIS DIA.	REMARKS	REF.
75	0.0 x/D	9.0 in.		
76	0.25	9.0		
77	0.50	9.0		
78	0.75	9.0		
79	1.00	10.0		
80	1.25	10.0		
81	1.50	10.5		
82	1.75	10.5		
83	2.00	11.0		
84	2.25	11.0		
85	2.50	11.5		
86	2.75	11.5		
87	3.0	12.0		
88	3.5	13.0		
89	4.0	14.0		
90	5.0	16.0		
91	6.0	18.0		
92	8.0	19.0		
93	10.0	21.0		
94	12.0	23.0		
95	14.0	25.0		
96	16.0	27.0		

MICROPHONE LAYOUT: 25 FOOT VERTICAL POLAR ARC

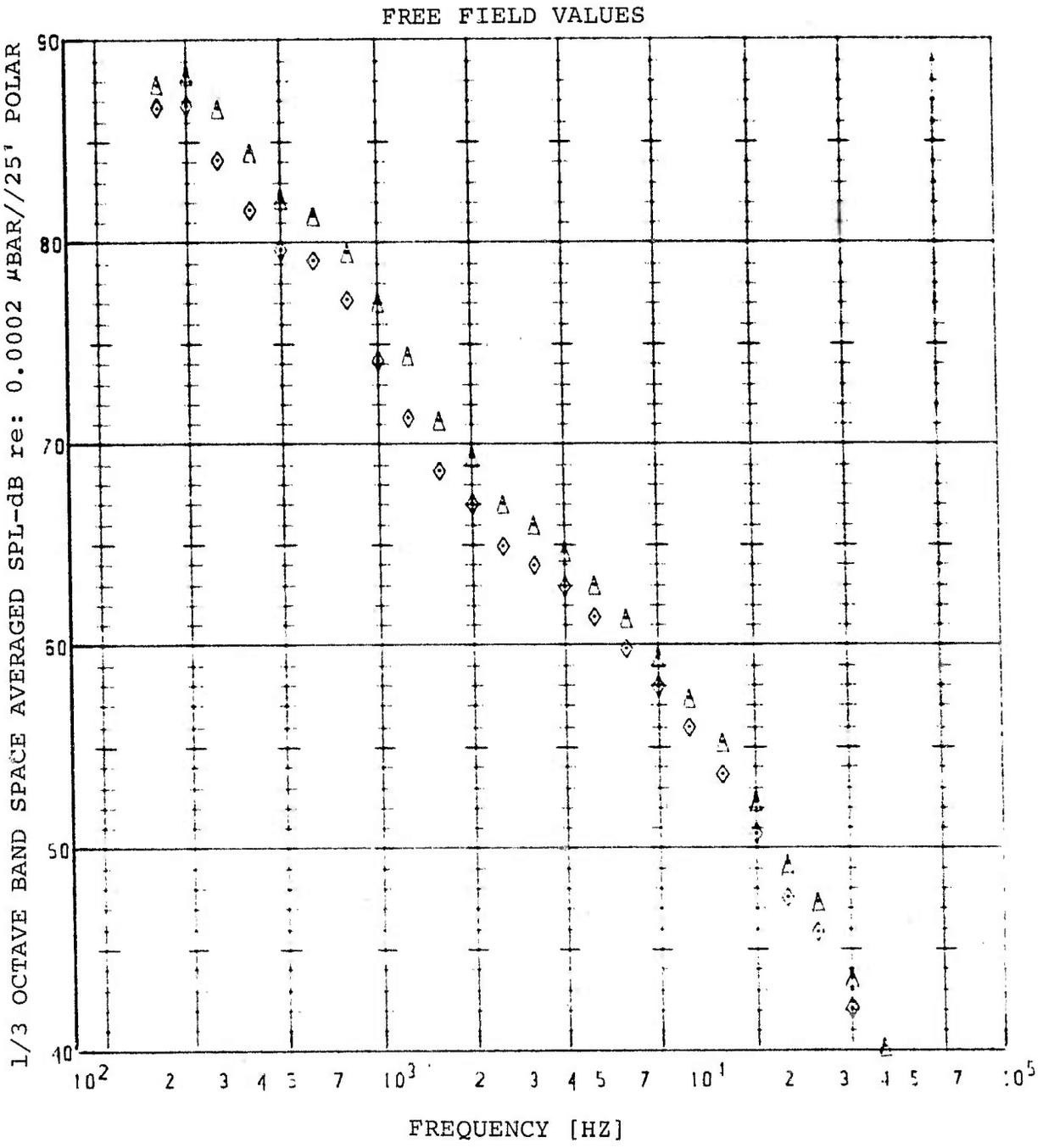
FREE FIELD VALUES



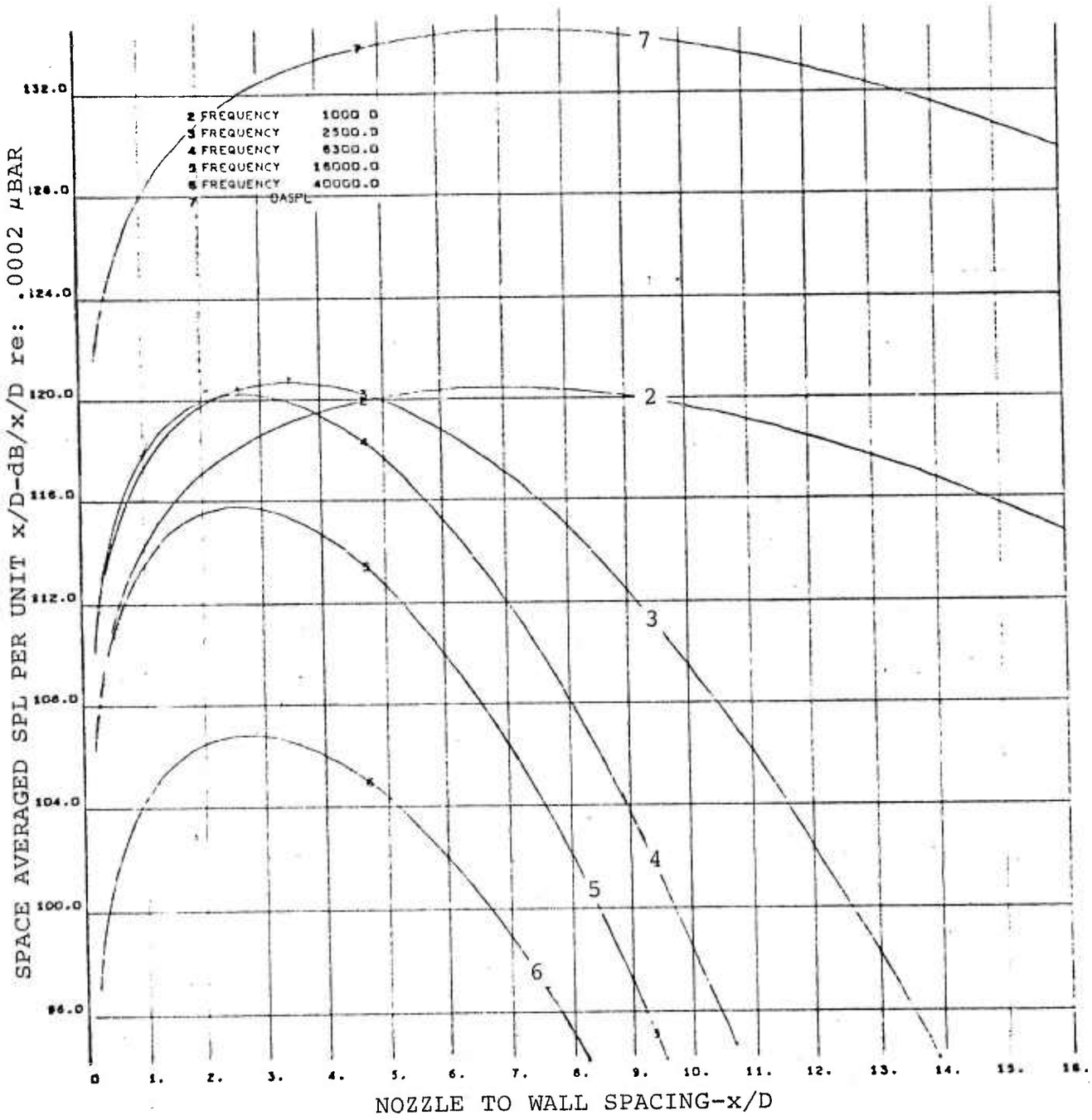
PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	AXIAL LOCATION, x/D
△	75	1150°F	3.000	0.0
◇	76	1150	3.000	.25
⬡	77	1150	3.000	.50
▽	78	1150	3.000	.75
⊡	79	1150	3.000	1.0
▽	80	1150	3.000	1.25
⊙	81	1150	3.000	1.5
✣	82	1150	3.000	1.75
△	83	1150	3.000	2.0
⊡	84	1150	3.000	2.25

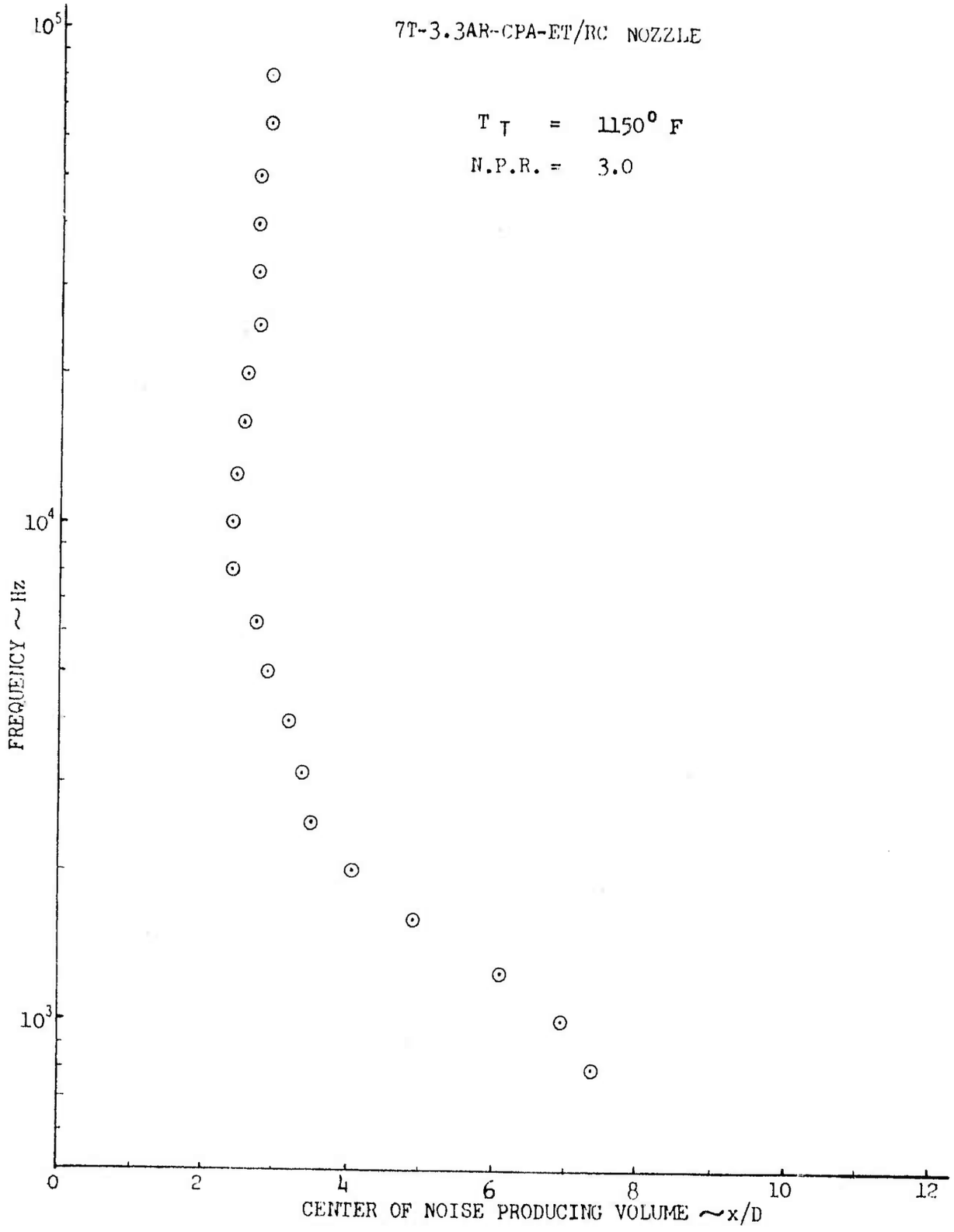


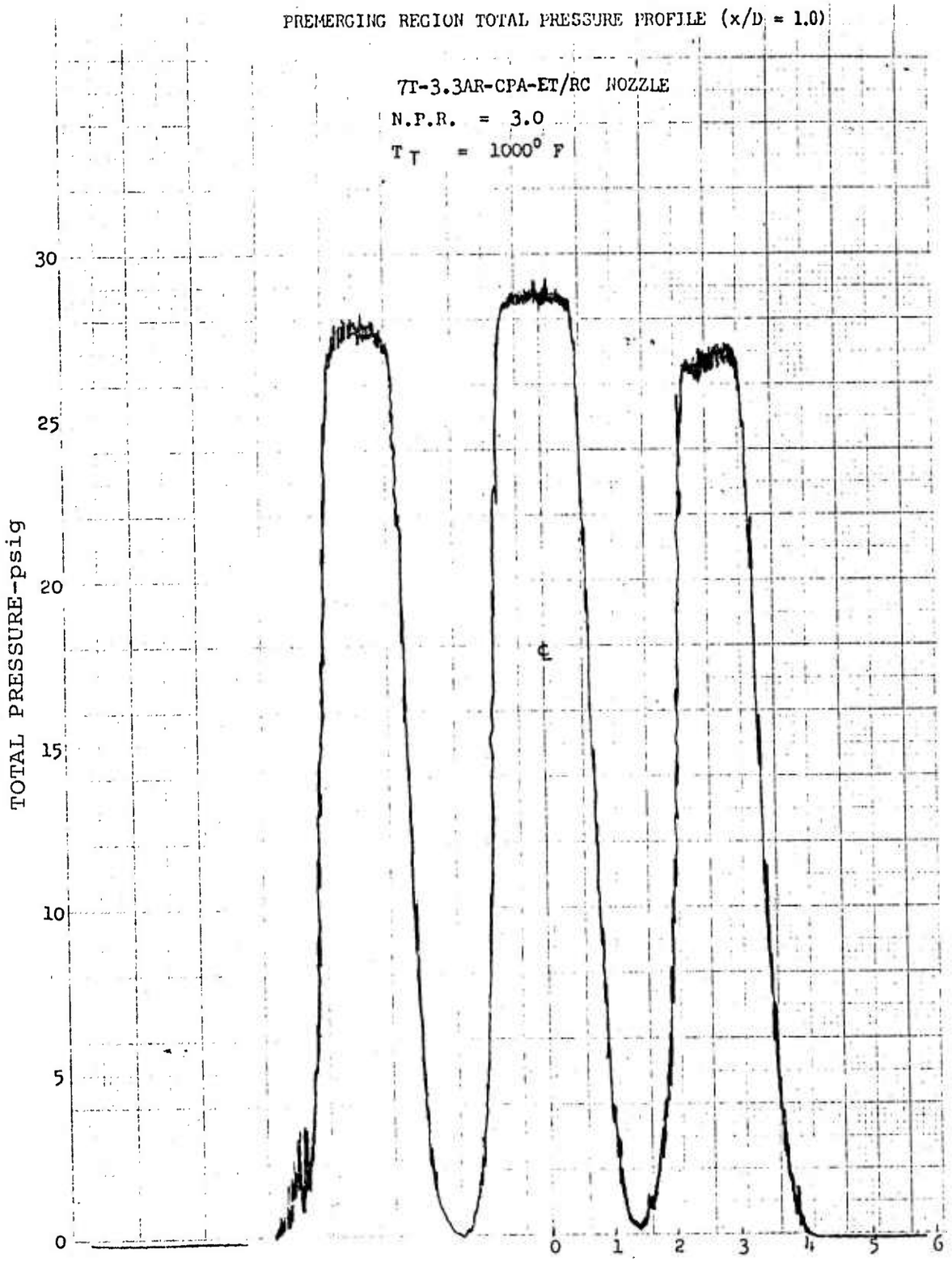
PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	AXIAL LOCATION, x/D
△	85	1150°F	3.000	2.5
◇	86	1150	3.000	2.75
⊙	87	1150	3.000	3.0
▽	88	1150	3.000	3.50
⊡	89	1150	3.000	4.00
▽	90	1150	3.000	5.00
⊙	91	1150	3.000	6.00
⬡	92	1150	3.000	8.00
⊡	93	1150	3.000	10.00
⊡	94	1150	3.000	12.00

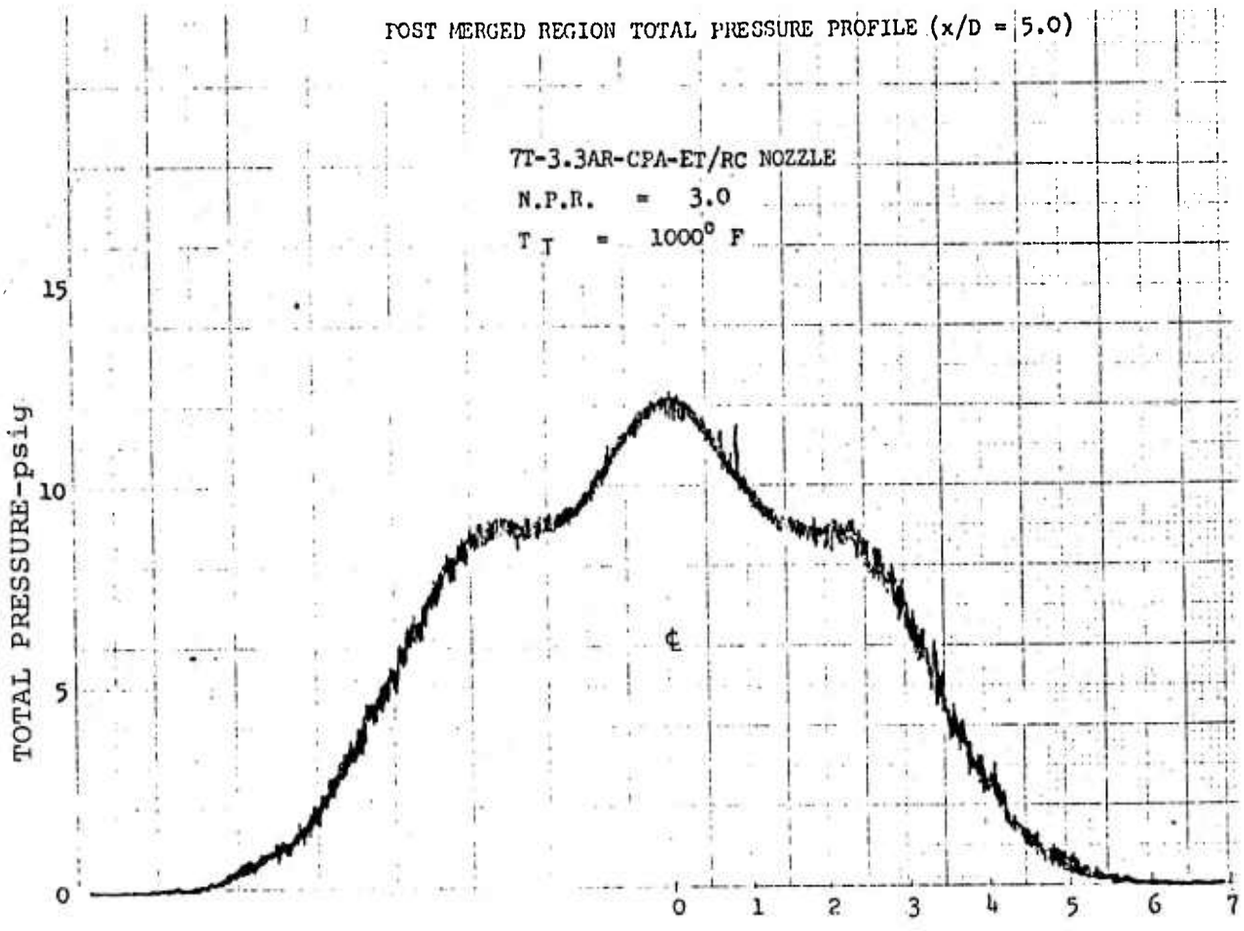


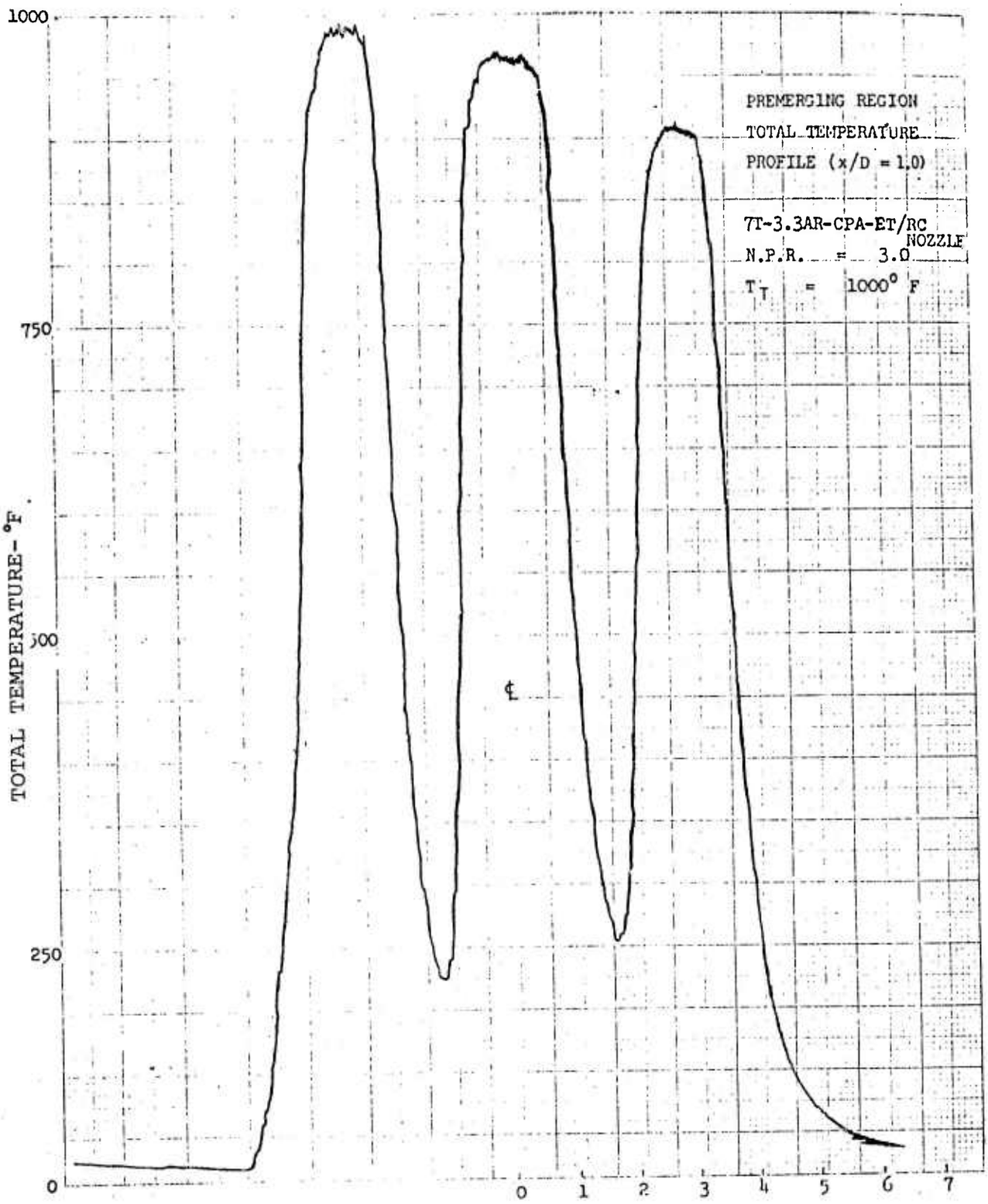
PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	AXIAL LOCATION, x/D
△	95	1150°F	3.0	14.00
◊	96	1150	3.0	16.00


2 FREQUENCY 1000.0
3 FREQUENCY 2500.0
4 FREQUENCY 6300.0
5 FREQUENCY 16000.0
6 FREQUENCY 40000.0
OASPL
SPACE AVERAGED SPL PER UNIT x/D-dB/x/D re: .0002 μBAR
132.0
128.0
124.0
120.0
116.0
112.0
108.0
104.0
100.0
96.0
0
1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.
13.
14.
15.
16.
NOZZLE TO WALL SPACING-x/D

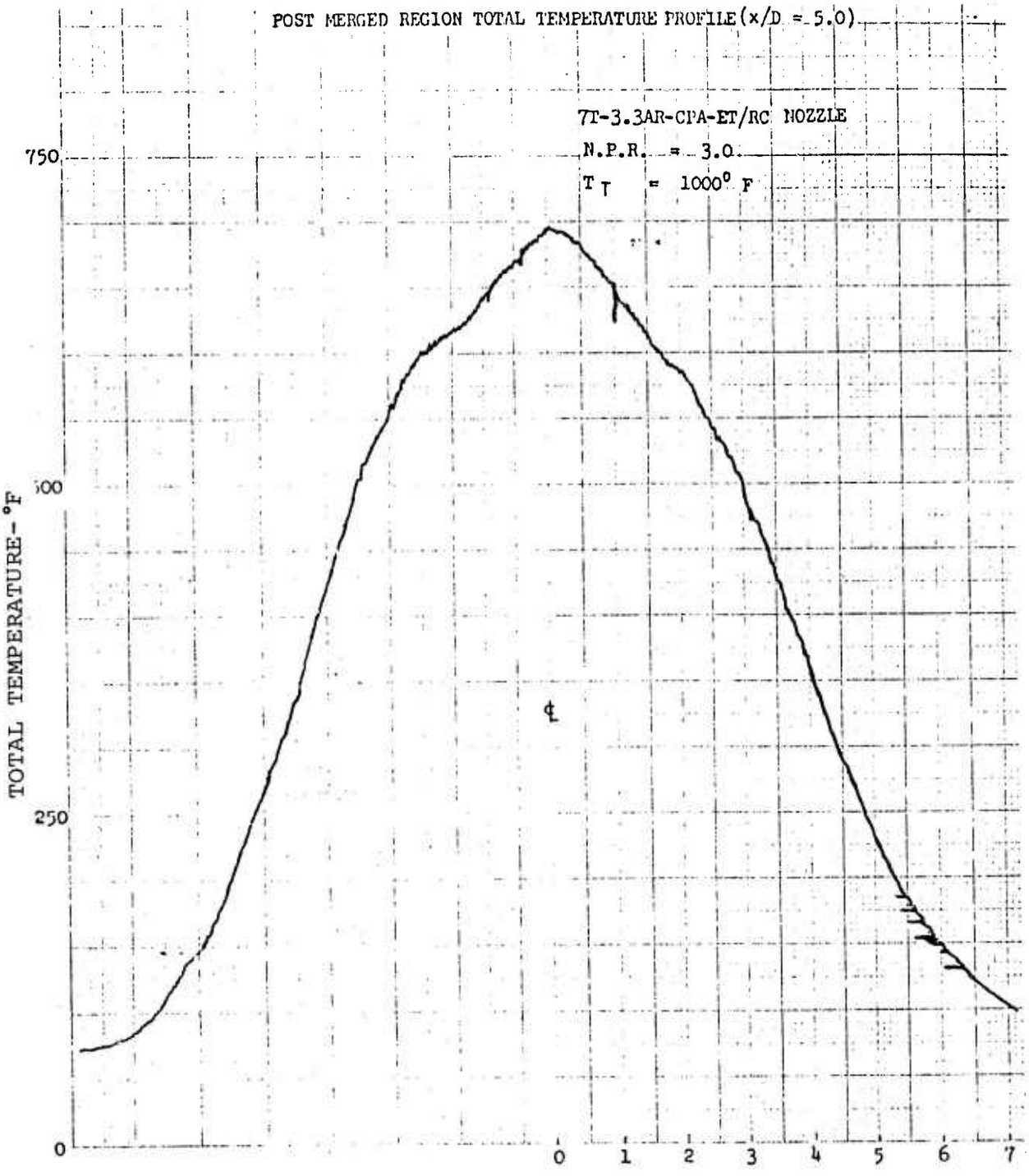

7T-3.3AR-CPA-ET/RC NOZZLE
T_T = 1150° F
N.P.R. = 3.0
10^5
10^4
10^3
FREQUENCY ~ Hz
0
2
4
6
8
10
12
CENTER OF NOISE PRODUCING VOLUME ~x/D

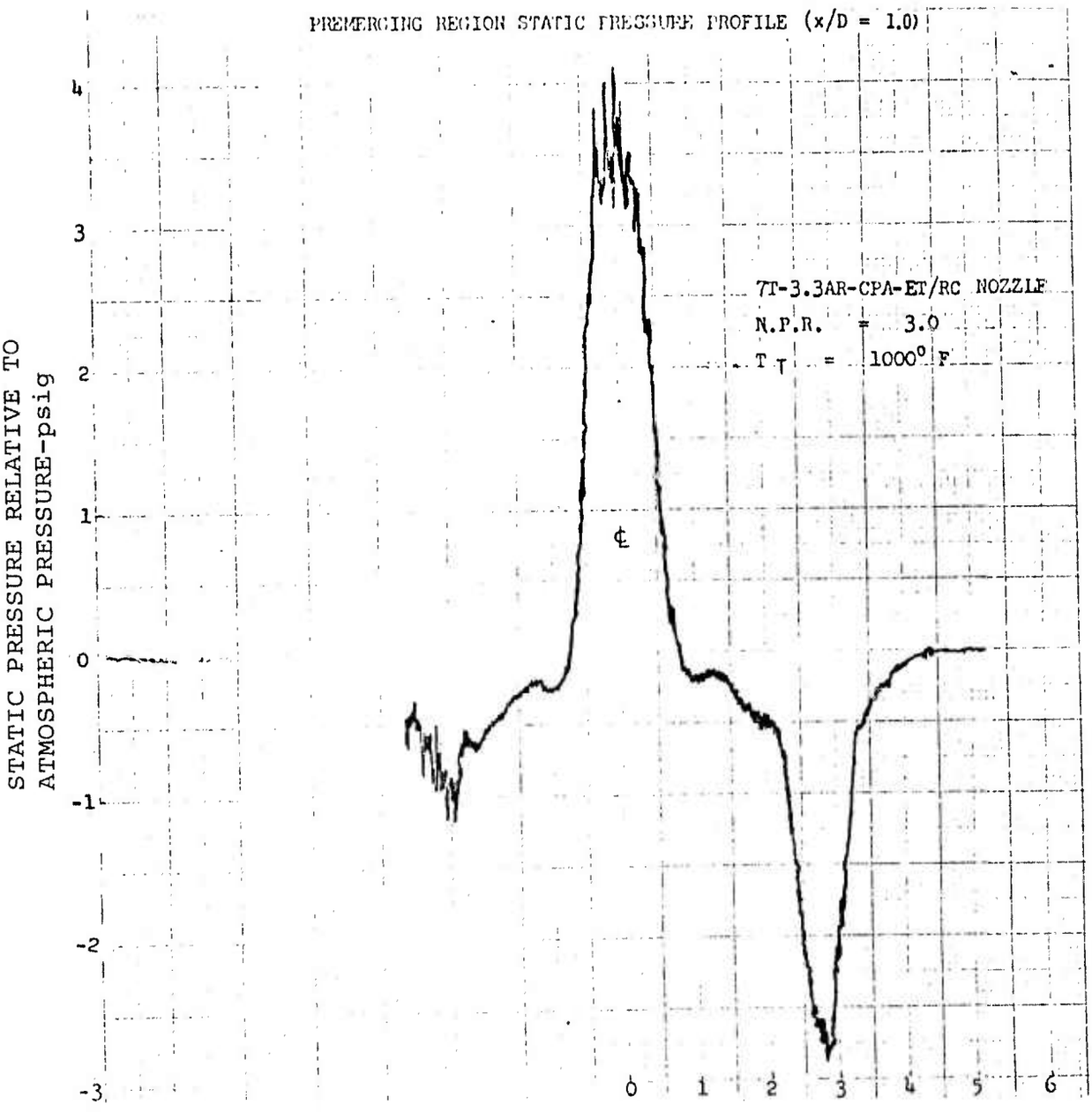

PREMERGING REGION TOTAL PRESSURE PROFILE (x/D = 1.0)
7T-3.3AR-CPA-ET/RC NOZZLE
N.P.R. = 3.0
T_T = 1000° F
TOTAL PRESSURE-psig
0
5
10
15
20
25
30
℄
0
1
2
3
4
5
6
RADIAL DISTANCE FROM JET ℄-in.

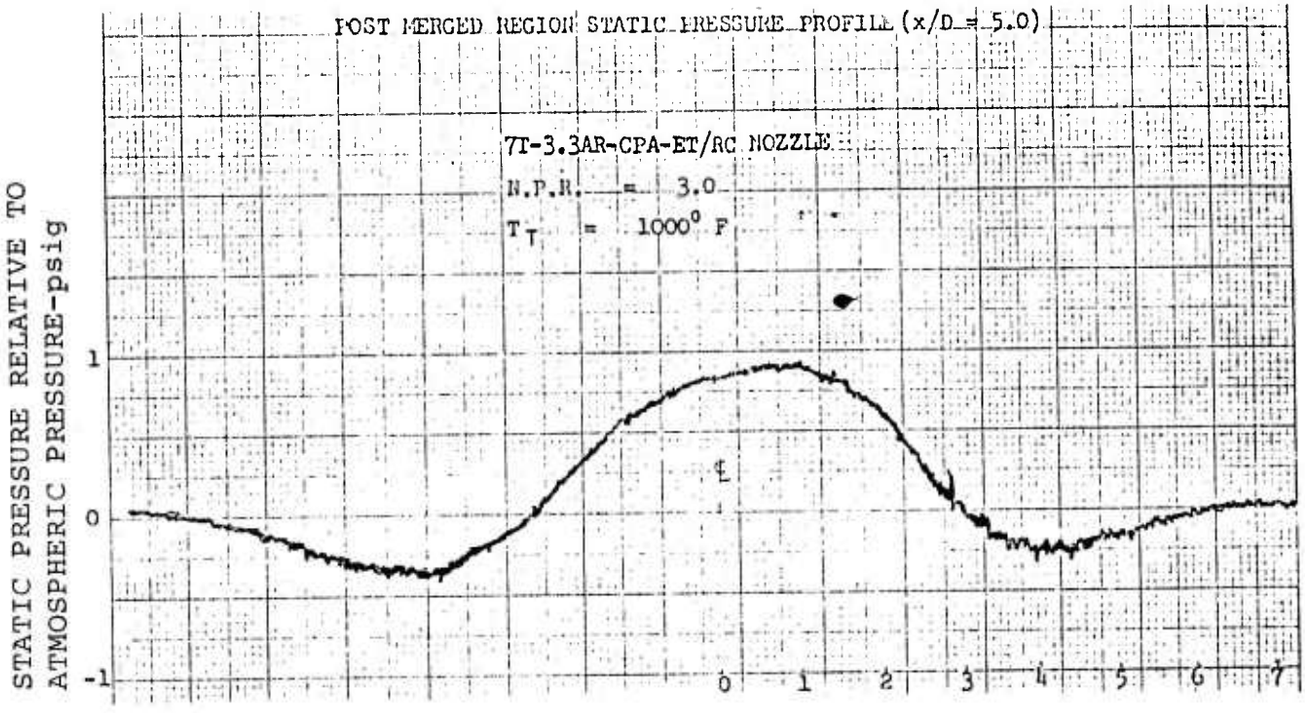

POST MERGED REGION TOTAL PRESSURE PROFILE (x/D = 5.0)
7T-3.3AR-CPA-ET/RC NOZZLE
N.P.R. = 3.0
T_T = 1000° F
TOTAL PRESSURE-psig
0
5
10
15
0
1
2
3
4
5
6
7
℄
RADIAL DISTANCE FROM JET ℄-in.

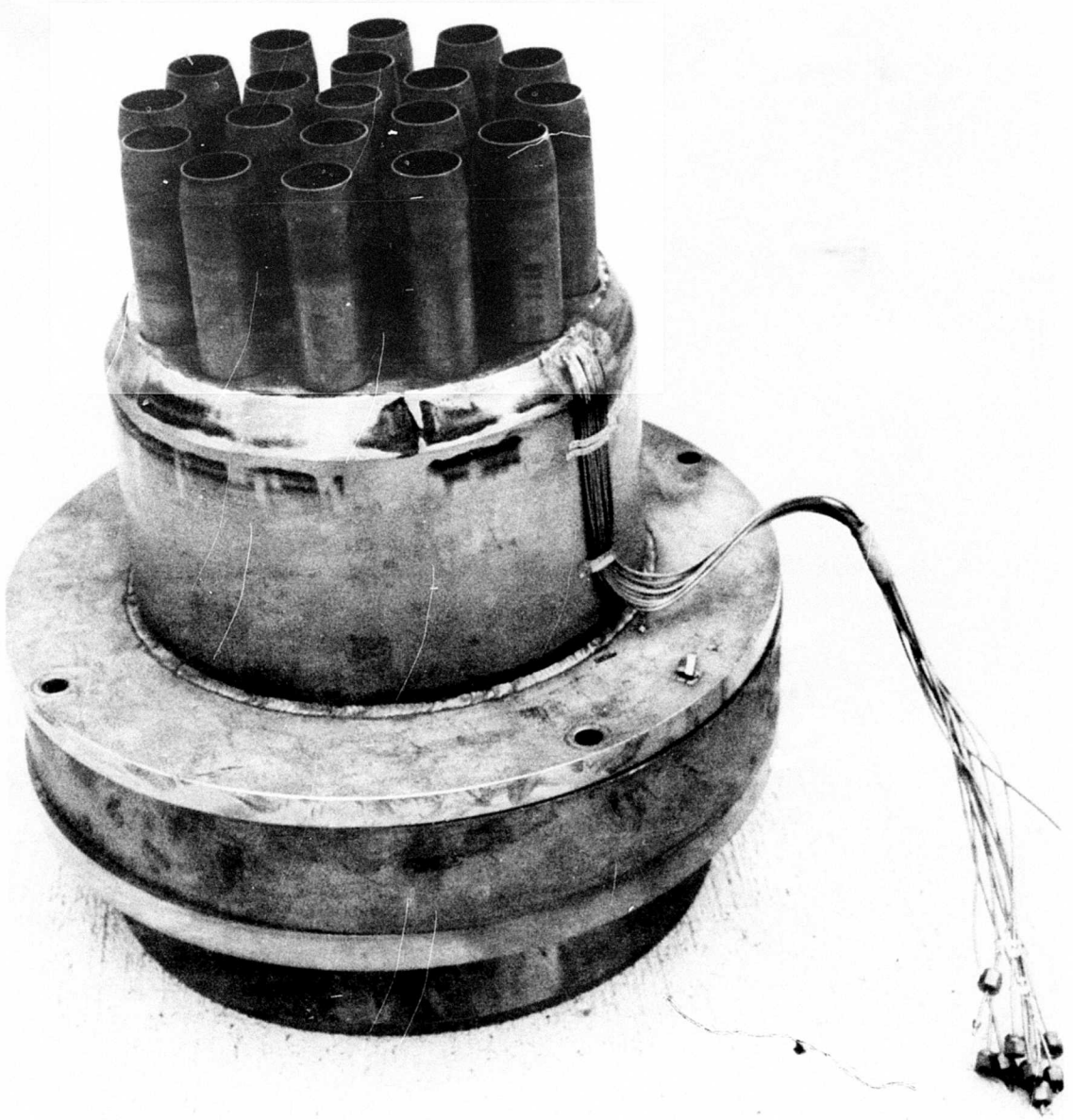


RADIAL DISTANCE FROM JET ℄-in.

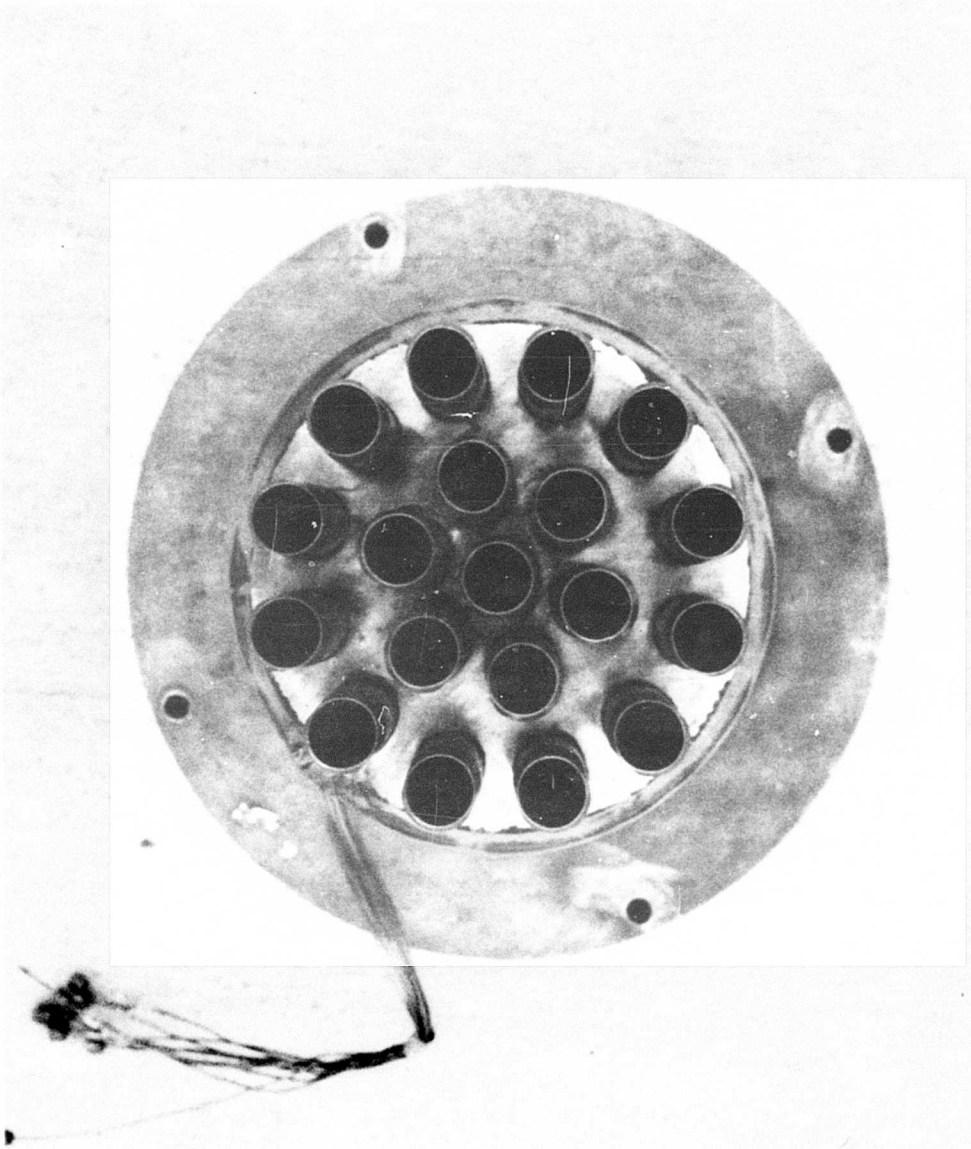

POST MERGED REGION TOTAL TEMPERATURE PROFILE (x/D = 5.0)
7T-3.3AR-CPA-ET/RC NOZZLE
N.P.R. = 3.0
T_T = 1000° F
750
500
250
0
TOTAL TEMPERATURE - °F
℄
0
1
2
3
4
5
6
7
RADIAL DISTANCE FROM JET ℄-in.


PREMERGING REGION STATIC PRESSURE PROFILE (x/D = 1.0)
7T-3.3AR-CPA-ET/RC NOZZLE
N.P.R. = 3.0
T_T = 1000° F
STATIC PRESSURE RELATIVE TO ATMOSPHERIC PRESSURE-psig
4
3
2
1
0
-1
-2
-3
0
1
2
3
4
5
6
RADIAL DISTANCE FROM JET ℄ -in.

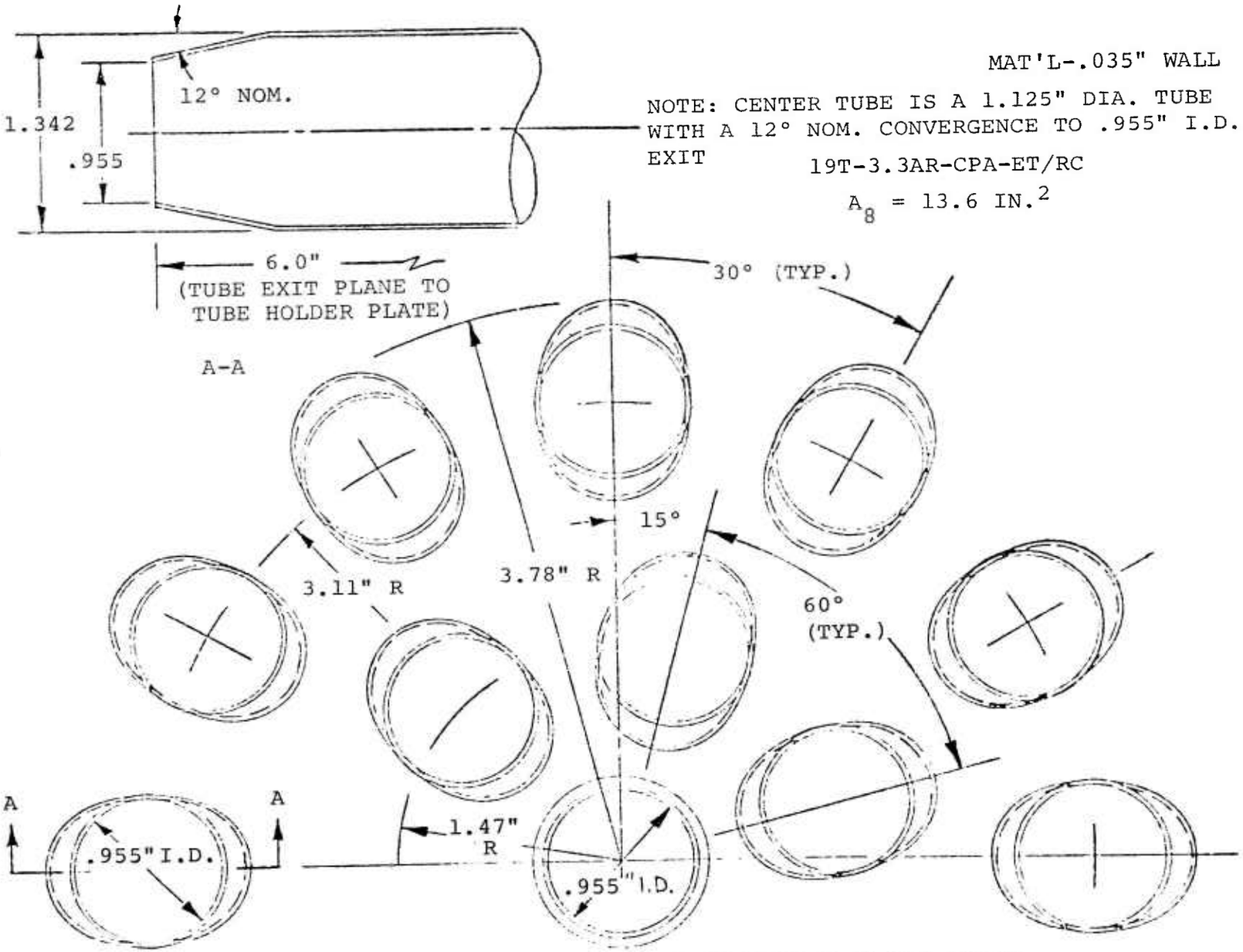

POST MERGED REGION STATIC PRESSURE PROFILE (x/D = 5.0)
7T-3.3AR-CPA-ET/RC NOZZLE
N.P.R. = 3.0
T_T = 1000° F
STATIC PRESSURE RELATIVE TO ATMOSPHERIC PRESSURE-psig
1
0
-1
0
1
2
3
4
5
6
7
RADIAL DISTANCE FROM JET ℄-in.



19T-3.3AR-CPA-ET/RC NOZZLE



19T-3.3AR-CPA-ET/RC NOZZLE



19 TUBE - AREA RATIO 3.3 ELLIPTICAL TUBES CLOSE ARRAY

TEST CONDITIONS

NOZZLE: 19T-3.3AR-CPA-ET/RC

FACILITY: HNTF

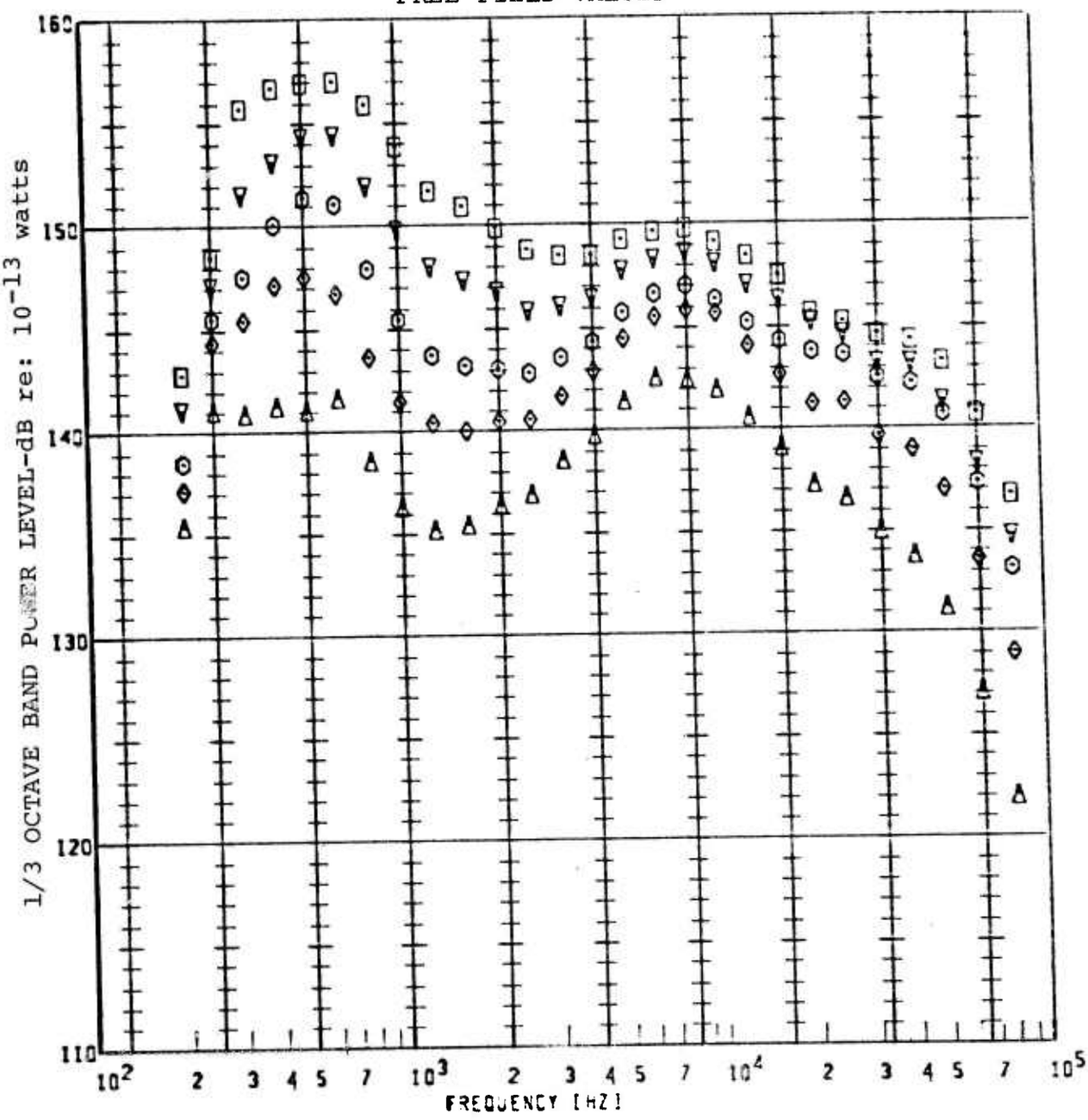
DATE: 6-11-73 T_{AMB} = 77°F **R.H.** = 24%

SCALE MODEL A_8 = 13.6 $in.^2$

RUN NO.	NPR	T_T	V_J (IDEAL)	REMARKS	REF
9	2.0	1150°F	1875 fps	6" tube lengths	
"	2.5	"	2126		
"	3.0	"	2303		
"	3.5	"	2437		
"	4.0	"	2544		

MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH CONCRETE GROUND SURFACE. MEASURED ACOUSTIC DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.

FREE FIELD VALUES



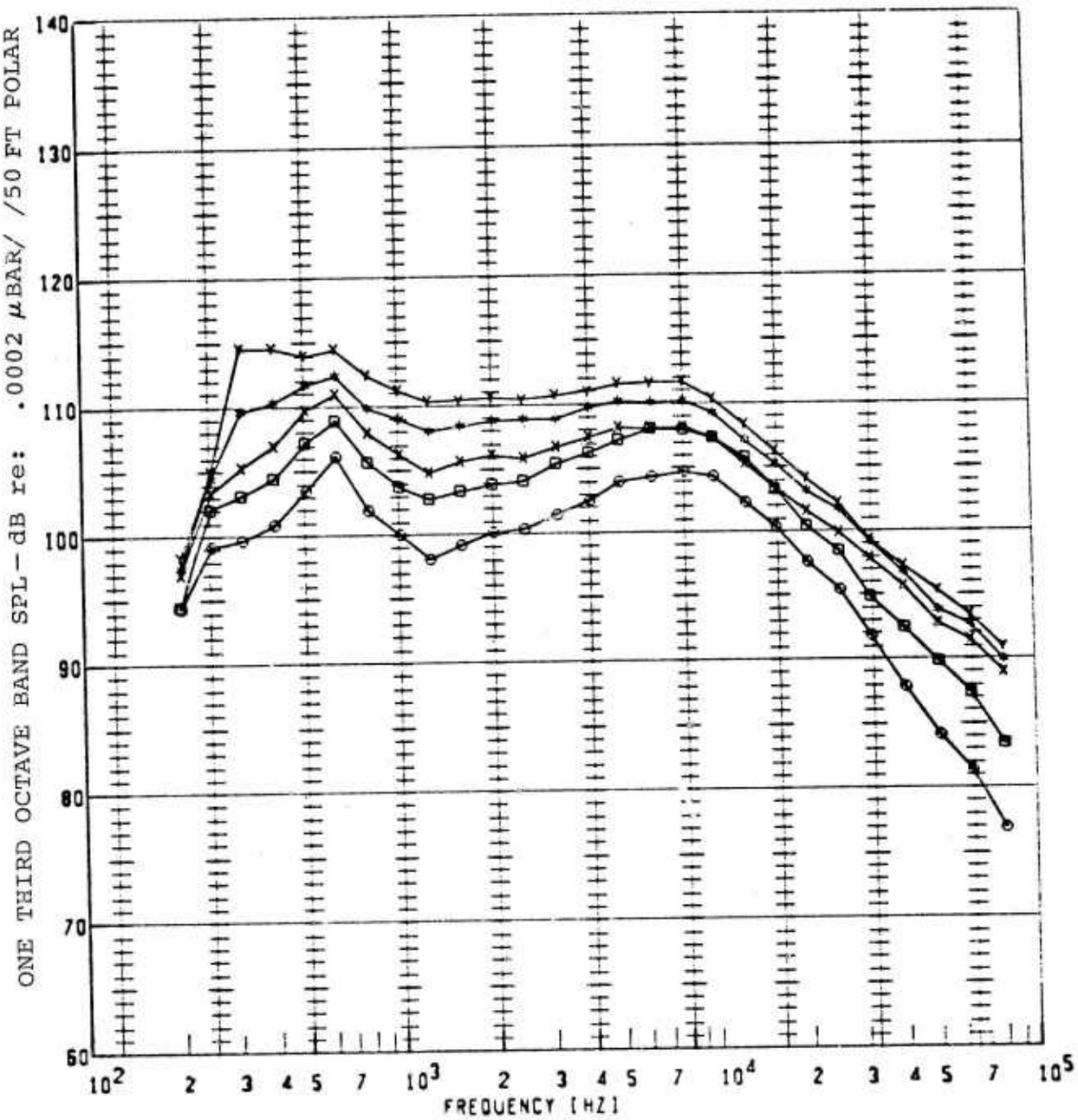
PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	009	2.00	1150°F
◇	009	2.50	1150
○	009	3.00	1150
▽	009	3.50	1150
□	009	4.00	1150

A_8 = 13.6 IN.^{2}

NOZZLE: 19T-3.3AR-CPA-ET/RC

JET NOISE POWER SPECTRA

SPECTRA ARE FREE FIELD + 6dB

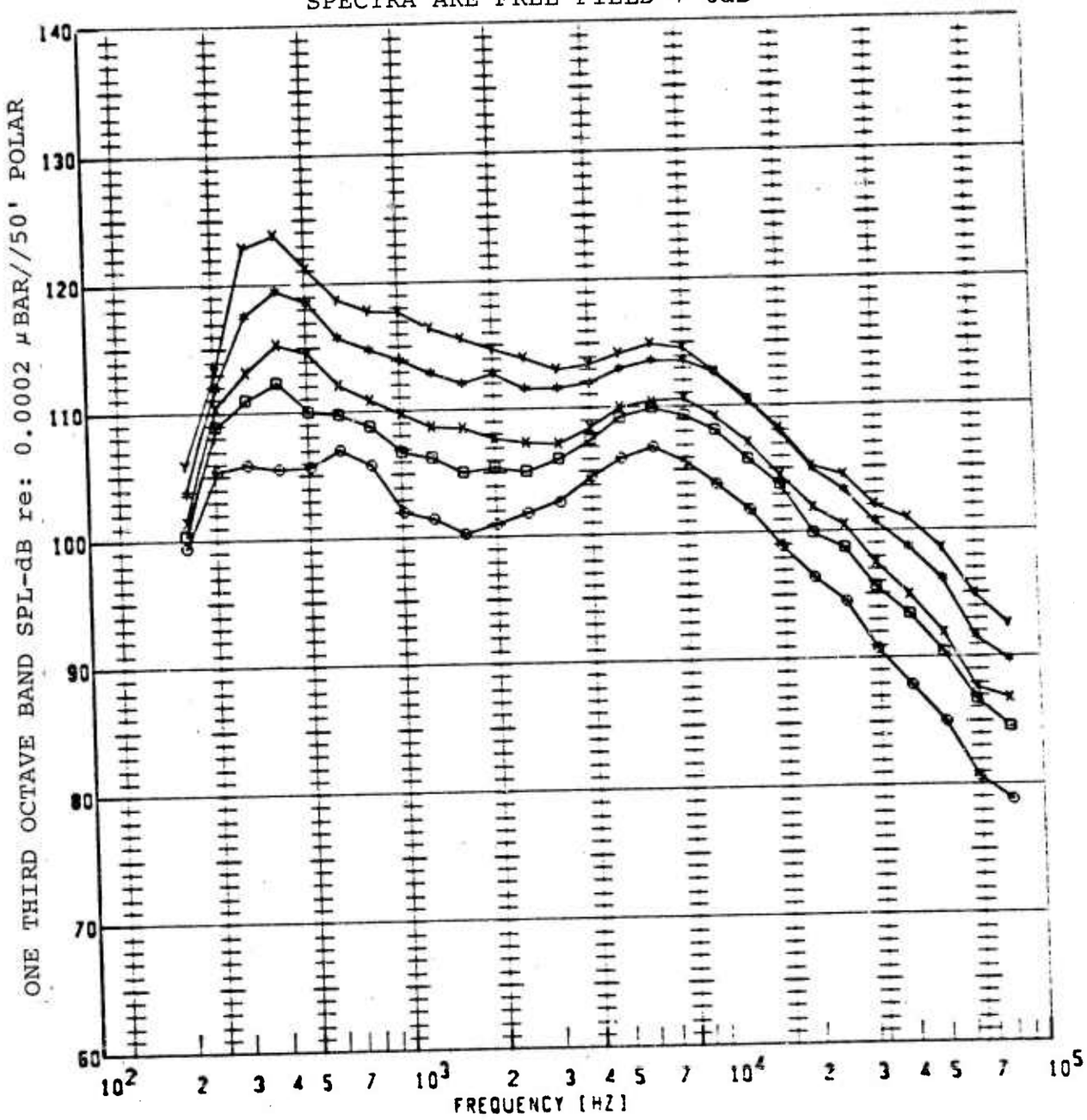


PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE-RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL [DB]
⊙	0096	1150°F	2.000	110	50FP	115.3
⊡	0096	1150	2.500	↓	50FP	118.7
x	0096	1150	3.000	↓	50FP	120.1
*	0096	1150	3.500	↓	50FP	122.4
Y	0096	1150	4.000	↓	50FP	124.5

NOZZLE: 19T-3.3AR-CPA-ET-/RC

MEASURED NOISE SPECTRA AT 110° re: NOZZLE INLET AXIS

SPECTRA ARE FREE FIELD + 6dB

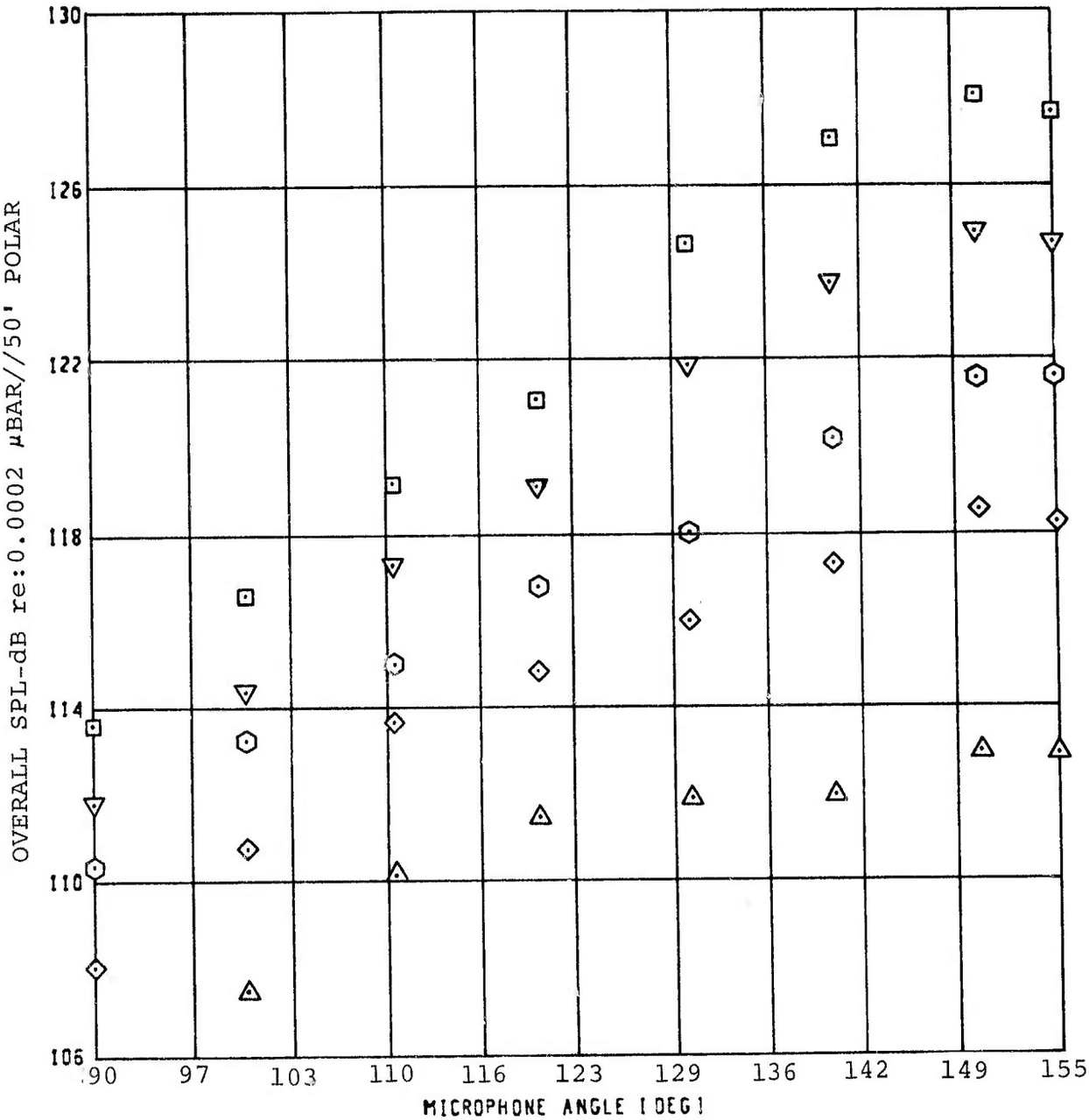


PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL (dB)
⊖	0096	1150°F	2.000	130°	SOFP	117.3
⊡	0095	1150	2.500	↓	SOFP	121.3
x	0096	1150	3.000	↓	SOFP	123.5
*	0096	1150	3.500	↓	SOFP	127.3
Y	0096	1150	4.000	↓	SOFP	130.4

NOZZLE: 19T-3.3AR-CPA-ET/RC

MEASURED NOISE SPECTRA AT 130° re: NOZZLE INLET AXIS

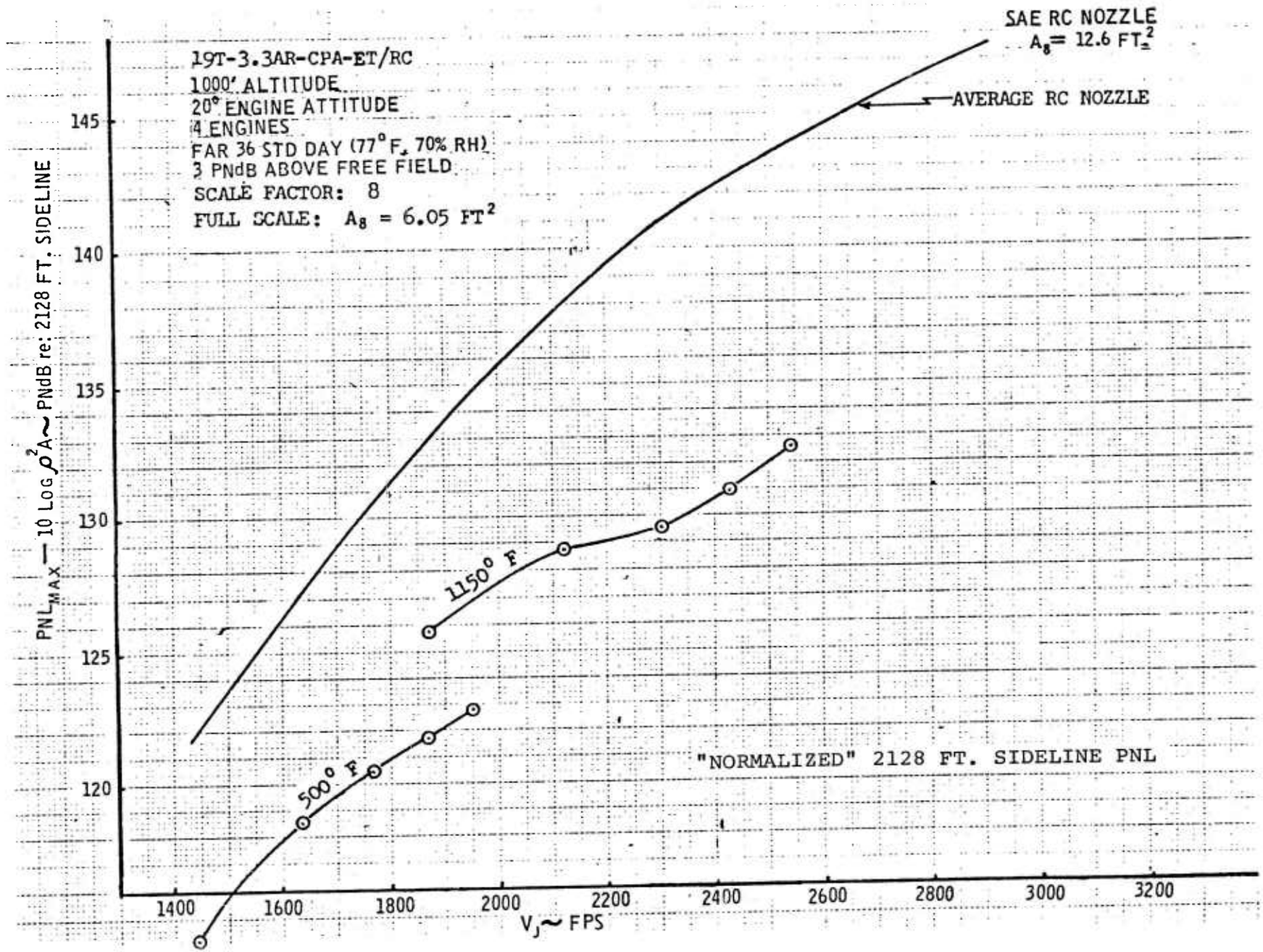
FREE FIELD VALUES

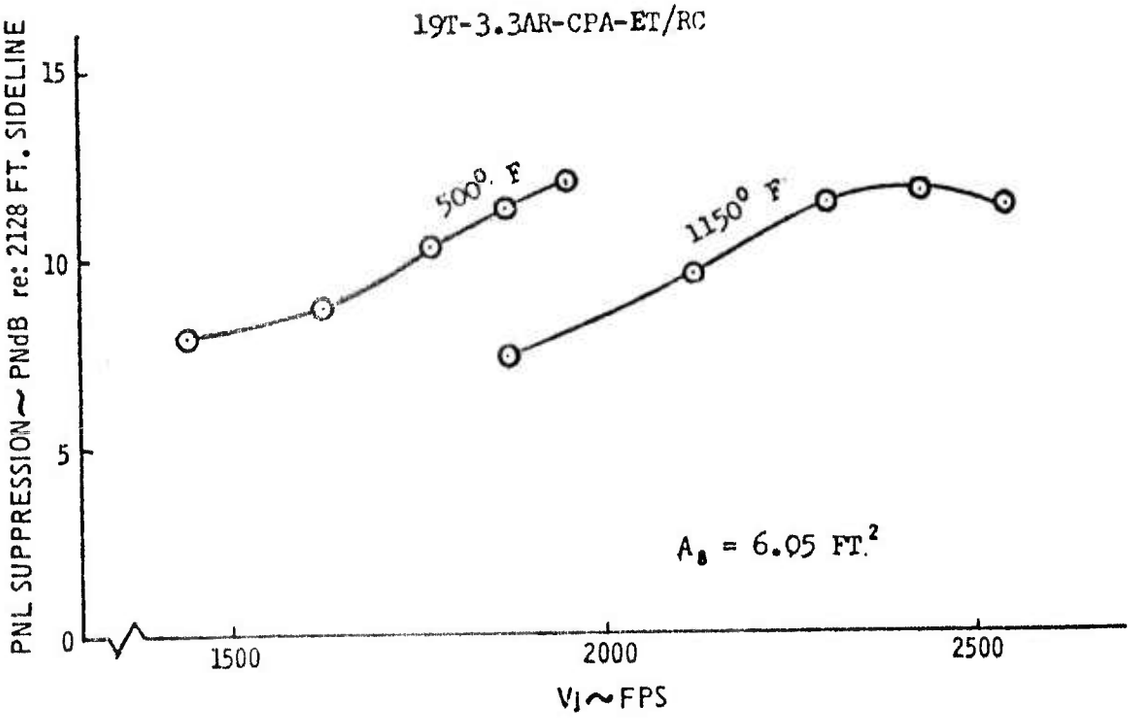


PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	009	2.00	1150°F
◇	009	2.50	1150
○	009	3.00	1150
▽	009	3.50	1150
□	009	4.00	1150

NOZZLE: 19T-3.3AR-CPA-ET/RC

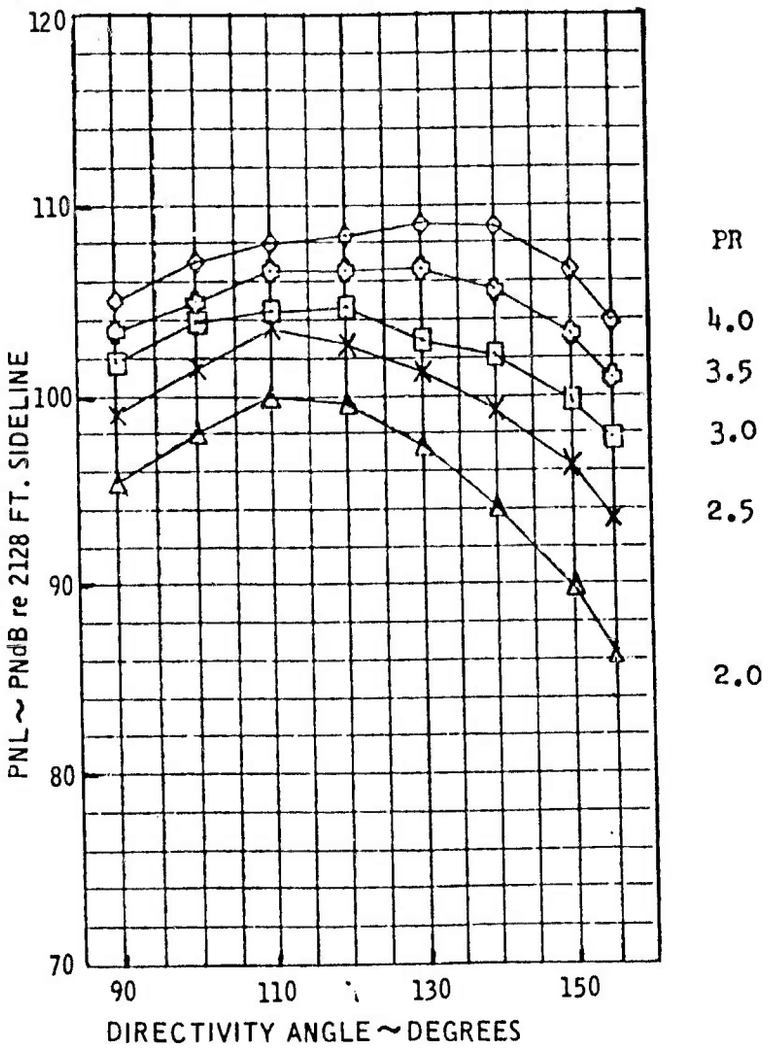
OASPL BEAM PATTERNS


19T-3.3AR-CPA-ET/RC
1000' ALTITUDE
20° ENGINE ATTITUDE
4 ENGINES
FAR 36 STD DAY (77° F, 70% RH)
3 PNdB ABOVE FREE FIELD
SCALE FACTOR: 8
FULL SCALE: A_8 = 6.05 FT^2
SAE RC NOZZLE
A_8 = 12.6 FT^2
AVERAGE RC NOZZLE
1150° F
500° F
"NORMALIZED" 2128 FT. SIDELINE PNL
PNL_{MAX} — 10 LOG $\rho^2 A$ ~ PNdB re: 2128 FT. SIDELINE
V_j ~ FPS
145
140
135
130
125
120
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200



PEAK PNL SUPPRESSION VALUES

NOZZLE: 19T-3.3AR-CPA-ET/RC



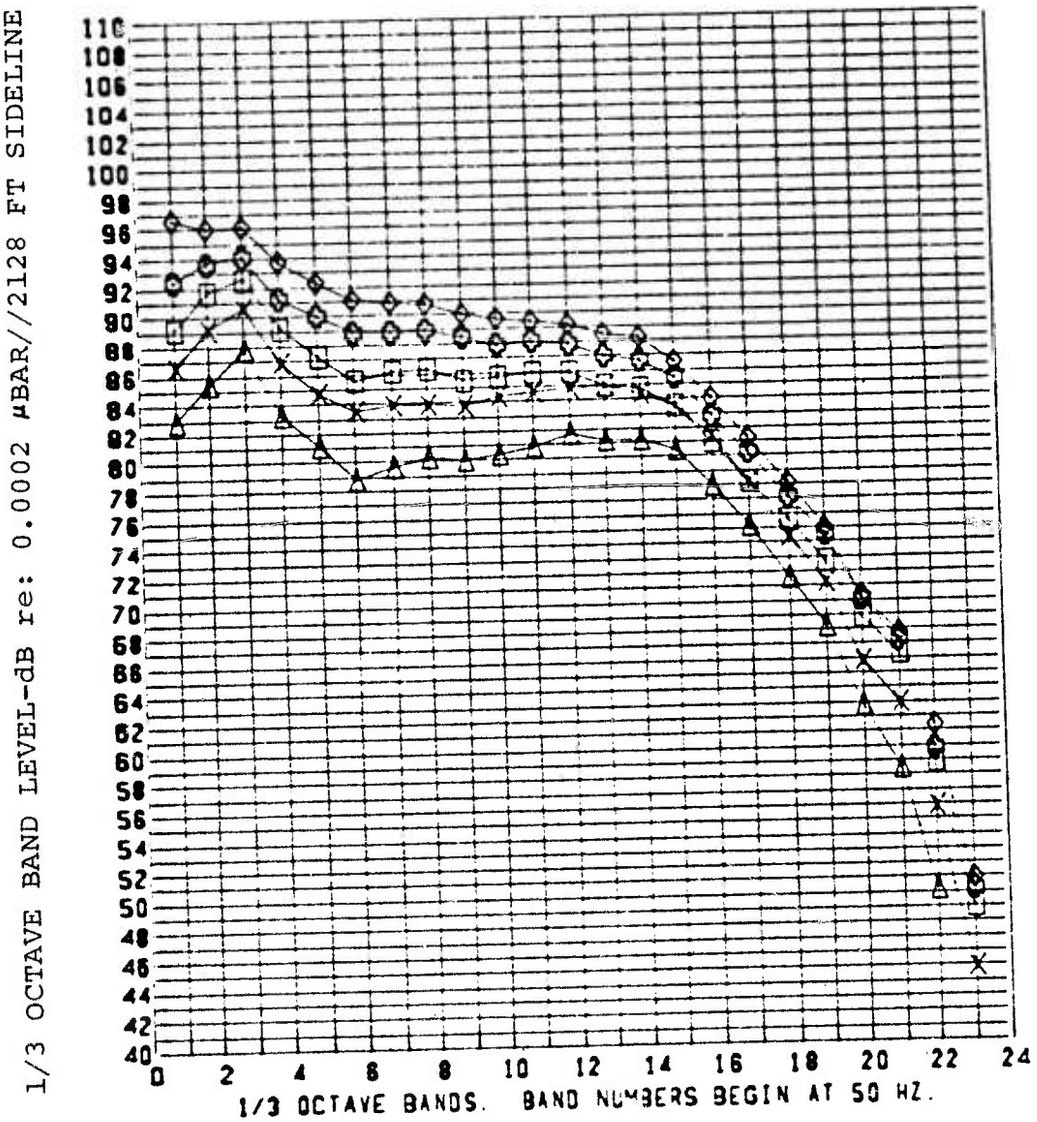
RUN 009

T_T = 1150° F A_8 = 6.05 FT^2

PNL BEAM PATTERNS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 110 DEG TEMP = 77 DEG R.H. = 70 PER CENT



T_T = 1150°F A_8 = 6.05 FT^2 RUN: 009

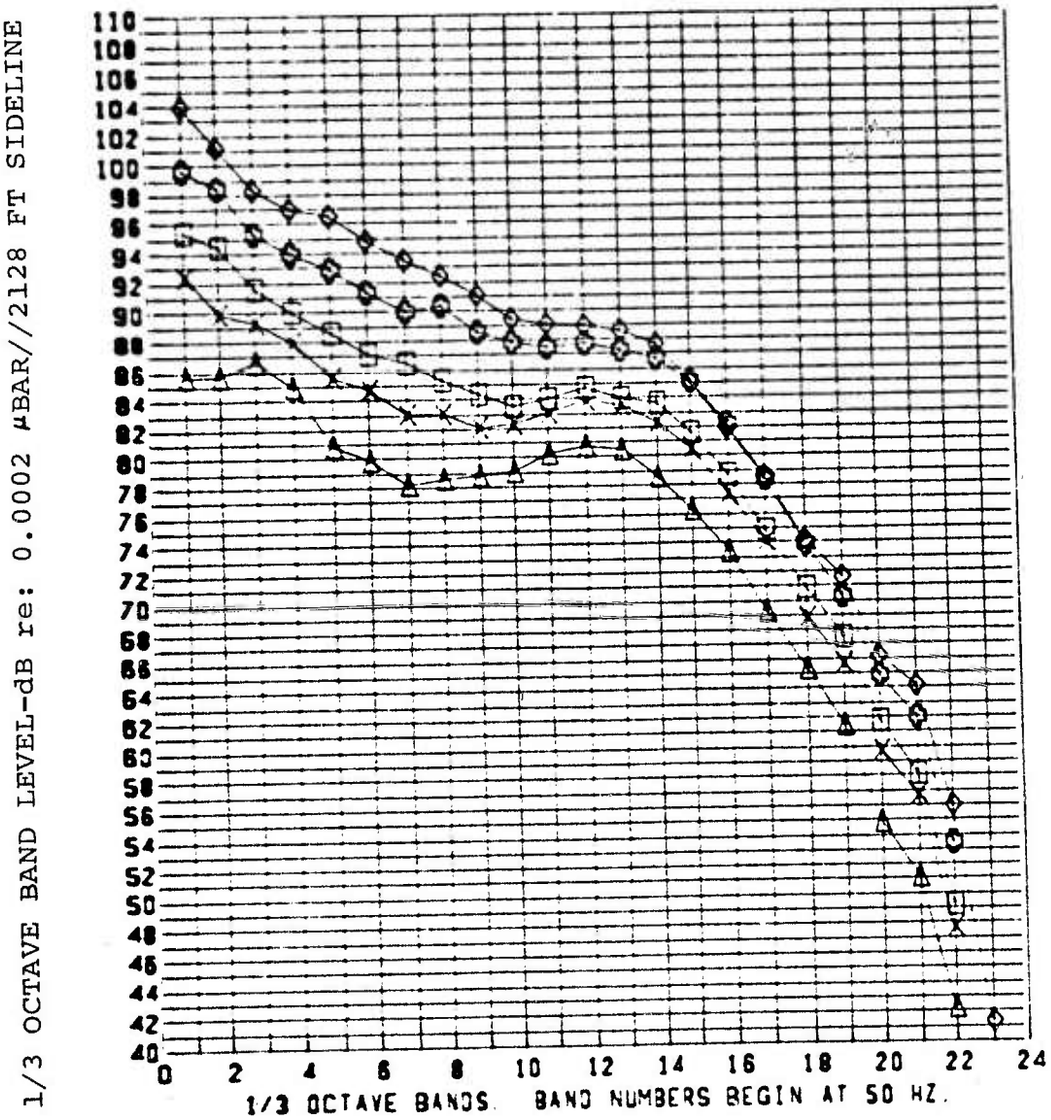
PR = △ 2.0, X 2.5, □ 3.0, ✣ 3.5, ◇ 4.0

NOZZLE: 19T-3.3AR-CPA-ET/RC

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 110°
re: NOZZLE INLET AXIS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 130 DEG TEMP = 77 DEG R.H. = 70 PER CENT



T_T = 1150°F A_8 = 6.05 FT^2 RUN: 009

PR = △ 2.0, X 2.5, □ 3.0, ✣ 3.5, ◇ 4.0

NOZZLE: 19T-3.3AR-CPA-ET/RC

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 130°
re: NOZZLE INLET AXIS

TEST CONDITIONS

NOZZLE: 19T-3.3AR-CPA-ET/RC

FACILITY: WALL ISOLATION FACILITY

DATE: January 19, 1973

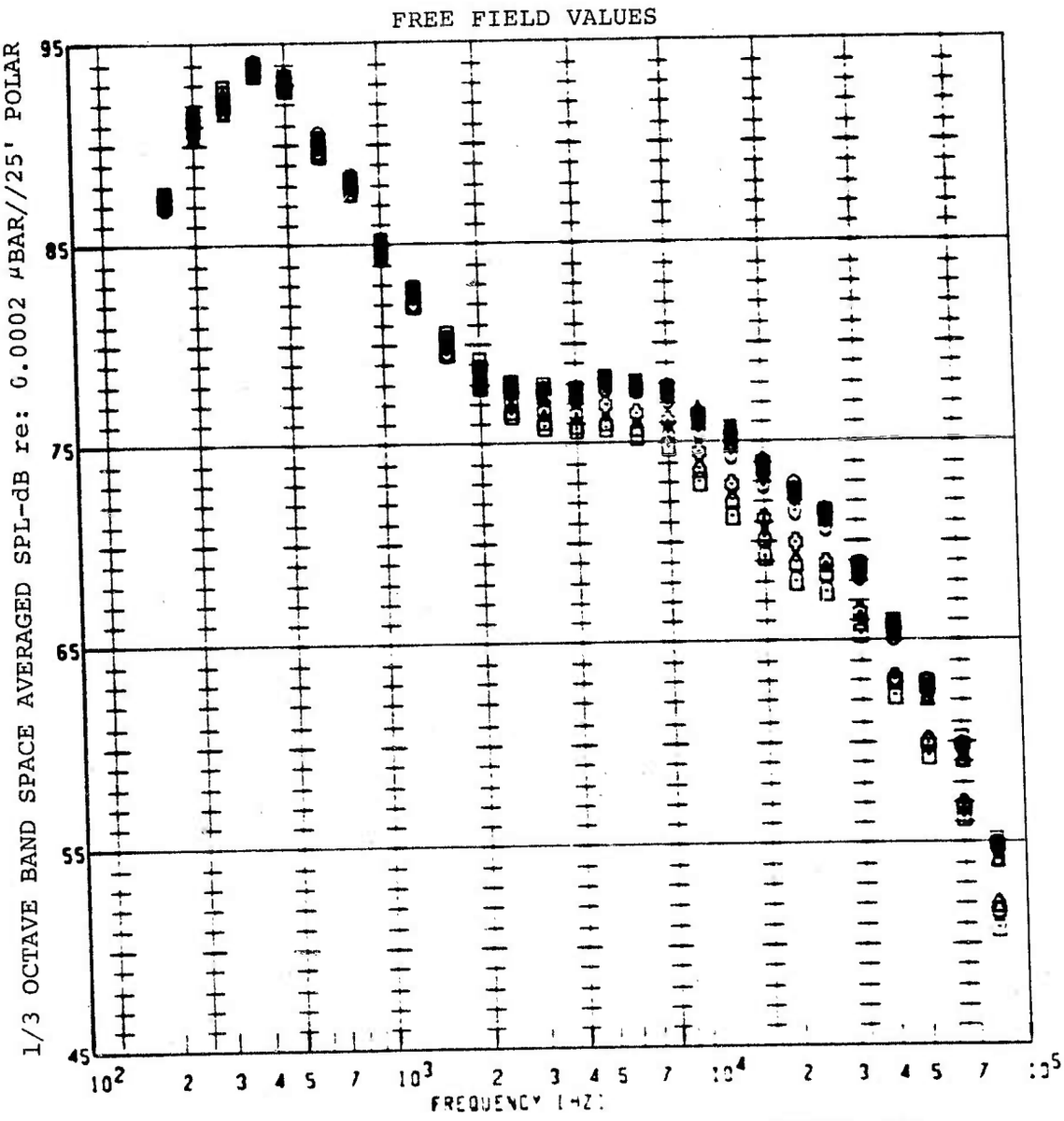
P_{AMB} = 29.92 in Hg T_{AMB} = 40°F R.H. = 83%

NPR = 3.0 T_T = 1150°F V_J (IDEAL) = 2300 FPS

SCALE MODEL A_8 = 13.6 in.^{2}

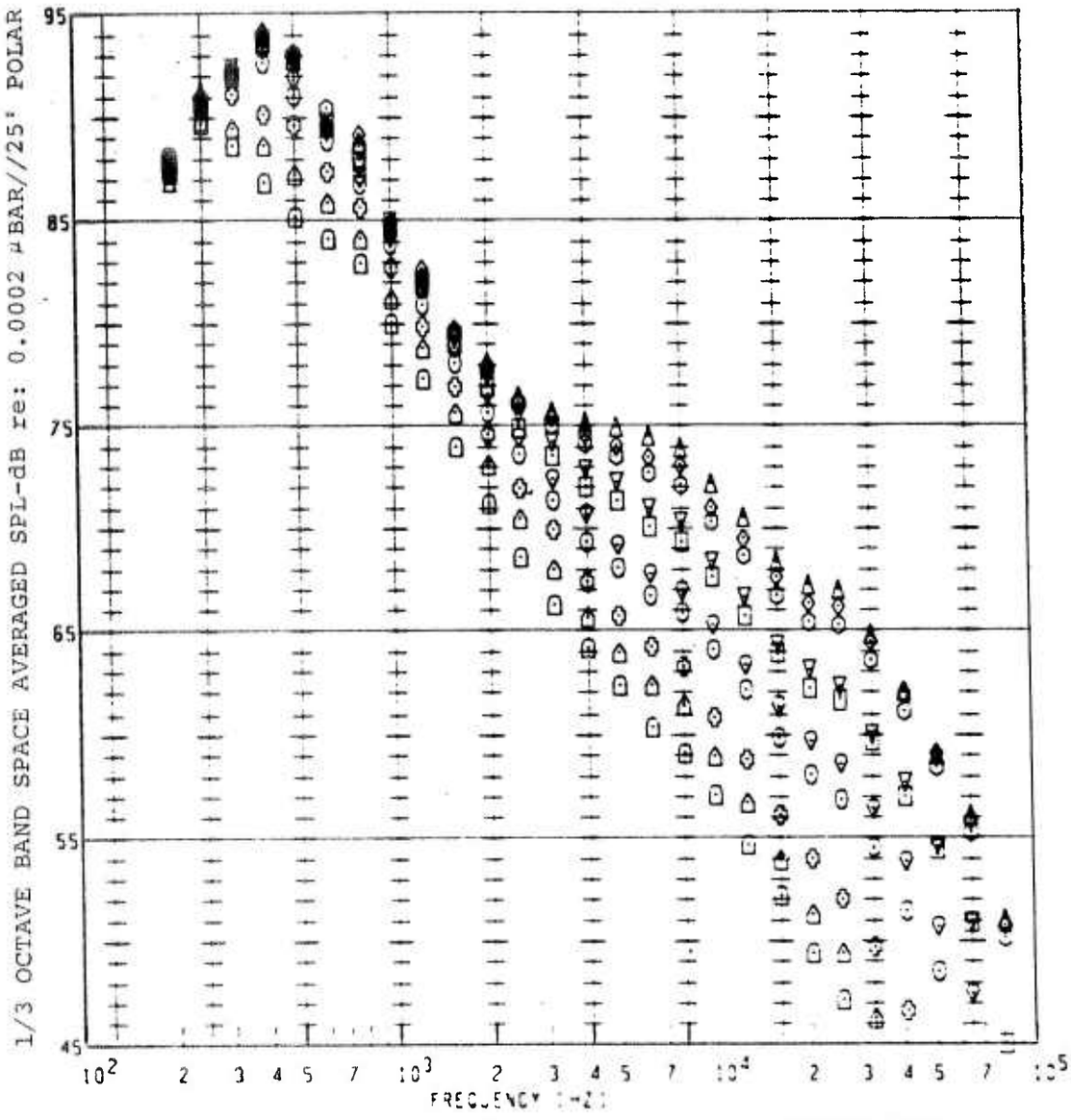
RUN NO.	AXIAL LOCATION	IRIS DIA.	REMARKS	REF.
99	0.0 x/D	9.0 in.		
100	0.25	9.0		
101	0.50	9.0		
102	0.75	10.0		
103	1.00	10.0		
104	1.25	10.5		
105	1.50	10.5		
106	1.75	11.0		
107	2.00	11.0		
108	2.25	11.5		
109	2.50	11.5		
110	2.75	12.0		
111	3.0	13.0		
112	3.5	14.0		
113	4.0	15.0		
114	5.0	16.0		
115	6.0	18.0		
116	8.0	19.0		
117	10.0	21.0		
118	12.0	23.0		
119	14.0	25.0		
120	160	27.0		

MICROPHONE LAYOUT: 25 FOOT VERTICAL POLAR ARC



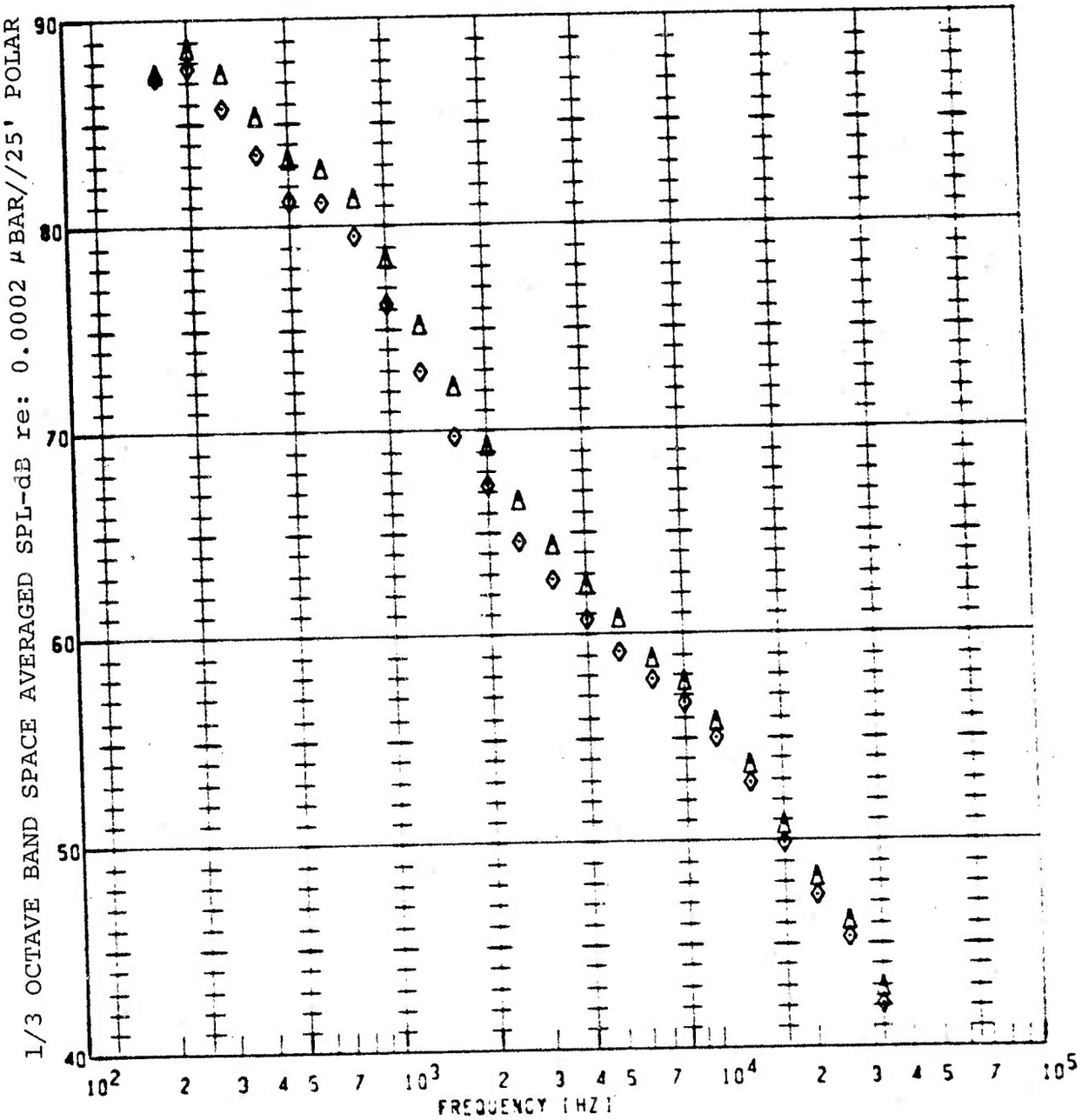
PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	AXIAL LOCATION, x/D
Δ	99	1150°F	3.000	0.00
◇	100	1150	3.000	0.25
○	101	1150	3.000	0.50
▽	102	1150	3.000	0.75
□	103	1150	3.000	1.00
⬡	104	1150	3.000	1.25
⊙	105	1150	3.000	1.50
◈	106	1150	3.000	1.75
▷	107	1150	3.000	2.0
⊡	108	1150	3.000	2.25

FREE FIELD VALUES

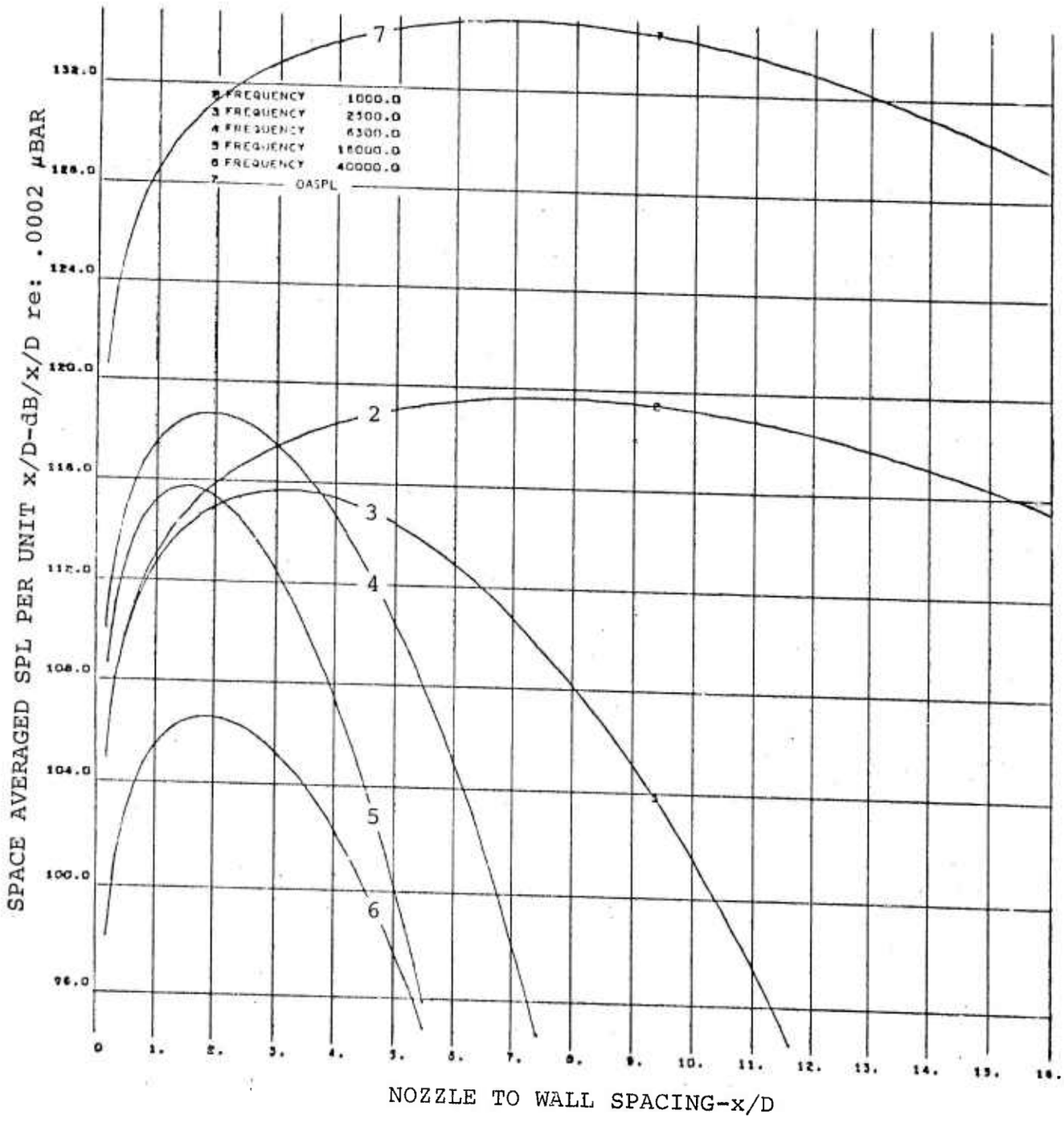


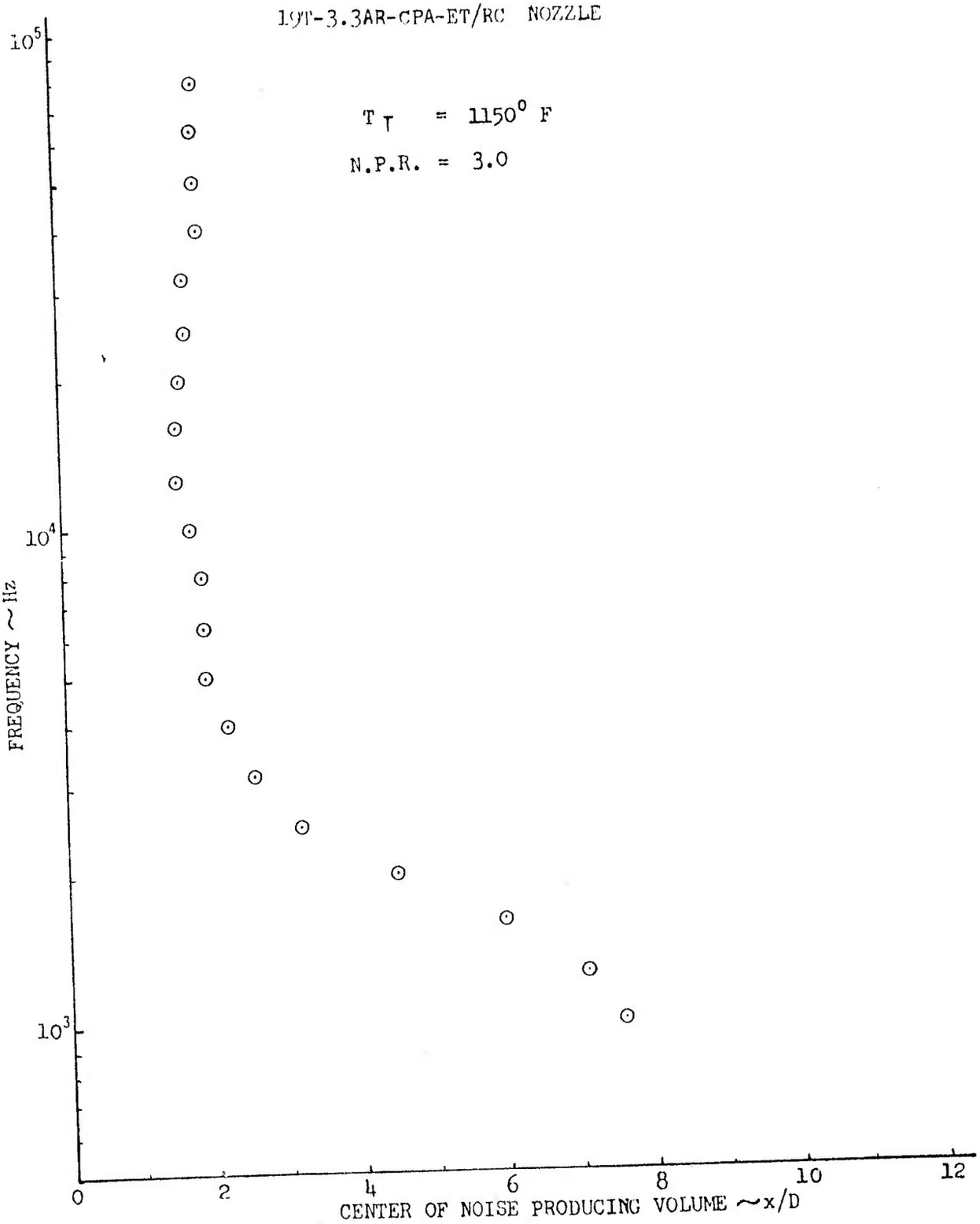
PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	AXIAL LOCATION, x/D
△	109	1150°F	3.000	2.5
◇	110	1150	3.000	2.75
○	111	1150	3.000	3.0
▽	112	1150	3.000	3.5
□	113	1150	3.000	4.0
◇	114	1150	3.000	5.00
○	115	1150	3.000	6.0
◇	116	1150	3.000	8.0
△	117	1150	3.000	10.0
□	118	1150	3.000	12.0

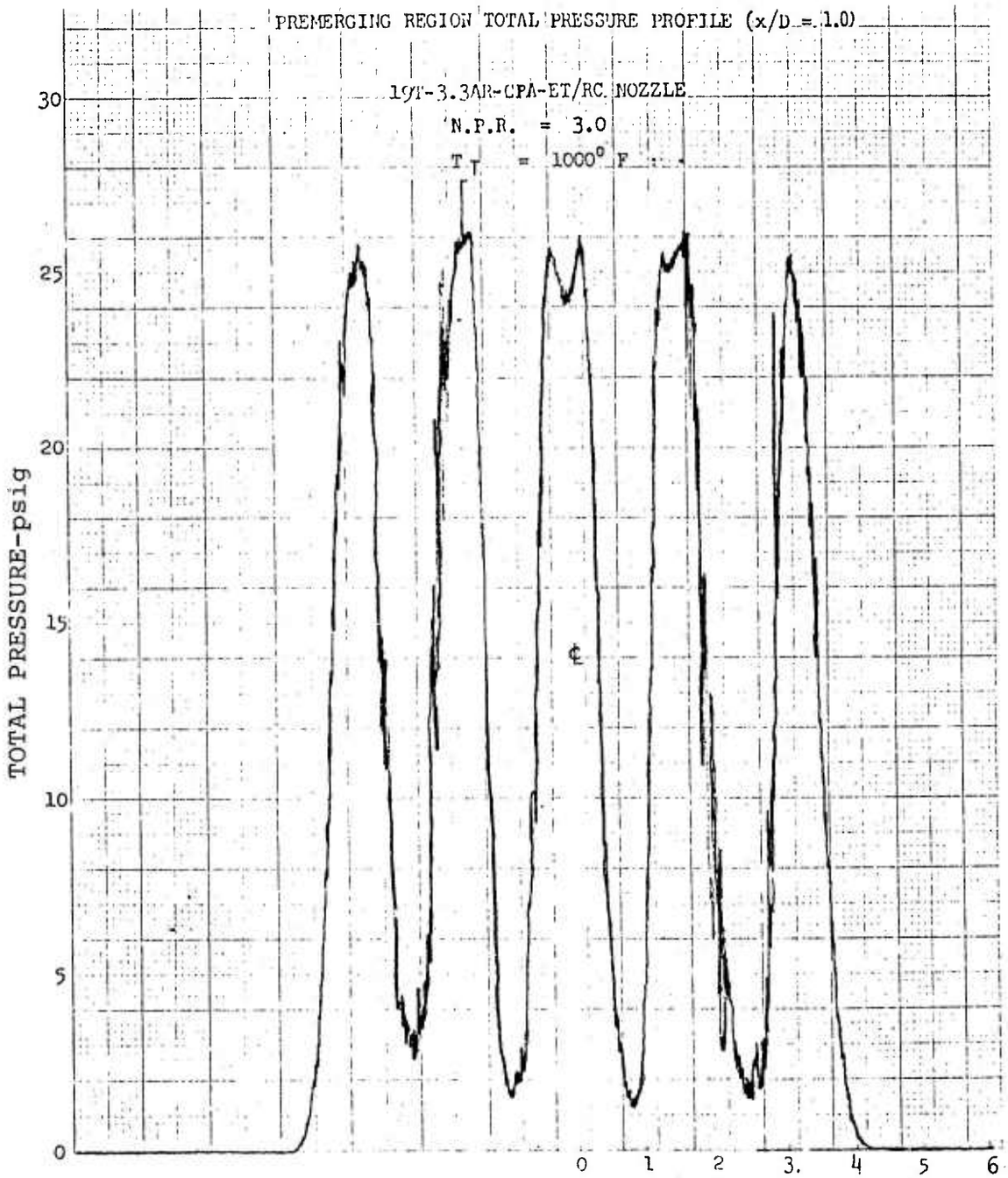
FREE FIELD VALUES

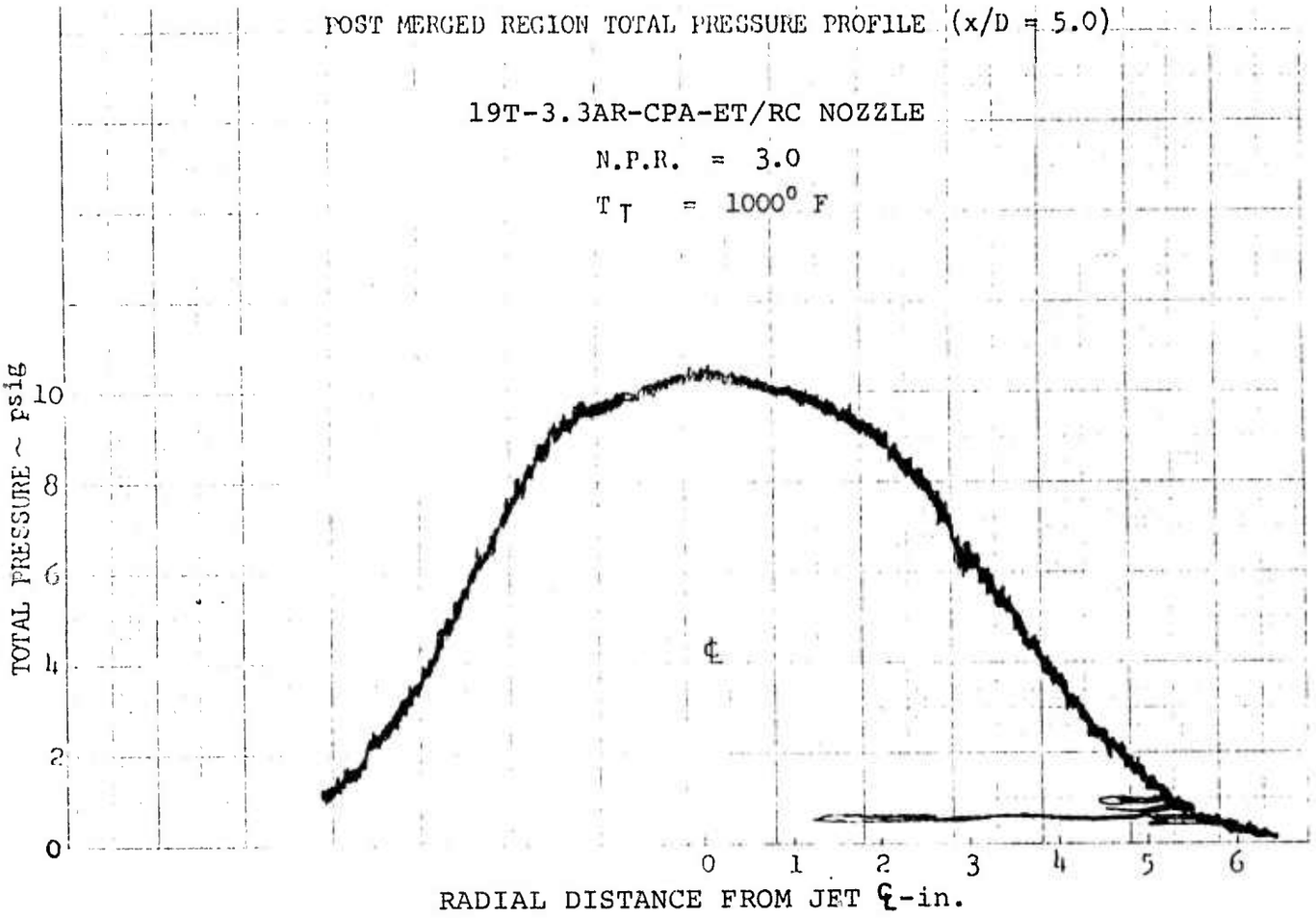


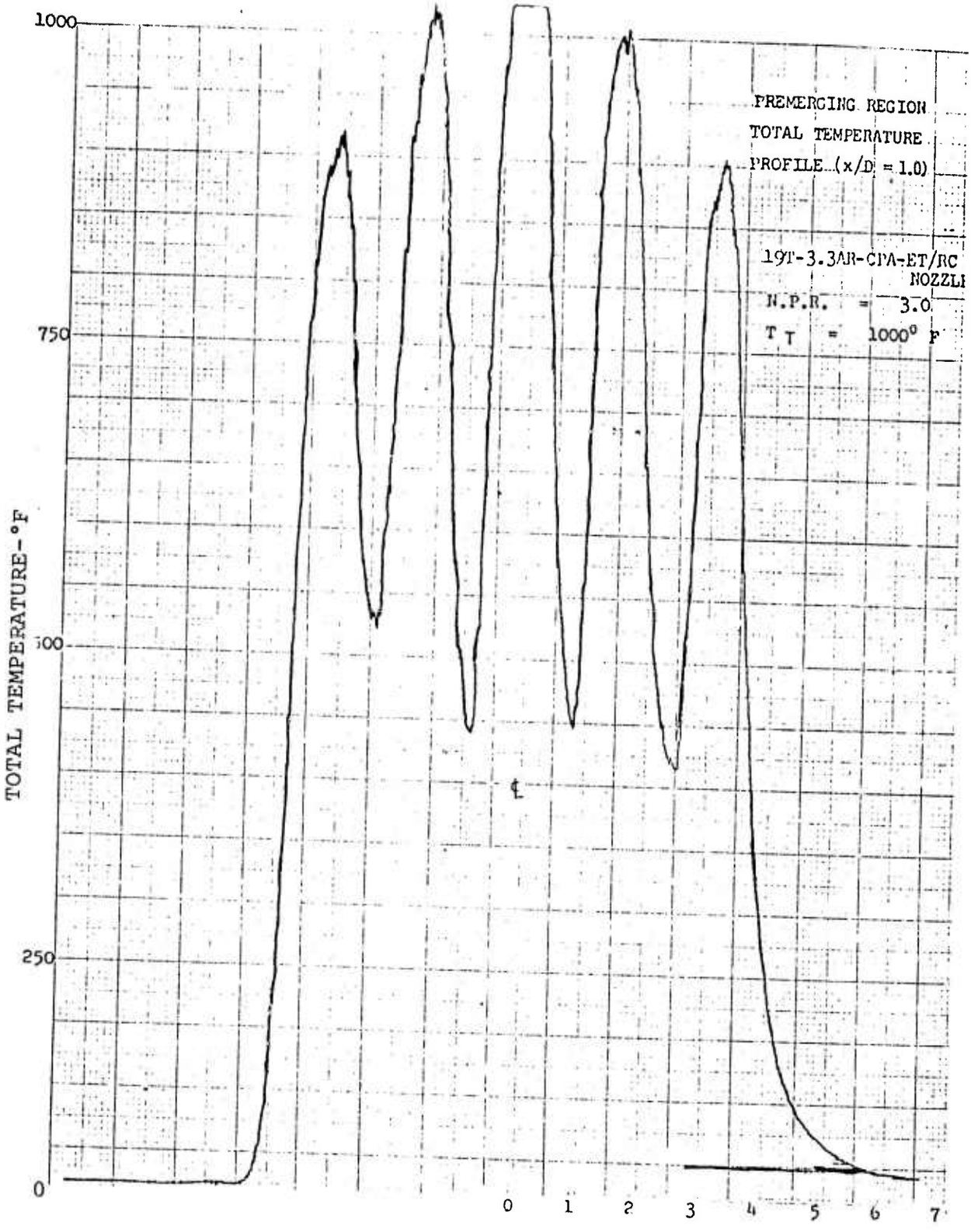
PLOT SYMBOL	RUN NUMBER	EY TEMP	PRESSURE RATIO	AXIAL LOCATION, x/D
Δ	119	1150°F	3.0	14.0
◇	120	1150	3.0	16.0

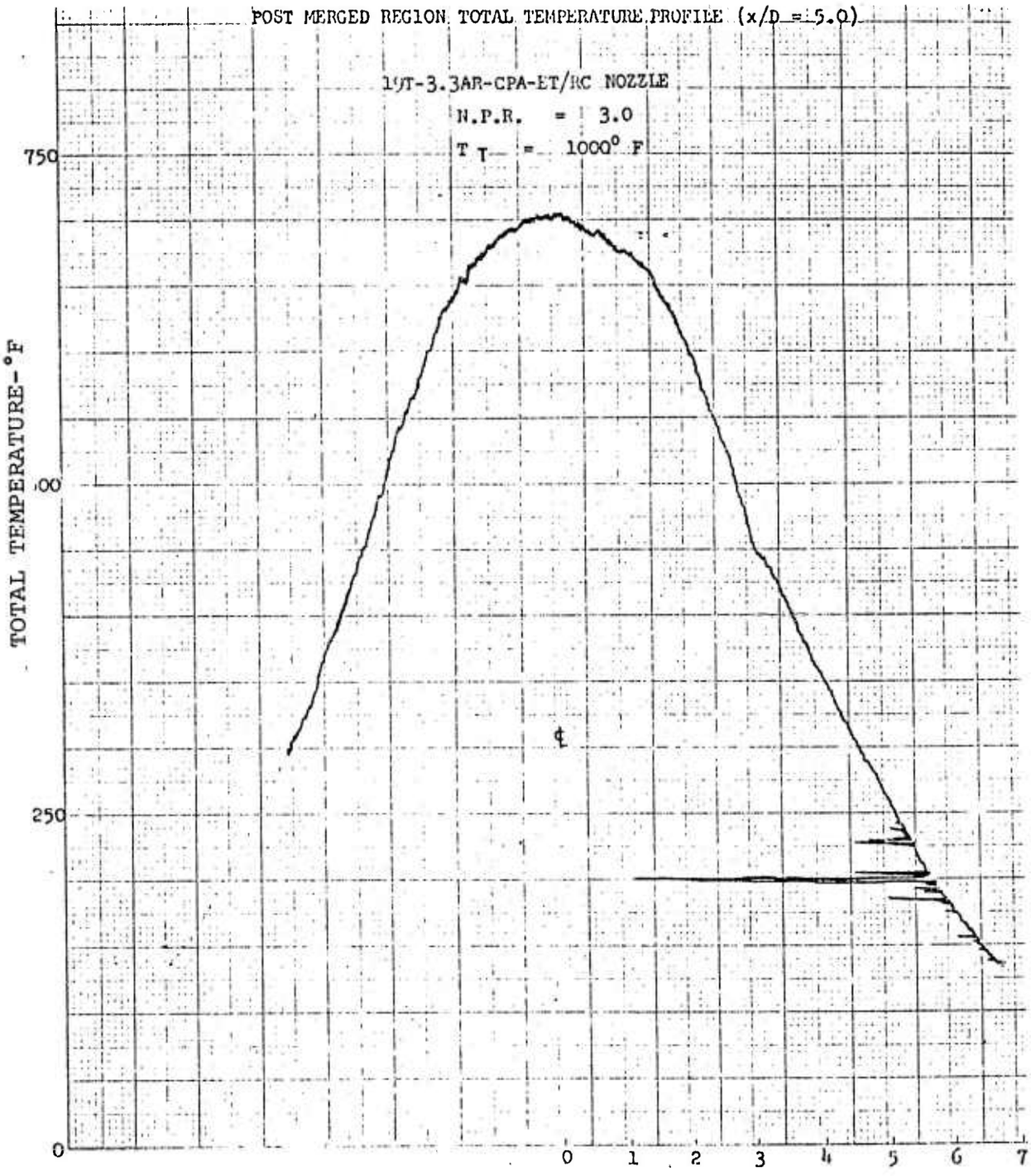

SPACE AVERAGED SPL PER UNIT x/D-dB/x/D re: .0002 μBAR
NOZZLE TO WALL SPACING-x/D
2 FREQUENCY 1000.0
3 FREQUENCY 2500.0
4 FREQUENCY 6300.0
5 FREQUENCY 16000.0
6 FREQUENCY 40000.0
7 OASPL
132.0
128.0
124.0
120.0
116.0
112.0
108.0
104.0
100.0
96.0
0
1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.
13.
14.
15.
16.

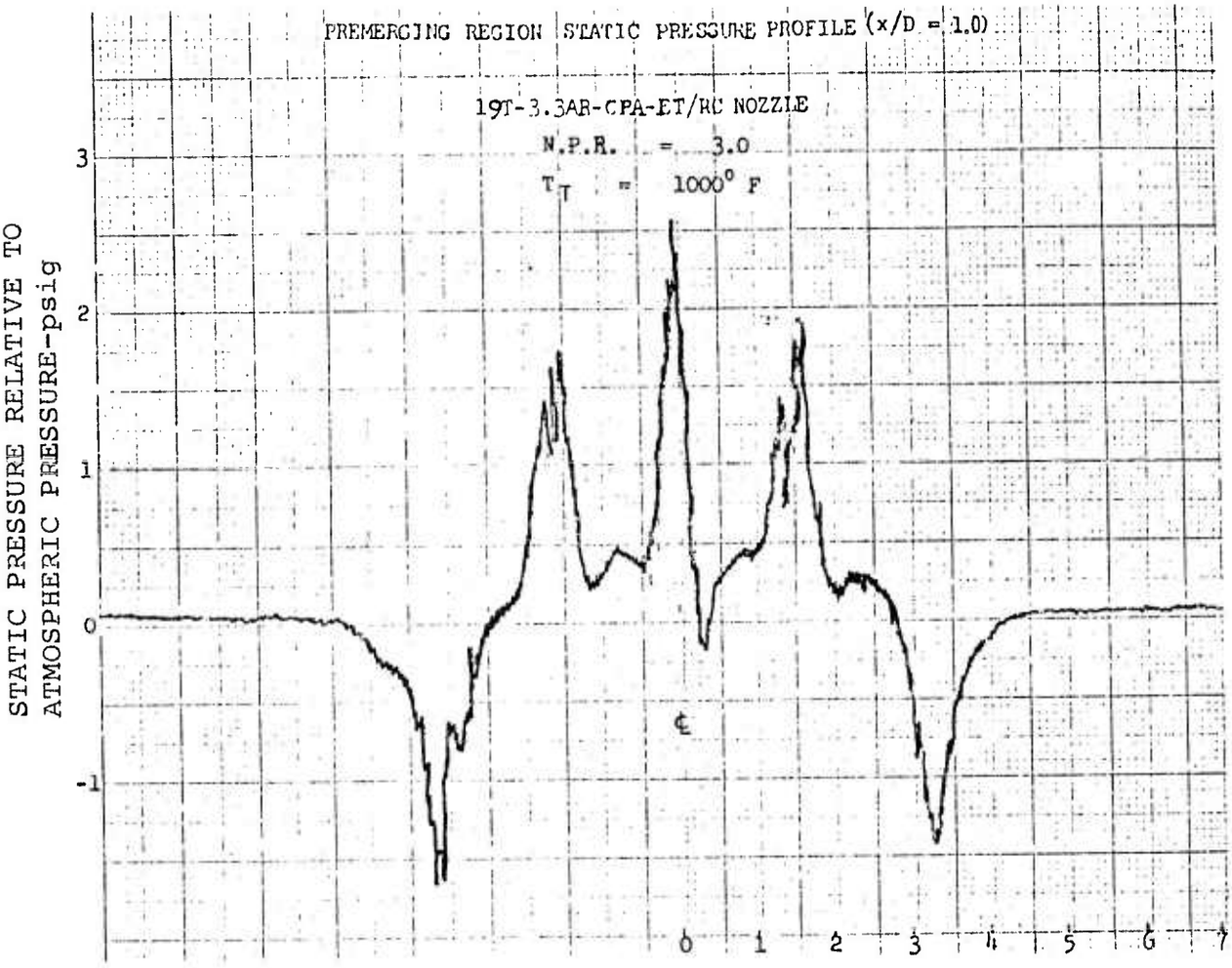

19T-3.3AR-CPA-ET/RC NOZZLE
T_T = 1150° F
N.P.R. = 3.0
10^5
10^4
10^3
FREQUENCY ~ Hz
0
2
4
6
8
10
12
CENTER OF NOISE PRODUCING VOLUME ~x/D

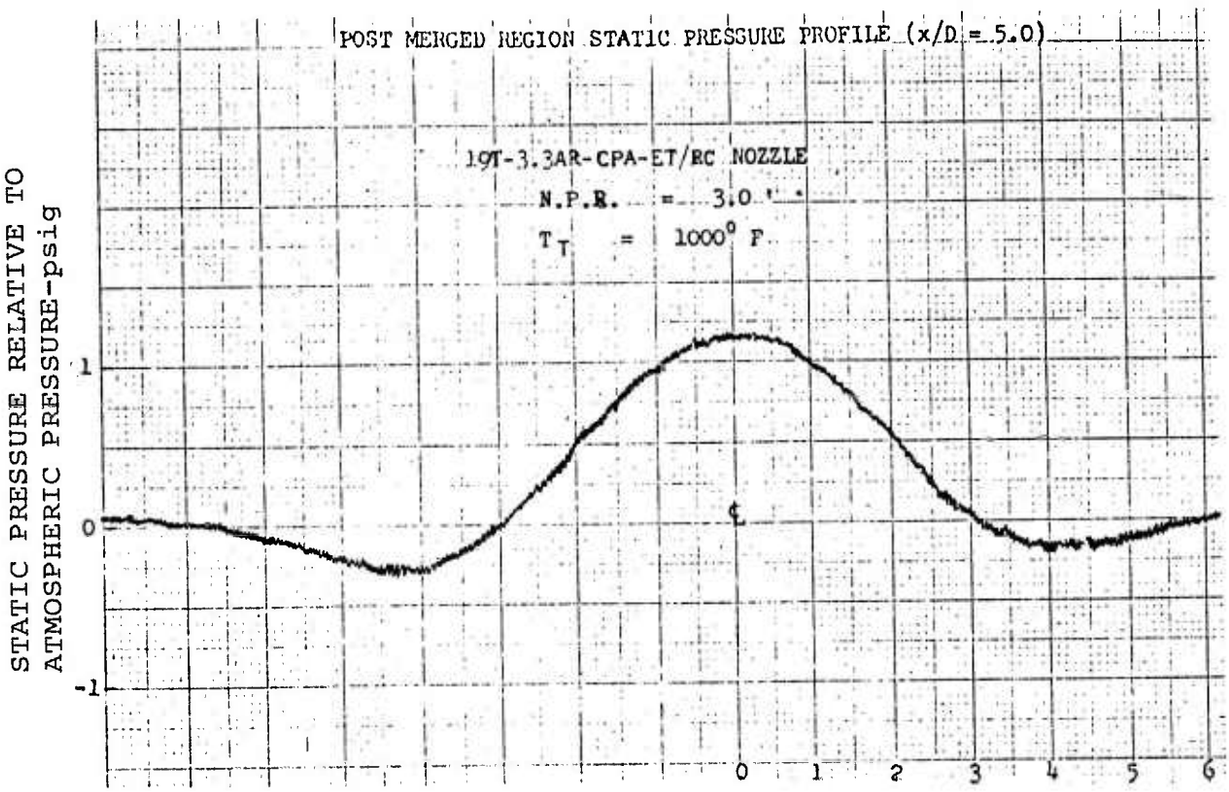

PREMERGING REGION TOTAL PRESSURE PROFILE (x/D = 1.0)
19T-3.3AR-CPA-ET/RC NOZZLE
N.P.R. = 3.0
T T = 1000° F
TOTAL PRESSURE-psig
0
5
10
15
20
25
30
0
1
2
3
4
5
6
RADIAL DISTANCE FROM JET ℄ -in.

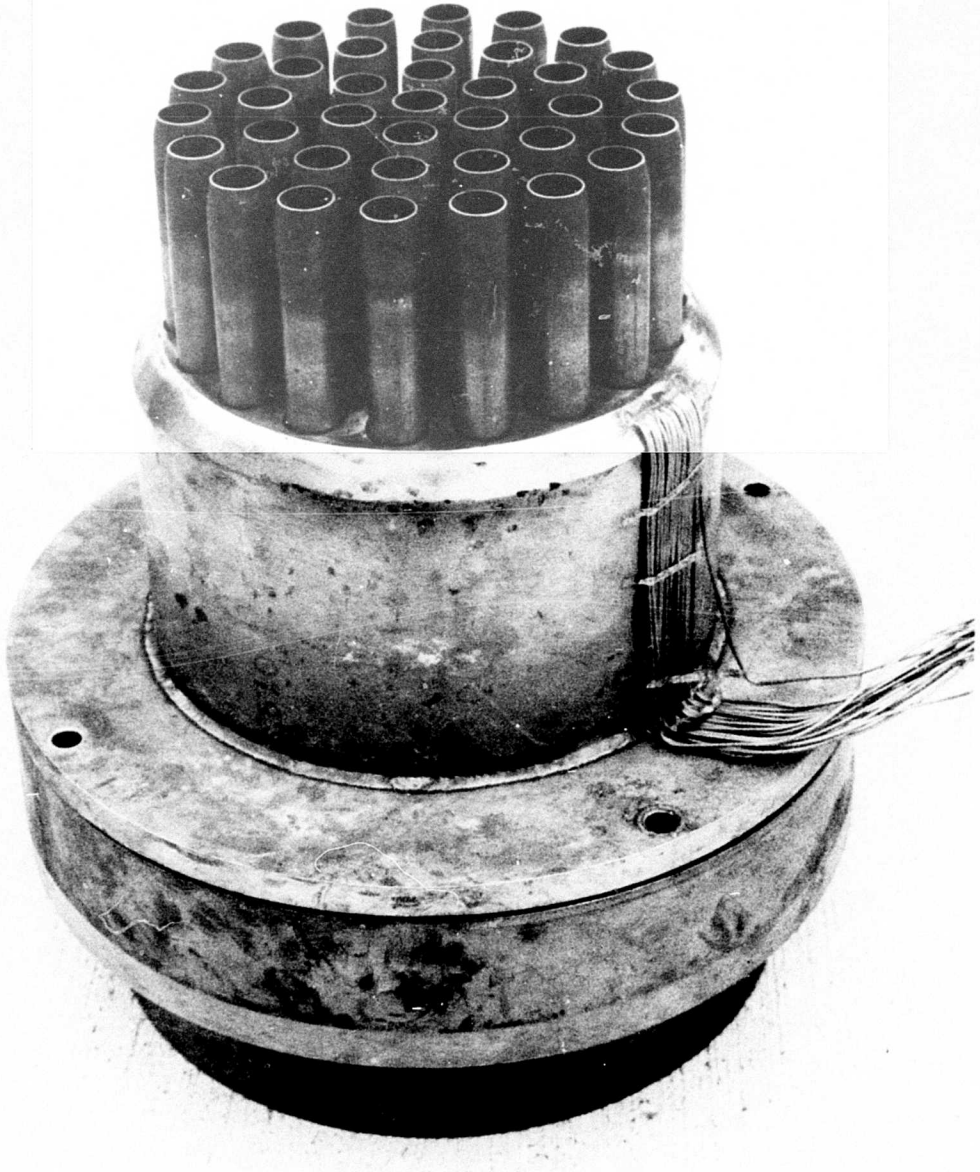

POST MERGED REGION TOTAL PRESSURE PROFILE (x/D = 5.0)
19T-3.3AR-CPA-ET/RC NOZZLE
N.P.R. = 3.0
T_T = 1000° F
TOTAL PRESSURE ~ psig
0
2
4
6
8
10
℄
0
1
2
3
4
5
6
RADIAL DISTANCE FROM JET ℄-in.


PREMERGING REGION
TOTAL TEMPERATURE
PROFILE (x/D = 1.0)
19T-3.3AR-CPA-ET/RC
NOZZLE
N.P.R. = 3.0
T T = 1000° F
TOTAL TEMPERATURE - °F
1000
750
500
250
0
℄
0
1
2
3
4
5
6
7
RADIAL DISTANCE FROM JET ℄-in.

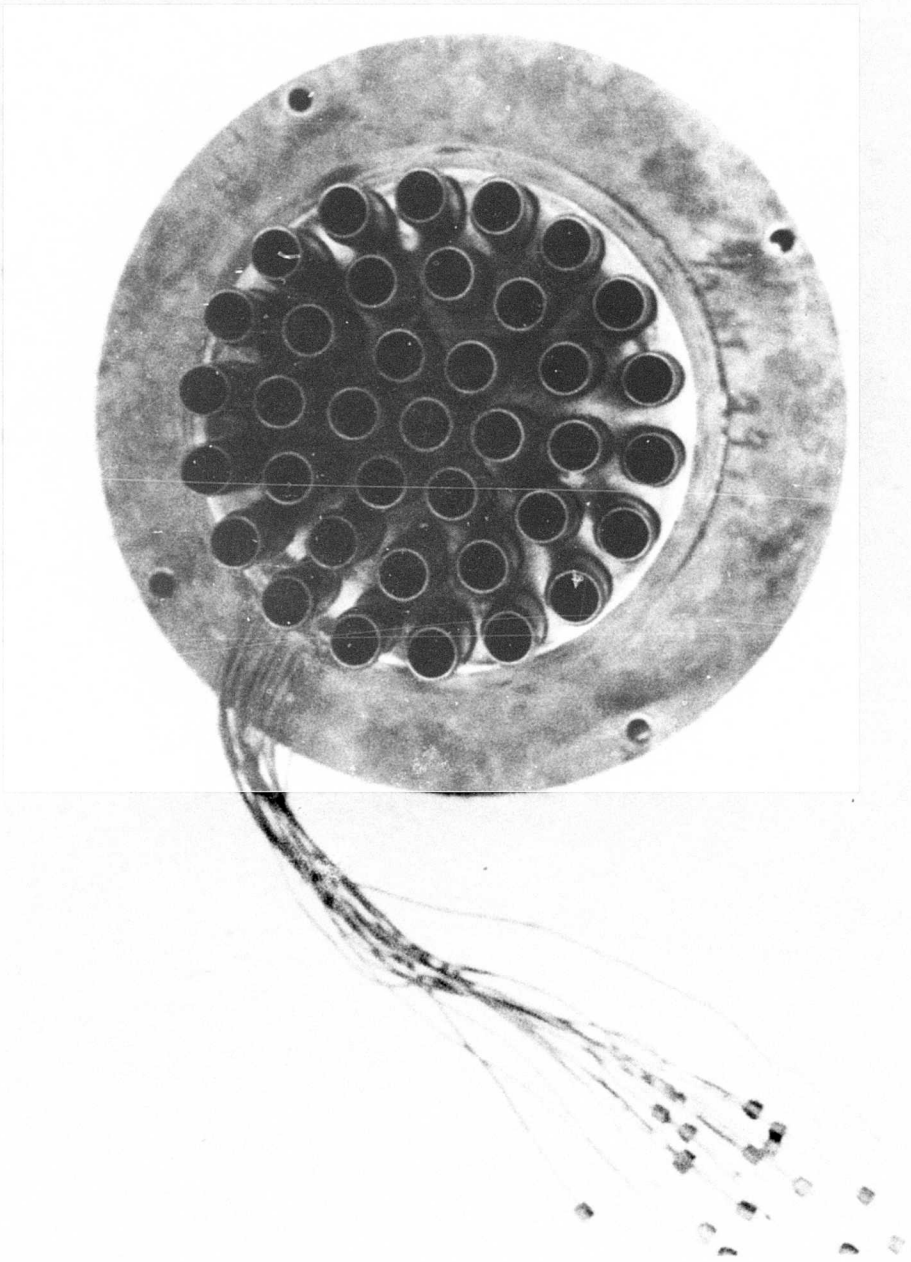

POST MERGED REGION TOTAL TEMPERATURE PROFILE (x/D = 5.0)
19T-3.3AR-CPA-ET/RC NOZZLE
N.P.R. = 3.0
T T = 1000° F
TOTAL TEMPERATURE - °F
750
500
250
0
0
1
2
3
4
5
6
7
RADIAL DISTANCE FROM JET ℄-in.


PREMERGING REGION STATIC PRESSURE PROFILE (x/D = 1.0)
19T-3.3AR-CPA-ET/RC NOZZLE
N.P.R. = 3.0
T_T = 1000° F
STATIC PRESSURE RELATIVE TO ATMOSPHERIC PRESSURE-psig
3
2
1
0
-1
℄
0
1
2
3
4
5
6
7
RADIAL DISTANCE FROM JET ℄-in.


POST MERGED REGION STATIC PRESSURE PROFILE (x/D = 5.0)
19T-3.3AR-CPA-ET/BC NOZZLE
N.P.R. = 3.0
T_T = 1000° F
STATIC PRESSURE RELATIVE TO ATMOSPHERIC PRESSURE-psig
1
0
-1
0
1
2
3
4
5
6
RADIAL DISTANCE FROM JET ℄-in.



37T-3.3AR-CPA-ET/RC NOZZLE



37T-3.3AR-CPA-ET/RC NOZZLE

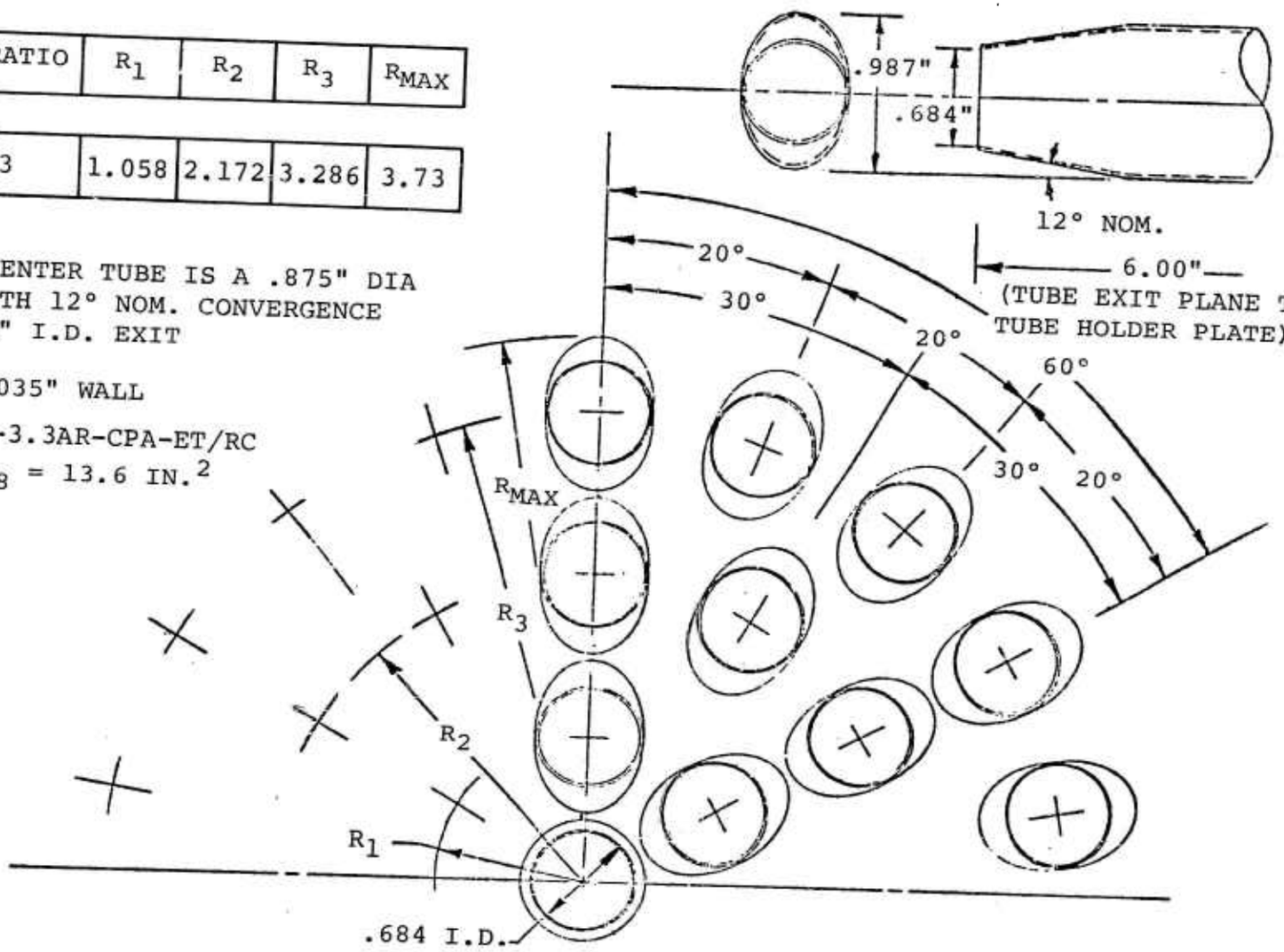
AREA RATIO	R_1	R_2	R_3	R_{MAX}
3.3	1.058	2.172	3.286	3.73

NOTE: CENTER TUBE IS A .875" DIA TUBE WITH 12° NOM. CONVERGENCE TO .684" I.D. EXIT

MAT'L-.035" WALL

37T-3.3AR-CPA-ET/RC

A_8 = 13.6 IN.^{2}



37 TUBE - AREA RATIO 3.3, ELLIPTICAL TUBES CLOSE ARRAY

TEST CONDITIONS

NOZZLE: 37T-3.3AR-CPA-ET/RC

FACILITY: HNTF

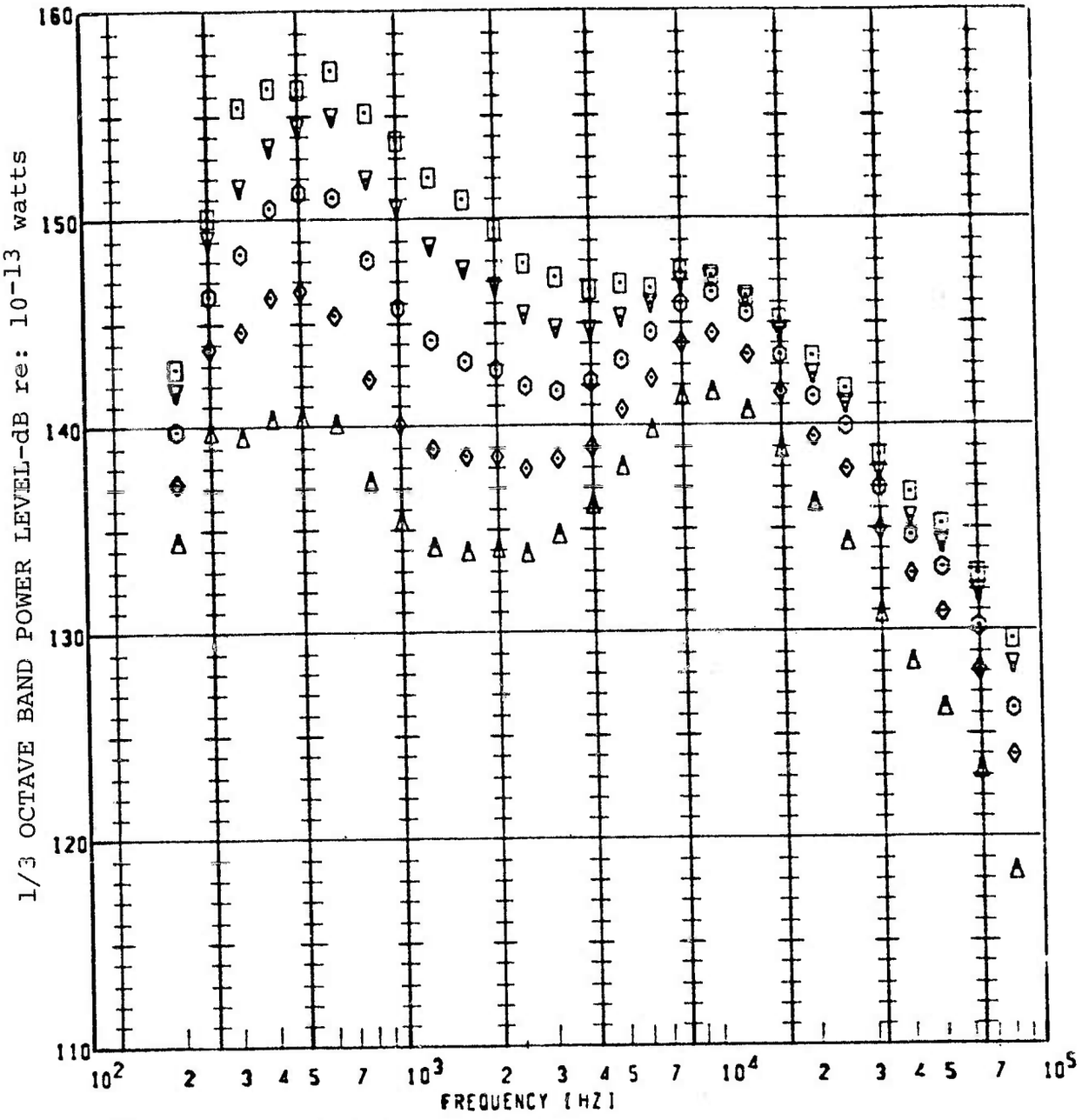
DATE: 6-11-73 T_{AMB} = 60°F **R.H.** = 58%

SCALE MODEL A_8 = 13.6 $in.^2$

RUN NO.	NPR	T_T	V_J (IDEAL)	REMARKS	REF
6	2.0	1150°F	1875 fps	6" tube lengths	
"	2.5	"	2126		
"	3.0	"	2303		
"	3.5	"	2437		
"	4.0	"	2544		

MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH CONCRETE GROUND SURFACE. MEASURED ACOUSTIC DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.

FREE FIELD VALUES

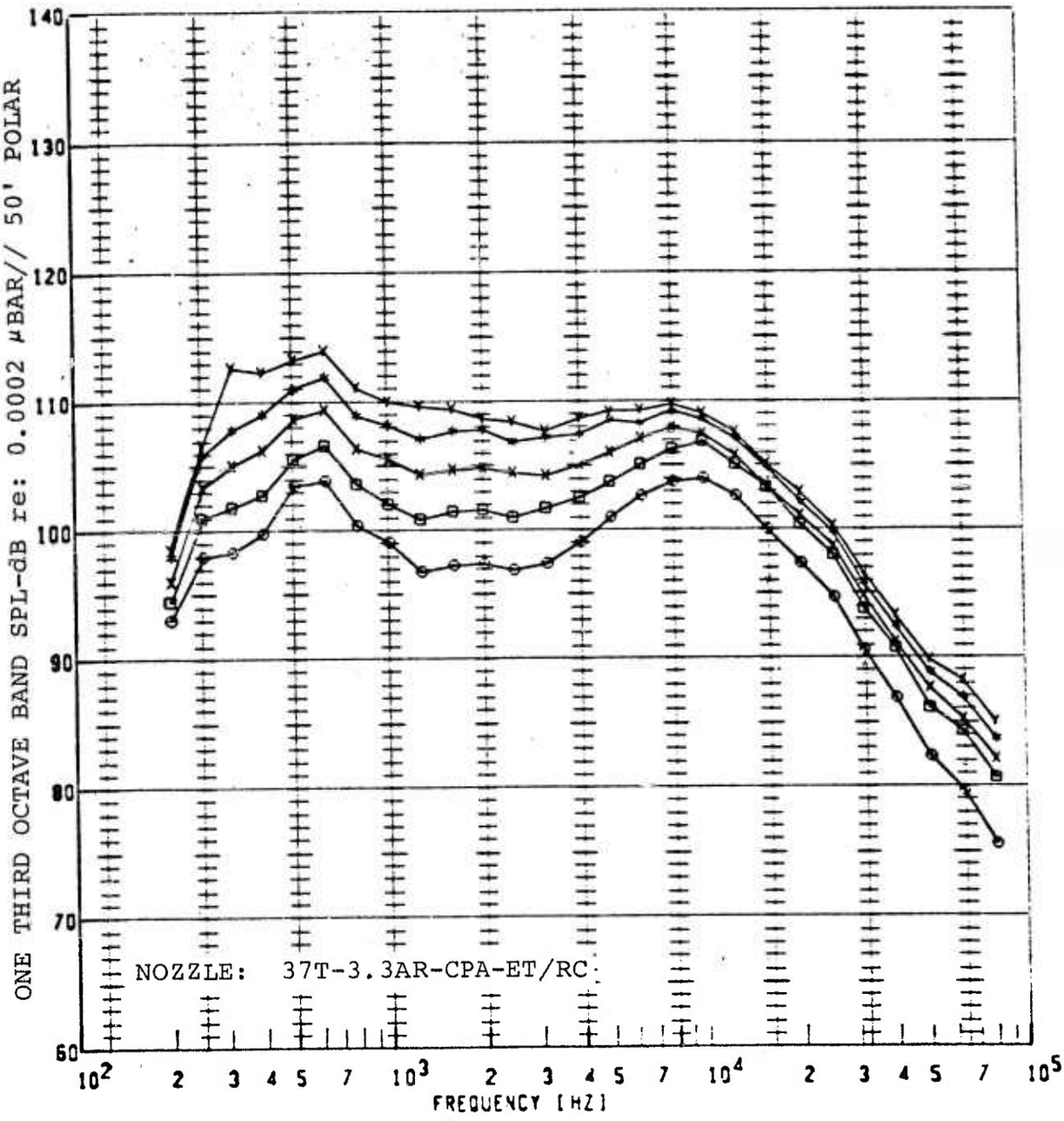


PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	006	2.00	1150°F
◇	006	2.50	1150
○	006	3.00	1150
▽	006	3.50	1150
□	006	4.00	1150

NOZZLE: 37T-3.3AR-CPA-ET/RC

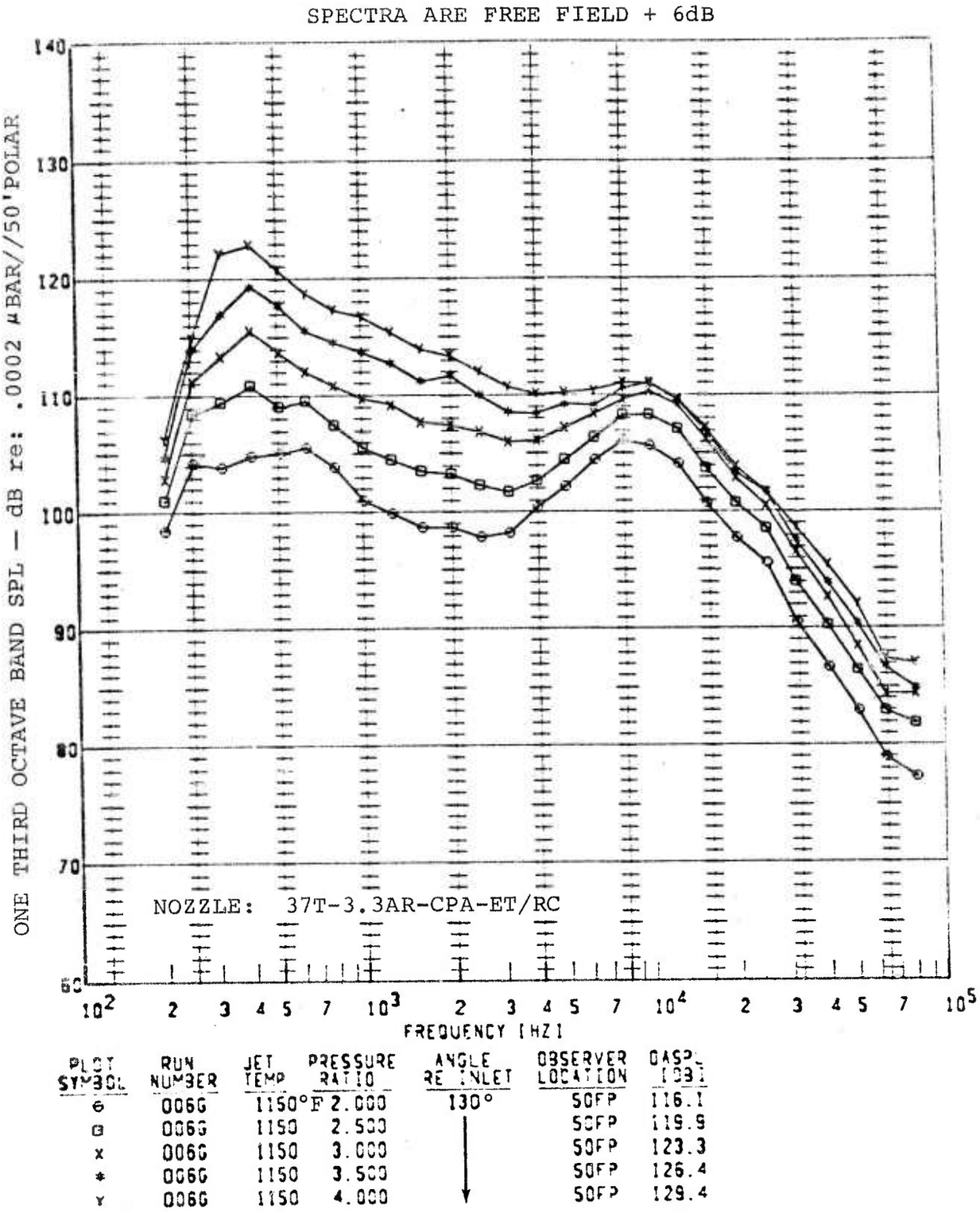
JET NOISE POWER SPECTRA

SPECTRA ARE FREE FIELD + 6dB



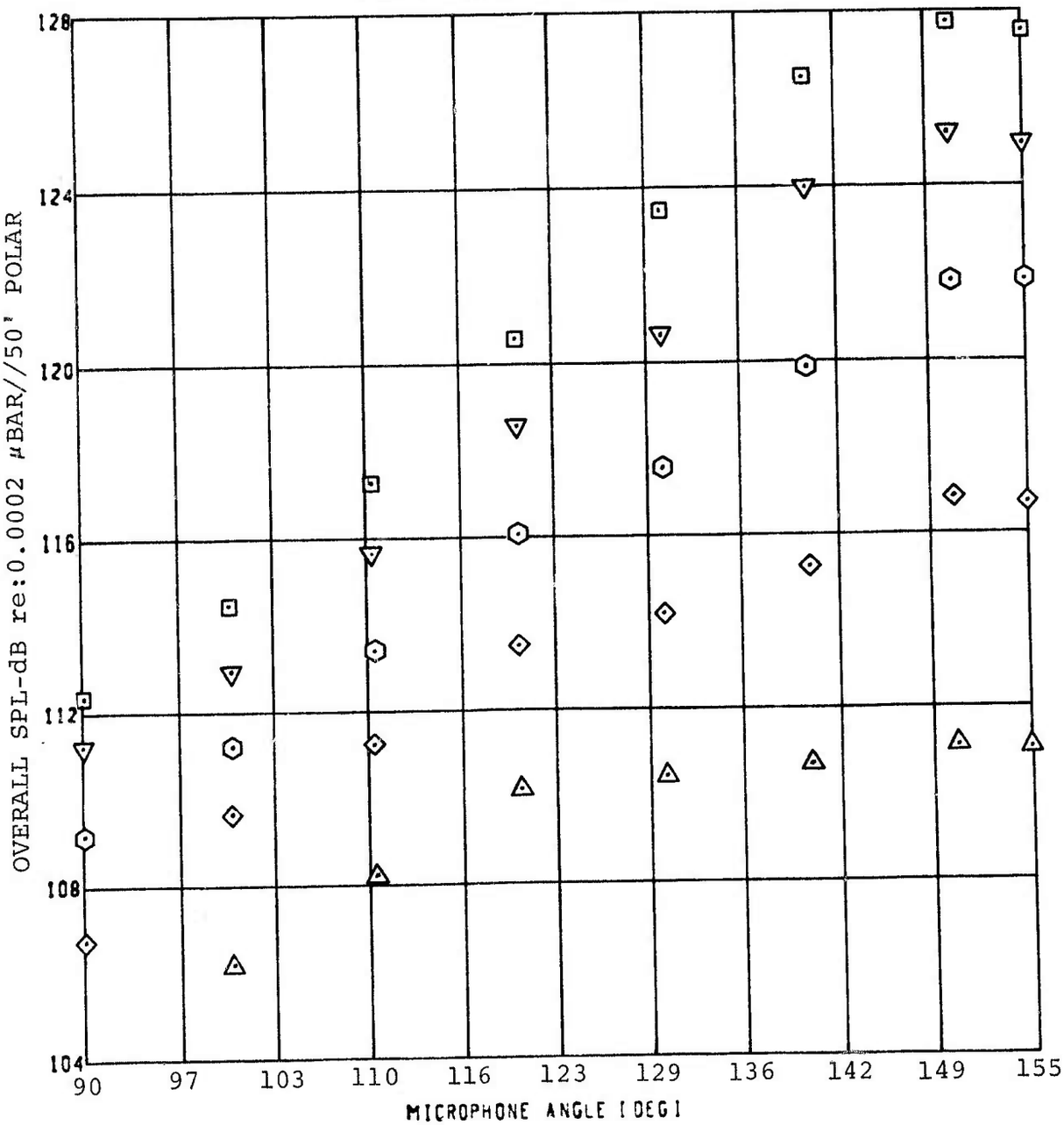
PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL [DB]
⊙	0066	1150°F	2.000	110°	SOFP	113.8
⊡	0066	1150	2.500	↓	SOFP	116.8
x	0066	1150	3.000	↓	SOFP	119.1
*	0066	1150	3.500	↓	SOFP	121.3
Y	0066	1150	4.000	↓	SOFP	123.0

MEASURED NOISE SPECTRA AT 110° re: NOZZLE INLET AXIS



MEASURED NOISE SPECTRA AT 130° re: NOZZLE INLET AXIS

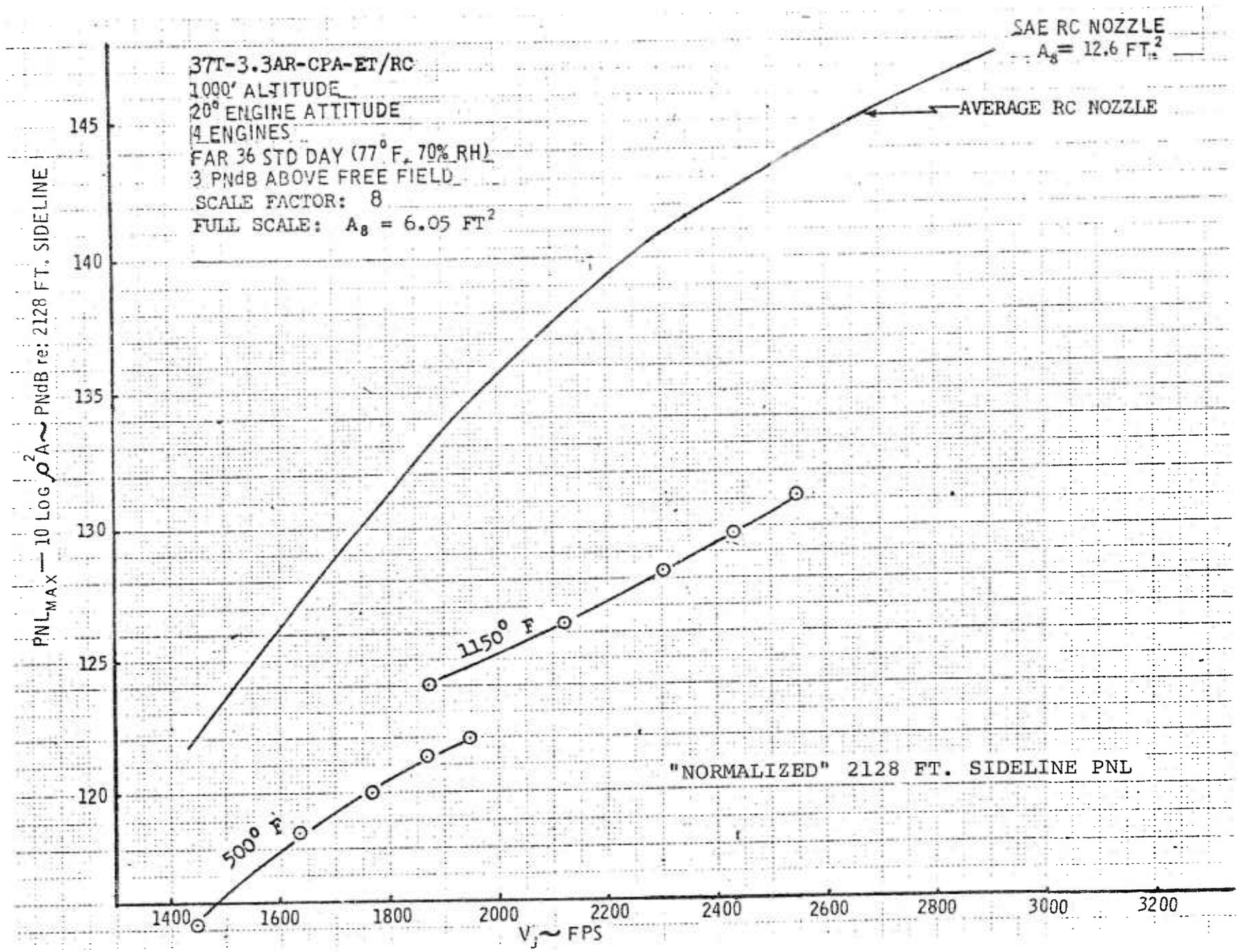
FREE FIELD VALUES

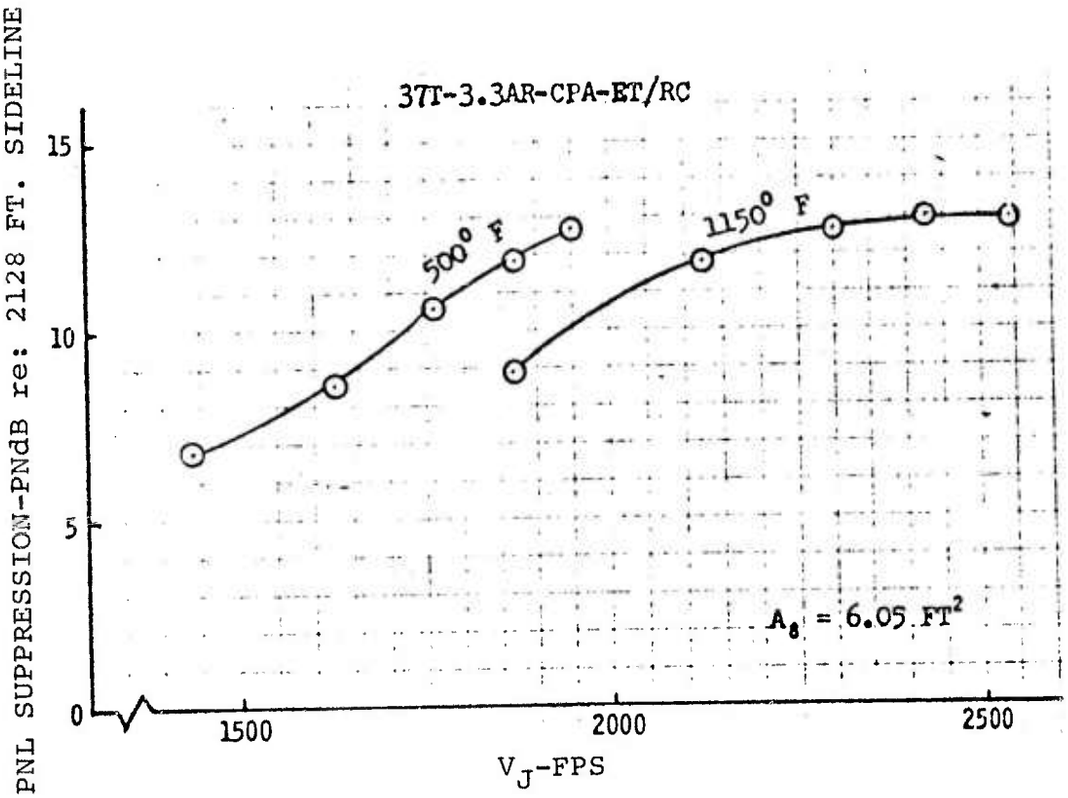


PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	006	2.00	1150°F
◇	006	2.50	1150
○	006	3.00	1150
▽	006	3.50	1150
□	006	4.00	1150

NOZZLE: 37T-3.3AR-CPA-ET/RC

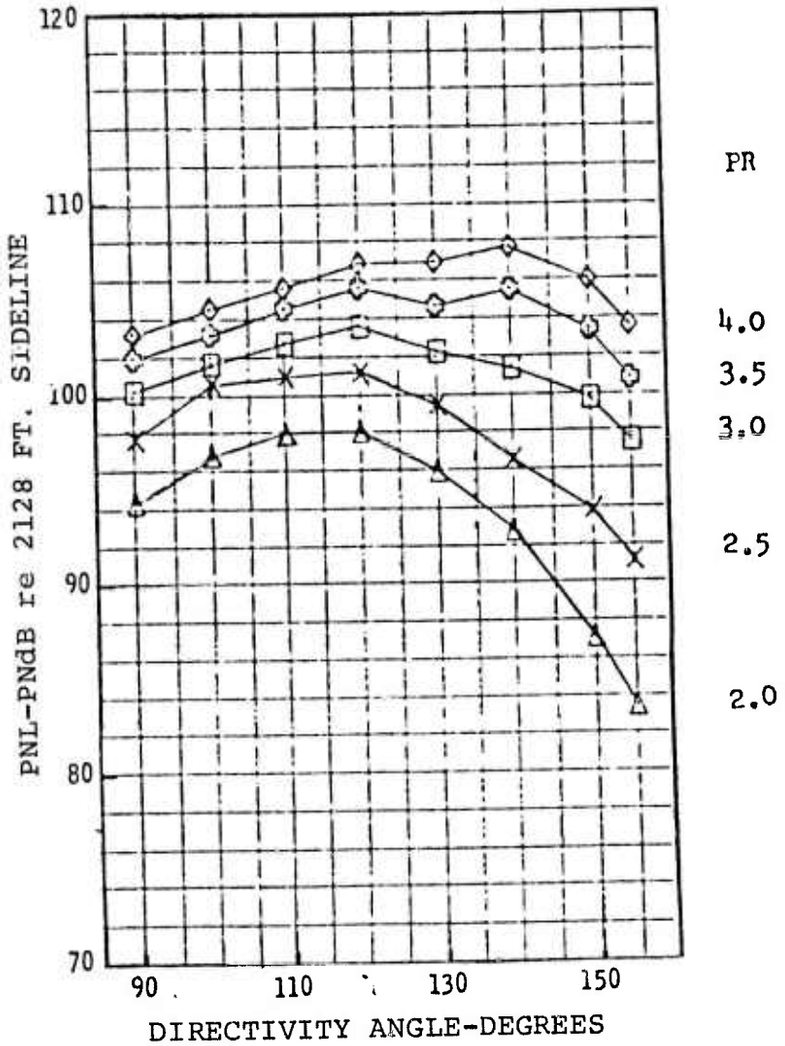
OASPL BEAM PATTERNS


37T-3.3AR-CPA-ET/RC
1000' ALTITUDE
20° ENGINE ATTITUDE
4 ENGINES
FAR 36 STD DAY (77° F, 70% RH)
3 PNdB ABOVE FREE FIELD
SCALE FACTOR: 8
FULL SCALE: A_8 = 6.05 FT^2
SAE RC NOZZLE
A_8 = 12.6 FT.^{2}
AVERAGE RC NOZZLE
1150° F
500° F
"NORMALIZED" 2128 FT. SIDELINE PNL
PNL_{MAX} — 10 LOG $\rho^2 A$ ~ PNdB re: 2128 FT. SIDELINE
V_j ~ FPS
145
140
135
130
125
120
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200



PEAK PNL SUPPRESSION VALUES

NOZZLE: 37T-3.3AR-CPA-ET/RC



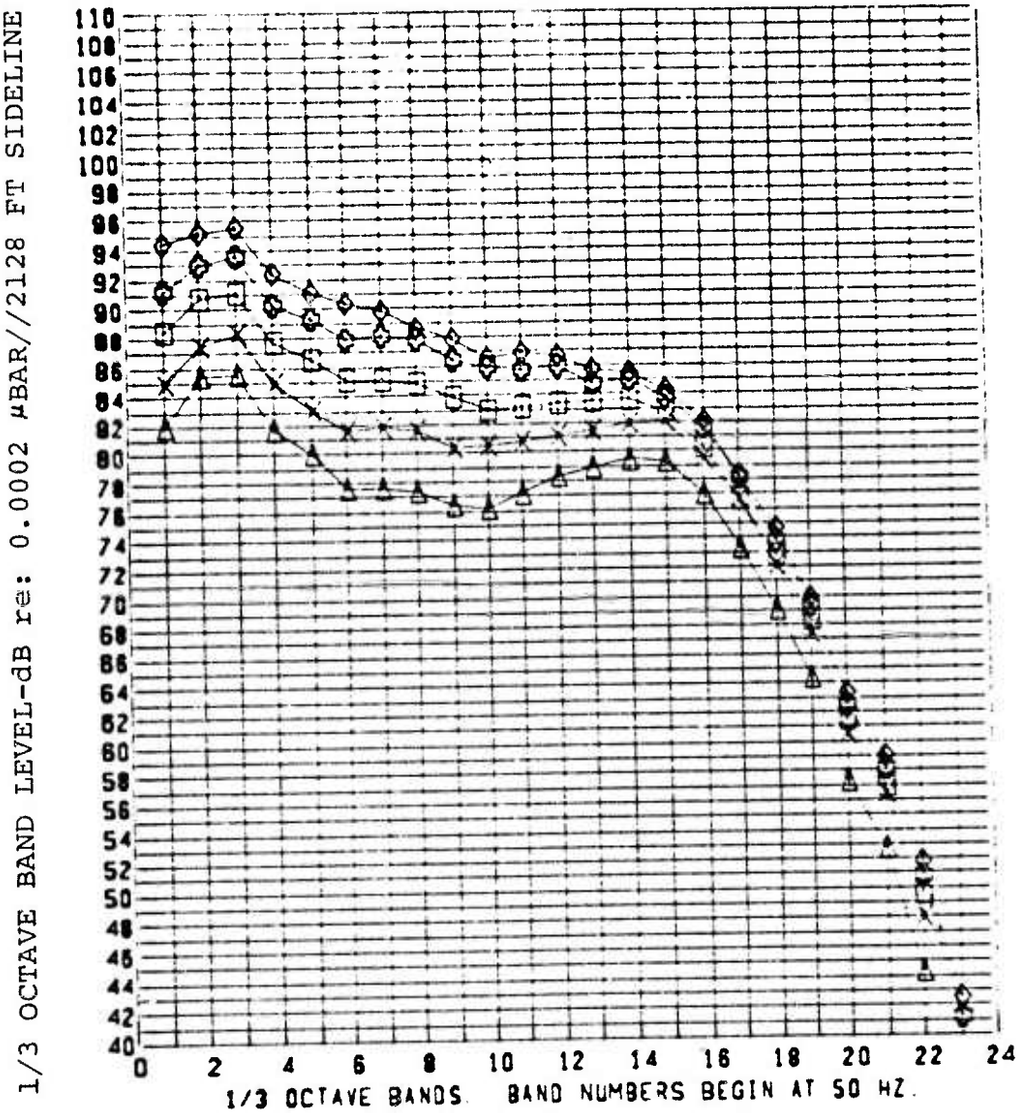
RUN: 006

T_T = 1150°F A_8 = 6.05 FT^2

PNL BEAM PATTERNS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 110 DEG TEMP = 77 DEG R.H. = 70 PER CENT



T_T = 1150°F A_8 = 6.05 FT^2 RUN: 006

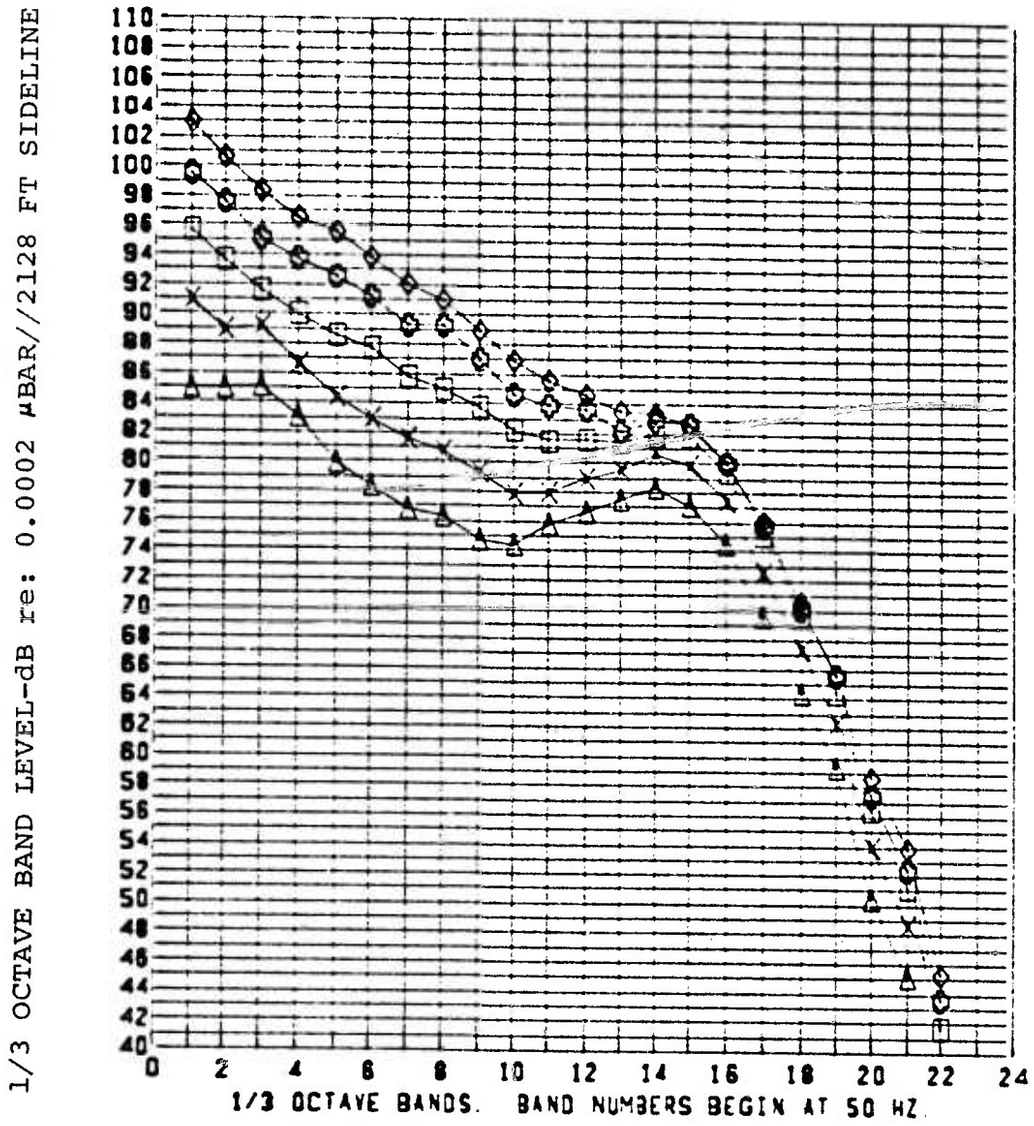
PR = △ 2.0, X 2.5, □ 3.0, ✣ 3.5, ◇ 4.0

NOZZLE: 37T-3.3AR-CPA-ET/RC

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 110°
re: NOZZLE INLET AXIS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 130 DEG TEMP = 77 DEG R.H. = 70 PER CENT



T_T = 1150°F A_8 = 6.05 FT^2 RUN: 006

PR = △ 2.0, X 2.5, □ 3.0, ✣ 3.5, ◇ 4.0

NOZZLE: 37T-3.3AR-CPA-ET/RC

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 130°
re: NOZZLE INLET AXIS

TEST CONDITIONS

NOZZLE: 37T-3.3AR-CPA-ET/RC
with 3.1AR Ejector

FACILITY: HNTF

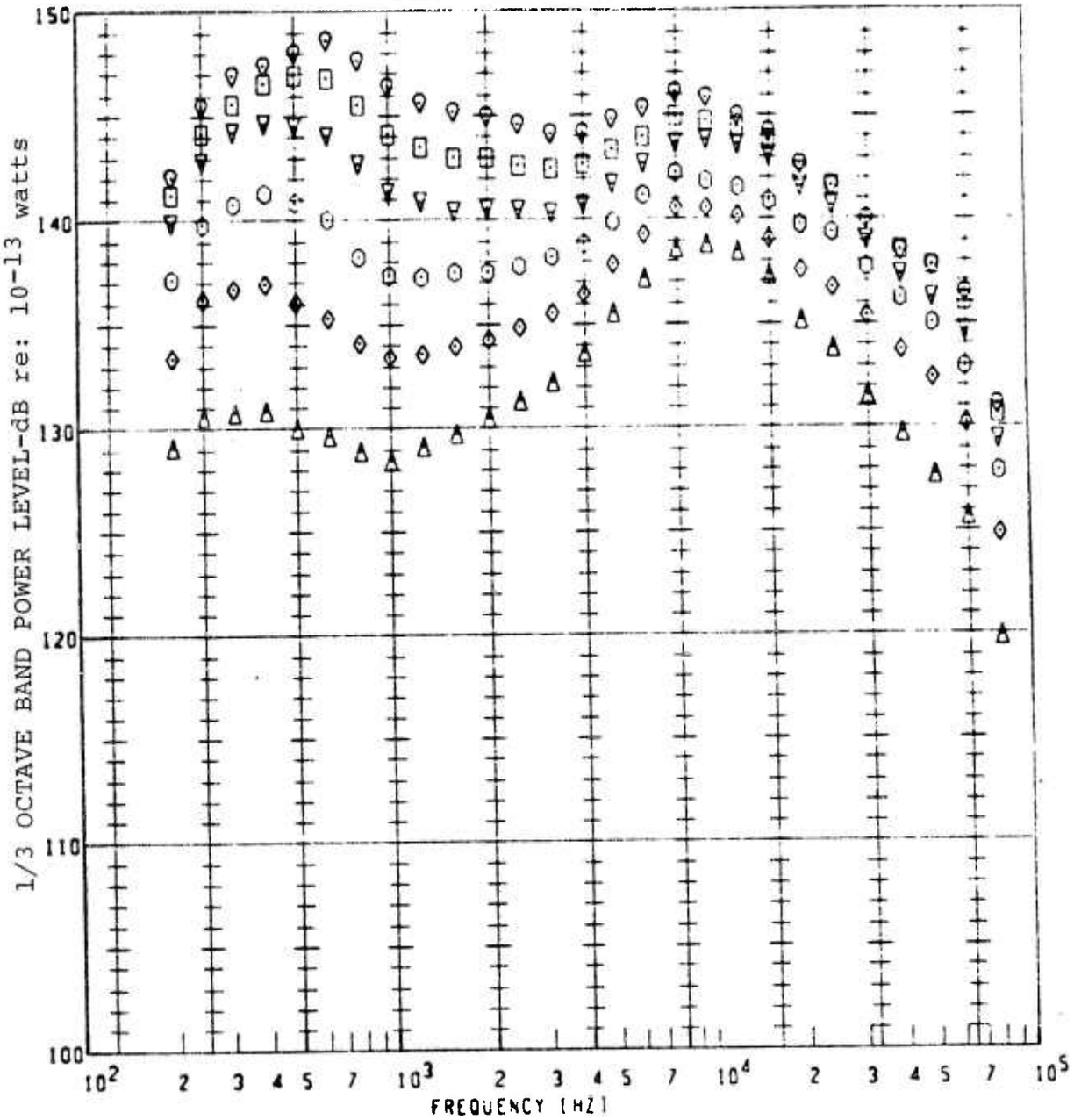
DATE: 8-23-73 T_{AMB} = 54.5°F **R.H.** = 70%

SCALE MODEL A_8 = 13.6 $in.^2$

RUN NO.	NPR	T_T	V_J (IDEAL)	REMARKS	REF
16	2.0	1150°F	1875 fps		
"	2.5	"	2126		
"	3.0	"	2303		
"	3.4	"	2413		
"	3.7	"	2483		
"	4.0	"	2544		

MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH CONCRETE GROUND SURFACE. MEASURED ACOUSTIC DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.

FREE FIELD VALUES

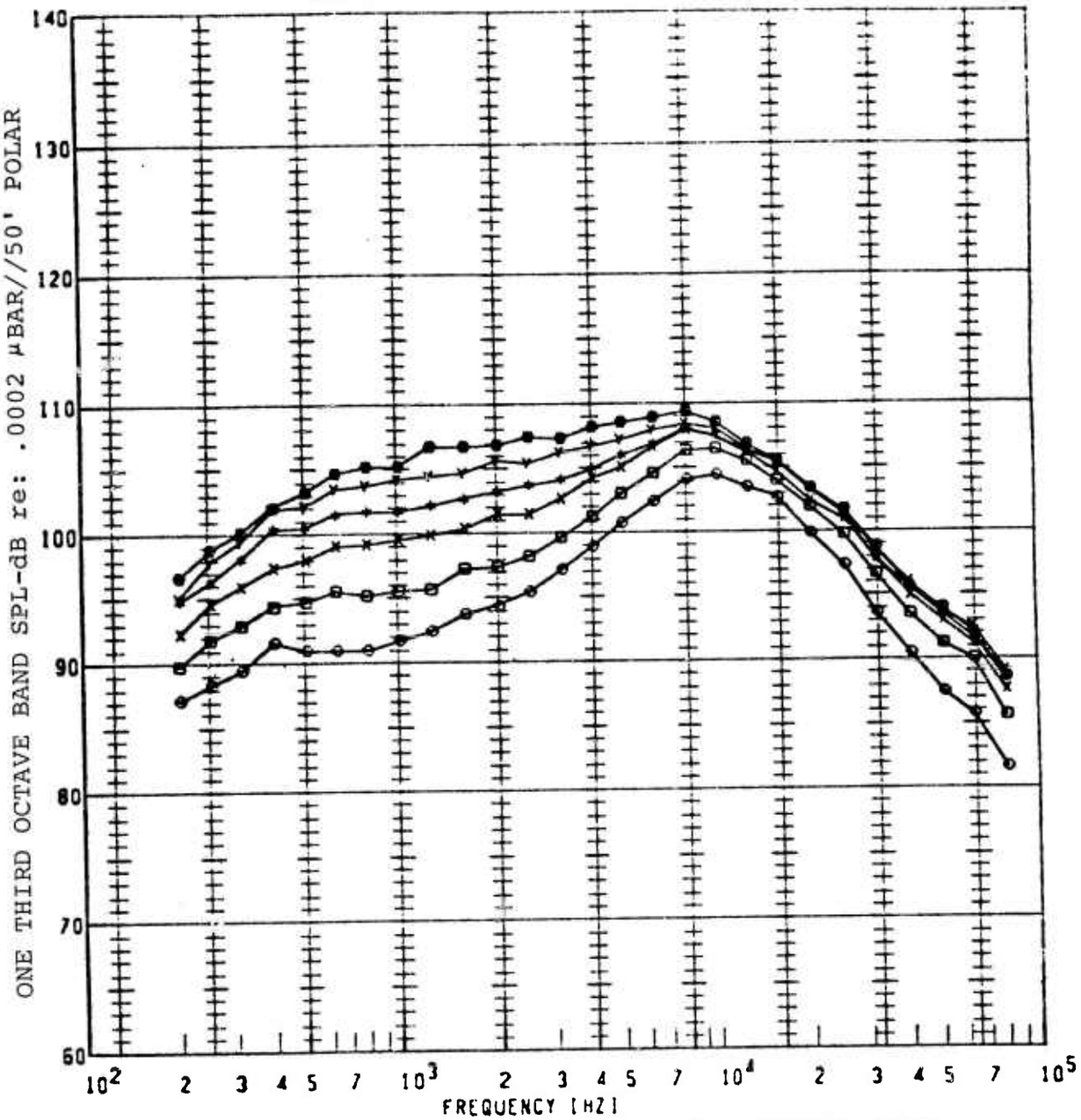


PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	16	2.00	1150°F
◇	16	2.50	1150
○	16	3.00	1150
▽	16	3.40	1150
□	16	3.70	1150
◇	16	4.00	1150

37T-3.3AR-CPA-ET/RC
WITH 3.1AR EJECTOR

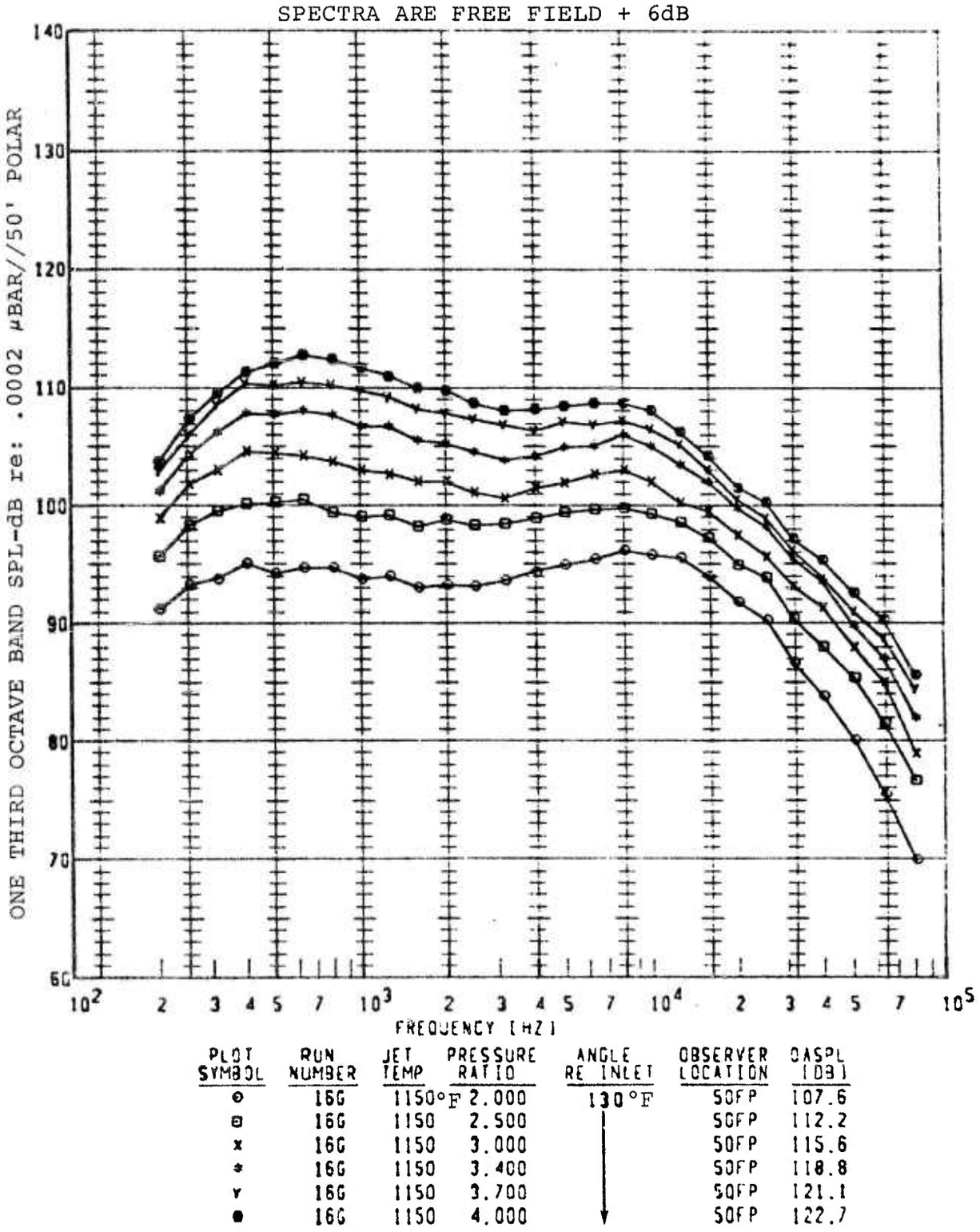
JET NOISE POWER SPECTRA

SPECTRA ARE FREE FIELD + 6dB



PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL [DB]
⊙	166	1150°F	2.000	110°	50FP	112.4
⊡	166	1150	2.500		50FP	114.7
x	166	1150	3.000		50FP	116.5
*	166	1150	3.400		50FP	117.4
Y	166	1150	3.700		50FP	118.6
●	166	1150	4.000		50FP	119.6

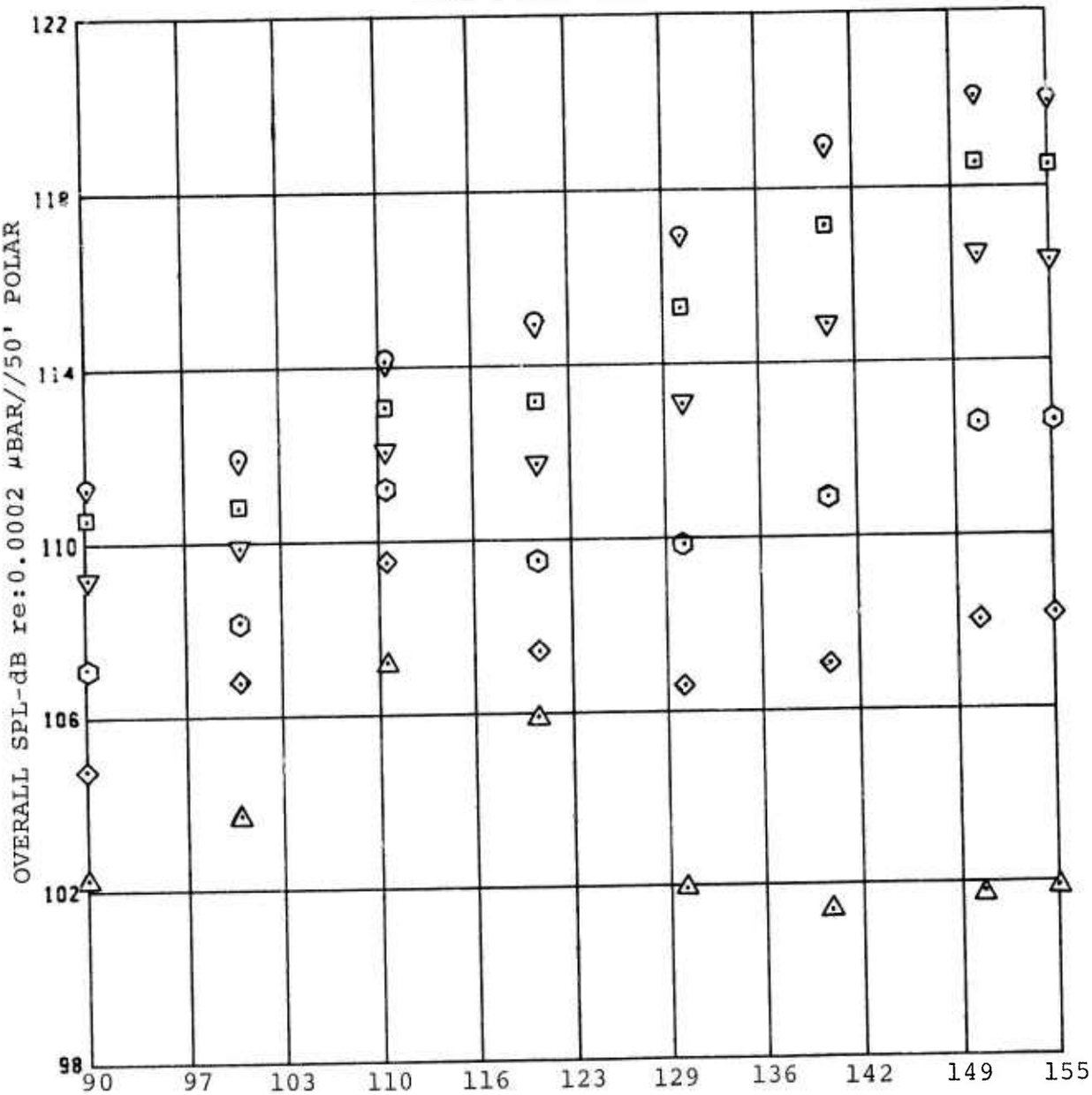
MEASURED NOISE SPECTRA AT 110° re: NOZZLE INLET AXIS



PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL [DB]
⊙	160	1150°F	2.000	130°F	SOFP	107.6
⊡	160	1150	2.500		SOFP	112.2
x	160	1150	3.000		SOFP	115.6
*	160	1150	3.400		SOFP	118.8
v	160	1150	3.700		SOFP	121.1
●	160	1150	4.000		SOFP	122.7

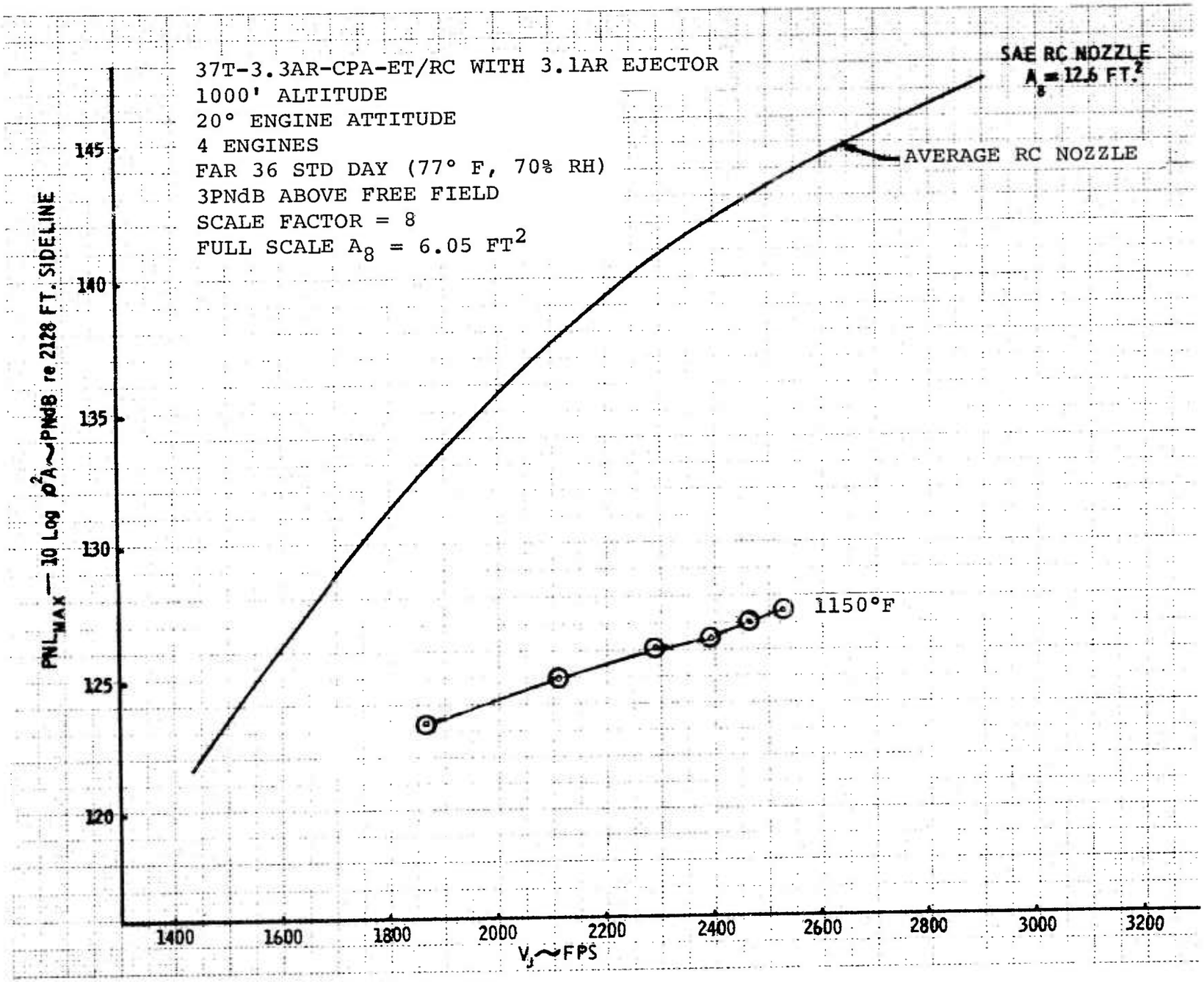
MEASURED NOISE SPECTRA AT 130° re: NOZZLE INLET AXIS

FREE FIELD VALUES

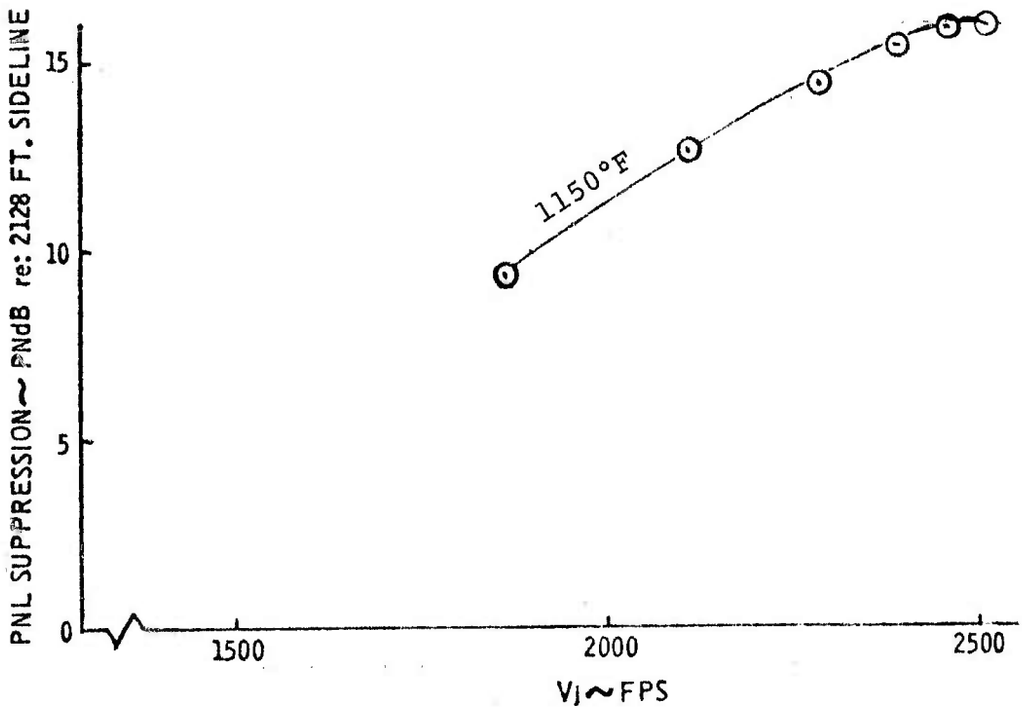


PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	16	2.00	1150 °F
◇	16	2.50	1150
○	16	3.00	1150
▽	16	3.40	1150
□	16	3.70	1150
▽	16	4.00	1150

OASPL BEAM PATTERNS

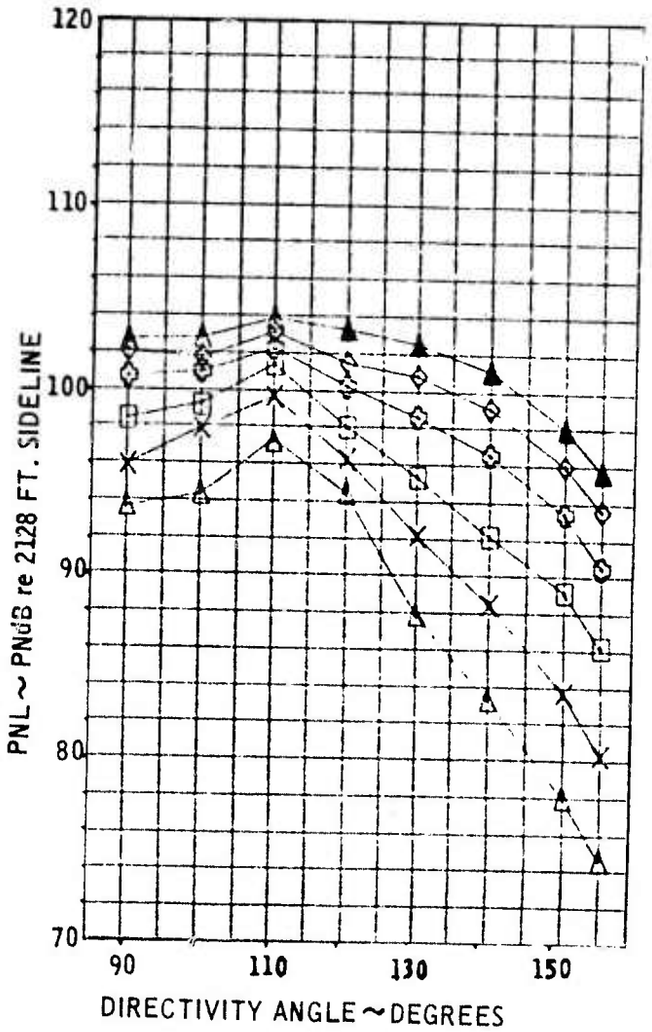

37T-3.3AR-CPA-ET/RC WITH 3.1AR EJECTOR
1000' ALTITUDE
20° ENGINE ATTITUDE
4 ENGINES
FAR 36 STD DAY (77° F, 70% RH)
3PNdB ABOVE FREE FIELD
SCALE FACTOR = 8
FULL SCALE A_8 = 6.05 FT^2
SAE RC NOZZLE
A_8 = 12.6 FT.^{2}
AVERAGE RC NOZZLE
1150°F
PNL_{MAX} — 10 Log $\rho^2 A$ ~ PNdB re 2128 FT. SIDELINE
145
140
135
130
125
120
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
V_j ~ FPS

37T-3.3AR-CPA-ET/RC WITH 3.1AR EJECTOR



PEAK PNL SUPPRESSION VALUES

NOZZLE:37T-3.3AR-CPA-ET/RC
WITH 3.1 AR EJECTOR



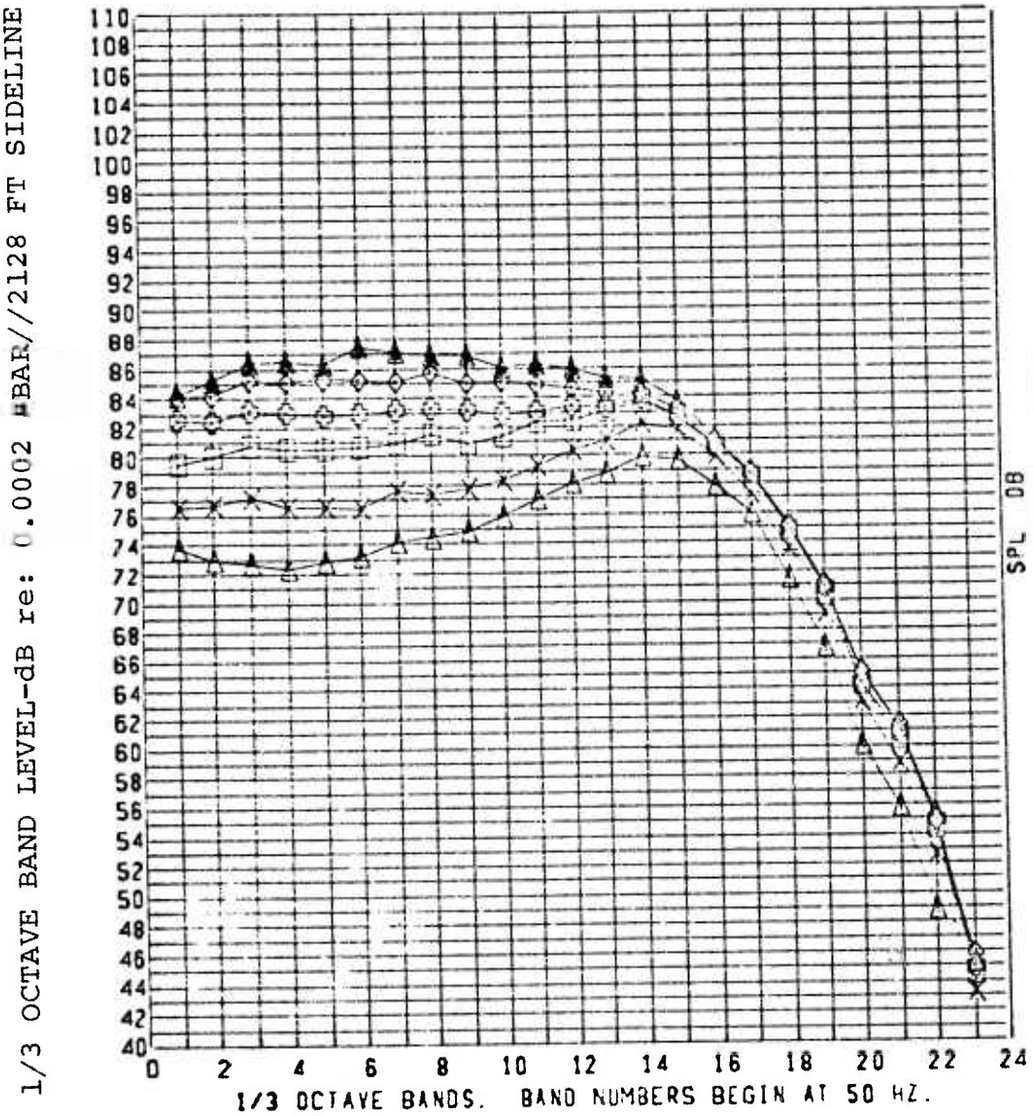
T_T = 1150°F A_8 = 6.05 FT^2 RUN: 16

PR = △ 2.0, X 2.5, □ 3.0, ✣ 3.4, ◇ 3.7 ▲ 4.0

PNL BEAM PATTERNS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 110 DEG TEMP = 77 DEG R.H. = 70 PER CENT



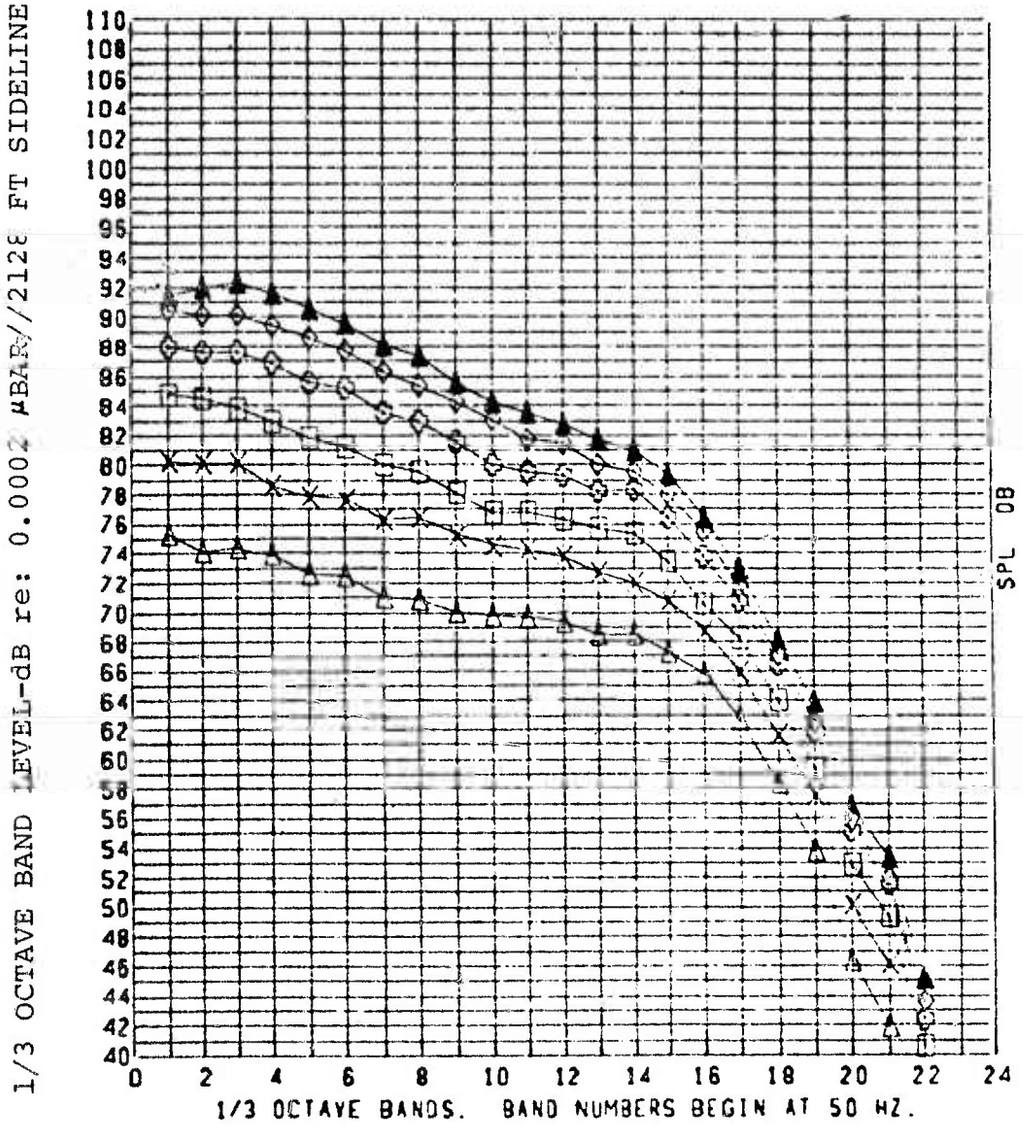
T_T = 1150°F A_8 = 6.05 FT^2 RUN: 16

PR = △ 2.0, X 2.5, □ 3.0, ✣ 3.4, ◇ 3.7, ▲ 4.0

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 110°
re: NOZZLE INLET AXIS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 130 DEG TEMP = 77 DEG R.H. = 70 PER CENT



T_T = 1150°F A_8 = 6.05 FT^2 RUN: 16

PR = △ 2.0, X 2.5, □ 3.0, ✣ 3.4, ◇ 3.7, ▲

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE 130°

re: NOZZLE INLET AXIS

TEST CONDITIONS

NOZZLE: 37?-3.3AR-CPA-ET/RC
WITH 3.1AR EJECTOR BELLMOUTH, L/D=2

FACILITY: WALL ISOLATION FACILITY

DATE: January 4, 1974

P_{AMB} = 29.83 in Hg T_{AMB} = 30°F **R.H.** = 56%

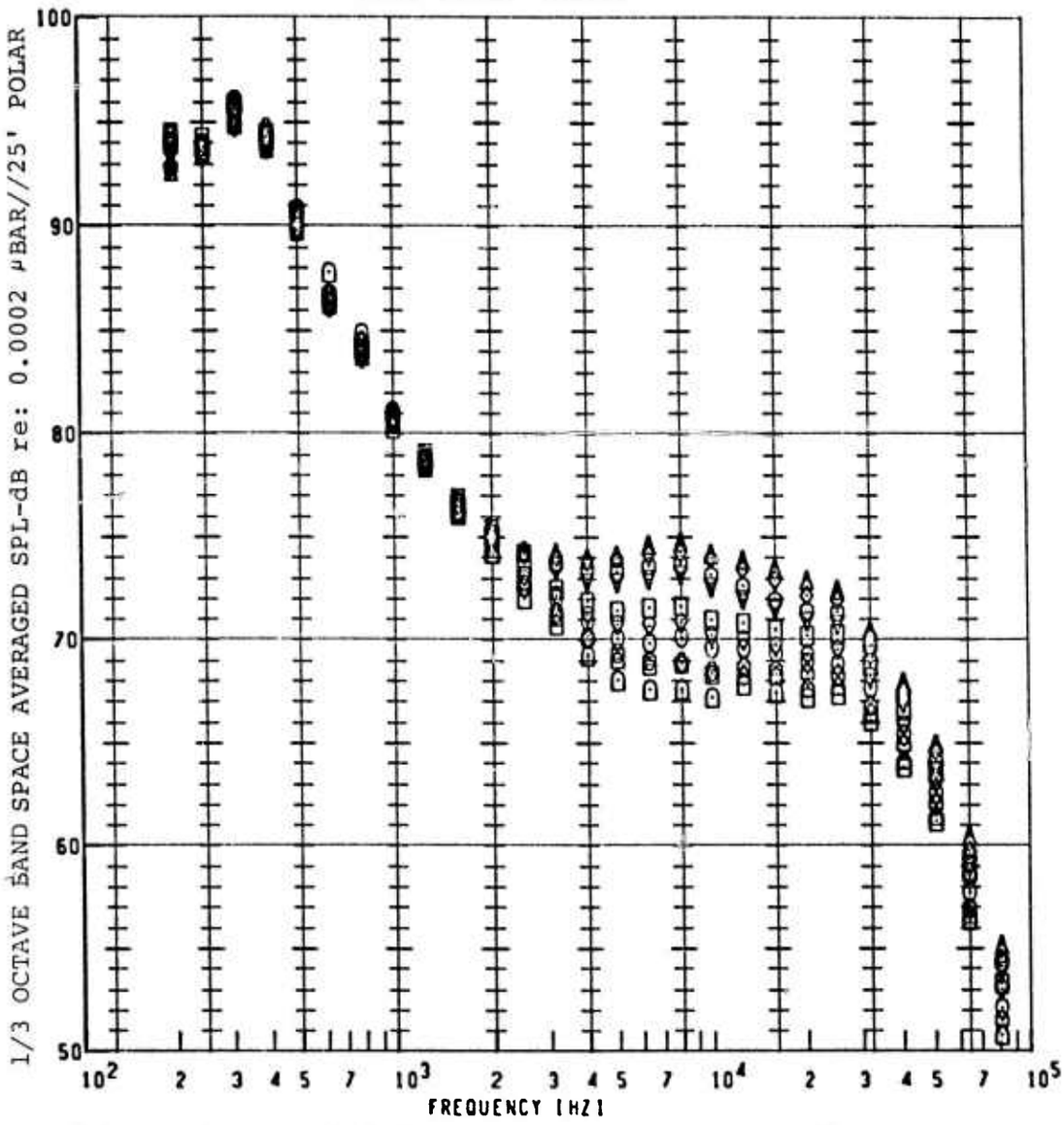
NPR = 3.0 T_T = 1150°F V_J(IDEAL) = 2300 FPS

SCALE MODEL A_8 = 13.6 in.^{2}

RUN NO.	AXIAL LOCATION	IRIS DIA.	REMARKS	REF.
377	0.0 x/D*	9.4 in.	*x/D is relative	
380	0.25	9.6	to ejector exit	
383	0.50	9.8	plane	
386	0.75	10.0		
389	1.00	10.4		
392	1.25	10.6		
395	1.50	10.8		
398	1.75	11.2		
401	2.0	13.6		
404	2.5	13.0		
407	3.0	13.4		
410	3.5	14.4		
413	4.0	15.4		
416	5.0	14.4		
419	6.0	15.6		
422	7.0	16.4		
425	8.0	17.8		
428	10.0	19.8		
	12.0			
431	14.0	22.0		
434		24.0		

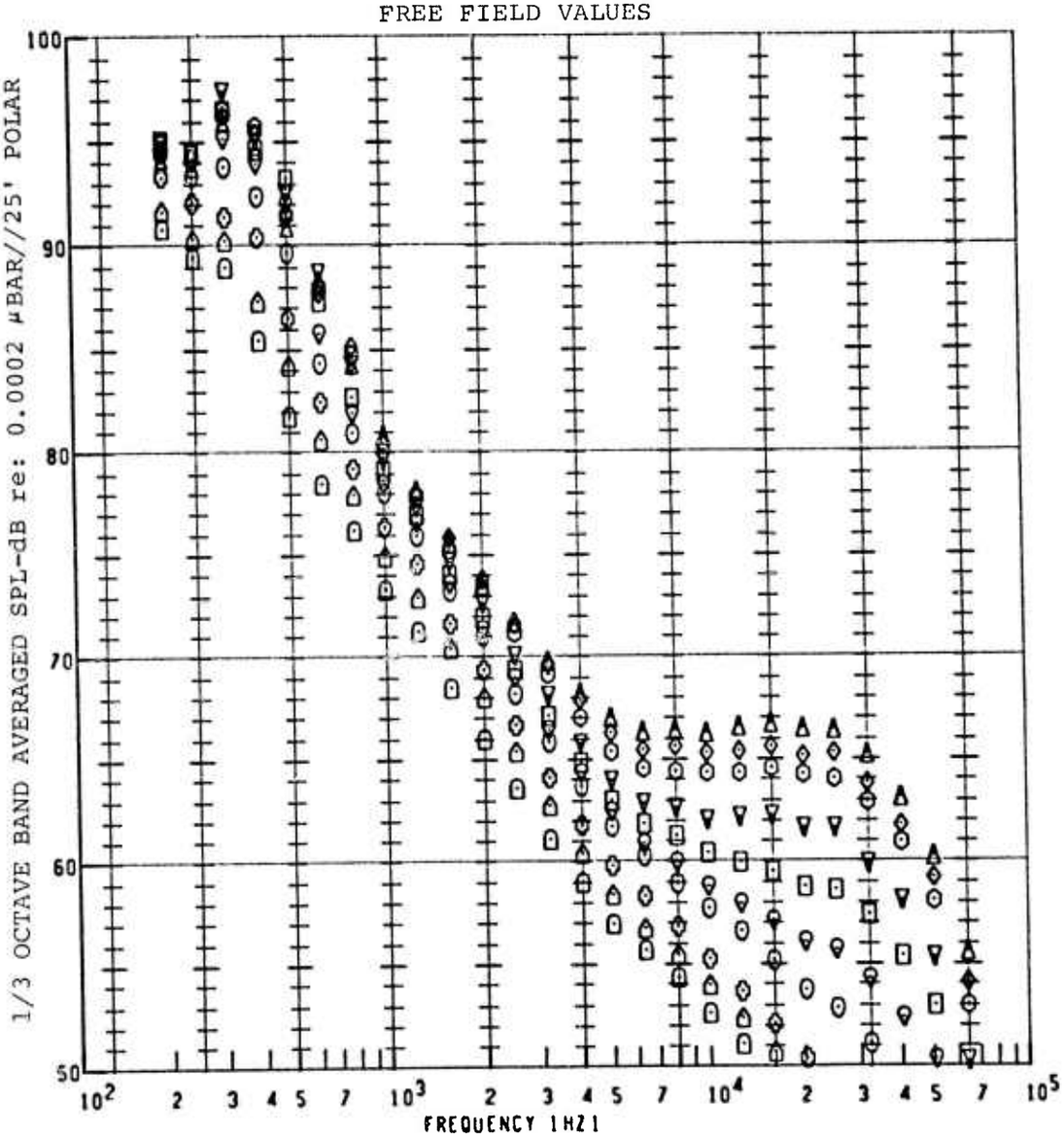
MICROPHONE LAYOUT: 25 FOOT VERTICAL POLAR ARC

FREE FIELD VALUES

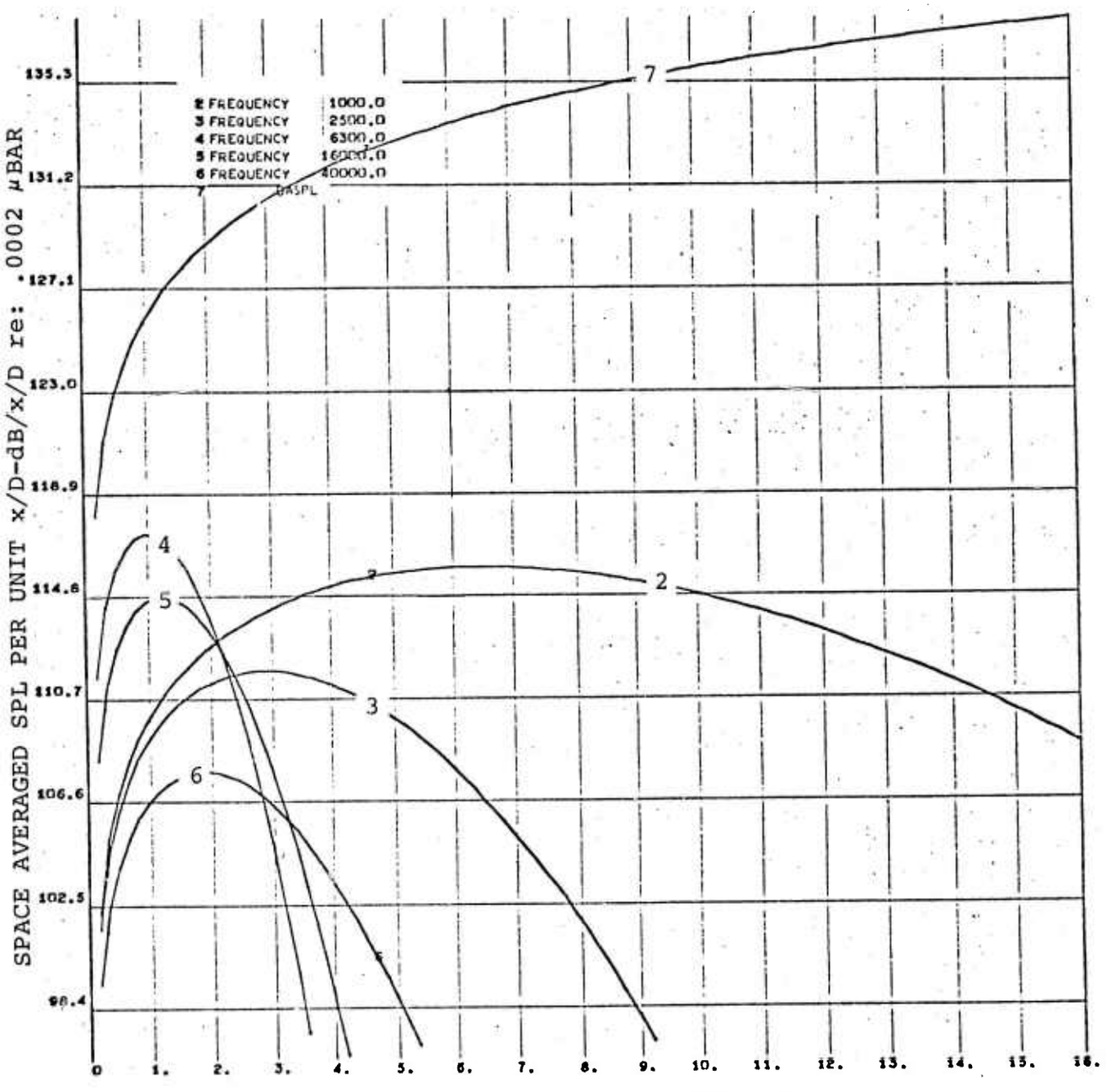


PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP	AXIAL LOCATION, x/D
△	377	3.00	1150°F	0
◇	380	3.00	1150	.25
⊙	383	3.00	1150	.50
▽	386	3.00	1150	.75
⊡	389	3.00	1150	1.0
♀	392	3.00	1150	1.2
⊙	395	3.00	1150	1.5
⊛	398	3.00	1150	1.7
⌂	401	3.00	1150	2.0
⊟	404	3.00	1150	2.5

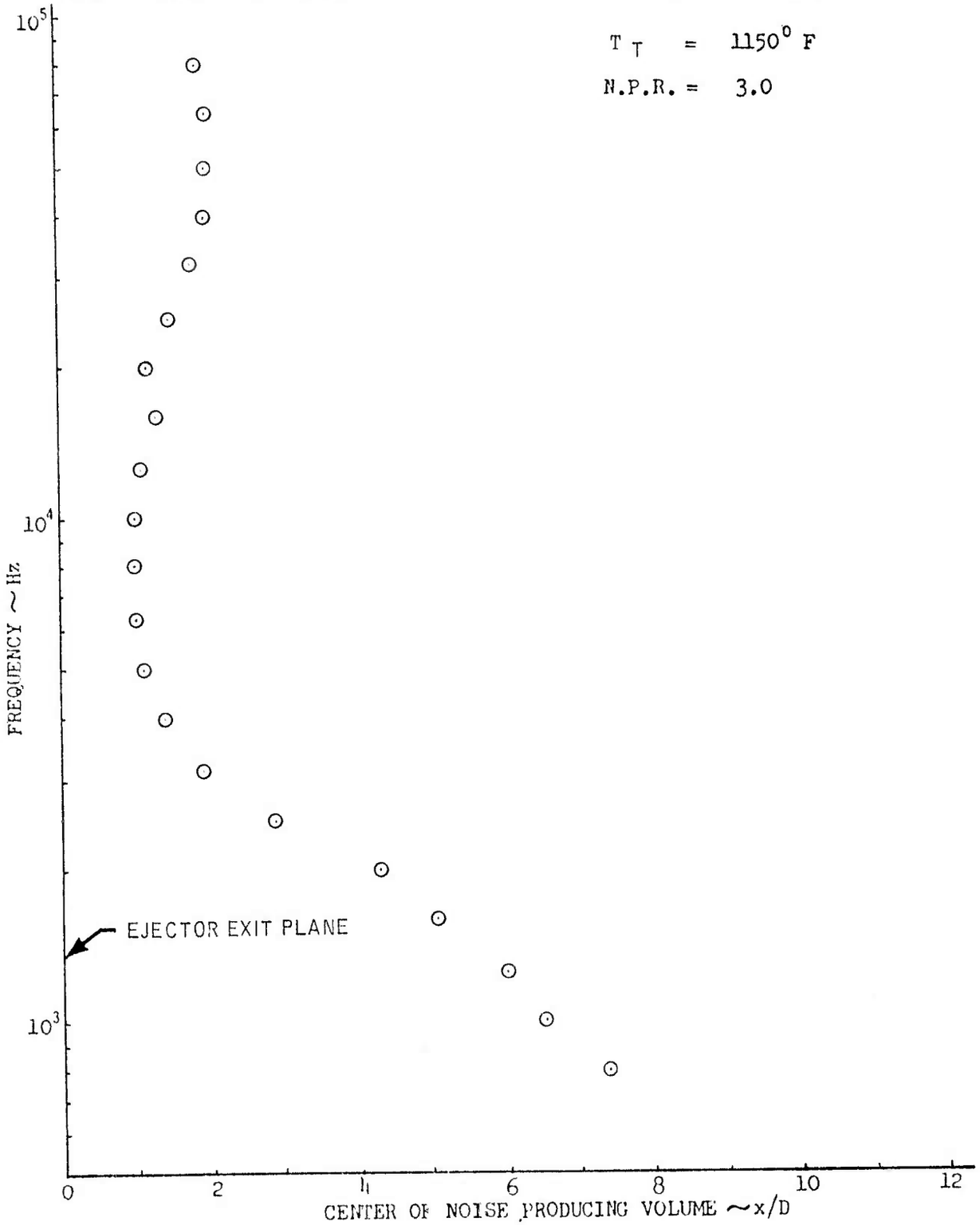
FREE FIELD VALUES

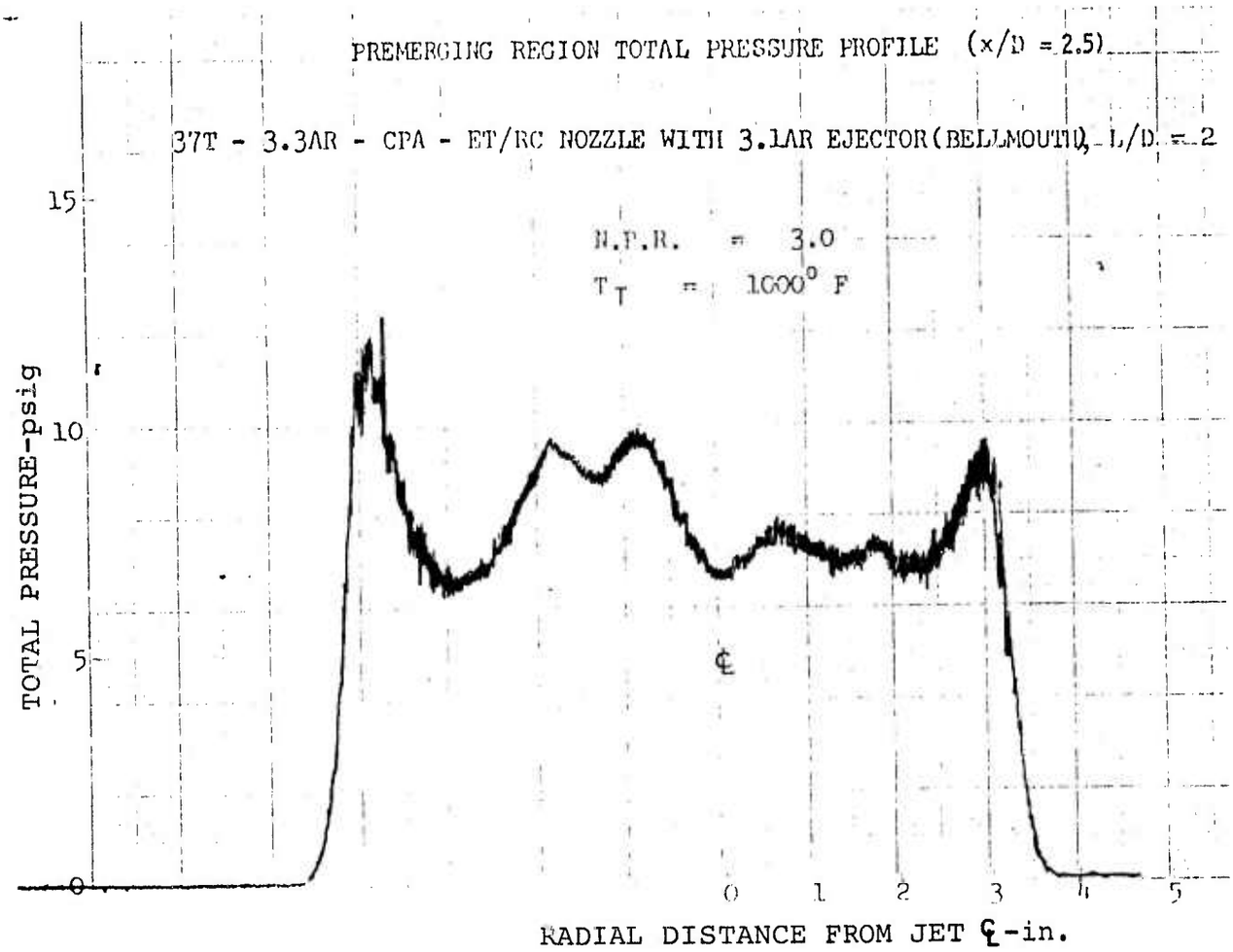


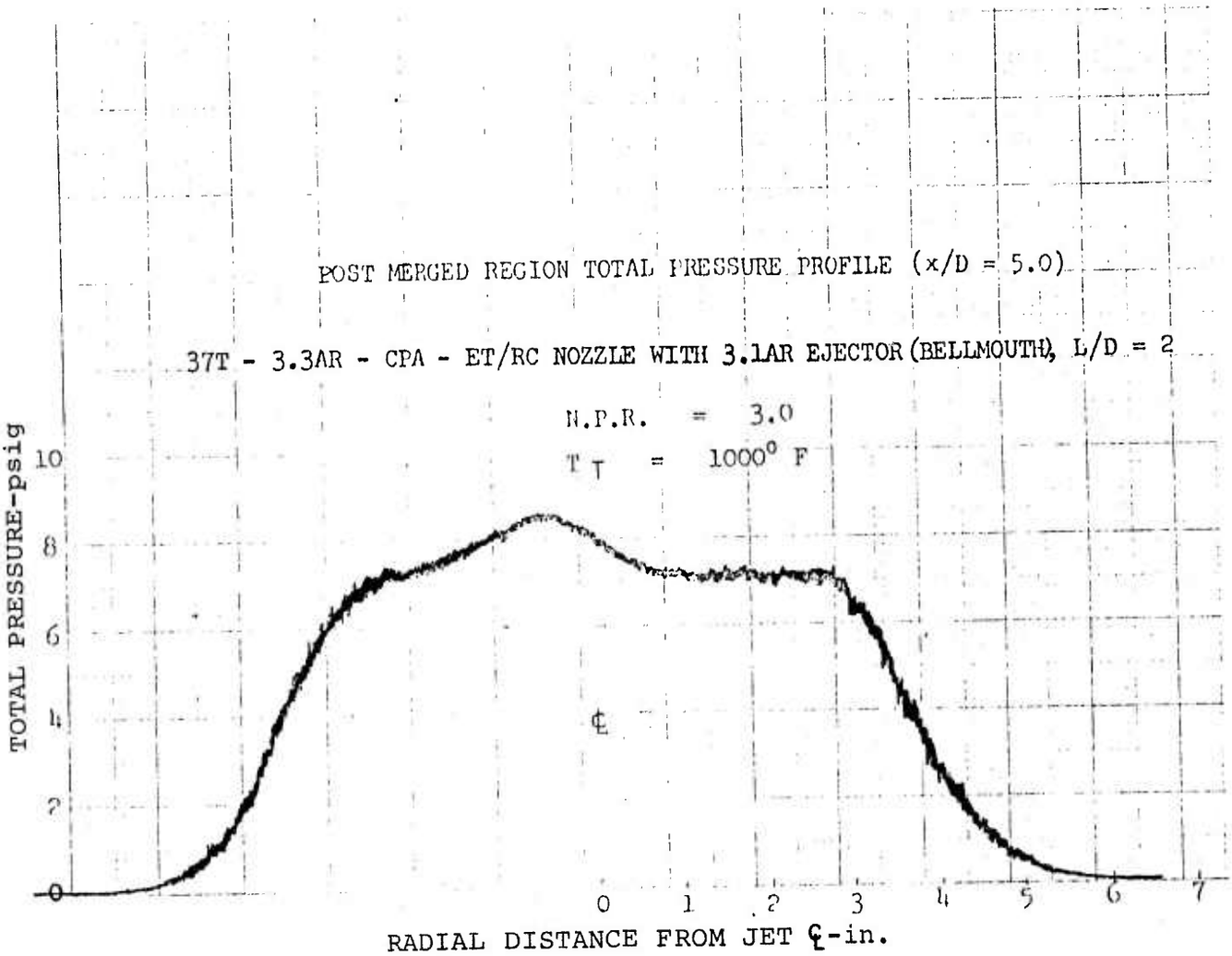
PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	407	3.00	1150°F
◇	410	3.00	1150
○	413	3.00	1150
▽	416	3.00	1150
□	419	3.00	1150
▽	422	3.00	1150
○	425	3.00	1150
◇	428	3.00	1150
△	431	3.00	1150
□	434	3.00	1150

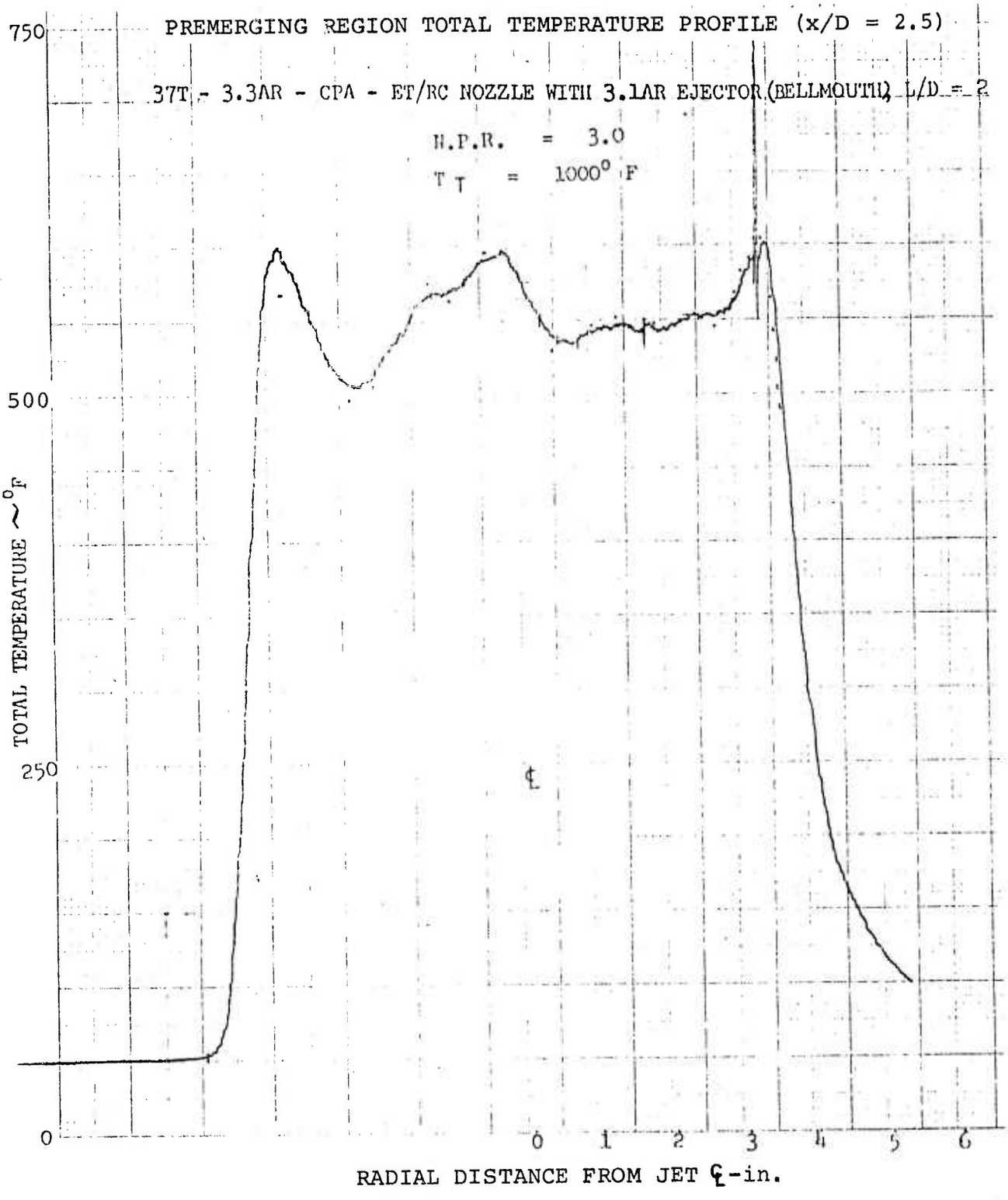

SPACE AVERAGED SPL PER UNIT x/D-dB/x/D re: .0002 μBAR
135.3
131.2
127.1
123.0
118.9
114.8
110.7
106.6
102.5
98.4
2 FREQUENCY 1000.0
3 FREQUENCY 2500.0
4 FREQUENCY 6300.0
5 FREQUENCY 16000.0
6 FREQUENCY 40000.0
DASPL
7
2
3
4
5
6
0
1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.
13.
14.
15.
16.
EJECTOR EXIT TO WALL SPACING-x/D

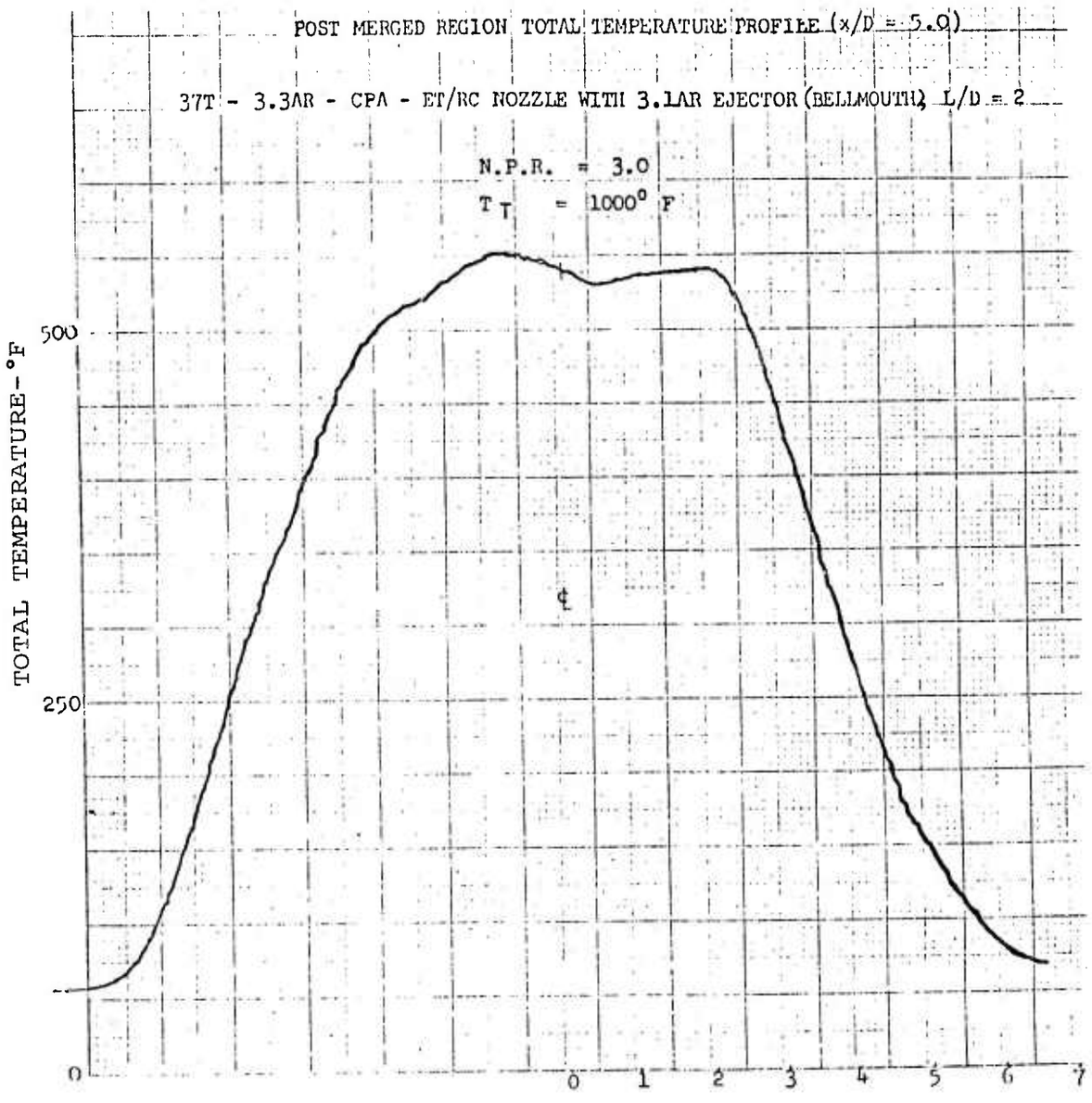
37T - 3.3AR - CPA - ET/RC NOZZLE WITH 3.1AR EJECTOR BELLMOUTH, L/D = 2

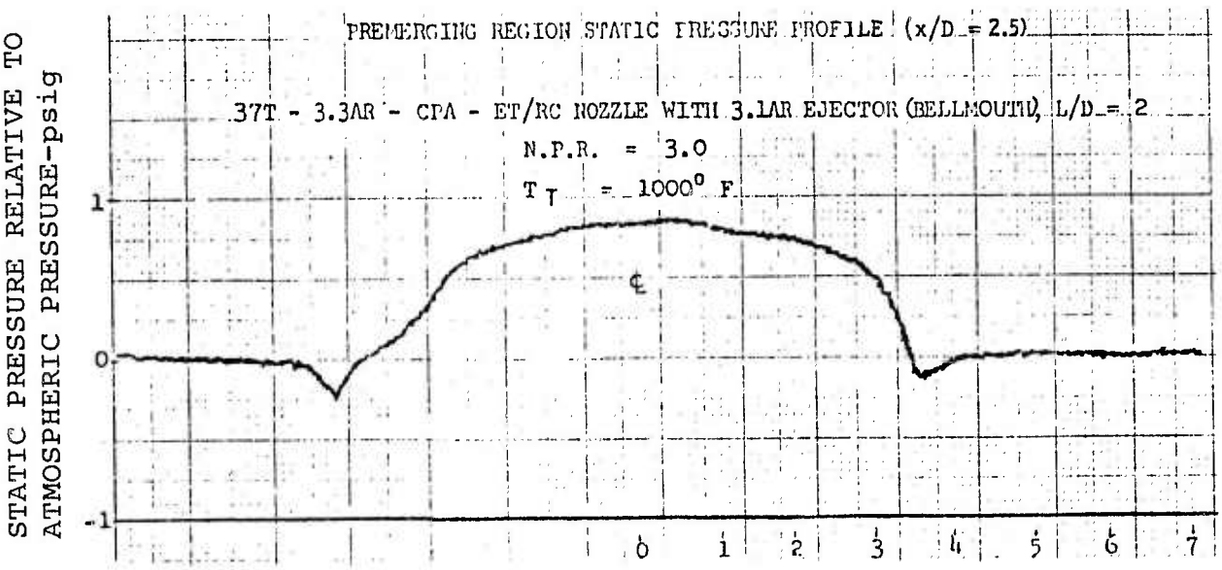


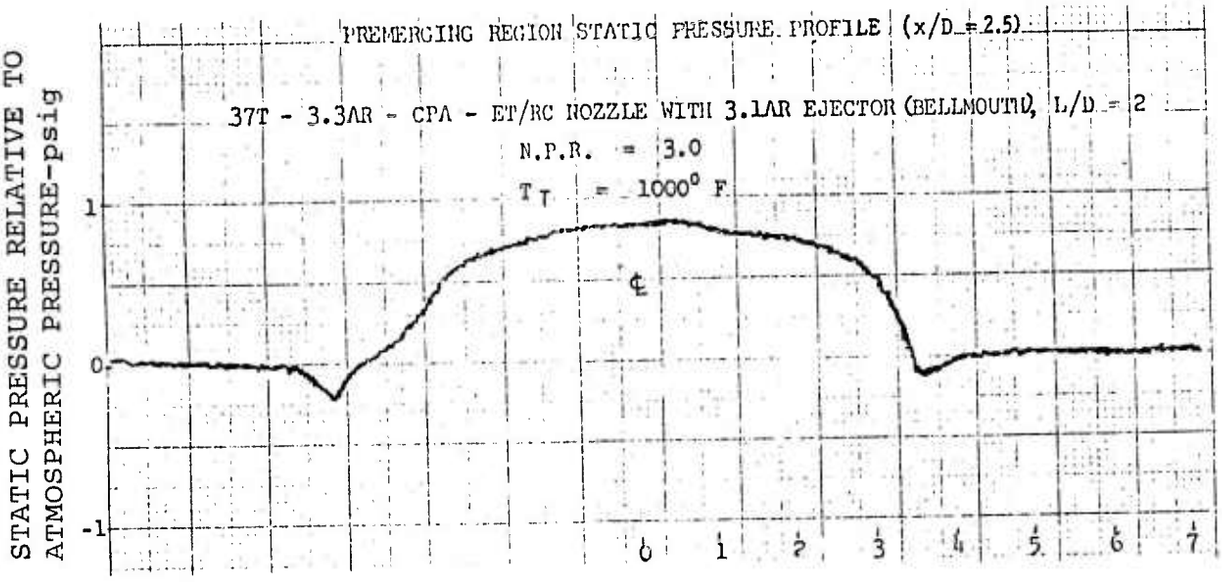

PREMERGING REGION TOTAL PRESSURE PROFILE (x/D = 2.5)
37T - 3.3AR - CPA - ET/RC NOZZLE WITH 3.1AR EJECTOR (BELLMOUTH), L/D = 2
N.P.R. = 3.0
T_T = 1000° F
TOTAL PRESSURE-psig
0
5
10
15
0
1
2
3
4
5
RADIAL DISTANCE FROM JET ℄-in.

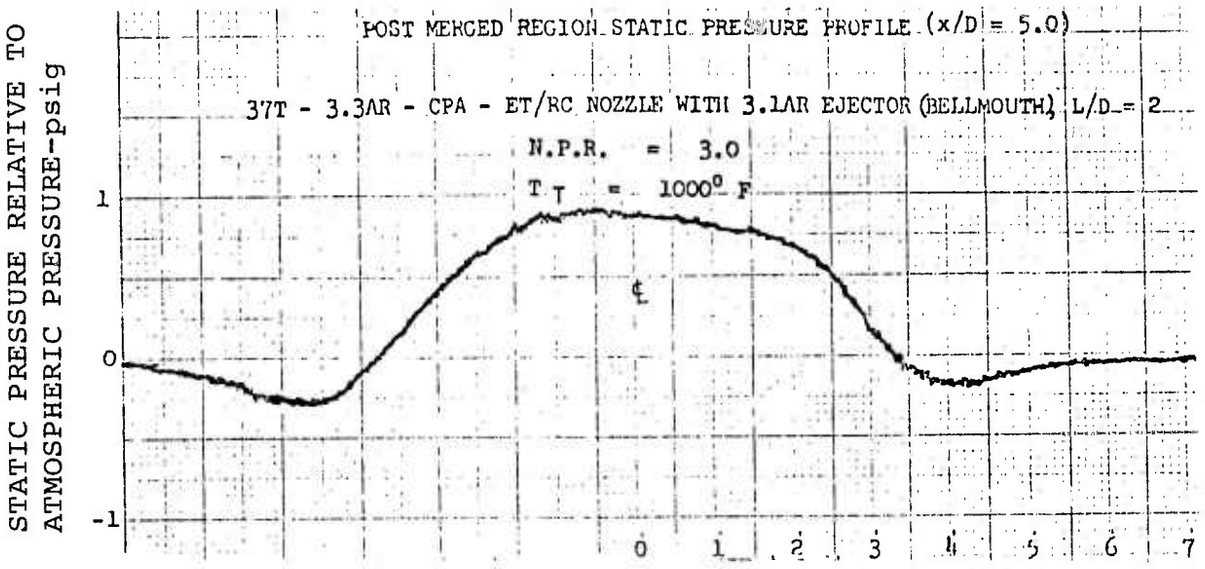

POST MERGED REGION TOTAL PRESSURE PROFILE (x/D = 5.0)
37T - 3.3AR - CPA - ET/RC NOZZLE WITH 3.1AR EJECTOR (BELLMOUTH), L/D = 2
N.P.R. = 3.0
T_T = 1000° F
TOTAL PRESSURE-psig
0
2
4
6
8
10
0
1
2
3
4
5
6
7
RADIAL DISTANCE FROM JET ℄-in.

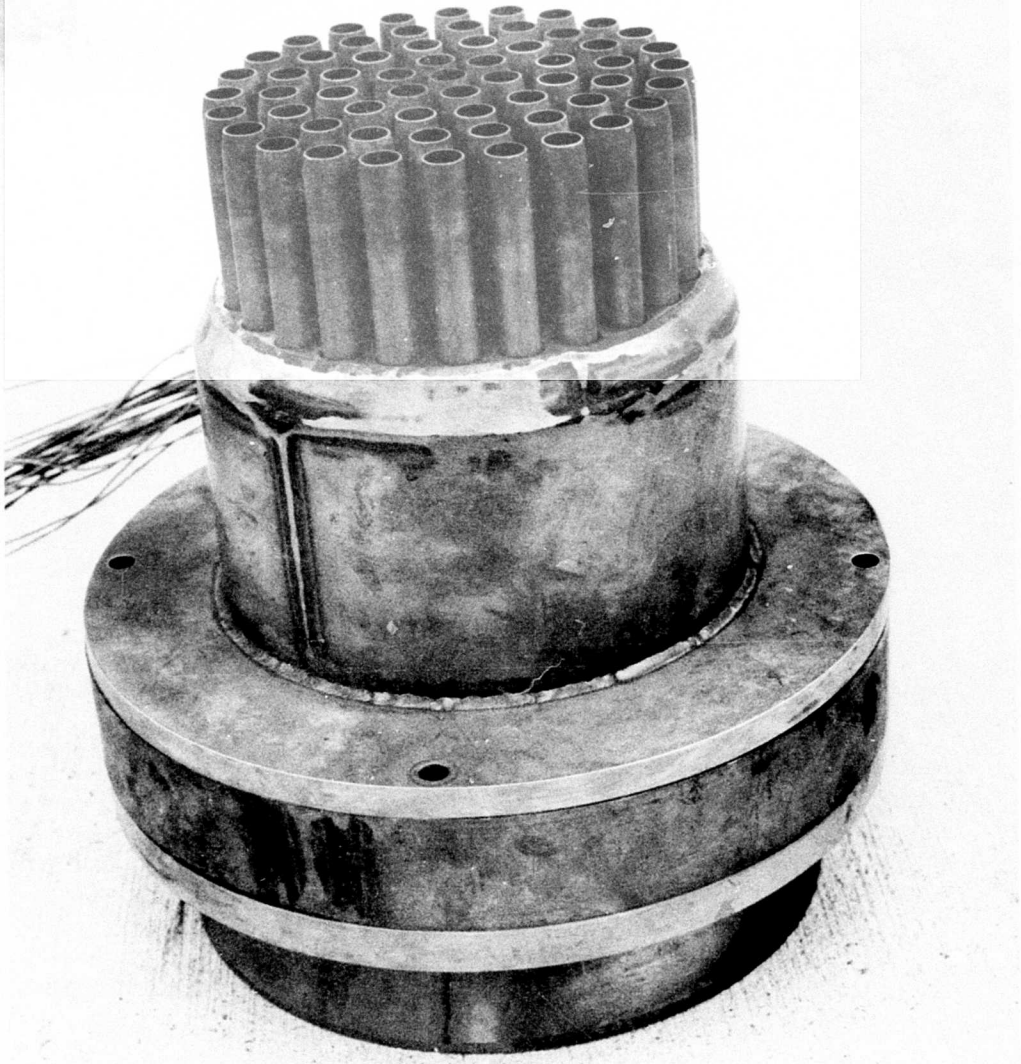

PREMERGING REGION TOTAL TEMPERATURE PROFILE (x/D = 2.5)
37T - 3.3AR - CPA - ET/RC NOZZLE WITH 3.1AR EJECTOR (BELLMOUTH) L/D = 2
N.P.R. = 3.0
T_T = 1000° F
750
500
250
0
TOTAL TEMPERATURE ~ °F
℄
0
1
2
3
4
5
6
RADIAL DISTANCE FROM JET ℄-in.


POST MERGED REGION TOTAL TEMPERATURE PROFILE (x/D = 5.0)
37T - 3.3AR - CPA - ET/RC NOZZLE WITH 3.1AR EJECTOR (BELLMOUTH) L/D = 2
N.P.R. = 3.0
T_T = 1000° F
TOTAL TEMPERATURE - °F
500
250
0
0
1
2
3
4
5
6
7
RADIAL DISTANCE FROM JET ℄-in.

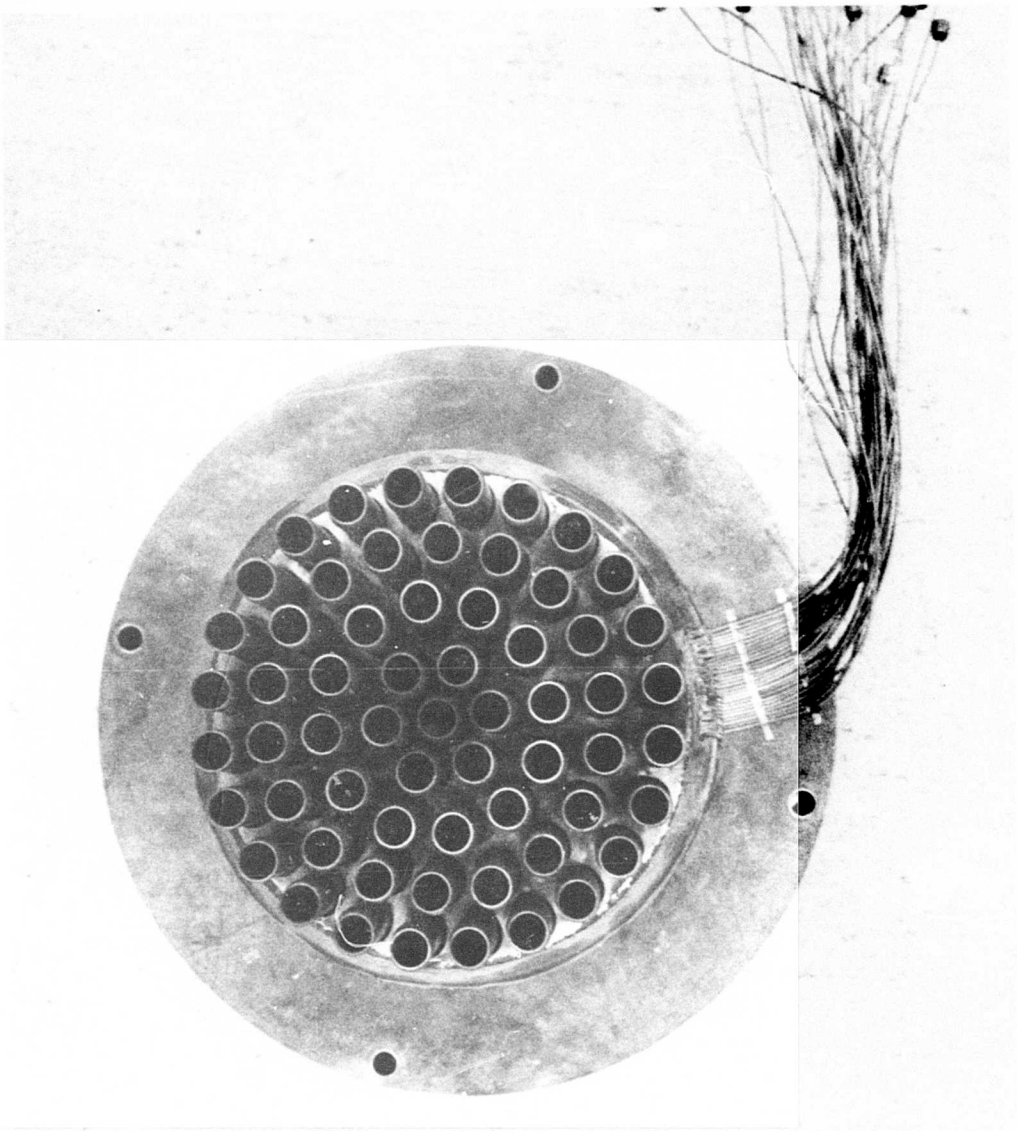

PREMERGING REGION STATIC PRESSURE PROFILE (x/D = 2.5)
37T - 3.3AR - CPA - ET/RC NOZZLE WITH 3.1AR EJECTOR (BELLMOUTH), L/D = 2
N.P.R. = 3.0
T_T = 1000° F
STATIC PRESSURE RELATIVE TO ATMOSPHERIC PRESSURE-psig
1
0
-1
℄
0
1
2
3
4
5
6
7
RADIAL DISTANCE FROM JET ℄-in.


PREMERGING REGION STATIC PRESSURE PROFILE (x/D = 2.5)
37T - 3.3AR - CPA - ET/RC NOZZLE WITH 3.1AR EJECTOR (BELLMOUTH), L/D = 2
N.P.R. = 3.0
T_T = 1000° F
STATIC PRESSURE RELATIVE TO ATMOSPHERIC PRESSURE-psig
1
0
-1
0
1
2
3
4
5
6
7
RADIAL DISTANCE FROM JET ℄ -in.

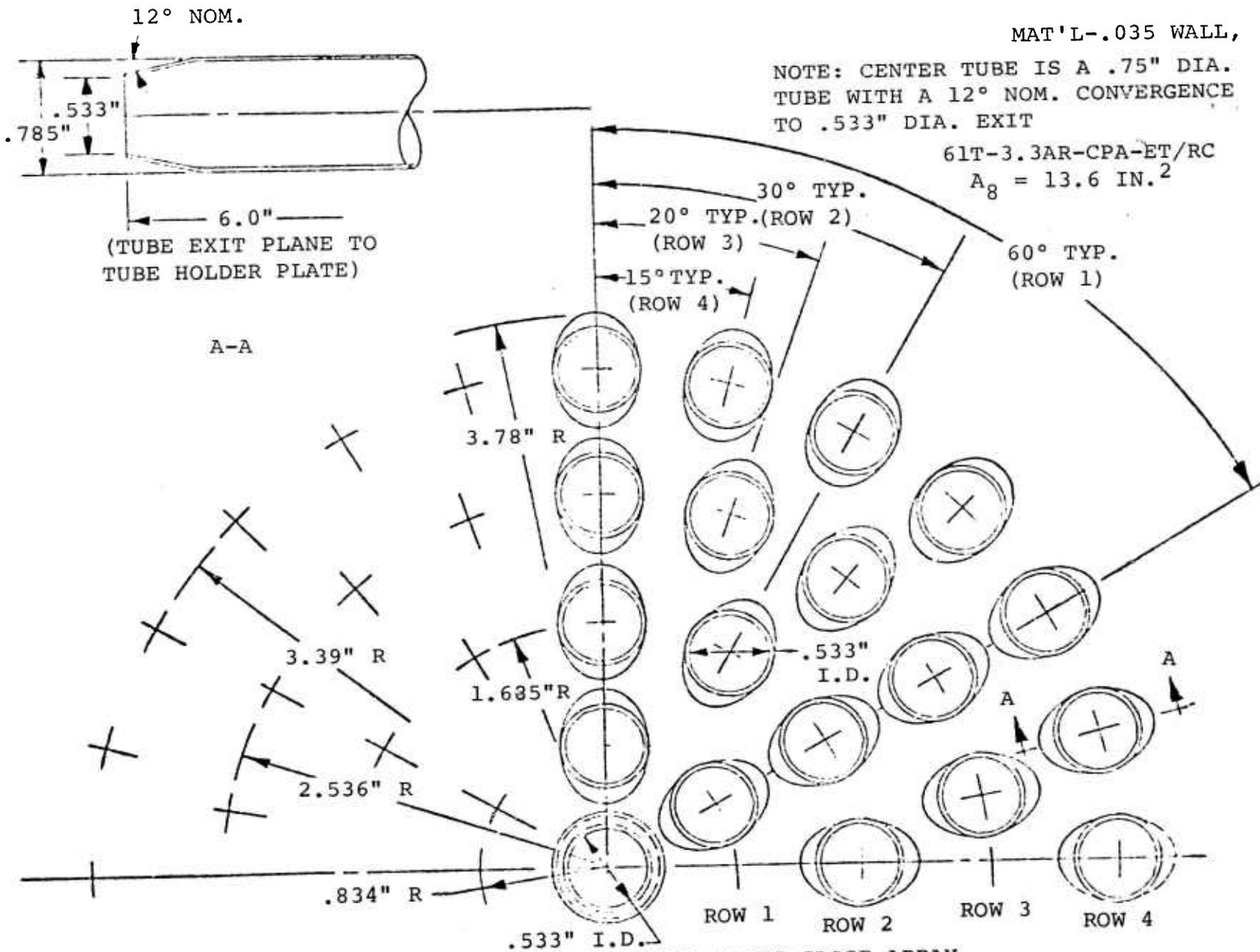

POST MERGED REGION STATIC PRESSURE PROFILE (x/D = 5.0)
37T - 3.3AR - CPA - ET/RC NOZZLE WITH 3.1AR EJECTOR (BELLMOUTH) L/D = 2
N.P.R. = 3.0
T_T = 1000° F
℄
STATIC PRESSURE RELATIVE TO ATMOSPHERIC PRESSURE-psig
1
0
-1
0
1
2
3
4
5
6
7
RADIAL DISTANCE FROM JET ℄-in.



61T-3.3AR-CPA-ET/RC NOZZLE



61T-3.3AR-CPA-ET/RC NOZZLE



61 TUBE - AREA RATIO 3.3 ELLIPTICAL RUBES CLOSE ARRAY

TEST CONDITIONS

NOZZLE: 61T-3.3AR-CPA-ET/RC

FACILITY: HNTF

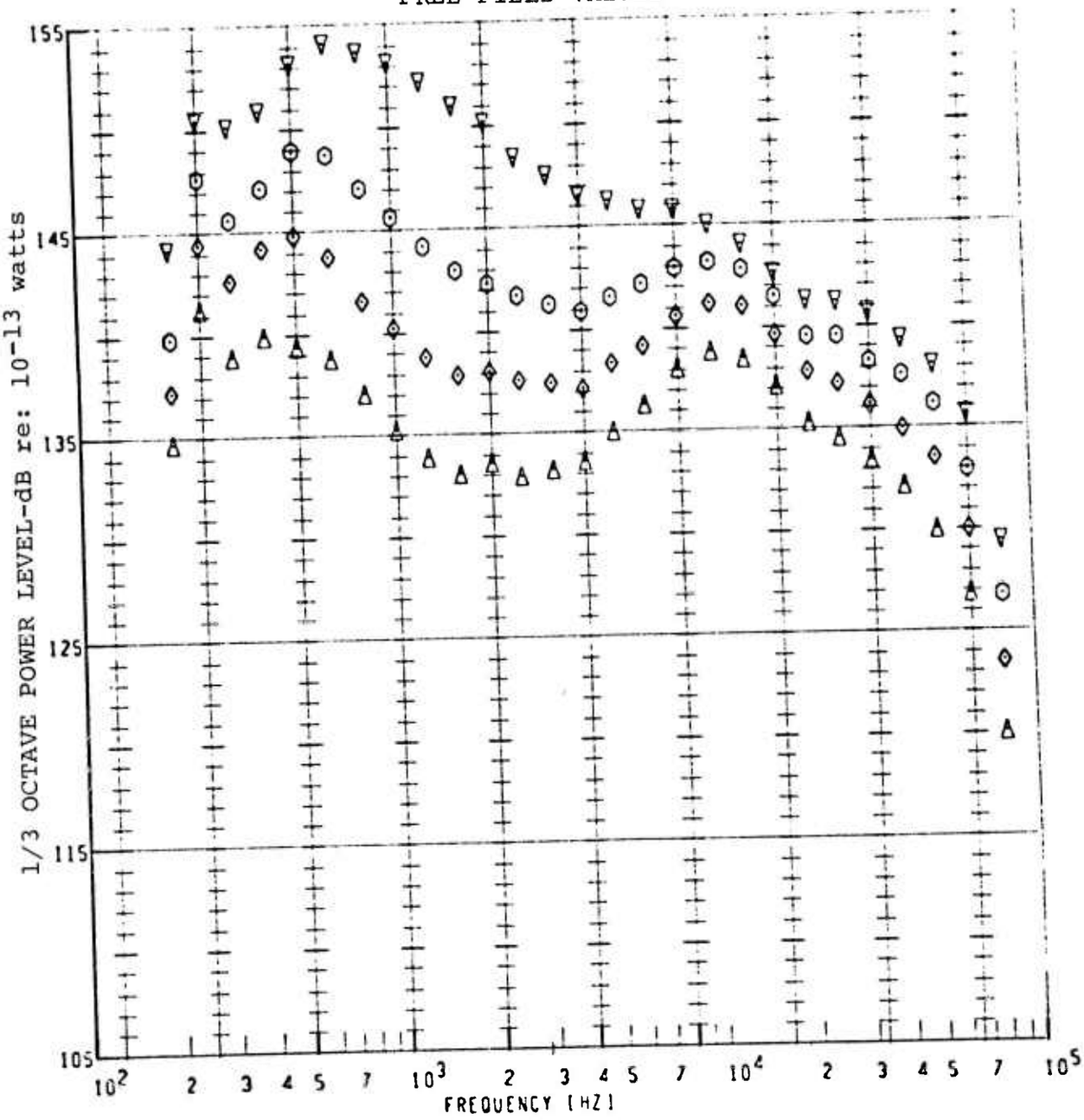
DATE: 1-31-73 T_{AMB} = 48.5°F **R.H.** = 68%

SCALE MODEL A_8 = 13.6 in.^{2}

RUN NO.	NPR	T_T	V_J (IDEAL)	REMARKS	REF
239	2.0	1150°F	1875 fps	3" tube lengths	
"	2.5	"	2126	" "	
"	3.0	"	2303	" "	
"	4.0	"	2544	" "	

MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH CONCRETE GROUND SURFACE. MEASURED ACOUSTIC DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.

FREE FIELD VALUES

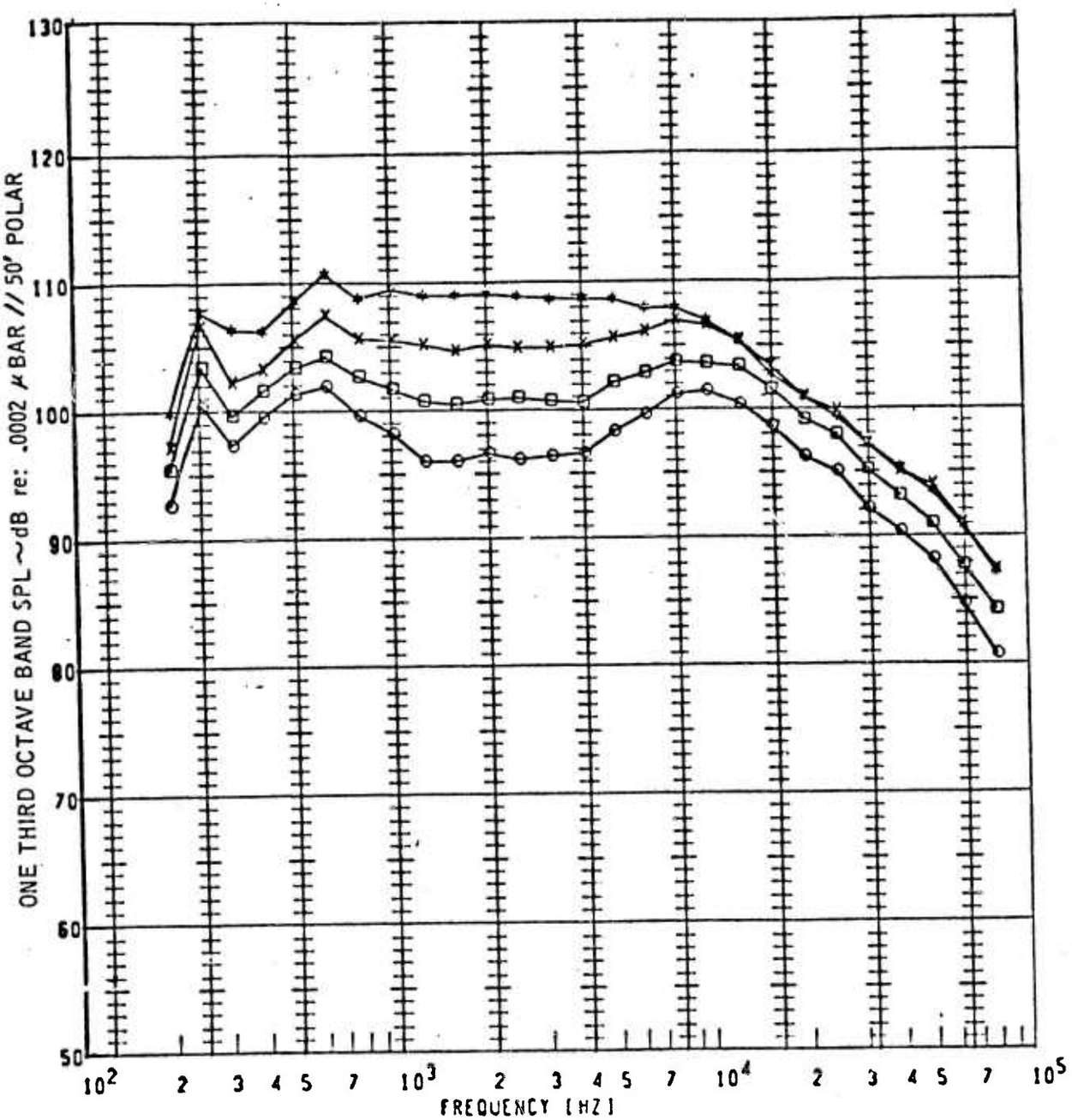


PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	239	2.00	1150°F
◇	239	2.50	1150
⊙	239	3.00	1150
▽	239	4.00	1150

NOZZLE: 61T-3.3AR-CPA-ET/RC

JET NOISE POWER SPECTRA

SPECTRA ARE FREE FIELD + 6dB

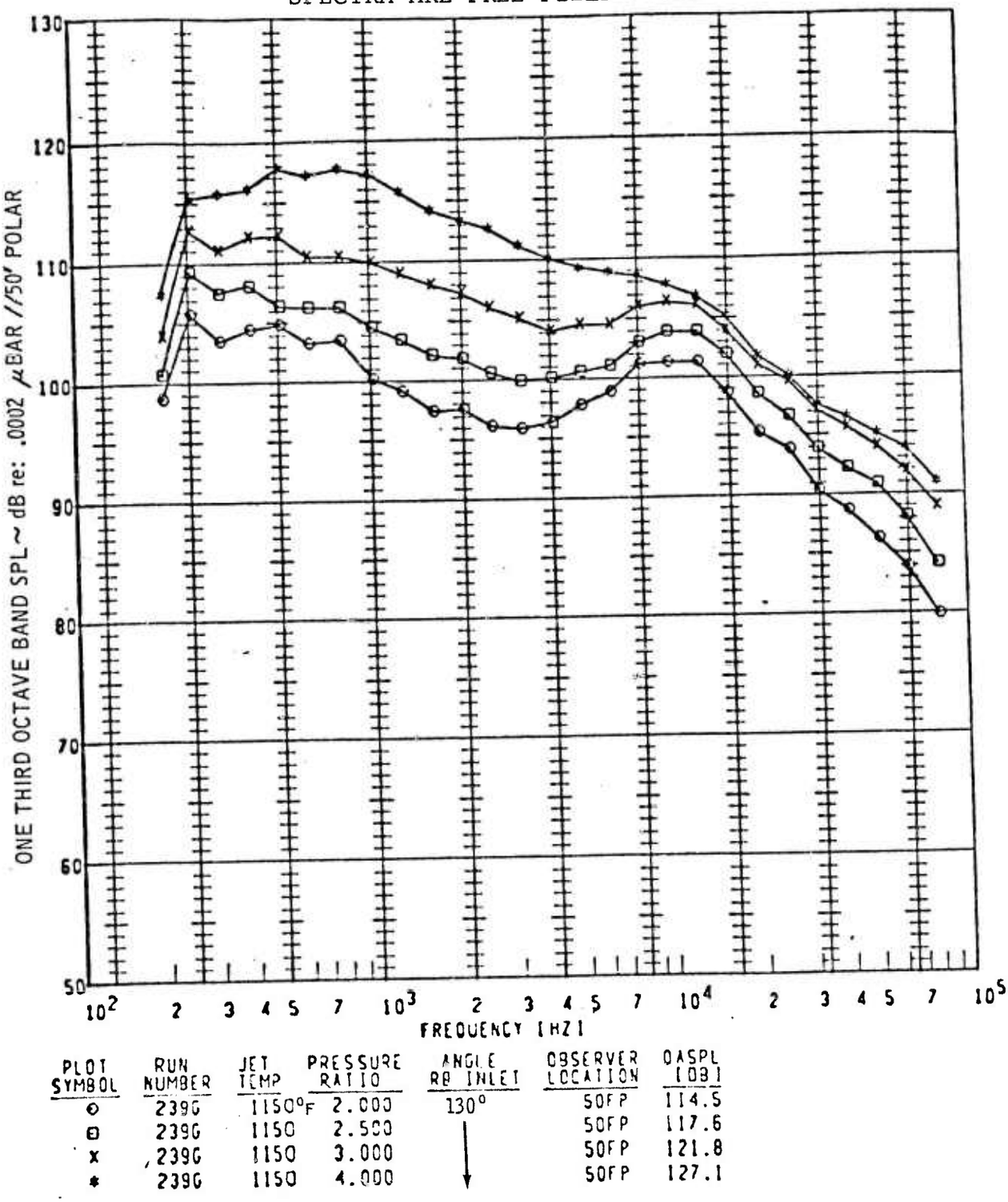


PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL [DB]
⊙	2396	1150°F	2.000	110°	50FP	112.3
⊡	2396	1150	2.500	↓	50FP	115.3
x	2396	1150	3.000	↓	50FP	118.5
*	2396	1150	4.000	↓	50FP	121.1

NOZZLE: .61T-3.3AR-CPA-ET/RC

MEASURED NOISE SPECTRA AT 110° re: NOZZLE INLET AXIS

SPECTRA ARE FREE FIELD + 6dB

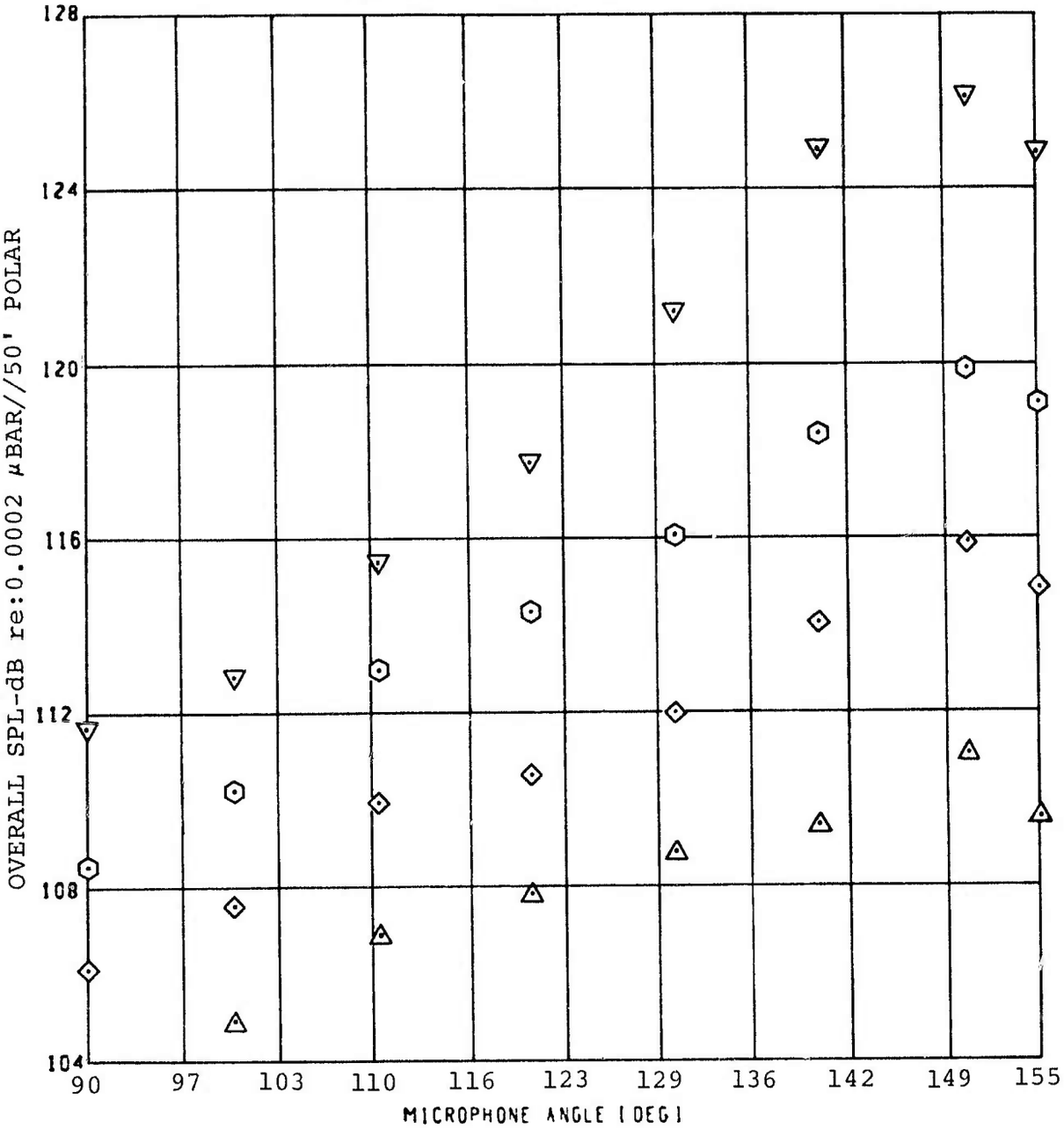


PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL [DB]
⊙	2396	1150°F	2.000	130°	SOFP	114.5
⊡	2396	1150	2.500	↓	SOFP	117.6
x	2396	1150	3.000	↓	SOFP	121.8
*	2396	1150	4.000	↓	SOFP	127.1

NOZZLE: 61T-3.3AR-CPA-ET/RC

MEASURED NOISE SPECTRA AT 130° re: NOZZLE INLET AXIS

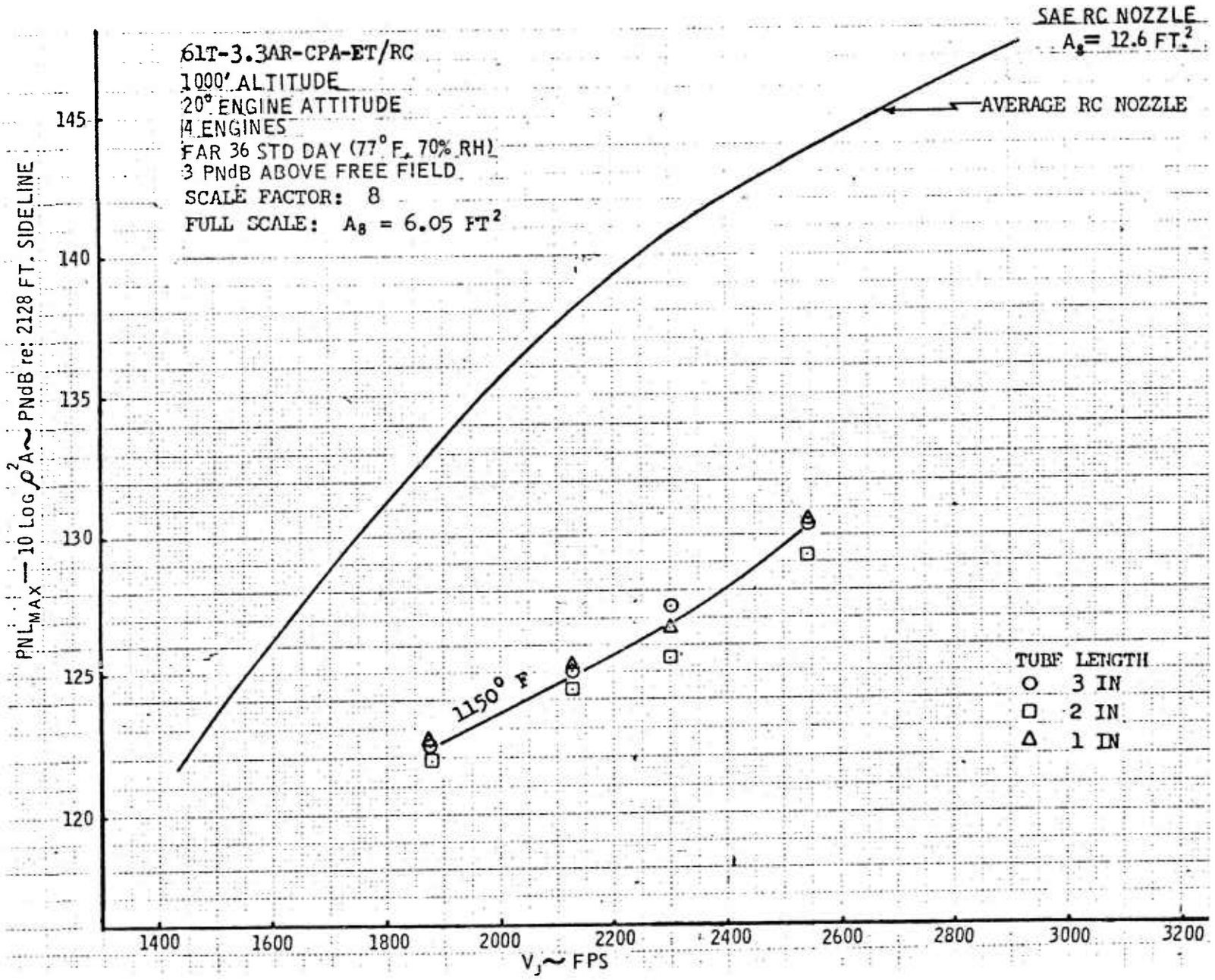
FREE FIELD VALUES

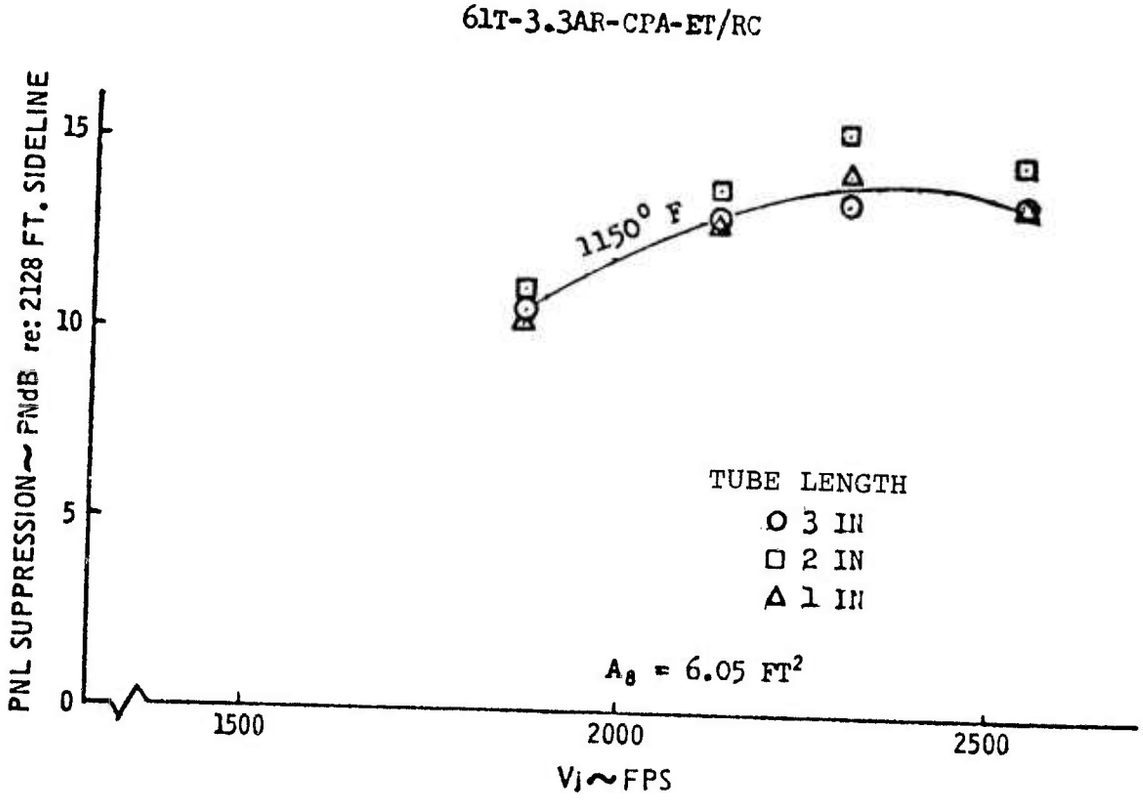


PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	239	2.00	1150°F
◇	239	2.50	1150
○	239	3.00	1150
▽	239	4.00	1150

NOZZLE: 61T-3.3AR-CPA-ET/RC

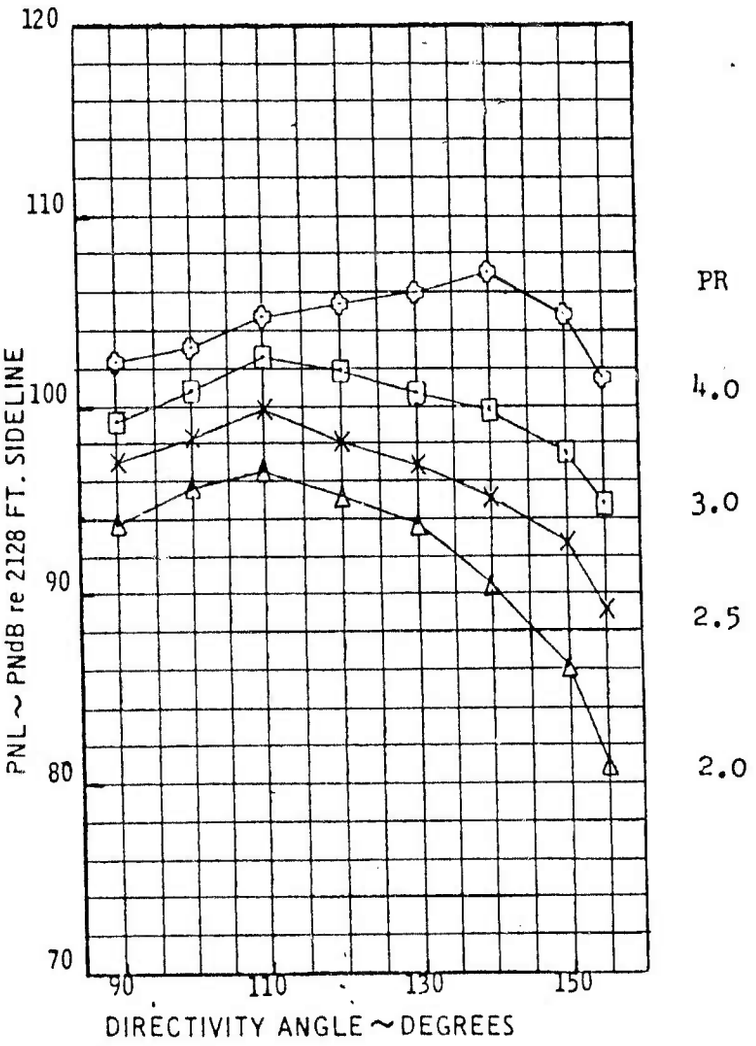
OASPL BEAM PATTERNS


SAE RC NOZZLE
A_8 = 12.6 FT.^{2}
AVERAGE RC NOZZLE
61T-3.3AR-CPA-ET/RC
1000' ALTITUDE
20° ENGINE ATTITUDE
4 ENGINES
FAR 36 STD DAY (77° F, 70% RH)
3 PNdB ABOVE FREE FIELD
SCALE FACTOR: 8
FULL SCALE: A_8 = 6.05 FT^2
1150° F
TUBE LENGTH
3 IN
2 IN
1 IN
PNL_{MAX} — 10 Log $\rho^2 A$ ~ PNdB re: 2128 FT. SIDELINE
145
140
135
130
125
120
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
V_j ~ FPS



PEAK PNL SUPPRESSION VALUES

NOZZLE: 61T-3.3AR-CPA-ET/RC



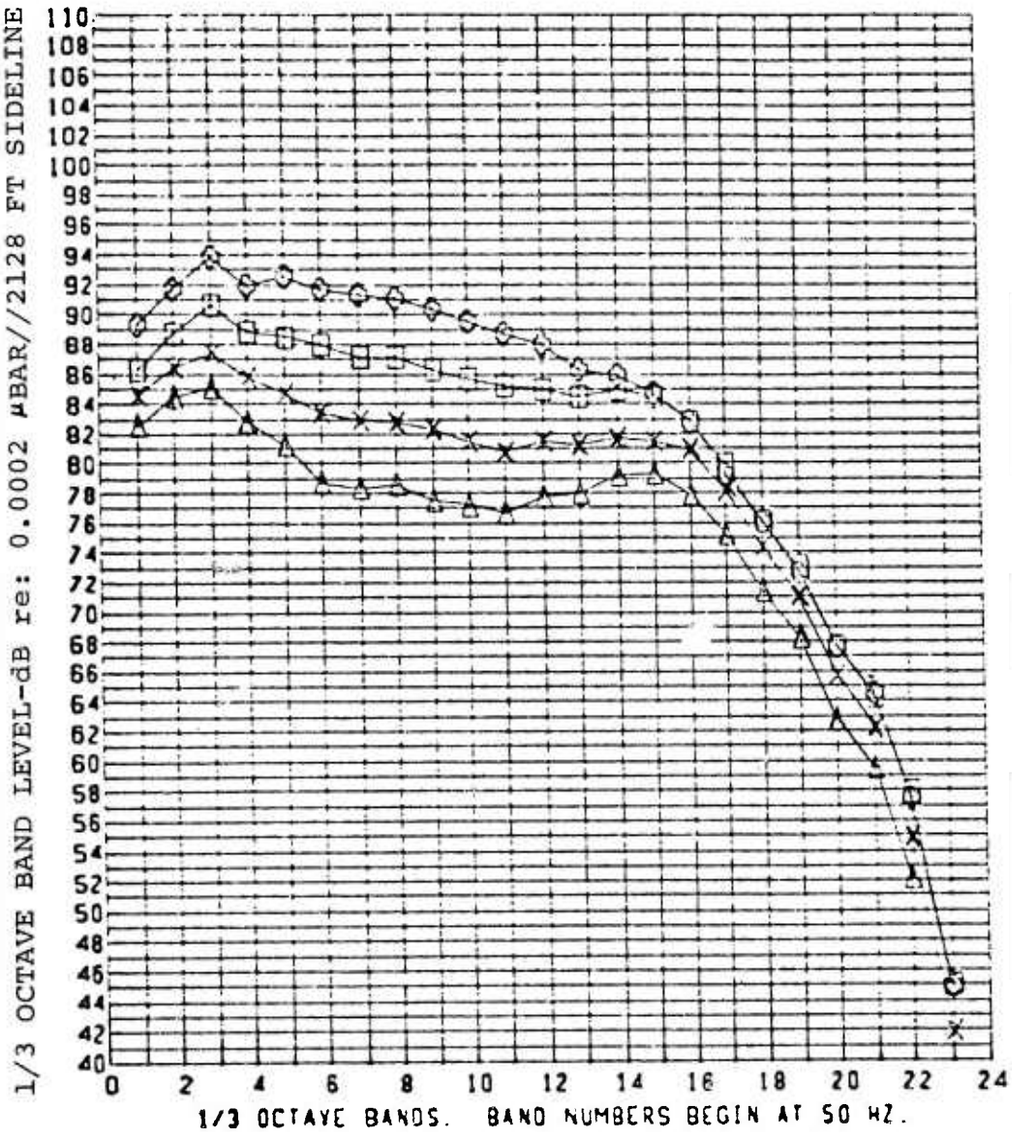
RUN 239

T_T = 1150° F A_8 = 6.05 FT^2

PNL BEAM PATTERNS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 110 DEG TEMP = 77 DEG R.H. = 70 PER CENT



T_T = 1150°F A_8 = 6.05 FT^2 RUN: 239

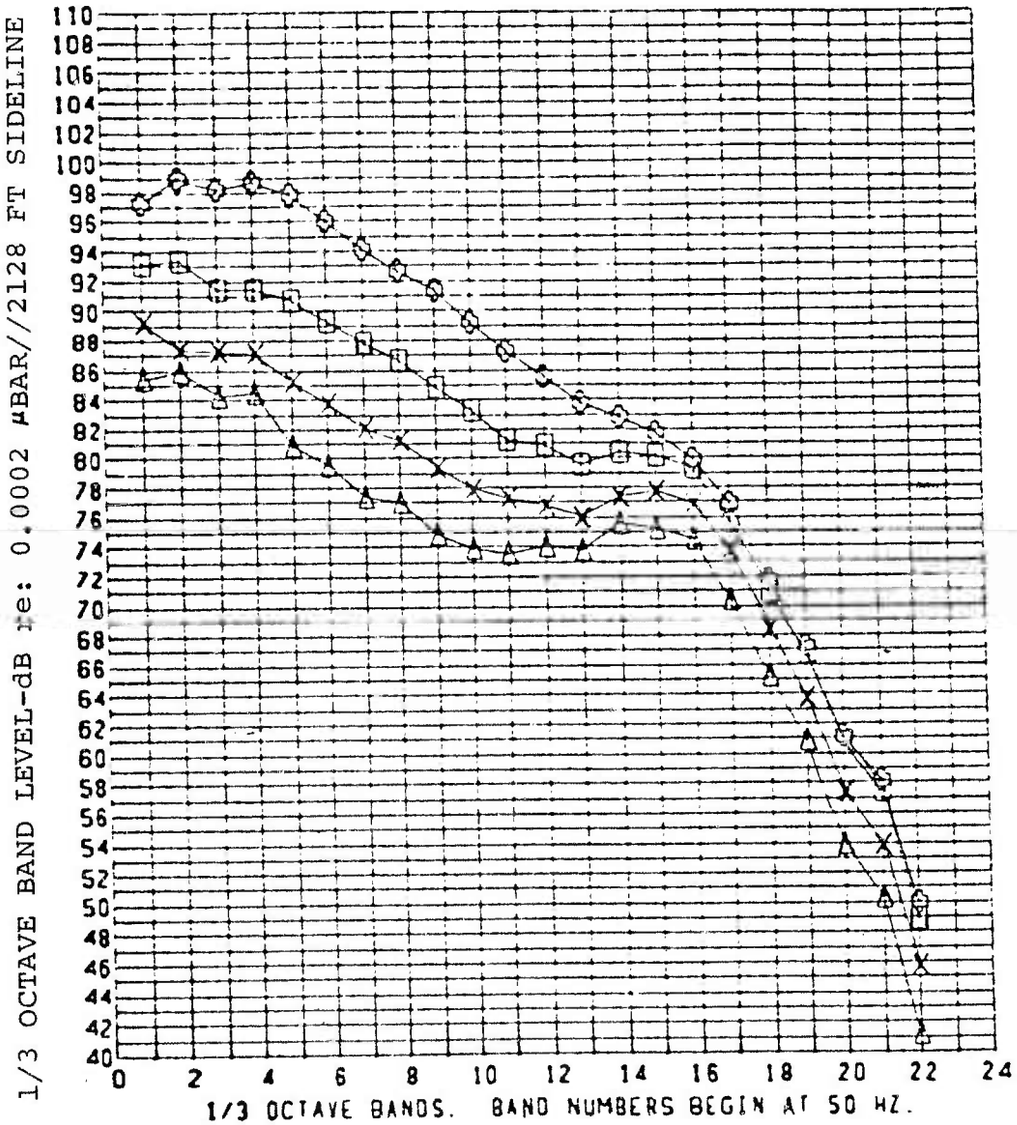
PR = △ 2.0, X 2.5, □ 3.0, ✣ 4.0

NOZZLE: 61T-3.3AR-CPA-ET/RC

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 110° re: NOZZLE INLET AXIS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 130 DEG TEMP = 77 DEG R.H. = 70 PER CENT



T_T = 1150°F A_8 = 6.05 FT^2 RUN: 239

PR = △ 2.0, X 2.5, □ 3.0, ✣ 4.0

NOZZLE: 61T-3.3AR-CPA-ET/RC

JET NOISE SPECTRA AT THE 2128 FT.
SIDELINE, 130° re: NOZZLE INLET AXIS

TEST CONDITIONS

NOZZLE: 61T-3.3AR-CPA-ET/RC

FACILITY: WALL ISOLATION FACILITY

DATE: January 20, 1973

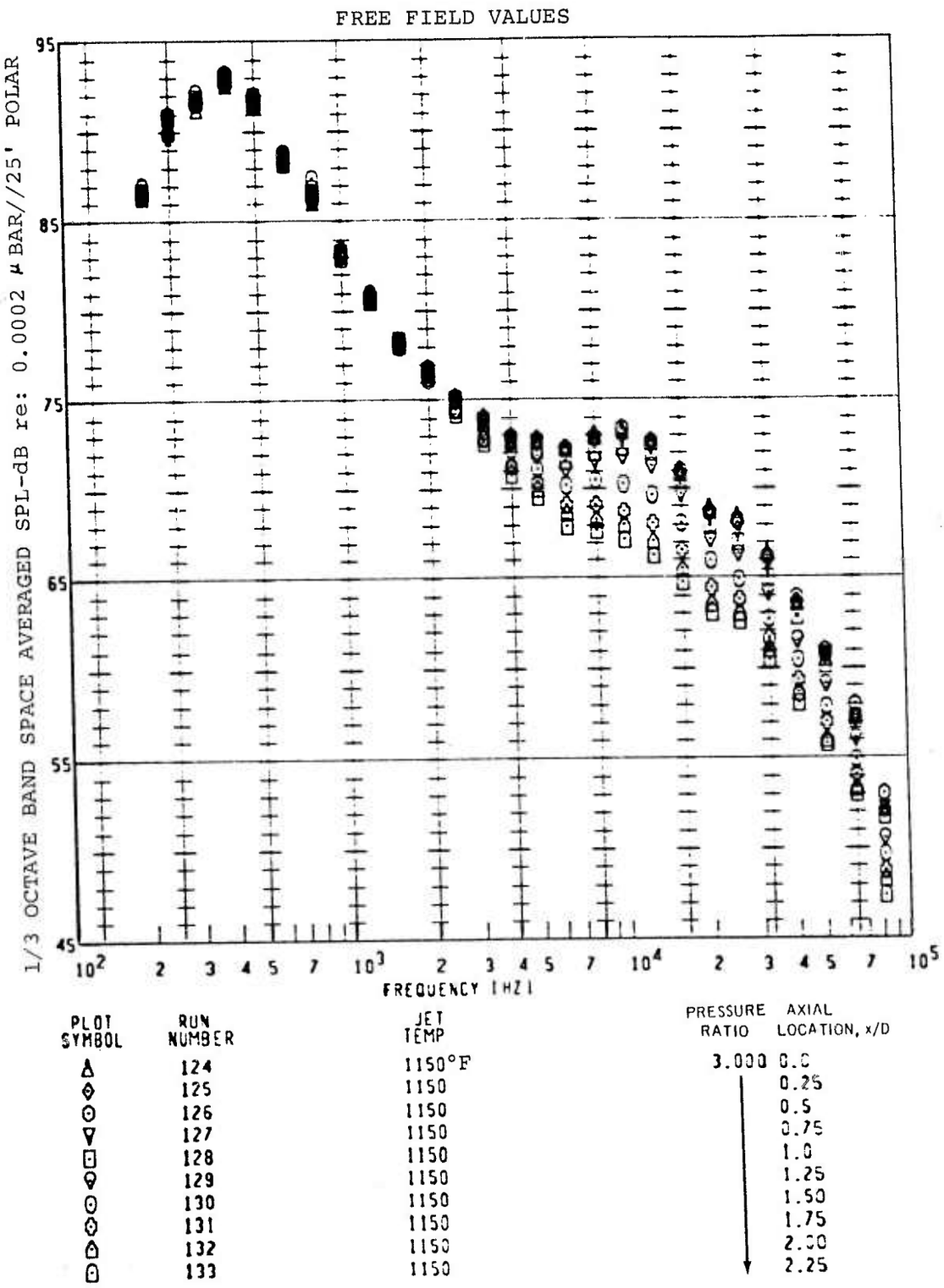
P_{AMB} = 30.06 in Hg T_{AMB} = 39°F R.H. = 92%

NPR = 3.0 T_T = 1150°F V_J (IDEAL) = 2300 FPS

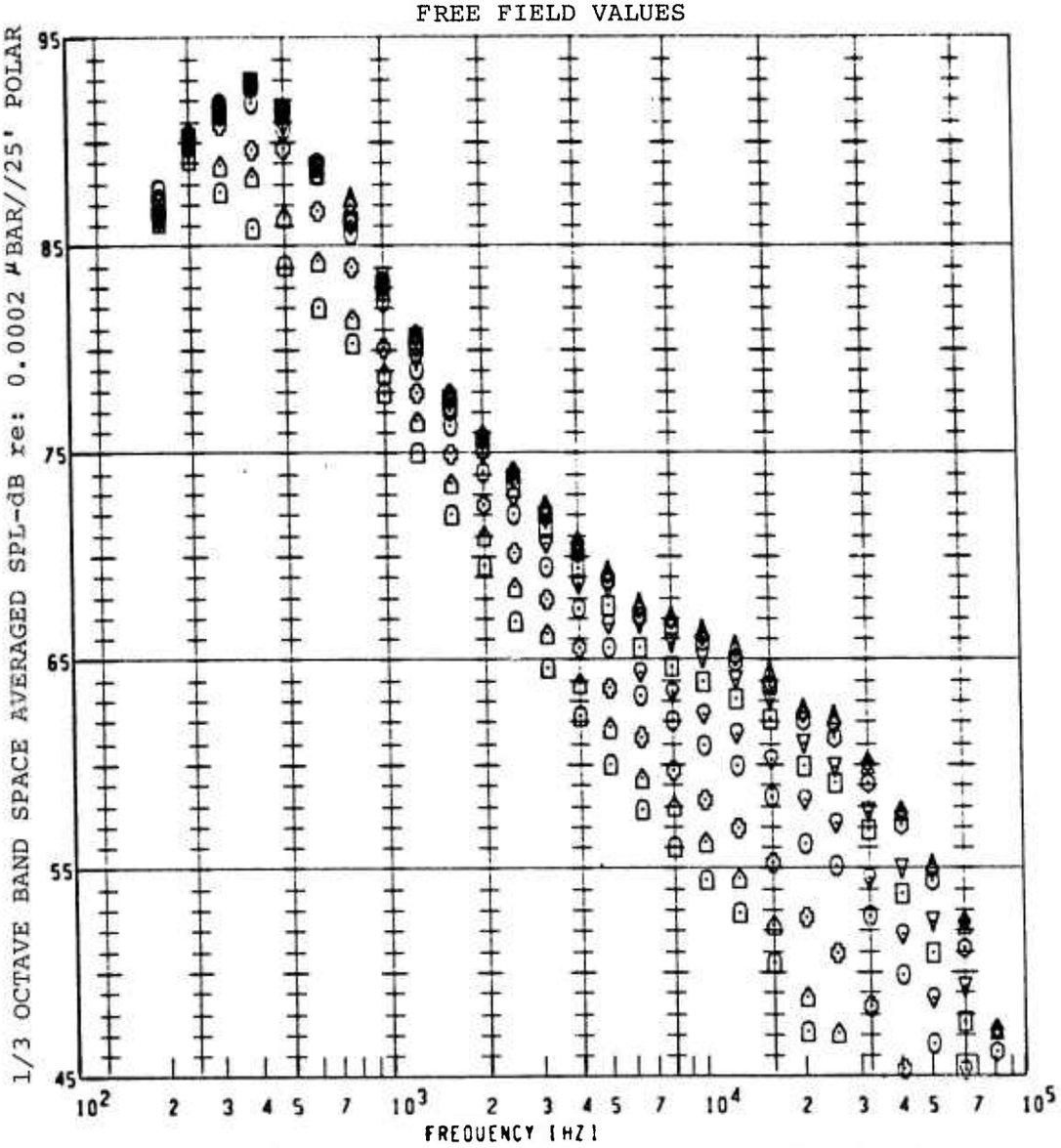
SCALE MODEL A_8 = 13.6 in.^{2}

RUN NO.	AXIAL LOCATION	IRIS DIA.	REMARKS	REF.
124	0.0 x/D	9.0 in.		
125	0.25	9.0		
126	0.50	10.0		
127	0.75	10.0		
128	1.00	10.0		
129	1.25	10.5		
130	1.50	10.5		
131	1.75	11.0		
132	2.00	11.0		
133	2.25	11.5		
134	2.50	11.5		
135	2.75	12.0		
136	3.0	13.0		
137	3.5	14.0		
138	4.0	15.0		
139	5.0	16.0		
140	6.0	18.0		
141	8.0	19.0		
142	10.0	21.0		
143	12.0	23.0		
144	14.0	25.0		
145	16.0	27.0		

MICROPHONE LAYOUT: 25 FOOT VERTICAL POLAR ARC

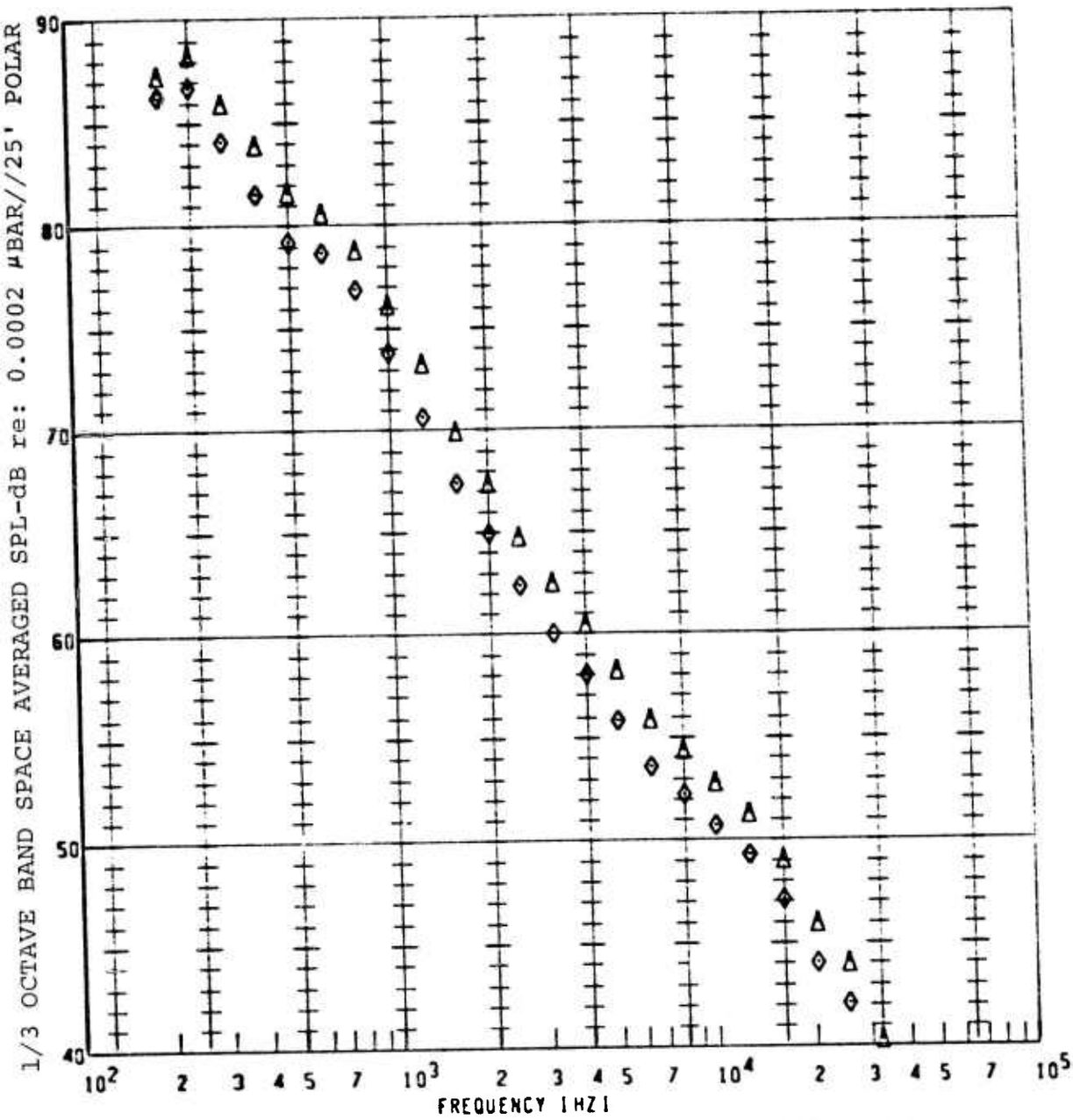

FREE FIELD VALUES
1/3 OCTAVE BAND SPACE AVERAGED SPL-dB re: 0.0002 μ BAR//25' POLAR
95
85
75
65
55
45
10^2 2 3 4 5 7 10^3 2 3 4 5 7 10^4 2 3 4 5 7 10^5
FREQUENCY (HZ)
PLOT SYMBOL
RUN NUMBER
JET TEMP
PRESSURE RATIO
AXIAL LOCATION, x/D
124 1150°F 3.000 0.0
125 1150 0.25
126 1150 0.5
127 1150 0.75
128 1150 1.0
129 1150 1.25
130 1150 1.50
131 1150 1.75
132 1150 2.00
133 1150 2.25

FREE FIELD VALUES

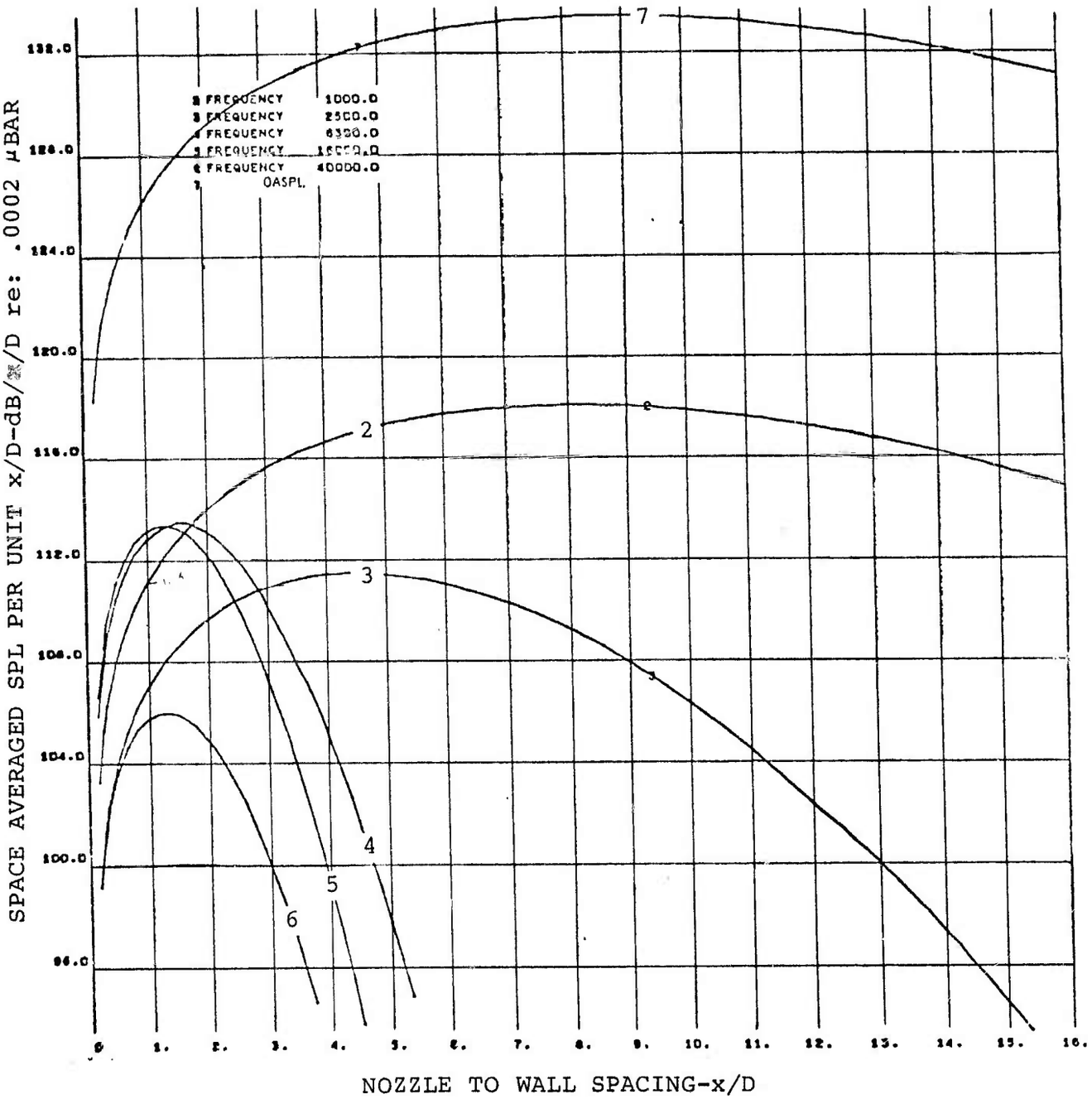


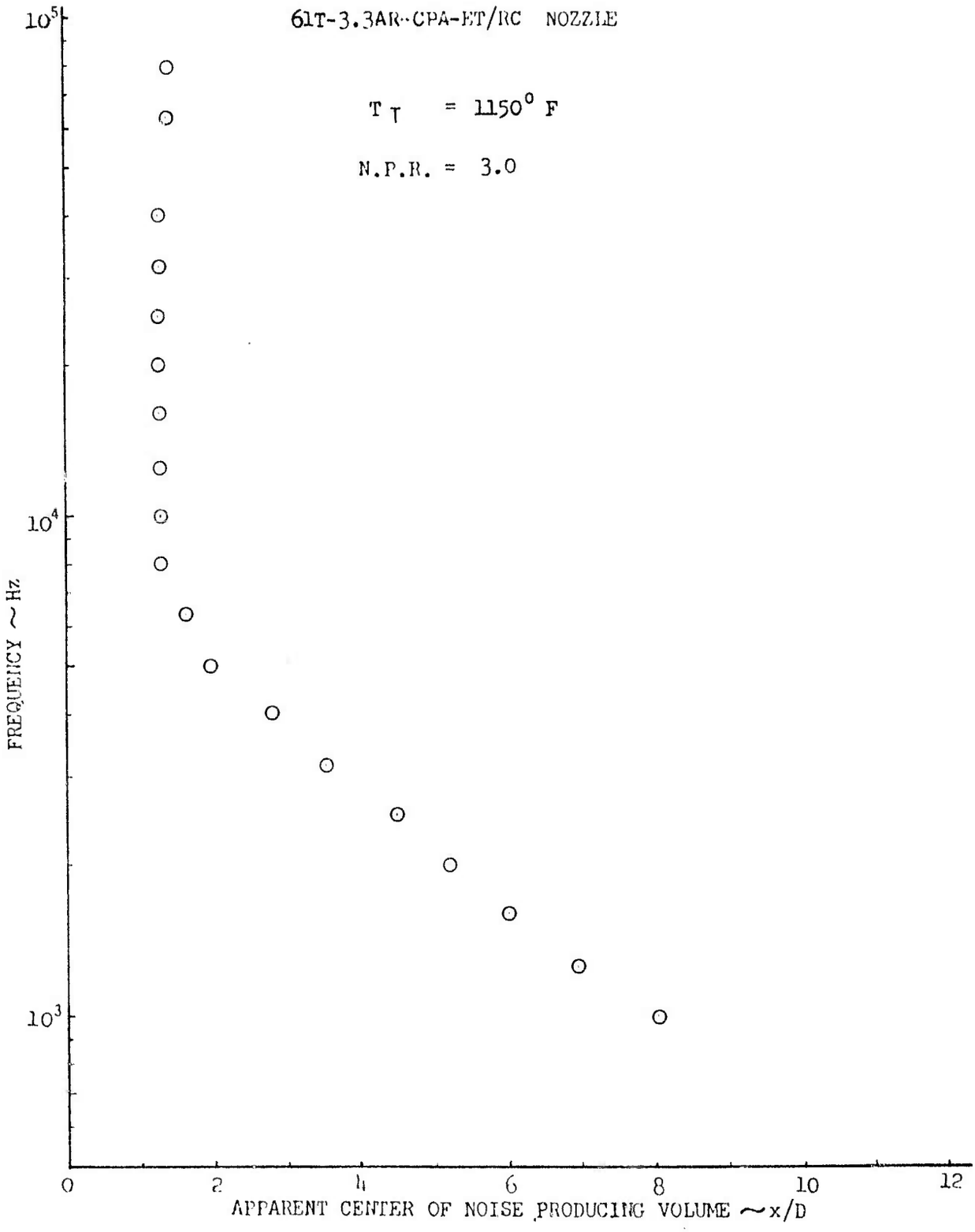
PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	AXIAL LOCATION, x/D
△	134	1150°F	3.000	2.50
◇	135	1150	↓	2.75
○	136	1150	↓	3.00
▽	137	1150	↓	3.50
□	138	1150	↓	4.00
⬡	139	1150	↓	5.00
⊙	140	1150	↓	6.00
◈	141	1150	↓	8.00
◬	142	1150	↓	10.00
▯	143	1150	↓	12.00

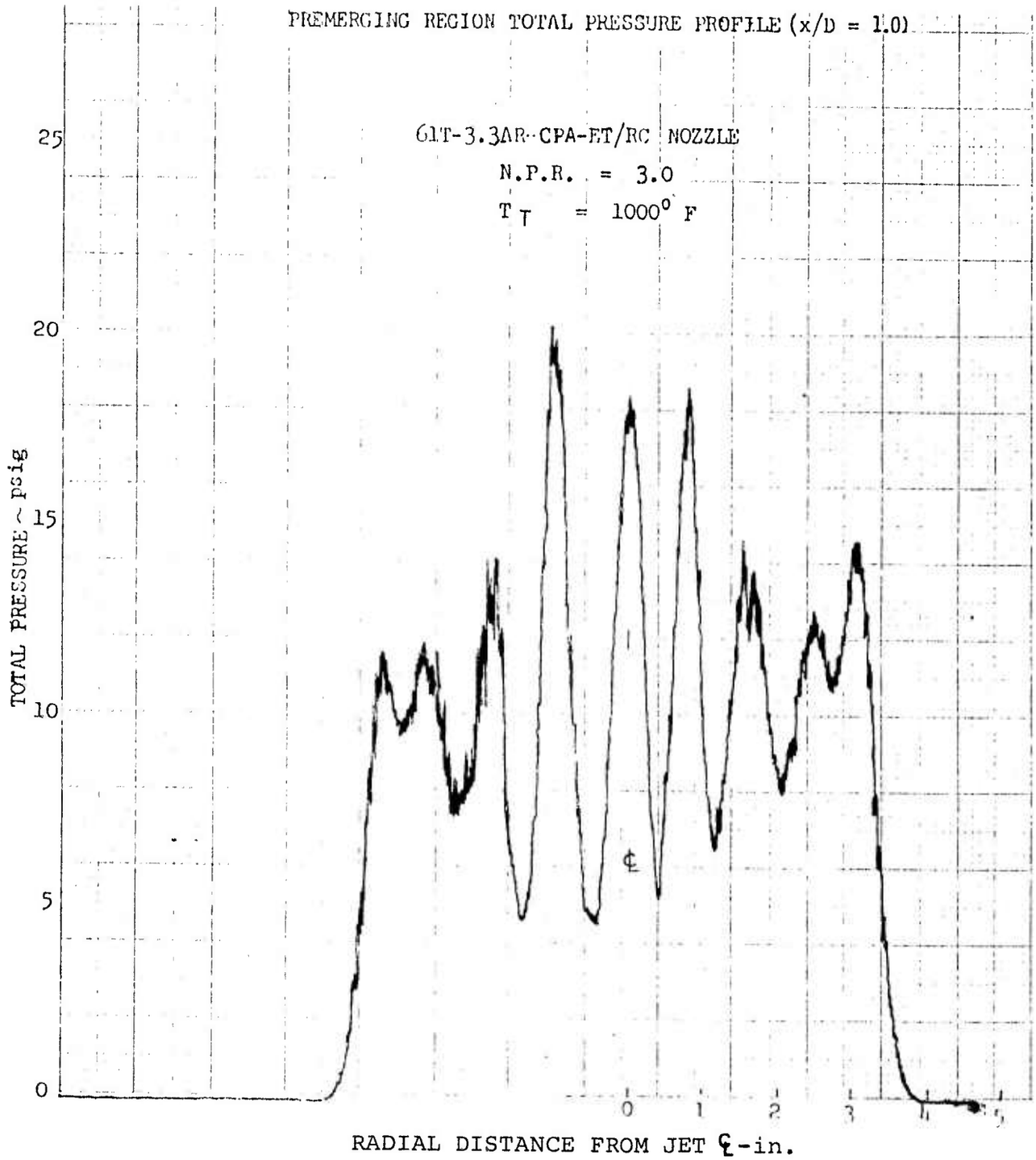
FREE FIELD VALUES

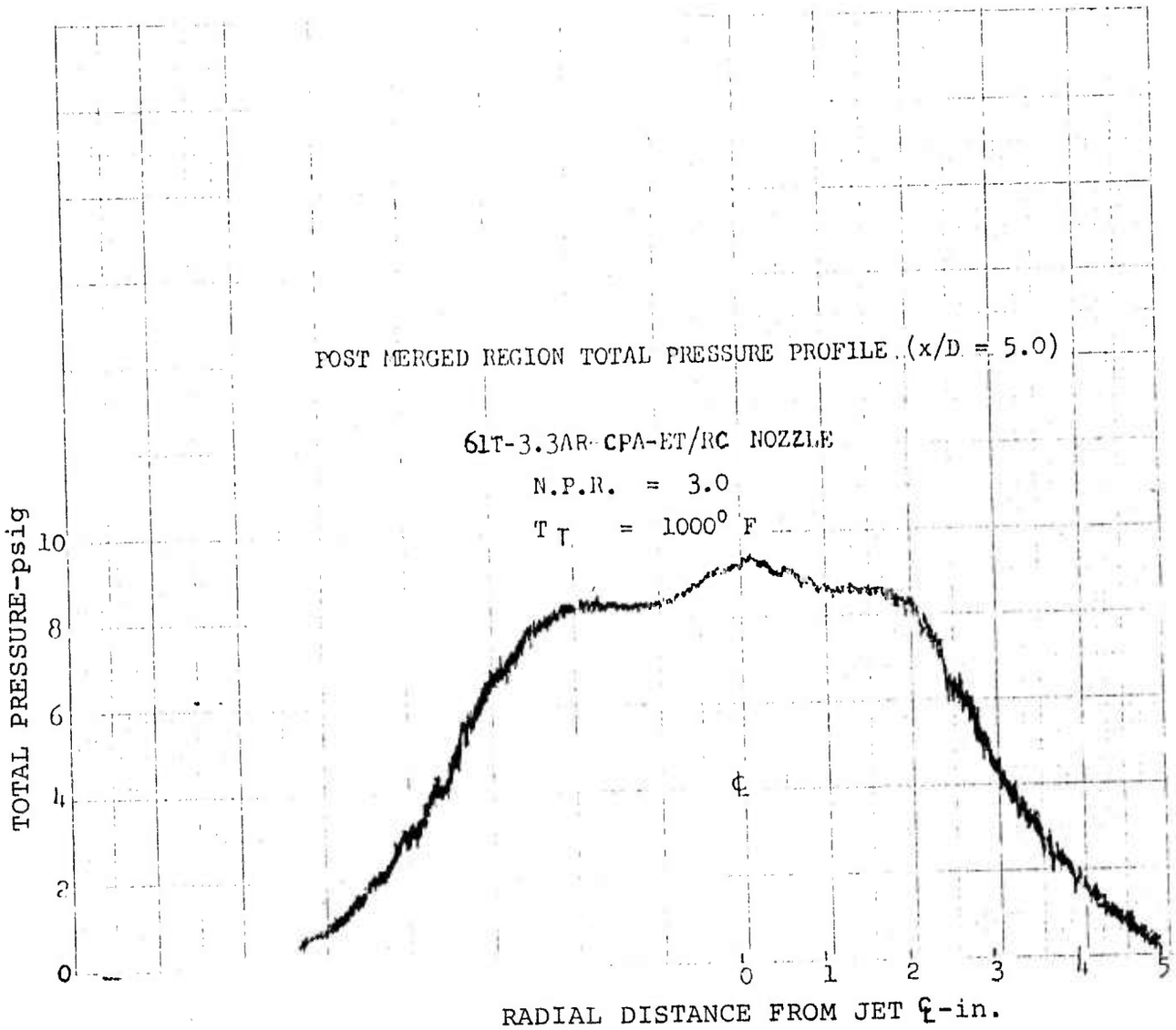


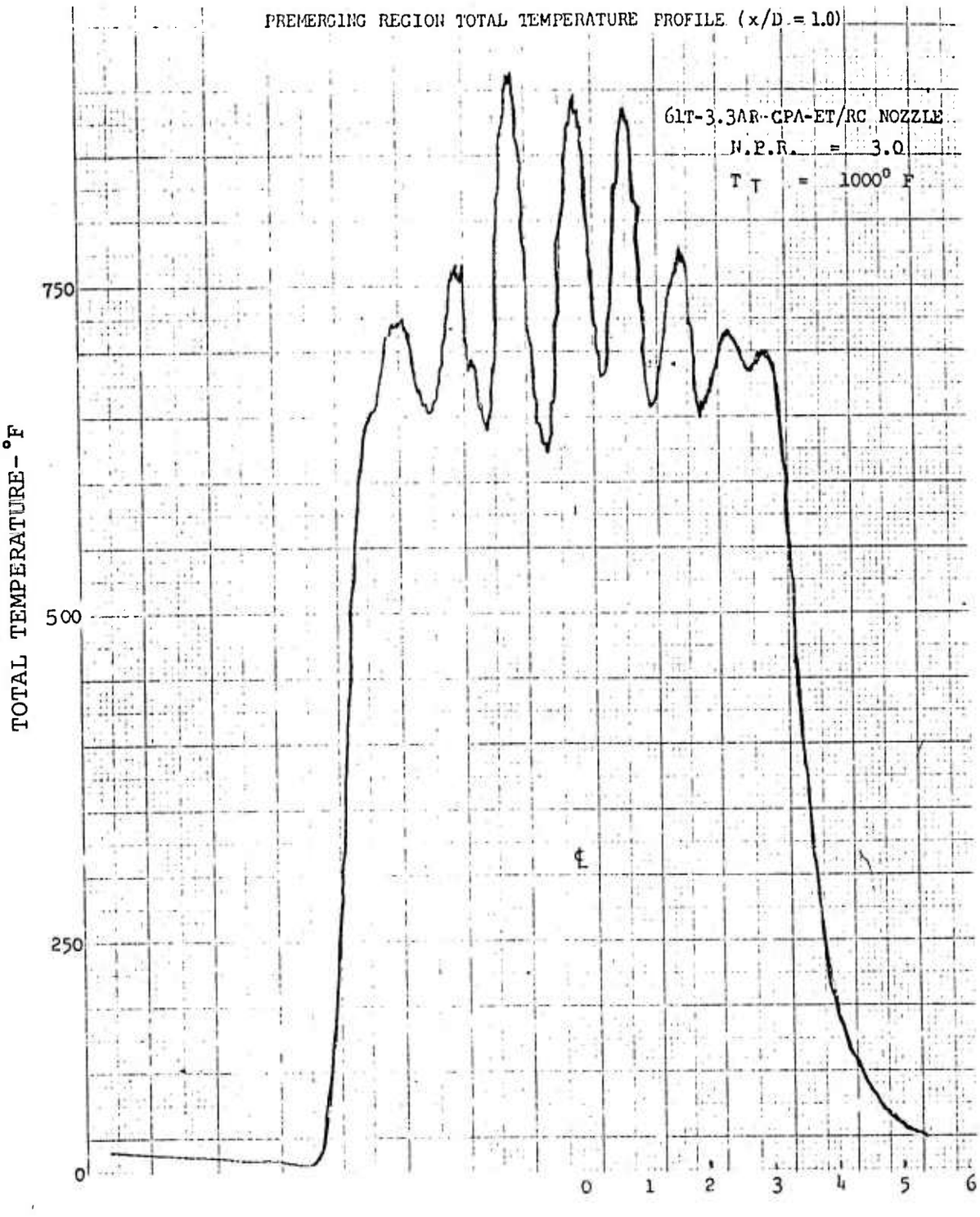
PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	AXIAL LOCATION, x/D
Δ	144	1150°F	3.0	14.00
◇	145	1150	3.0	16.00

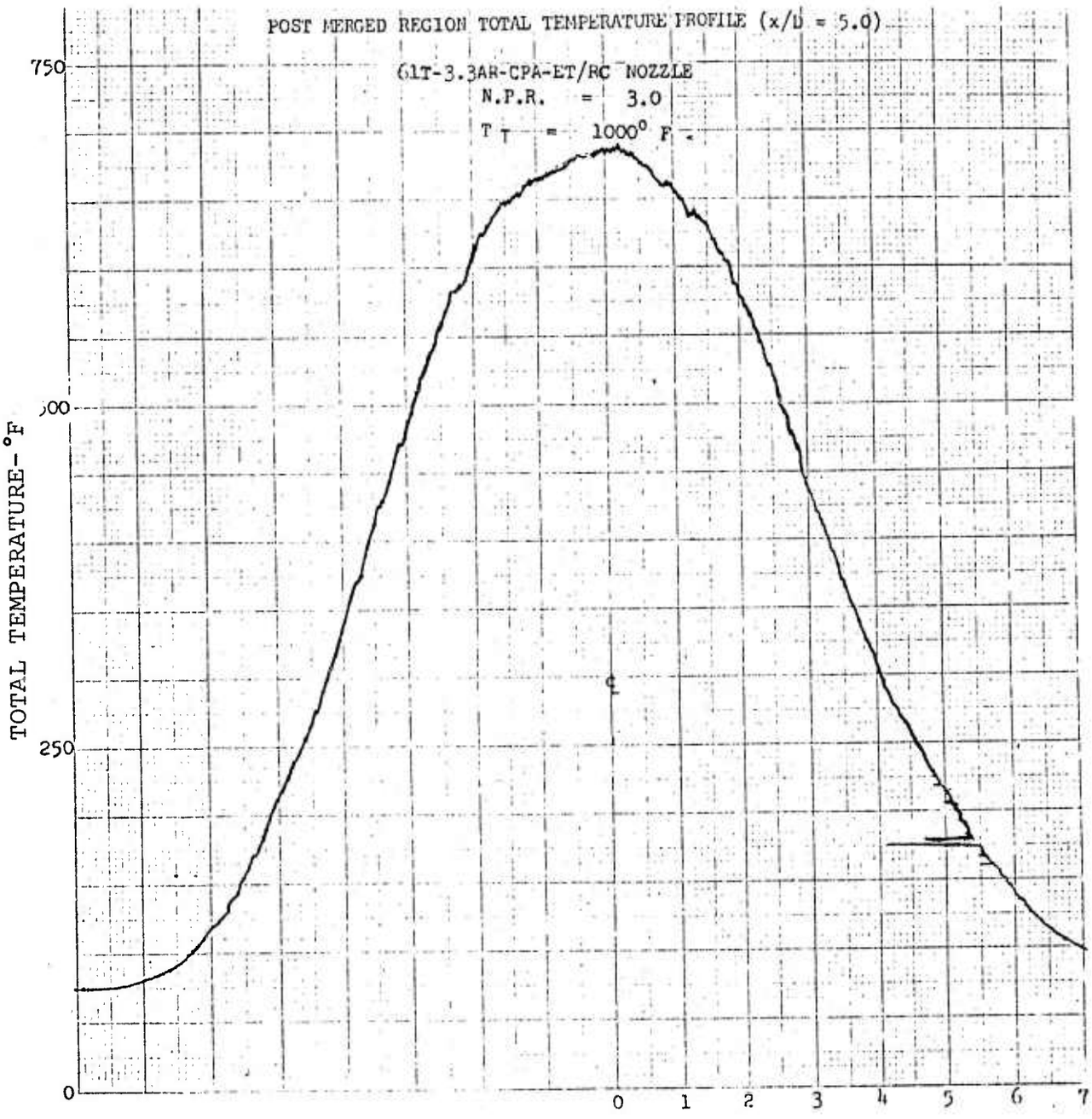

SPACE AVERAGED SPL PER UNIT x/D-dB/ /D re: .0002 μBAR
NOZZLE TO WALL SPACING-x/D
2 FREQUENCY 1000.0
3 FREQUENCY 2500.0
4 FREQUENCY 6300.0
5 FREQUENCY 16000.0
6 FREQUENCY 40000.0
7 OASPL
7
2
3
4
5
6
132.0
128.0
124.0
120.0
116.0
112.0
108.0
104.0
100.0
96.0
0
1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.
13.
14.
15.
16.

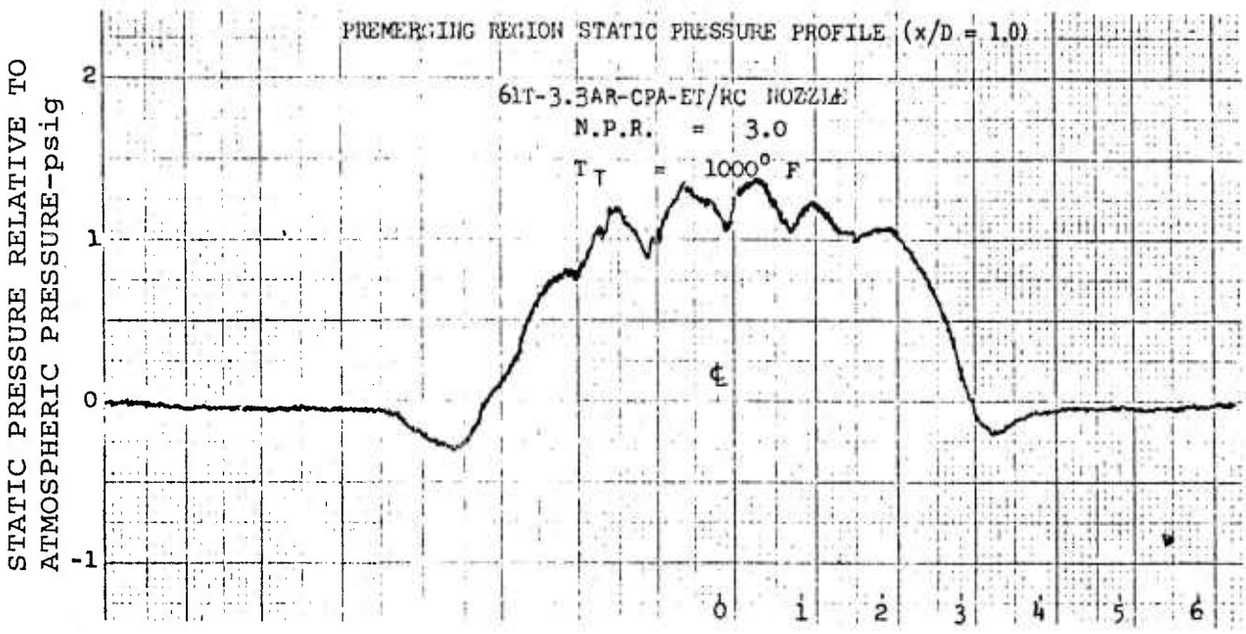

61T-3.3AR-CPA-ET/RC NOZZLE
T_T = 1150° F
N.P.R. = 3.0
10^5
10^4
10^3
FREQUENCY ~ Hz
0
2
4
6
8
10
12
APPARENT CENTER OF NOISE PRODUCING VOLUME ~x/D

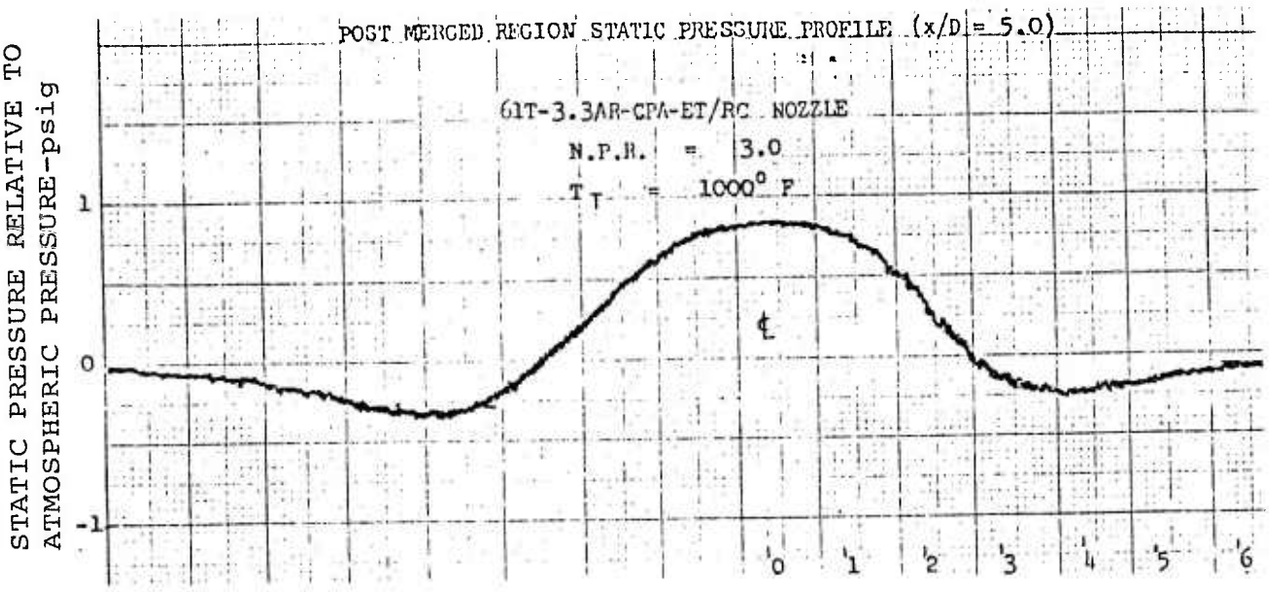

PREMERGING REGION TOTAL PRESSURE PROFILE (x/D = 1.0)
GIT-3.3AR-CPA-ET/RC NOZZLE
N.P.R. = 3.0
T_T = 1000° F
TOTAL PRESSURE ~ psig
0
5
10
15
20
25
℄
0
1
2
3
4
5
RADIAL DISTANCE FROM JET ℄-in.

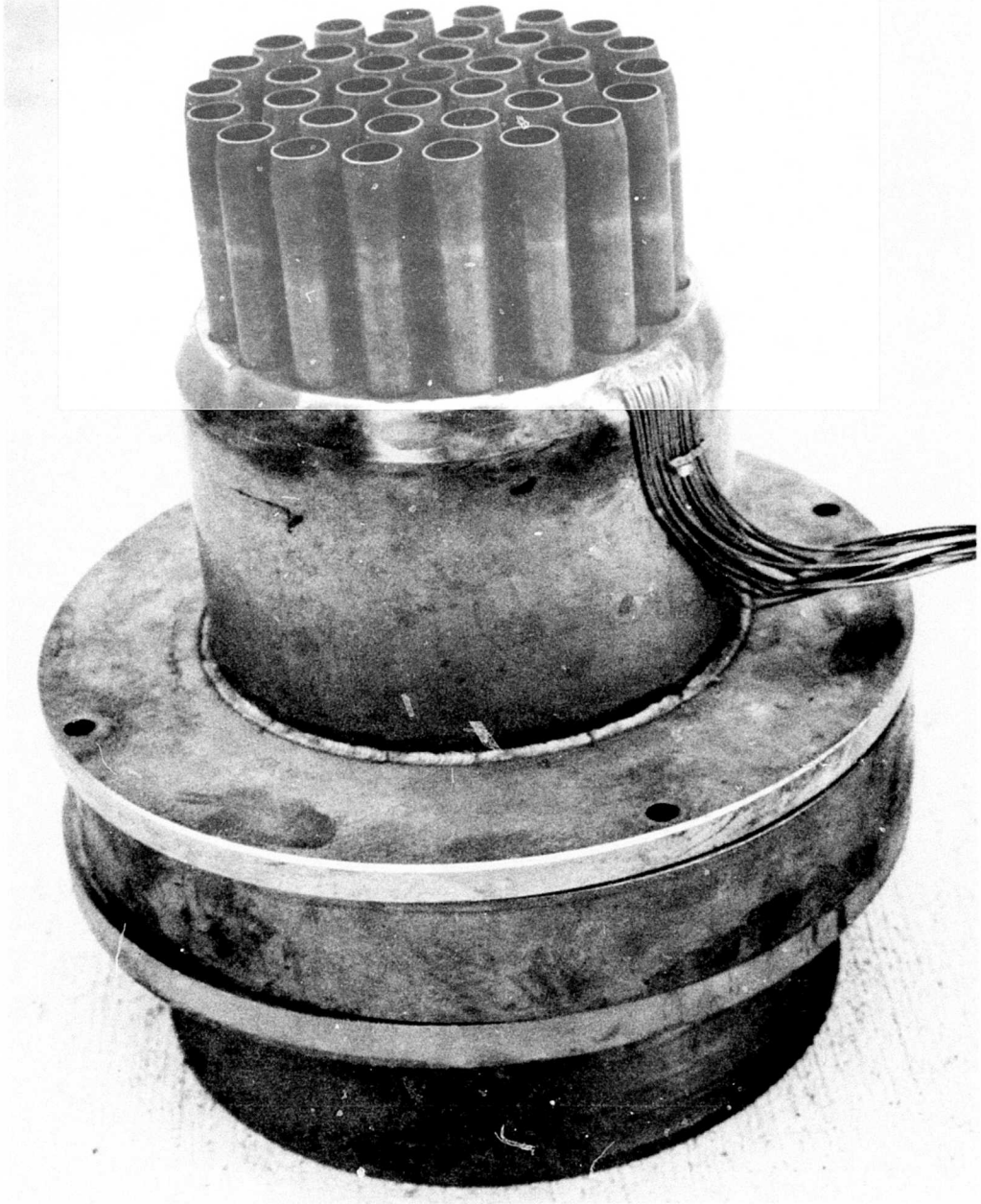

POST MERGED REGION TOTAL PRESSURE PROFILE (x/D = 5.0)
61T-3.3AR CPA-ET/RC NOZZLE
N.P.R. = 3.0
T_T = 1000° F
TOTAL PRESSURE-psig
0
2
4
6
8
10
0
1
2
3
4
5
RADIAL DISTANCE FROM JET ℄-in.


PREMERGING REGION TOTAL TEMPERATURE PROFILE (x/D = 1.0)
61T-3.3AR-CPA-ET/RC NOZZLE
N.P.R. = 3.0
T_T = 1000° F
TOTAL TEMPERATURE - °F
750
500
250
0
0
1
2
3
4
5
6
RADIAL DISTANCE FROM JET ℄ - in.

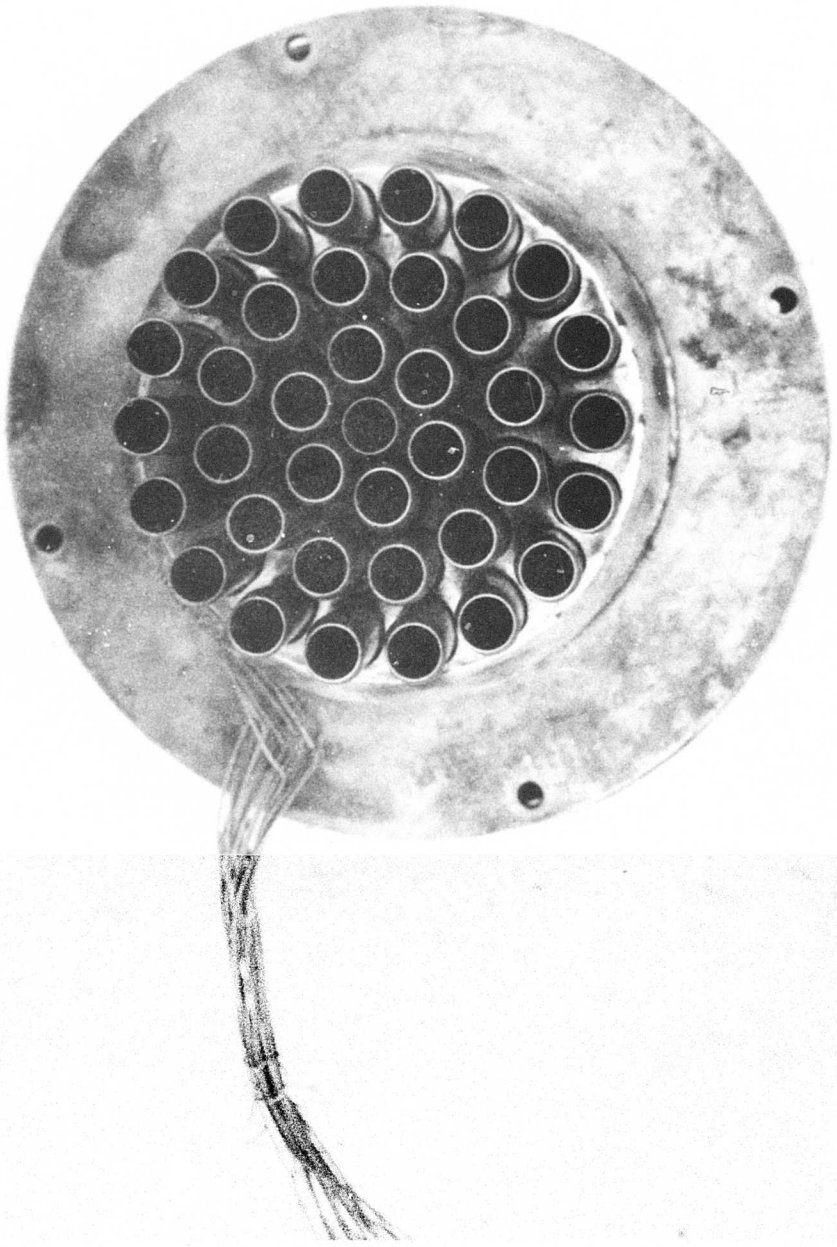

POST MERGED REGION TOTAL TEMPERATURE PROFILE (x/D = 5.0)
61T-3.3AR-CPA-ET/RC NOZZLE
N.P.R. = 3.0
T_T = 1000° F
750
500
250
0
TOTAL TEMPERATURE- °F
0
1
2
3
4
5
6
7
RADIAL DISTANCE FROM JET ℄-in.


PREMERGING REGION STATIC PRESSURE PROFILE (x/D = 1.0)
61T-3.3AR-CPA-ET/RC NOZZLE
N.P.R. = 3.0
T_T = 1000° F
STATIC PRESSURE RELATIVE TO ATMOSPHERIC PRESSURE-psig
2
1
0
-1
℄
0
1
2
3
4
5
6
RADIAL DISTANCE FROM JET ℄-in.

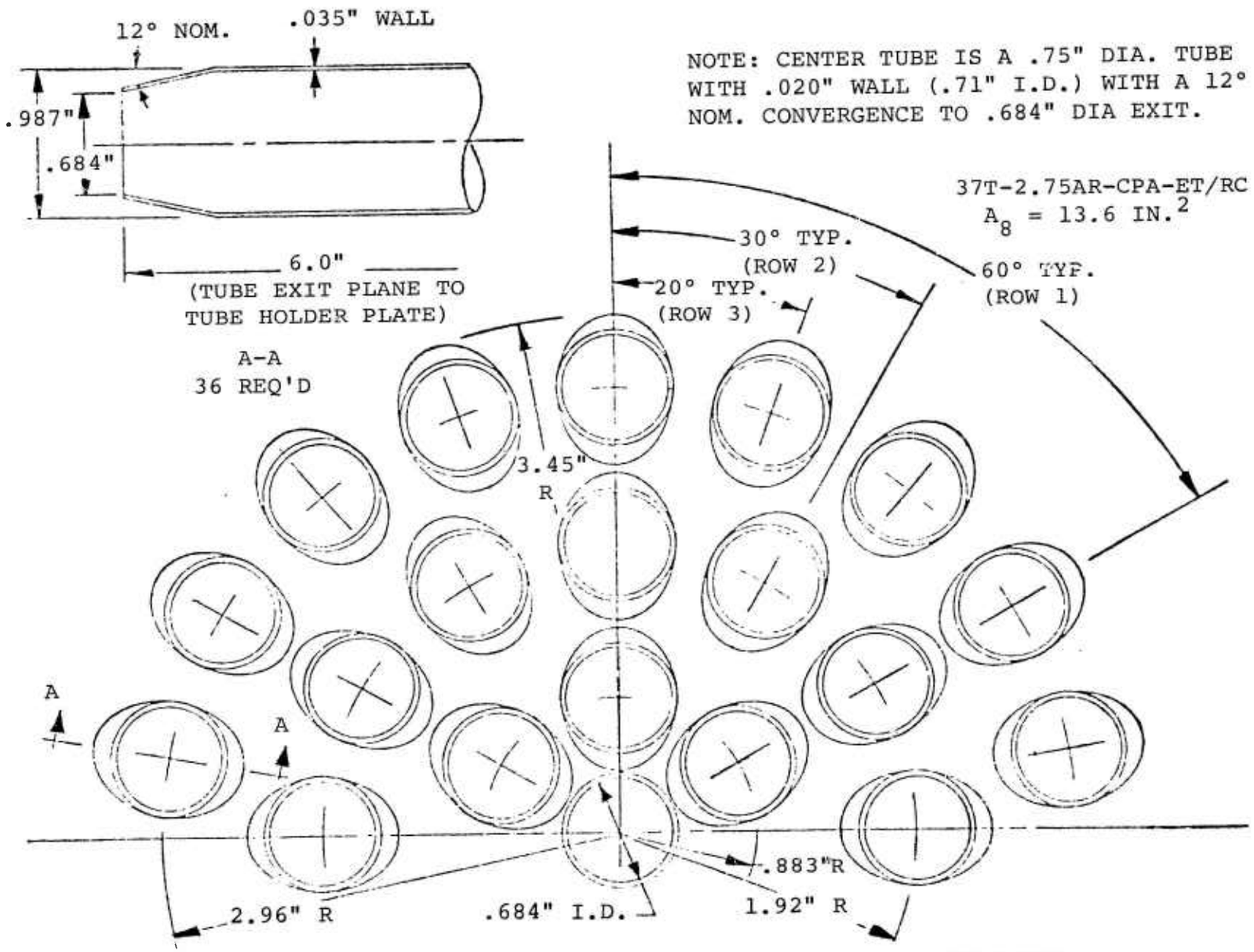

POST MERGED REGION STATIC PRESSURE PROFILE (x/D = 5.0)
61T-3.3AR-CPA-ET/RC NOZZLE
N.P.R. = 3.0
T_T = 1000° F
STATIC PRESSURE RELATIVE TO ATMOSPHERIC PRESSURE-psig
1
0
-1
℄
0
1
2
3
4
5
6
RADIAL DISTANCE FROM JET ℄-in.



37T-2.75AR-CPA-ET/RC NOZZLE



37T-2.75AR-CPA-ET/RC NOZZLE



37 TUBE - AREA RATIO 2.75 ELLIPTICAL TUBES CLOSE ARRAY

TEST CONDITIONS

NOZZLE: 37T-2.75AR-CPA-ET/RC

FACILITY: HNTF

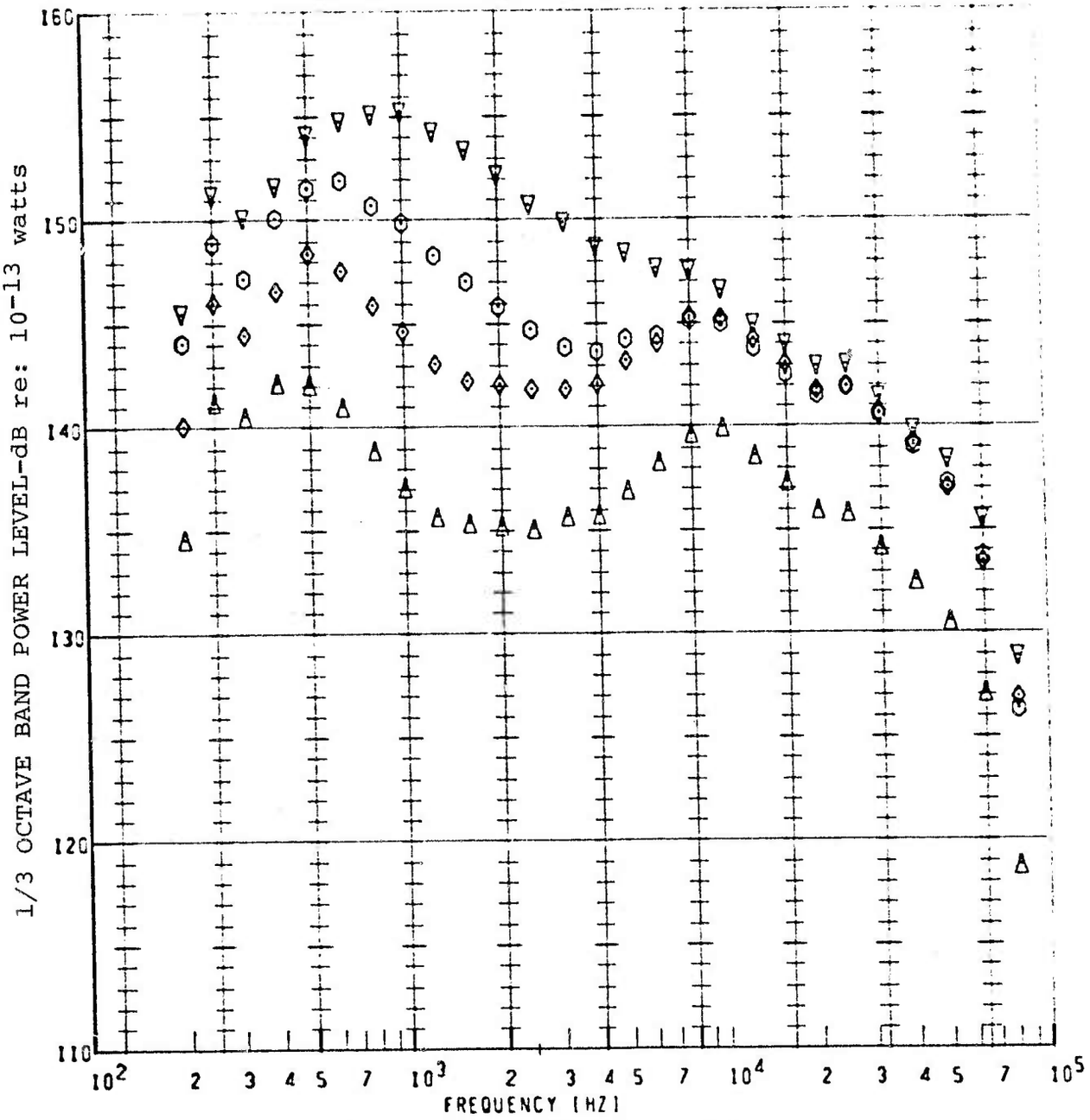
DATE: 1-10-73 T_{AMB} = 42°F **R.H.** = 72%

SCALE MODEL A_8 = 13.6 in.^{2}

RUN NO.	NPR	T_T	V_J (IDEAL)	REMARKS	REF
181	2.0	1150°F	1875 fps	3" tube lengths	
"	2.5	"	2126		
"	3.0	"	2303		
"	4.0	"	2544		

MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH CONCRETE GROUND SURFACE. MEASURED ACOUSTIC DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.

FREE FIELD VALUES

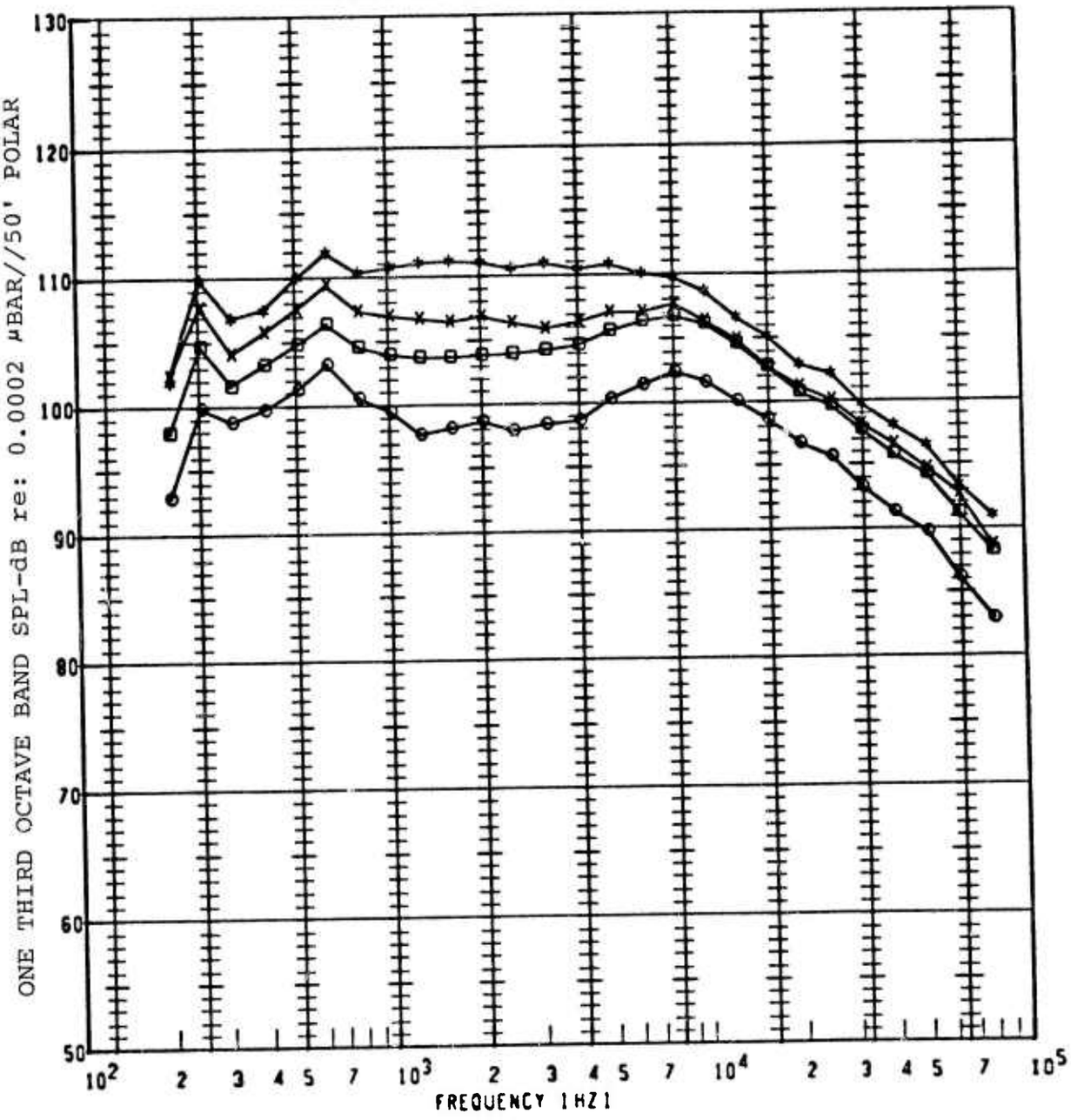


PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	181	2.00	1150 °F
◇	181	2.50	1150
○	181	3.00	1150
▽	181	4.00	1150

NOZZLE: 37T-2.75AR-CPA-ET/RC

JET NOISE POWER SPECTRA

SPECTRA ARE FREE FIELD + 6dB

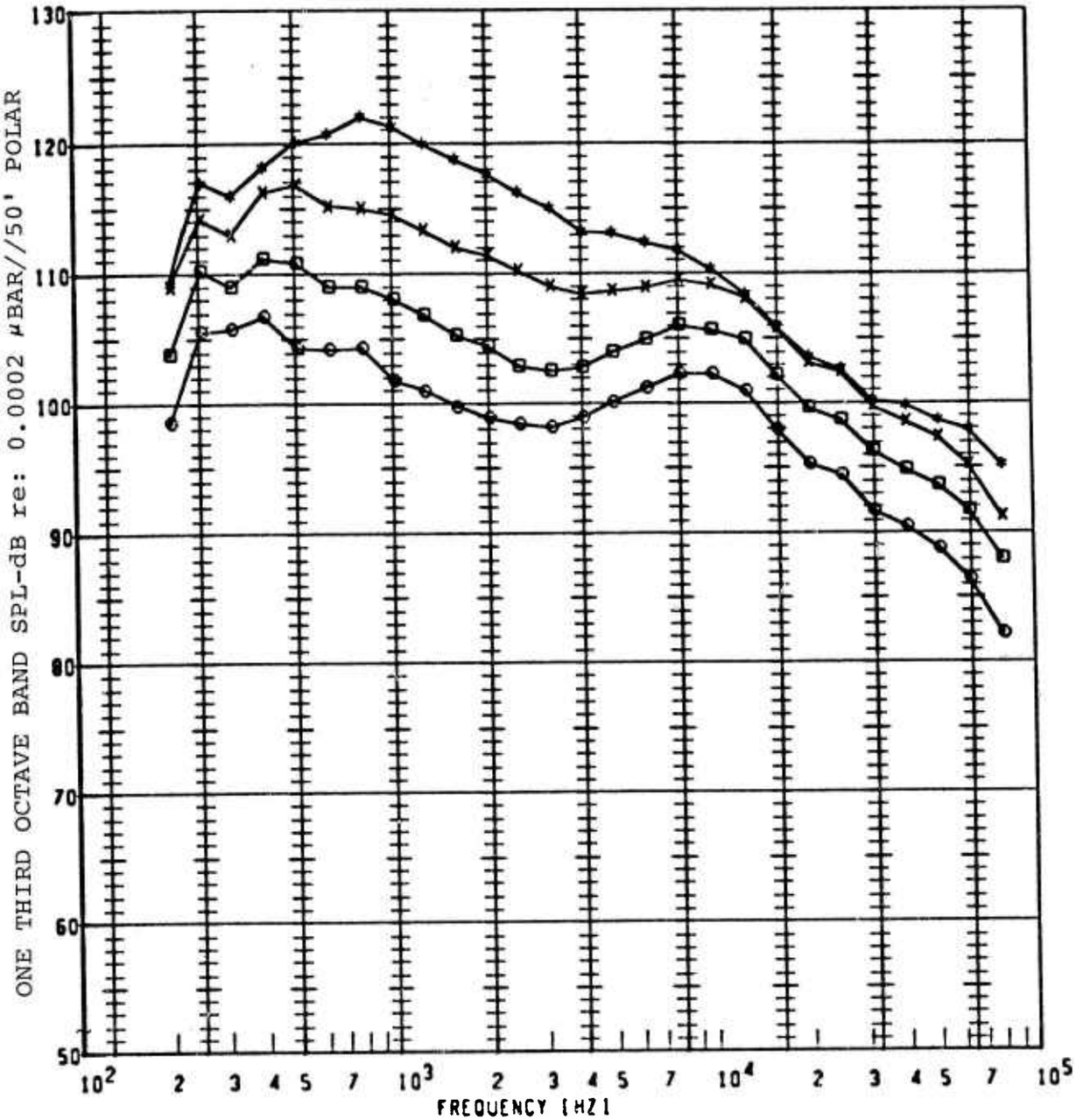


PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL (DB)
⊙	181G	1150°F	2.000	110°	50FP	113.2
⊡	181G	1150	2.500	↓	50FP	117.8
x	181G	1150	3.000	↓	50FP	119.8
*	181G	1150	4.000	↓	50FP	122.9

NOZZLE: 37T-2.75AR-CPA-ET/RC

MEASURED NOISE SPECTRA AT 110° re: NOZZLE INLET AXIS

SPECTRA ARE FREE FIELD + 6dB

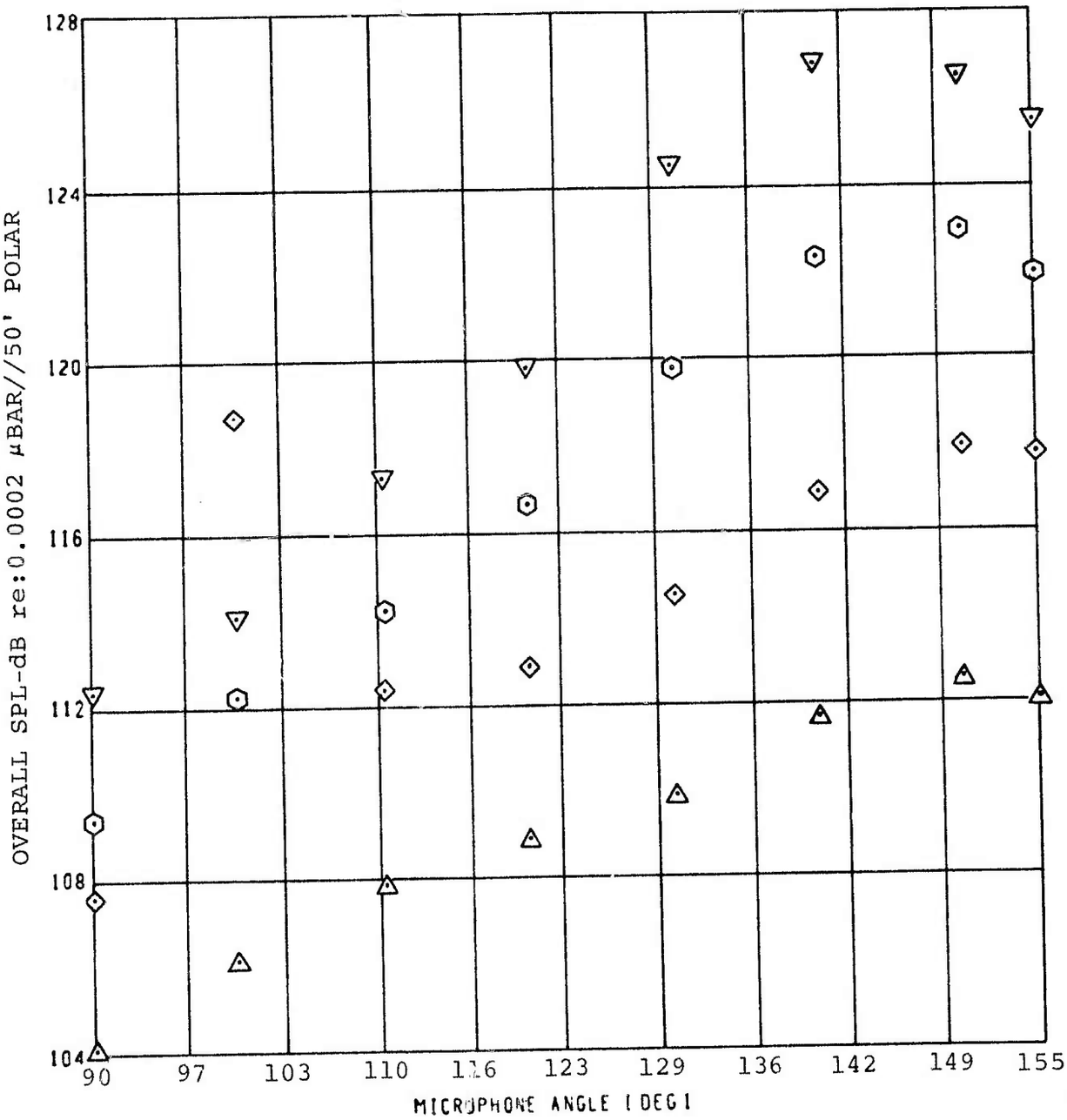


PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL (DB)
⊙	181G	1150°F	2.000	130°	SOFP	115.6
⊡	181G	1150	2.500	↓	SOFP	120.2
×	181G	1150	3.000	↓	SOFP	125.6
*	181G	1150	4.000	↓	SOFP	130.4

NOZZLE: 37T-2.75AR-CPA-ET/RC

MEASURED NOISE SPECTRA AT 130° re: NOZZLE INLET AXIS

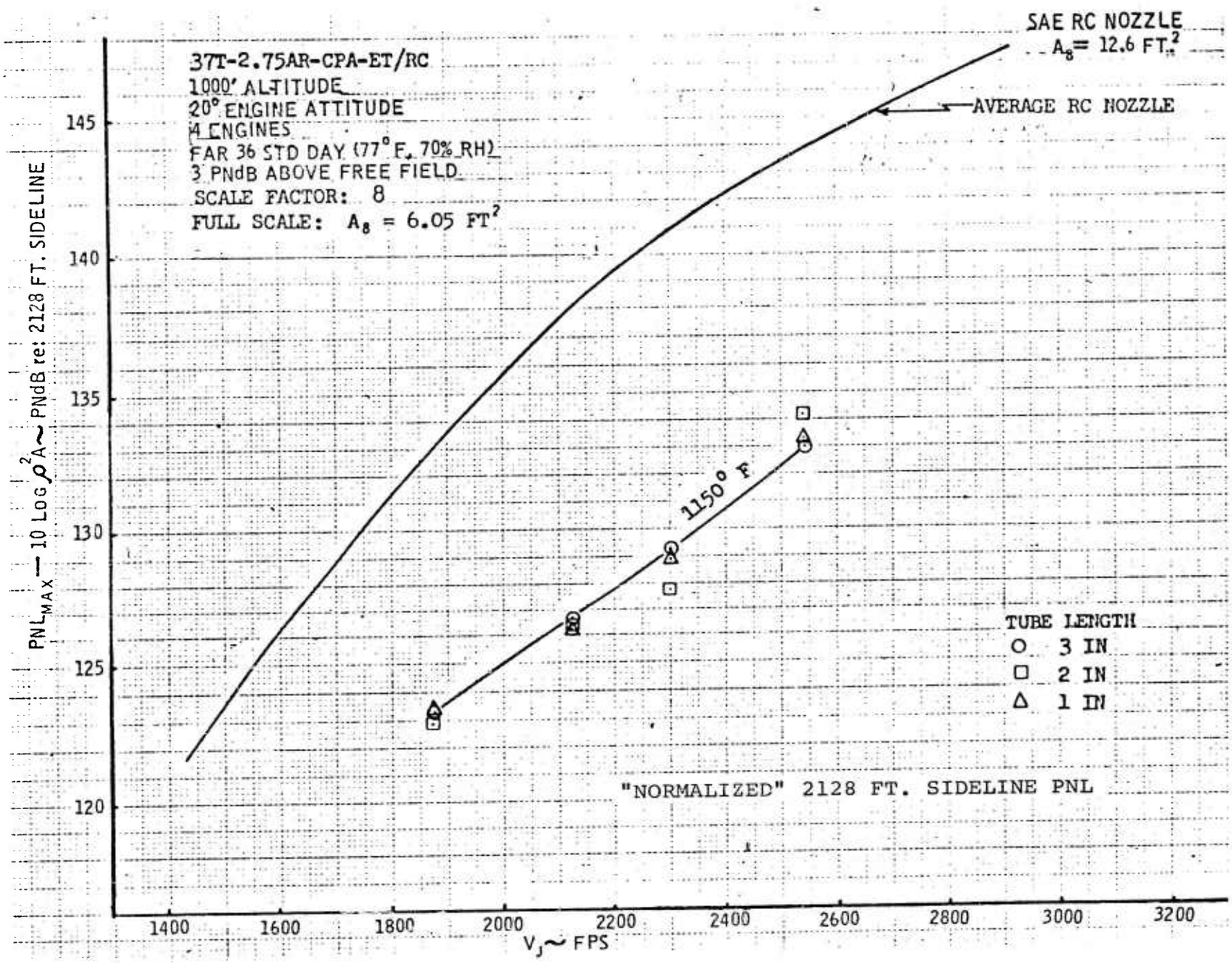
FREE FIELD VALUES

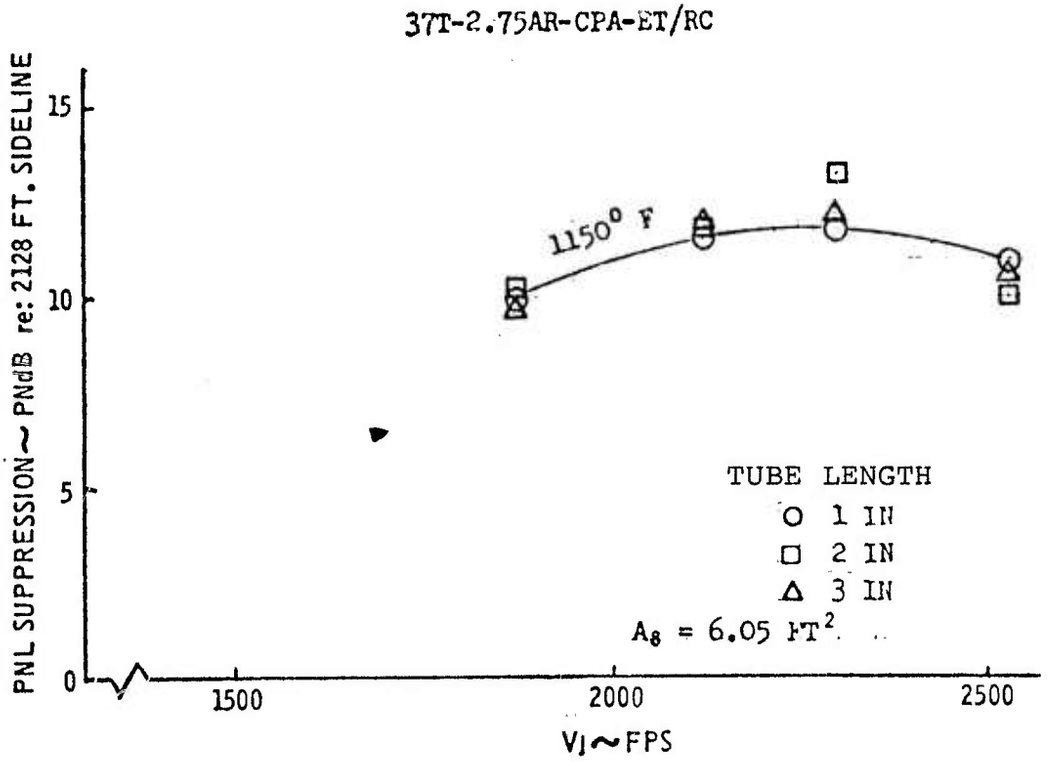


PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	181	2.00	1150°F
◇	181	2.50	1150
○	181	3.00	1150
▽	181	4.00	1150

NOZZLE: 37T-2.75AR-CPA-ET/RC

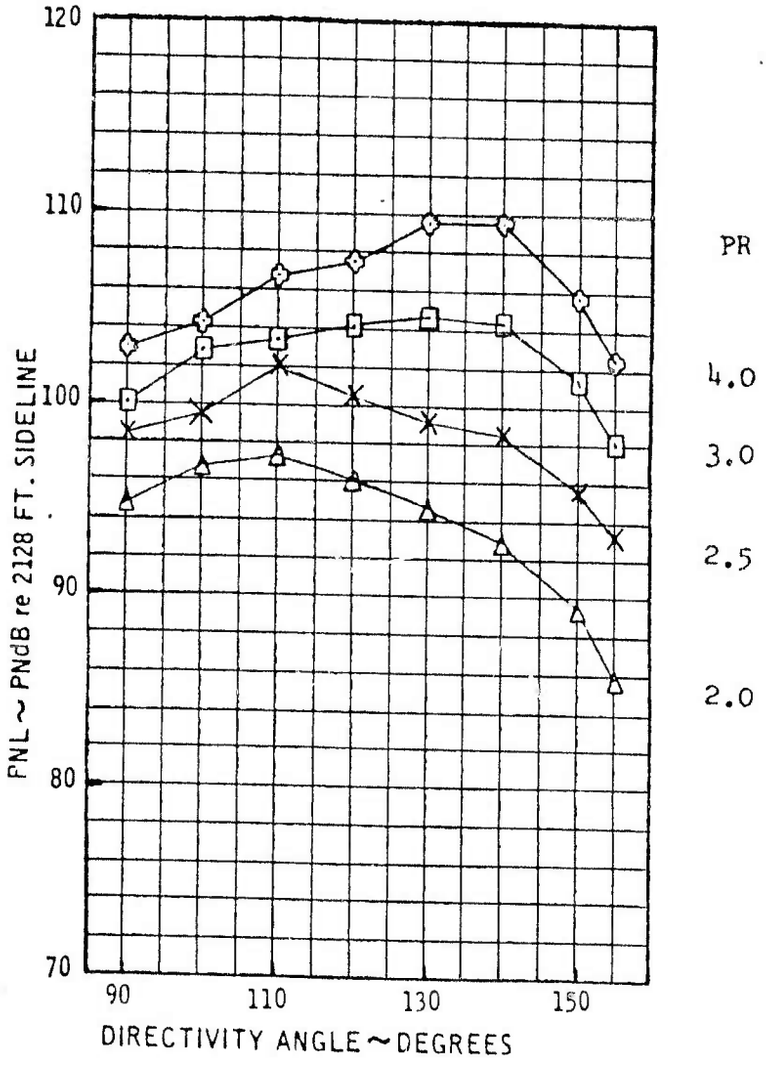
OASPL BEAM PATTERNS


37T-2.75AR-CPA-ET/RC
1000' ALTITUDE
20° ENGINE ATTITUDE
4 ENGINES
FAR 36 STD DAY (77° F, 70% RH)
3 PNdB ABOVE FREE FIELD
SCALE FACTOR: 8
FULL SCALE: A_8 = 6.05 FT²
SAE RC NOZZLE
A_8 = 12.6 FT.²
AVERAGE RC NOZZLE
1150° F
TUBE LENGTH
3 IN
2 IN
1 IN
"NORMALIZED" 2128 FT. SIDELINE PNL
PNL_{MAX} — 10 Log $\rho^2 A$ ~ PNdB re: 2128 FT. SIDELINE
V_j ~ FPS
120
125
130
135
140
145
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200



PEAK PNL SUPPRESSION VALUES

NOZZLE: 37T-2.75AR-CPA-ET/RC



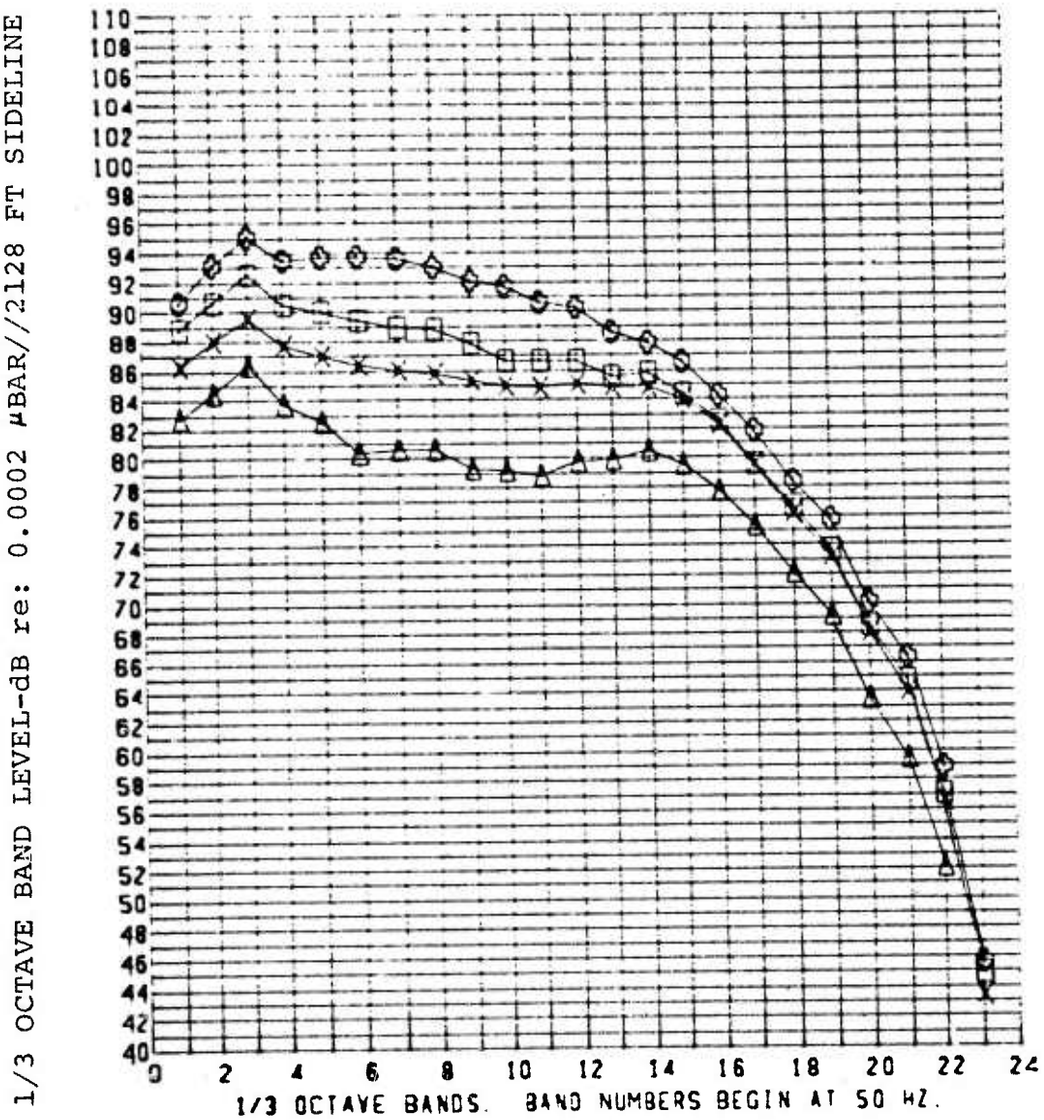
RUN 181

T_T = 1150° F A_8 = 6.05 FT^2

PNL BEAM PATTERNS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 110 DEG TEMP = 77 DEG R.H. = 70 PER CENT



T_T = 1150°F A_8 = 6.05 FT^2 RUN: 181

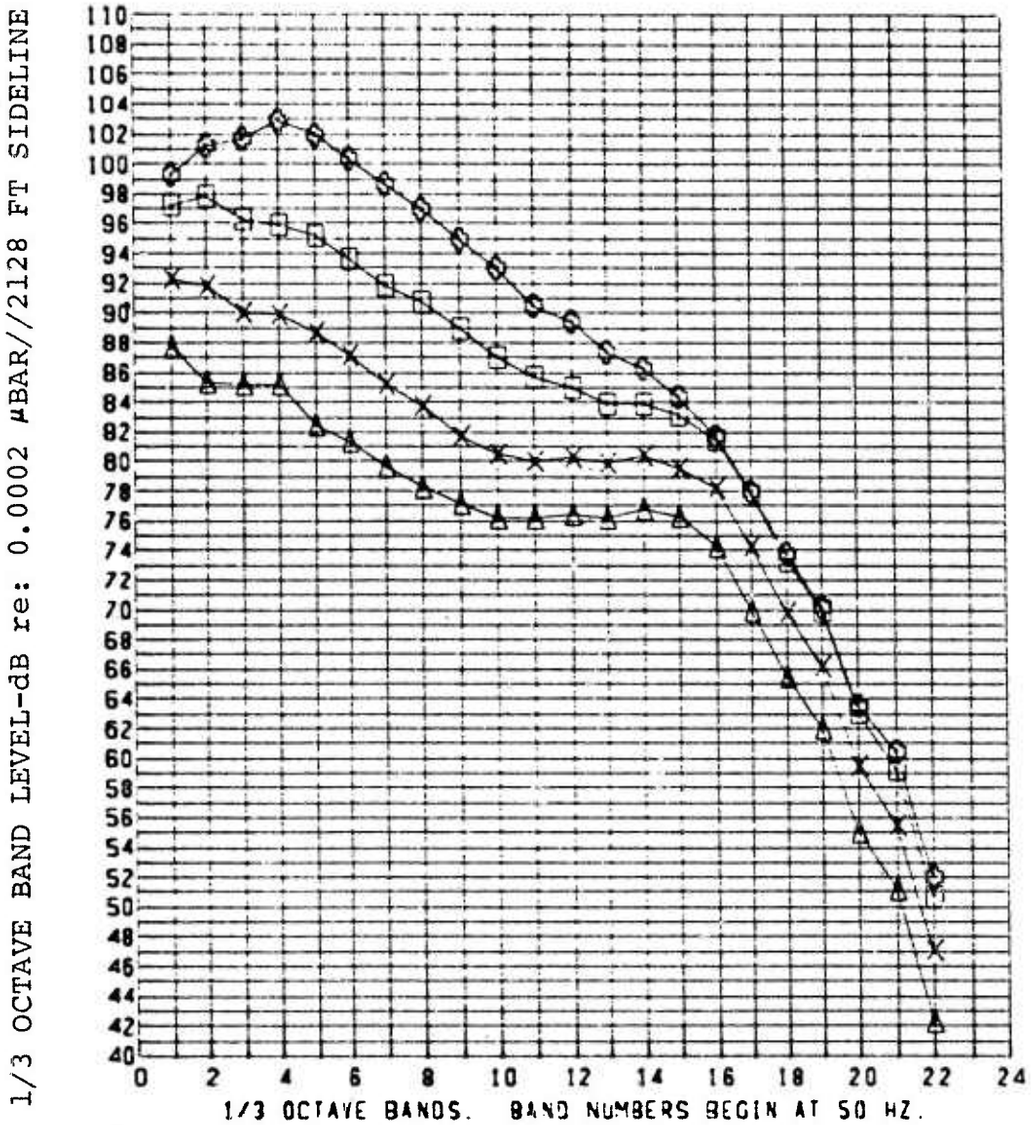
PR = △ 2.0, X 2.5, □ 3.0, ✣ 4.0

NOZZLE: 37T-2.75AR-CPA-ET/RC

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 110°
re: NOZZLE INLET AXIS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 130 DEG TEMP = 77 DEG R.H. = 70 PER CENT



T_T = 1150°F A_8 = 6.05 FT^2 RUN: 181

PR = △ 2.0, X 2.5, □ 3.0, ✣ 4.0

NOZZLE: 37T-2.75AR-CPA-ET/RC

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 130°

re: NOZZLE INLET AXIS

TEST CONDITIONS

NOZZLE: 37T-2.75AR-CPA-ET/RC

FACILITY: WALL ISOLATION FACILITY

DATE: January 17, 1973

P_{AMB} = 29.73 in Hg T_{AMB} = 44°F R.H. = 88%

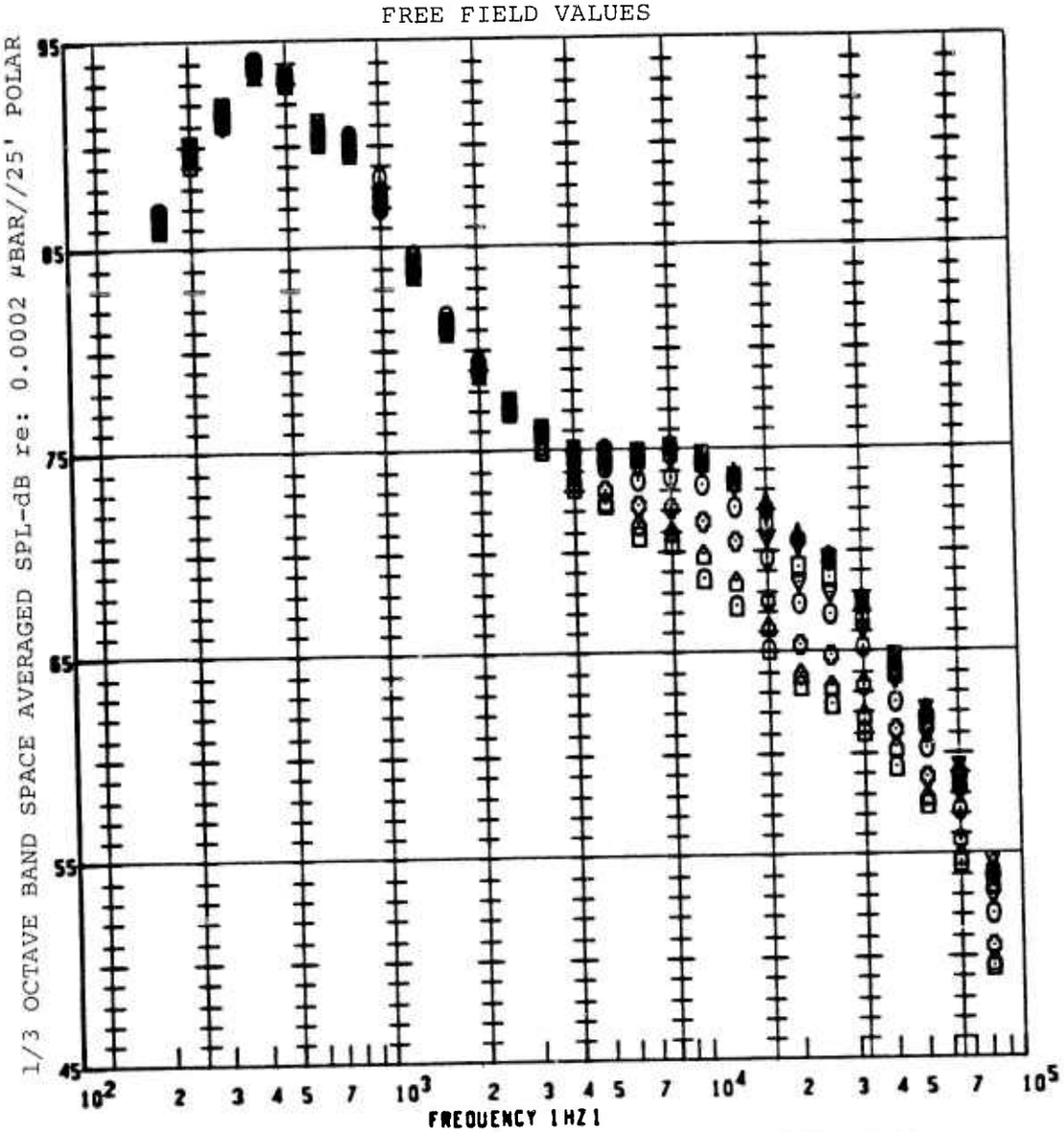
NPR = 3.0 T_T = 1150°F V_J (IDEAL) = 2300 FPS

SCALE MODEL A_8 = 13.6 in.^{2}

RUN NO.	AXIAL LOCATION	IRIS DIA.	REMARKS	REF.
50	0.0 x/D	9.0 in.		
51	0.25	9.0		
52	0.50	10.0		
53	0.75	9.5		
54	1.00	10.5		
55	1.25	9.5		
56	1.50	10.0		
57	1.75	10.0		
58	2.0	10.5		
59	2.25	10.5		
60	2.50	11.0		
61	2.50	11.0		
62	3.0	11.5		
63	3.5	12.0		
64	4.0	12.5		
65	5.0	13.0		
66	6.0	14.0		
67	8.0	16.0		
68	10.0	18.0		
69	12.0	20.0		
70	14.0	21.5		
71	16.0	23.5		

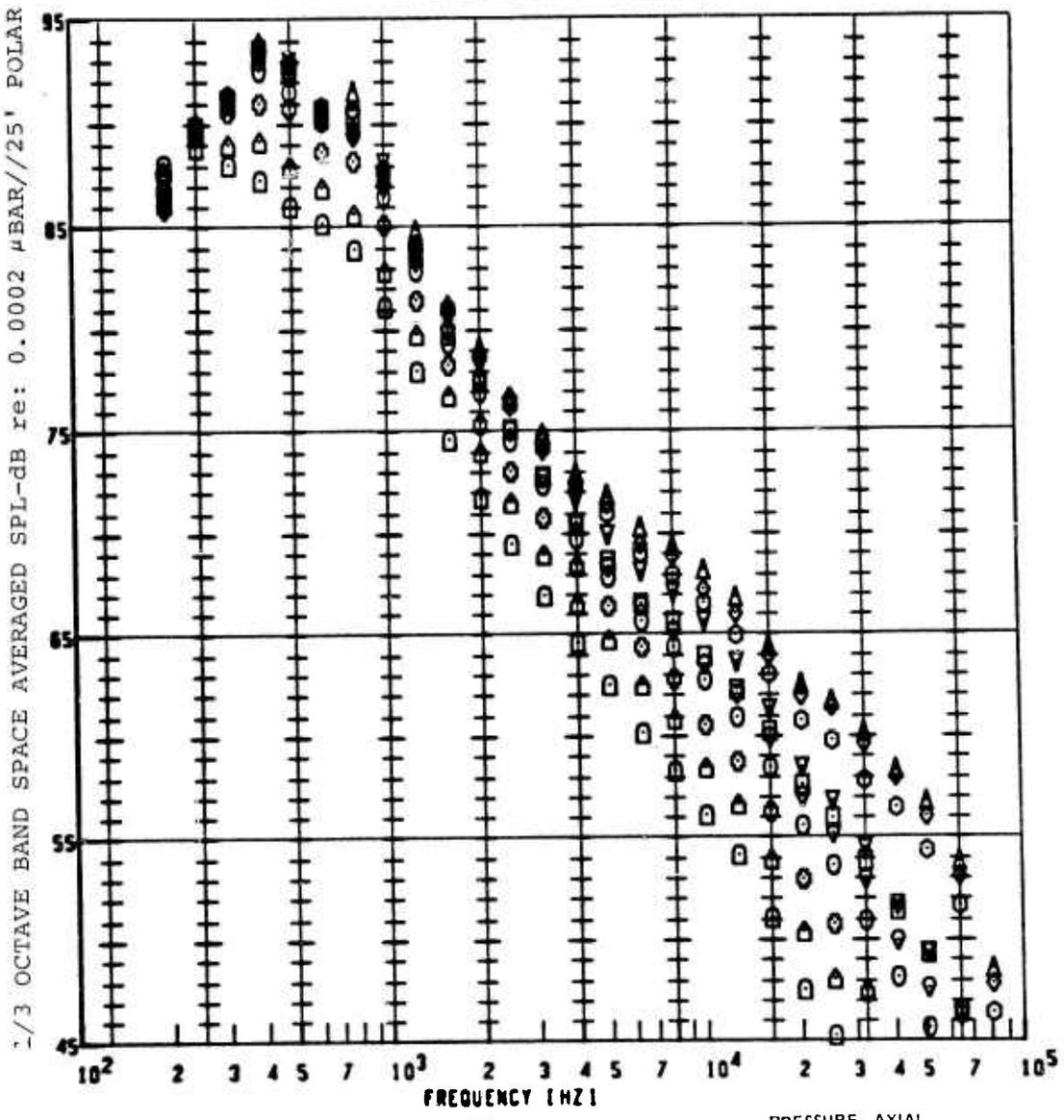
MICROPHONE LAYOUT: 25 FOOT VERTICAL POLAR ARC

FREE FIELD VALUES

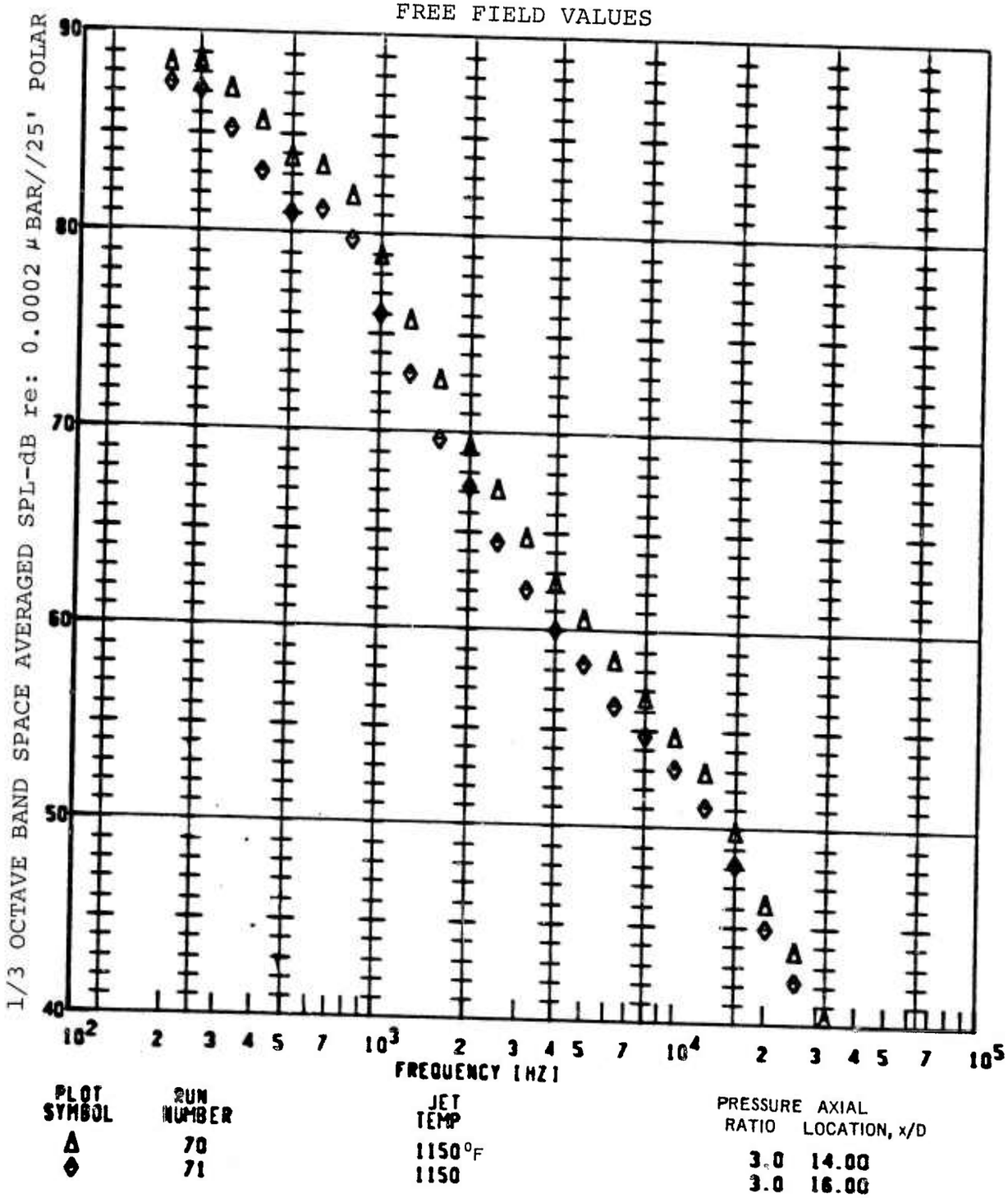


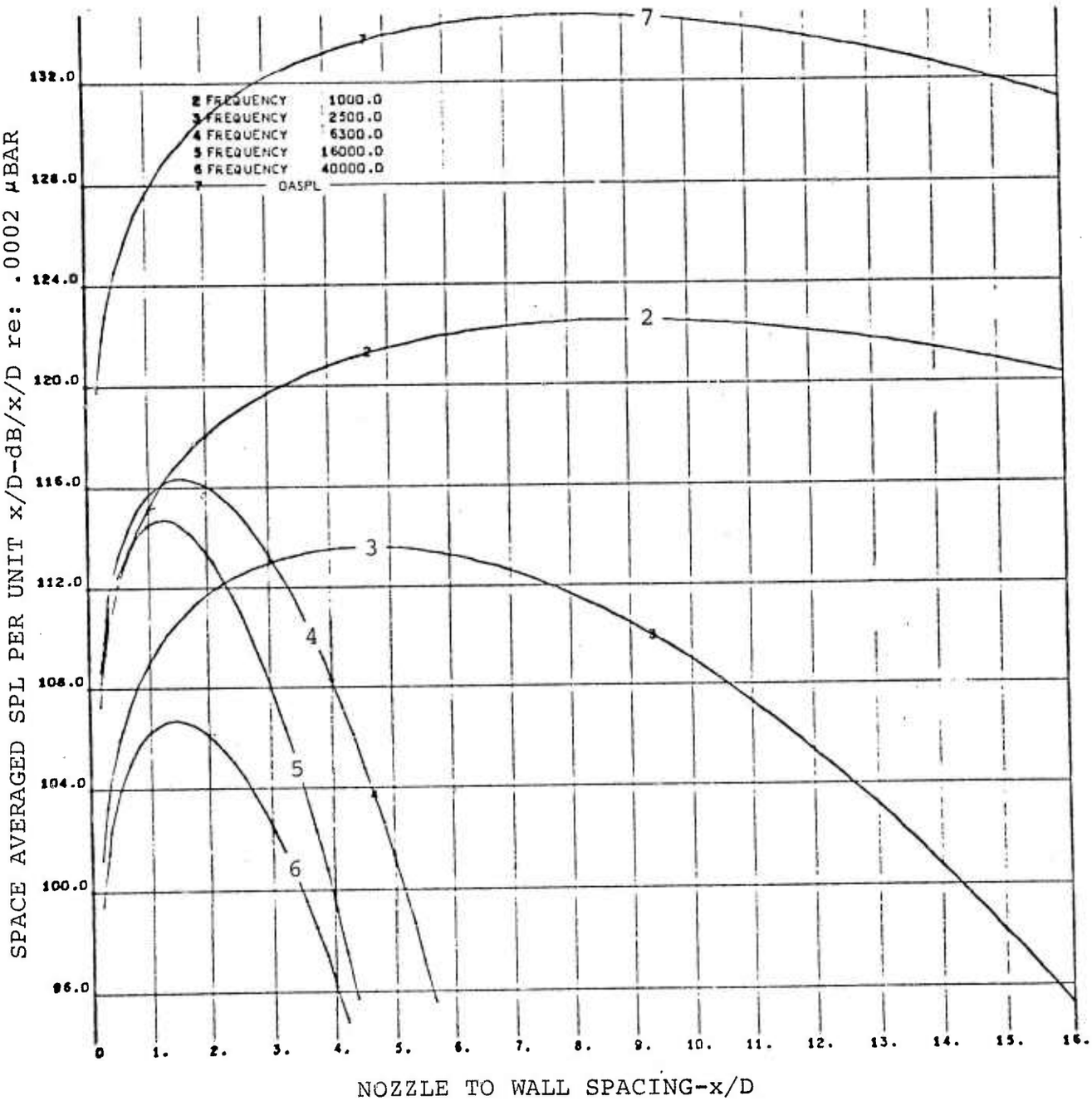
PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	AXIAL LOCATION, x/D
△	50	1150°F	3.000	0.00
◇	51	1150	3.000	0.25
○	52	1150	3.000	0.50
▽	53	1150	3.000	0.75
□	54	1150	3.000	1.00
◇	55	1150	3.000	1.25
○	56	1150	3.000	1.50
⊗	57	1150	3.000	1.75
△	58	1150	3.000	2.00
□	59	1150	3.000	2.25

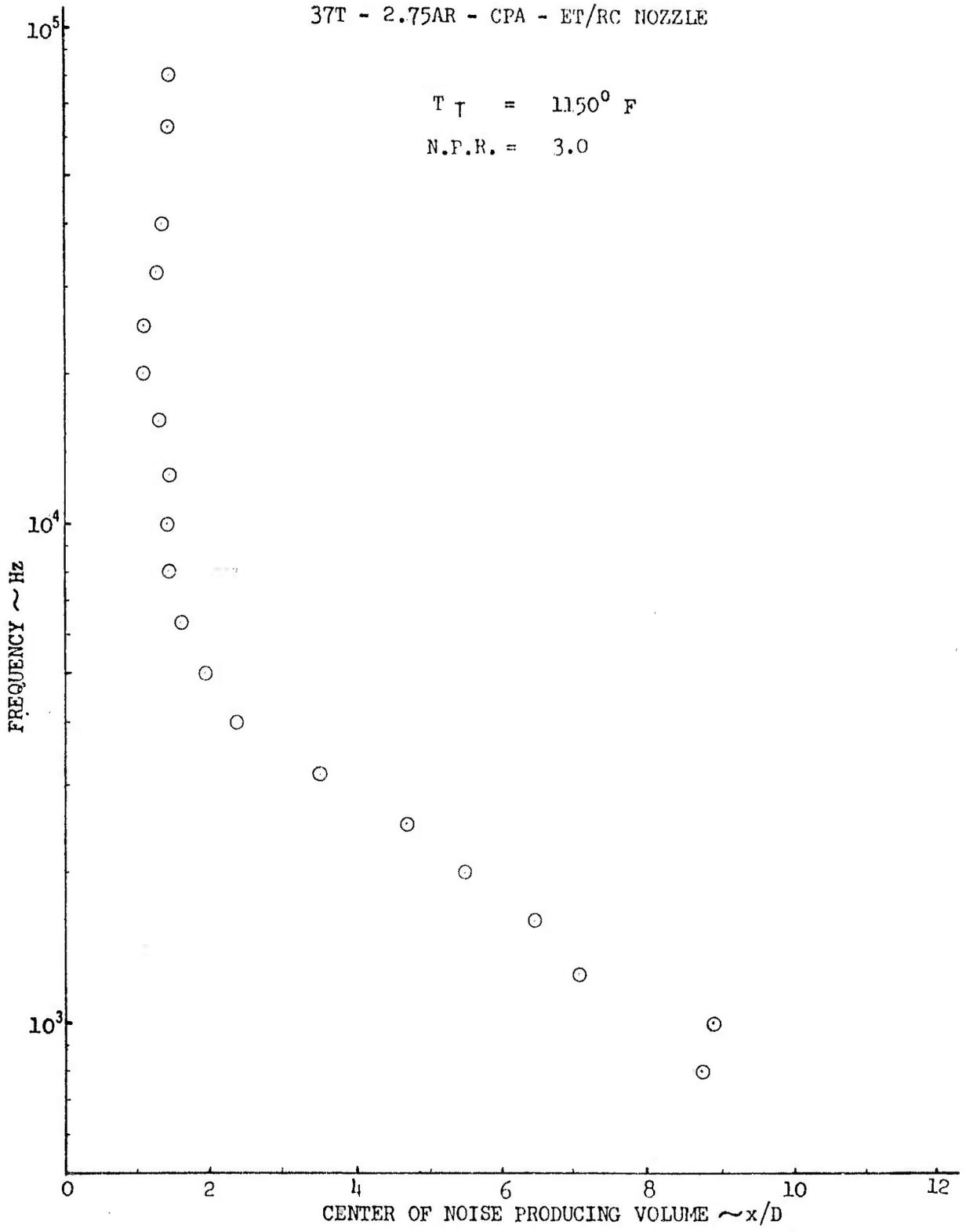
FREE FIELD VALUES

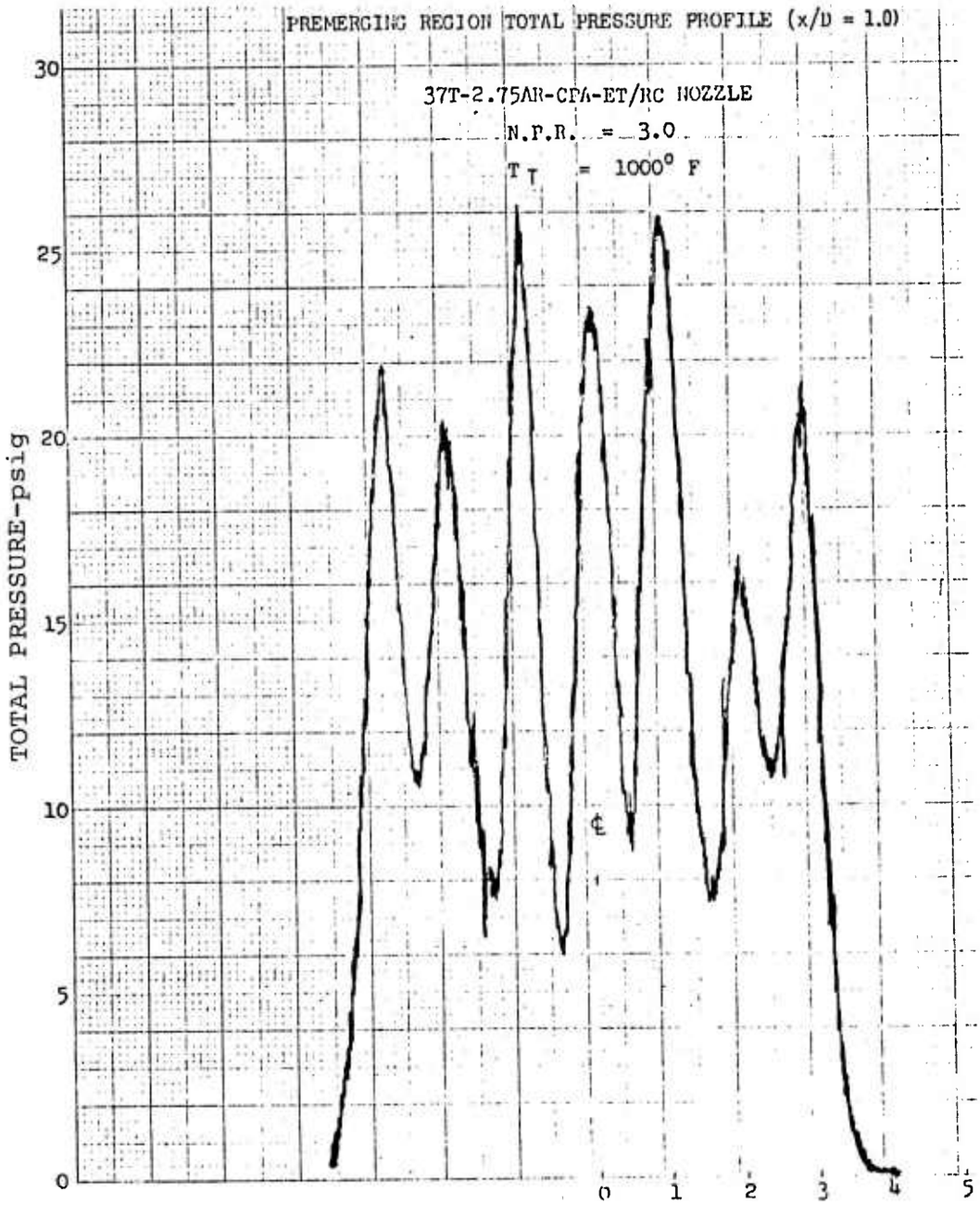


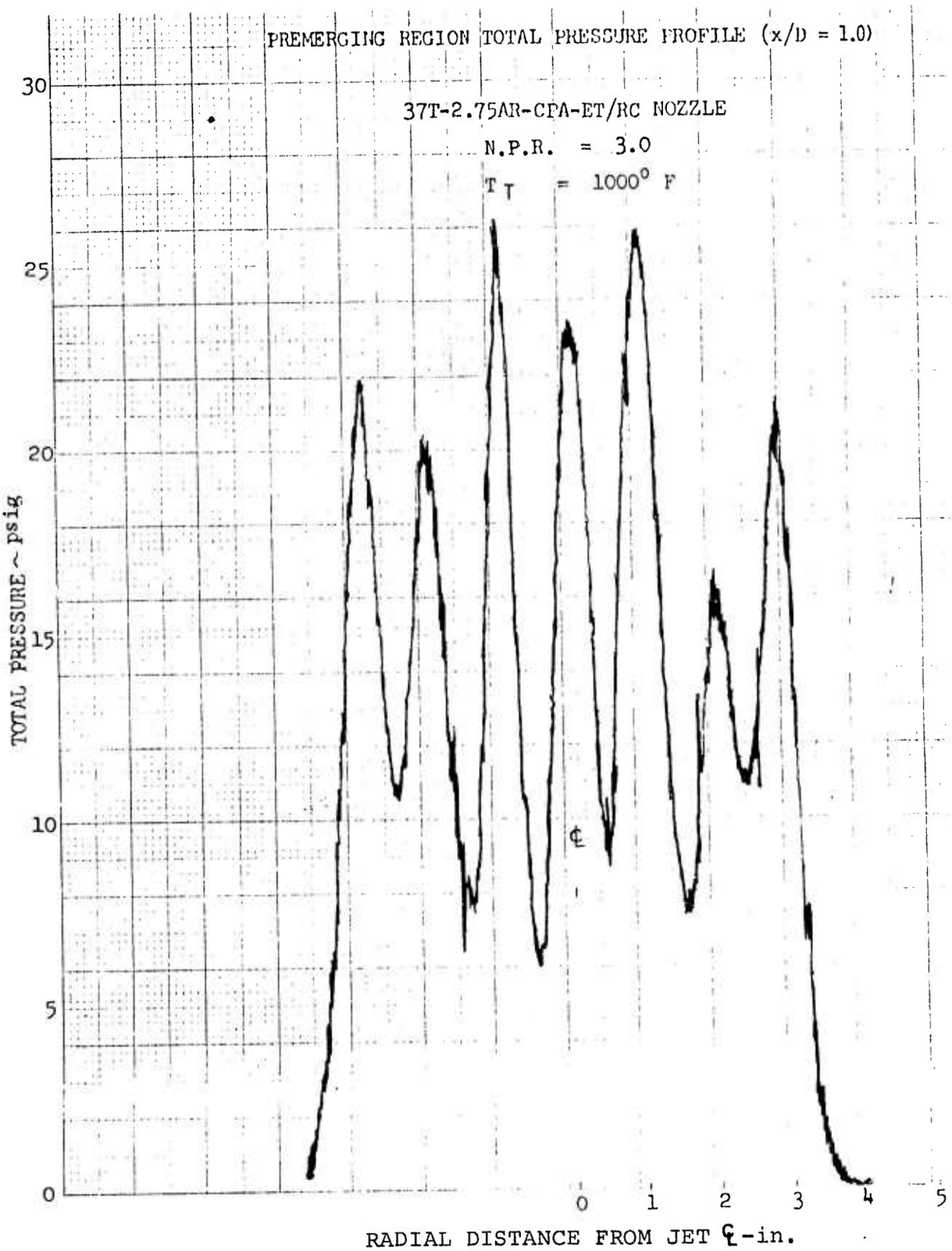
PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	AXIAL LOCATION, x/D
△	60	1150°F	3.000	2.50
◇	61	1150	3.000	2.50
○	62	1150	3.000	3.00
▽	63	1150	3.000	3.50
□	64	1150	3.000	4.00
◇	65	1150	3.000	5.00
○	66	1150	3.000	6.00
◇	67	1150	3.000	8.00
△	68	1150	3.000	10.00
□	69	1150	3.000	12.00

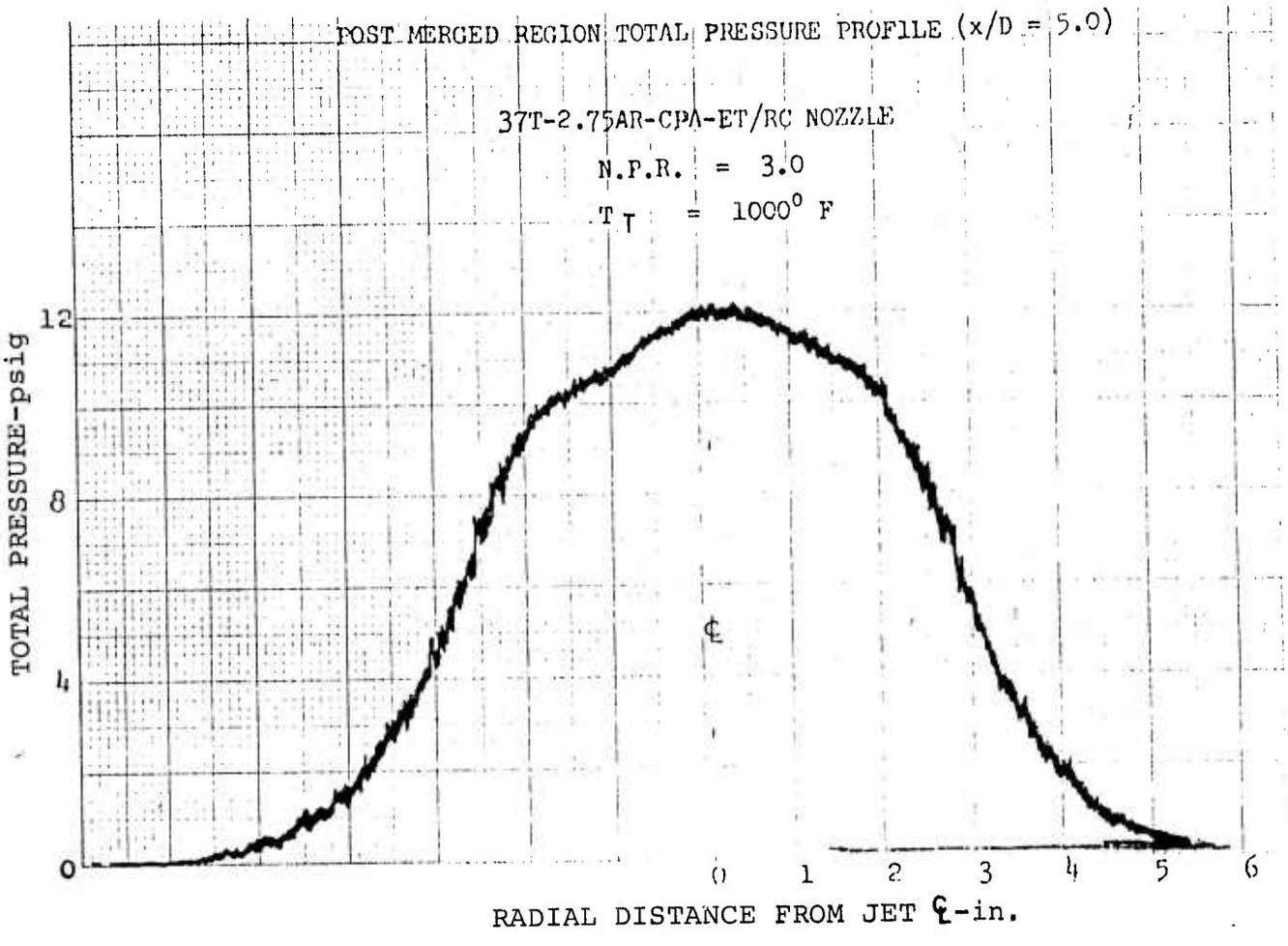

FREE FIELD VALUES
1/3 OCTAVE BAND SPACE AVERAGED SPL-dB re: 0.0002 μBAR//25' POLAR
90
80
70
60
50
40
10²
2
3
4
5
7
10³
2
3
4
5
7
10⁴
2
3
4
5
7
10⁵
FREQUENCY [HZ]
PLOT SYMBOL
RUN NUMBER
JET TEMP
PRESSURE RATIO
AXIAL LOCATION, x/D
Δ
70
1150°F
3.0
14.00
◇
71
1150
3.0
16.00

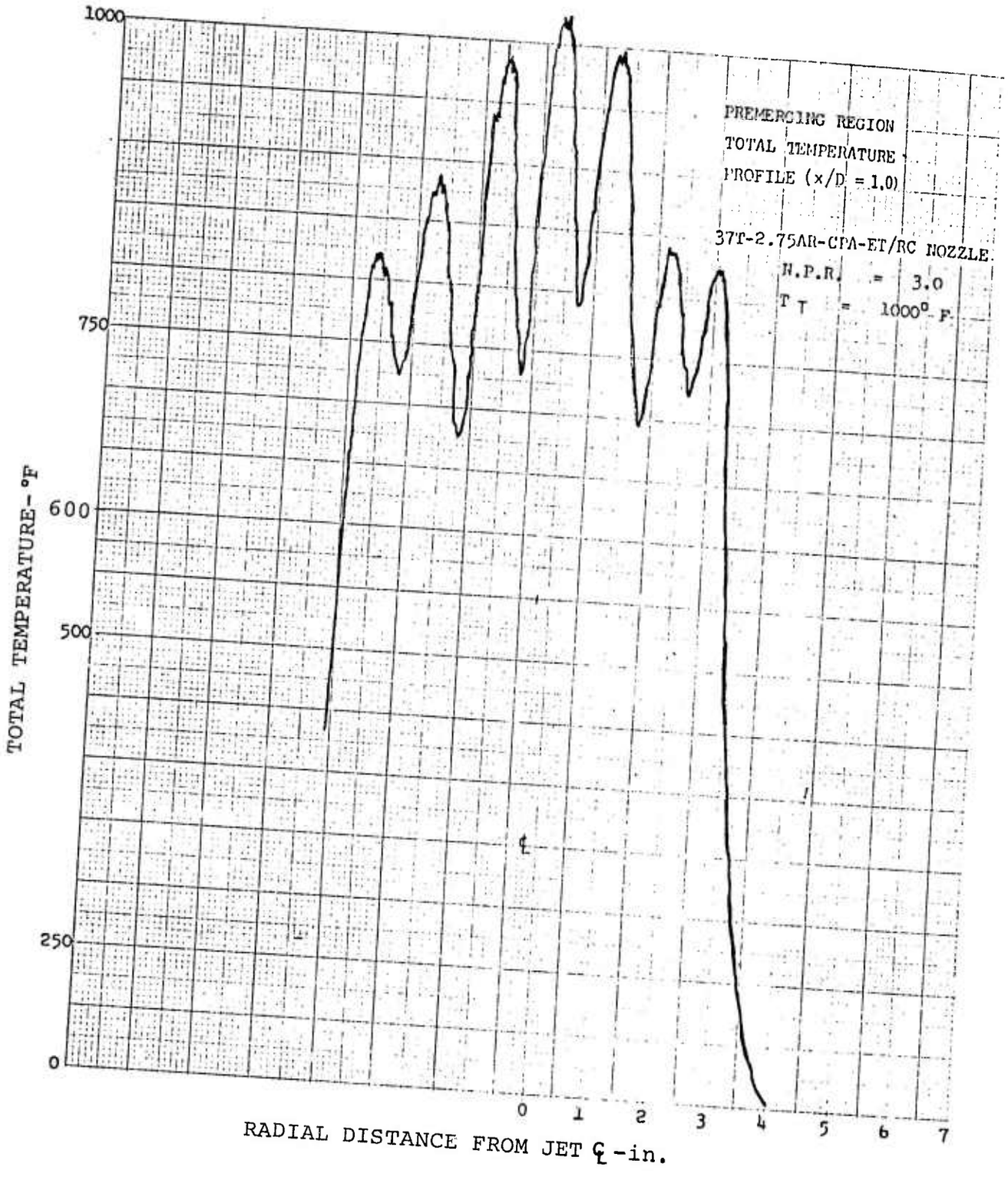

2 FREQUENCY 1000.0
3 FREQUENCY 2500.0
4 FREQUENCY 6300.0
5 FREQUENCY 16000.0
6 FREQUENCY 40000.0
7 OASPL
SPACE AVERAGED SPL PER UNIT x/D-dB/x/D re: .0002 μBAR
132.0
128.0
124.0
120.0
116.0
112.0
108.0
104.0
100.0
96.0
0
1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.
13.
14.
15.
16.
NOZZLE TO WALL SPACING-x/D

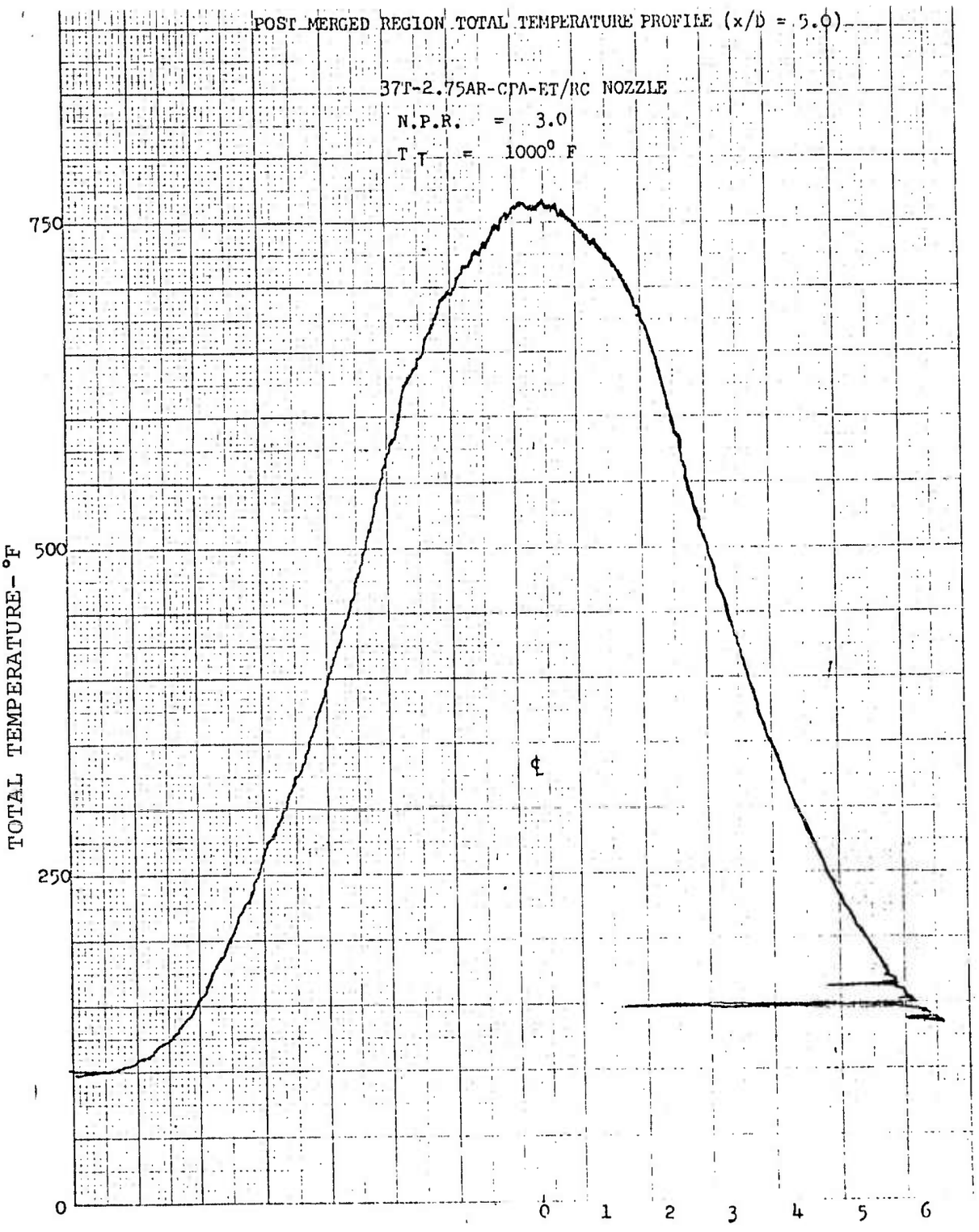

37T - 2.75AR - CPA - ET/RC NOZZLE
T_T = 1150° F
N.P.R. = 3.0
10^5
10^4
10^3
FREQUENCY ~ Hz
0
2
4
6
8
10
12
CENTER OF NOISE PRODUCING VOLUME ~x/D

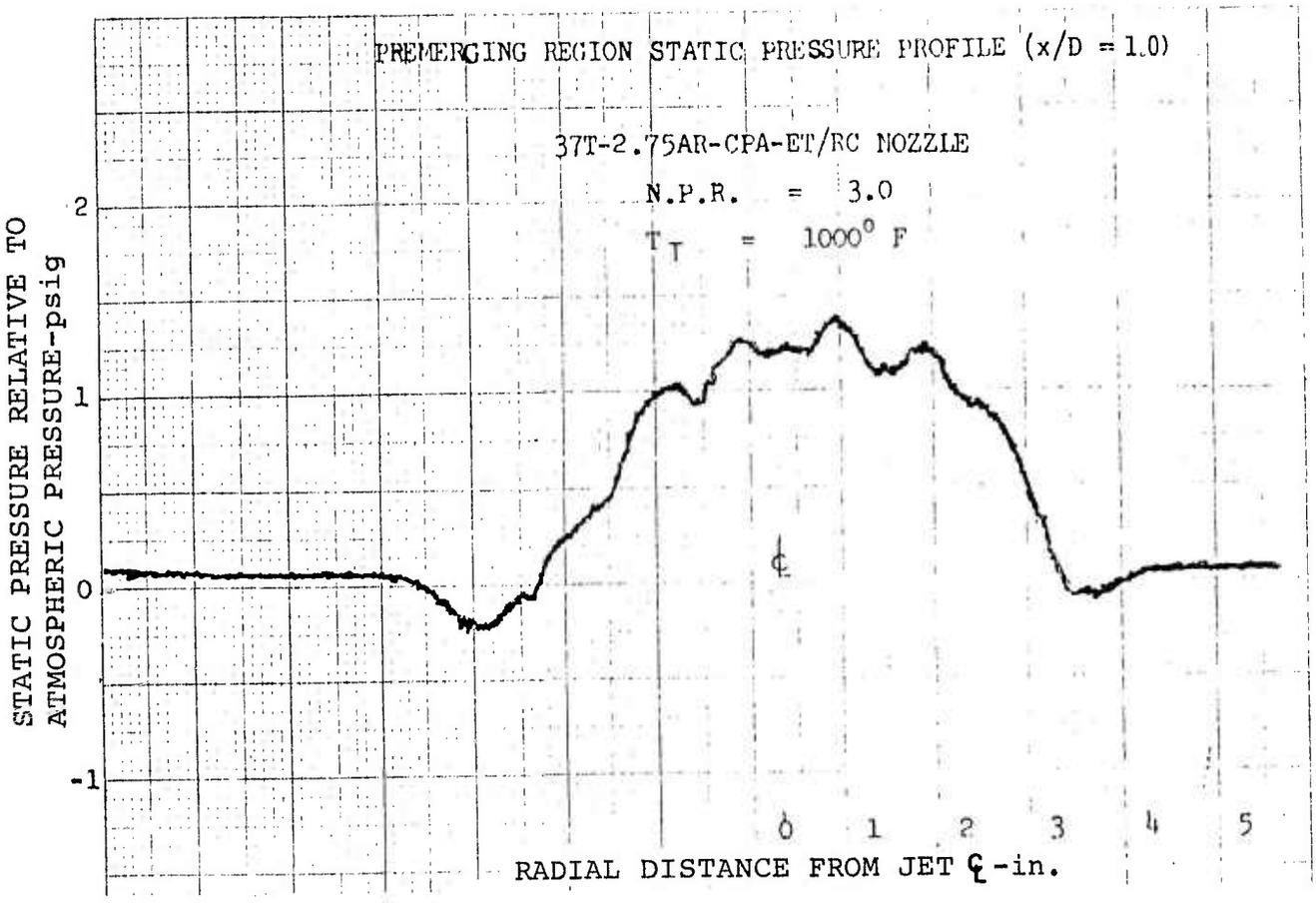

PREMERGING REGION TOTAL PRESSURE PROFILE (x/D = 1.0)
37T-2.75AR-CFA-ET/RC NOZZLE
N.P.R. = 3.0
T_T = 1000° F
TOTAL PRESSURE-psig
0
5
10
15
20
25
30
0
1
2
3
4
5
RADIAL DISTANCE FROM JET ℄-in.

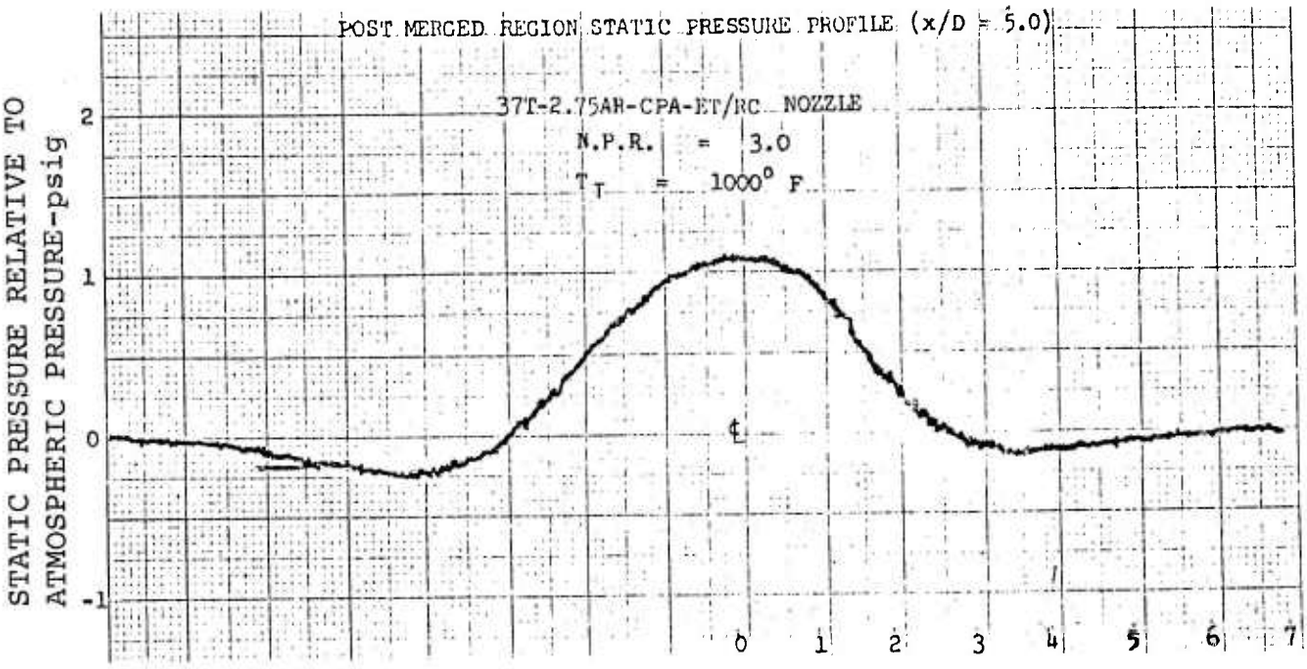

PREMERGING REGION TOTAL PRESSURE PROFILE (x/D = 1.0)
37T-2.75AR-CPA-ET/RC NOZZLE
N.P.R. = 3.0
T_T = 1000° F
TOTAL PRESSURE ~ psig
0
5
10
15
20
25
30
0
1
2
3
4
5
RADIAL DISTANCE FROM JET ℄-in.

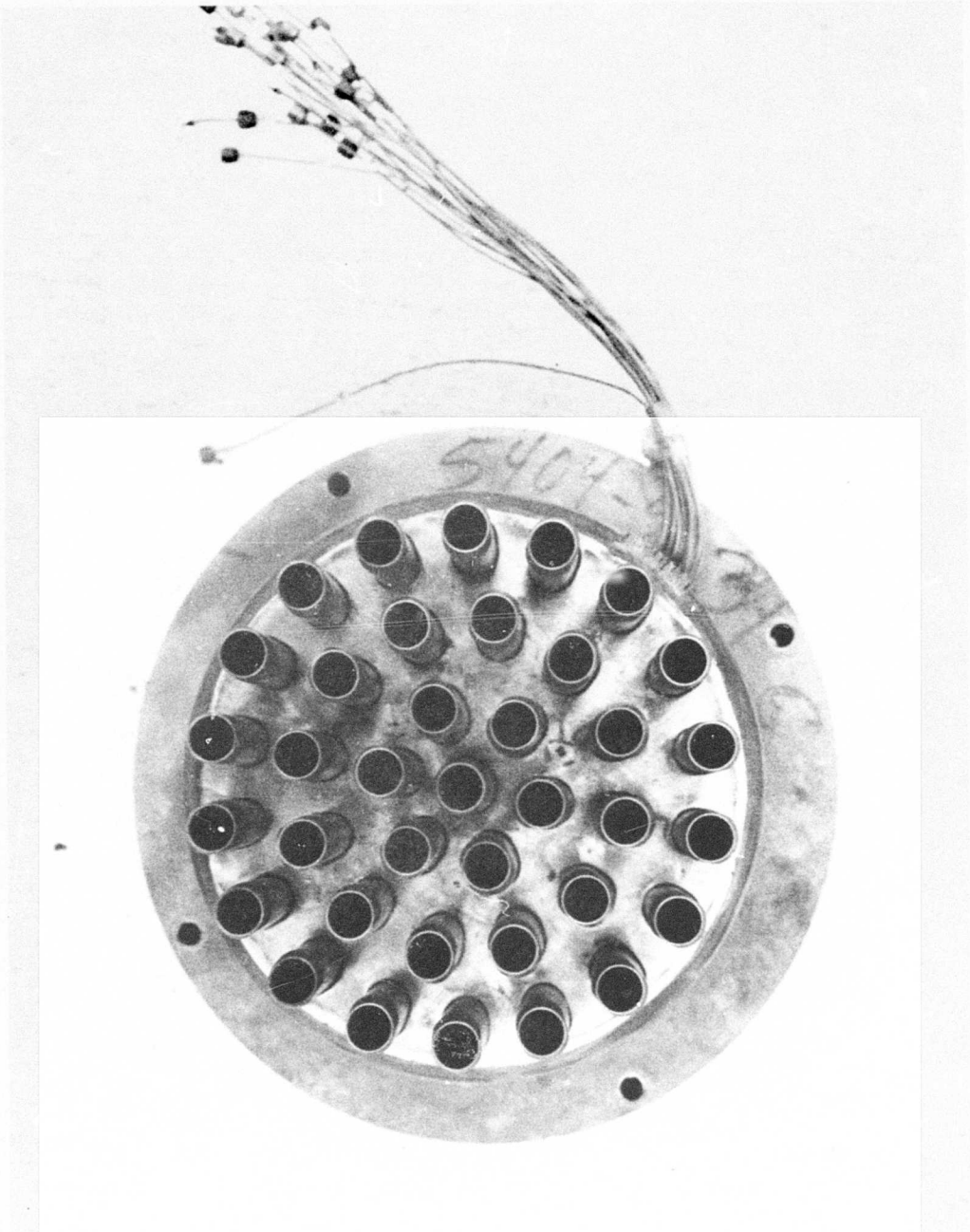

POST MERGED REGION TOTAL PRESSURE PROFILE (x/D = 5.0)
37T-2.75AR-CPA-ET/RC NOZZLE
N.P.R. = 3.0
T_T = 1000° F
TOTAL PRESSURE-psig
0
4
8
12
0
1
2
3
4
5
6
RADIAL DISTANCE FROM JET ℄-in.


PREMERGING REGION
TOTAL TEMPERATURE
PROFILE (x/D = 1.0)
37T-2.75AR-CPA-ET/RC NOZZLE
N.P.R. = 3.0
T T = 1000° F.
TOTAL TEMPERATURE - °F
1000
750
600
500
250
0
0
1
2
3
4
5
6
7
RADIAL DISTANCE FROM JET ℄ -in.


POST MERGED REGION TOTAL TEMPERATURE PROFILE (x/D = 5.0)
37T-2.75AR-CPA-ET/RC NOZZLE
N.P.R. = 3.0
T_T = 1000° F
750
500
250
0
TOTAL TEMPERATURE - °F
℄
0
1
2
3
4
5
6
RADIAL DISTANCE FROM JET ℄ -in.


PREMERGING REGION STATIC PRESSURE PROFILE (x/D = 1.0)
37T-2.75AR-CPA-ET/RC NOZZLE
N.P.R. = 3.0
T_T = 1000° F
STATIC PRESSURE RELATIVE TO ATMOSPHERIC PRESSURE-psig
2
1
0
-1
0
1
2
3
4
5
RADIAL DISTANCE FROM JET ℄-in.


POST MERGED REGION STATIC PRESSURE PROFILE (x/D = 5.0)
37T-2.75AH-CPA-ET/RC NOZZLE
N.P.R. = 3.0
T_T = 1000° F
STATIC PRESSURE RELATIVE TO ATMOSPHERIC PRESSURE-psig
2
1
0
-1
0
1
2
3
4
5
6
7
℄
RADIAL DISTANCE FROM JET ℄-in.



37T-4.5AR-CPA-ET/RC NOZZLE

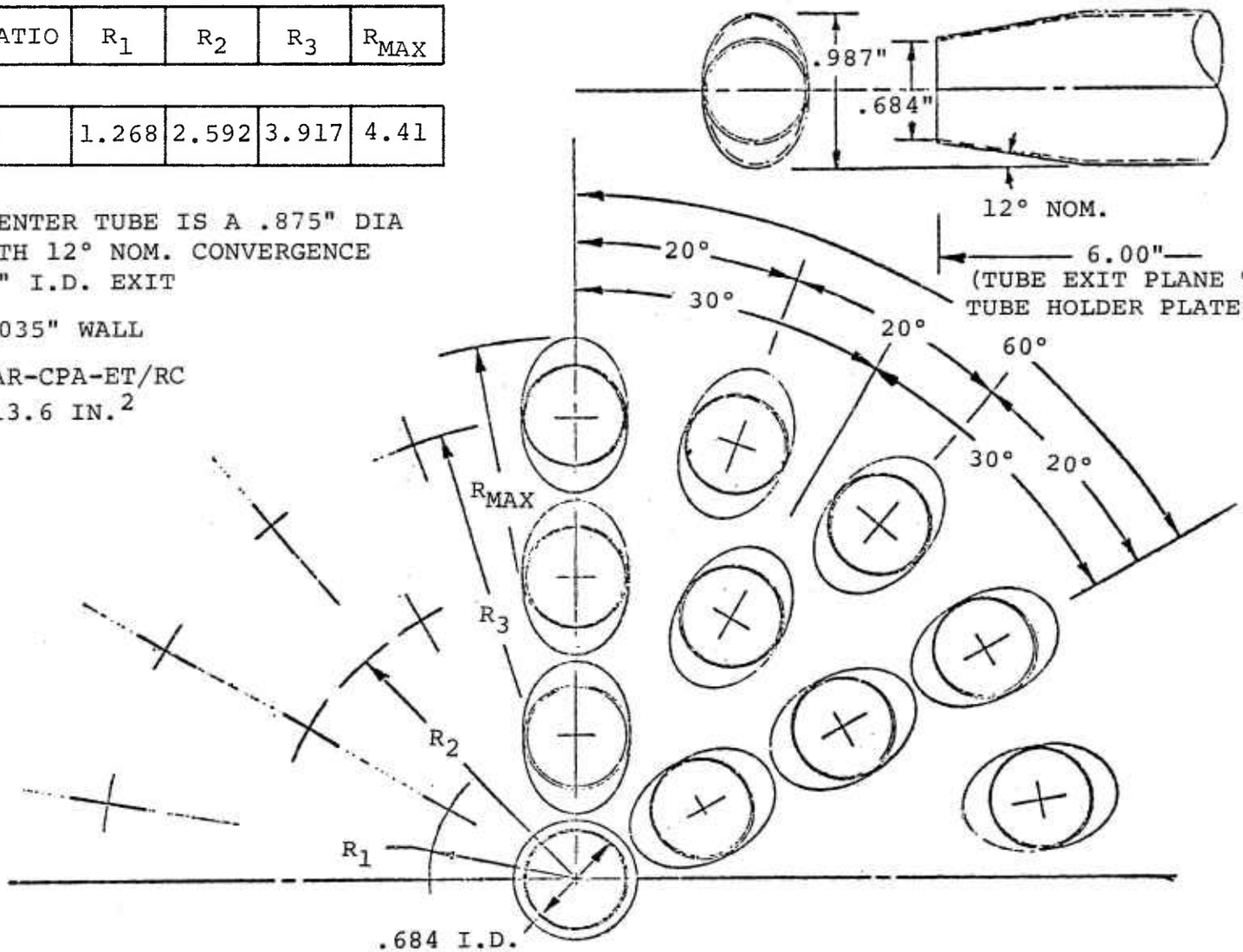
AREA RATIO	R_1	R_2	R_3	R_{MAX}
4.5	1.268	2.592	3.917	4.41

NOTE: CENTER TUBE IS A .875" DIA TUBE WITH 12° NOM. CONVERGENCE TO .684" I.D. EXIT

MAT'L-.035" WALL

37T-4.5AR-CPA-ET/RC

A_8 = 13.6 IN.^{2}



37 TUBE - AREA RATIO 4.5 ELLIPTICAL TUBES CLOSE ARRAY

TEST CONDITIONS

NOZZLE: 37T-4.5AR-CPA-ET/RC

FACILITY: HNTF

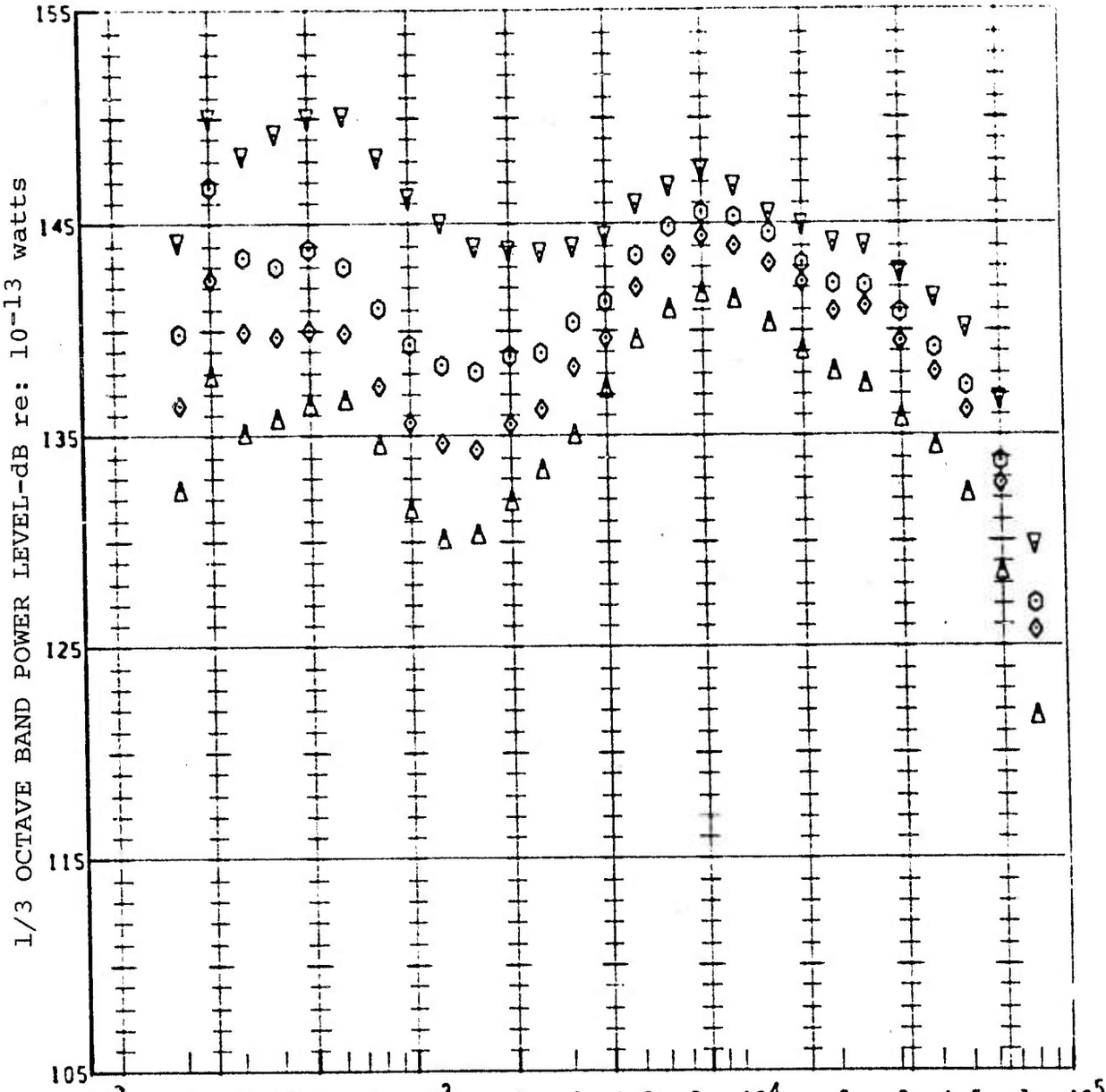
DATE: 10-19-73 T_{AMB} = 65°F **R.H.** = 62%

SCALE MODEL A_8 = 13.6 in.^{2}

RUN NO.	NPR	T_T	V_J (IDEAL)	REMARKS	REF
190	2.0	1150°F	1875 fps	3" tube lengths	
"	2.5	"	2126		
"	3.0	"	2303		
"	4.0	"	2544		

MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH CONCRETE GROUND SURFACE. MEASURED ACOUSTIC DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.

FREE FIELD VALUES

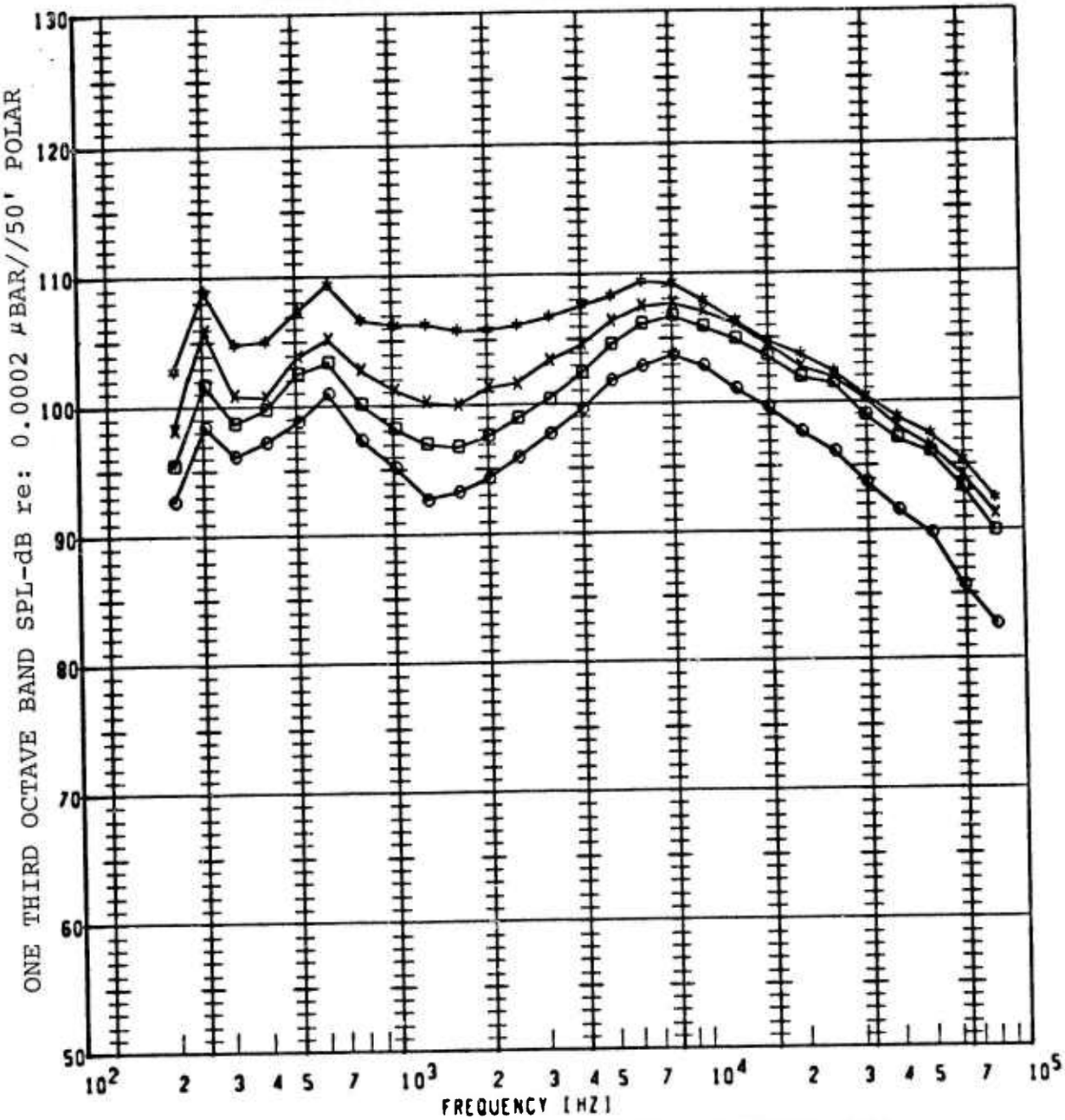


PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	190	2.00	1150°F
◇	190	2.50	1150
○	190	3.00	1150
▽	190	4.00	1150

NOZZLE: 37T-4.5AR-CPA-ET/RC

JET NOISE POWER SPECTRA

SPECTRA ARE FREE FIELD + 6dB

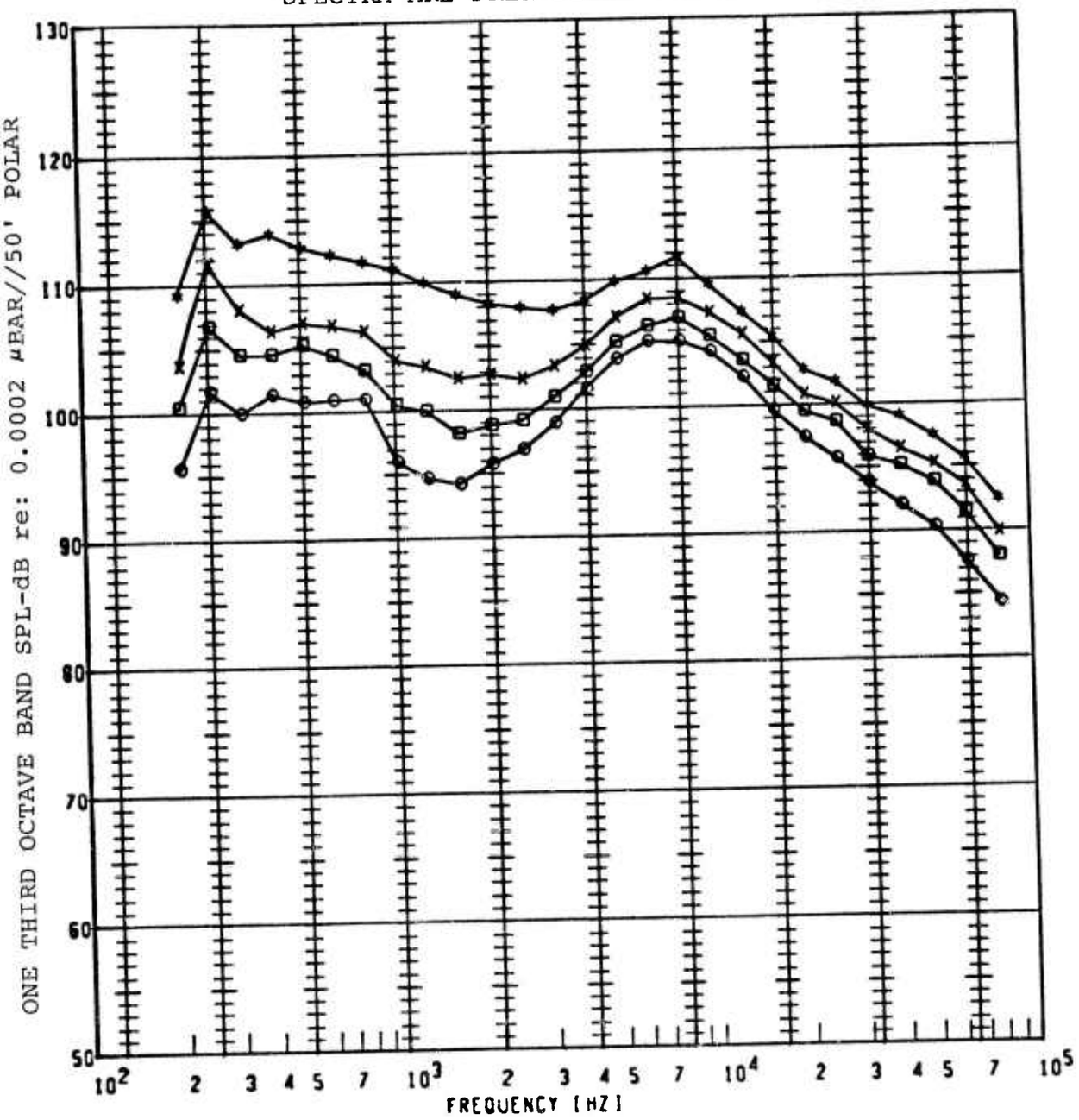


PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL [DB]
⊙	190G	1150°F	2.000	110°	50FP	112.7
⊡	190G	1150	2.500		50FP	116.0
x	190G	1150	3.000		50FP	117.7
*	190G	1150	4.000		50FP	120.4

NOZZLE: 37T-4.5AR-CPA-ET/RC

MEASURED NOISE SPECTRA AT 110° re: NOZZLE INLET AXIS

SPECTRA ARE FREE FIELD + 6dB

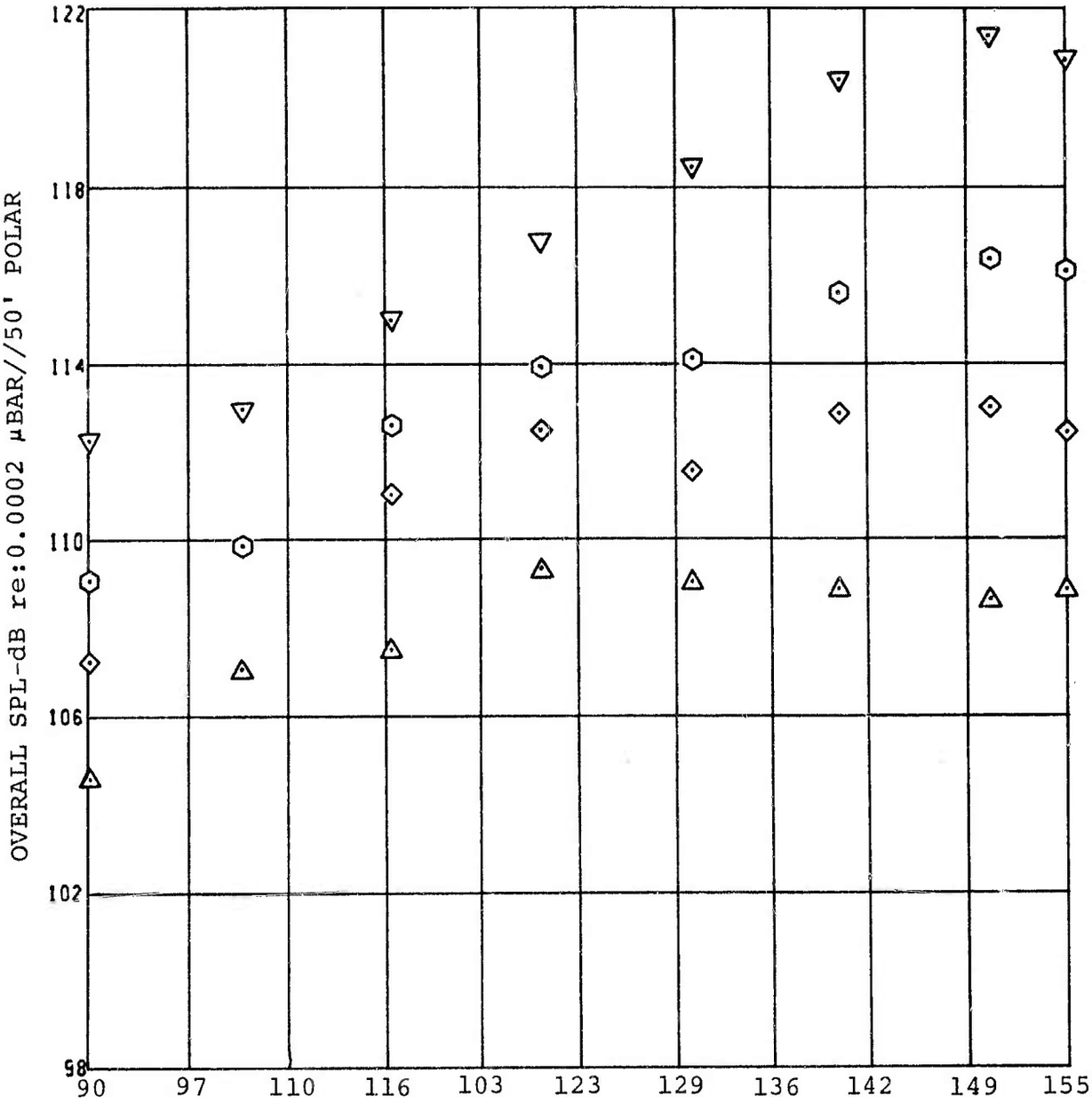


PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL [DB]
⊙	190G	1150°F	2.000	130°	SOFP	114.4
⊡	190G	1150	2.500	↓	SOFP	117.0
x	190G	1150	3.000		SOFP	119.6
*	190G	1150	4.000		SOFP	124.1

NOZZLE: 37T-4.5AR-CPA-ET/RC

MEASURED NOISE SPECTRA AT 130° re: NOZZLE INLET AXIS

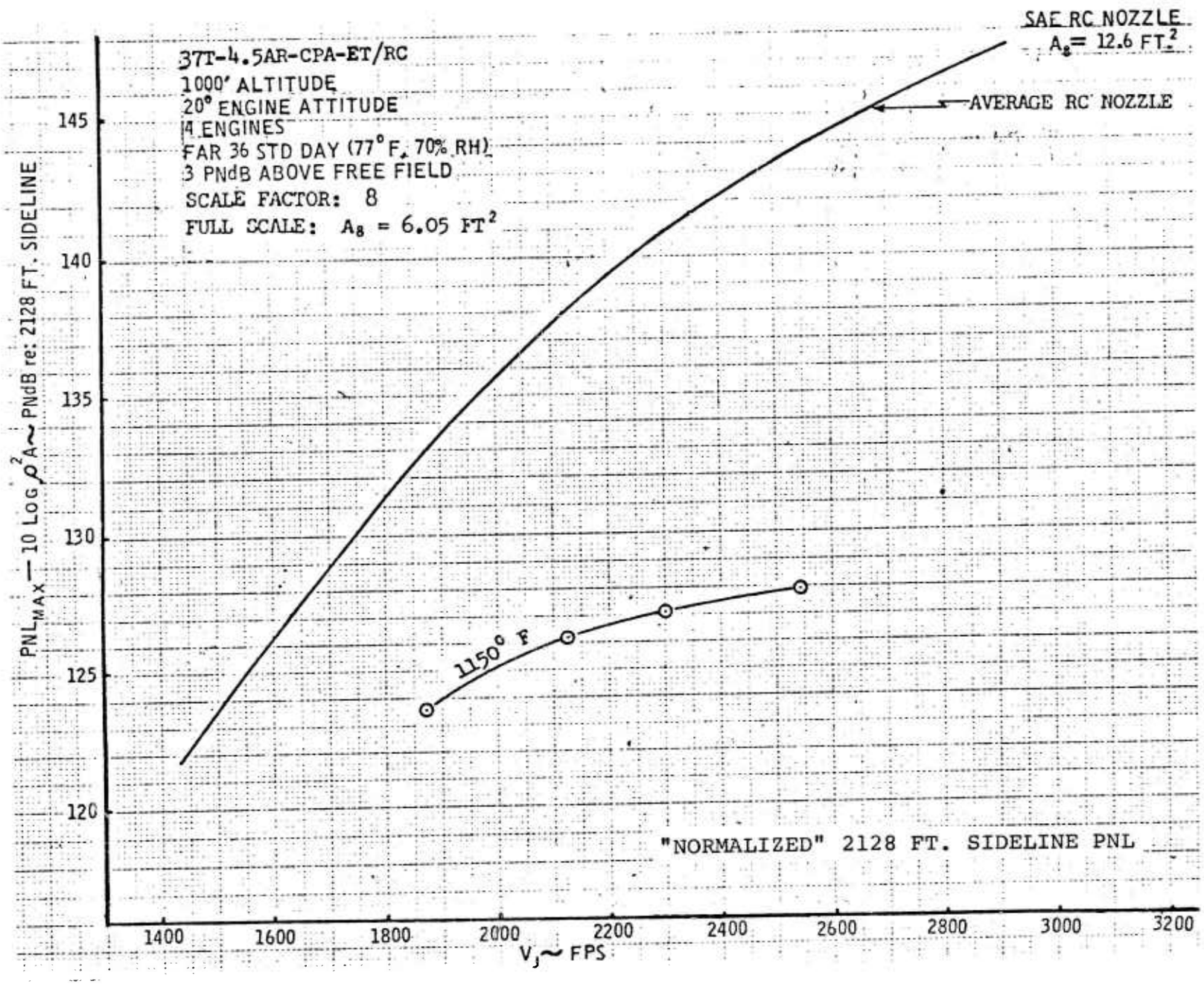
FREE FIELD VALUES

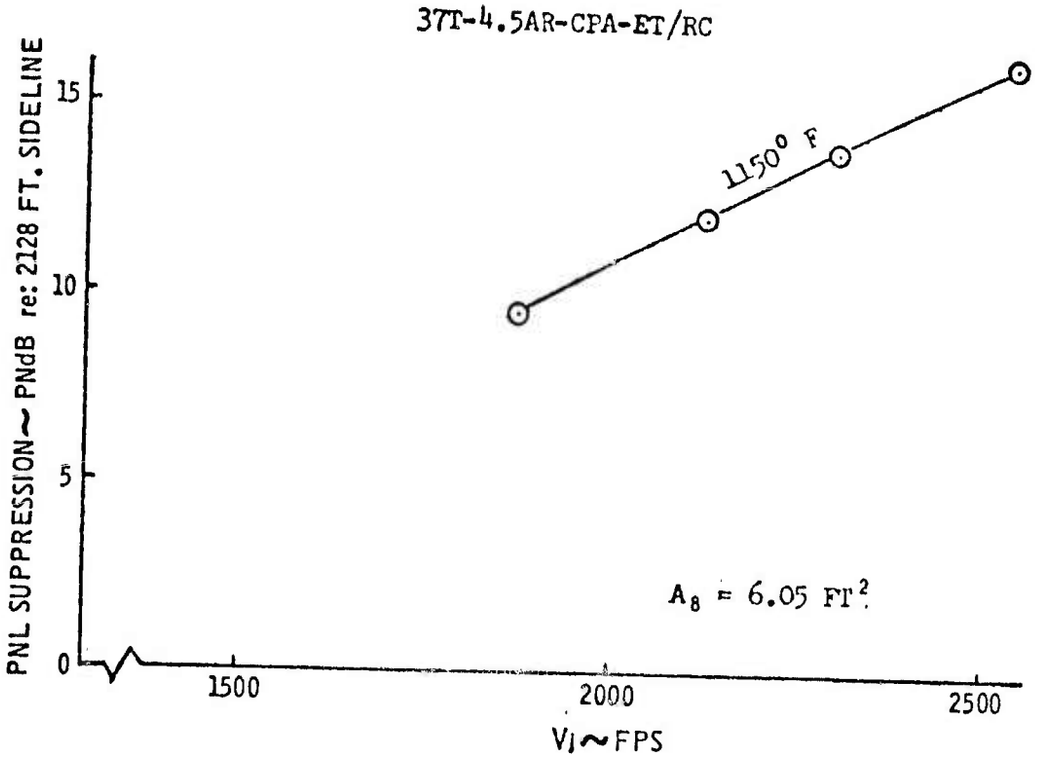


PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	190	2.00	1150°F
◇	190	2.50	1150
○	190	3.00	1150
▽	190	4.00	1150

NOZZLE: 37T-4.5AR-CPA-ET/RC

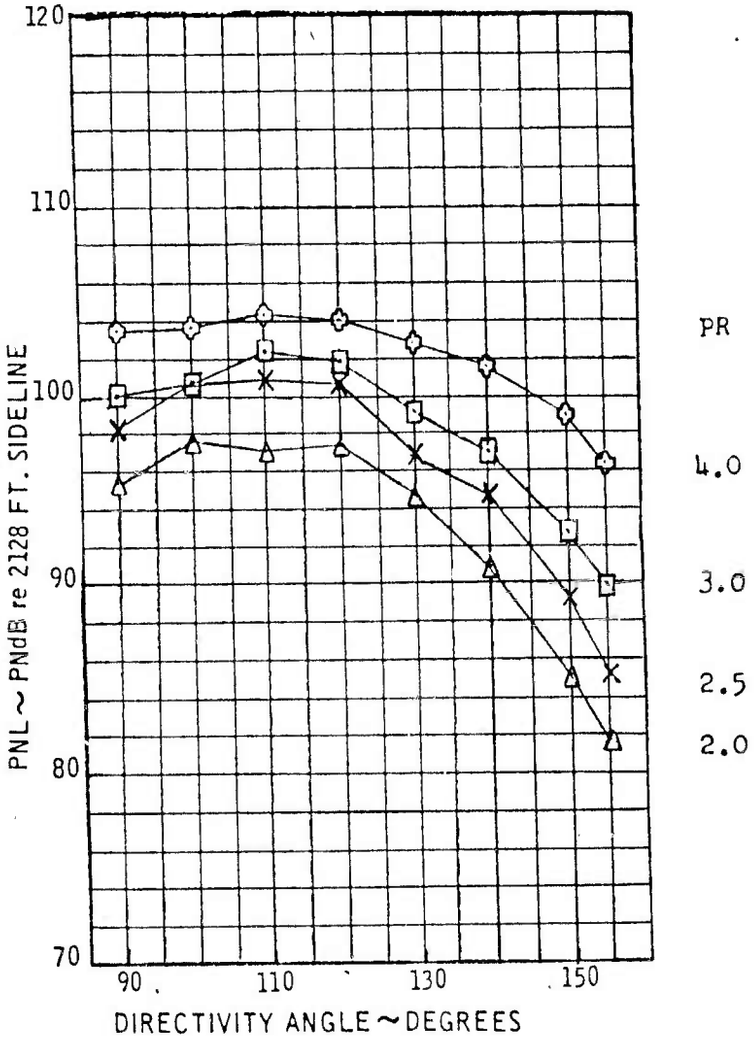
OASPL BEAM PATTERNS


37T-4.5AR-CPA-ET/RC
1000' ALTITUDE
20° ENGINE ATTITUDE
4 ENGINES
FAR 36 STD DAY (77° F, 70% RH)
3 PNdB ABOVE FREE FIELD
SCALE FACTOR: 8
FULL SCALE: A_8 = 6.05 FT^2
SAE RC NOZZLE
A_8 = 12.6 FT.^{2}
AVERAGE RC NOZZLE
1150° F
"NORMALIZED" 2128 FT. SIDELINE PNL
PNL_{MAX} — 10 Log $\rho^2 A$ ~ PNdB re: 2128 FT. SIDELINE
145
140
135
130
125
120
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
V_j ~ FPS



PEAK PNL SUPPRESSION VALUES

NOZZLE: 37T-4.5AR-CPA-ET/RC



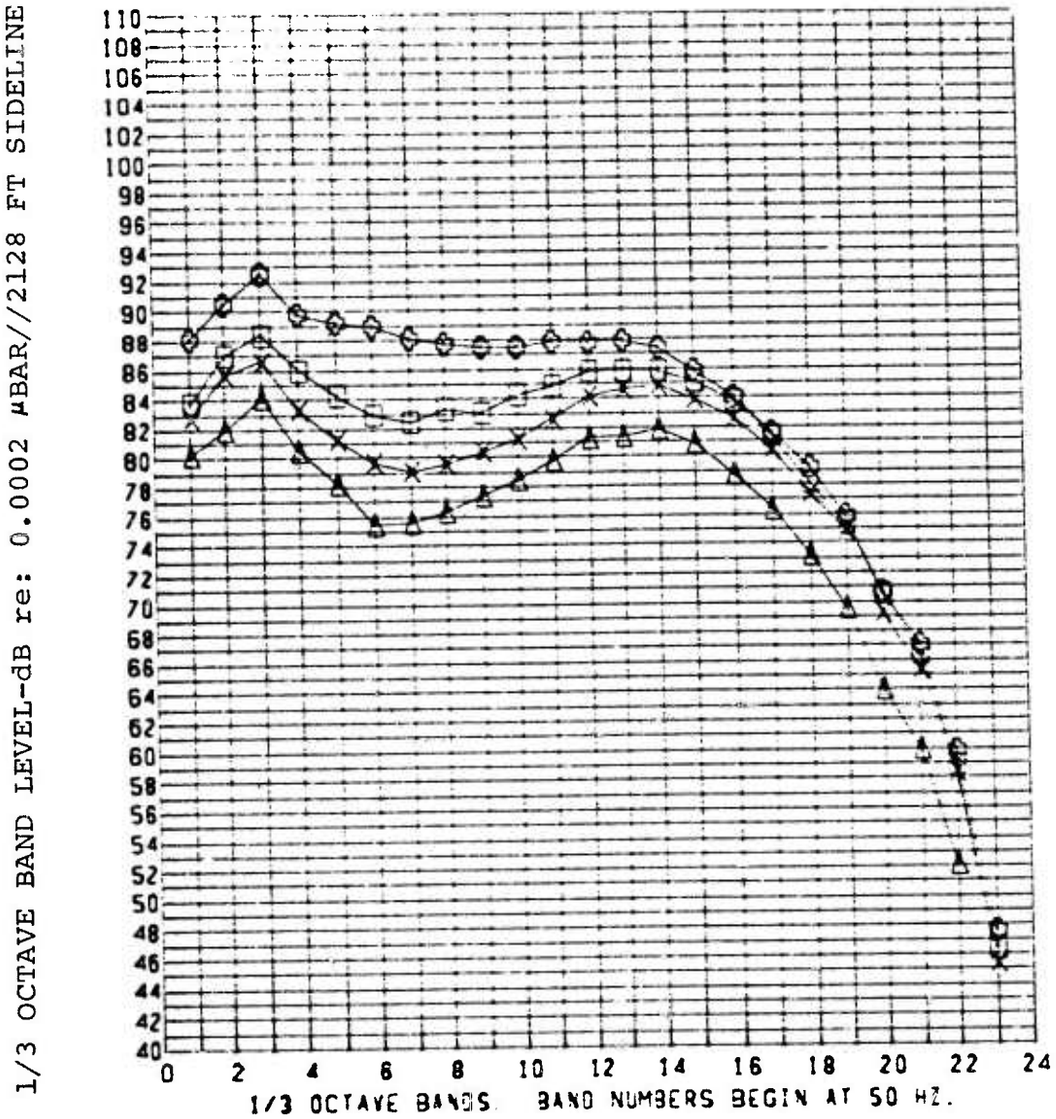
RUN 190

$T_T = 1150^0$ F $A_8 = 6.05$ FT^2

PNL BEAM PATTERNS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 110 DEG TEMP = 77 DEG R.H. = 70 PER CENT



T_T = 1150°F A_8 = 6.05 FT^2 RUN: 190

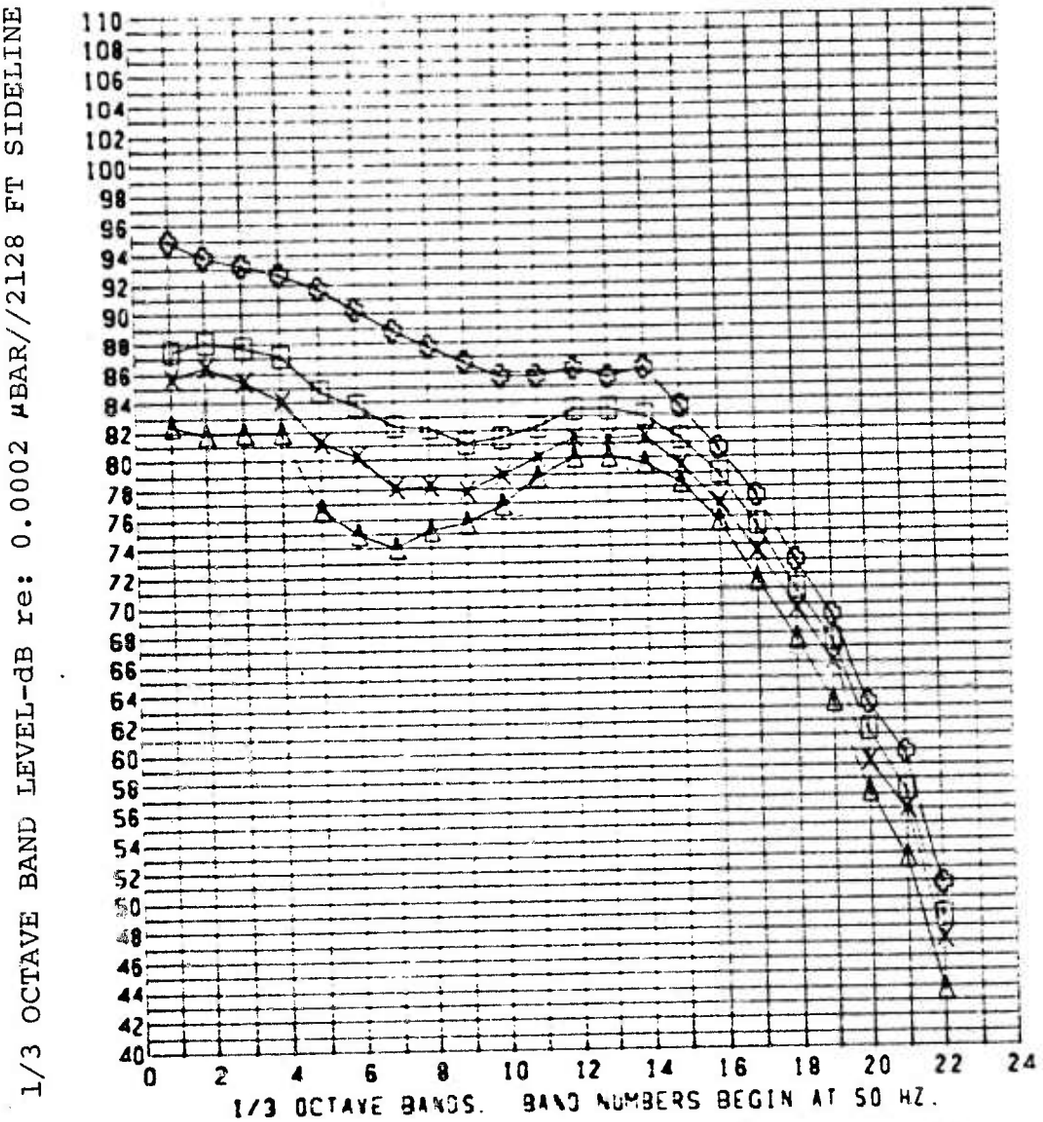
PR = △ 2.0, X 2.5, □ 3.0, ✣ 4.0

NOZZLE: 37T-4.5AR-CPA-ET/RC

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 110°
re: NOZZLE INLET AXIS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 130 DEG TEMP = 77 DEG R.H. = 70 PER CENT



T_T = 1150°F A_8 = 6.05 FT^2 RUN: 190

PR = △ 2.0, X 2.5, □ 3.0, ✣ 4.0

NOZZLE: 37T-4.5AR-CPA-ET/RC

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 130°
re: NOZZLE INLET AXIS

TEST CONDITIONS

NOZZLE: 37T-4.5AR-CPA-ET/RC

FACILITY: WALL ISOLATION FACILITY

DATE: January 16, 1973

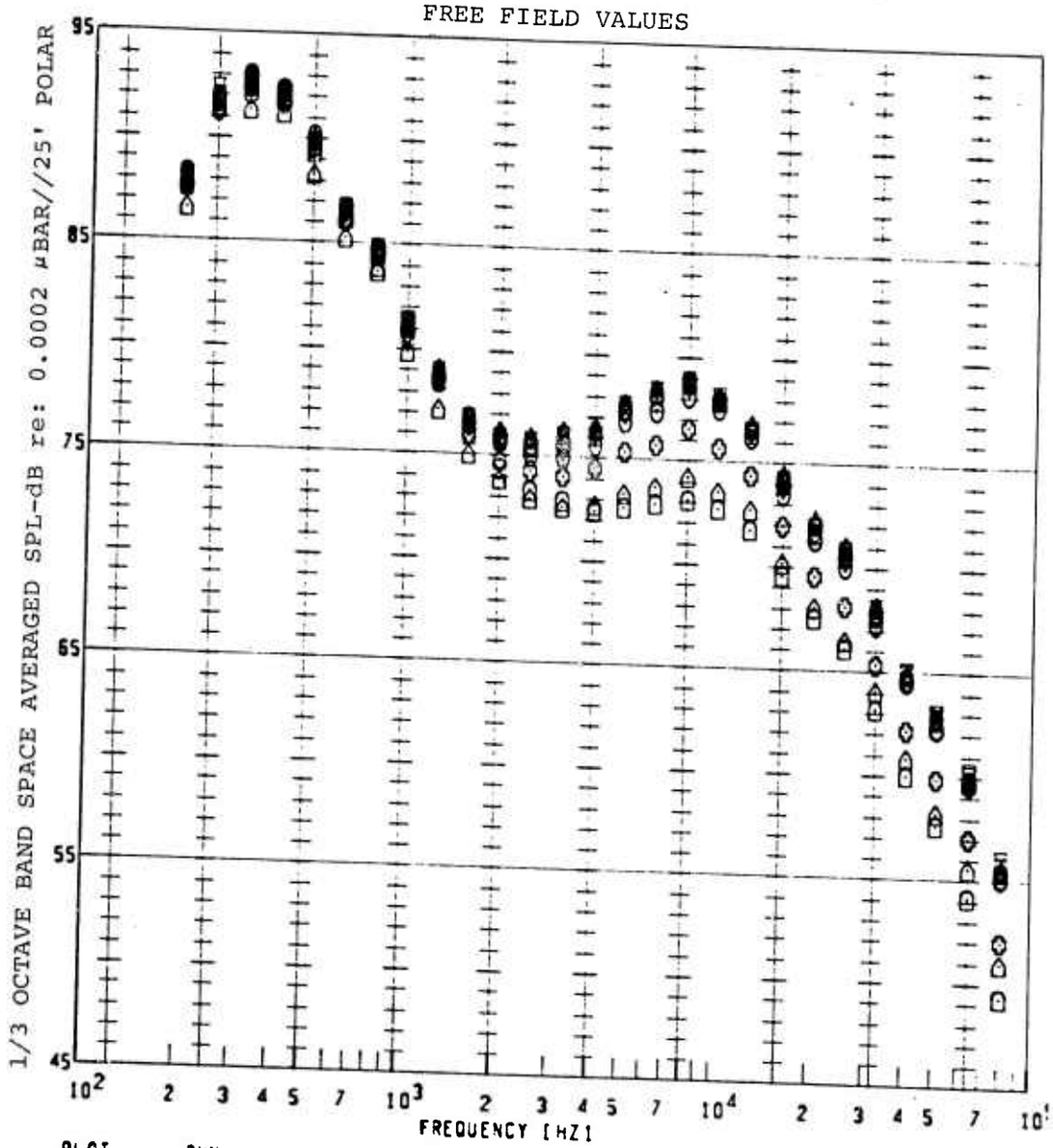
P_{AMB} = 29.34 in Hg T_{AMB} = 46°F **R.H.** = 91%

NPR = 3.0 T_T = 1150°F V_J (**IDEAL**) = 2300 FPS

SCALE MODEL A_8 = 13.6 $in.^2$

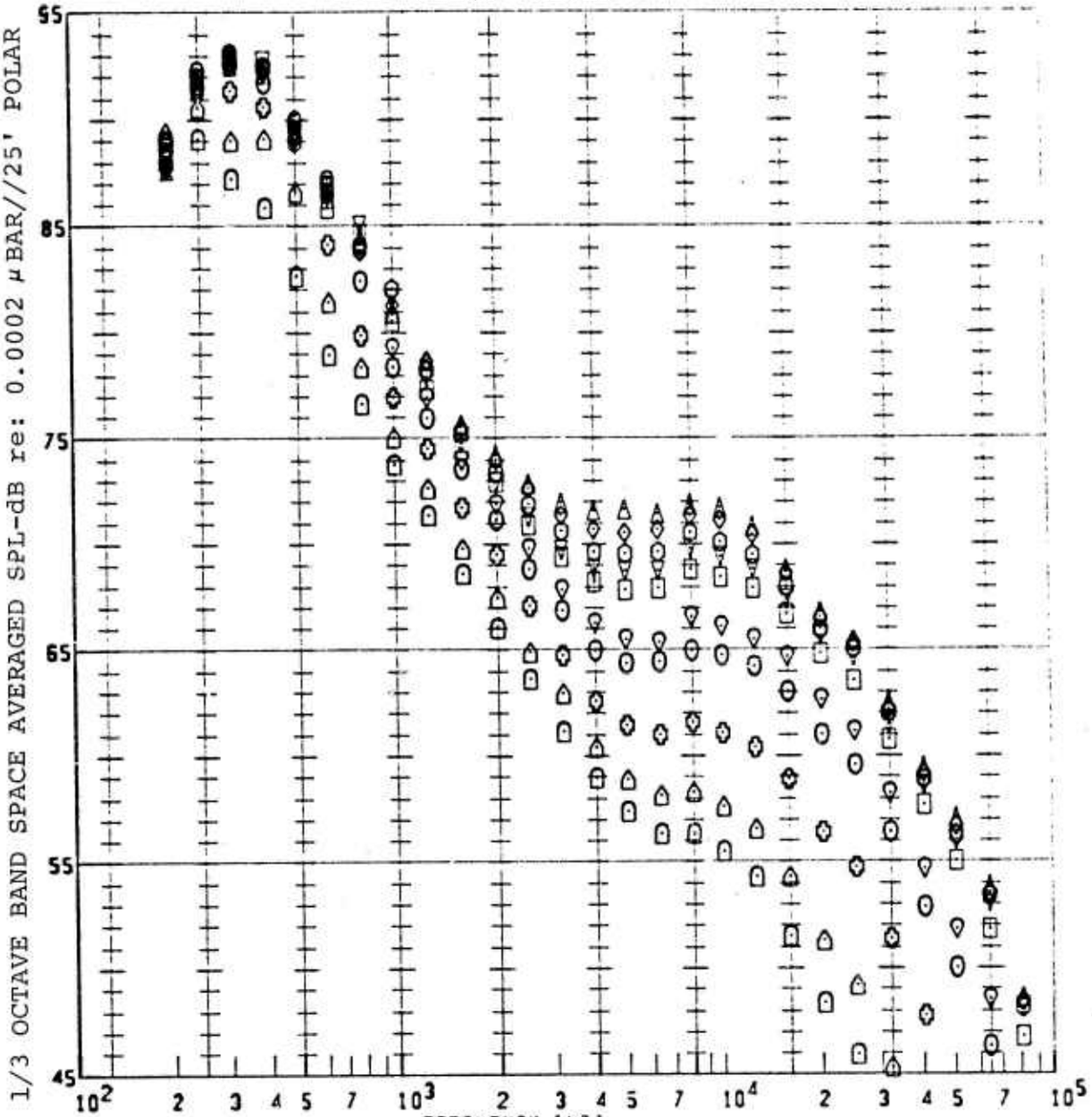
RUN NO.	AXIAL LOCATION	IRIS DIA.	REMARKS	REF.
26	0.0 x/D	11.0 in.		
27	0.25	12.0		
28	0.50	12.5		
29	0.75	12.5		
30	1.00	15.0		
31	1.25	13.0		
32	1.50	12.0		
33	1.75	12.5		
34	2.00	12.5		
35	2.25	13.0		
36	2.50	13.0		
37	2.75	13.5		
38	3.0	14.5		
39	3.5	14.0		
40	4.0	14.5		
41	5.0	16.5		
42	6.0	16.5		
43	8.0	18.0		
44	10.0	20.0		
45	12.0	22.0		
46	14.0	24.0		
47	16.0	24.0		

MICROPHONE LAYOUT: 25 FOOT VERTICAL POLAR ARC

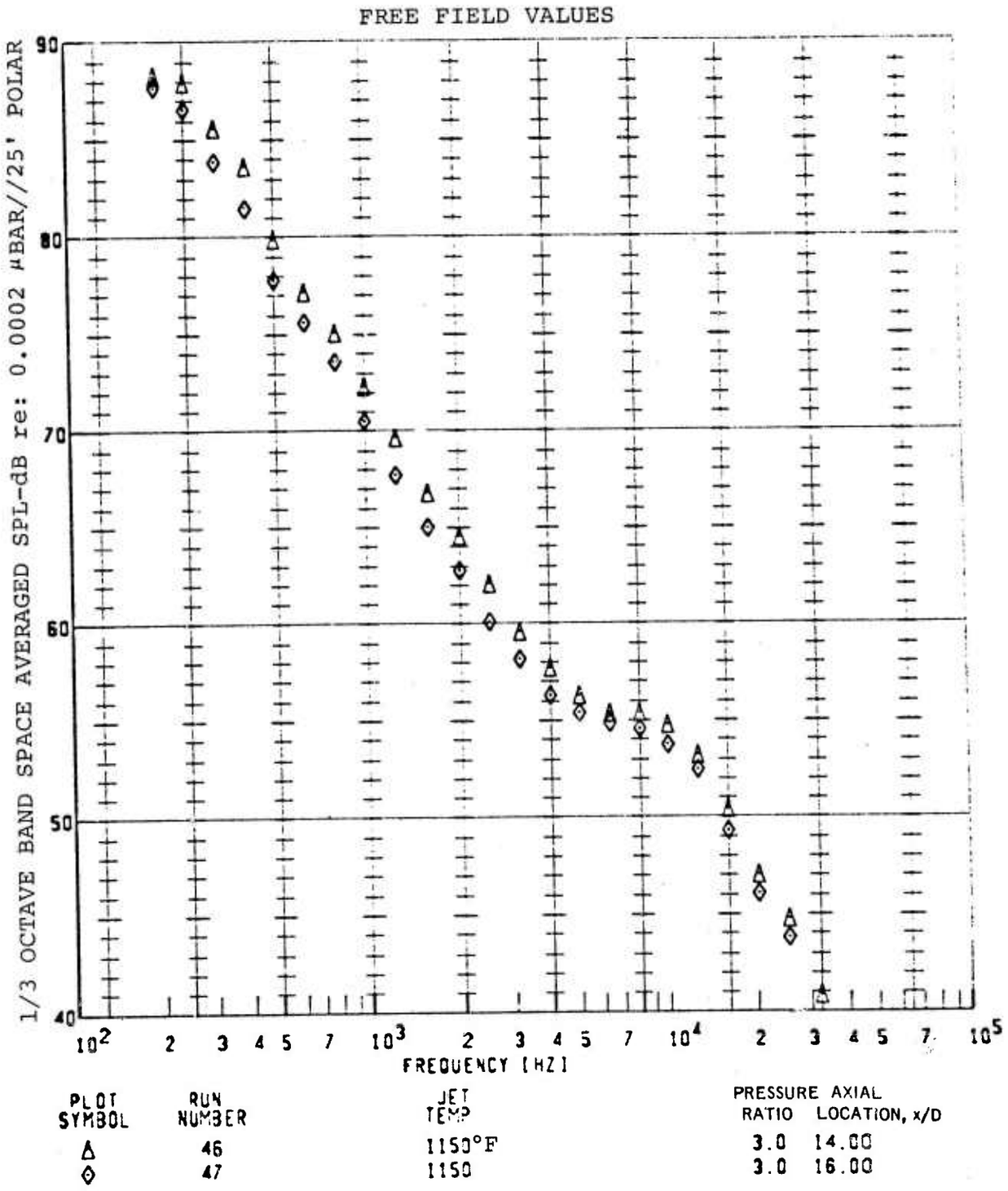


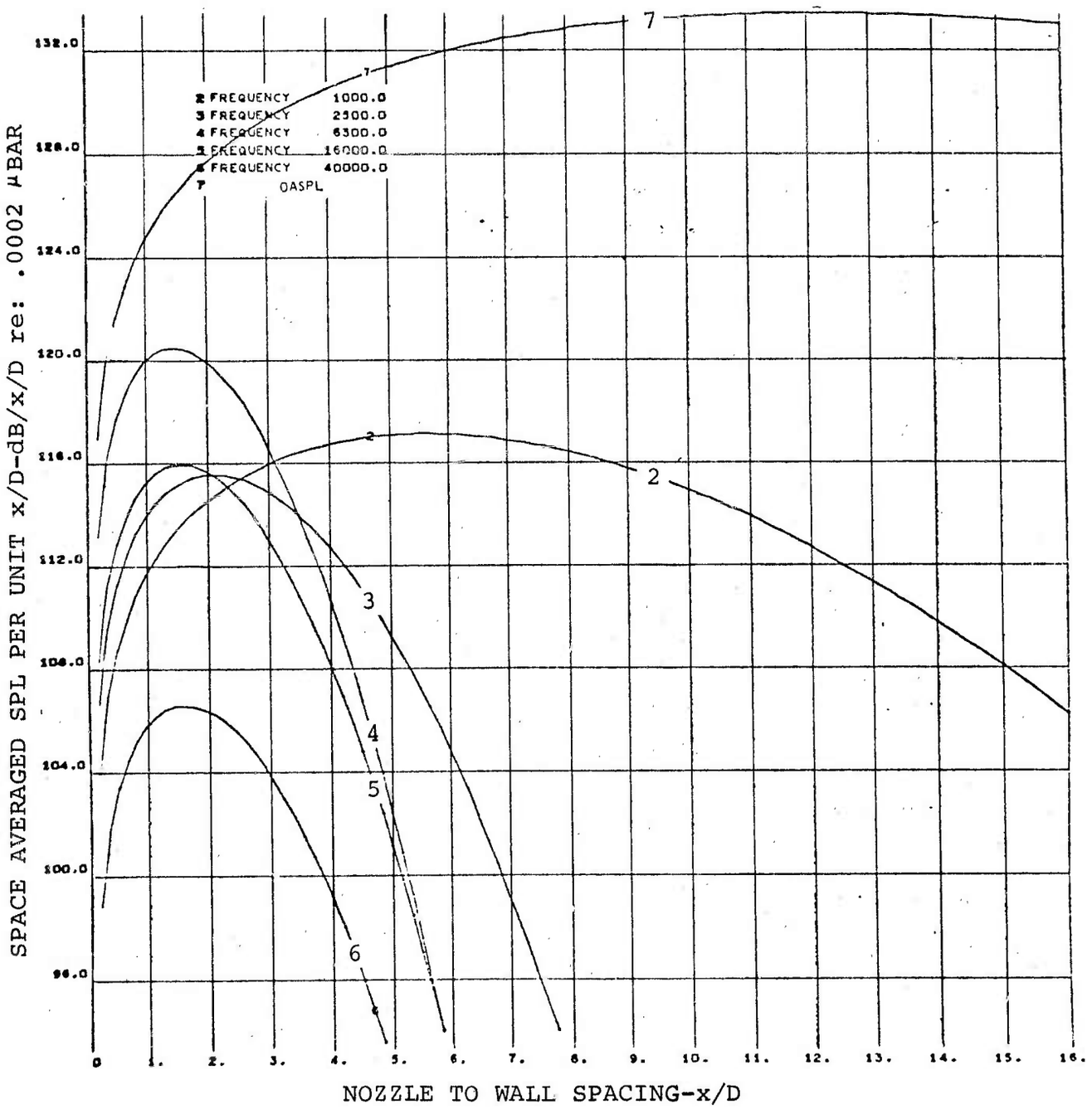
PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	AXIAL LOCATION, x/D
△	26	1150°F	3.0	0.00
◇	27	1150	3.0	0.25
○	28	1150	3.0	0.50
▽	29	1150	3.0	0.75
□	30	1150	3.0	1.00
⬡	31	1150	3.0	1.25
⊙	32	1150	3.0	1.50
◈	33	1150	3.0	1.75
▷	34	1150	3.0	2.00
⊡	35	1150	3.0	2.25

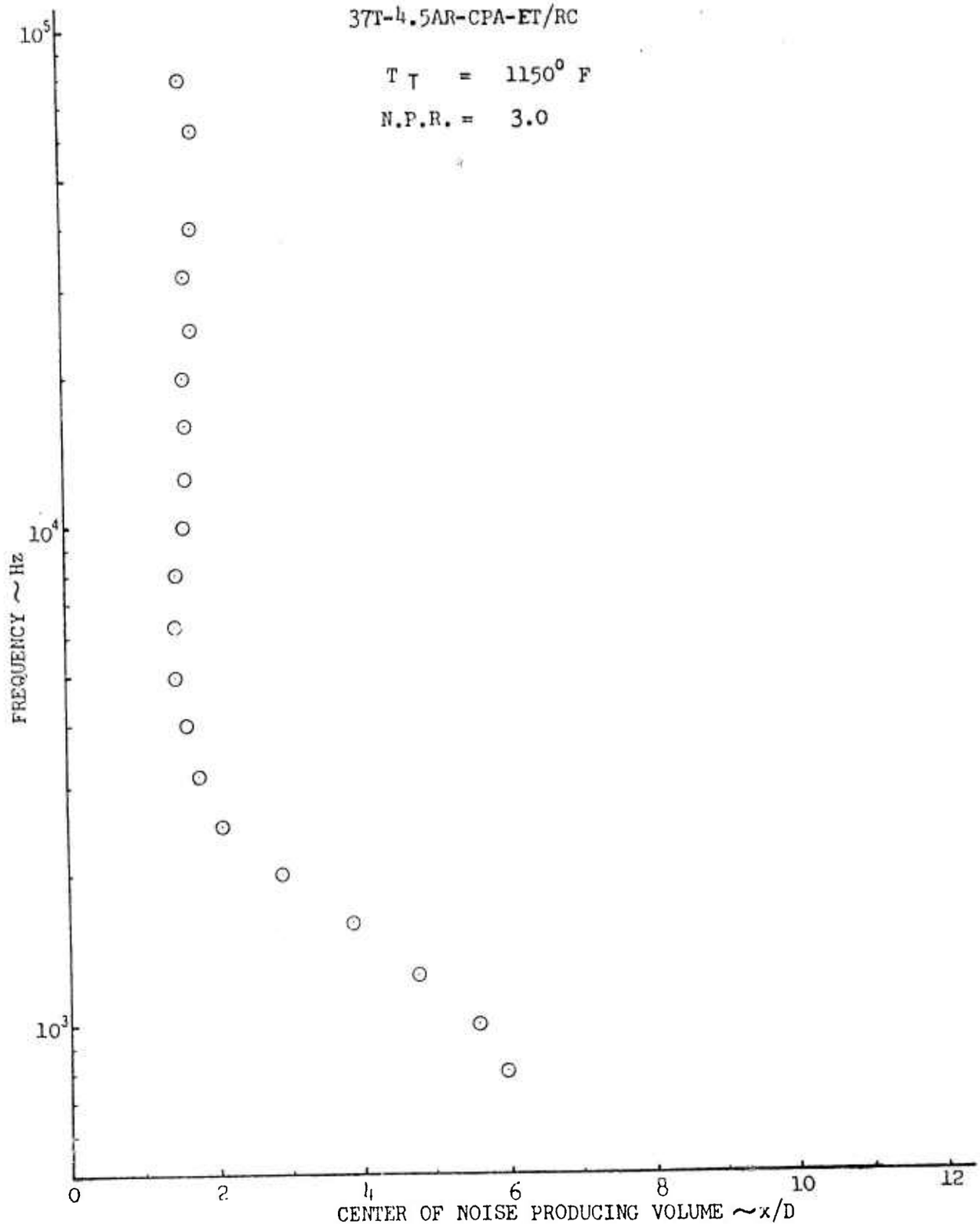
FREE FIELD VALUES

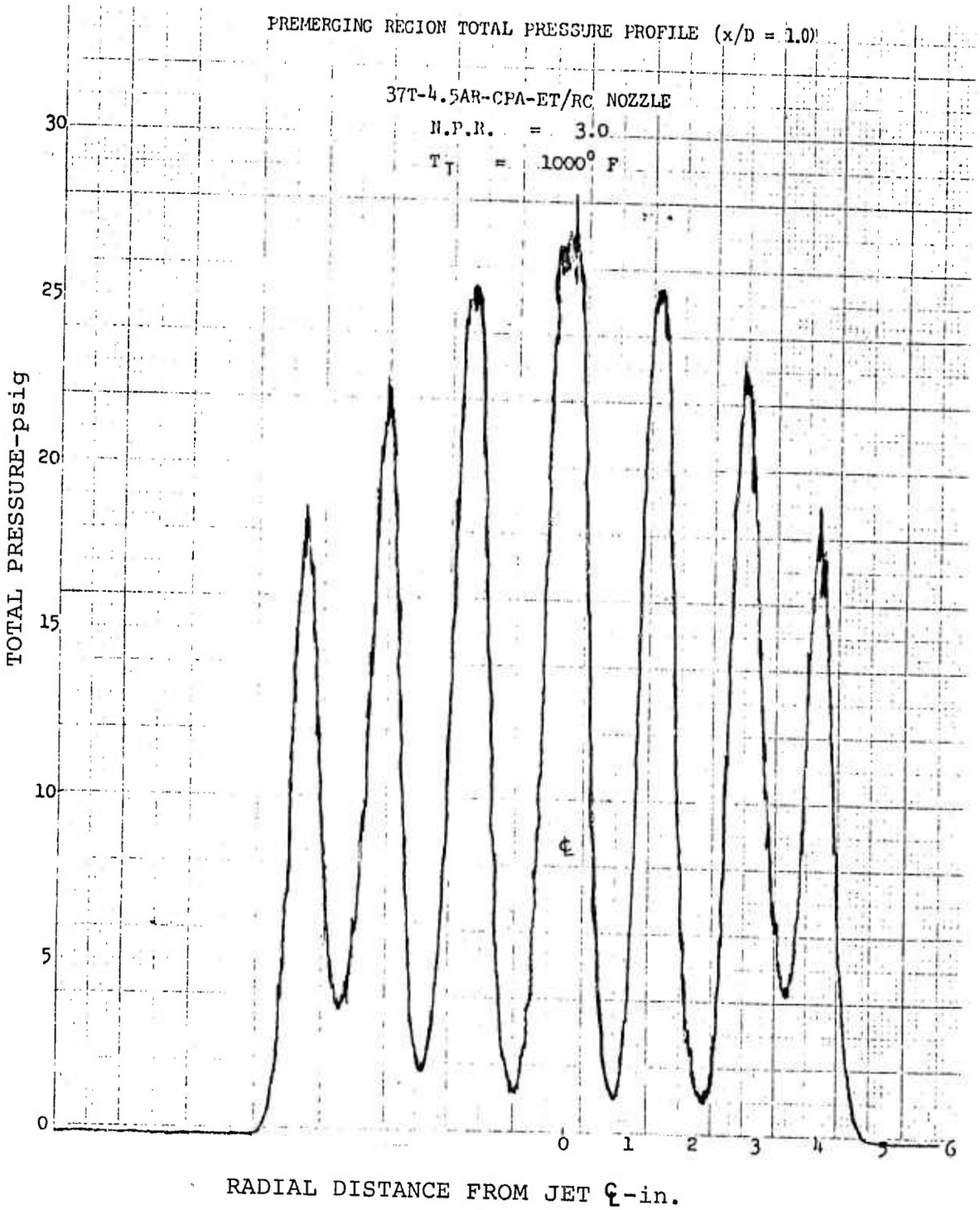


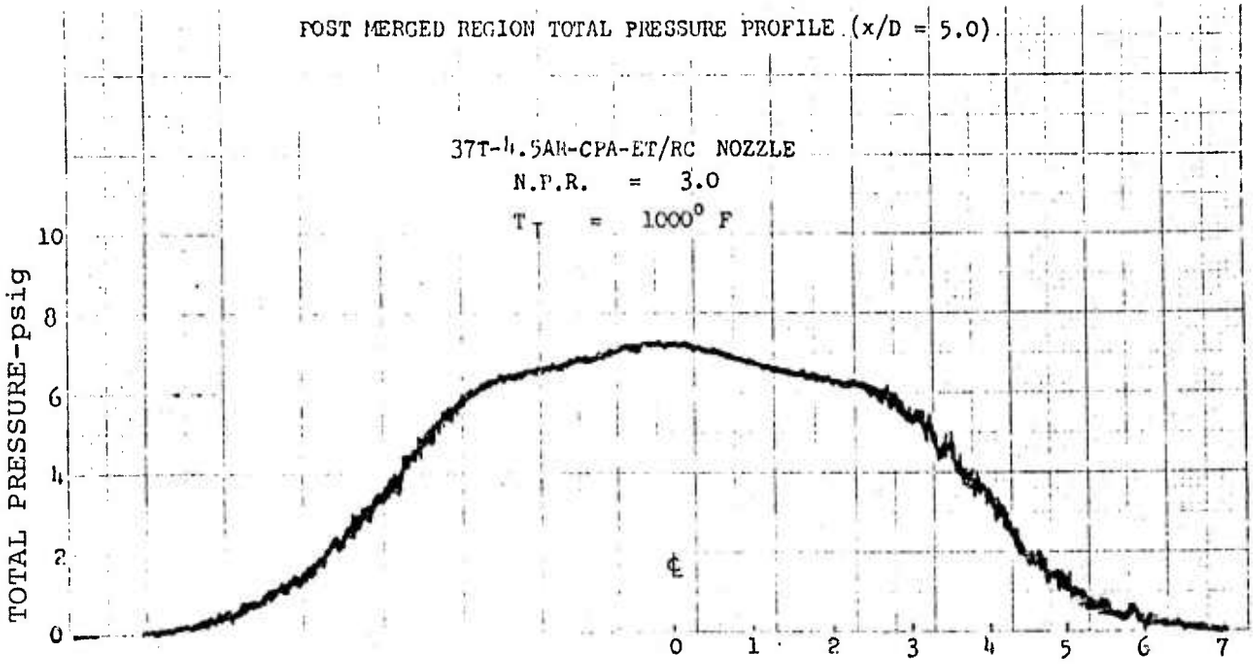
PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	AXIAL LOCATION, x/D
△	36	1150°F	3.000	2.50
◇	37	1150	3.000	2.75
○	38	1150	3.000	3.00
▽	39	1150	3.000	3.50
□	40	1150	3.000	4.00
⬠	41	1150	3.000	5.00
⬡	42	1150	3.000	6.00
⯁	43	1150	3.000	8.00
⬠	44	1150	3.000	10.00
⬡	45	1150	3.000	12.00

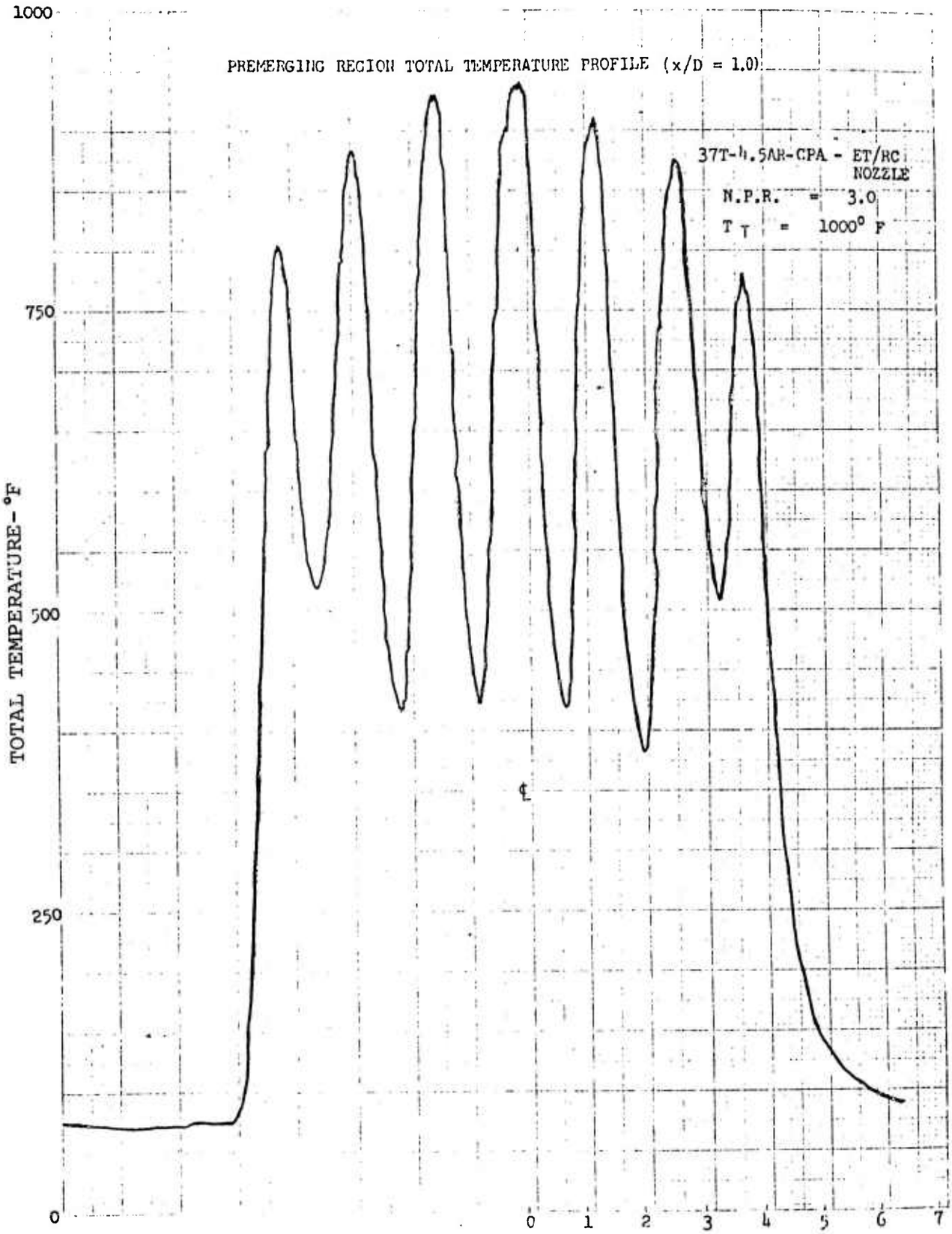

FREE FIELD VALUES
1/3 OCTAVE BAND SPACE AVERAGED SPL-dB re: 0.0002 μBAR//25' POLAR
90
80
70
60
50
40
10²
2
3
4
5
7
10³
2
3
4
5
7
10⁴
2
3
4
5
7
10⁵
FREQUENCY [HZ]
PLOT SYMBOL
RUN NUMBER
JET TEMP
PRESSURE RATIO
AXIAL LOCATION, x/D
Δ
46
1150°F
3.0
14.00
◇
47
1150
3.0
16.00

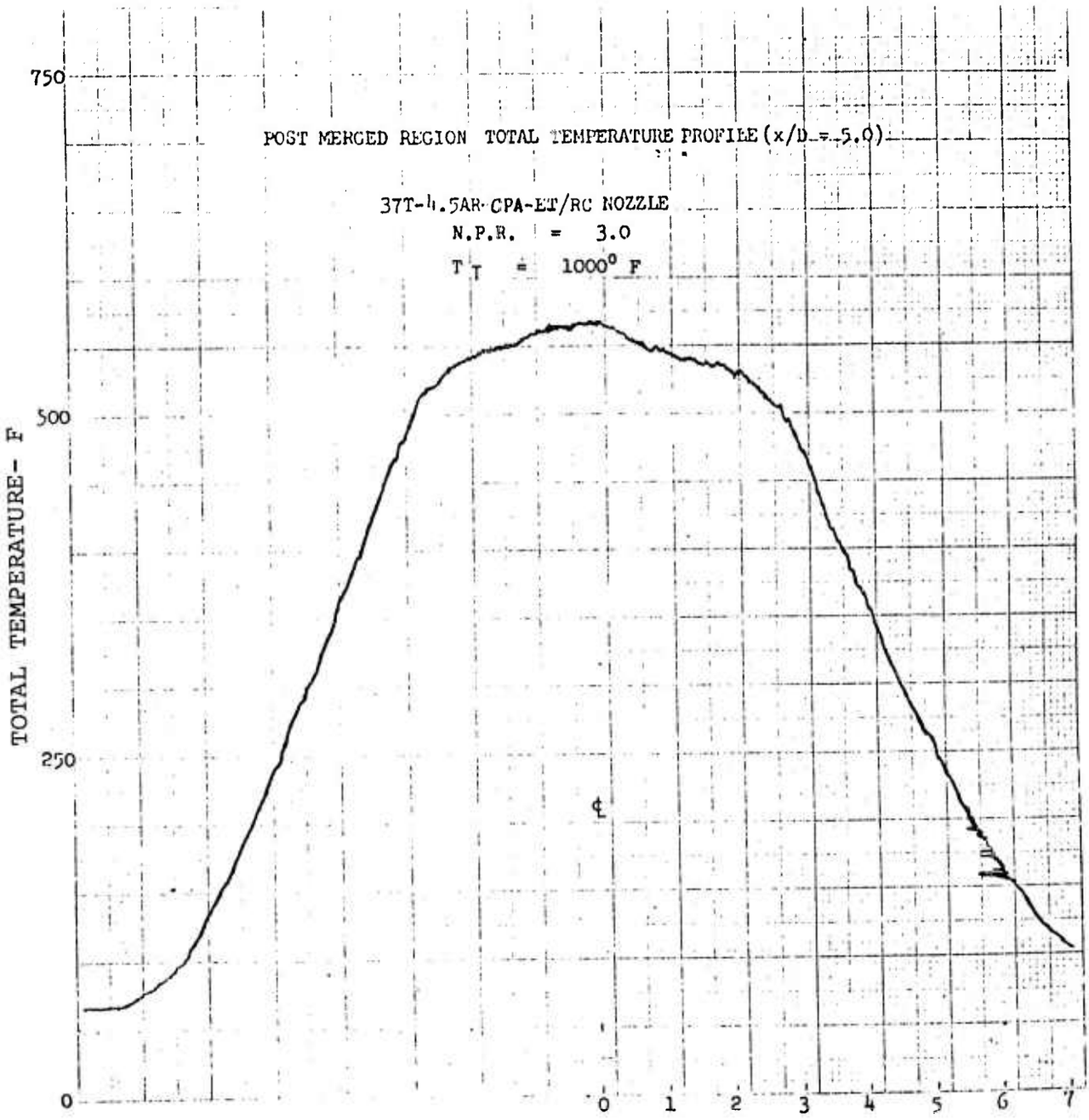

2 FREQUENCY 1000.0
3 FREQUENCY 2500.0
4 FREQUENCY 6300.0
5 FREQUENCY 16000.0
6 FREQUENCY 40000.0
7 OASPL
SPACE AVERAGED SPL PER UNIT x/D-dB/x/D re: .0002 μBAR
NOZZLE TO WALL SPACING-x/D
132.0
128.0
124.0
120.0
116.0
112.0
108.0
104.0
100.0
96.0
0
1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.
13.
14.
15.
16.

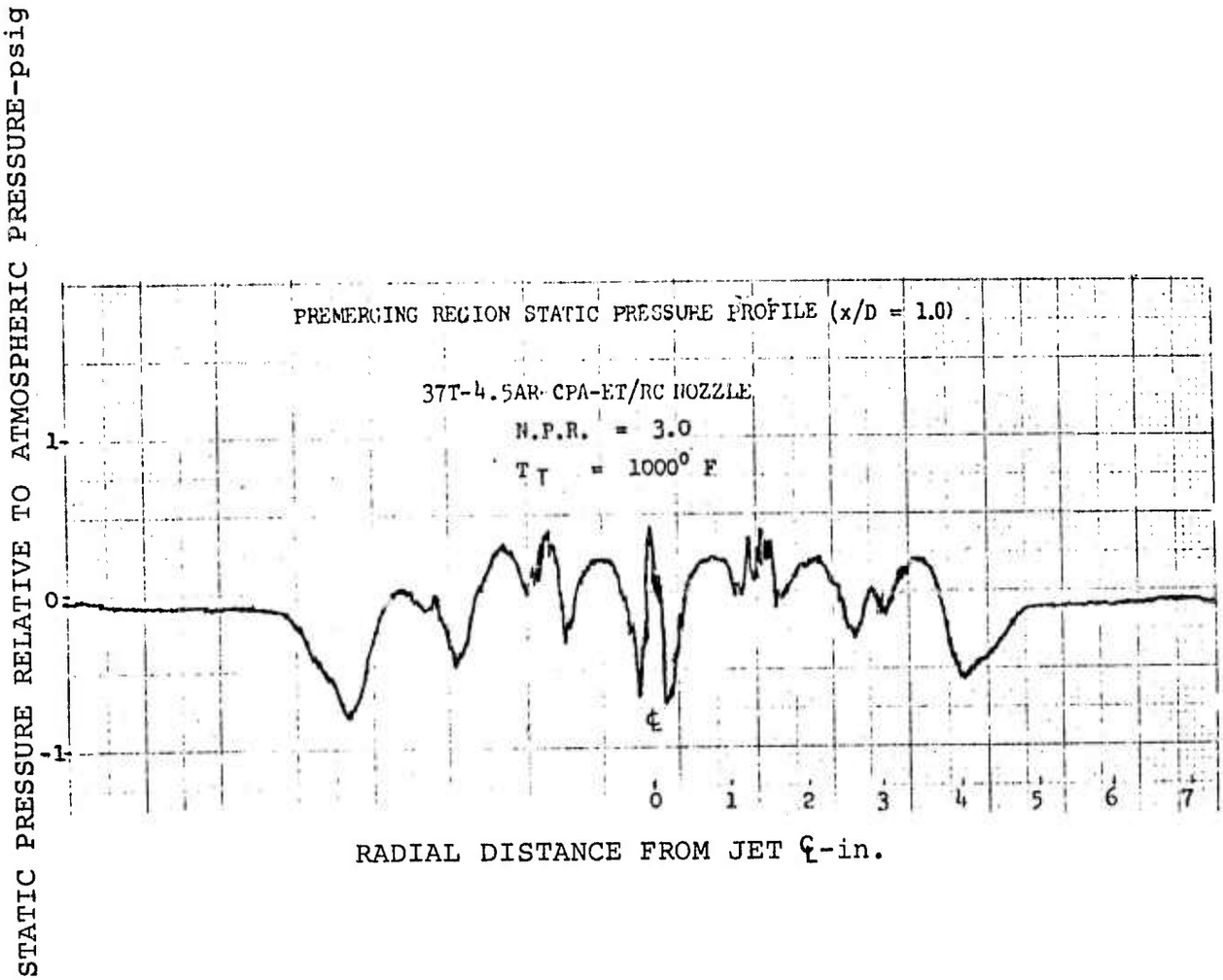

37T-4.5AR-CPA-ET/RC
T_T = 1150° F
N.P.R. = 3.0
10^5
10^4
10^3
FREQUENCY ~ Hz
0
2
4
6
8
10
12
CENTER OF NOISE PRODUCING VOLUME ~x/D

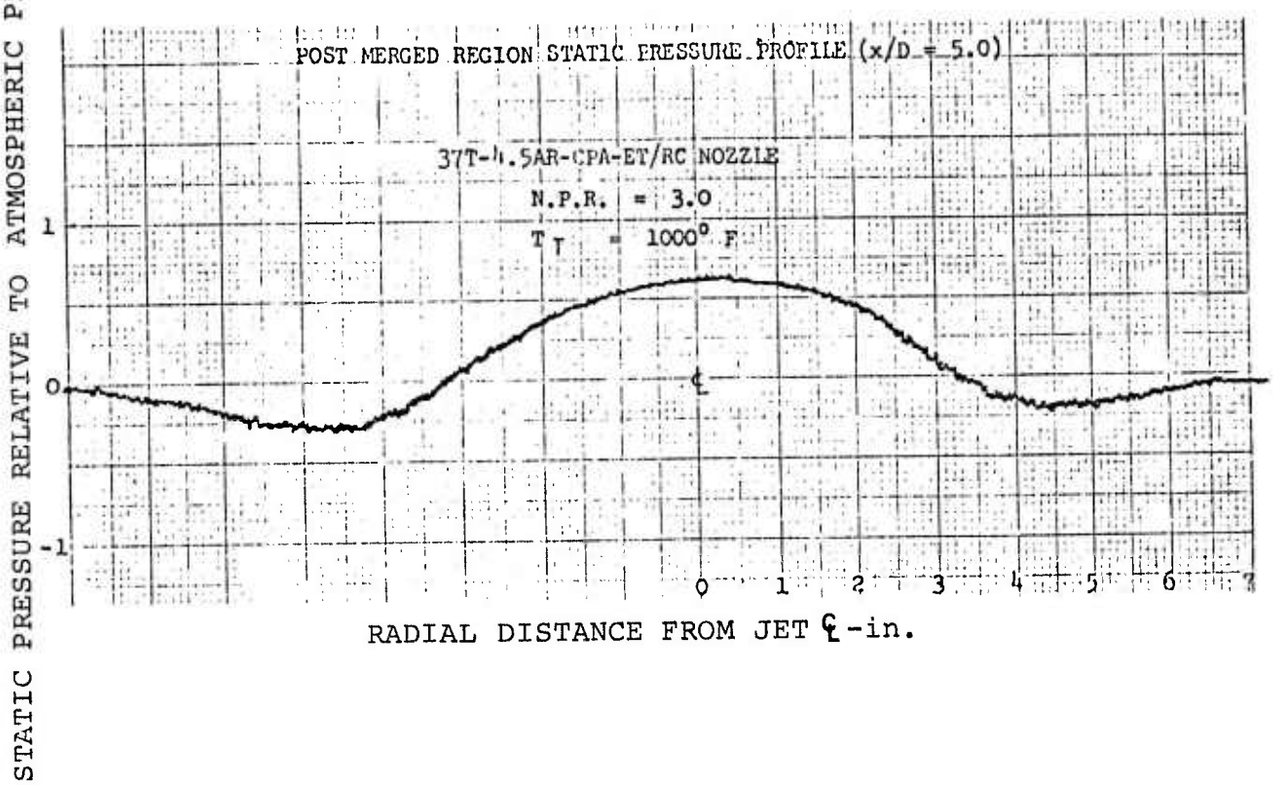

PREMERGING REGION TOTAL PRESSURE PROFILE (x/D = 1.0)
37T-4.5AR-CPA-ET/RC NOZZLE
N.P.R. = 3.0
T_T = 1000° F
TOTAL PRESSURE-psig
0
5
10
15
20
25
30
0
1
2
3
4
5
6
RADIAL DISTANCE FROM JET ℄-in.

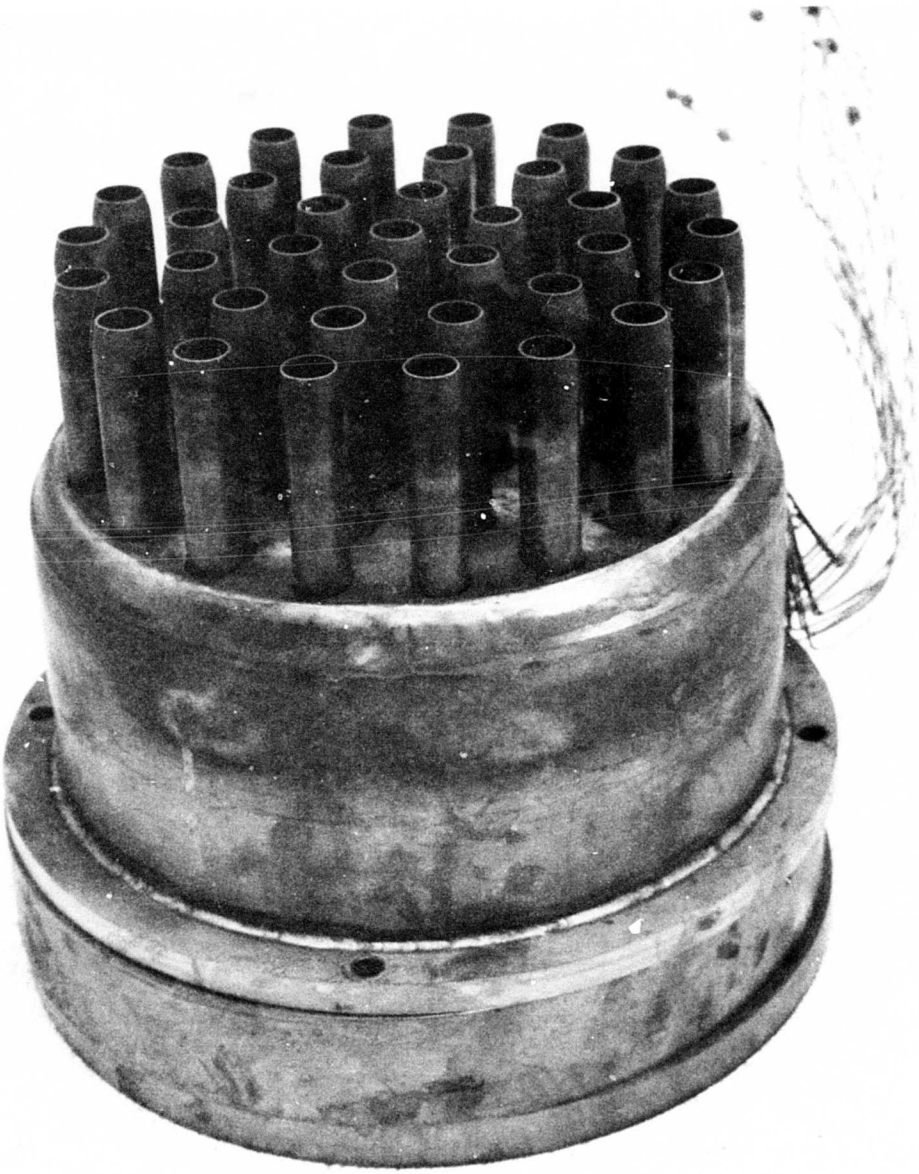

POST MERGED REGION TOTAL PRESSURE PROFILE (x/D = 5.0)
37T-4.5AR-CPA-ET/RC NOZZLE
N.P.R. = 3.0
T_T = 1000° F
TOTAL PRESSURE-psig
0
2
4
6
8
10
℄
0
1
2
3
4
5
6
7
RADIAL DISTANCE FROM JET ℄-in.


PREMERGING REGION TOTAL TEMPERATURE PROFILE (x/D = 1.0)
37T-4.5AR-CPA - ET/RC NOZZLE
N.P.R. = 3.0
T_T = 1000° F
TOTAL TEMPERATURE - °F
1000
750
500
250
0
℄
0 1 2 3 4 5 6 7
RADIAL DISTANCE FROM JET ℄ - in.

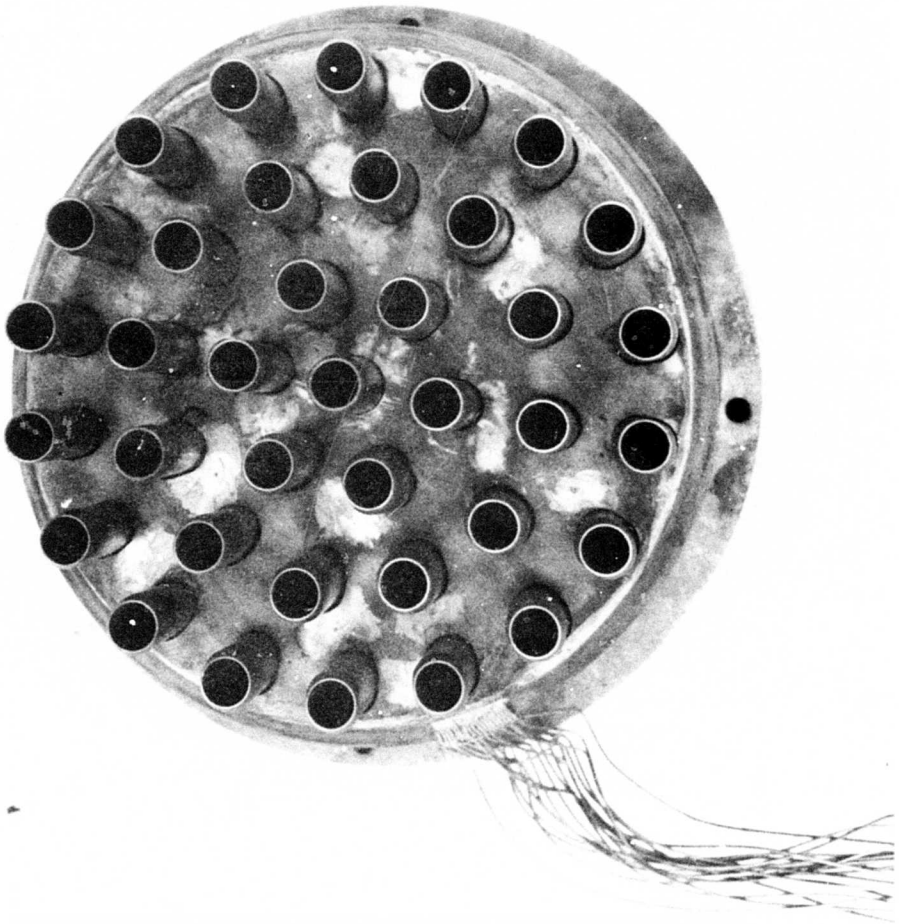

POST MERGED REGION TOTAL TEMPERATURE PROFILE (x/D = 5.0)
37T-4.5AR-CPA-ET/RC NOZZLE
N.P.R. = 3.0
T_T = 1000° F
TOTAL TEMPERATURE- F
750
500
250
0
0
1
2
3
4
5
6
7
RADIAL DISTANCE FROM JET ℄ -in.


PREMERGING REGION STATIC PRESSURE PROFILE (x/D = 1.0)
37T-4.5AR CPA-ET/RC NOZZLE
N.P.R. = 3.0
T_T = 1000° F
STATIC PRESSURE RELATIVE TO ATMOSPHERIC PRESSURE-psig
1
0
-1
℄
0
1
2
3
4
5
6
7
RADIAL DISTANCE FROM JET ℄-in.


POST MERGED REGION STATIC PRESSURE PROFILE (x/D = 5.0)
37T-4.5AR-CPA-ET/RC NOZZLE
N.P.R. = 3.0
T_T = 1000° F
STATIC PRESSURE RELATIVE TO ATMOSPHERIC PRESSURE-psig
1
0
-1
0
1
2
3
4
5
6
RADIAL DISTANCE FROM JET ℄-in.



37T-6.0AR-CPA-ET/RC NOZZLE

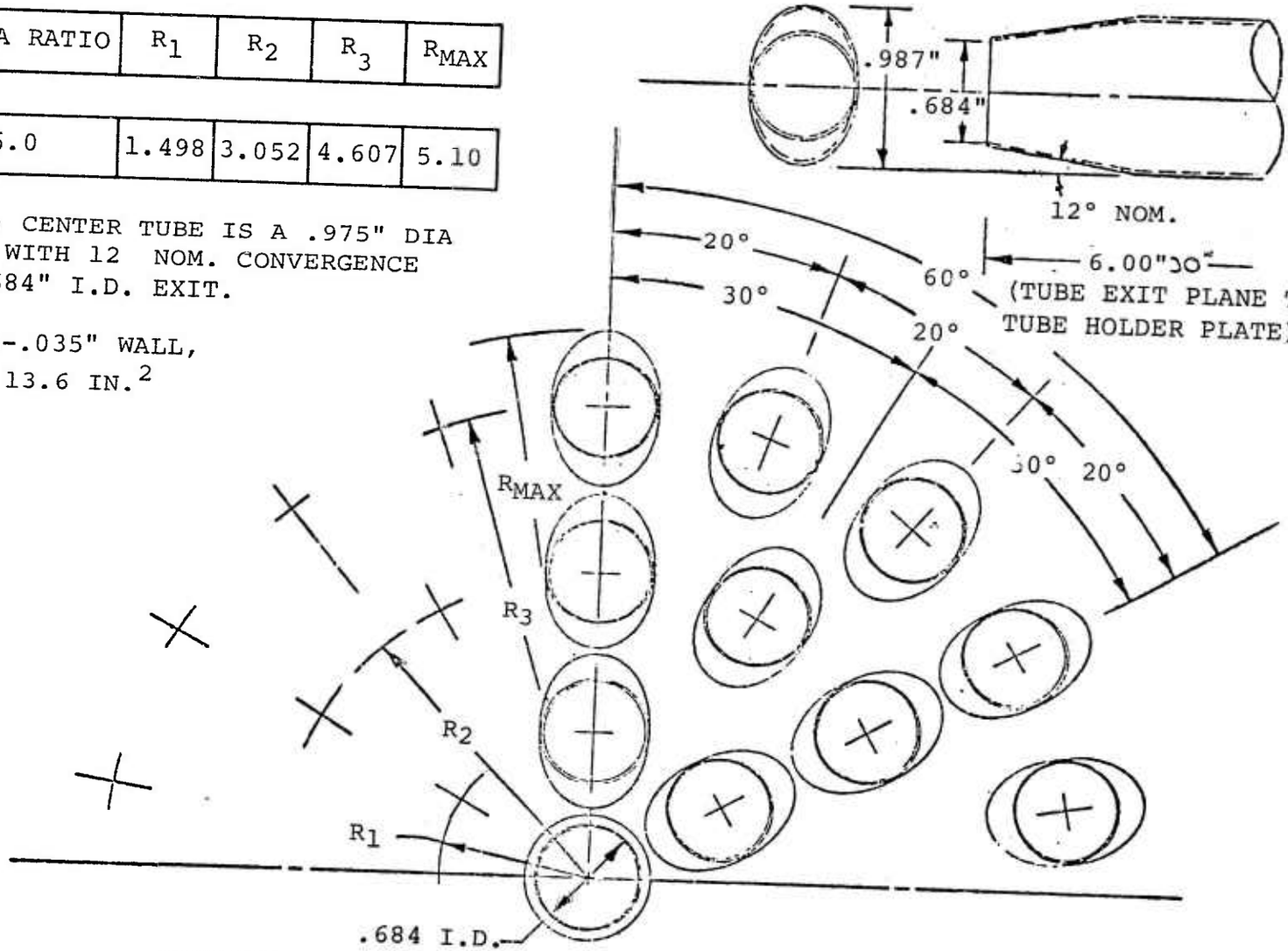


37T-6.0AR-CPA-ET/RC NOZZLE

AREA RATIO	R_1	R_2	R_3	R_{MAX}
6.0	1.498	3.052	4.607	5.10

NOTE: CENTER TUBE IS A .975" DIA TUBE WITH 12 NOM. CONVERGENCE TO .684" I.D. EXIT.

MAT'L-.035" WALL,
A_8 = 13.6 IN.^{2}



37 TUBE - AREA RATIO 6.0 ELLIPTICAL RUBES CLOSE ARRAY

TEST CONDITIONS

NOZZLE: 37T-6.0AR-CPA-ET/RC

FACILITY: HNTF

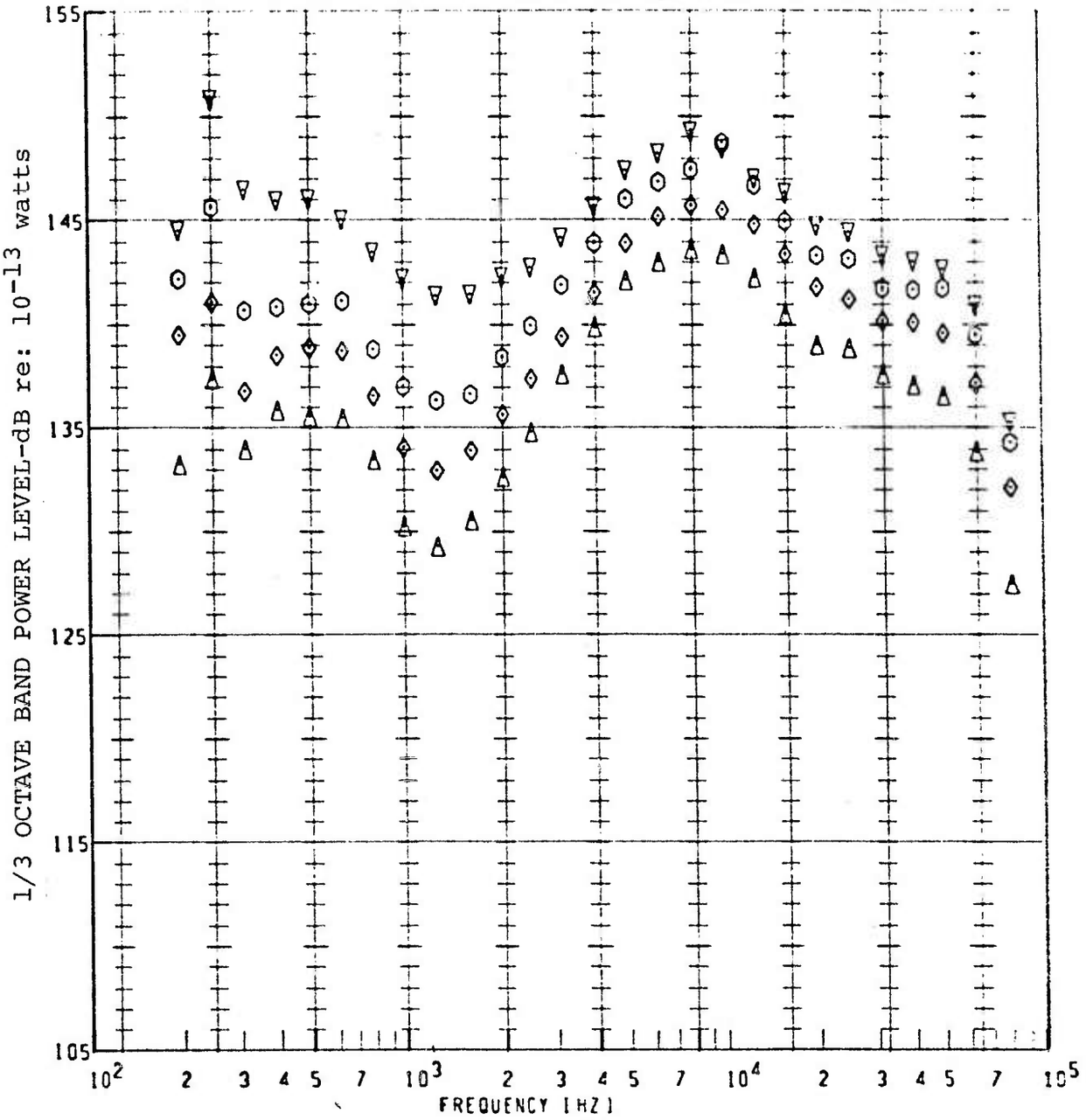
DATE: 10-22-73 T_{AMB} = 51.5°F **R.H.** = 87%

SCALE MODEL A_8 = 13.6 in.^{2}

RUN NO.	NPR	T_T	V_J (IDEAL)	REMARKS	REF
193	2.0	1150°F	1875 fps	3" tube lengths	
"	2.5	"	2126		
"	3.0	"	2303		
"	4.0	"	2544		

MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH CONCRETE GROUND SURFACE. MEASURED ACOUSTIC DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.

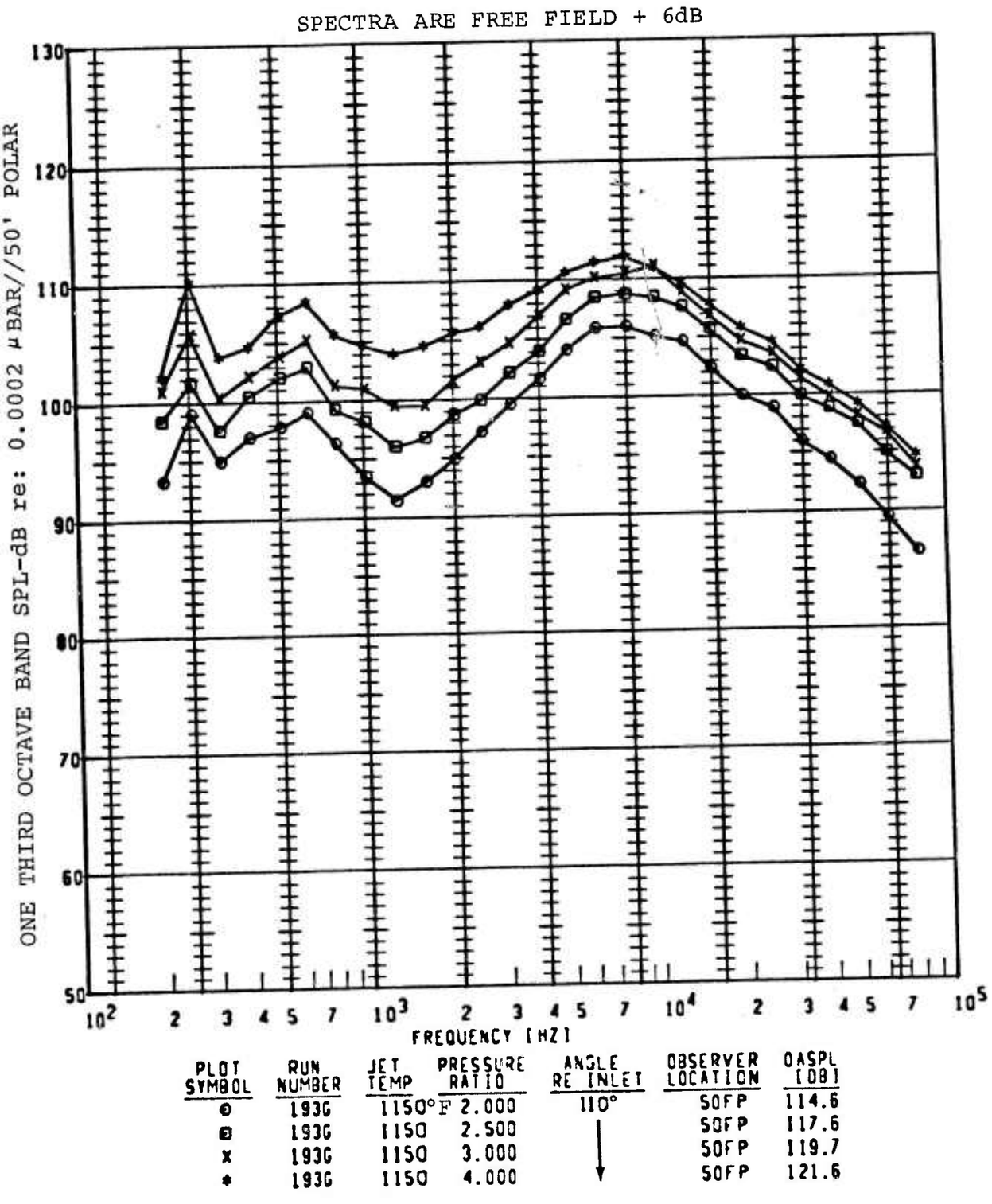
FREE FIELD VALUES



PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	193	2.00	1150°F
◇	193	2.50	1150
⊙	193	3.00	1150
▽	193	4.00	1150

NOZZLE: 37T-6.0AR-CPA-ET/RC

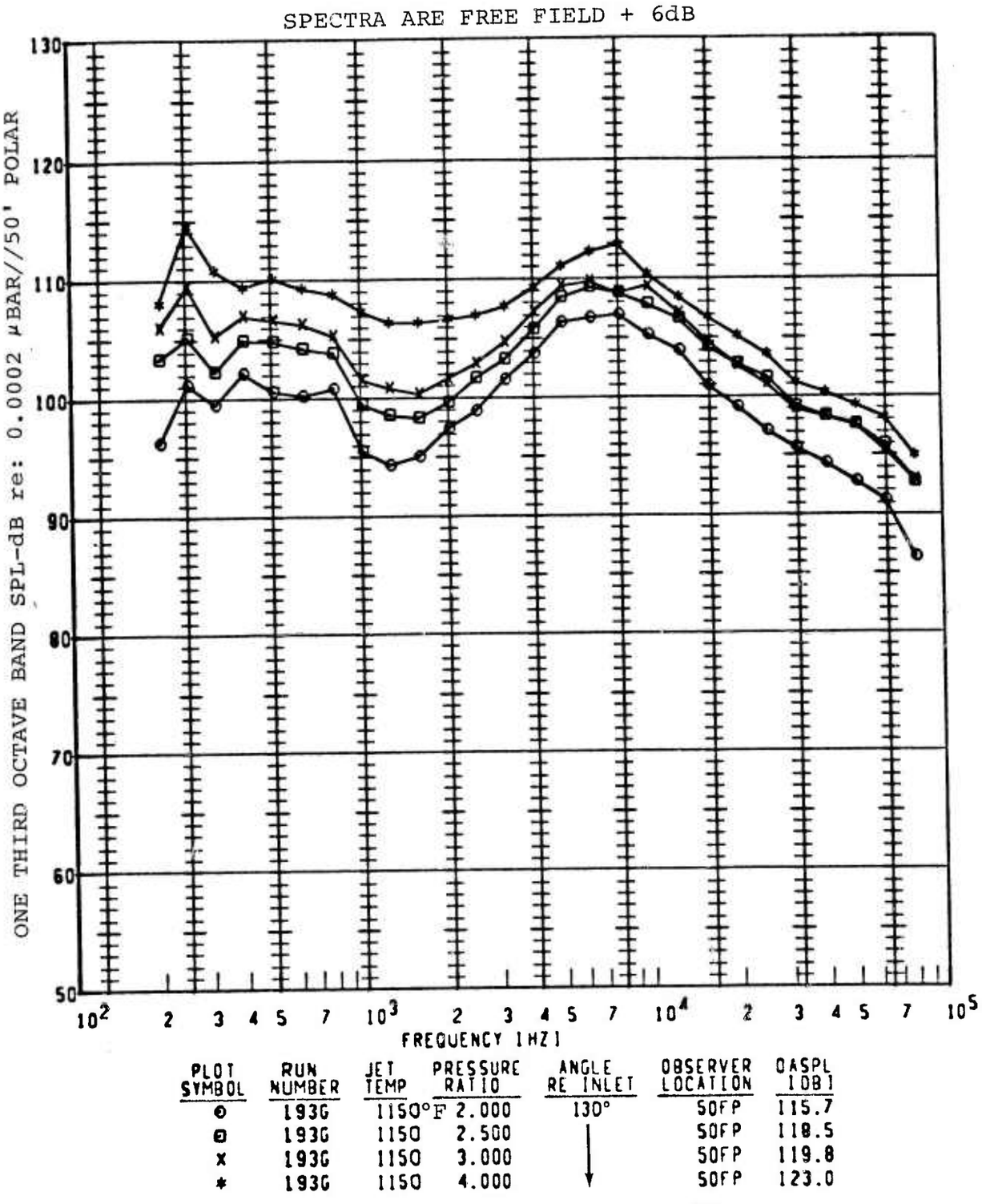
JET NOISE POWER SPECTRA



PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL [DB]
○	1936	1150°F	2.000	110°	50FP	114.6
□	1936	1150	2.500	↓	50FP	117.6
x	1936	1150	3.000	↓	50FP	119.7
*	1936	1150	4.000	↓	50FP	121.6

NOZZLE: 37T-6.0AR-CPA-ET/RC

MEASURED NOISE SPECTRA AT 110° re: NOZZLE INLET AXIS

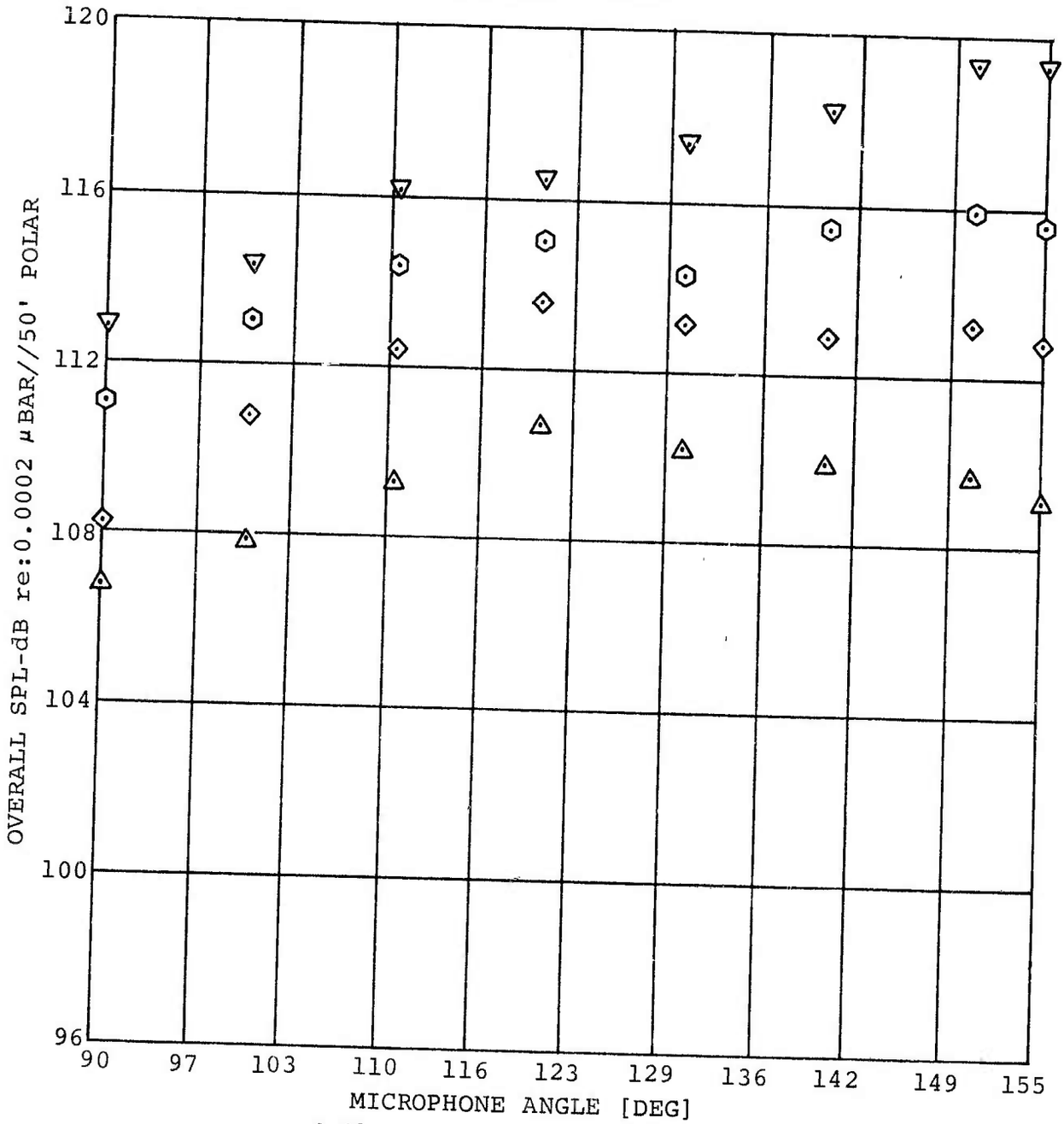


PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL (DB)
⊙	193G	1150°F	2.000	130°	50FP	115.7
⊡	193G	1150	2.500	↓	50FP	118.5
x	193G	1150	3.000	↓	50FP	119.8
*	193G	1150	4.000	↓	50FP	123.0

NOZZLE: 37T-6.0AR-CPA-ET/RC

MEASURED NOISE SPECTRA AT 130° re: NOZZLE INLET AXIS

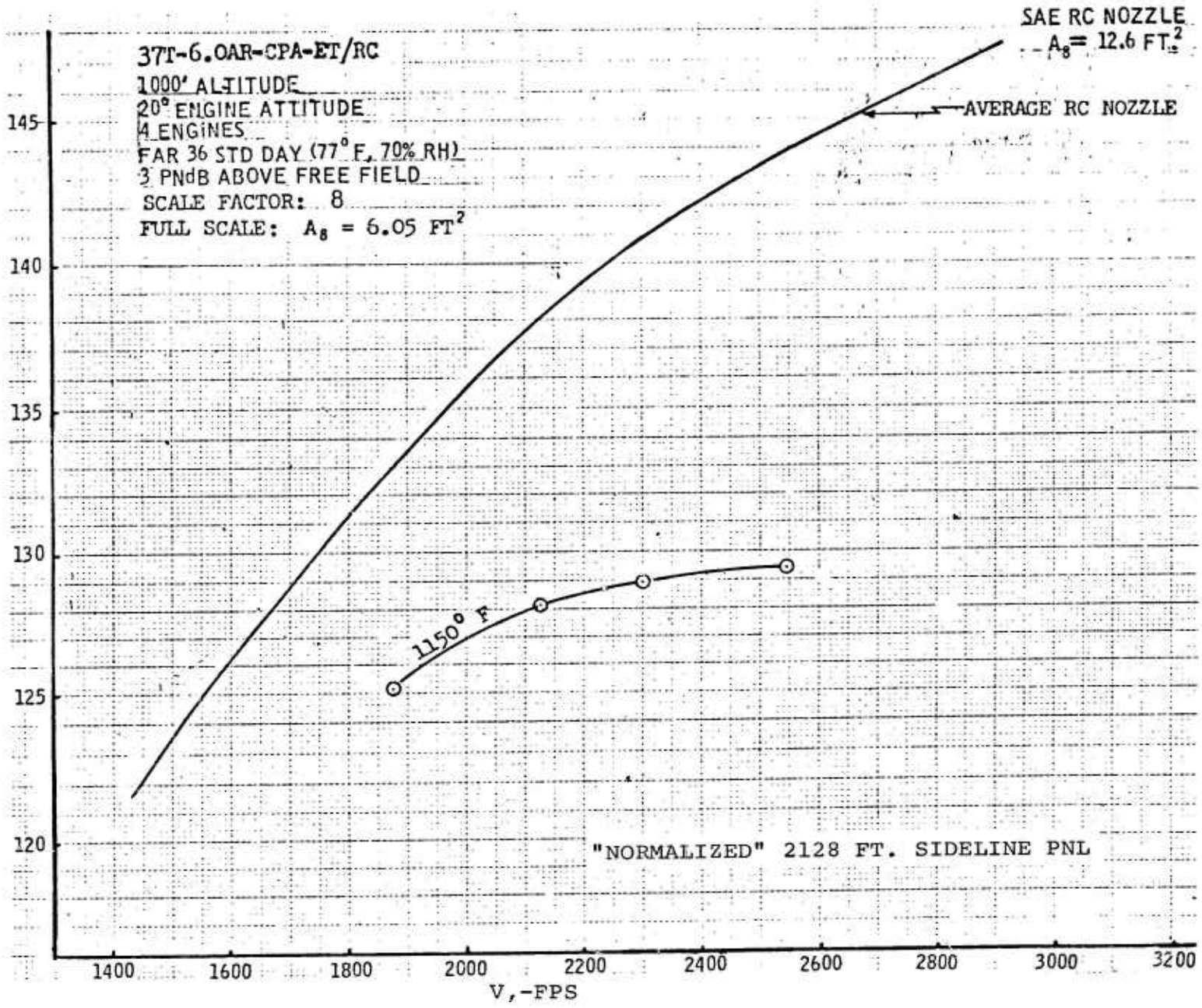
FREE FIELD VALUES

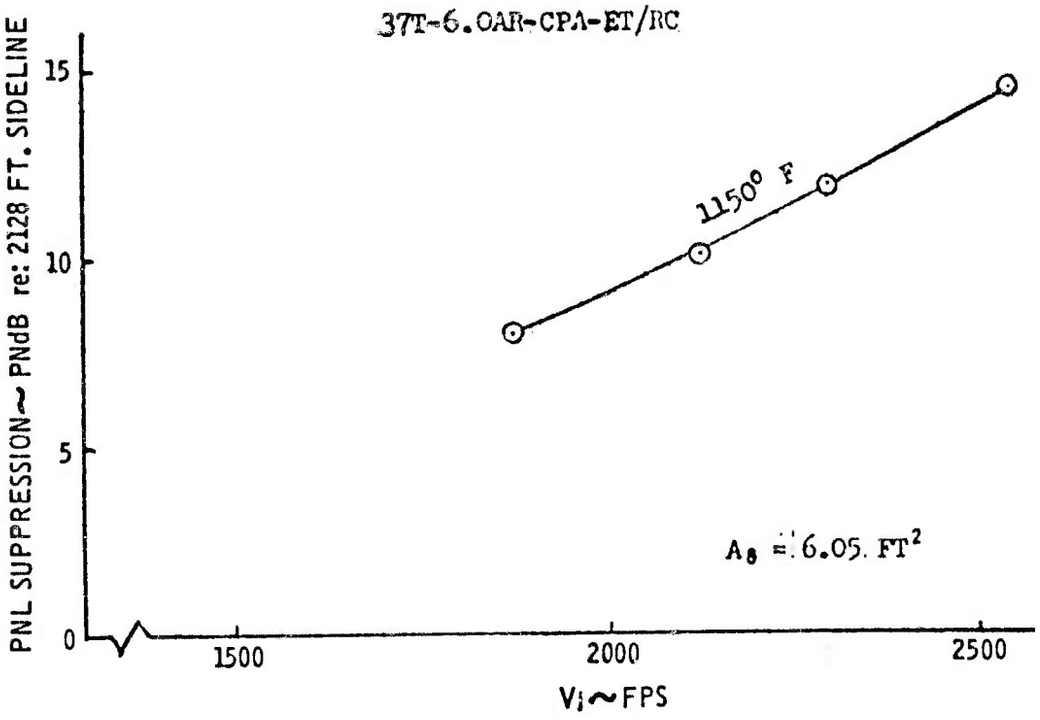


PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	193	2.00	1150°F
◇	193	2.50	1150
○	193	3.00	1150
▽	193	4.00	1150

NOZZLE: 37T-6.0AR-CPA-ET/RC

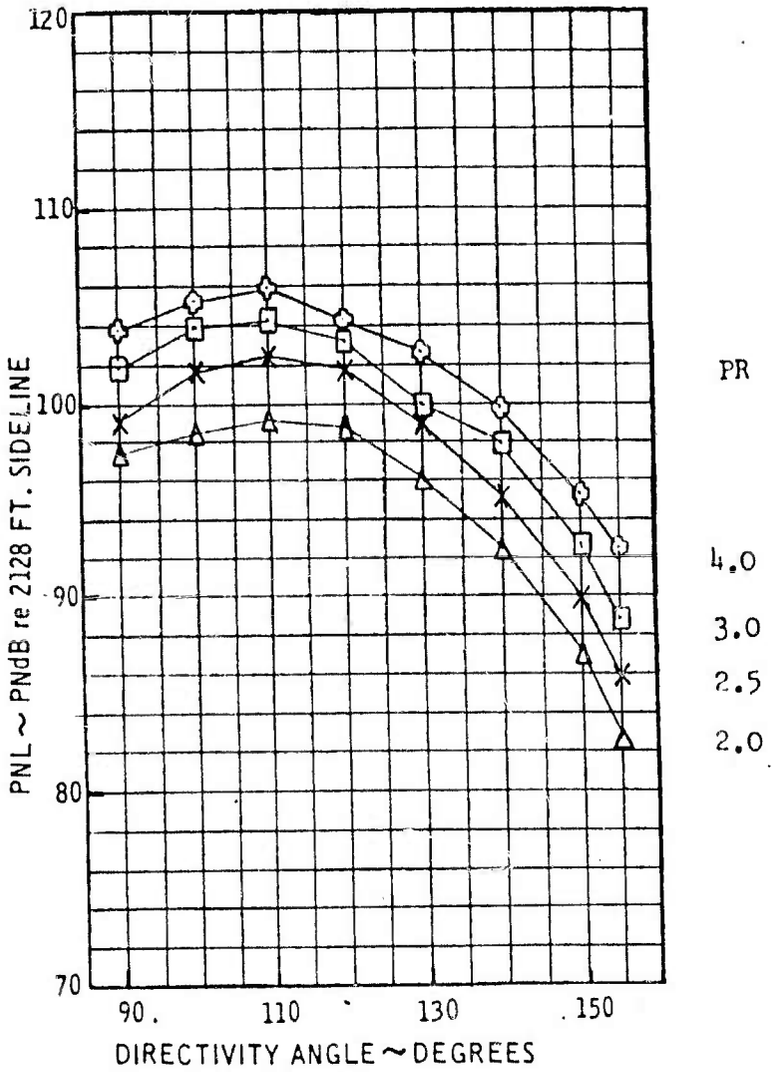
OASPL BEAM PATTERNS


37T-6.OAR-CPA-ET/RC
1000' ALTITUDE
20° ENGINE ATTITUDE
4 ENGINES
FAR 36 STD DAY (77° F, 70% RH)
3 PNdB ABOVE FREE FIELD
SCALE FACTOR: 8
FULL SCALE: A_8 = 6.05 FT^2
SAE RC NOZZLE
A_8 = 12.6 FT.^{2}
AVERAGE RC NOZZLE
1150° F
"NORMALIZED" 2128 FT. SIDELINE PNL
145
140
135
130
125
120
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
V,-FPS



PEAK PNL SUPPRESSION VALUES

NOZZLE: 37T-6.0AR-CPA-ET/RC



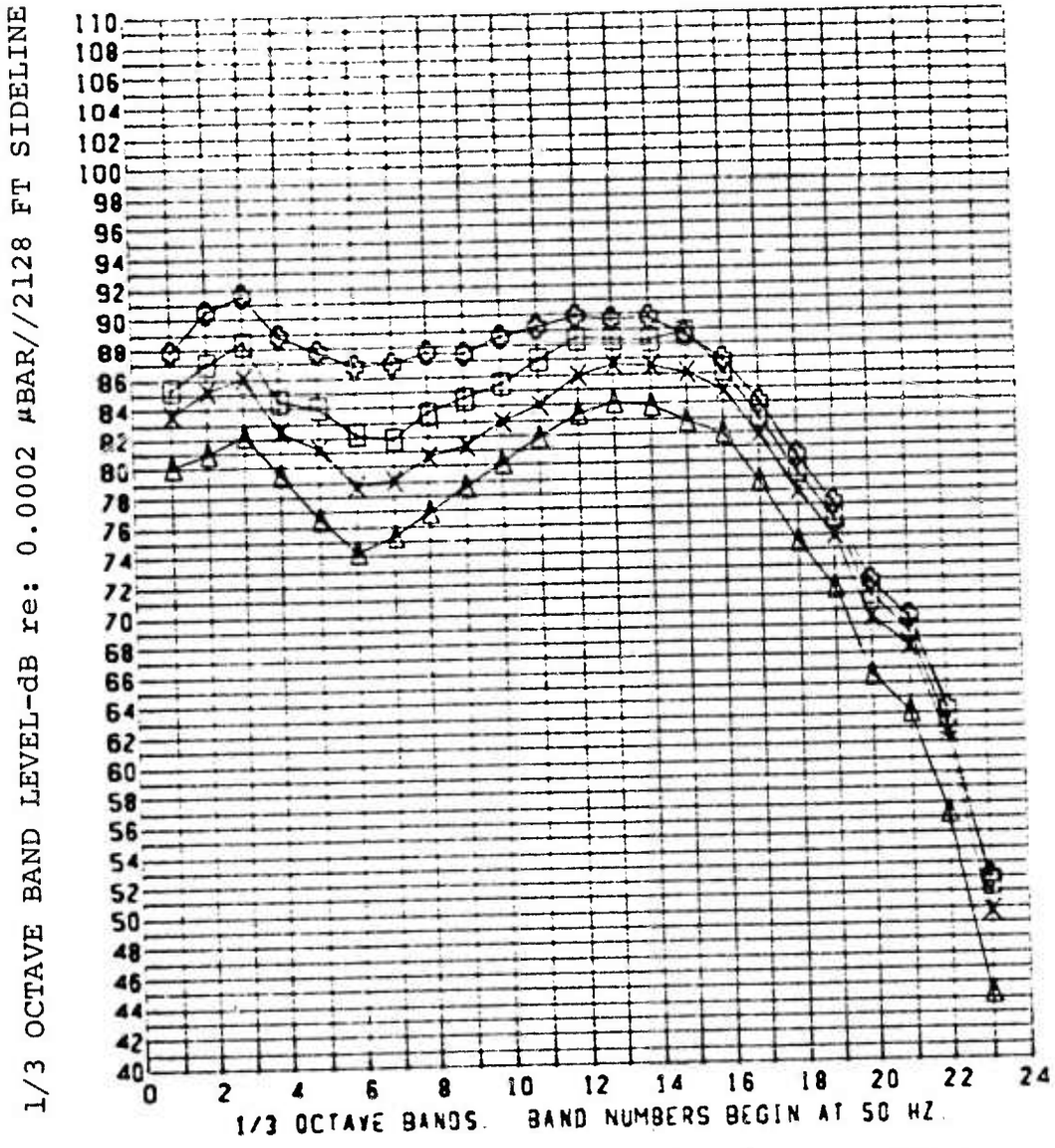
RUN 193

$T_T = 1150^0$ F $A_8 = 6.05$ FT^2

PNL BEAM PATTERNS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 110 DEG TEMP = 77 DEG R.H. = 70 PER CENT



T_T = 1150°F A_8 = 6.05 FT^2 RUN: 193

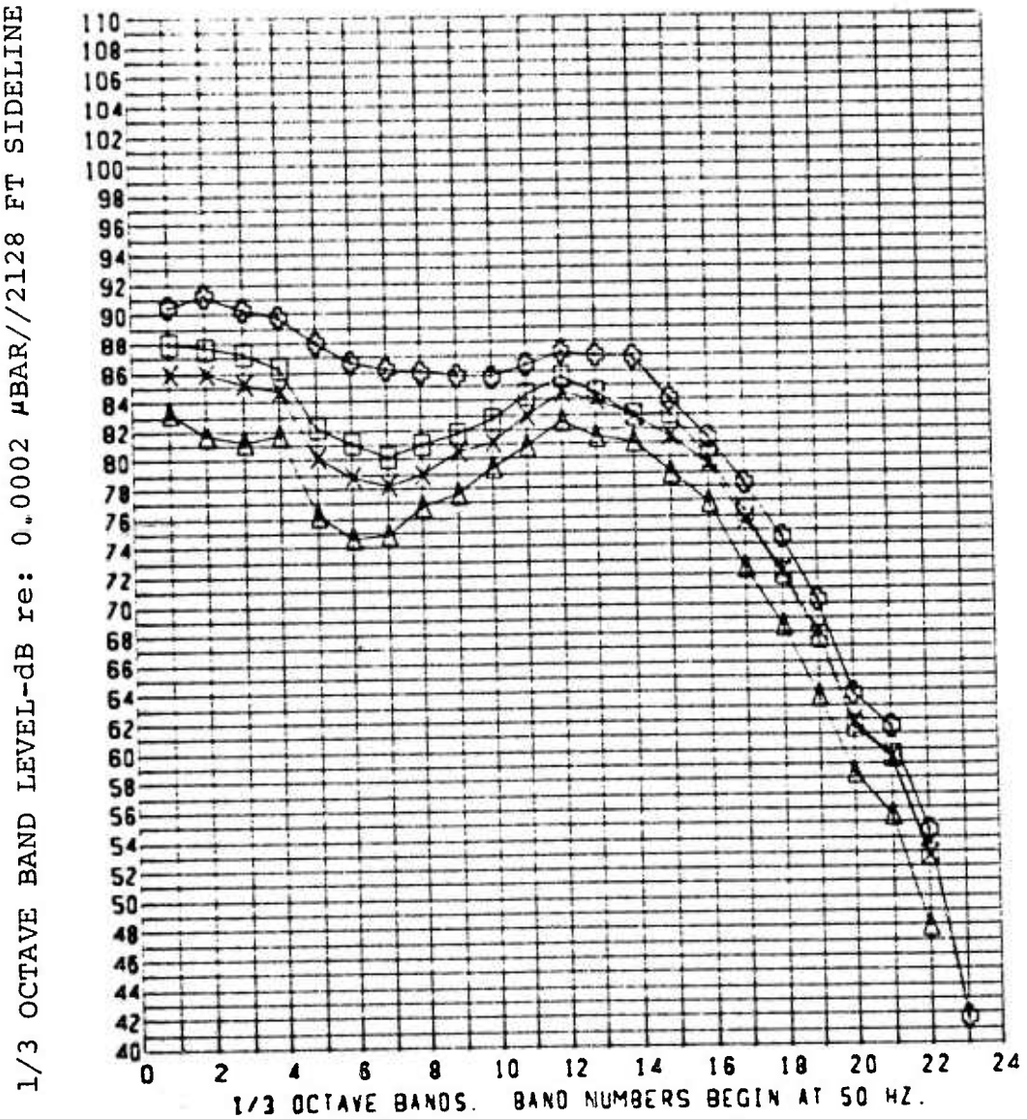
PR = △ 2.0, X 2.5, □ 3.0, ✣ 4.0

NOZZLE: 37T-6.0AR-CPA-ET/RC

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 110°
re: NOZZLE INLET AXIS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 130 DEG TEMP = 77 DEG R.H. = 70 PER CENT



T_T = 1150°F A_8 = 6.05 FT^2 RUN: 193

PR = △ 2.0, X 2.5, □ 3.0, ✣ 3.4, ◇ 4.0

NOZZLE: 37T-6.0AR-CPA-ET/RC

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 130°

re: NOZZLE INLET AXIS

TEST CONDITIONS

NOZZLE: 37T-6.0AR-CPA-ET/RC

FACILITY: WALL ISOLATION FACILITY

DATE: January 15, 1973

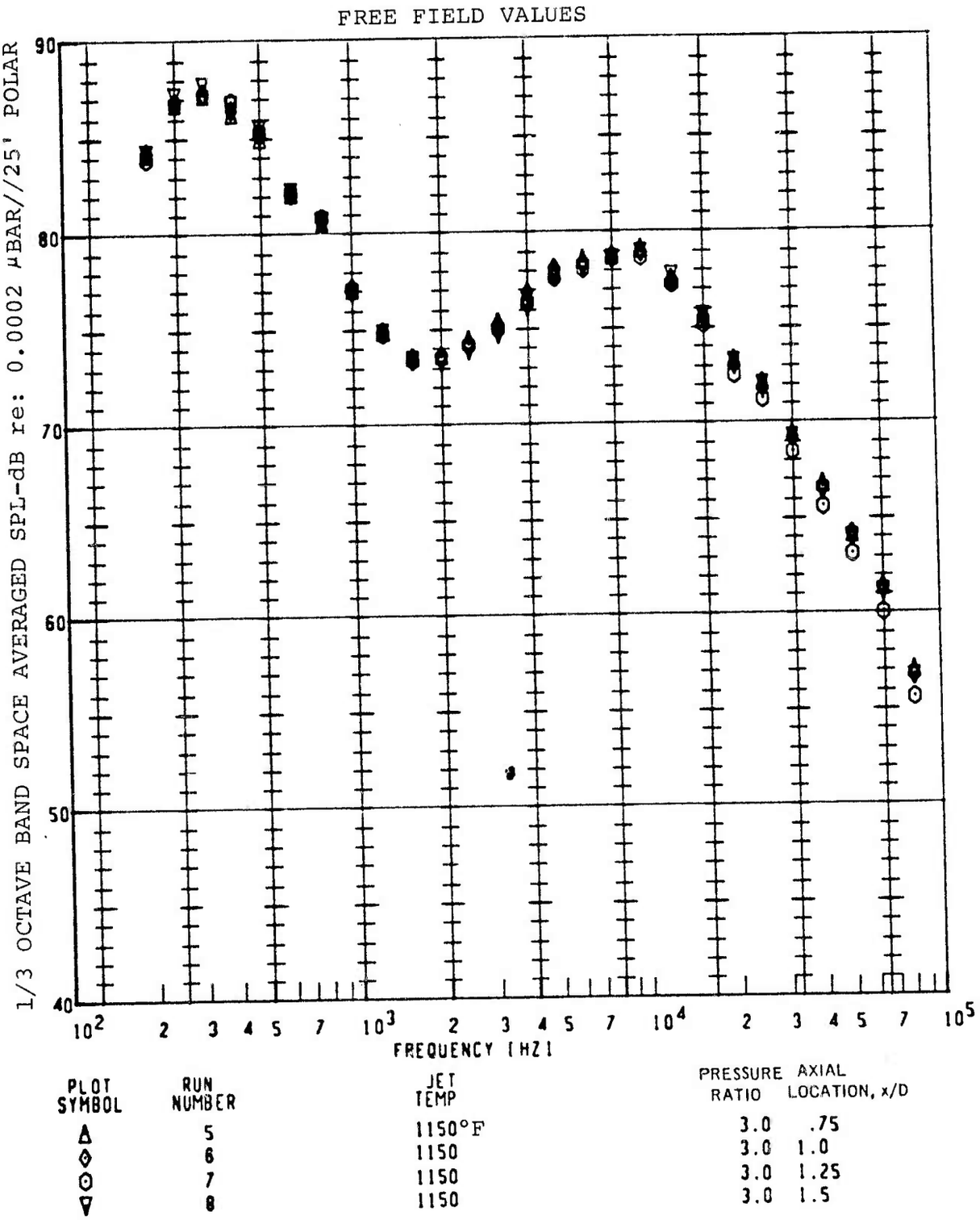
P_{AMB} = 29.58 in Hg T_{AMB} = 46°F **R.H.** = 78%

NPR = 3.0 T_T = 1150°F V_J (IDEAL) = 2300 FPS

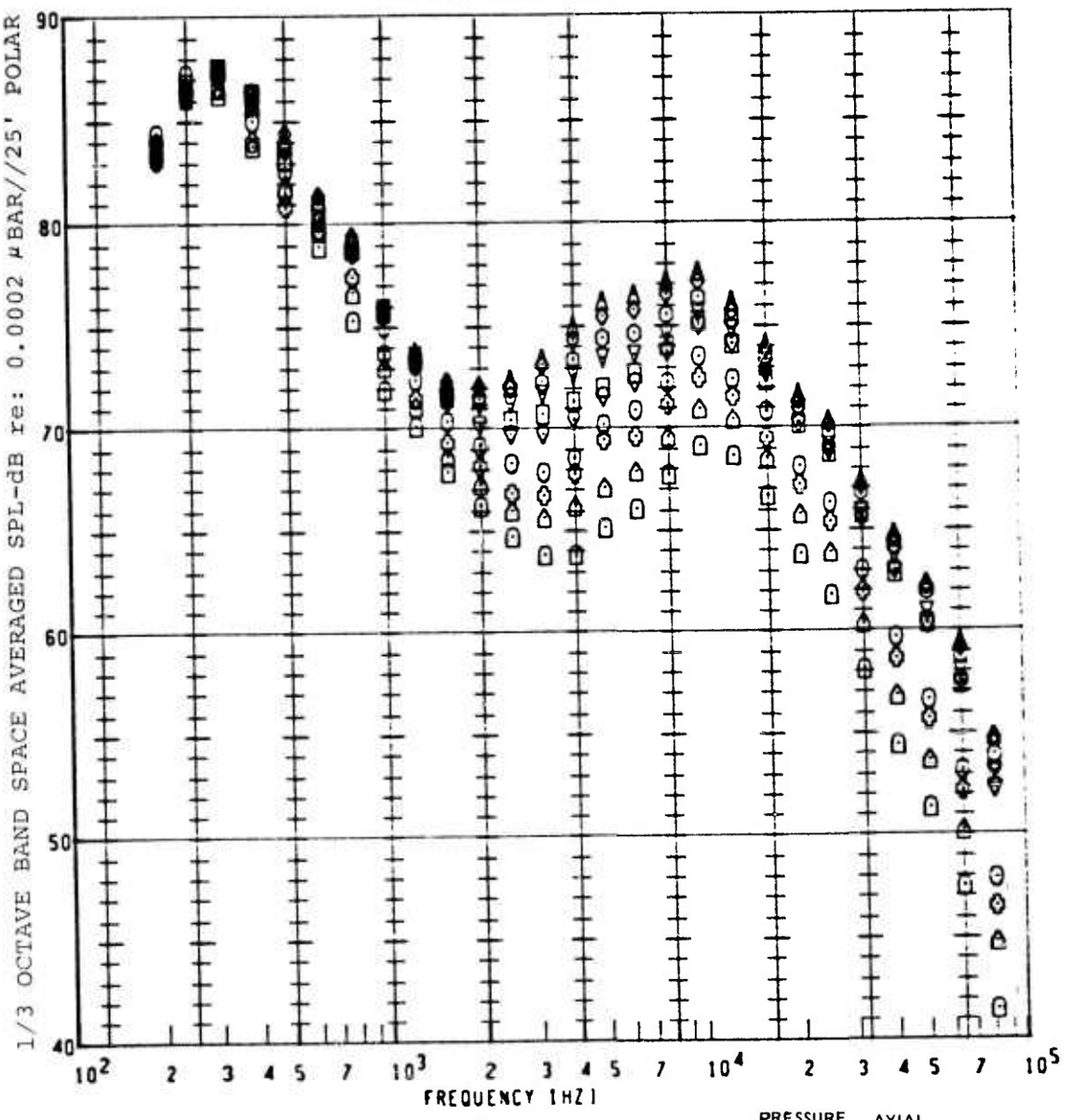
SCALE MODEL A_8 = 13.6 in.^{2}

RUN NO.	AXIAL LOCATION	IRIS DIA.	REMARKS	REF.
2	0.0 x/D	12.5 in.		
3	.25	12.5		
4	.50	13.0		
5	.75	13.0		
6	1.00	13.5		
7	1.25	13.5		
8	1.50	14.0		
9	1.75	14.0		
10	2.00	14.5		
11	2.25	14.5		
12	2.50	15.0		
13	2.75	15.0		
14	3.0	15.5		
15	3.5	15.5		
16	4.0	16.0		
17	5.0	19.0		
18	6.0	20.0		
19	8.0	22.0		
20	10.0	24.0		
21	12.0	27.5		

MICROPHONE LAYOUT: 25 FOOT VERTICAL POLAR ARC

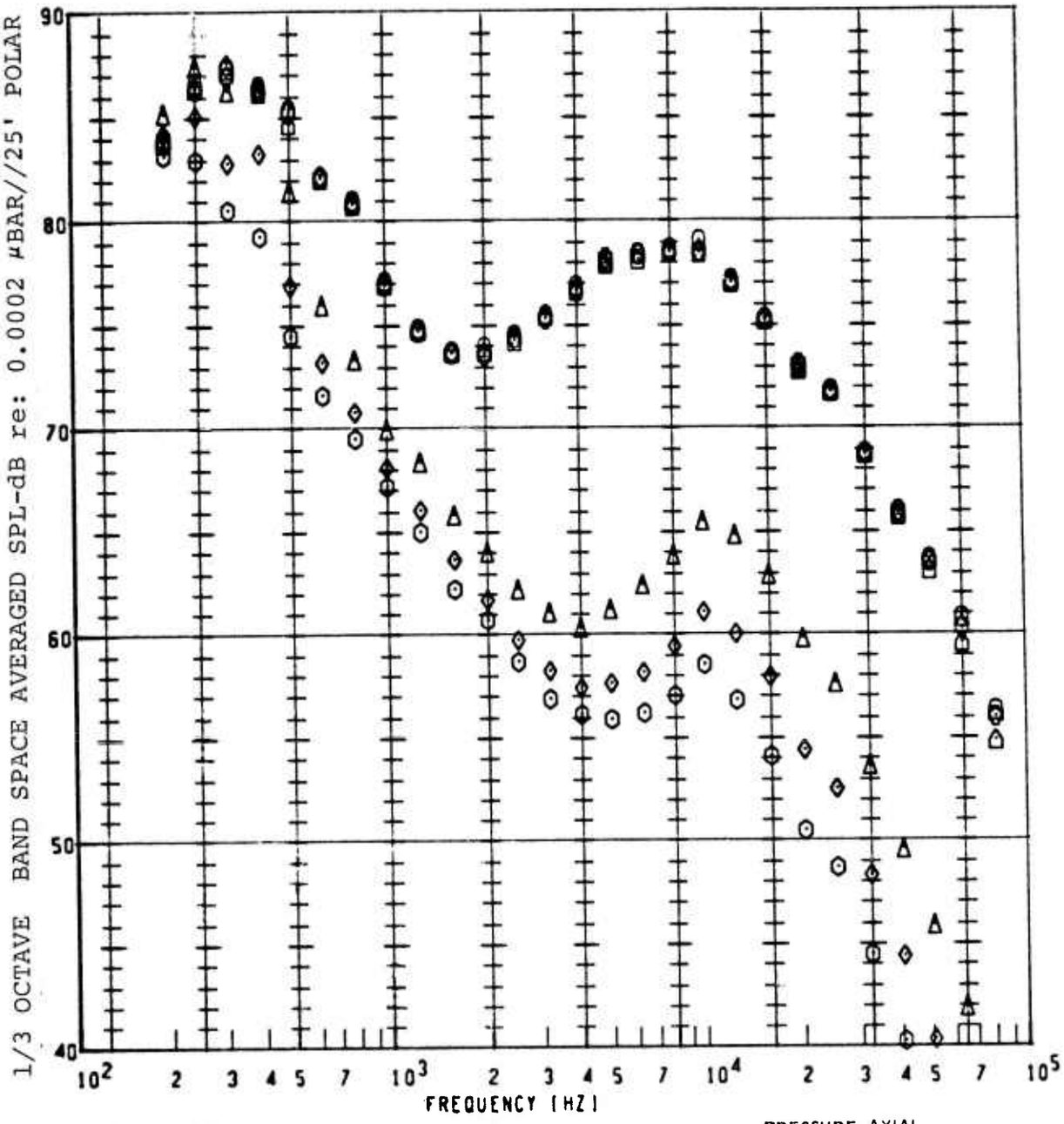

FREE FIELD VALUES
1/3 OCTAVE BAND SPACE AVERAGED SPL-dB re: 0.0002 μBAR//25' POLAR
90
80
70
60
50
40
10^2 2 3 4 5 7 10^3 2 3 4 5 7 10^4 2 3 4 5 7 10^5
FREQUENCY (HZ)
PLOT SYMBOL
RUN NUMBER
JET TEMP
PRESSURE RATIO
AXIAL LOCATION, x/D
△ 5 1150°F 3.0 .75
◇ 6 1150 3.0 1.0
⊙ 7 1150 3.0 1.25
▽ 8 1150 3.0 1.5

FREE FIELD VALUES

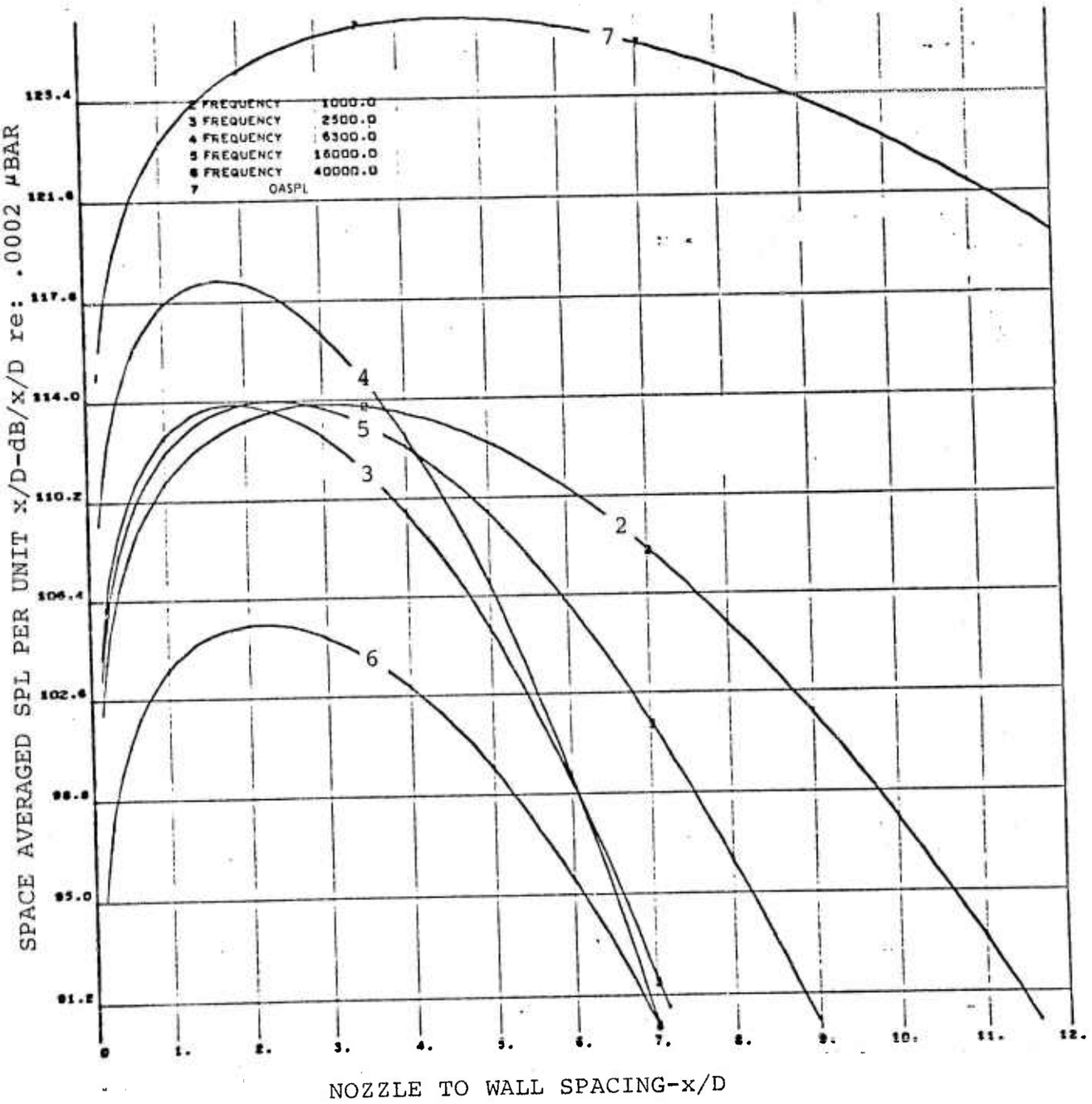


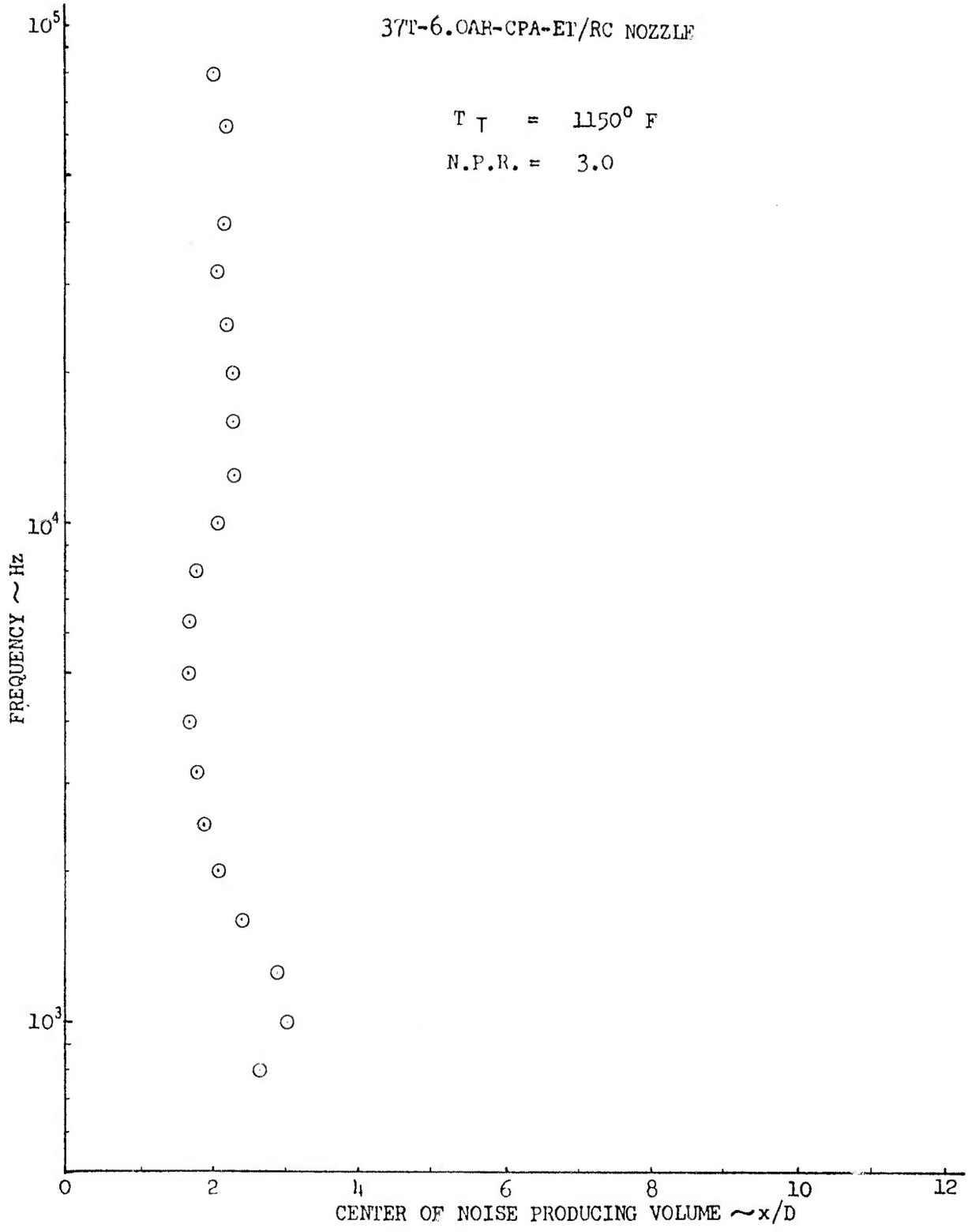
PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	AXIAL LOCATION, x/D
△	9	1150°F	3.0	1.75
◇	10	1150	3.0	2.0
○	11	1150	3.0	2.25
▽	12	1150	3.0	2.50
□	13	1150	3.0	2.75
▽	14	1150	3.0	3.0
○	15	1150	3.0	3.50
◇	16	1150	3.0	4.0
△	17	1150	3.0	5.0
□	18	1150	3.0	6.0

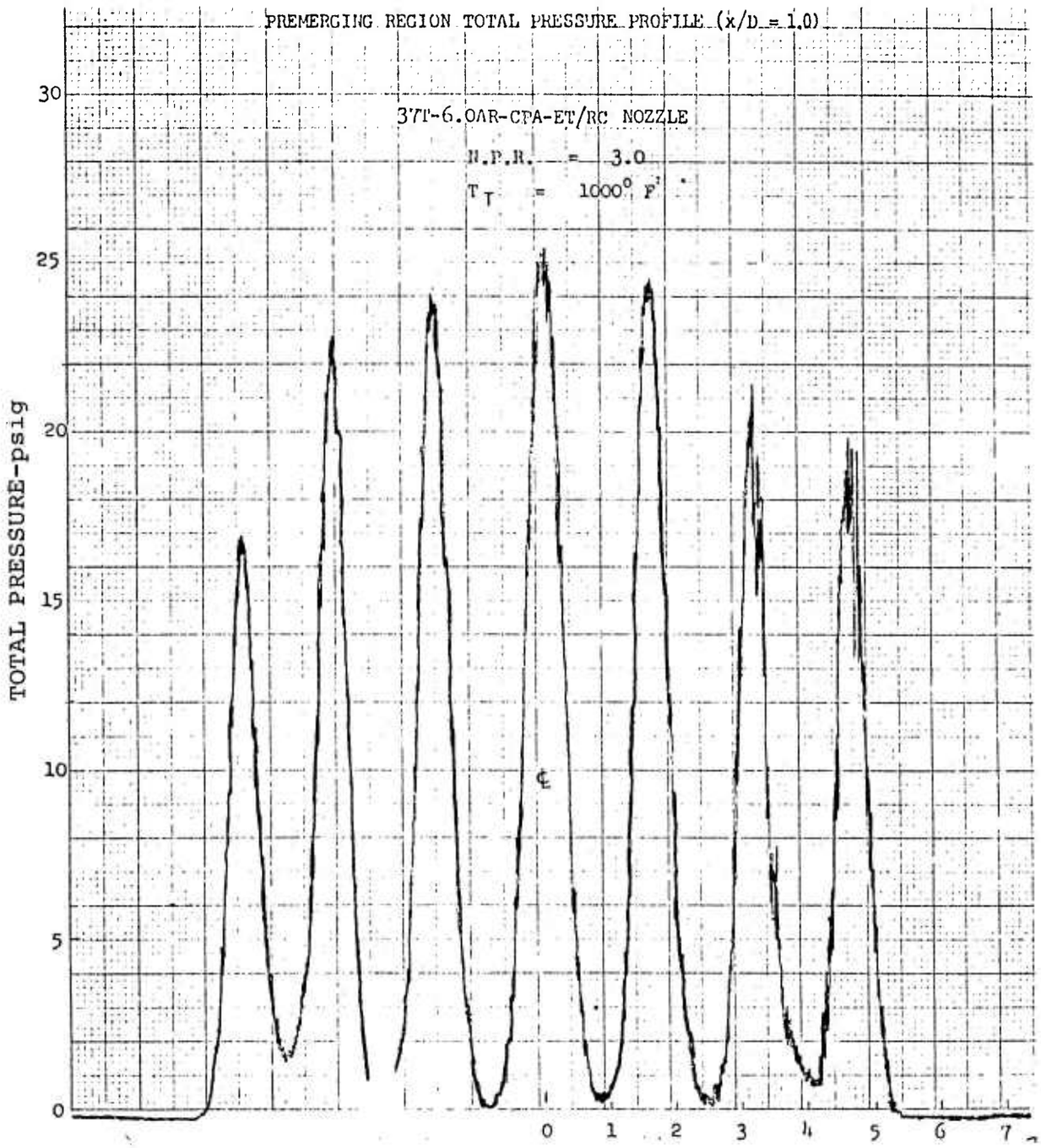
FREE FIELD VALUES

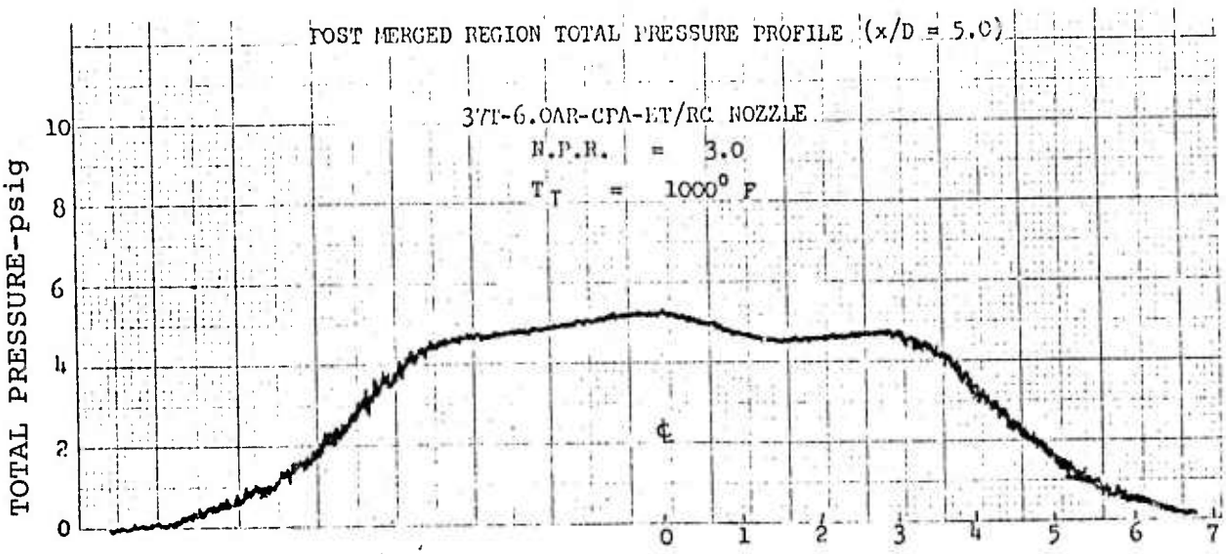


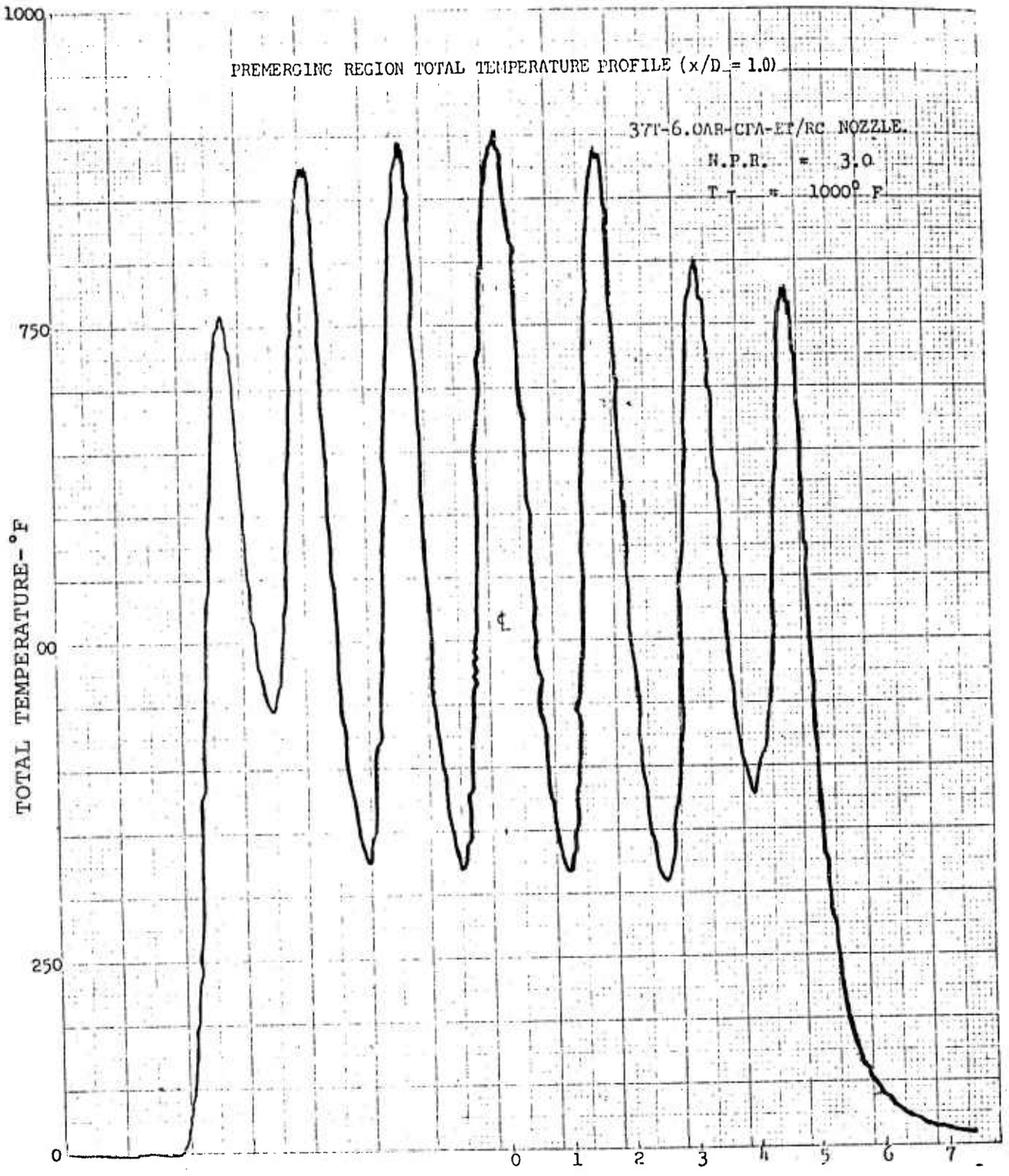
PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	AXIAL LOCATION, x/D
△	19	1150°F	3.0	8.0
◇	20	1150	3.0	0.0
⊙	21	1150	3.0	2.0
⊙	2	1150	3.0	0
△	3	1150	3.0	.25
□	4	1150	3.0	.5

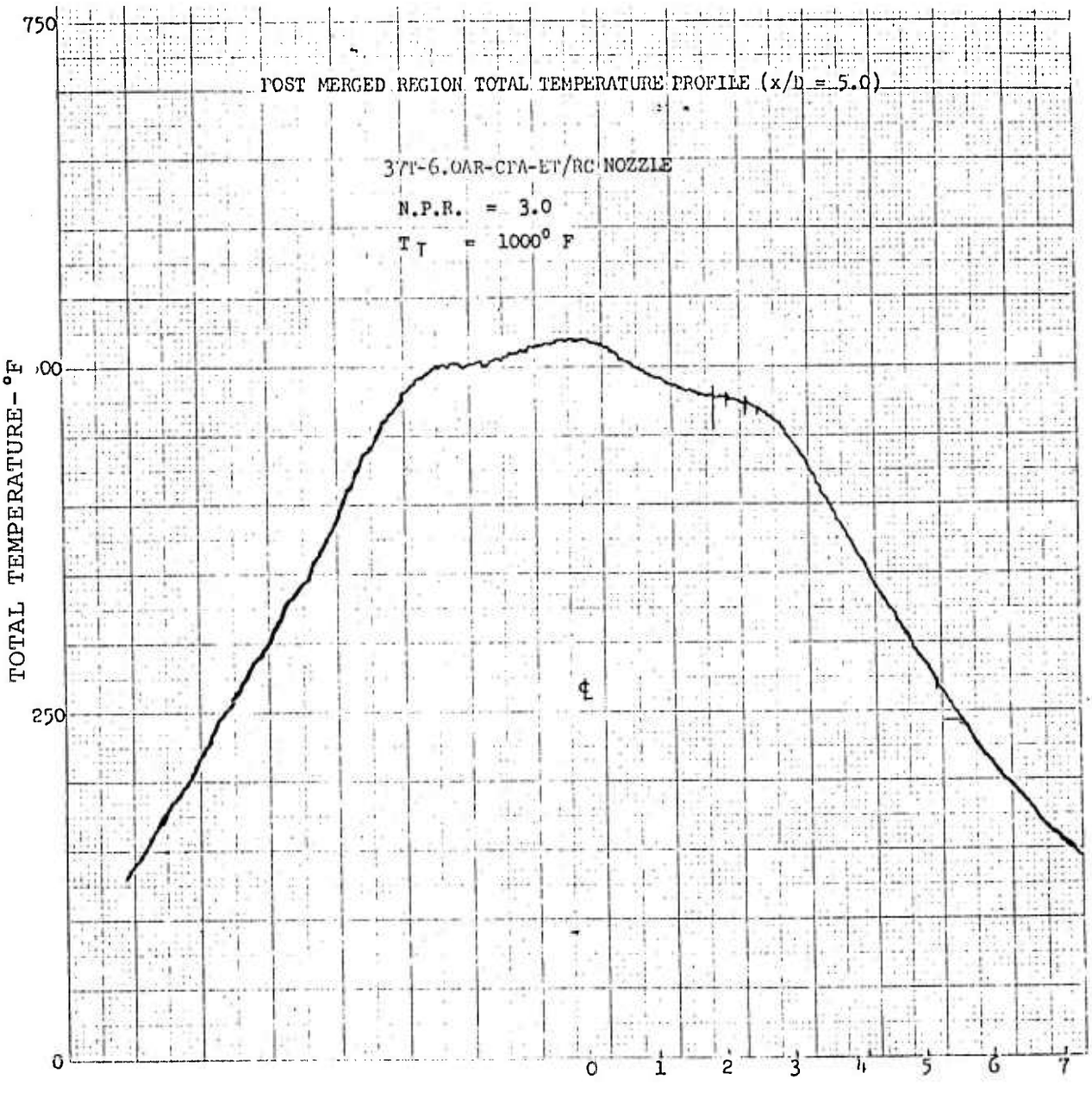

2 FREQUENCY 1000.0
3 FREQUENCY 2500.0
4 FREQUENCY 6300.0
5 FREQUENCY 16000.0
6 FREQUENCY 40000.0
7 OASPL
SPACE AVERAGED SPL PER UNIT x/D-dB/x/D re: .0002 μBAR
123.4
121.6
117.8
114.0
110.2
106.4
102.6
98.8
95.0
91.2
0
1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.
NOZZLE TO WALL SPACING-x/D


37T-6.0AR-CPA-ET/RC NOZZLE
T_T = 1150° F
N.P.R. = 3.0
10^5
10^4
10^3
FREQUENCY ~ Hz
0
2
4
6
8
10
12
CENTER OF NOISE PRODUCING VOLUME ~x/D

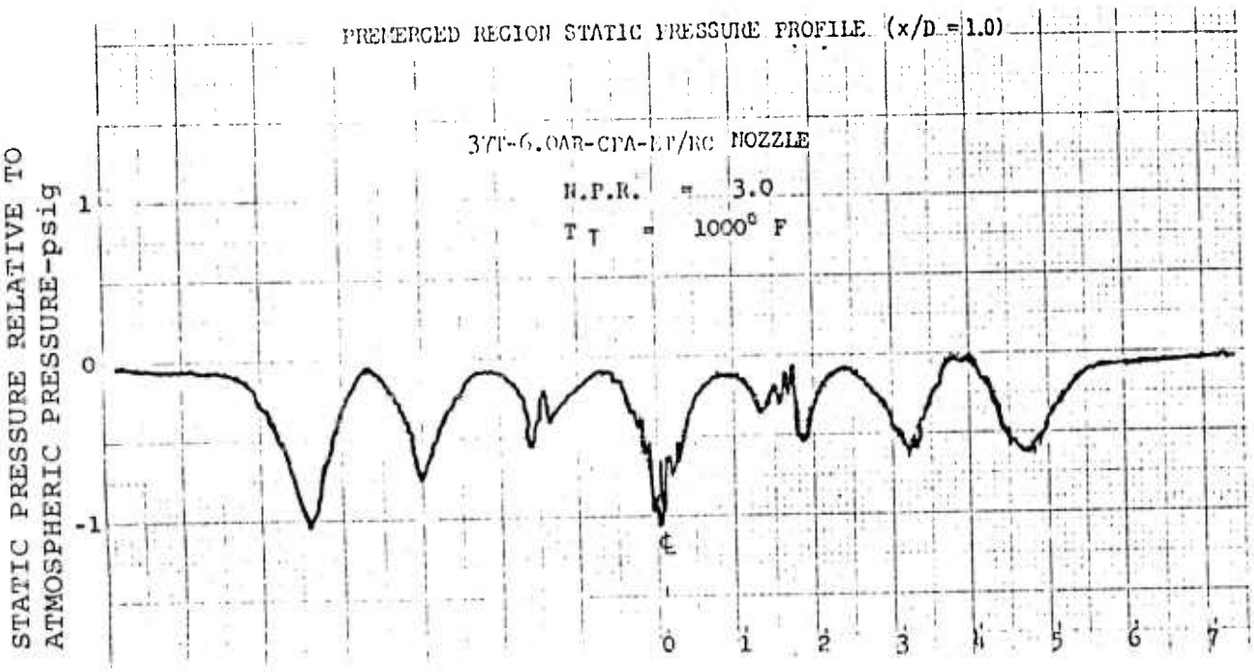

PREMERGING REGION TOTAL PRESSURE PROFILE (x/D = 1.0)
3TT-6.0AR-CPA-ET/RC NOZZLE
N.P.R. = 3.0
T_T = 1000° F
TOTAL PRESSURE-psig
0
5
10
15
20
25
30
℄
0 1 2 3 4 5 6 7
RADIAL DISTANCE FROM JET ℄-in.

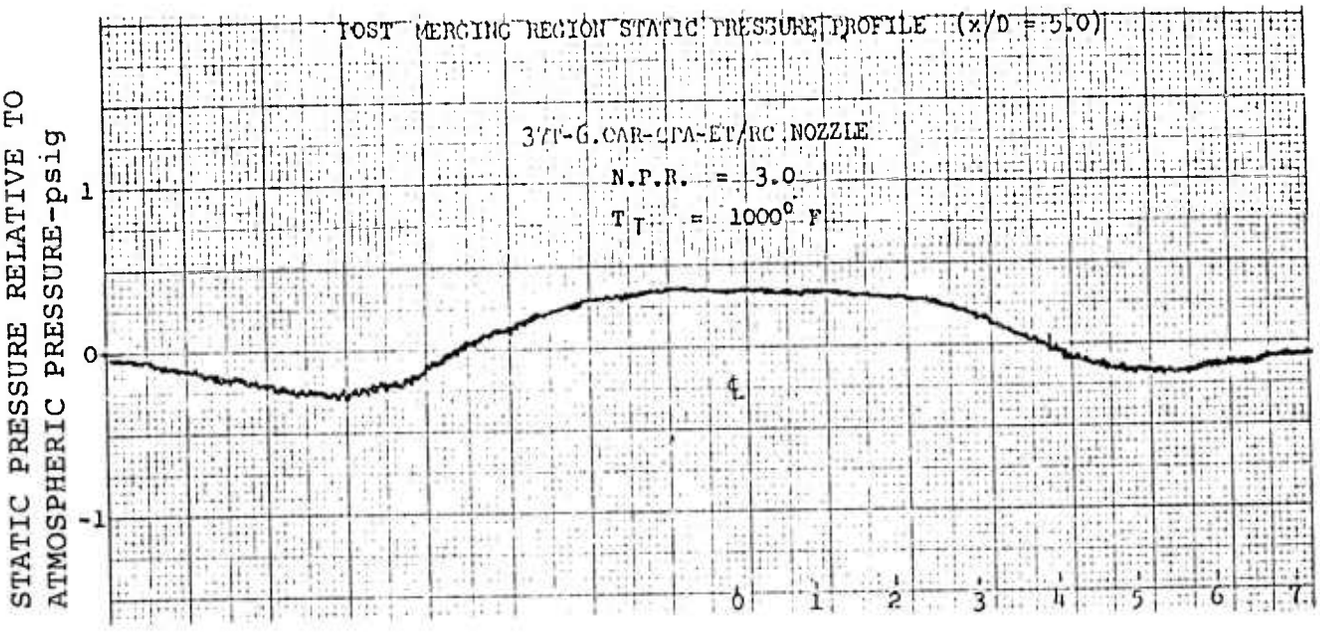

POST MERGED REGION TOTAL PRESSURE PROFILE (x/D = 5.0)
3TT-6.0AR-CPA-ET/RC NOZZLE
N.P.R. = 3.0
T_T = 1000° F
TOTAL PRESSURE-psig
0
2
4
6
8
10
℄
0
1
2
3
4
5
6
7
RADIAL DISTANCE FROM JET ℄-in.

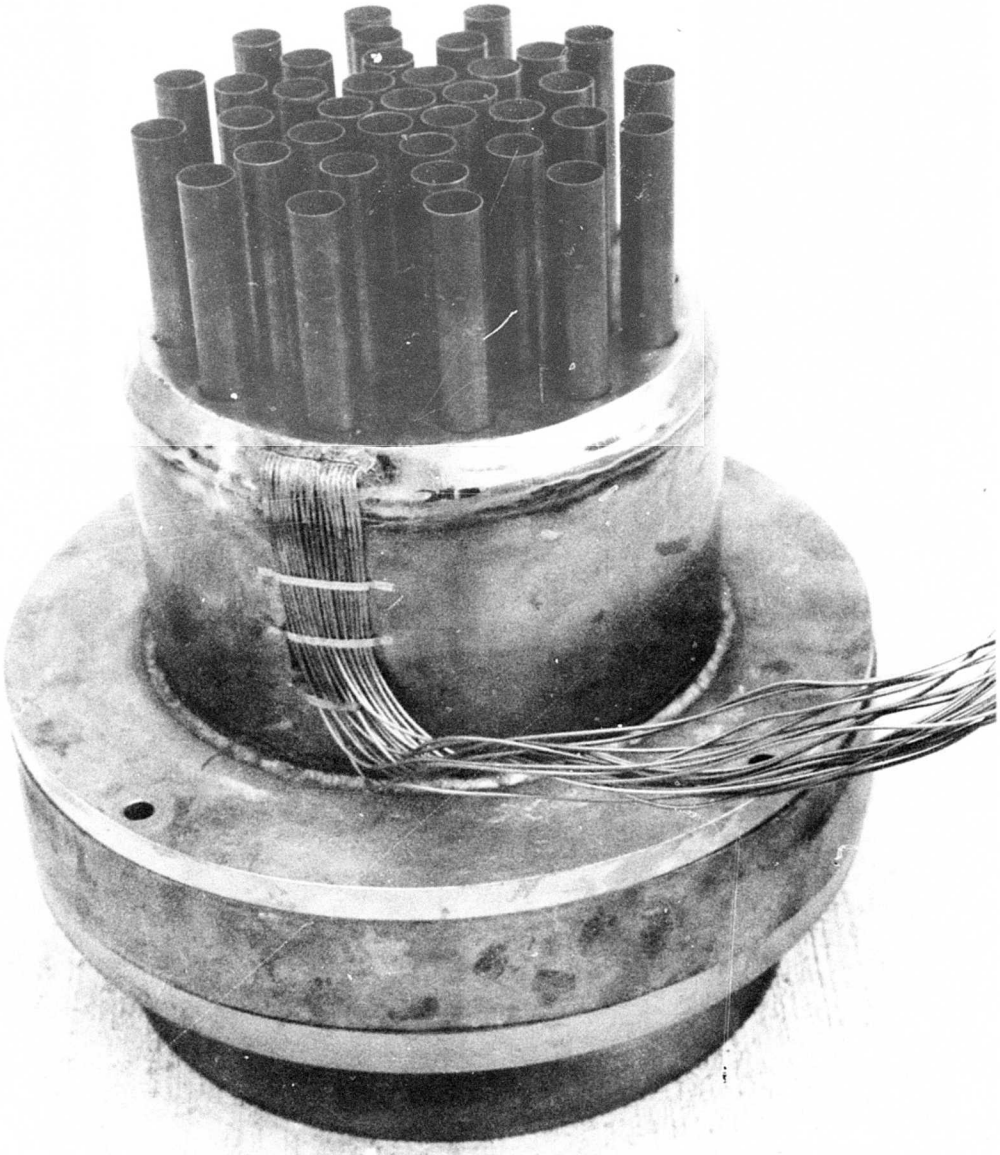

PREMERGING REGION TOTAL TEMPERATURE PROFILE (x/D = 1.0)
37T-6.0AR-CTA-ET/RC NOZZLE.
N.P.R. = 3.0
T T = 1000° F
TOTAL TEMPERATURE- °F
1000
750
500
250
0
℄
0
1
2
3
4
5
6
7
RADIAL DISTANCE FROM JET ℄-in.



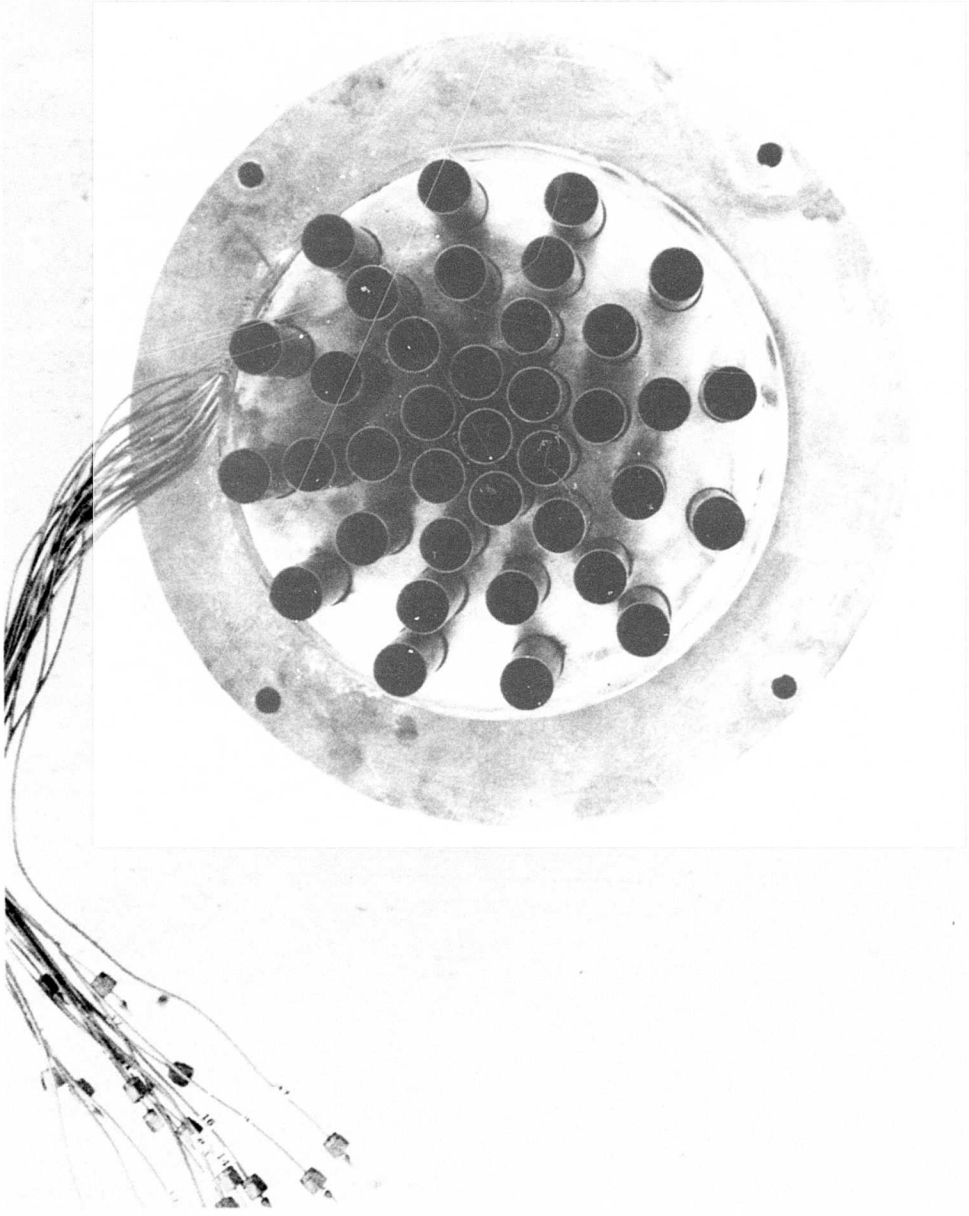
RADIAL DISTANCE FROM JET ℄-in.


PREMERGED REGION STATIC PRESSURE PROFILE (x/D = 1.0)
3TT-6.0AR-CFA-LF/RC NOZZLE
N.P.R. = 3.0
T_T = 1000° F
STATIC PRESSURE RELATIVE TO ATMOSPHERIC PRESSURE-psig
1
0
-1
℄
0
1
2
3
4
5
6
7
RADIAL DISTANCE FROM JET ℄-in.


TOST MERGING REGION STATIC PRESSURE PROFILE (x/D = 5.0)
37T-G.CAR-GPA-ET/RC NOZZLE
N.P.R. = 3.0
T_T = 1000° F
STATIC PRESSURE RELATIVE TO ATMOSPHERIC PRESSURE-psig
1
0
-1
℄
0
1
2
3
4
5
6
7
RADIAL DISTANCE FROM JET ℄-in.



37T-3.3AR-RA-RT/NC NOZZLE



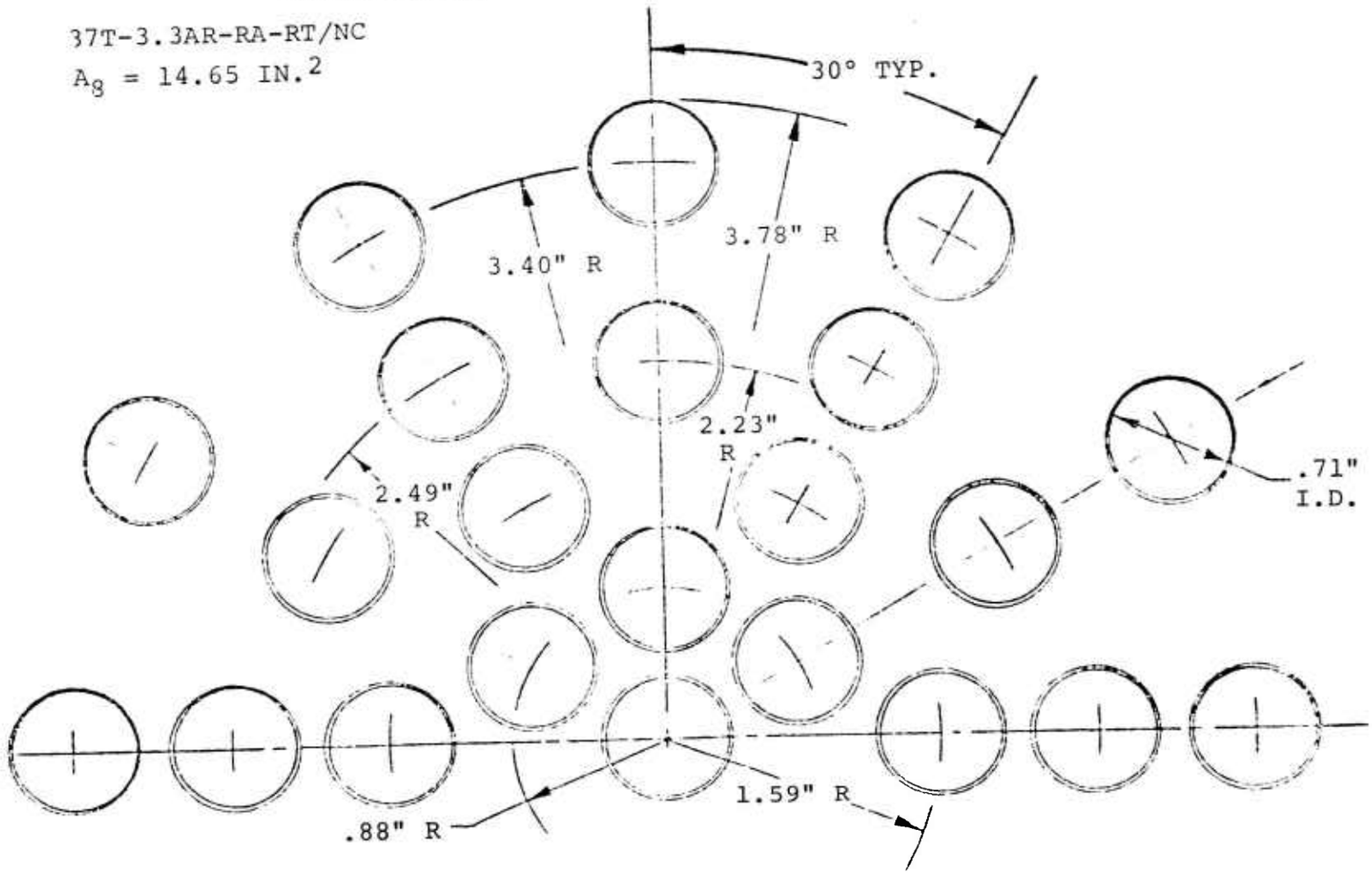
37T-3.3AR-RA-RT/NC NOZZLE

MAR'L-.75" DIA. .020 WALL

TUBE LENGTH = 6.0" (EXIT PLANE TO TUBE HOLDER PLATE)

37T-3.3AR-RA-RT/NC

A_8 = 14.65 IN.^{2}



37 TUBE - AREA RATIO 3.3 STRAIGHT TUBES RADIAL ARRAY

TEST CONDITIONS

NOZZLE: 37T-3.3AR-RA-ET/NC

FACILITY: HNTF

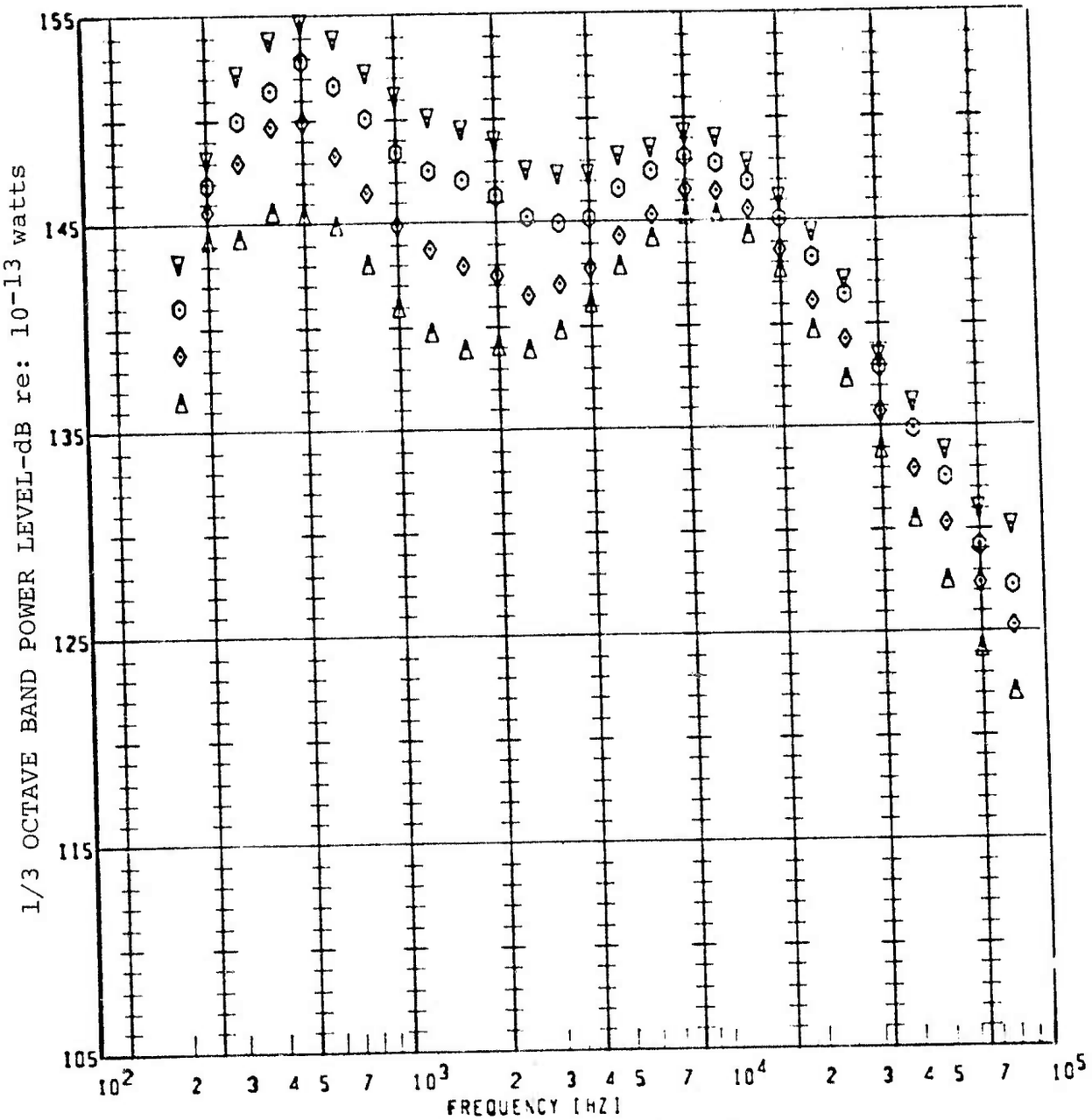
DATE: 6-11-73 T_{AMB} = 68°F **R.H.** = 58%

SCALE MODEL A_8 = 14.65 in.^{2}

RUN NO.	NPR	T_T	V_J (IDEAL)	REMARKS	REF
10	2.0	1150°F	1875 fps	6" tube lengths	
"	2.5	"	2126	" "	
"	3.0	"	2303	" "	
"	3.5	"	2437	" "	
"	4.0	"	2544	" "	

MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH CONCRETE GROUND SURFACE. MEASURED ACOUSTIC DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.

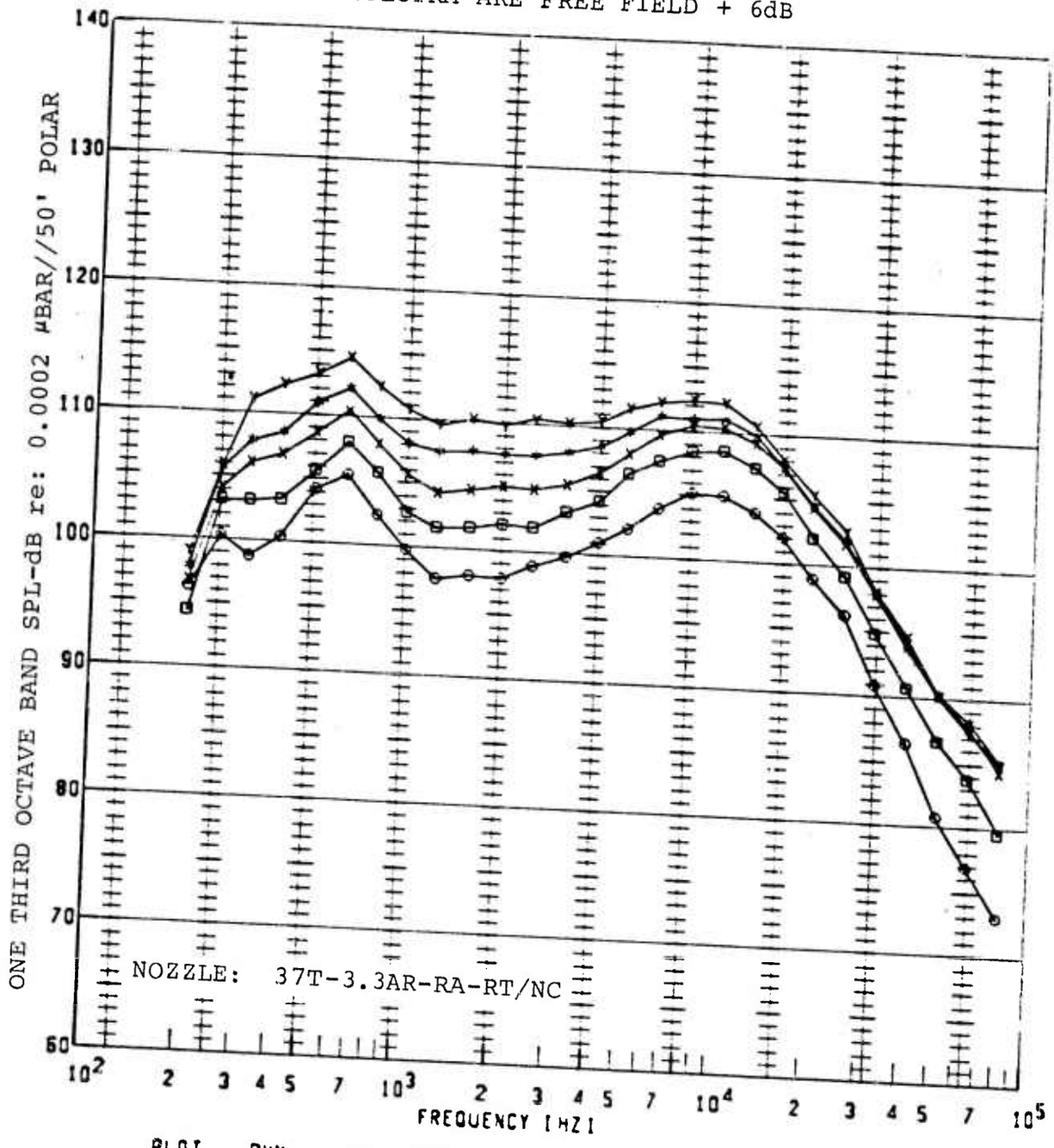
FREE FIELD VALUES



PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	010	2.50	1150°F
◇	010	3.00	1150
⊙	010	3.50	1150
▽	010	4.00	1150

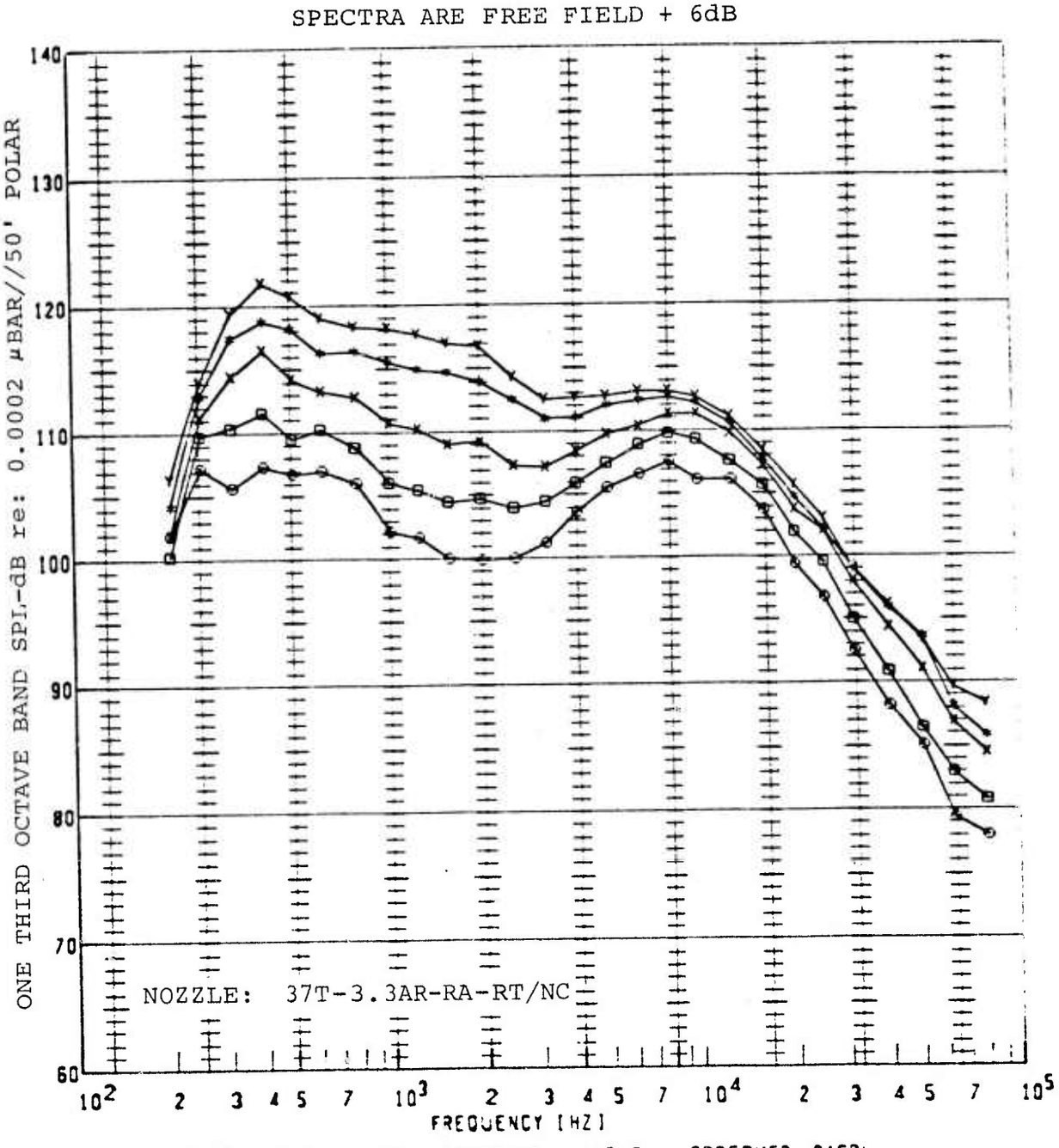
NOZZLE: 37T-3.3AR-RA-RT/NC

JET NOISE POWER SPECTRA



PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL (dB)
⊙	0106	1150°F	2.000	110°	50FP	115.2
⊡	0105	1150	2.500		50FP	118.4
x	0106	1150	3.000		50FP	120.7
*	0106	1150	3.500		50FP	122.2
Y	0106	1150	4.000		50FP	124.2

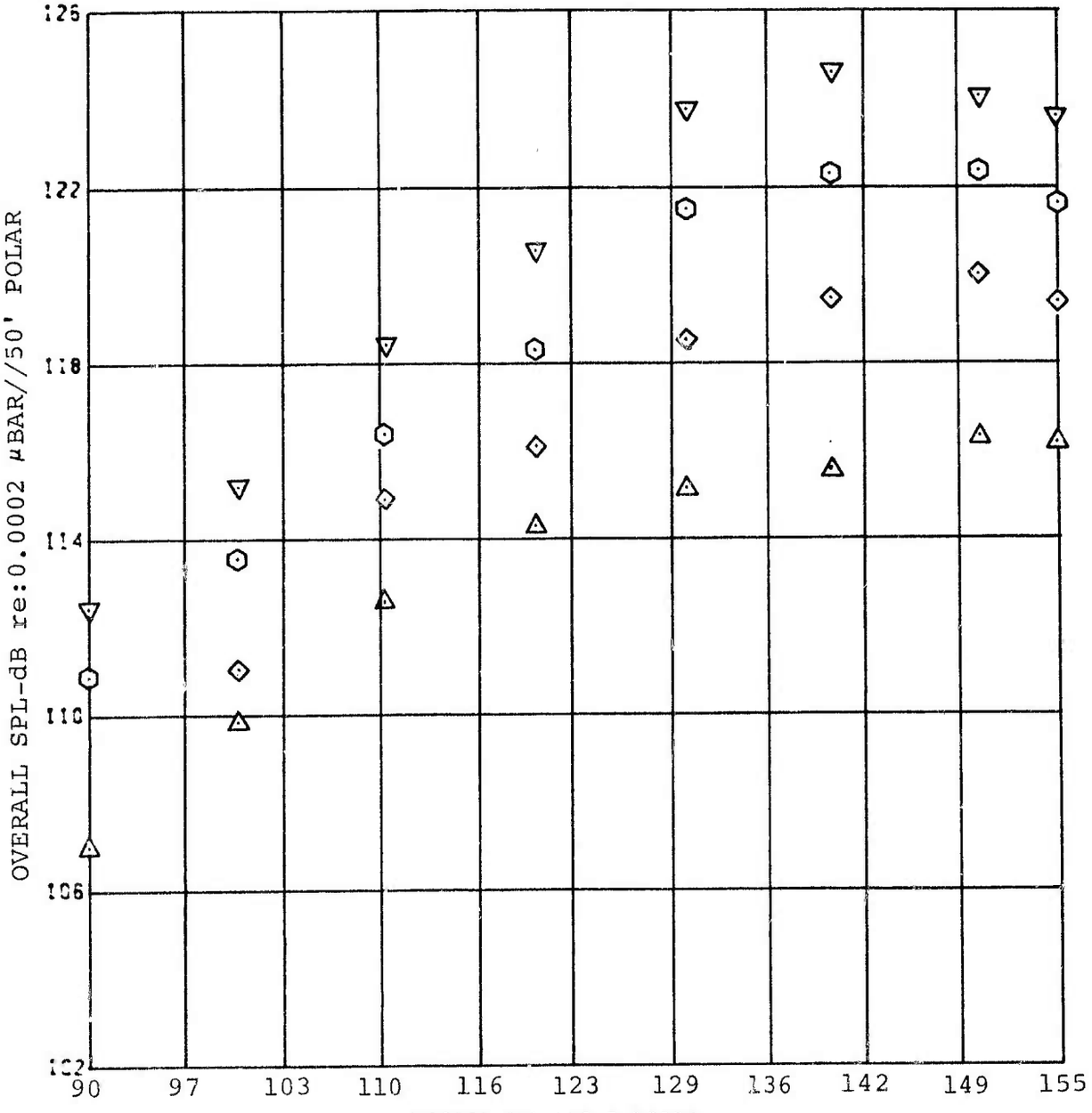
MEASURED NOISE SPECTRA AT 110° re: NOZZLE INLET AXIS



PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL [DB]
⊙	0106	1150°F	2.000	130°	SOFP	118.1
⊡	0103	1150	2.500		SOFP	121.1
x	0106	1150	3.000		SOFP	124.4
*	0106	1150	3.500		SOFP	127.5
Y	0106	1150	4.000		SOFP	129.6

MEASURED NOISE SPECTRA AT 130° re: NOZZLE INLET AXIS

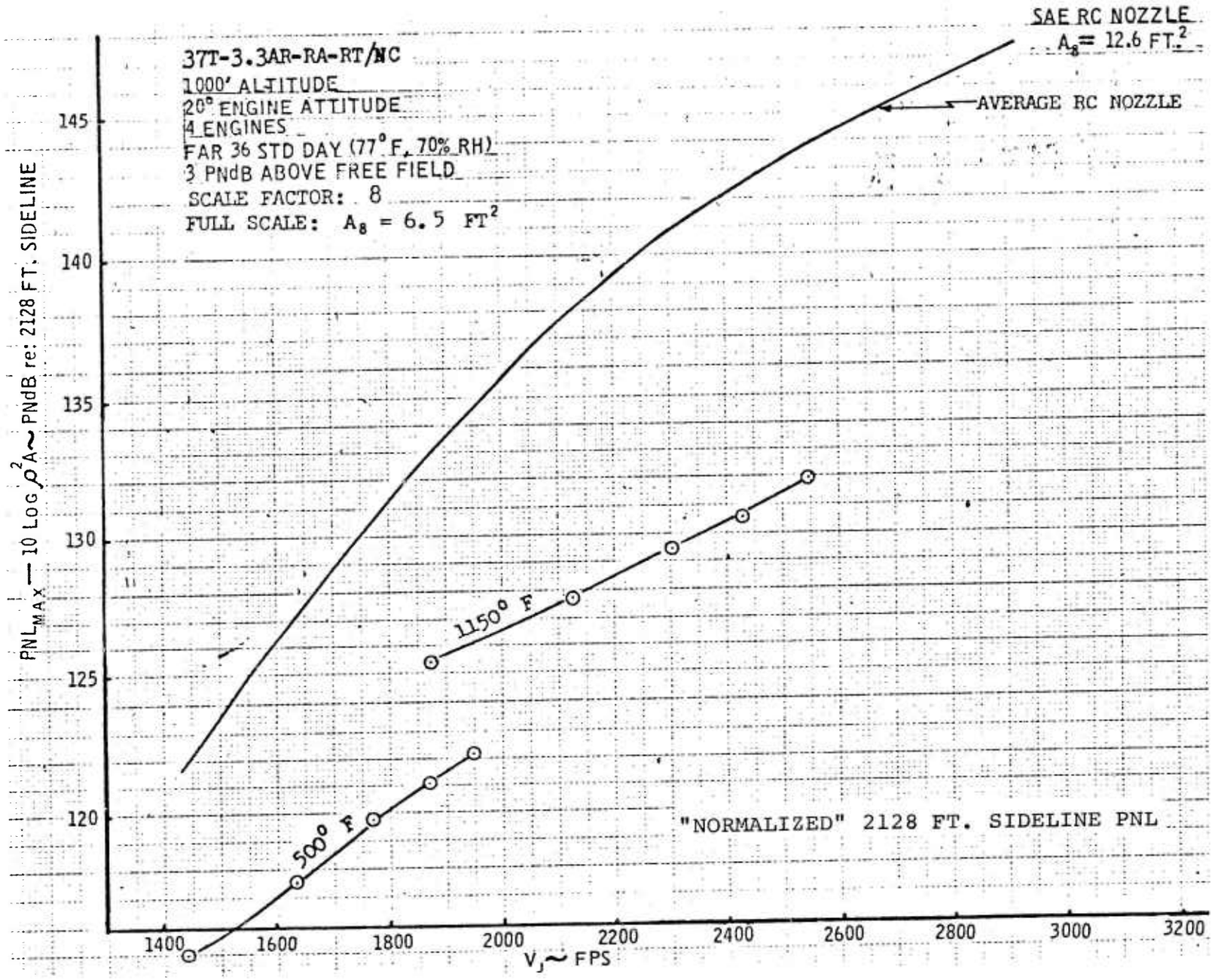
FREE FIELD VALUES

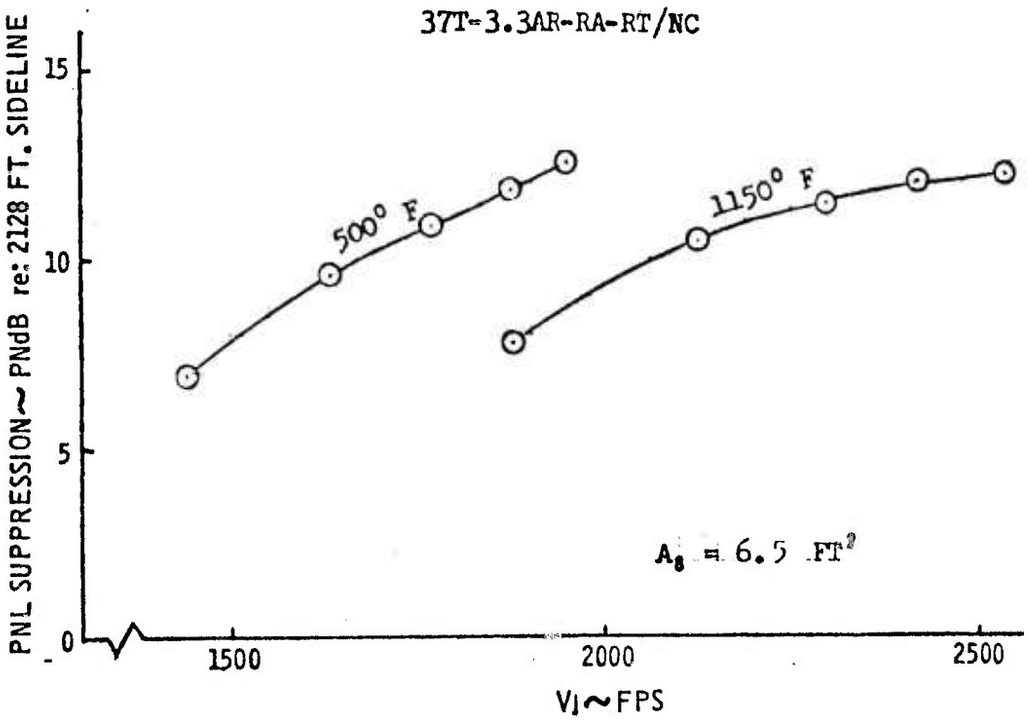


PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	010	2.50	1150°F
◇	010	3.00	1150
○	010	3.50	1150
▽	010	4.00	1150

NOZZLE: 37T-3.3AR-RA-RT/NC

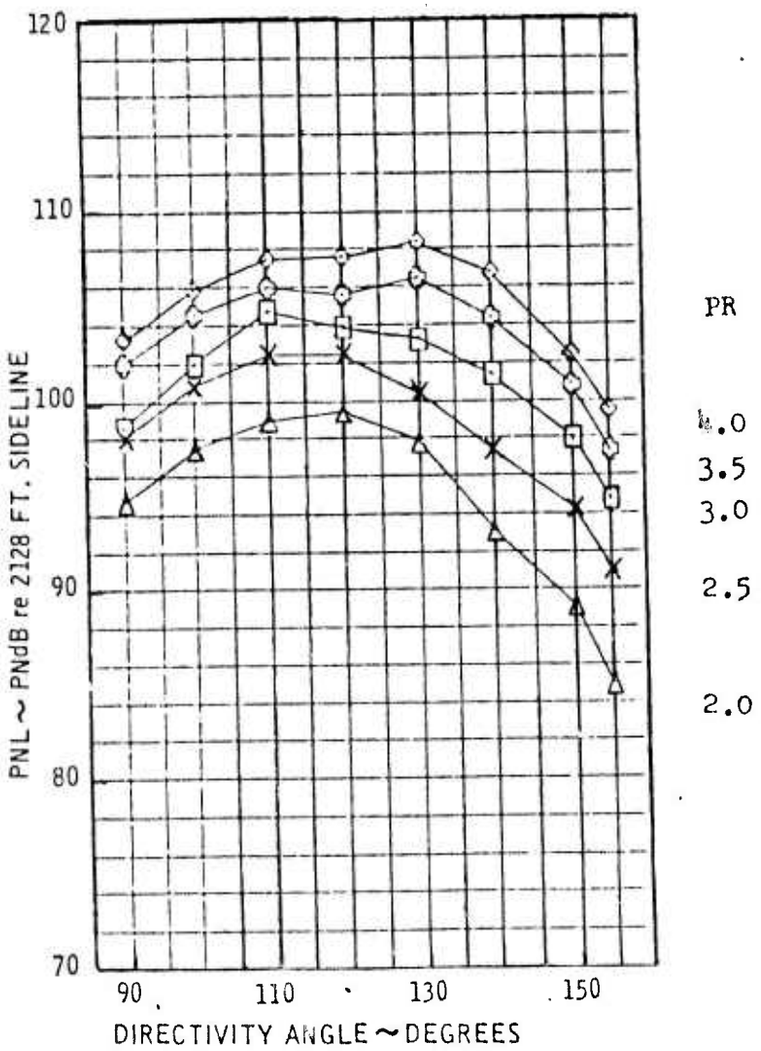
OASPL BEAM PATTERNS


37T-3.3AR-RA-RT/NC
1000' ALTITUDE
20° ENGINE ATTITUDE
4 ENGINES
FAR 36 STD DAY (77° F, 70% RH)
3 PNdB ABOVE FREE FIELD
SCALE FACTOR: 8
FULL SCALE: A_8 = 6.5 FT^2
SAE RC NOZZLE
A_8 = 12.6 FT.^{2}
AVERAGE RC NOZZLE
1150° F
500° F
"NORMALIZED" 2128 FT. SIDELINE PNL
PNL_{MAX} — 10 Log $\rho^2 A$ ~ PNdB re: 2128 FT. SIDELINE
145
140
135
130
125
120
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
V_j ~ FPS



PEAK PNL SUPPRESSION VALUES

NOZZLE: 37T-3.3AR-RA-RT/[redacted]C



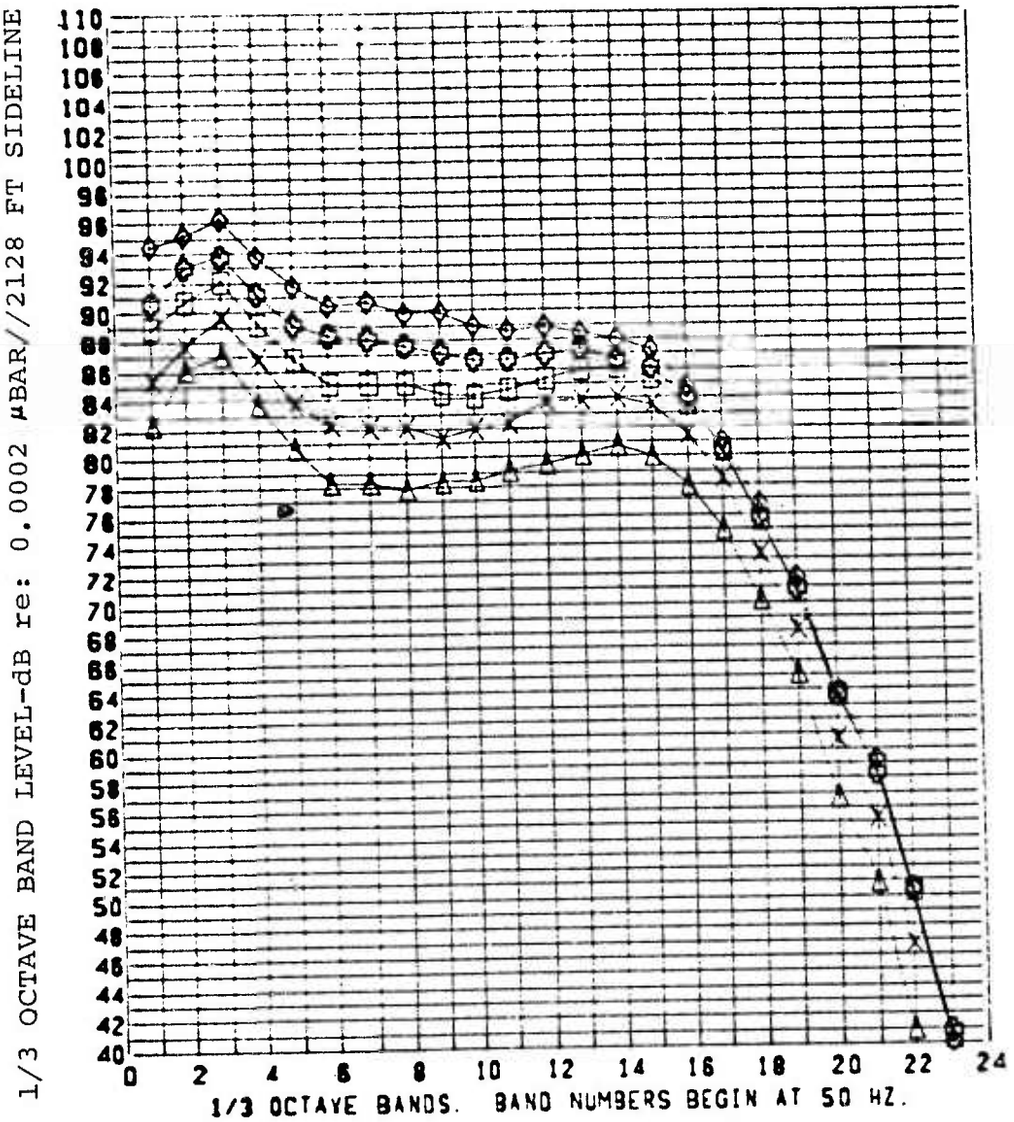
RUN 010

T_T = 1150° F A_8 = 6.5 FT²

PNL BEAM PATTERNS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 110 DEG TEMP = 77 DEG R.H. = 70 PER CENT



T_T = 1150°F A_8 = 6.05 FT^2 RUN:010

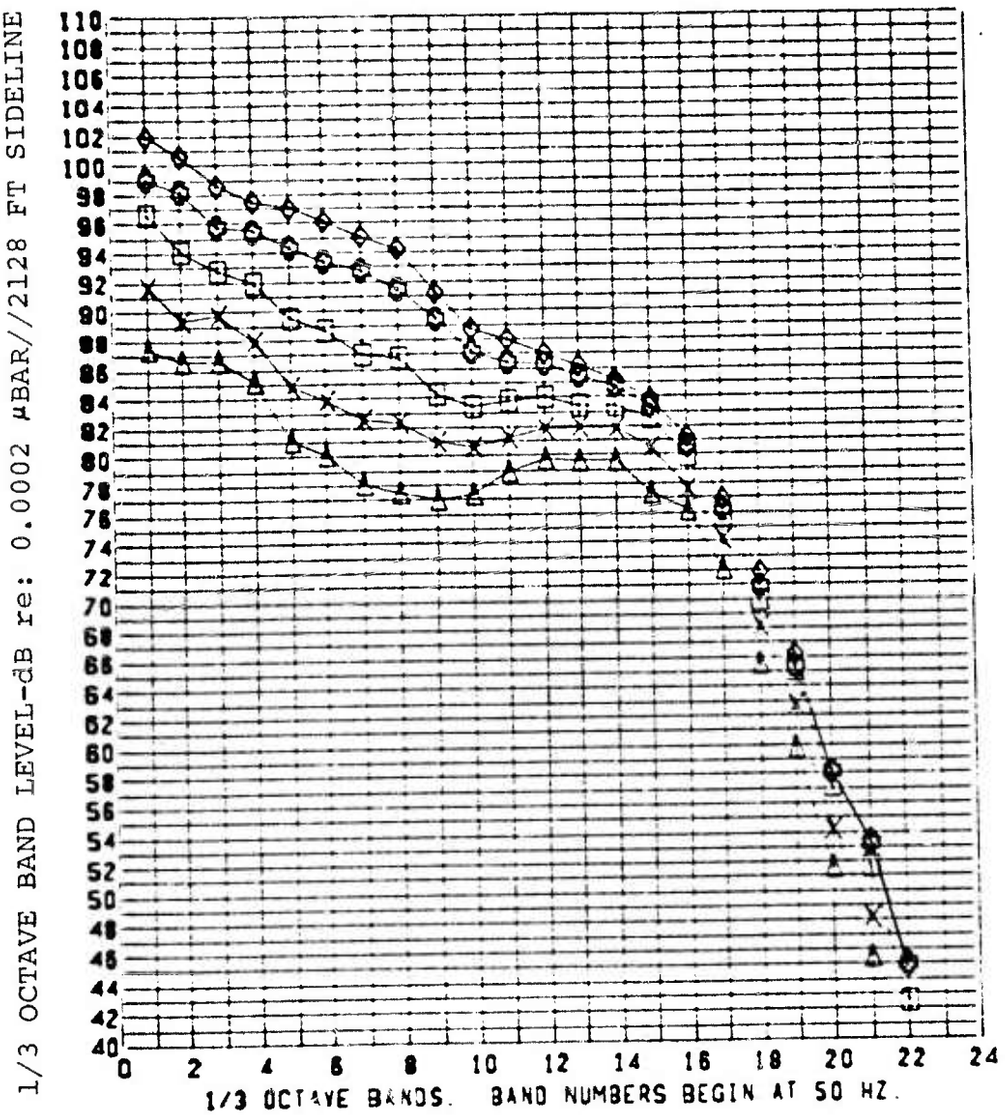
PR = △2.0, ×2.5, □3.0, ✣3.5, ◇4.0

NOZZLE: 37T-3.3AR-RA-RT/NC

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 110°
re: NOZZLE INLET AXIS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 130 DEG TEMP = 77 DEG R.H. = 70 PER CENT



T_T = 1150°F A_8 = 6.05 FT^2 RUN: 010

PR = △ 2.0, X 2.5, □ 3.0, ✣ 3.4, ◇ 3.7

NOZZLE: 37T-3.3AR-RA-RT/NC

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 130°
re: NOZZLE INLET AXIS

TEST CONDITIONS

NOZZLE: 37T-3.3AR-RA-RT/NC

FACILITY: WALL ISOLATION FACILITY

DATE: January 20, 1973

P_{AMB} = 30.06 in Hg T_{AMB} = 41°F R.H. = 85%

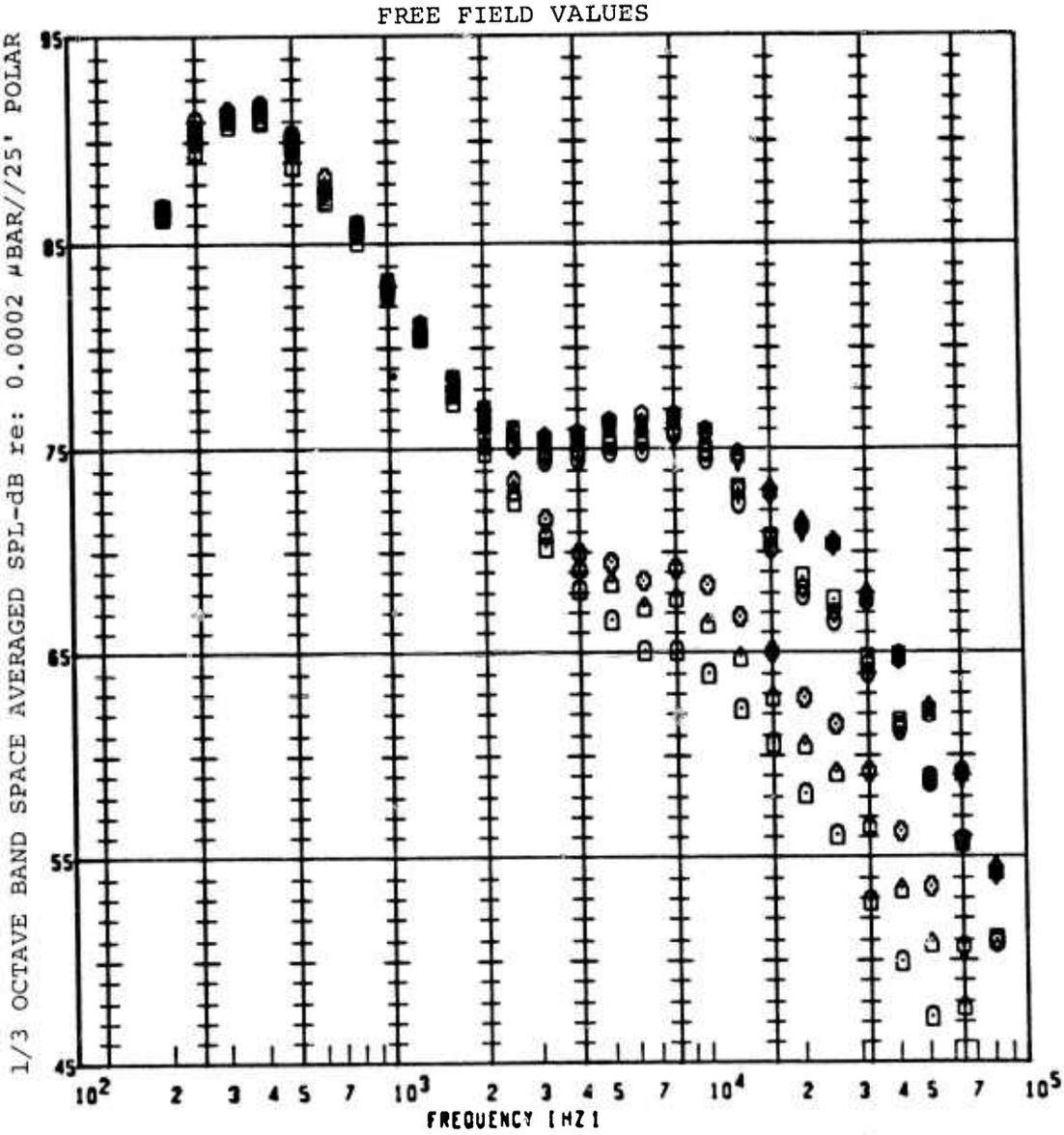
NPR = 3.0 T_T = 1150°F V_J (IDEAL) = 2300 FPS

SCALE MODEL A_8 = 13.6 $in.^2$

RUN NO.	AXIAL LOCATION	IRIS DIA.	REMARKS	REF.
146	0.0 x/D	9.0 in.		
147	0.25	9.0		
148	0.50	9.0		
149	0.75	10.0		
150	1.00	14.0		
151	1.25	10.5		
152	1.50	10.5		
153	1.75	11.0		
154	2.00	11.0		
155	2.25	11.5		
156	2.50	11.5		
157	2.75	12.0		
158	3.0	13.0		
159	3.5	14.0		
160	4.0	15.0		
161	5.0	16.0		
162	6.0	18.0		
163	8.0	19.0		
164	10.0	21.0		
165	12.0	23.0		
166	14.0	35.0		
167	16.0	27.0		

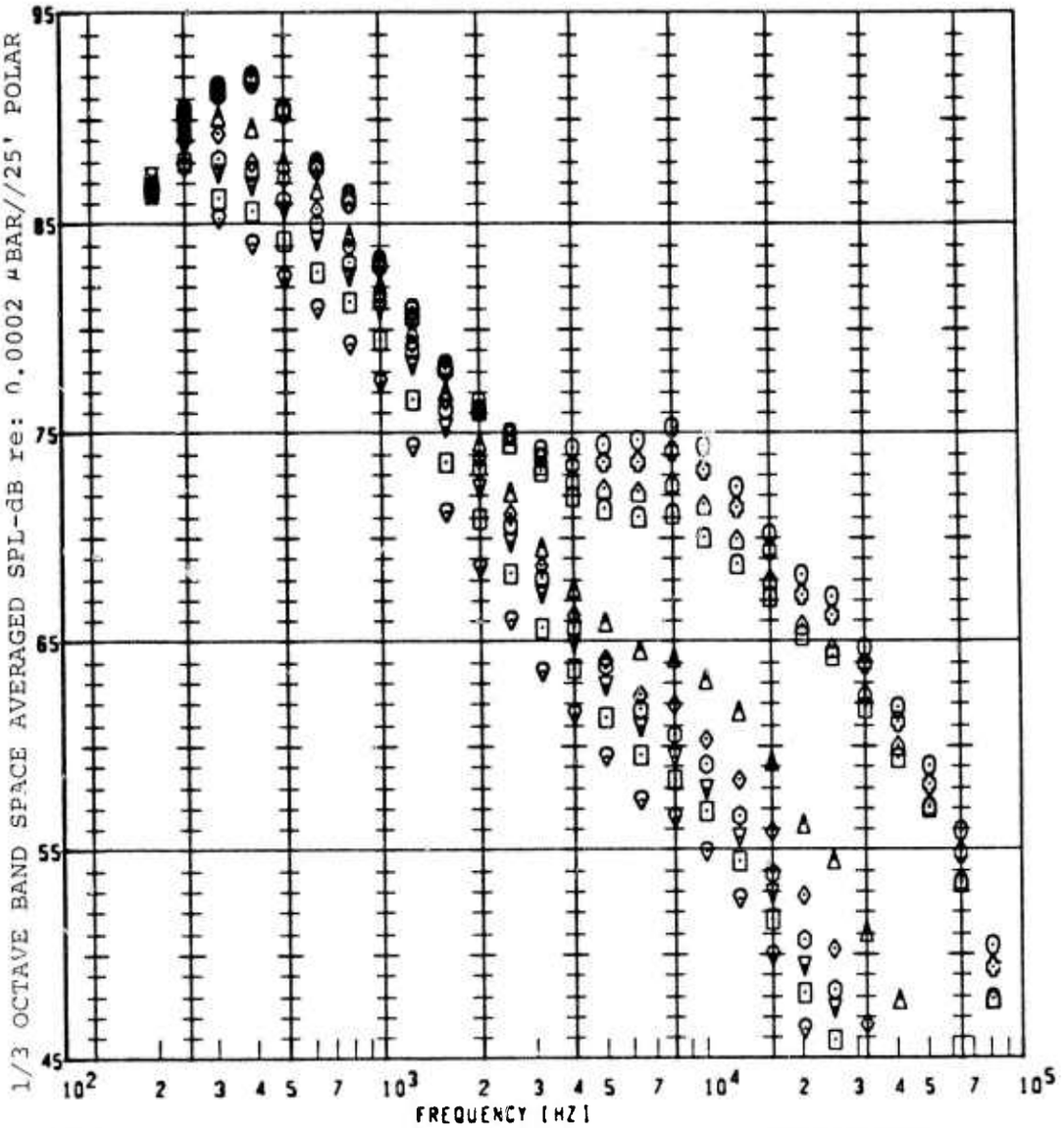
MICROPHONE LAYOUT: 25 FOOT VERTICAL POLAR ARC

FREE FIELD VALUES

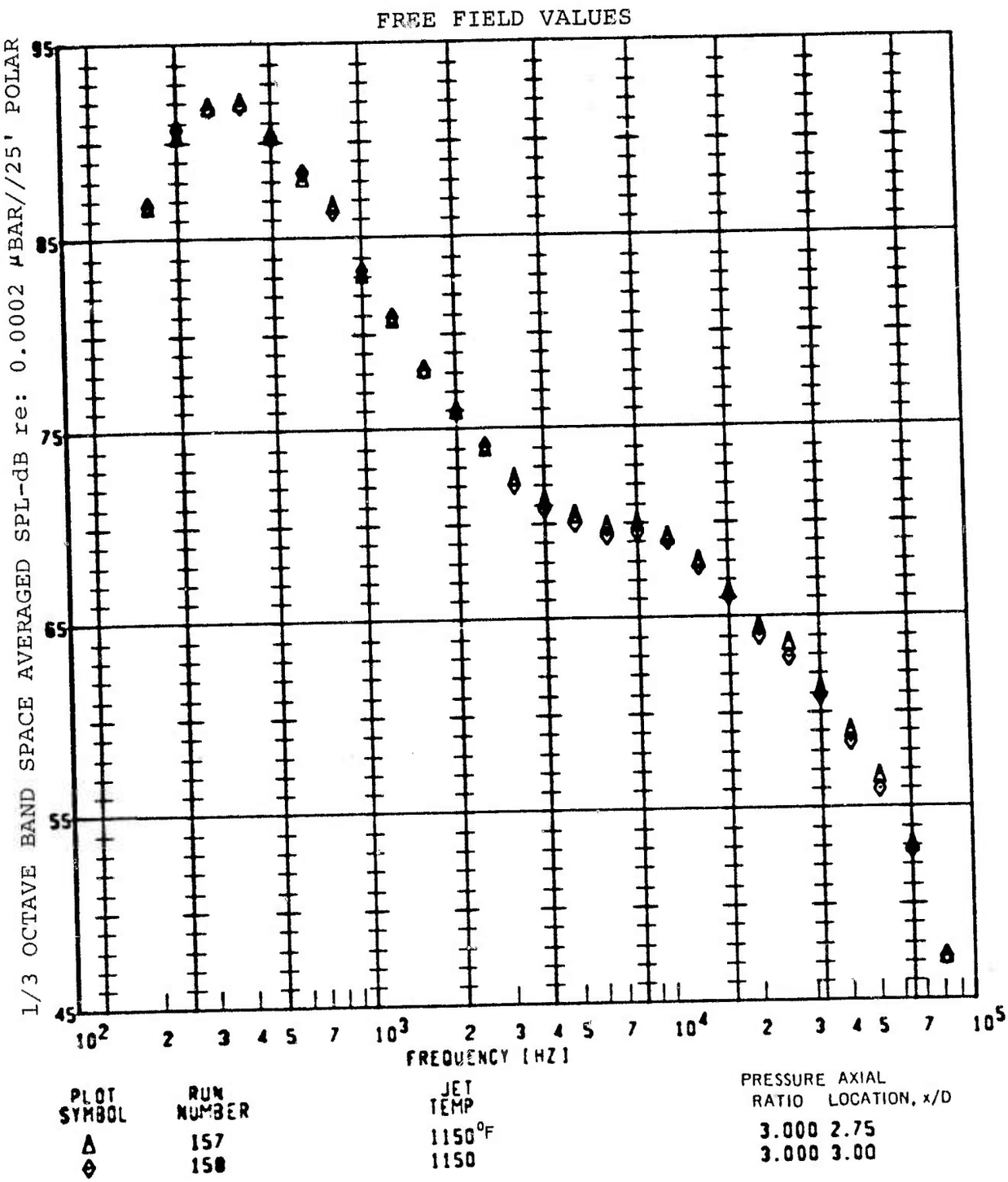


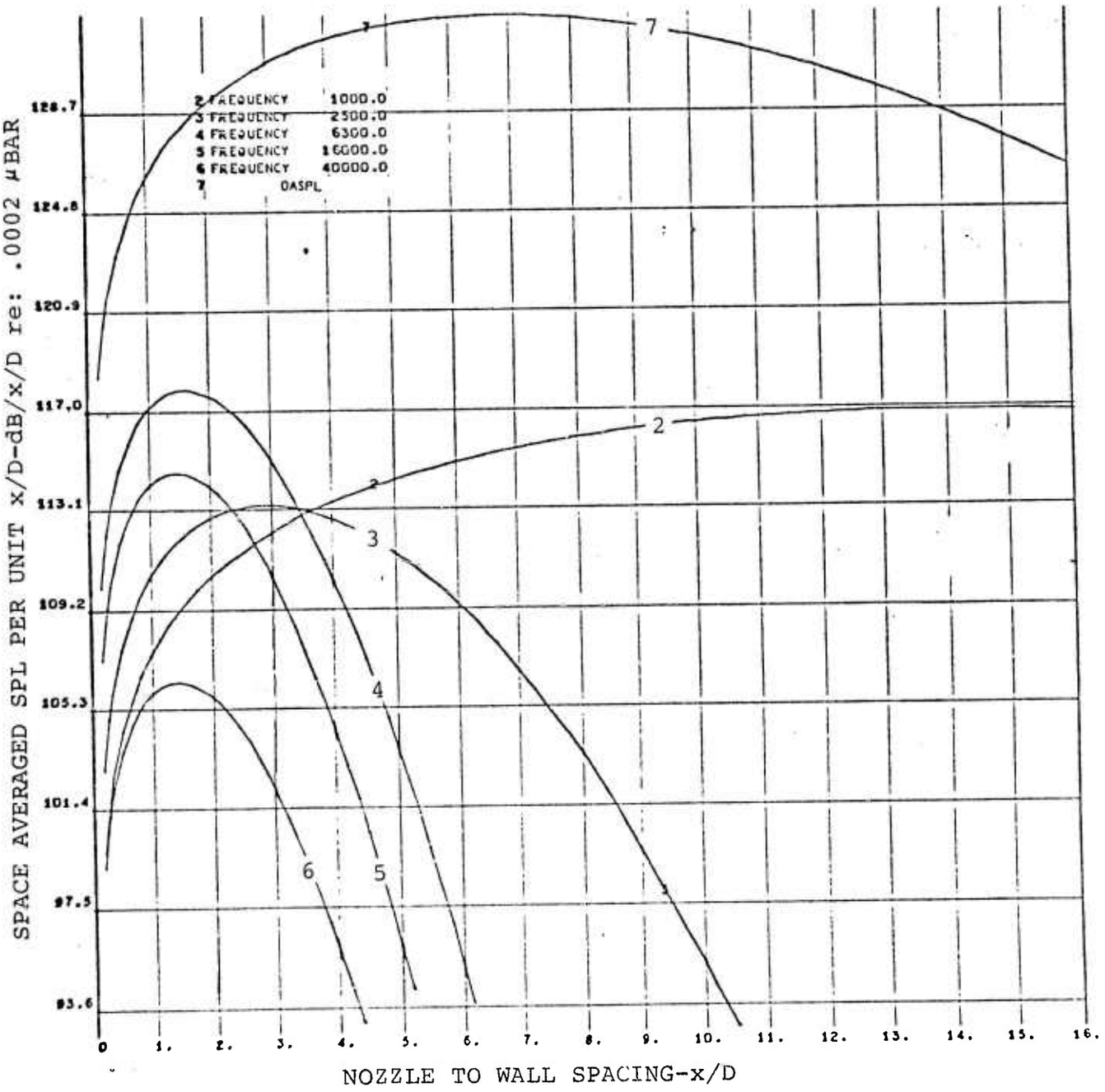
PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	AXIAL LOCATION, x/D
△	146	1150 °F	3.000	0.00
◈	147	1150		0.25
⊙	148	1150		0.50
▽	149	1150		0.75
⊡	150	1150		1.00
▽	151	1150		1.25
⊙	152	1150		1.50
◈	159	1150		3.50
△	160	1150		4.00
⊡	161	1150		5.00

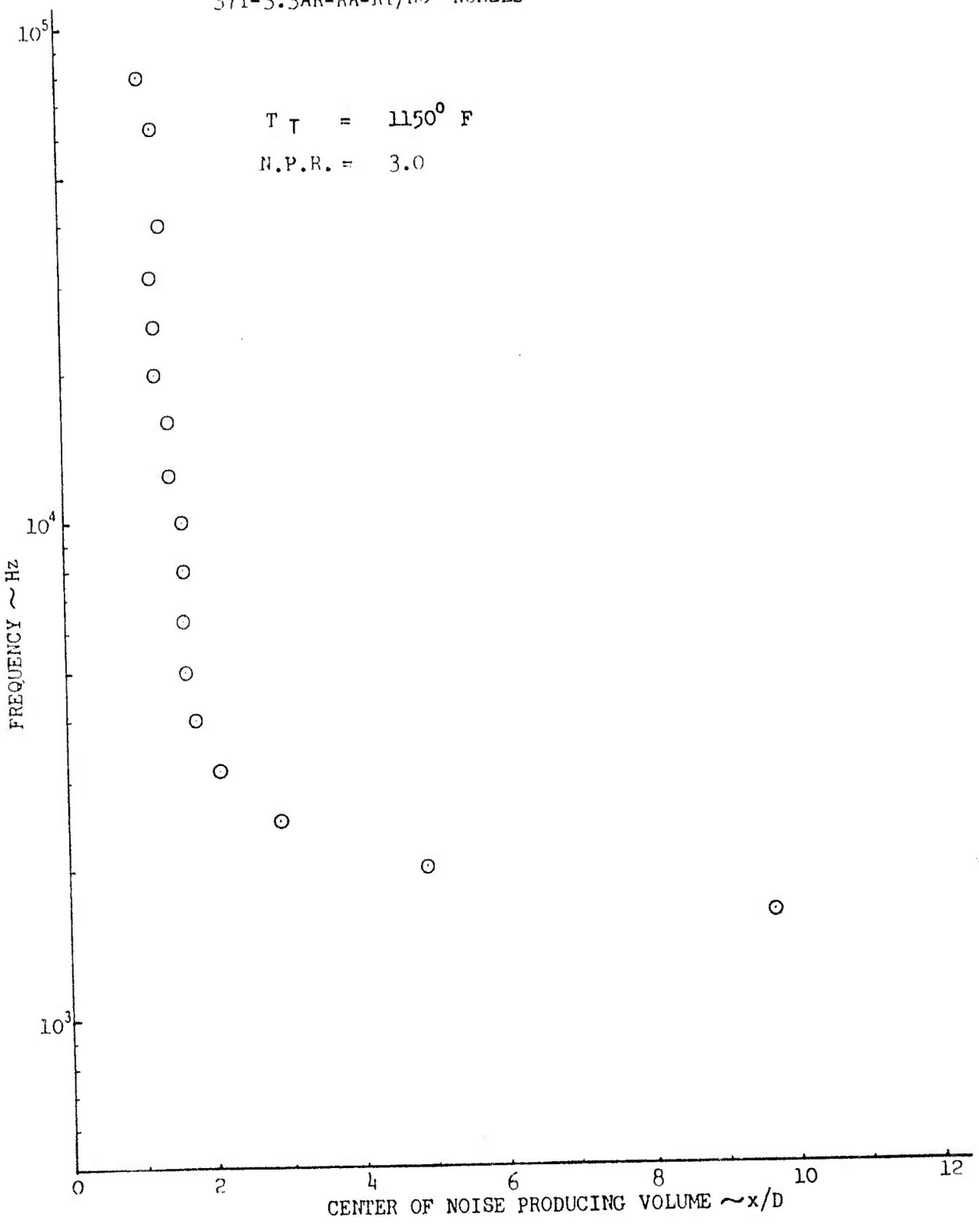
FREE FIELD VALUES

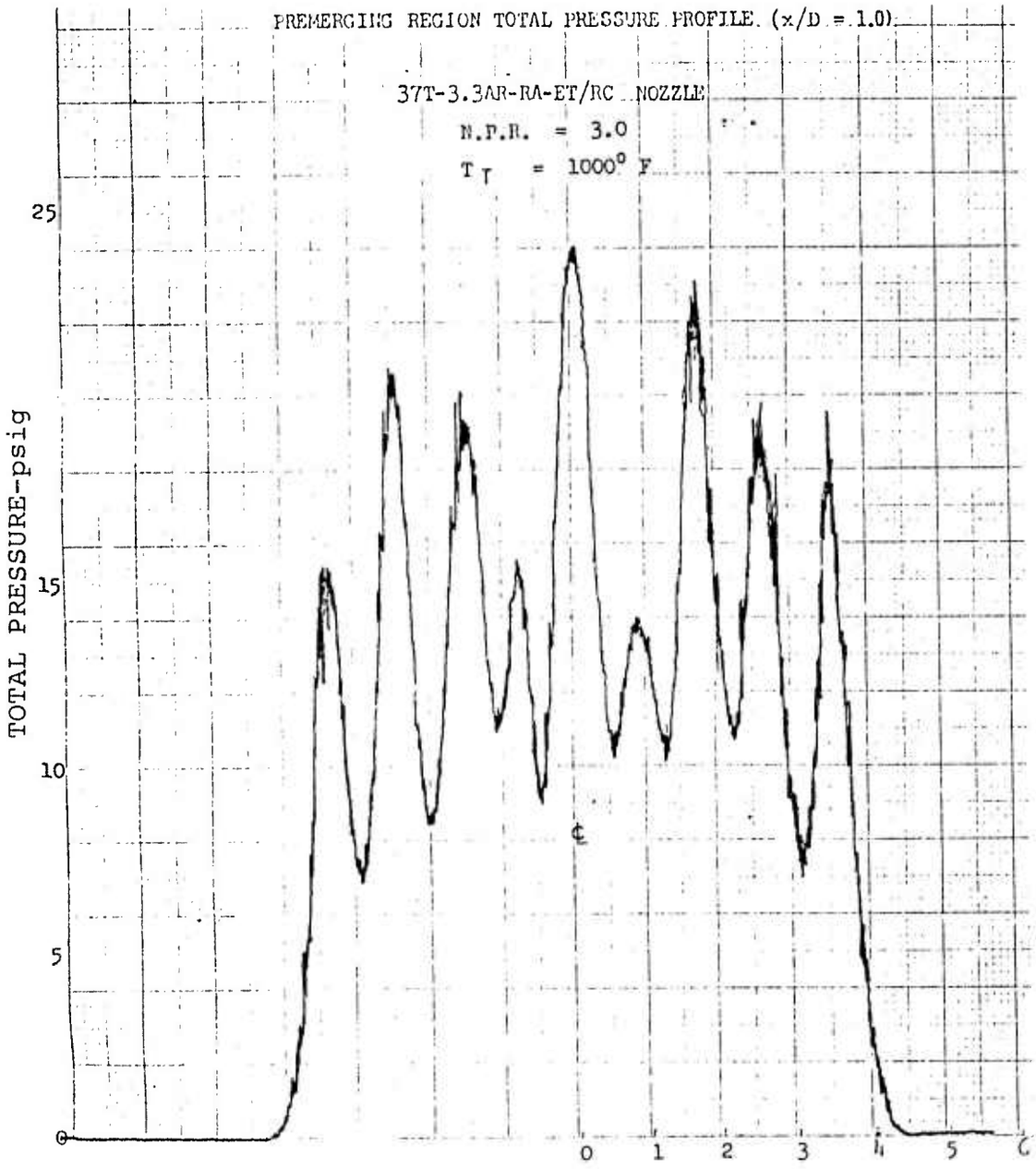


PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	AXIAL LOCATION, x/D
△	162	1150°F	3.0	6.00
◇	163	1150	3.0	8.00
○	164	1150	3.0	10.00
▽	165	1150	3.0	12.00
□	166	1150	3.0	14.00
♀	167	1150	3.0	16.00
⊙	153	1150	3.0	1.75
◈	154	1150	3.0	2.00
⏢	155	1150	3.0	2.25
⊡	156	1150	3.0	2.50

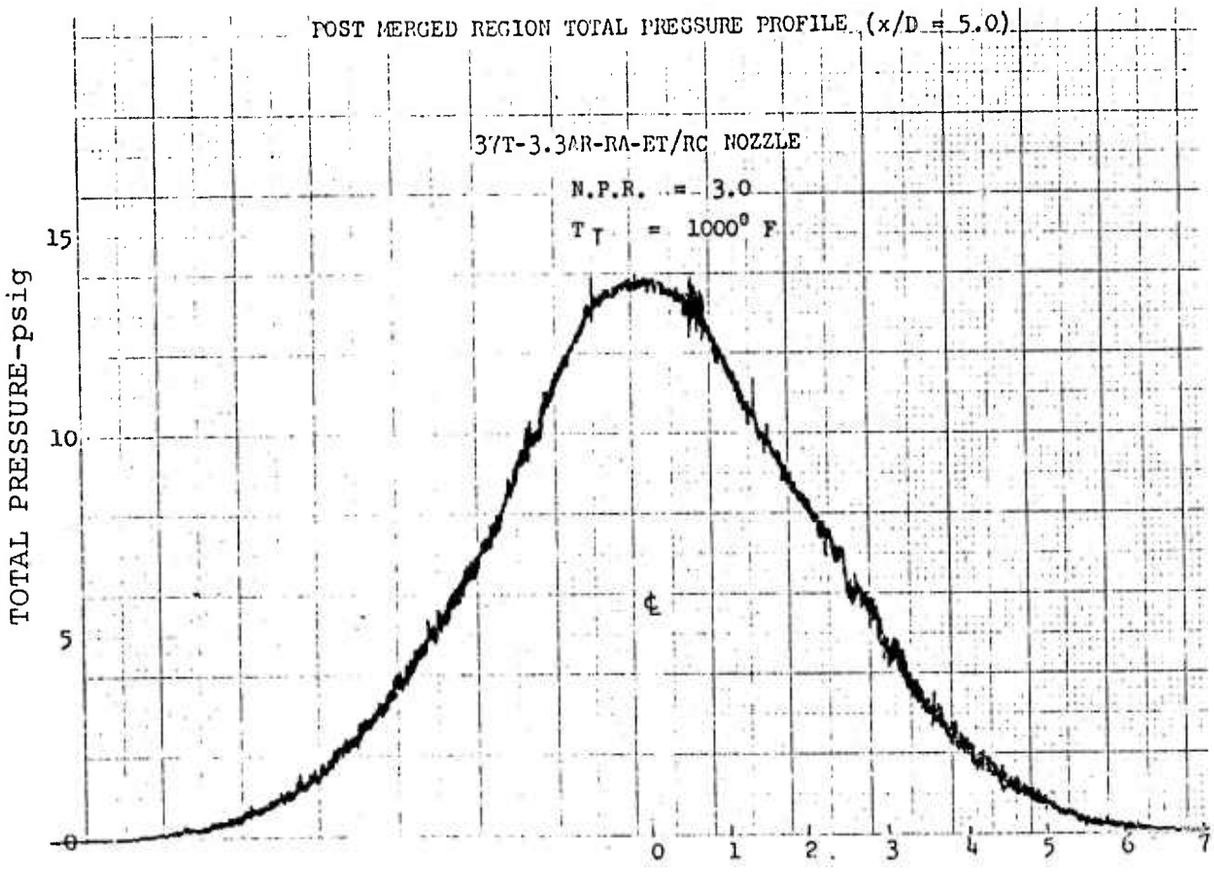

FREE FIELD VALUES
1/3 OCTAVE BAND SPACE AVERAGED SPL-dB re: 0.0002 μBAR//25' POLAR
95
85
75
65
55
45
10^2 2 3 4 5 7 10^3 2 3 4 5 7 10^4 2 3 4 5 7 10^5
FREQUENCY [HZ]
PLOT SYMBOL
RUN NUMBER
JET TEMP
PRESSURE RATIO
AXIAL LOCATION, x/D
Δ 157 1150°F 3.000 2.75
◇ 158 1150 3.000 3.00

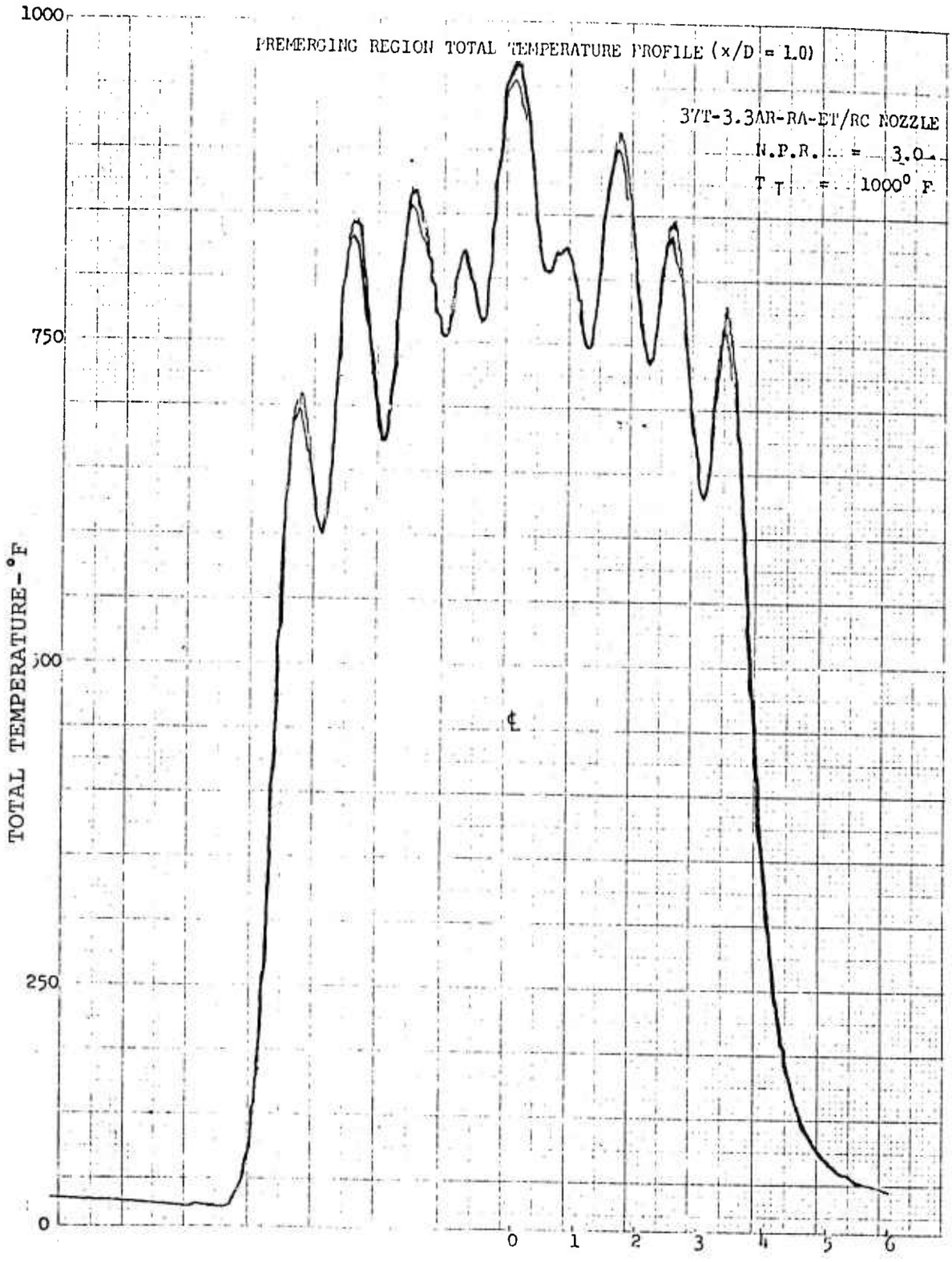

2 FREQUENCY 1000.0
3 FREQUENCY 2500.0
4 FREQUENCY 6300.0
5 FREQUENCY 16000.0
6 FREQUENCY 40000.0
7 OASPL
128.7
124.8
120.9
117.0
113.1
109.2
105.3
101.4
97.5
93.6
SPACE AVERAGED SPL PER UNIT x/D-dB/x/D re: .0002 μBAR
0
1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.
13.
14.
15.
16.
NOZZLE TO WALL SPACING-x/D

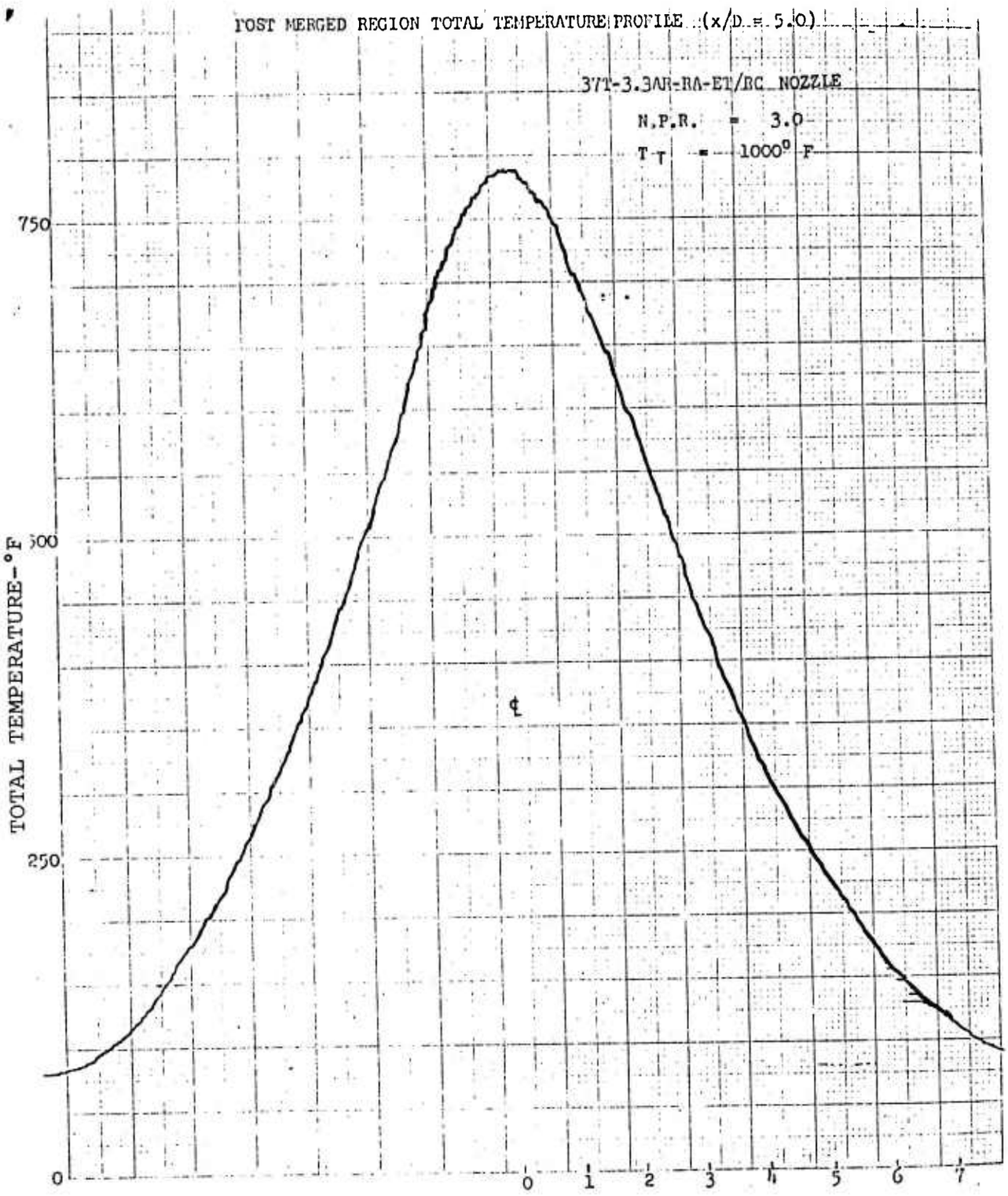

37T-3.3AR-RA-RT/HC NOZZLE
T_T = 1150° F
N.P.R. = 3.0
10^5
10^4
10^3
FREQUENCY ~ Hz
0
2
4
6
8
10
12
CENTER OF NOISE PRODUCING VOLUME ~x/D

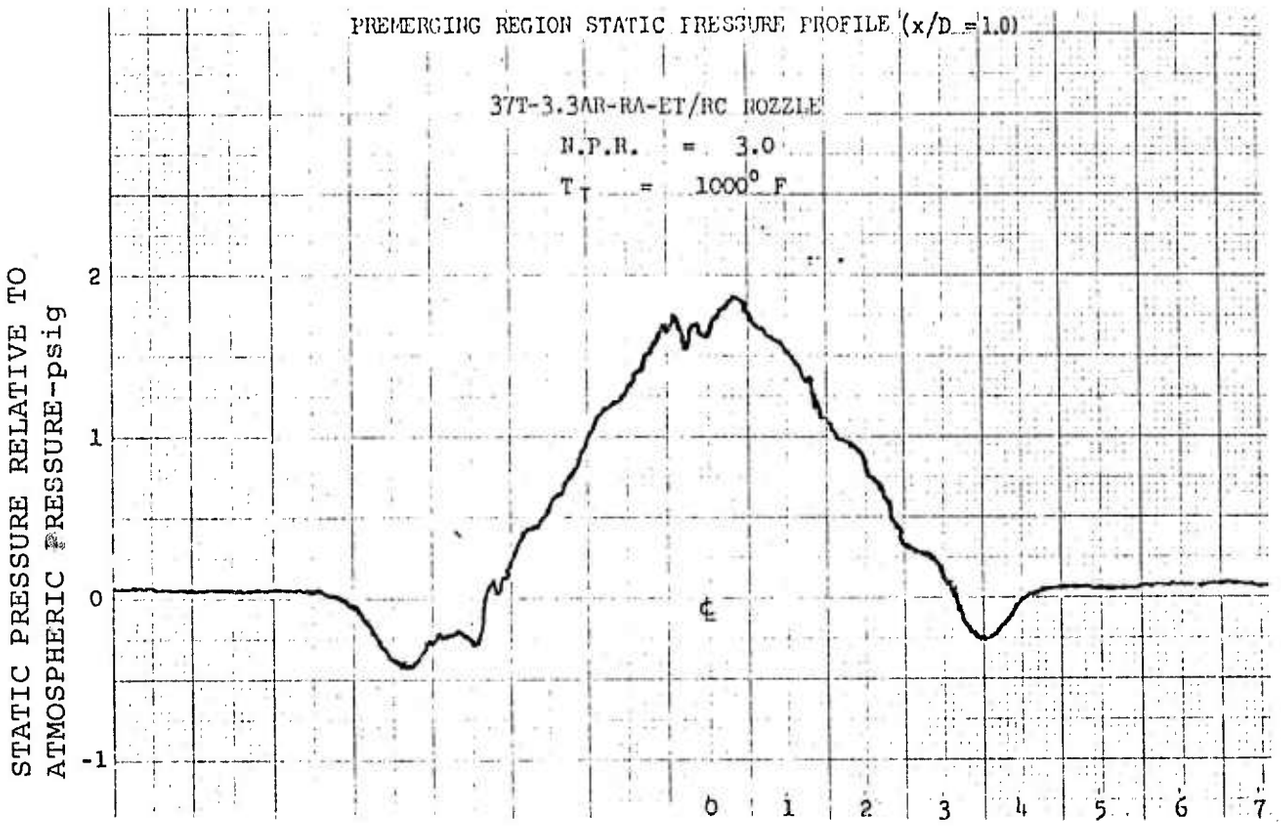


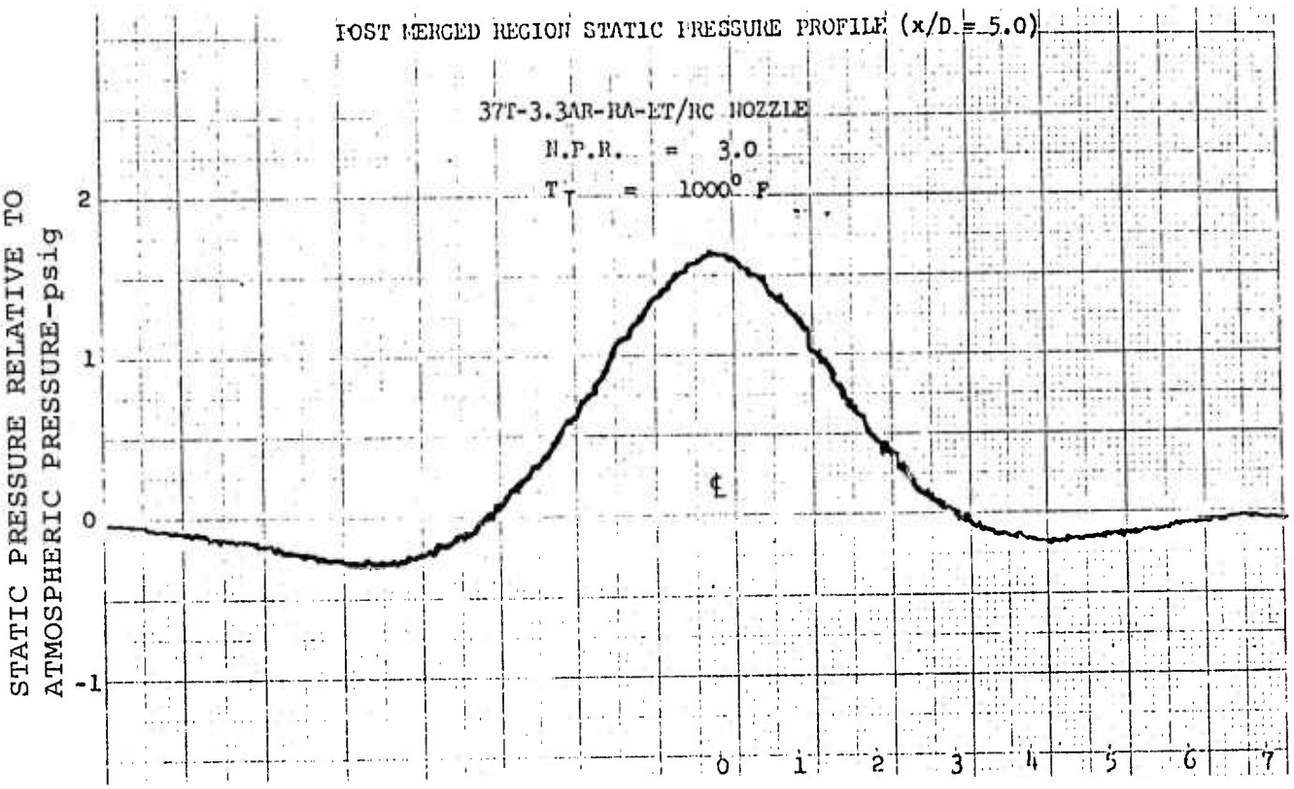
RADIAL DISTANCE FROM JET ℄-in.

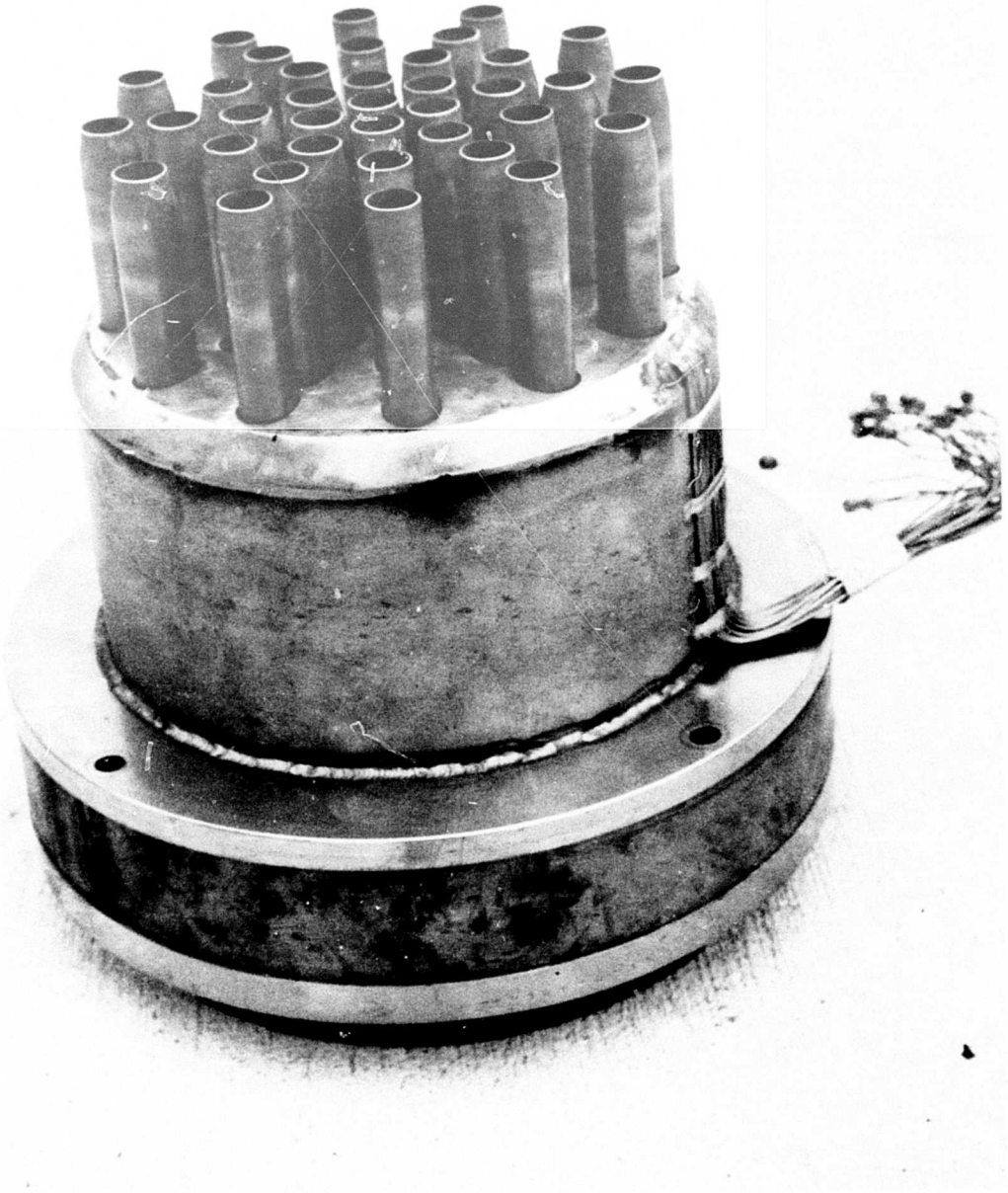

POST MERGED REGION TOTAL PRESSURE PROFILE (x/D = 5.0)
37T-3.3AR-RA-ET/RC NOZZLE
N.P.R. = 3.0
T_T = 1000° F
TOTAL PRESSURE-psig
15
10
5
0
℄
0
1
2
3
4
5
6
7
RADIAL DISTANCE FROM JET ℄-in.


PREMERGING REGION TOTAL TEMPERATURE PROFILE (x/D = 1.0)
3'/T-3.3AR-RA-ET/RC NOZZLE
N.P.R. = 3.0
T T = 1000° F
TOTAL TEMPERATURE-°F
1000
750
500
250
0
0
1
2
3
4
5
6
RADIAL DISTANCE FROM JET ℄-in.

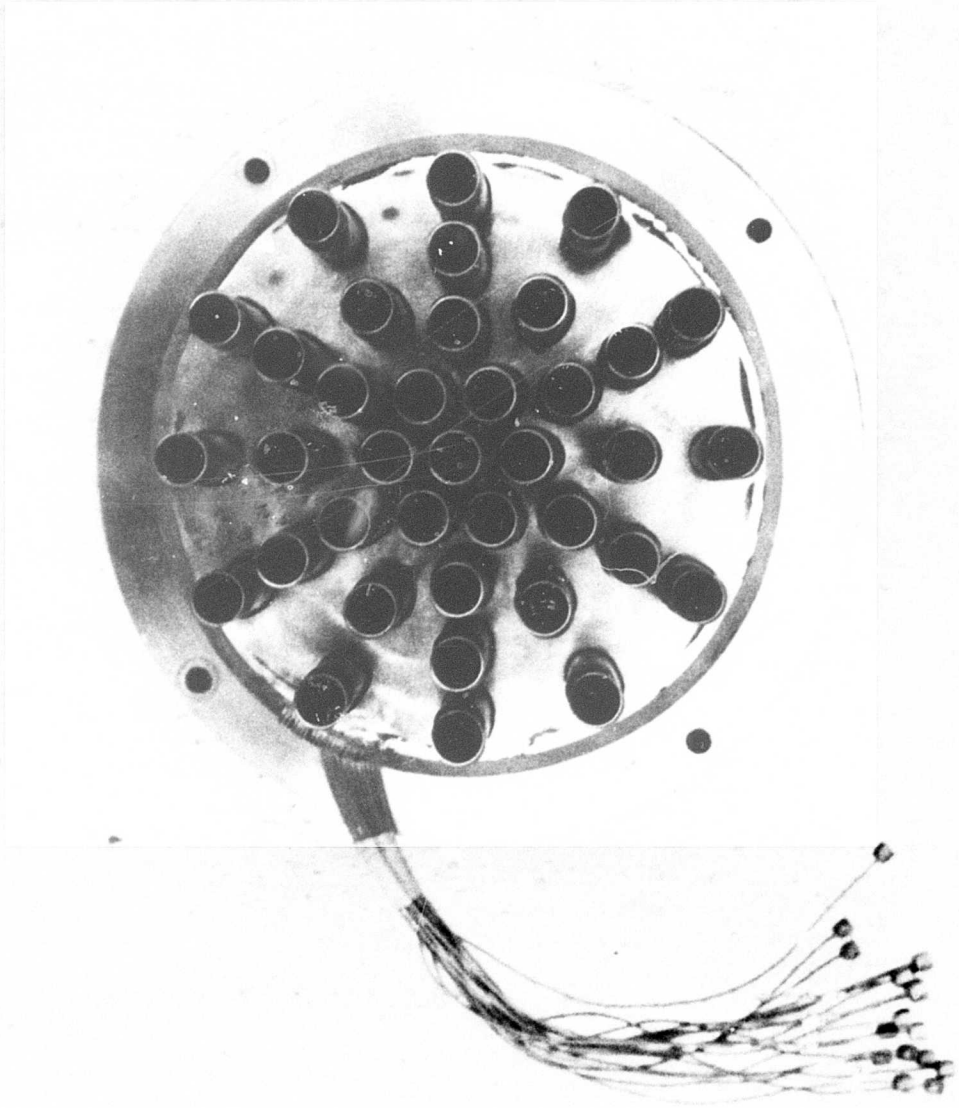

POST MERGED REGION TOTAL TEMPERATURE PROFILE (x/D = 5.0)
3TT-3.3AR-RA-ET/BC NOZZLE
N.P.R. = 3.0
T_T = 1000° F
TOTAL TEMPERATURE-°F
750
500
250
0
℄
0
1
2
3
4
5
6
7
RADIAL DISTANCE FROM JET ℄-in.


PREMERGING REGION STATIC PRESSURE PROFILE (x/D = 1.0)
37T-3.3AR-RA-ET/RC NOZZLE
N.P.R. = 3.0
T_T = 1000° F
STATIC PRESSURE RELATIVE TO ATMOSPHERIC PRESSURE-psig
2
1
0
-1
℄
0
1
2
3
4
5
6
7
RADIAL DISTANCE FROM JET ℄ -in.

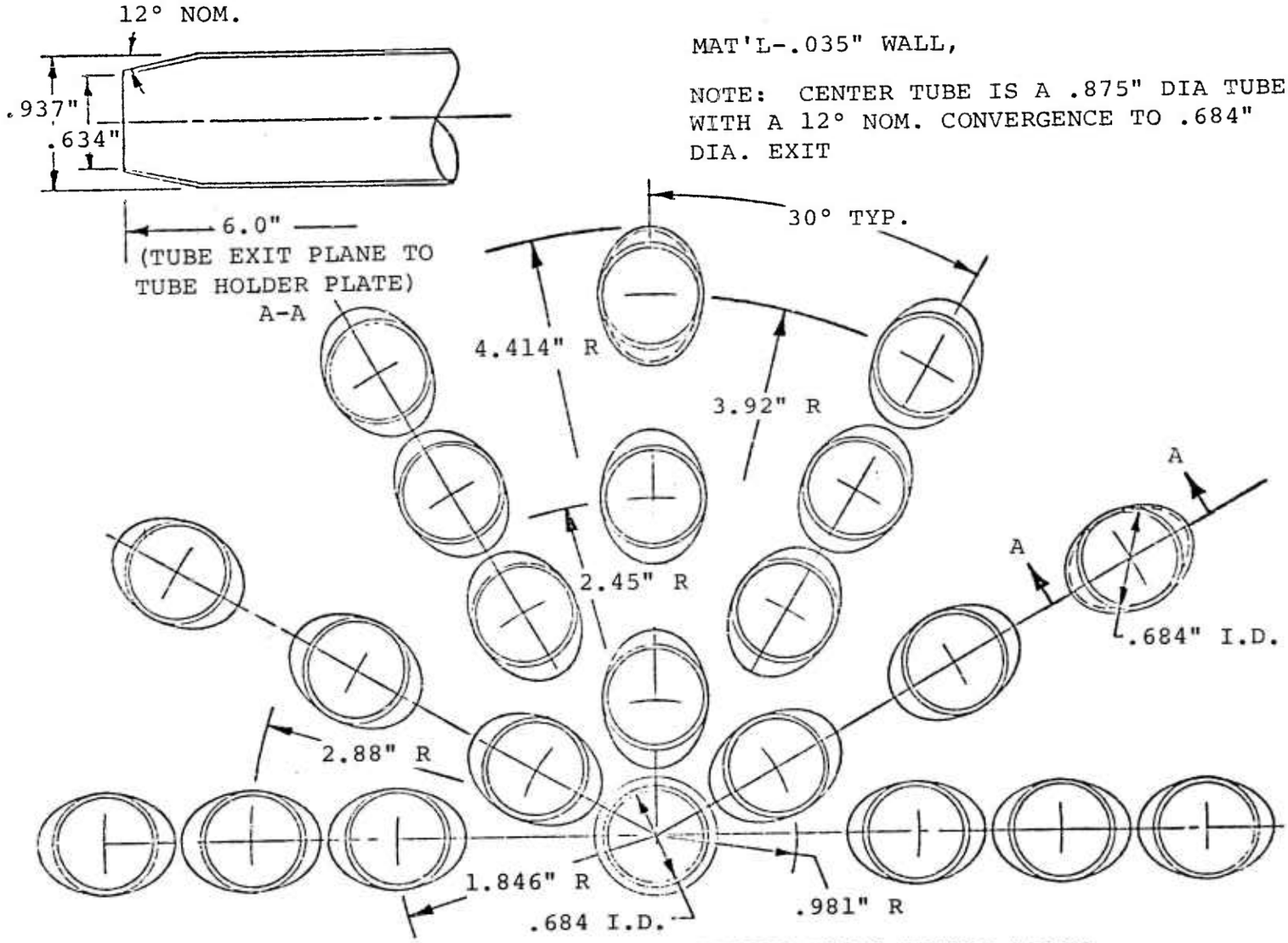

POST MERGED REGION STATIC PRESSURE PROFILE (x/D = 5.0)
37T-3.3AR-RA-ET/RC NOZZLE
N.P.R. = 3.0
T_T = 1000° F
STATIC PRESSURE RELATIVE TO ATMOSPHERIC PRESSURE-psig
2
1
0
-1
℄
0
1
2
3
4
5
6
7
RADIAL DISTANCE FROM JET ℄-in.



37T-4.5AR-RA-ET/RC NOZZLE



37T-4.5AR-RA-ET/RC NOZZLE



37 TUBE - AREA RATIO 4.5 ELLIPTICAL TUBES RADIAL ARRAY

TEST CONDITIONS

NOZZLE: 37T-4.5AR-RA-ET/RC

FACILITY: HNTF

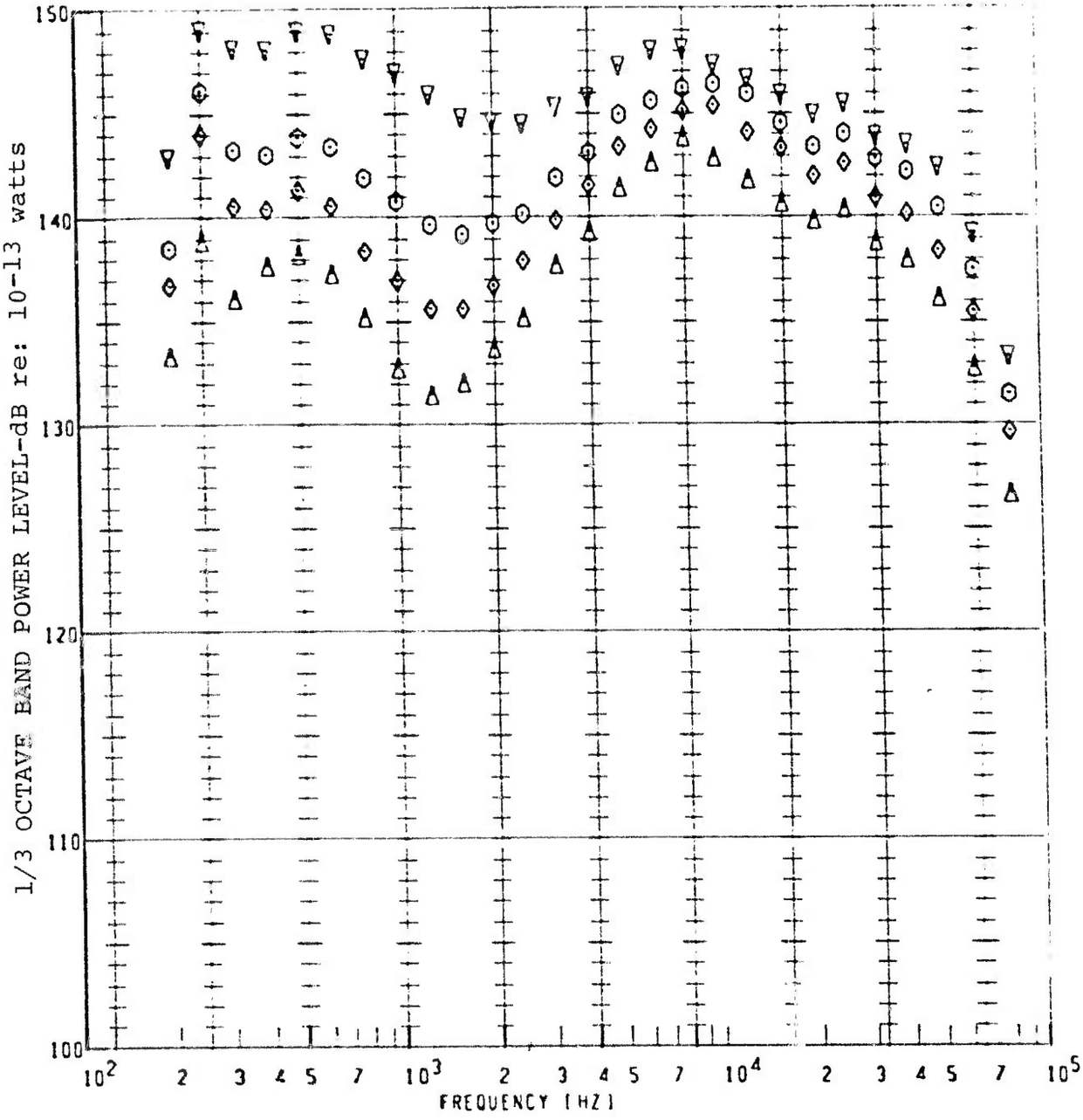
DATE: 1-26-73 T_{AMB} = 41.4°F **R.H.** = 80%

SCALE MODEL A_8 = 13.6 $in.^2$

RUN NO.	NPR	T_T	V_J (IDEAL)	REMARKS	REF
215	2.0	1150°F	1875 fps	3" tube lengths	
"	2.5	"	2126		
"	3.0	"	2303		
"	4.0	"	2544		

MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH CONCRETE GROUND SURFACE. MEASURED ACOUSTIC DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.

FREE FIELD VALUES

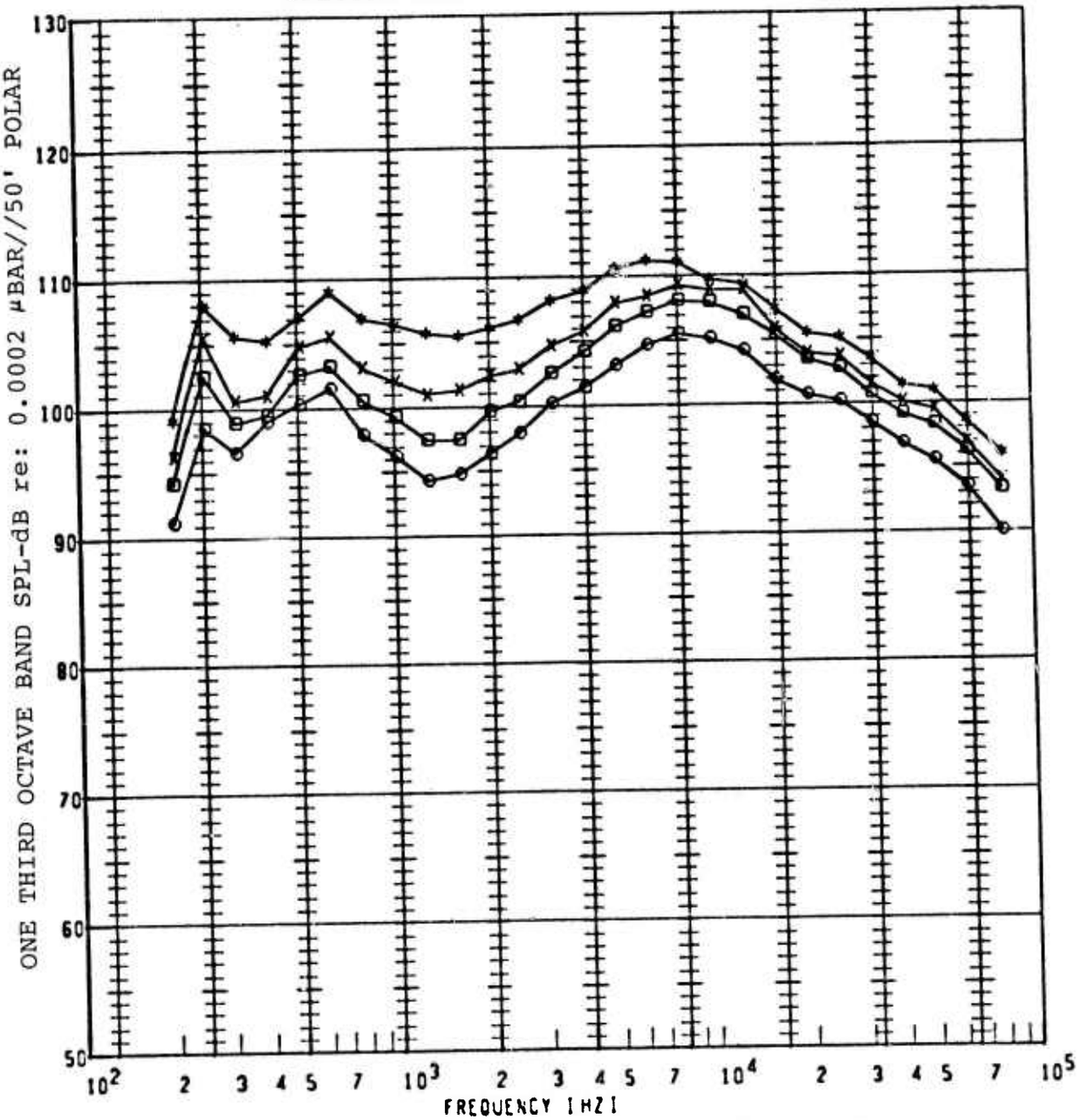


PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	215	2.00	1150°F
◇	215	2.50	1150
○	215	3.00	1150
▽	215	4.00	1150

NOZZLE: 37T-4.5AR-RA-ET/RC

JET NOISE POWER SPECTRA

SPECTRA ARE FREE FIELD + 6dB

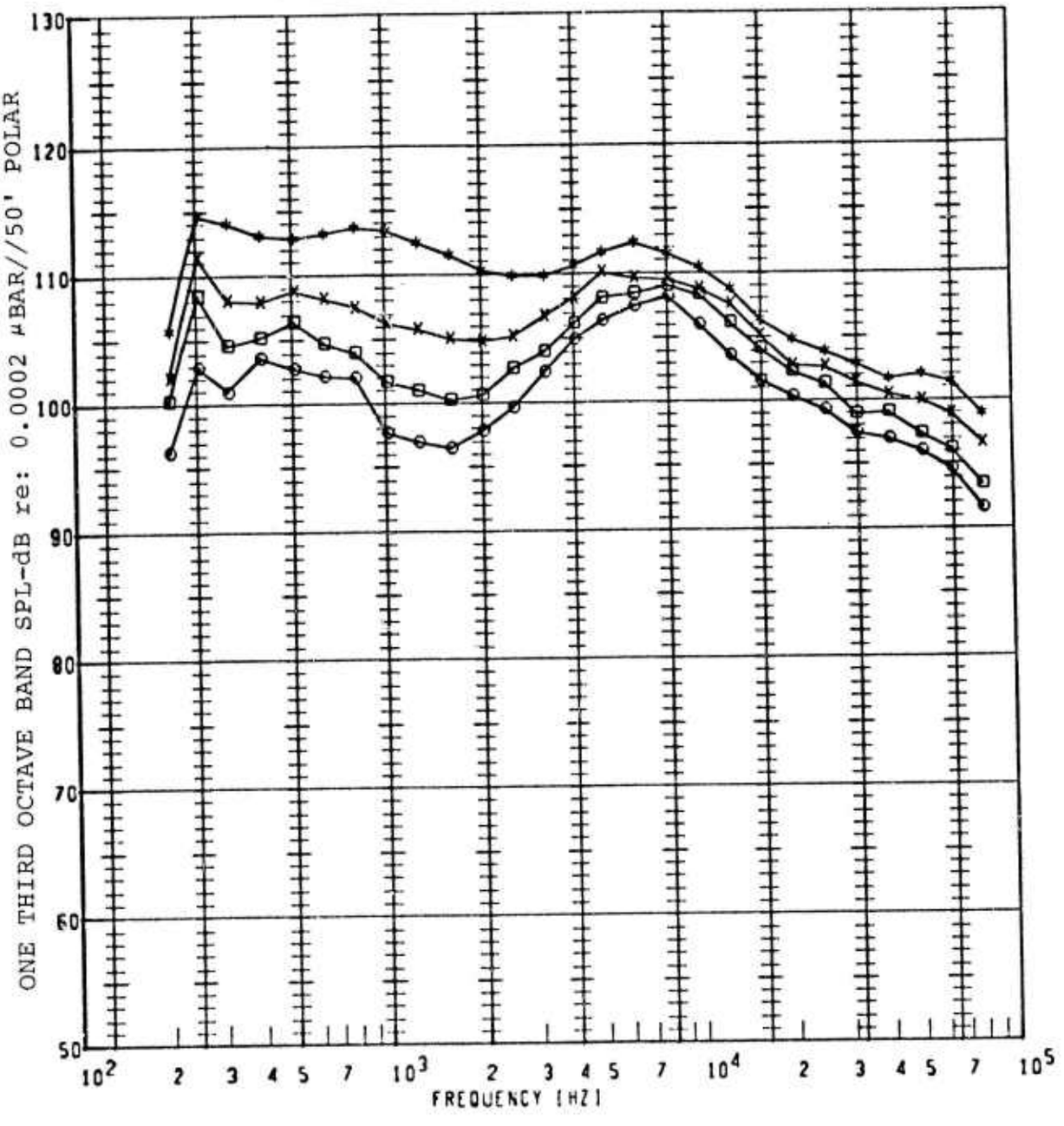


PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL (DB)
⊙	215G	1150°F	2.000	110°	SOFP	114.7
⊡	215G	1150	2.500	↓	SOFP	117.4
x	215G	1150	3.000	↓	SOFP	119.0
*	215G	1150	4.000	↓	SOFP	121.5

NOZZLE: 37T-4.5AR-RA-ET/RC

MEASURED NOISE SPECTRA AT 110° re: NOZZLE INLET AXIS

SPECTRA ARE FREE FIELD + 6dB

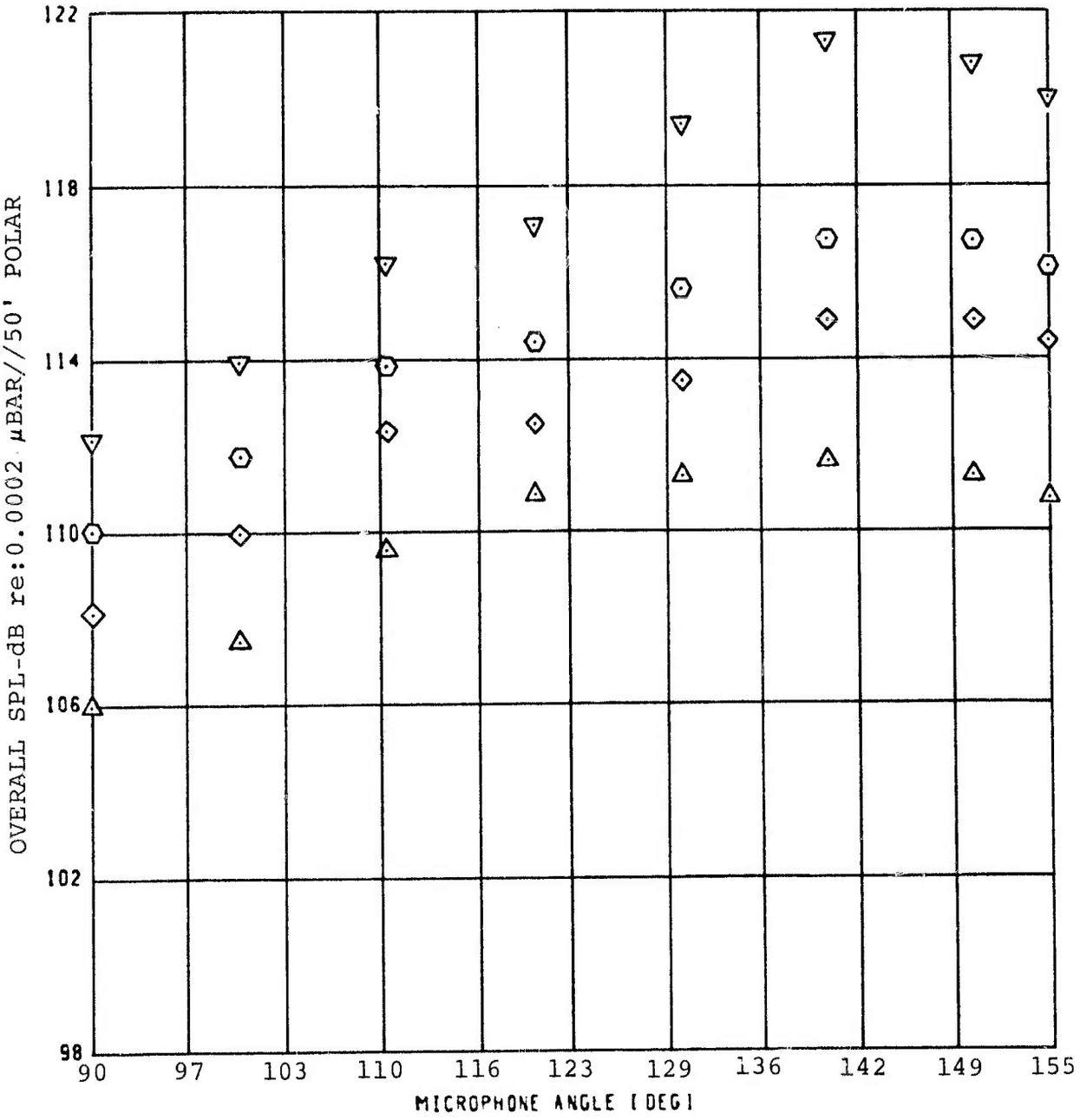


PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL (OBI)
⊖	215G	1150°F	2.000	130°	50FP	116.7
⊡	215G	1150	2.500	↓	50FP	118.9
x	215G	1150	3.000	↓	50FP	121.1
*	215G	1150	4.000	↓	50FP	125.1

NOZZLE: 37T-4.5AR-RA-ET/RC

MEASURED NOISE SPECTRA AT 130° re: NOZZLE INLET AXIS

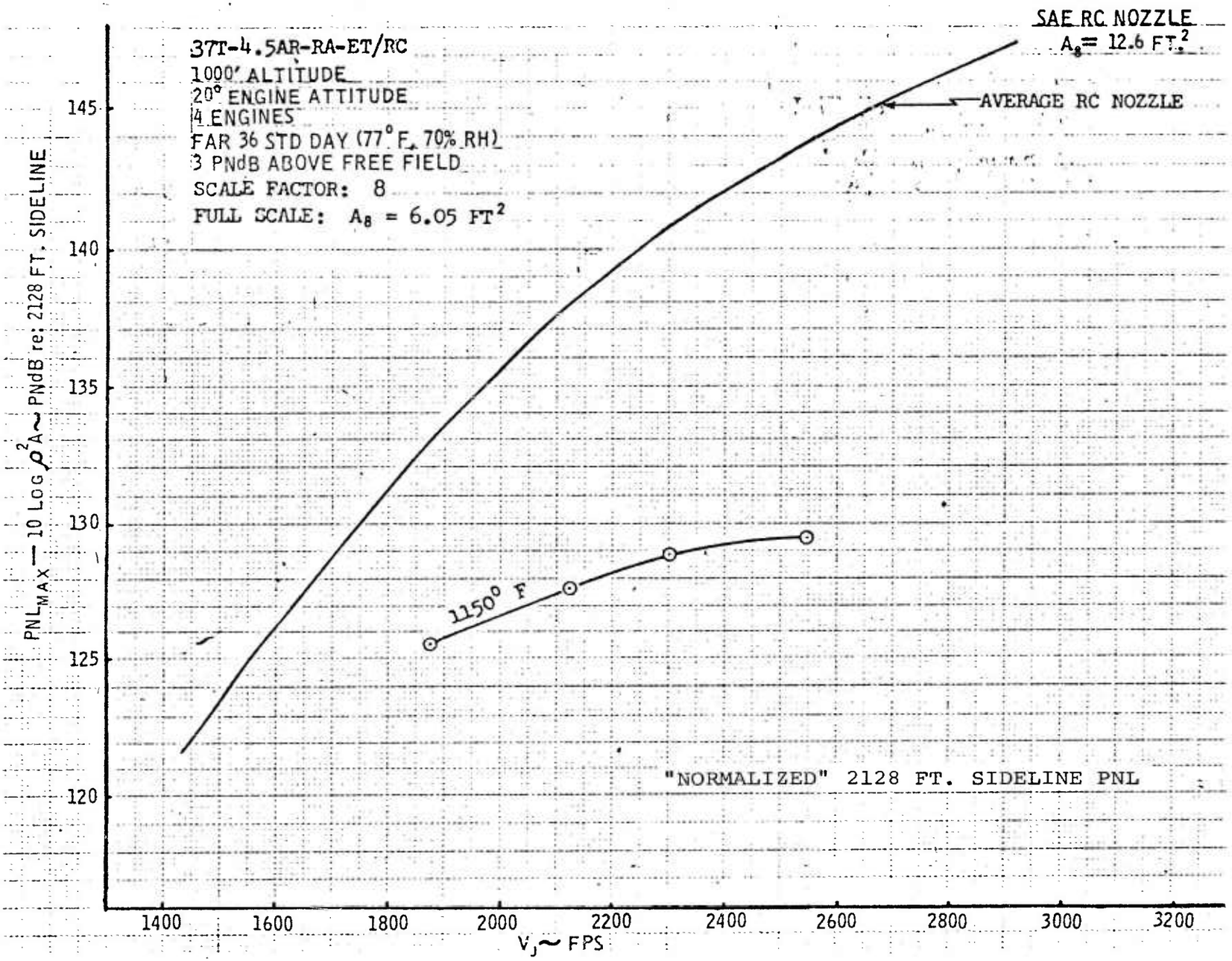
FREE FIELD VALUES

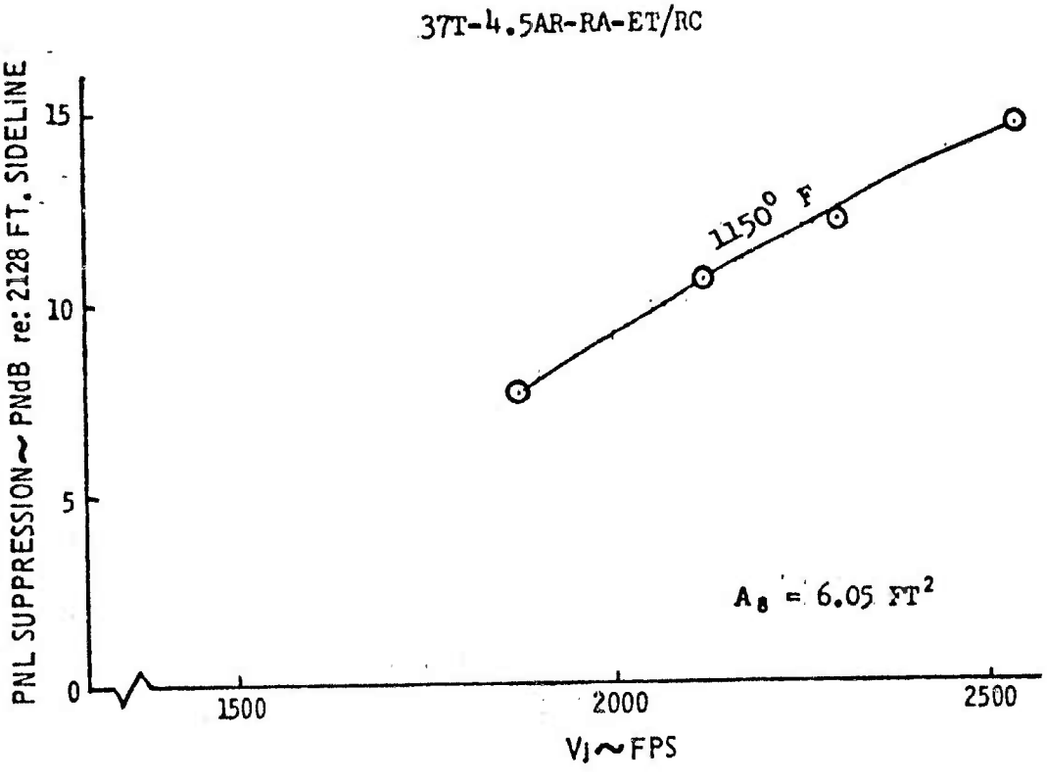


PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	215	2.00	1150°F
◇	215	2.50	1150
⊙	215	3.00	1150
▽	215	4.00	1150

NOZZLE: 37T-4.5AR-RA-ET/RC

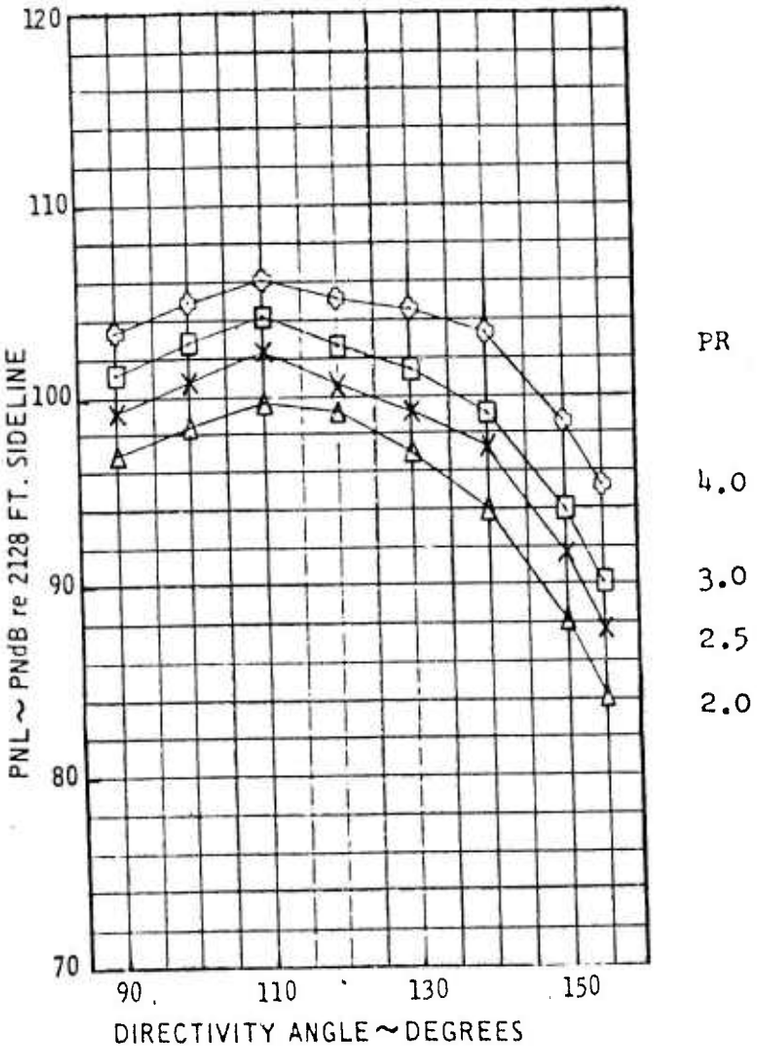
OASPL BEAM PATTERNS


37T-4.5AR-RA-ET/RC
1000' ALTITUDE
20° ENGINE ATTITUDE
4 ENGINES
FAR 36 STD DAY (77° F, 70% RH)
3 PNdB ABOVE FREE FIELD
SCALE FACTOR: 8
FULL SCALE: A_8 = 6.05 FT^2
SAE RC NOZZLE
A_8 = 12.6 FT.^{2}
AVERAGE RC NOZZLE
1150° F
"NORMALIZED" 2128 FT. SIDELINE PNL
PNL_{MAX} — 10 Log $\rho^2 A$ ~ PNdB re: 2128 FT. SIDELINE
V_j ~ FPS
145
140
135
130
125
120
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200



PEAK PNL SUPPRESSION VALUES

NOZZLE: 37T-4.5AR-RA-ET/RC



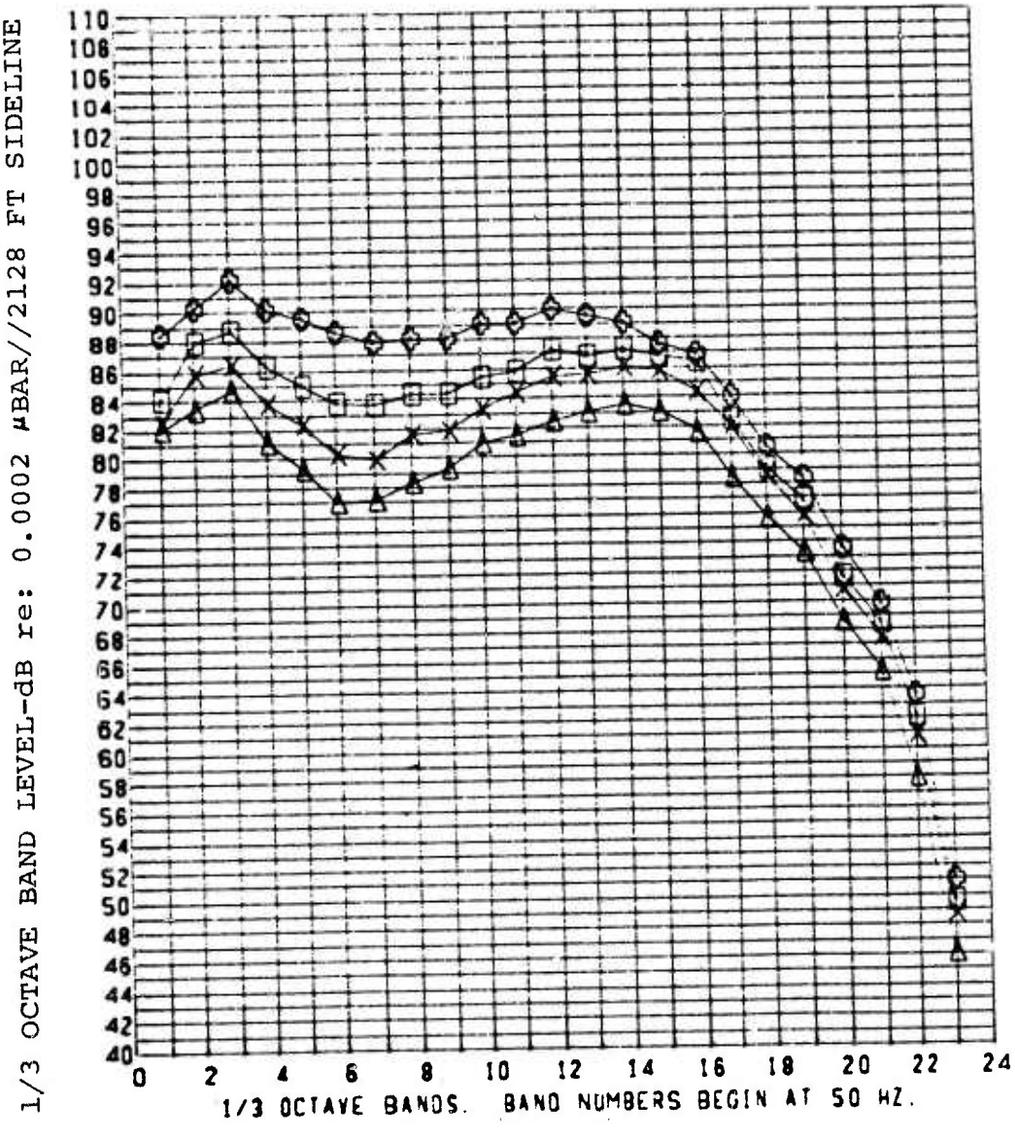
RUN 215

T_T = 1150° F A_8 = 6.05 FT^2

PNL BEAM PATTERNS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 110 DEG TEMP = 77 DEG R.H. = 70 PER CENT



T_T = 1150°F A_8 = 6.05 FT^2 RUN: 215

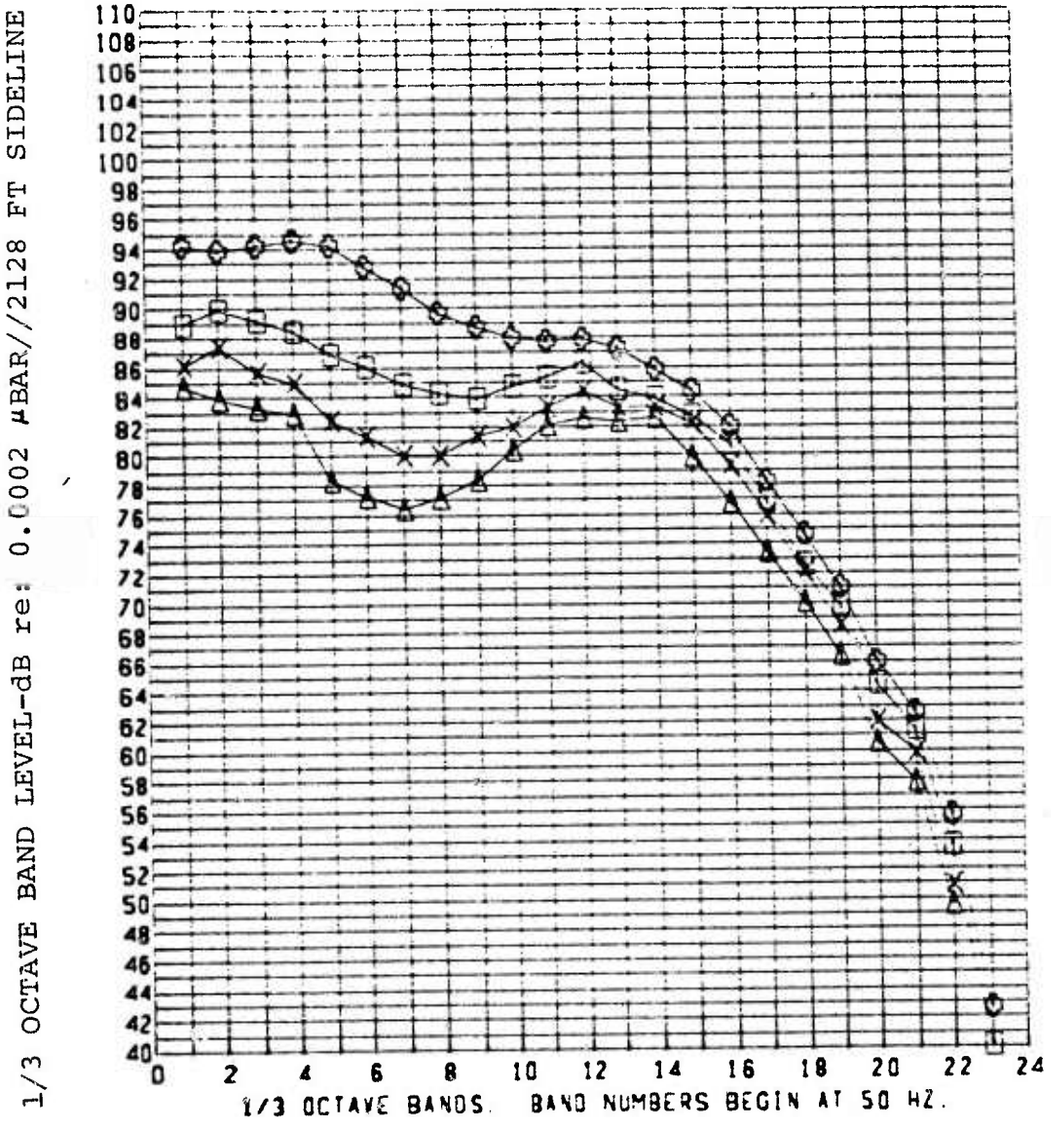
PR = △2.0, X2.5, □3.0, ✣4.0,

NOZZLE: 37T-4.5AR-RA-ET/RC

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 110° re: NOZZLE INLET AXIS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 130 DEG TEMP = 77 DEG R.H. = 70 PER CENT



T_T = 1150°F A_8 = 6.05 FT^2 RUN: 215

PR = △ 2.0, X 2.5, □ 3.0, ✣ 4.0

NOZZLE: 37T-4.5AR-RA-ET/RC

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 130°
re: NOZZLE INLET AXIS

TEST CONDITIONS

NOZZLE: 37T-4.5AR-RA-ET/RC

FACILITY: WALL ISOLATION FACILITY

DATE: January 21, 1973

P_{AMB} = 30.06 in Hg T_{AMB} = 41°F R.H. = 85%

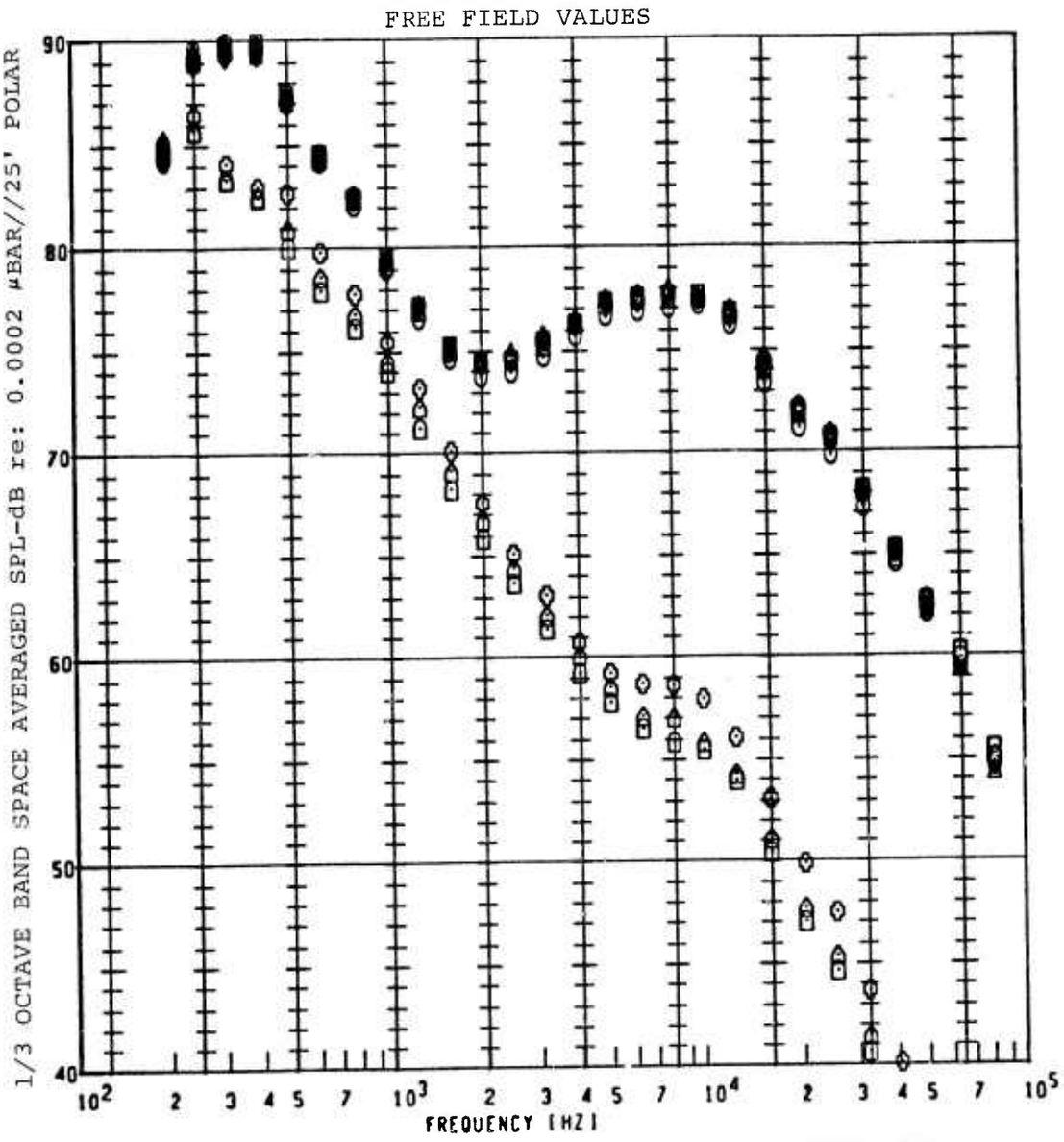
NPR = 3.0 T_T = 1150°F V_J (IDEAL) = 2300 FPS

SCALE MODEL A_8 = 13.6 in.^{2}

RUN NO.	AXIAL LOCATION	IRIS DIA.	REMARKS	REF.
168	0.0 x/D	11.0 in.		
169	0.25	11.0		
170	0.50	11.5		
171	0.75	11.5		
172	1.00	12.0		
173	1.25	12.0		
174	1.50	12.0		
175	1.75	12.5		
176	2.00	12.5		
177	2.25	13.0		
178	2.50	13.0		
179	2.75	13.5		
180	3.0	13.5		
181	3.5	14.0		
182	4.0	14.5		
183	5.0	15.5		
184	6.0	16.5		
185	8.0	18.0		
186	10.0	20.0		
187	12.0	22.0		
188	14.0	24.0		
189	16.0	25.5		

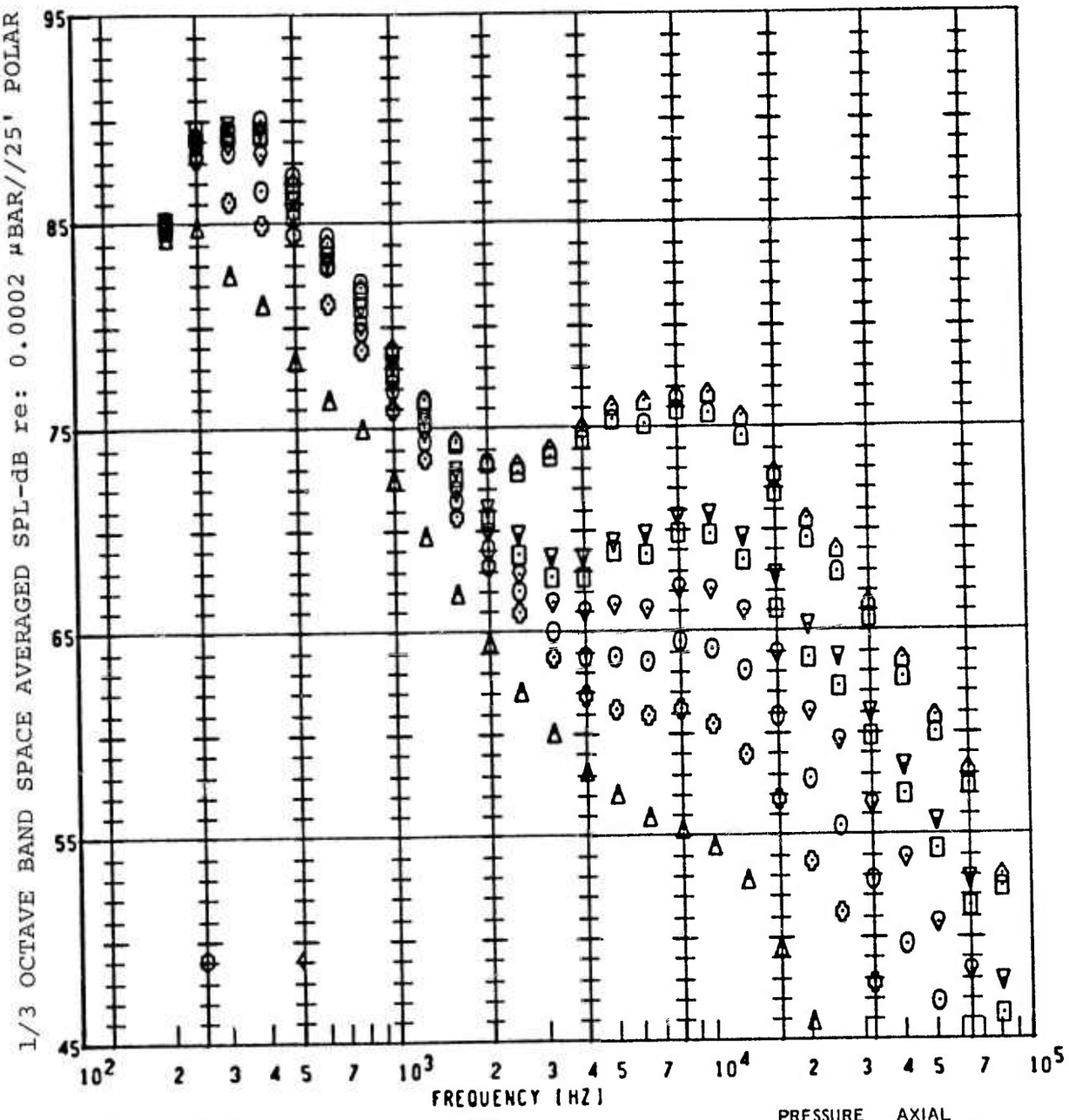
MICROPHONE LAYOUT: 25 FOOT VERTICAL POLAR ARC

FREE FIELD VALUES

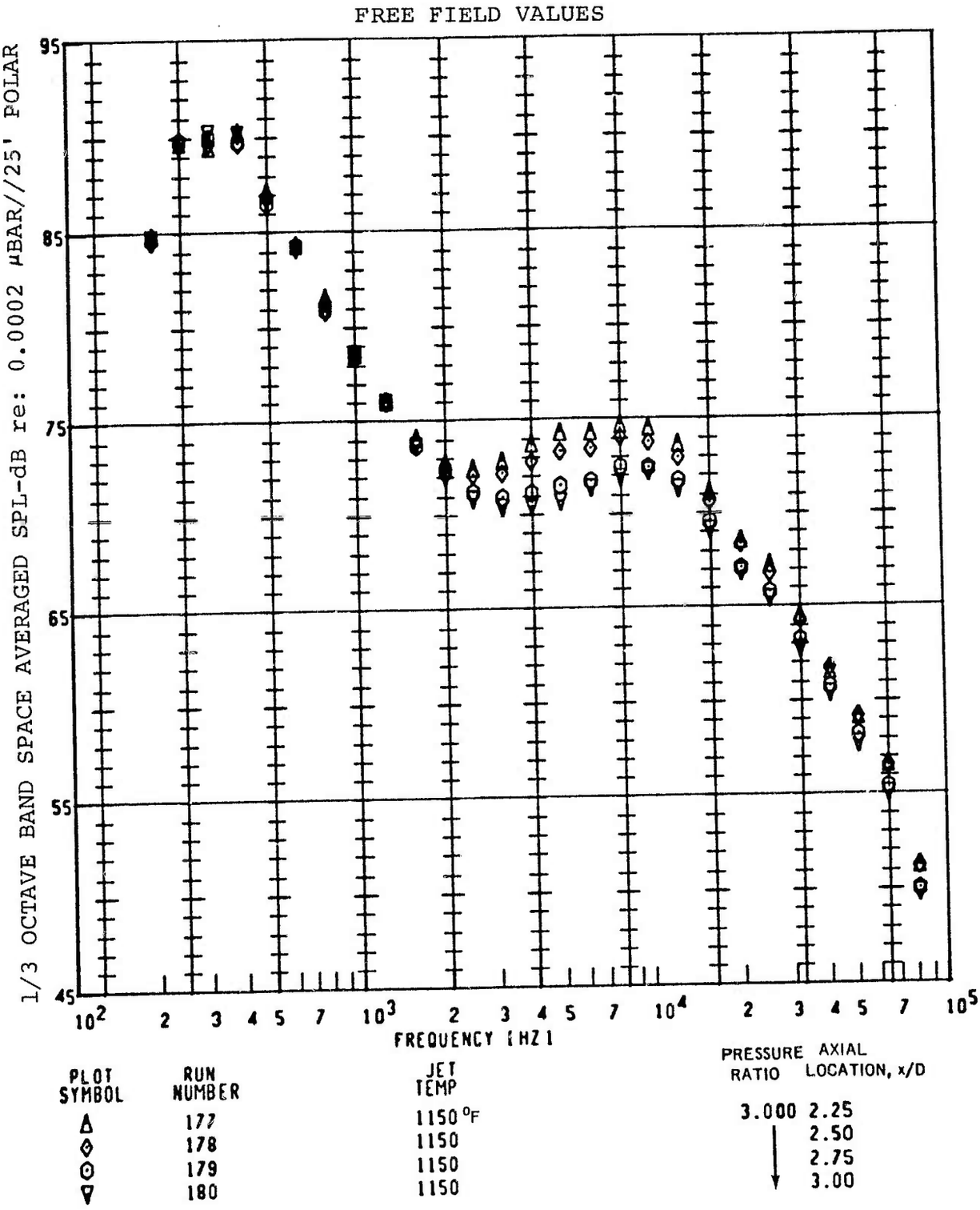


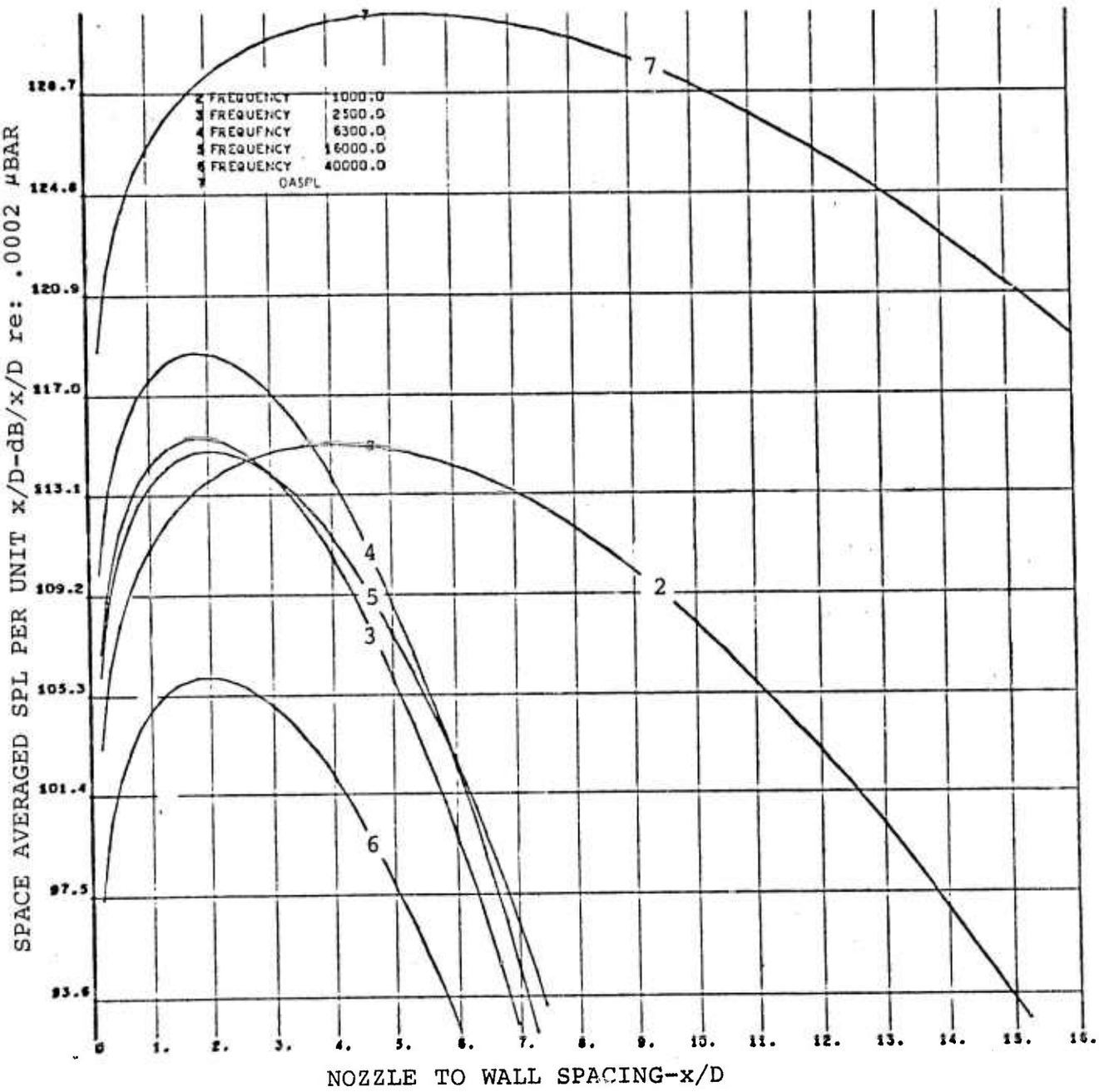
PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	AXIAL LOCATION, x/D
△	168	1150°F	3.000	0.00
◇	169	1150		0.25
○	170	1150		0.50
▽	171	1150		0.75
□	172	1150		1.00
◇	173	1150		1.25
○	174	1150		1.50
◇	186	1150		10.00
△	187	1150		12.00
□	188	1150		14.00

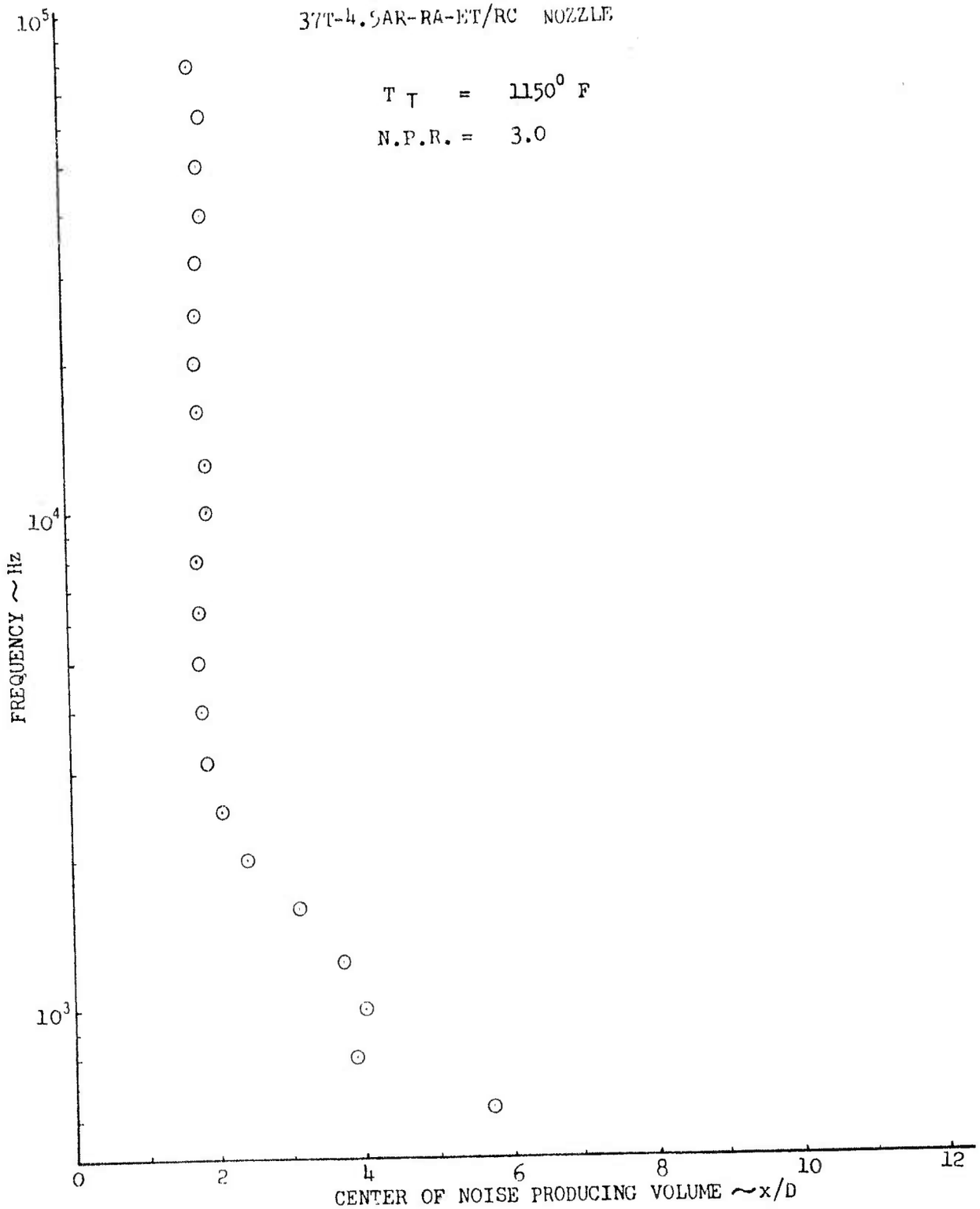
FREE FIELD VALUES

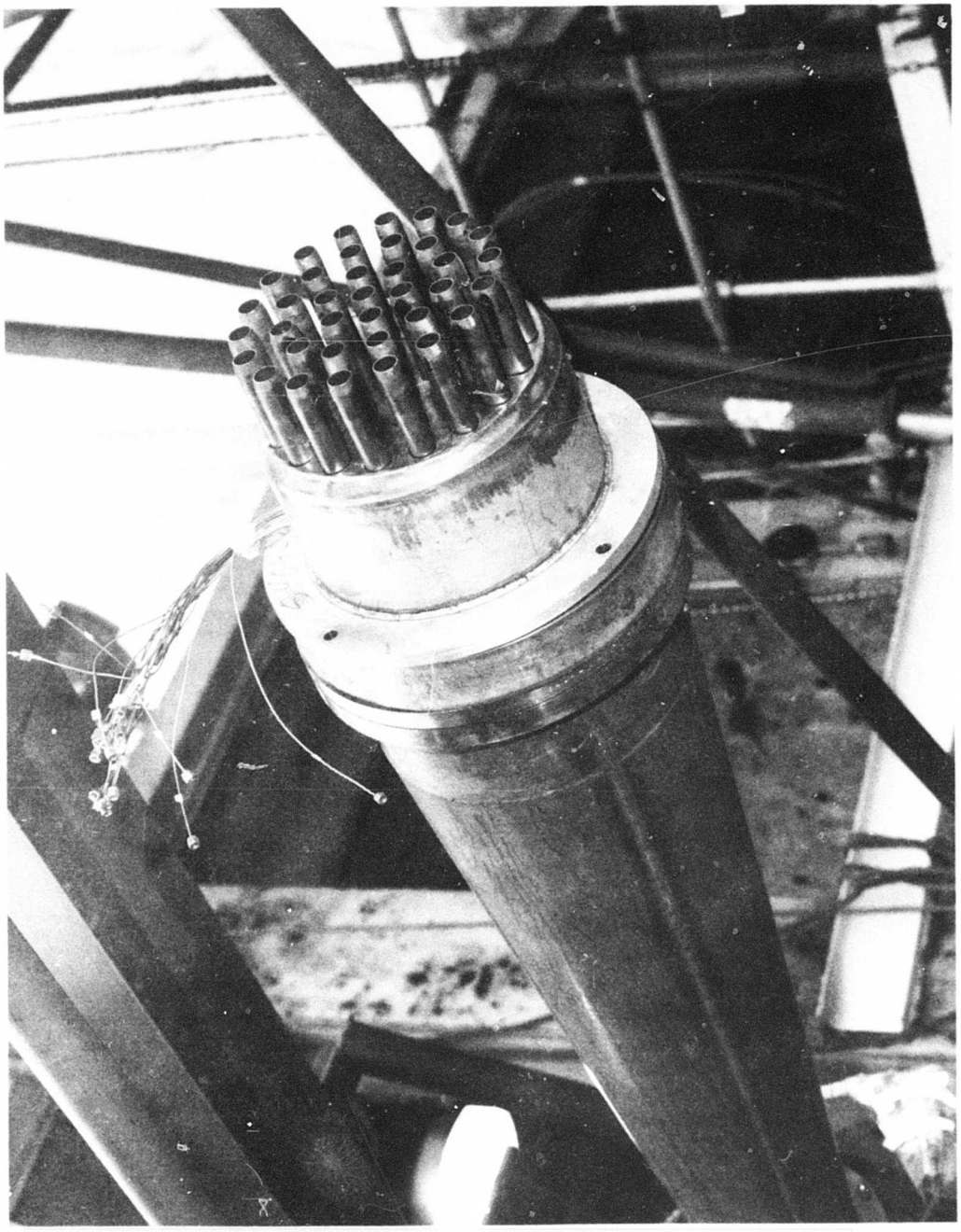


PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	AXIAL LOCATION, x/D
△	189	1150°F	3.0	16.00
▽	181	1150	3.0	3.50
⊡	182	1150	3.0	4.00
◇	183	1150	3.0	5.00
○	184	1150	3.0	6.00
◈	185	1150	3.0	8.00
⌂	175	1150	3.0	1.75
⊡	176	1150	3.0	2.00

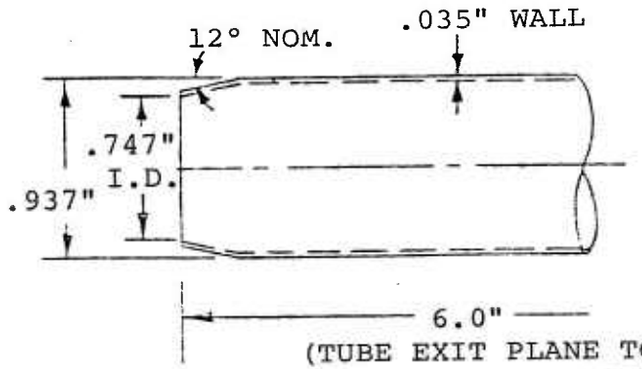

FREE FIELD VALUES
1/3 OCTAVE BAND SPACE AVERAGED SPL-dB re: 0.0002 μBAR//25' POLAR
95
85
75
65
55
45
10^2 2 3 4 5 7 10^3 2 3 4 5 7 10^4 2 3 4 5 7 10^5
FREQUENCY (HZ)
PLOT SYMBOL
RUN NUMBER
JET TEMP
PRESSURE RATIO
AXIAL LOCATION, x/D
177 1150 °F 3.000 2.25
178 1150 2.50
179 1150 2.75
180 1150 3.00


2 FREQUENCY 1000.0
3 FREQUENCY 2500.0
4 FREQUENCY 6300.0
5 FREQUENCY 16000.0
6 FREQUENCY 40000.0
7 OASPL
128.7
124.8
120.9
117.0
113.1
109.2
105.3
101.4
97.5
93.6
SPACE AVERAGED SPL PER UNIT x/D-dB/x/D re: .0002 μBAR
0 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14. 15. 16.
NOZZLE TO WALL SPACING-x/D


37T-4.9AR-RA-ET/RC NOZZLE
T_T = 1150° F
N.P.R. = 3.0
10^5
10^4
10^3
FREQUENCY ~ Hz
0
2
4
6
8
10
12
CENTER OF NOISE PRODUCING VOLUME ~x/D



31T-2.75AR-RA-ET/RC NOZZLE

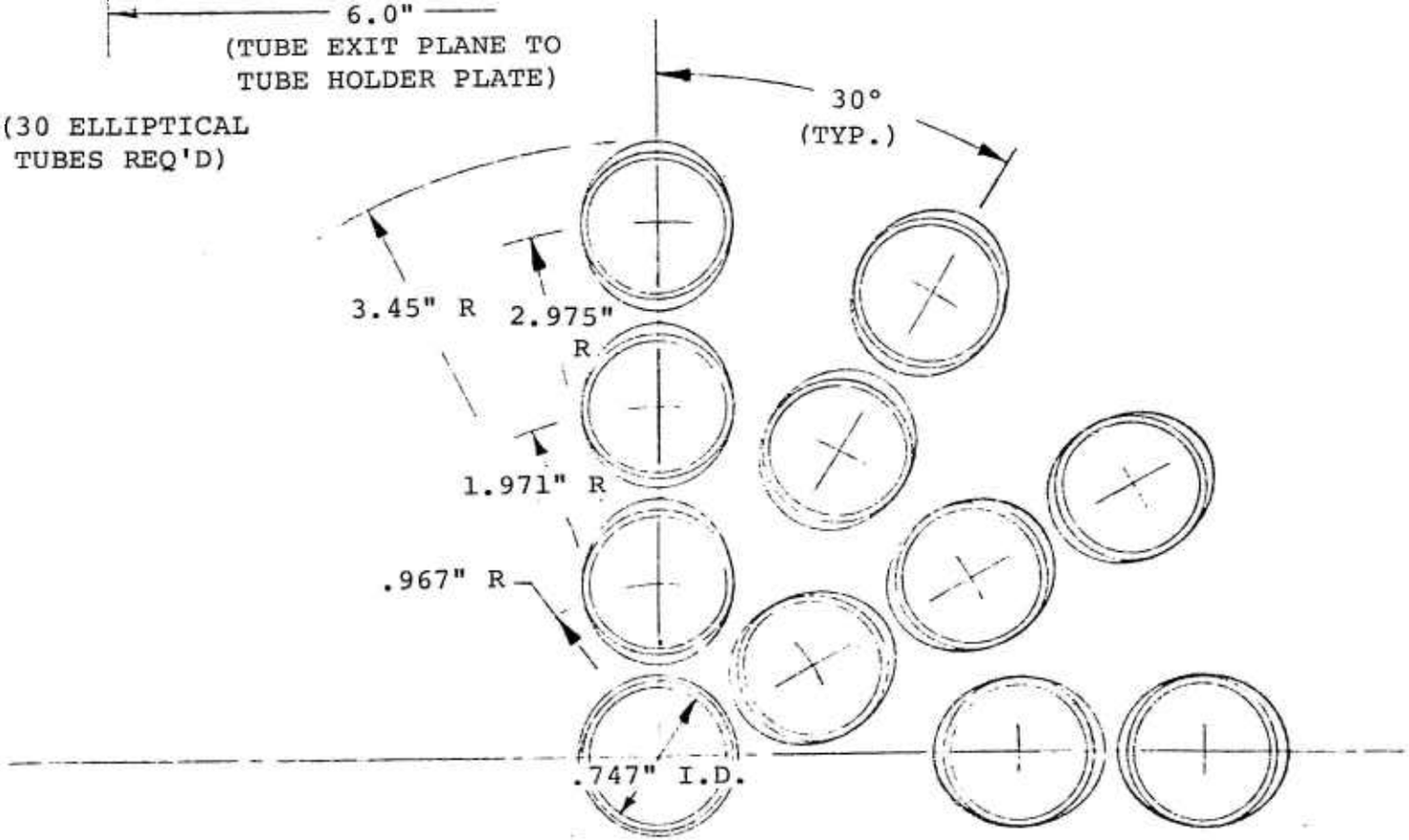


(30 ELLIPTICAL
TUBES REQ'D)

NOTE: CENTER TUBE IS A .875" DIA. TUBE
WITH .020" WALL (.835" I.D.) WITH A
12° NOM. CONVERGENCE TO .747" DIA. EXIT

31T-2.75AR-RA-ET/RC NOZZLE

A_8 = 13.6 IN.^{2}



31 TUBE - AREA RATIO 2.75 ELLIPTICAL TUBES RADIAL ARRAY

TEST CONDITIONS

NOZZLE: 31T-2.75AR-RA-ET/RC

FACILITY: HNTF

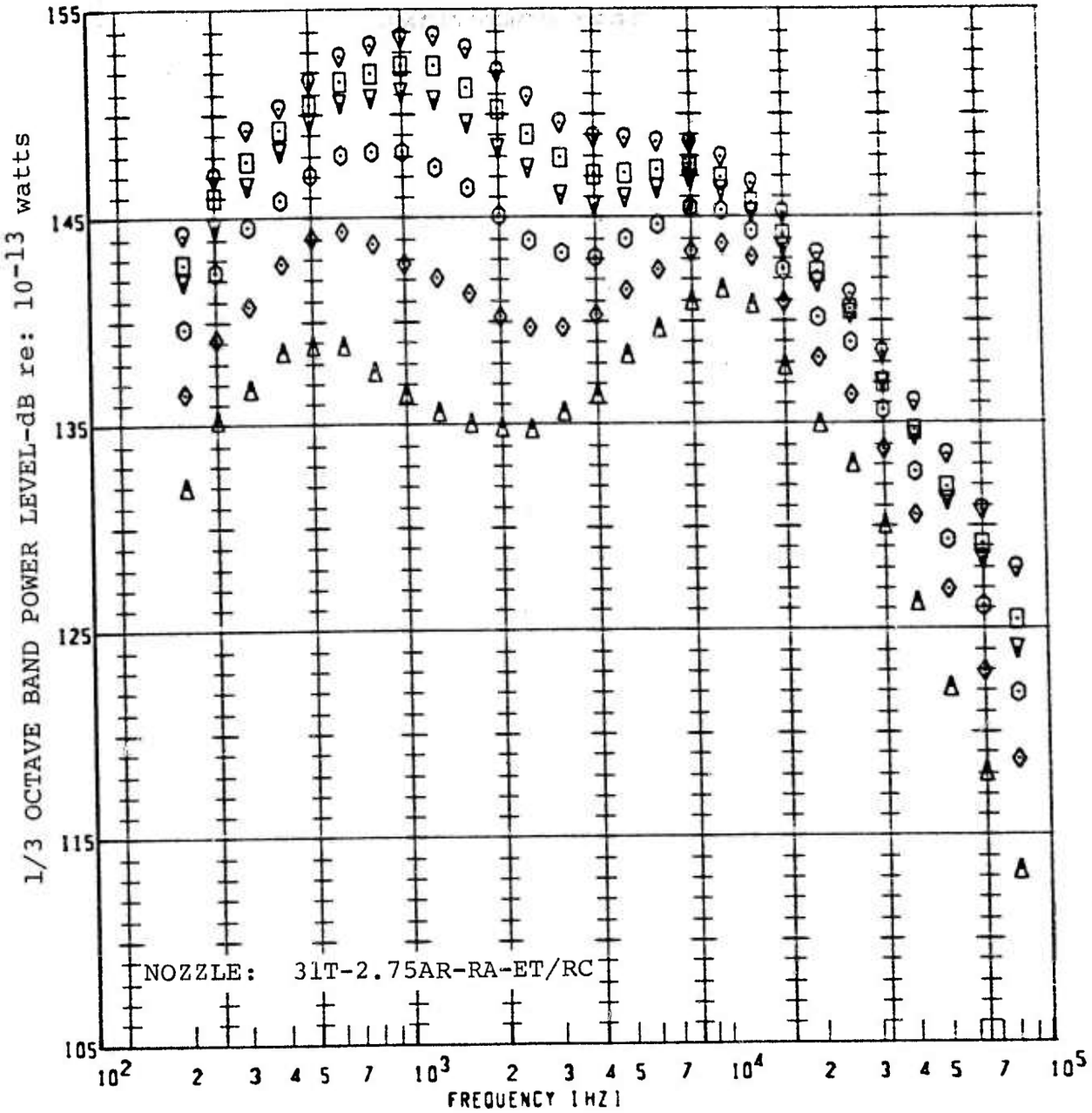
DATE: 6-18-73 T_{AMB} = 58°F **R.H.** = 66%

SCALE MODEL A_8 = 13.6 $in.^2$

RUN NO.	NPR	T_T	V_J (IDEAL)	REMARKS	REF
82	2.0	1150°F	1875 fps		
"	2.5	"	2126		
"	3.0	"	2303		
"	3.4	"	2413		
"	3.7	"	2483		
"	4.0	"	2544		

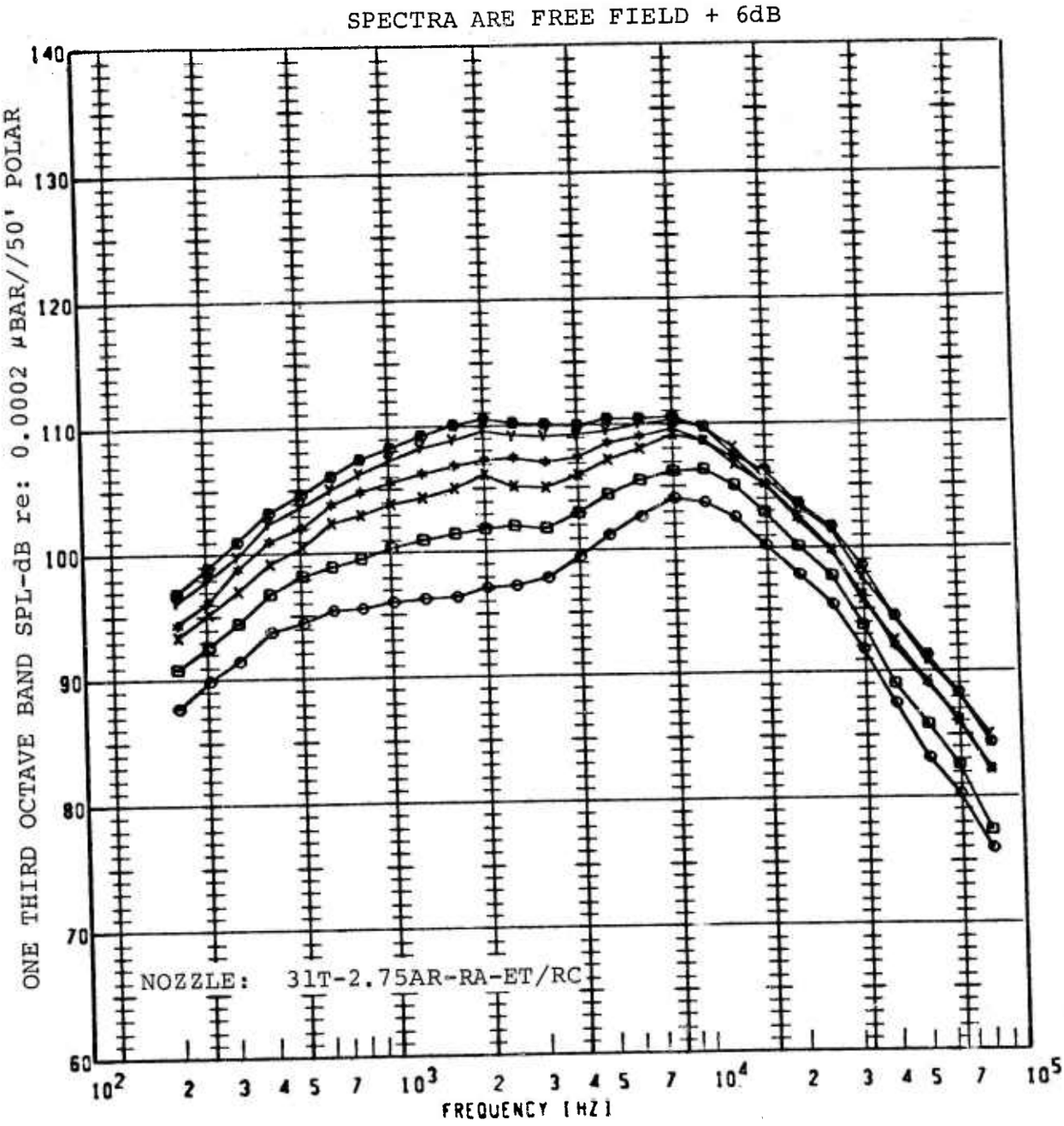
MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH CONCRETE GROUND SURFACE. MEASURED ACOUSTIC DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.

FREE FIELD VALUES



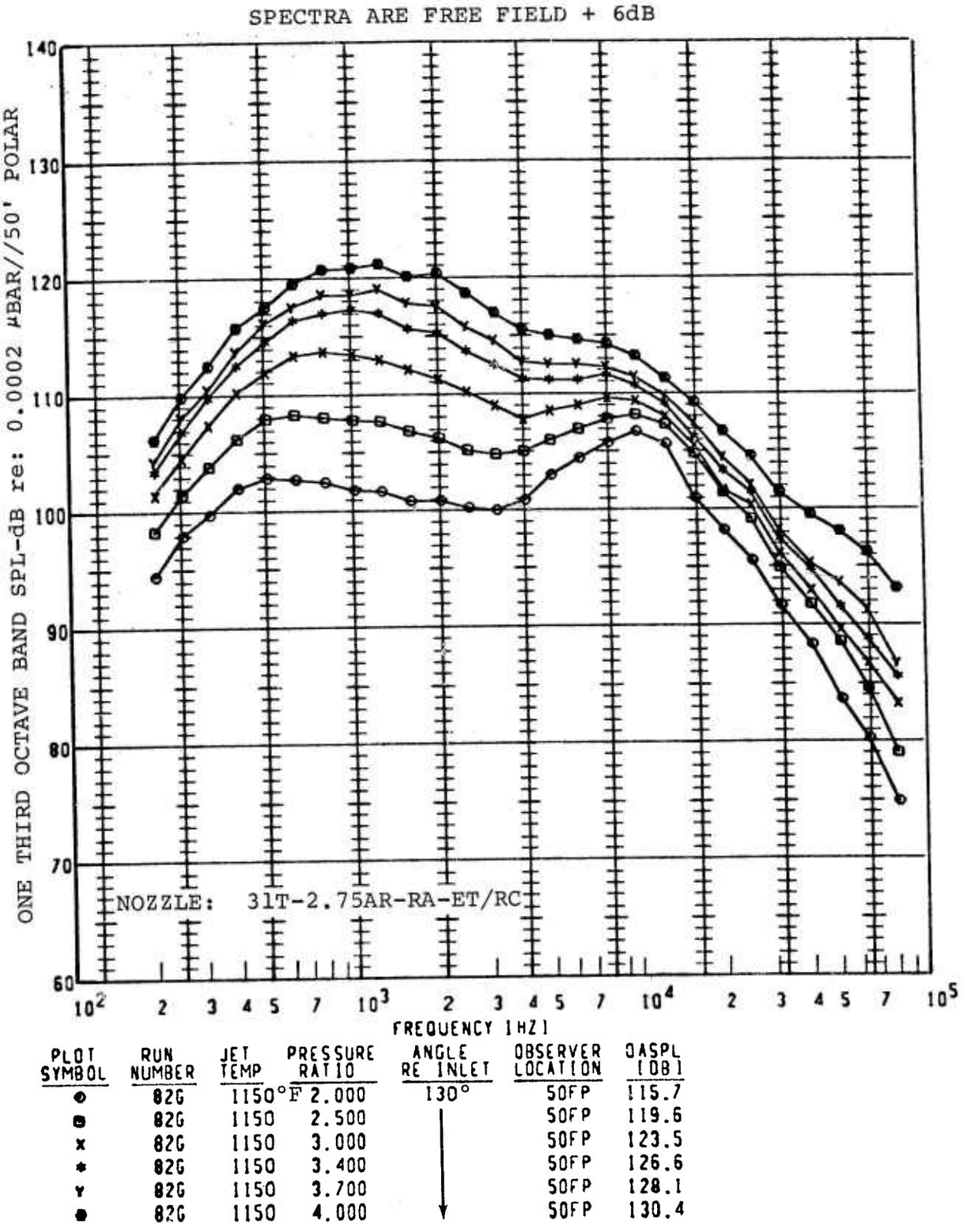
PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	82	2.00	1150°F
◇	82	2.50	1150
○	82	3.00	1150
▽	82	3.40	1150
□	82	3.70	1150
◇	82	4.00	1150

JET NOISE POWER SPECTRA



PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL [OBI]
●	826	1150°F	2.000	110°	SOFP	112.4
■	826	1150	2.500		SOFP	115.5
x	826	1150	3.000		SOFP	118.3
*	826	1150	3.400		SOFP	119.4
Y	826	1150	3.700		SOFP	120.8
●	826	1150	4.000		SOFP	121.6

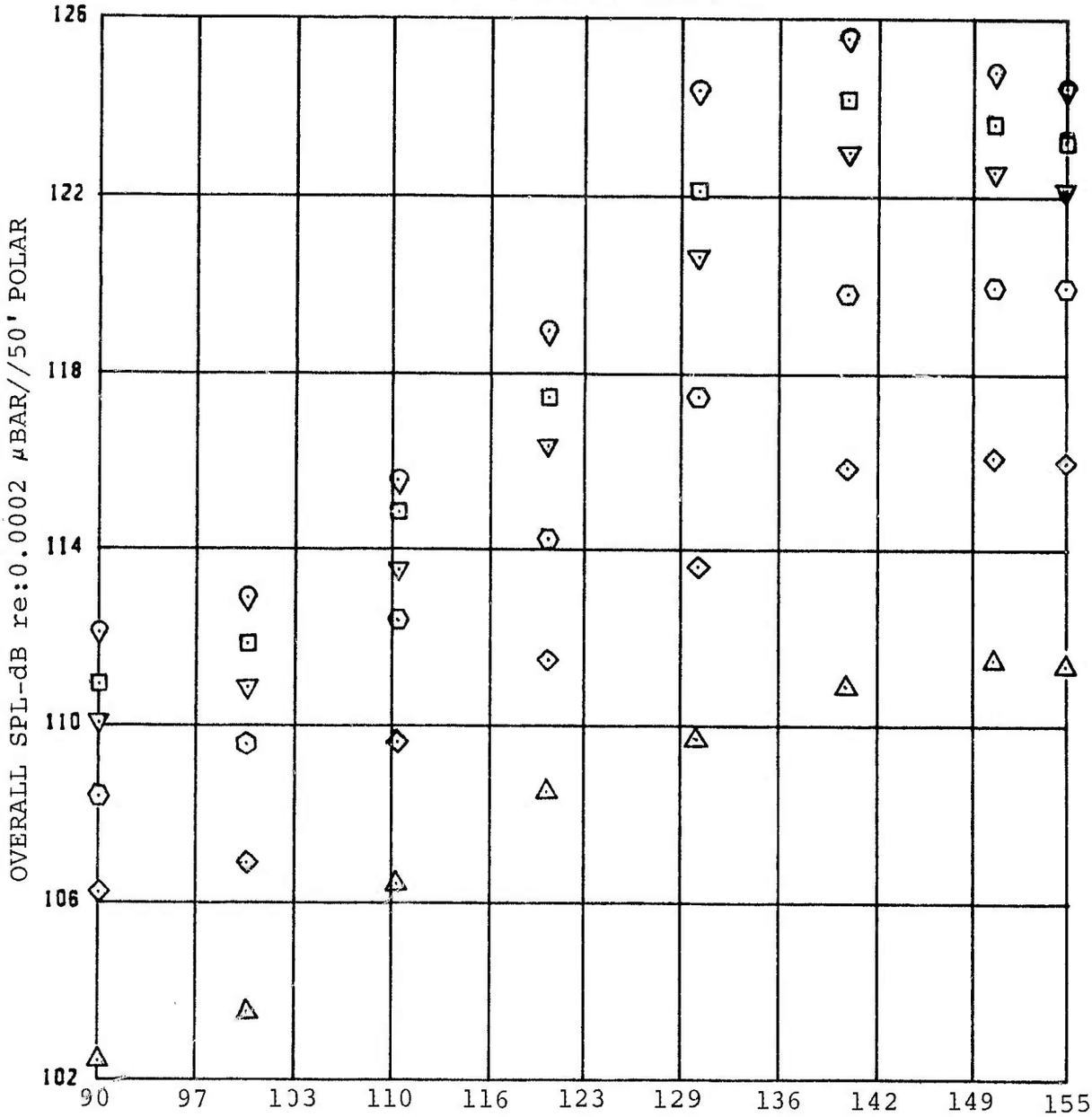
MEASURED NOISE SPECTRA AT 110° re: NOZZLE INLET AXIS



PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL (DB)
●	82G	1150°F	2.000	130°	SOFP	115.7
■	82G	1150	2.500	↓	SOFP	119.6
x	82G	1150	3.000	↓	SOFP	123.5
*	82G	1150	3.400	↓	SOFP	126.6
Y	82G	1150	3.700	↓	SOFP	128.1
●	82G	1150	4.000	↓	SOFP	130.4

MEASURED NOISE SPECTRA AT 130° re: NOZZLE INLET AXIS

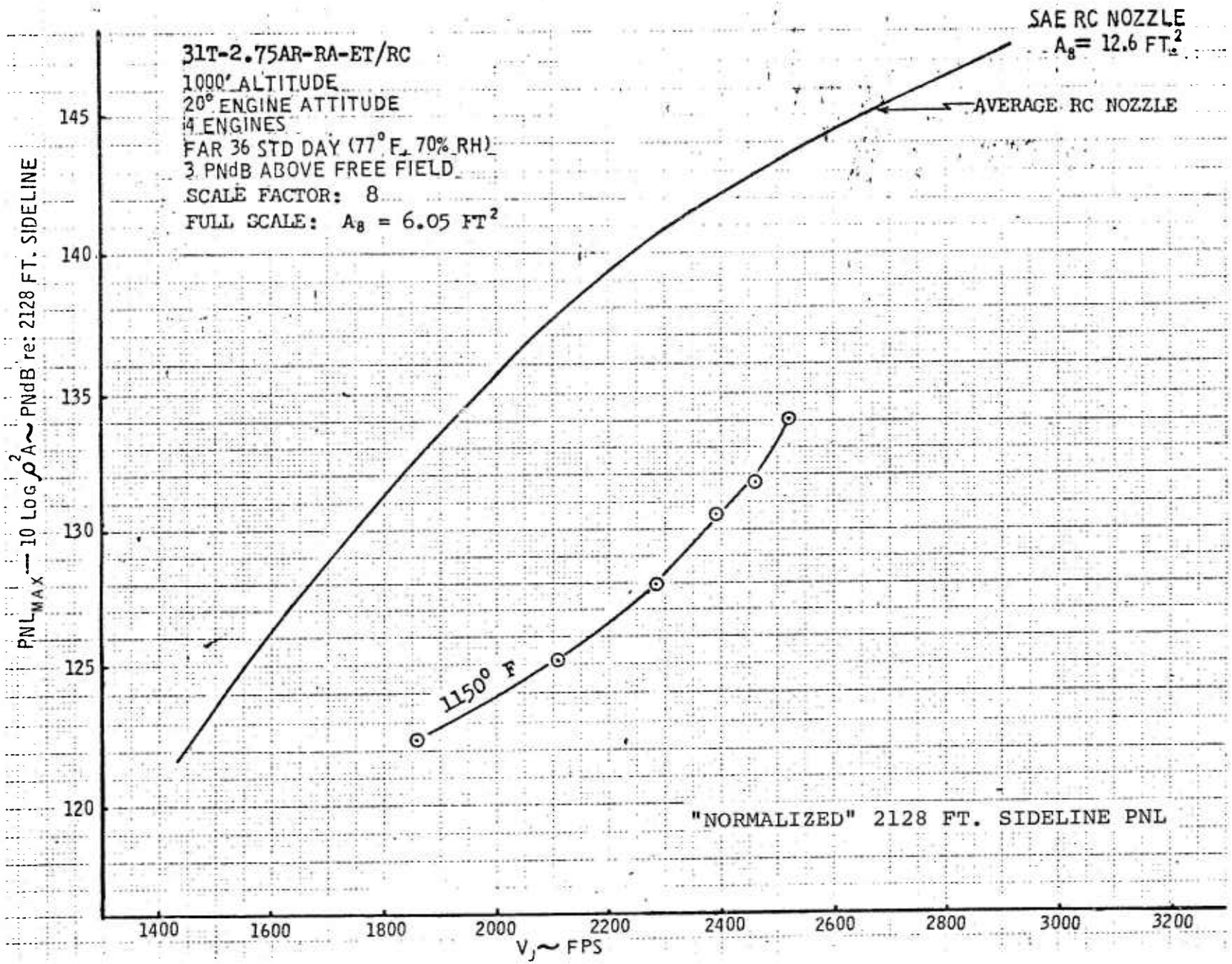
FREE FIELD VALUES

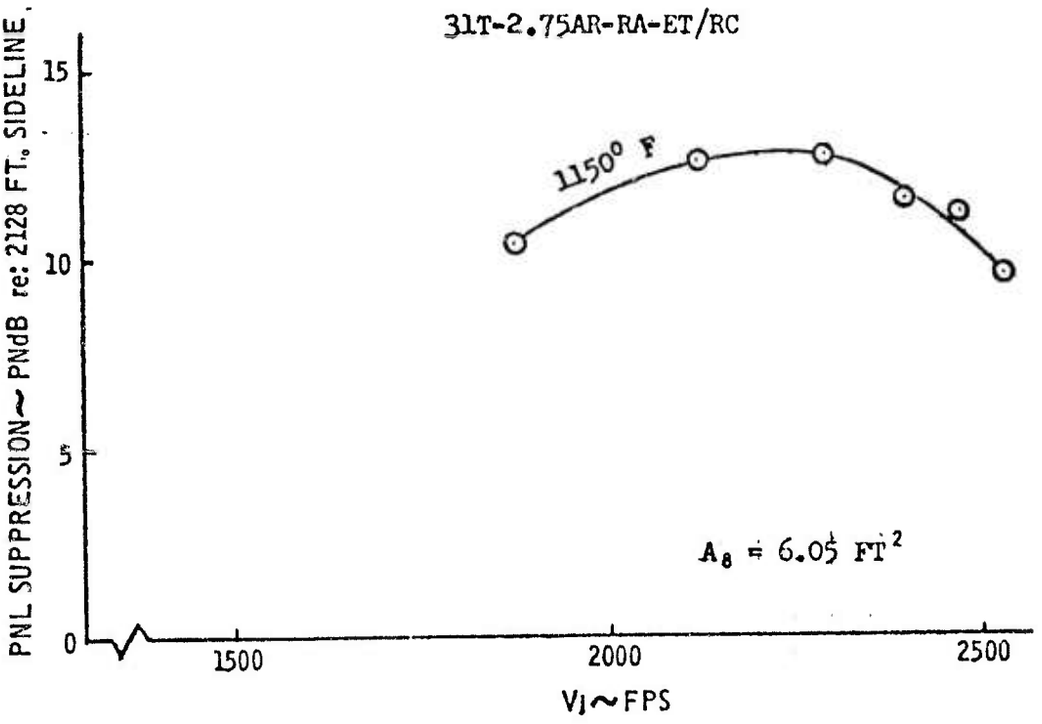


PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	82	2.00	1150°F
◇	82	2.50	1150
○	82	3.00	1150
▽	82	3.40	1150
□	82	3.70	1150
◇	82	4.00	1150

NOZZLE: 31T-2.75AR-RA-ET/RC

OASPL BEAM PATTERNS


SAE RC NOZZLE
A_8= 12.6 FT.^{2}
AVERAGE RC NOZZLE
31T-2.75AR-RA-ET/RC
1000' ALTITUDE
20° ENGINE ATTITUDE
4 ENGINES
FAR 36 STD DAY (77° F, 70% RH)
3 PNdB ABOVE FREE FIELD
SCALE FACTOR: 8
FULL SCALE: A_8 = 6.05 FT^2
1150° F
"NORMALIZED" 2128 FT. SIDELINE PNL
PNL_{MAX} — 10 Log $\rho^2 A$ ~ PNdB re: 2128 FT. SIDELINE
145
140
135
130
125
120
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
V_j ~ FPS

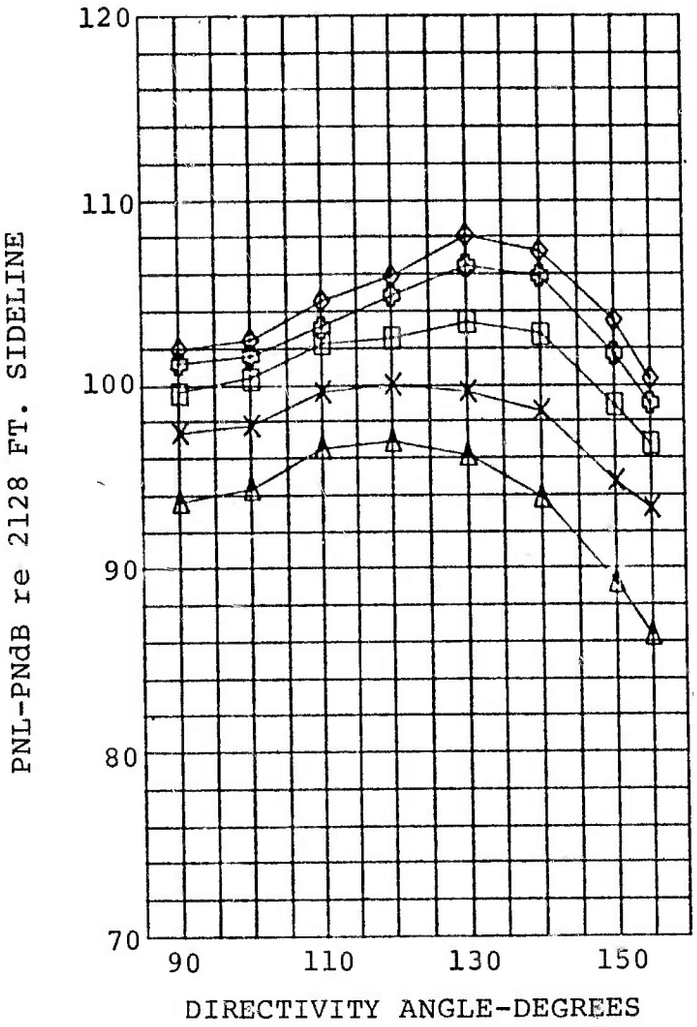


PEAK PNL SUPPRESSION VALUES

NOZZLE: 31T-2.75AR-RA-ET/RC

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = TEMP = 77 DEG R.H. = 70 PER CENT



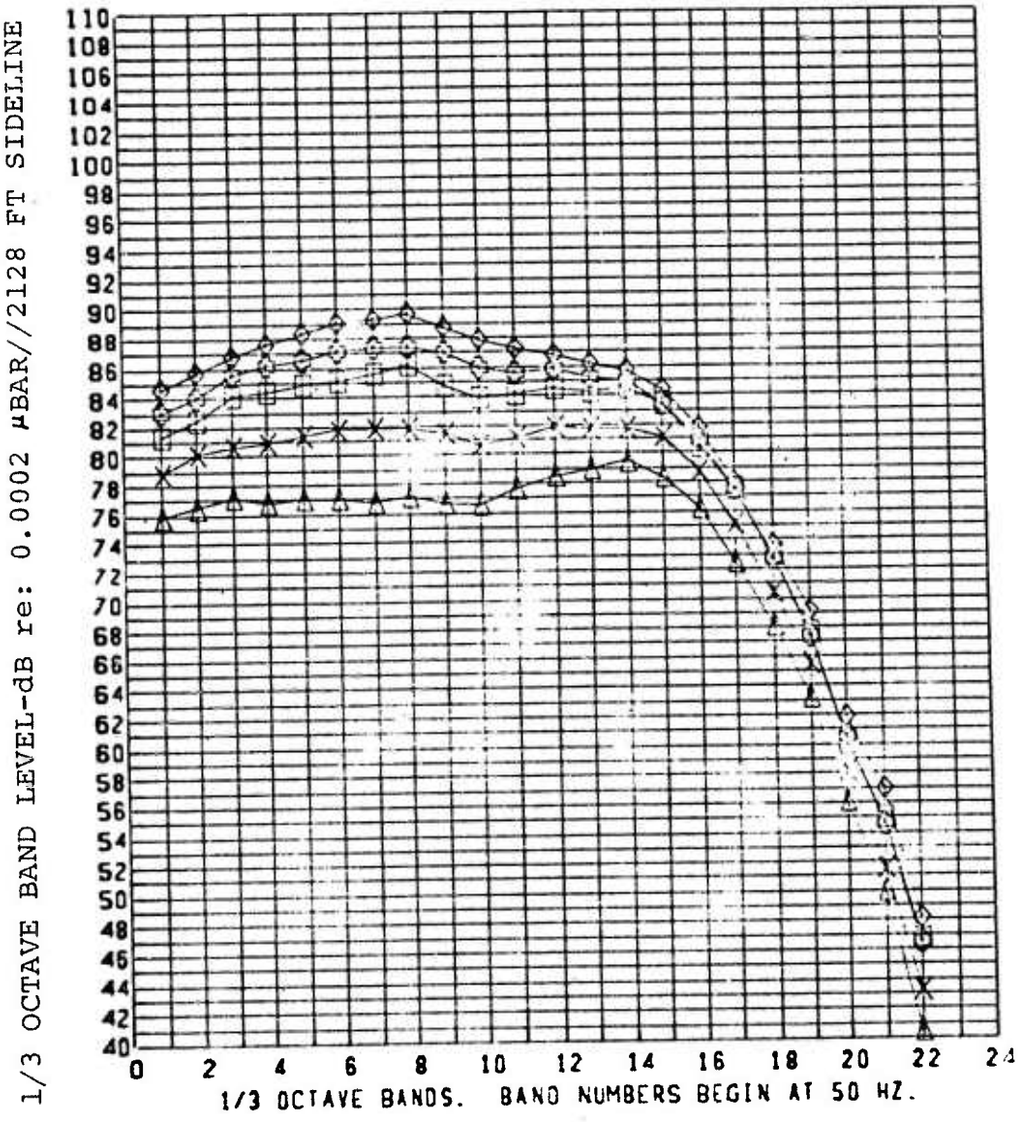
T_T = 1150°F A_8 = 6.05 FT^2 RUN: 82

PR = △ 2.0, X 2.5, □ 3.0, ✣ 3.4, ◇ 3.7

PNL BEAM PATTERNS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 110 DEG TEMP = 77 DEG R.H. = 70 PER CENT



T_T = 1150°F A_8 = 6.05 FT^2 RUN: 82

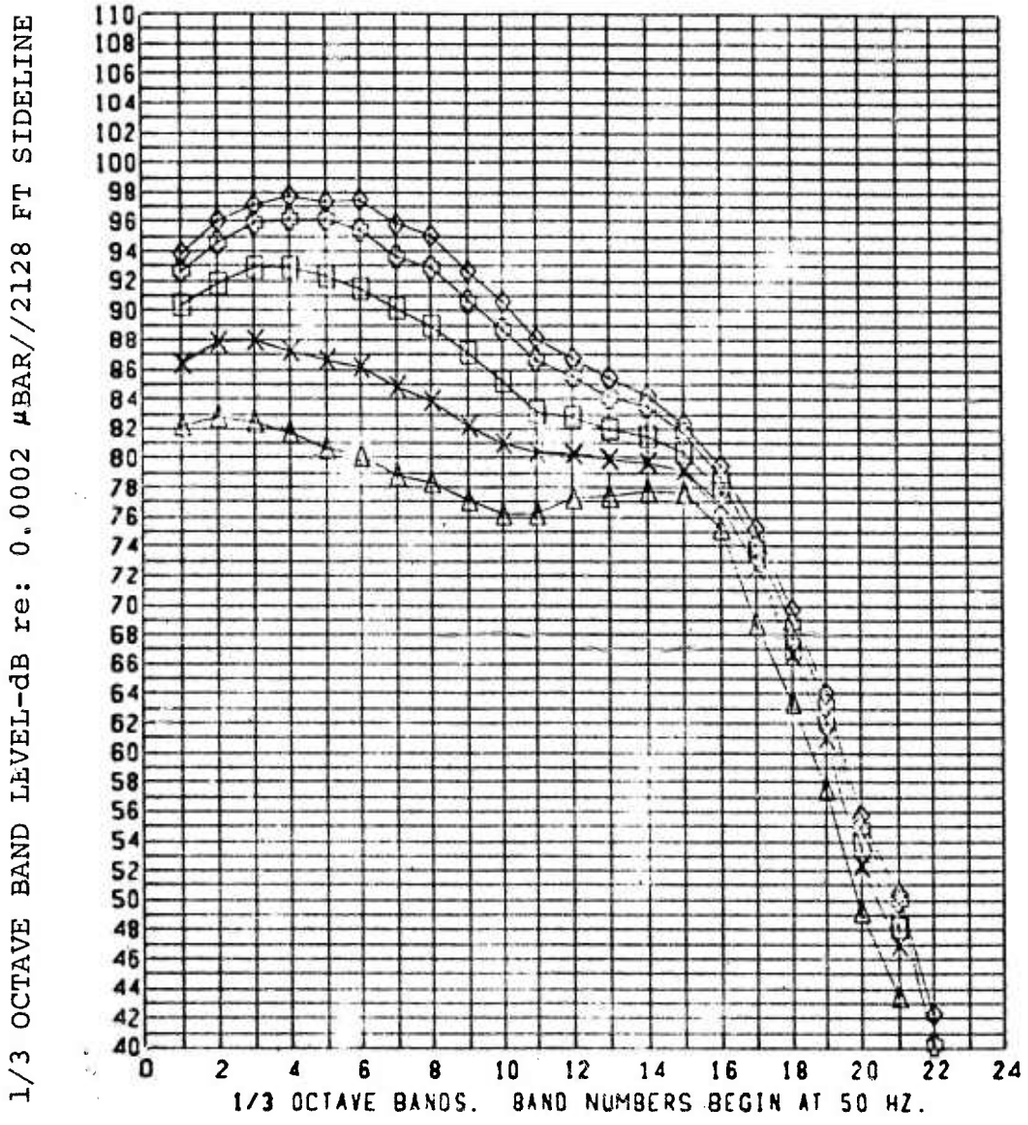
PR = △ 2.0, X 2.5, □ 3.0, ✣ 3.4, ◇ 3.7

NOZZLE: 31T-2.75AR-RA-ET/RC

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 110°
re: NOZZLE INLET AXIS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 130 DEG TEMP = 77 DEG R.H. = 70 PER CENT



T_T = 1150°F A_8 = 6.05 FT^2 RUN: 82

PR = △2.0, X 2.5, □ 3.0, ✣3.4, ◇ 3.7

NOZZLE: 31T-2.75AR-RA-ET/RC

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 130°

re: NOZZLE INLET AXIS

TEST CONDITIONS

NOZZLE: 31T-2.75AR-RA-ET/RC
with 2.6AR Ejector

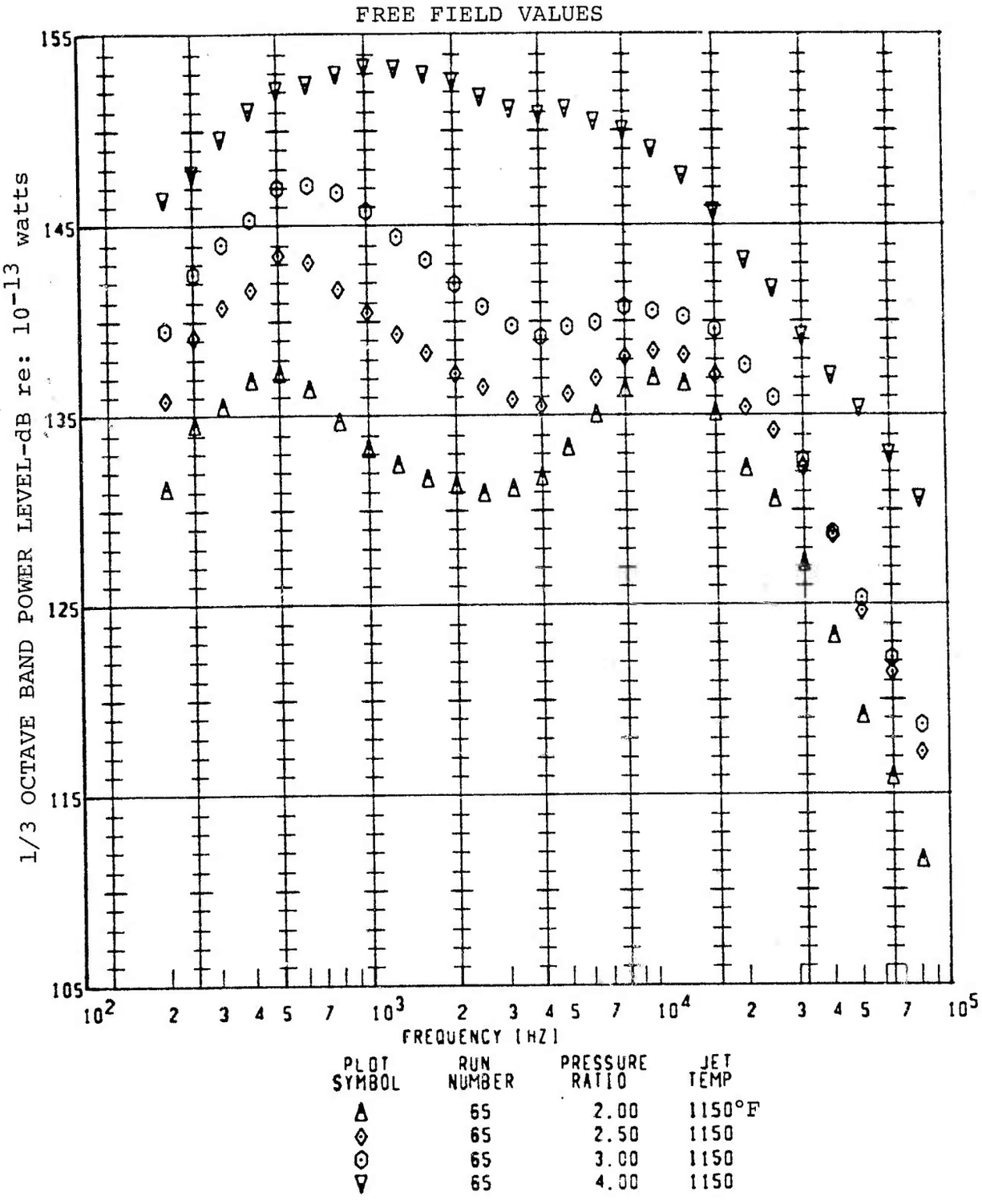
FACILITY: HNTF

DATE: 9-12-73 T_{AMB} = 66°F **R.H.** = 72%

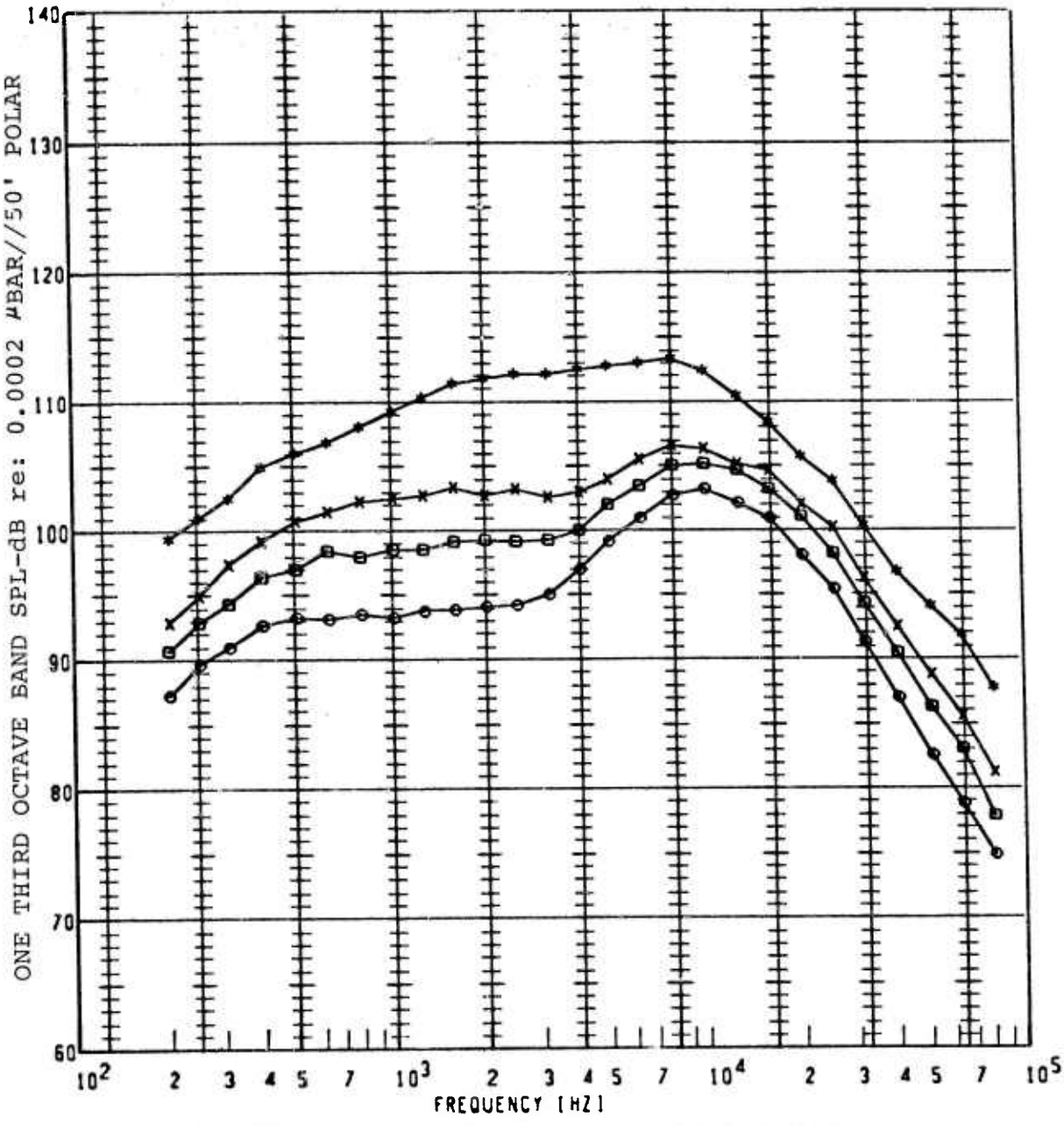
SCALE MODEL A_8 = 13.6 in.^{2}

RUN NO.	NPR	T_T	V_J (IDEAL)	REMARKS	REF
65	2.0	1150°F	1875 fps		
"	2.5	"	2126		
"	3.0	"	2303		
"	4.0	"	2544		

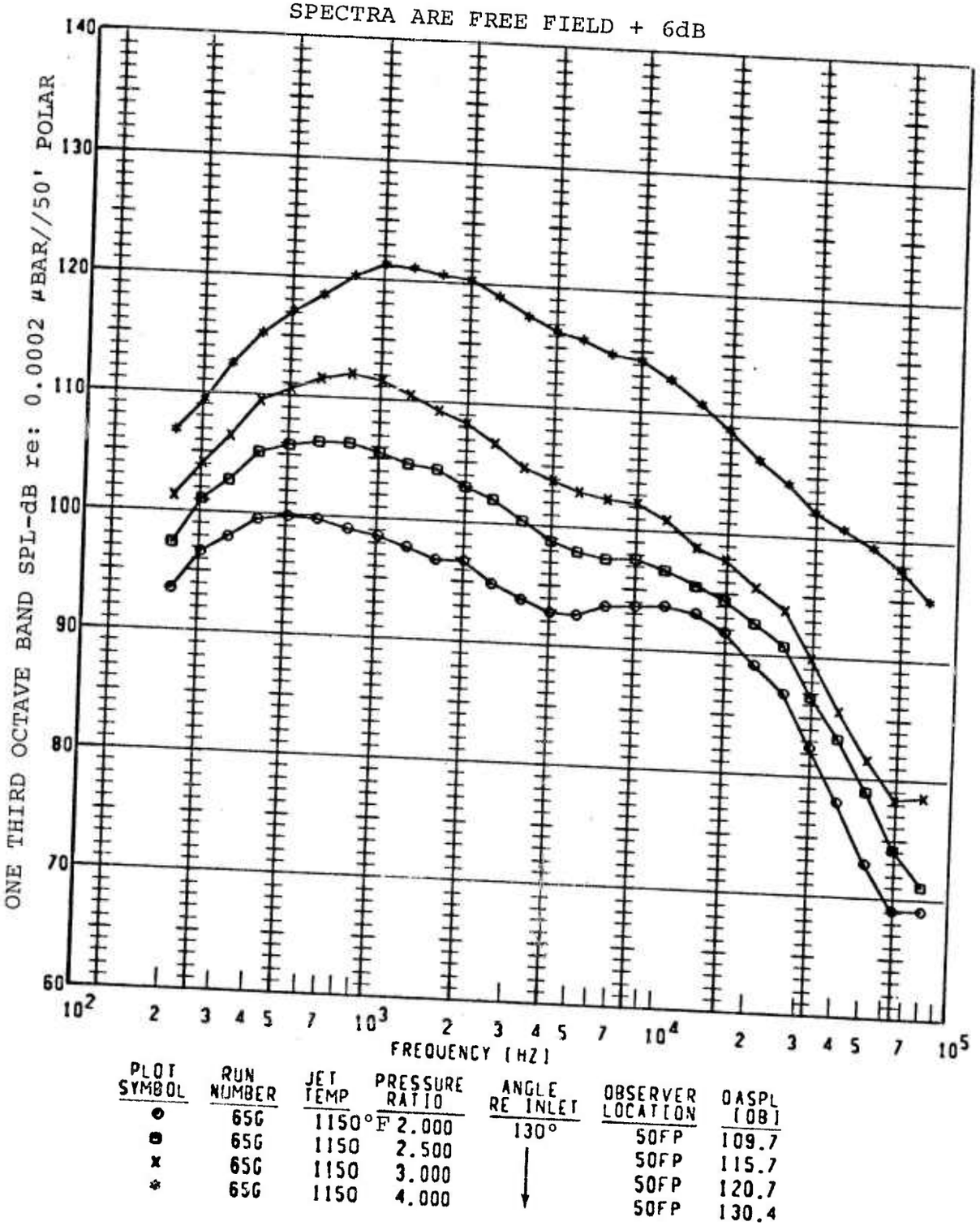
MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH CONCRETE GROUND SURFACE. MEASURED ACOUSTIC DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.


FREE FIELD VALUES
1/3 OCTAVE BAND POWER LEVEL-dB re: 10^{-13} watts
155
145
135
125
115
105
10^2 2 3 4 5 7 10^3 2 3 4 5 7 10^4 2 3 4 5 7 10^5
FREQUENCY [HZ]
PLOT SYMBOL | RUN NUMBER | PRESSURE RATIO | JET TEMP
Δ | 65 | 2.00 | 1150°F
◇ | 65 | 2.50 | 1150
○ | 65 | 3.00 | 1150
▽ | 65 | 4.00 | 1150

SPECTRA ARE FREE FIELD + 6dB

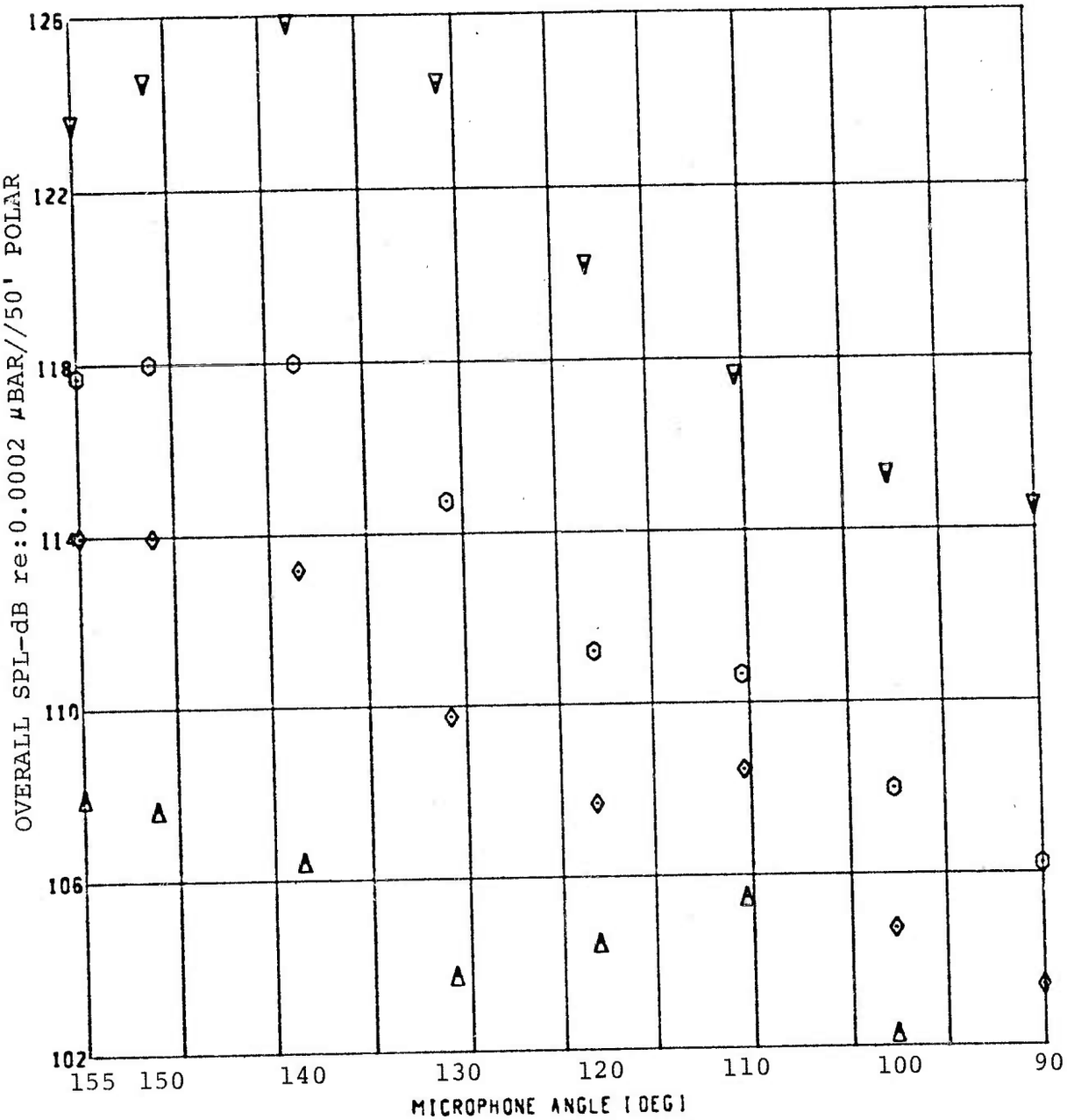


PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL [DB]
●	65G	1150°F	2.000	110°	50FP	111.2
■	65G	1150	2.500	↓	50FP	114.2
x	65G	1150	3.000		50FP	116.5
*	65G	1150	4.000		50FP	123.5

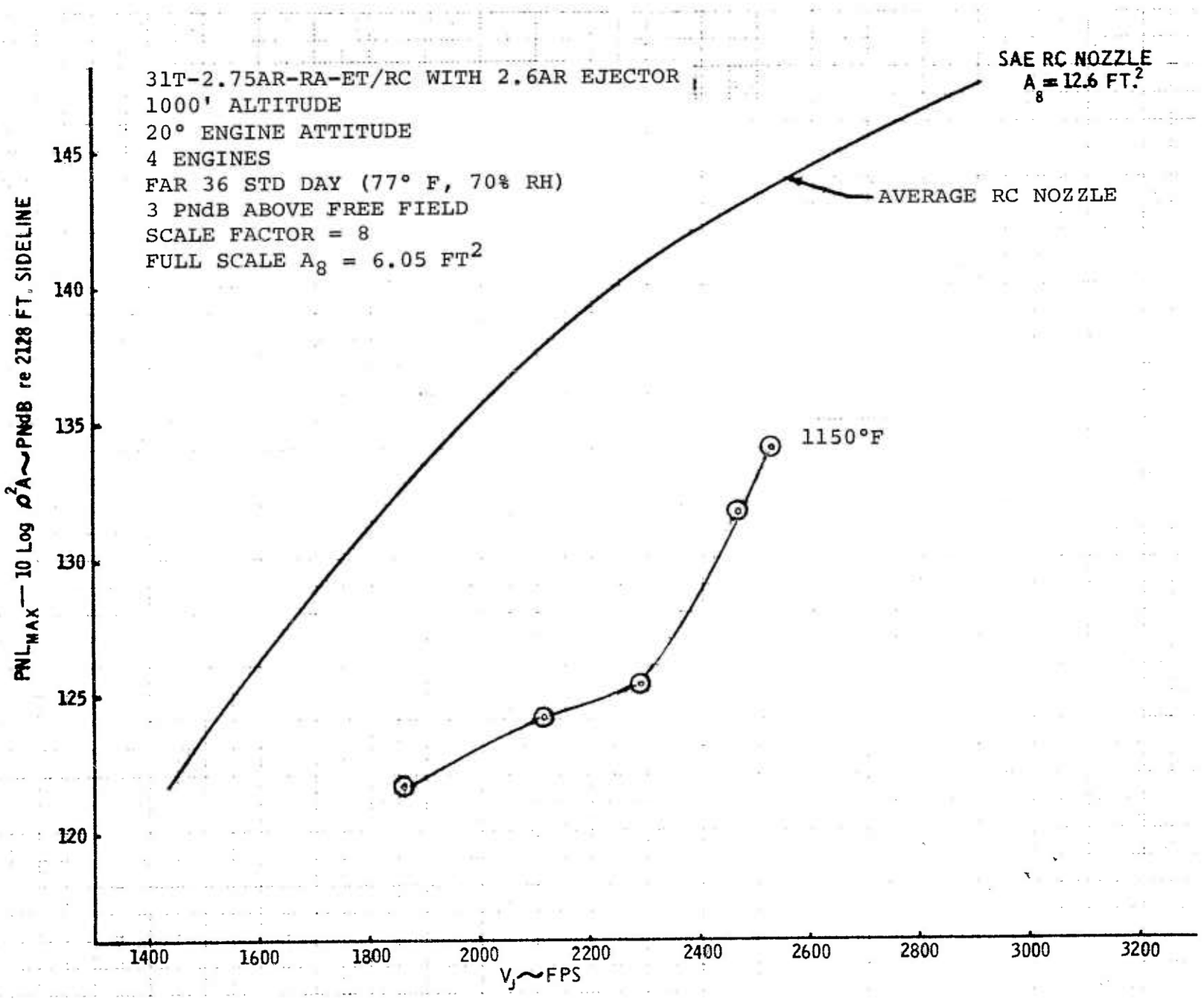


PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL (OB)
●	65G	1150°F	2.000	130°	50FP	109.7
■	65G	1150	2.500		50FP	115.7
x	65G	1150	3.000		50FP	120.7
*	65G	1150	4.000		50FP	130.4

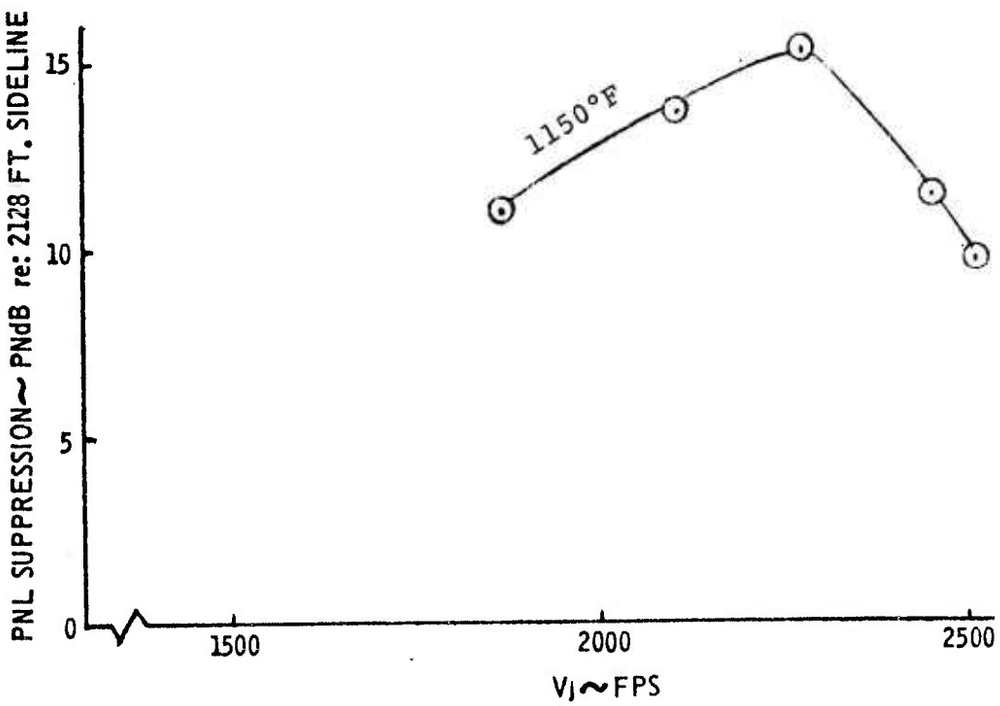
FREE FIELD VALUES



PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	65	2.00	1150°F
◇	65	2.50	1150
○	65	3.00	1150
▽	65	4.00	1150

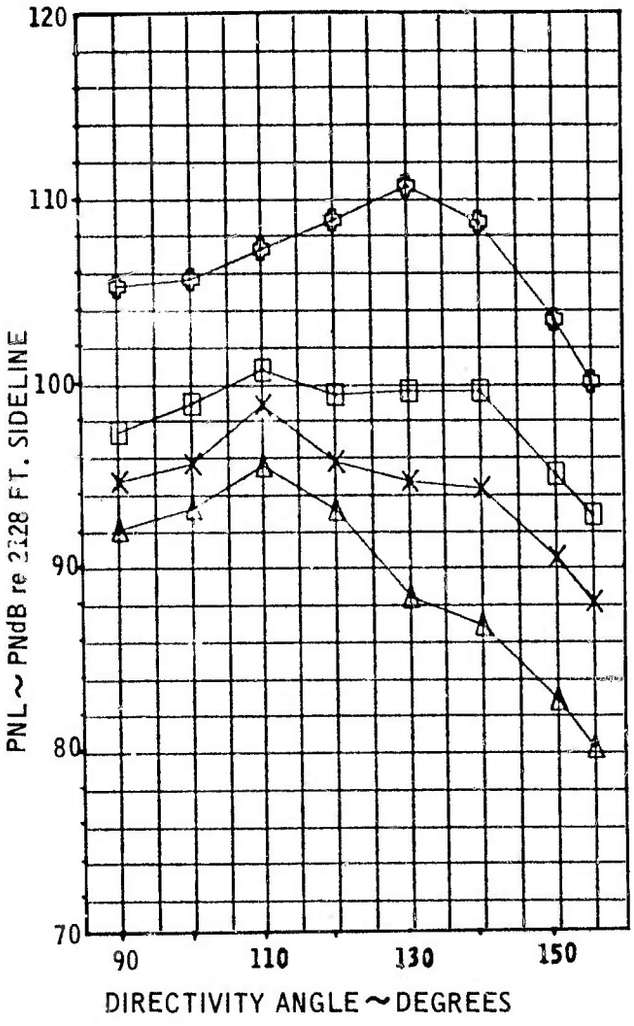

31T-2.75AR-RA-ET/RC WITH 2.6AR EJECTOR
1000' ALTITUDE
20° ENGINE ATTITUDE
4 ENGINES
FAR 36 STD DAY (77° F, 70% RH)
3 PNdB ABOVE FREE FIELD
SCALE FACTOR = 8
FULL SCALE A_8 = 6.05 FT^2
SAE RC NOZZLE
A_8 = 12.6 FT.^{2}
AVERAGE RC NOZZLE
1150°F
PNL_{MAX} — 10 Log $\rho^2 A$ ~ PNdB re 2128 FT. SIDELINE
145
140
135
130
125
120
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
V_j ~ FPS

31T-2.75AR-RA-ET/RC WITH 2.6AR EJECTOR



PEAK PNL SUPPRESSION VALUES

NOZZLE: 31T-2.75AR-RA-ET/RC
WITH 2.6AR EJECTOR



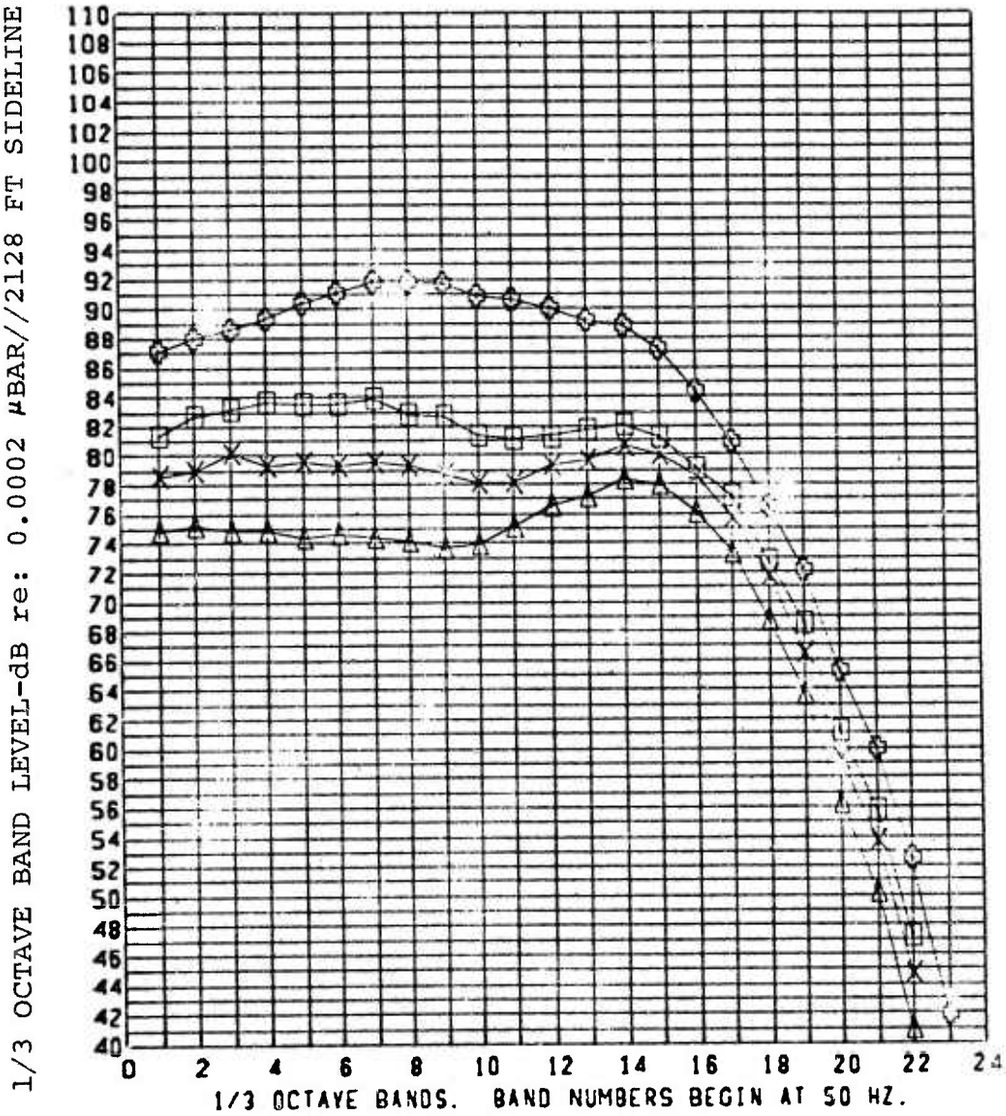
T_T = 1150°F A_8 = 6.05 FT^2 RUN:65

PR = △ 2.0, X 2.5, □ 3.0, ✣ 4.0

PNL BEAM PATTERNS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 110 DEG TEMP = 77 DEG R.H. = 70 PER CENT

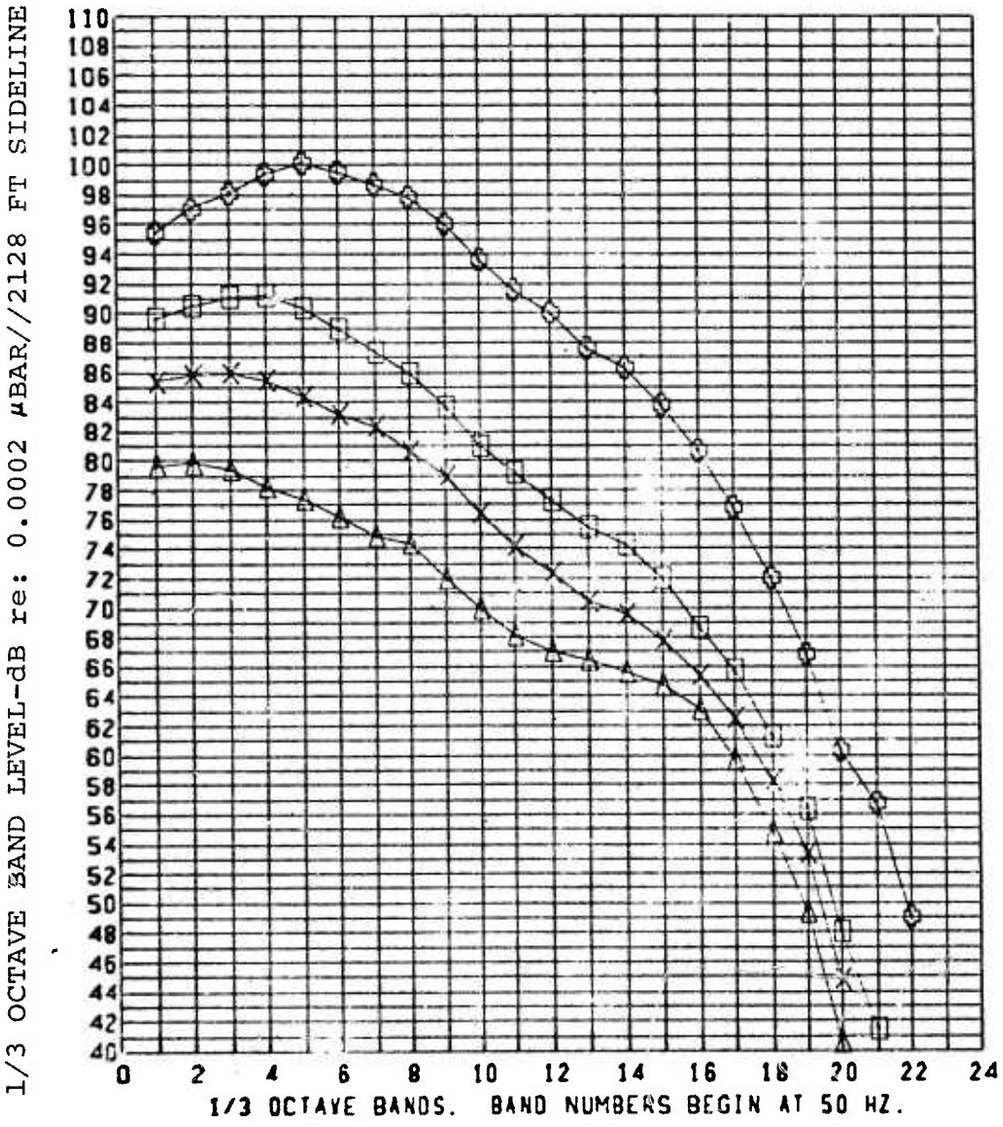


T_T = 1150°F A_8 = 6.05 FT^2 RUN: 65

PR = △2.0, X2.5, □3.0, ✣4.0 ◇3.7

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 130 DEG TEMP = 77 DEG R.H. = 70 PER CENT



T_T = 1150°F A_8 = 6.05 FT^2 RUN: 65

PR = △ 2.0, X 2.5, □ 3.0, ✣ 4.0

TEST CONDITIONS

NOZZLE: 31T-2.75AR-RA-ET/RC
with 3.1AR Ejector

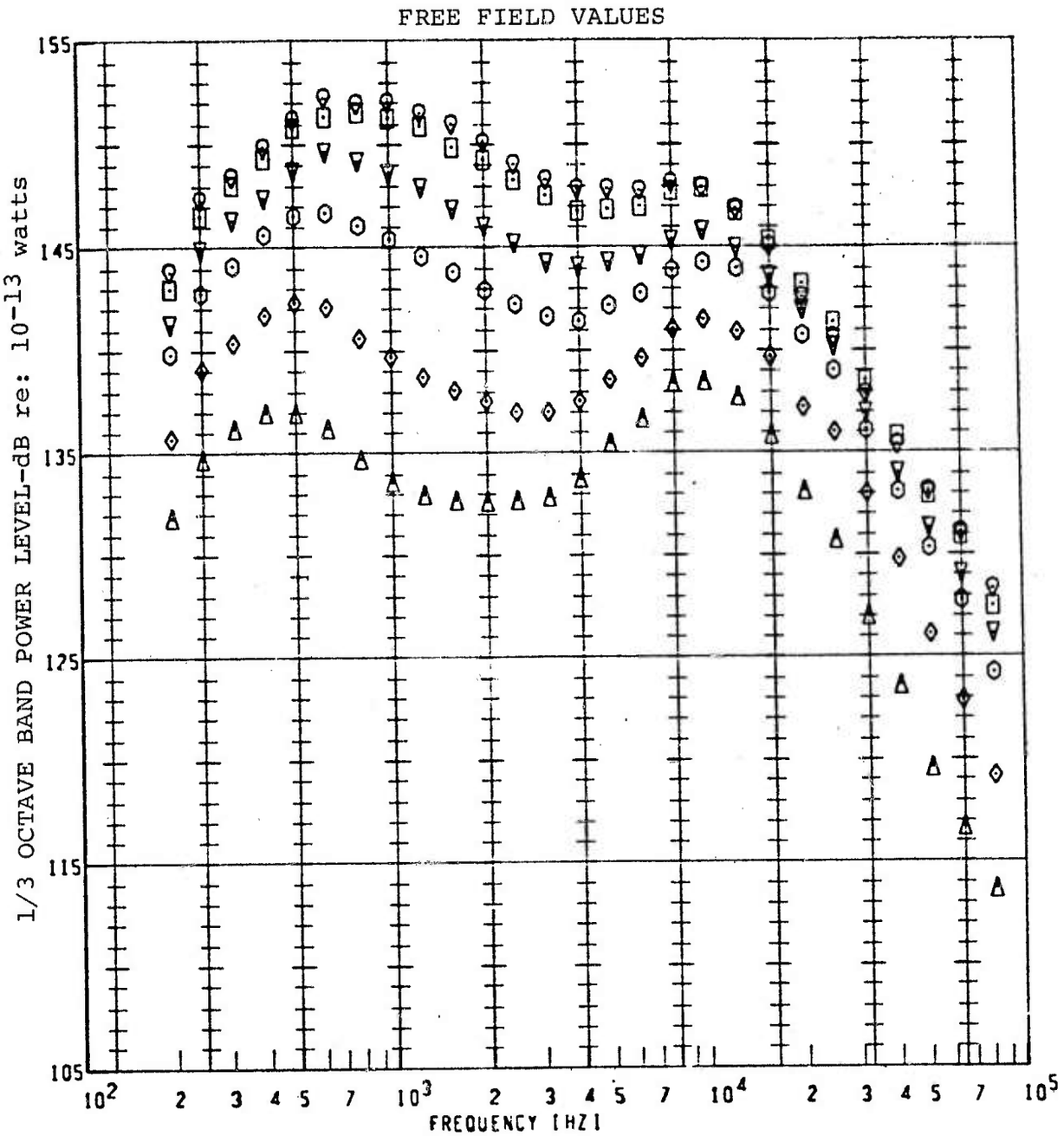
FACILITY: HNTF

DATE: 9-21-73 T_{AMB} = 70°F **R.H.** = 58%

SCALE MODEL A_8 = 13.6 in.^{2}

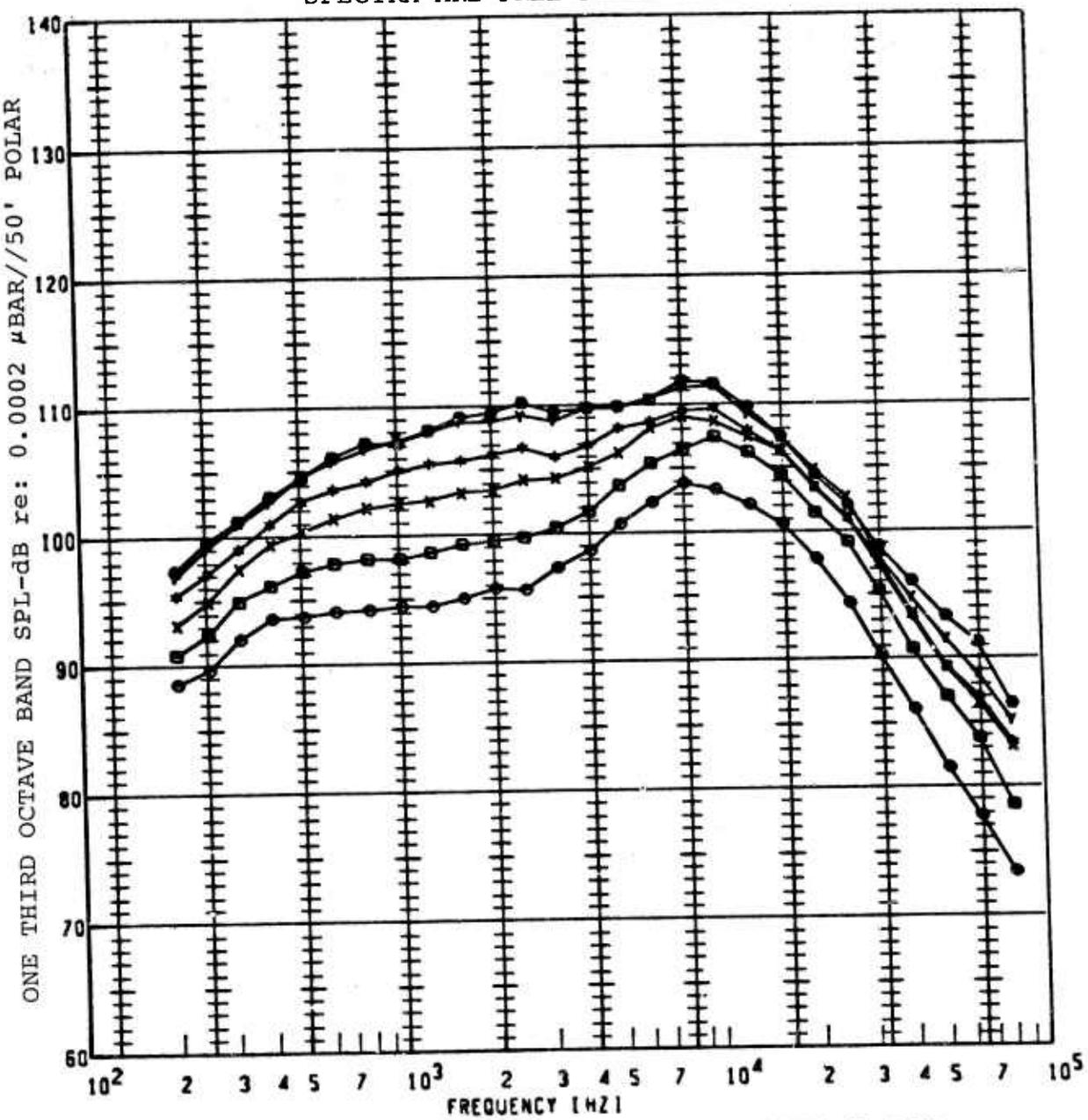
RUN NO.	NPR	T_T	V_J (IDEAL)	REMARKS	REF
87	2.0	1150°F	1875 fps		
"	2.5	"	2126		
"	3.0	"	2303		
"	3.4	"	2413		
"	3.7	"	2483		
"	4.0	"	2544		

MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH CONCRETE GROUND SURFACE. MEASURED ACOUSTIC DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.



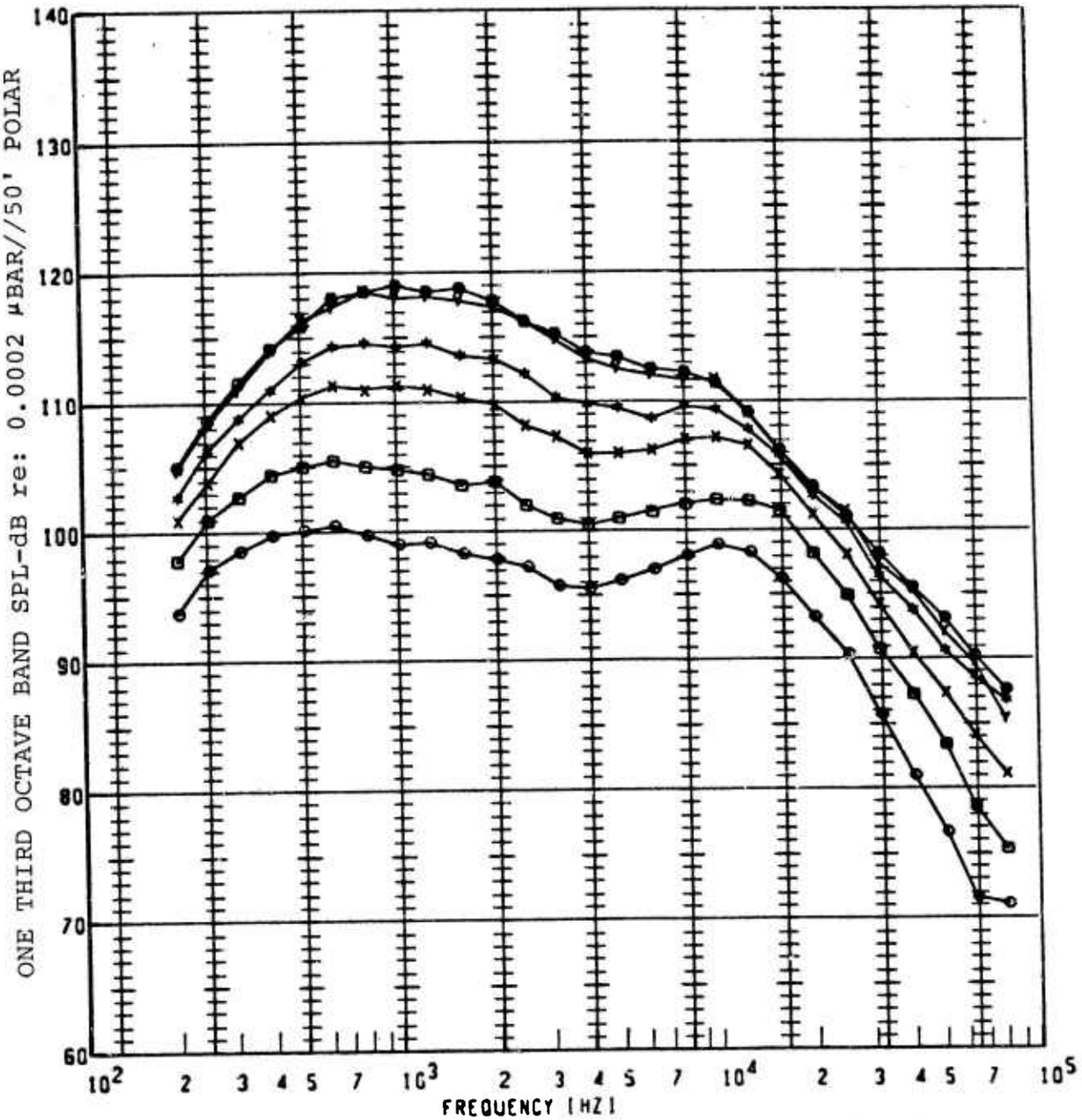
PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	87	2.00	1150°
◇	87	2.50	1150
⊙	87	3.00	1150
▽	87	3.40	1150
⊡	87	3.70	1150
⊽	87	4.00	1150

SPECTRA ARE FREE FIELD + 6dB



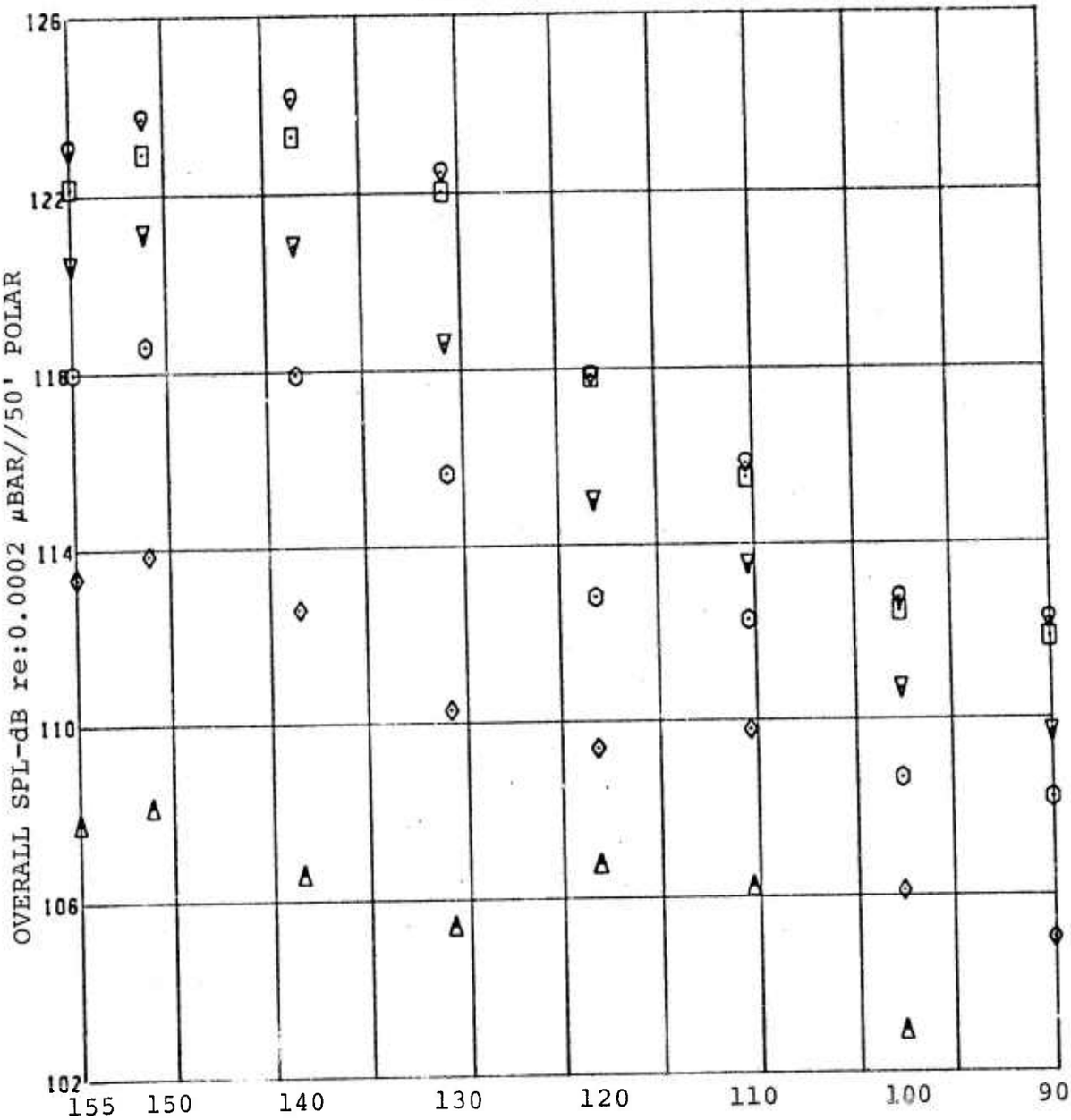
PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL [DB]
●	87G	1150	2.000	110°	SOFP	111.9
■	87G	1150	2.500		SOFP	115.4
x	87G	1150	3.000		SOFP	118.0
*	87G	1150	3.400		SOFP	119.3
▼	87G	1150	3.700		SOFP	121.3
●	87G	1150	4.000		SOFP	121.6

SPECTRA ARE FREE FIELD + 6dB

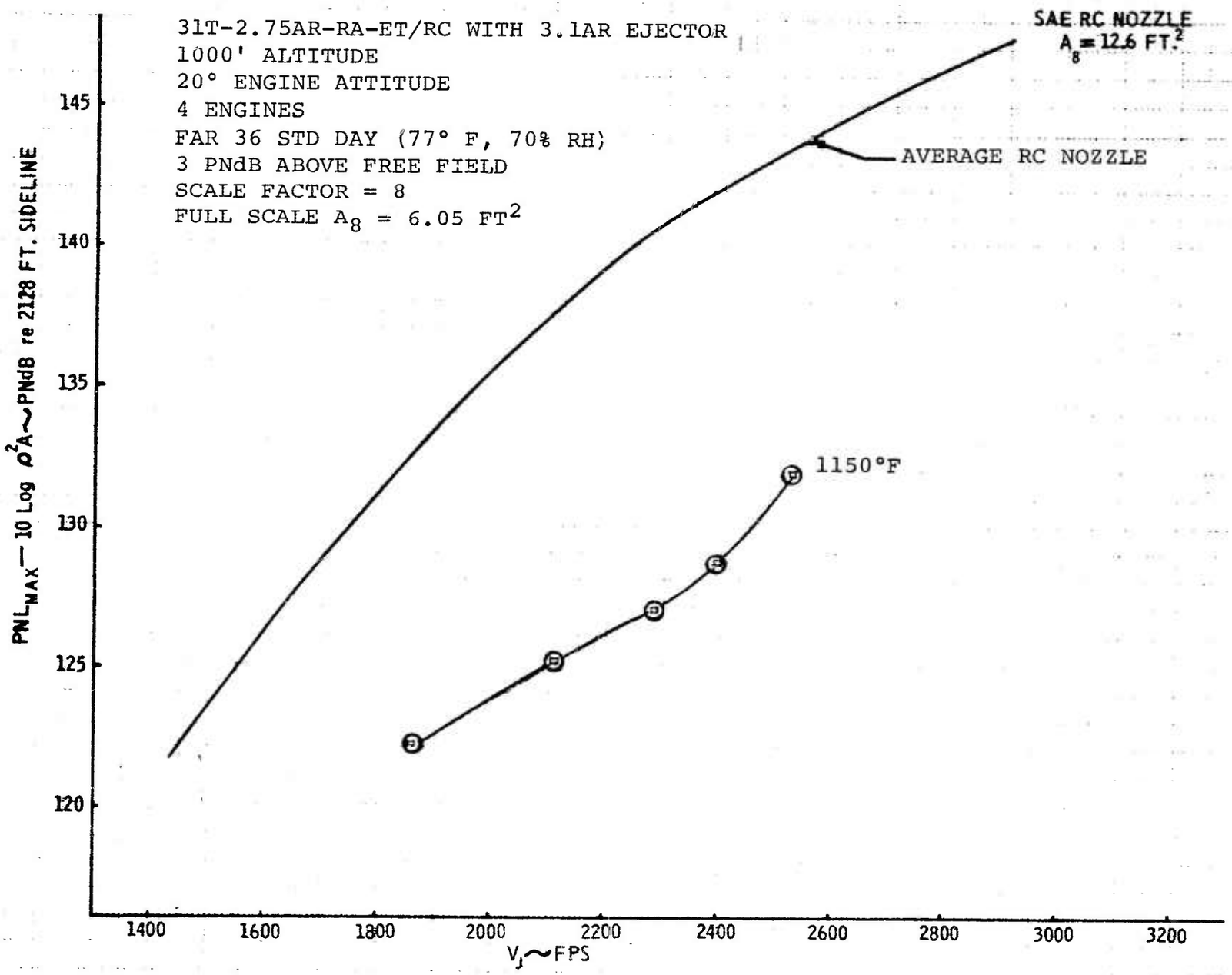


PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL (DB)
●	87G	1150	2.000	130°	50FP	111.3
■	87G	1150	2.500		50FP	116.2
x	87G	1150	3.000		50FP	121.6
*	87G	1150	3.400		50FP	124.6
▼	87G	1150	3.700		50FP	128.0
●	87G	1150	4.000		50FP	128.4

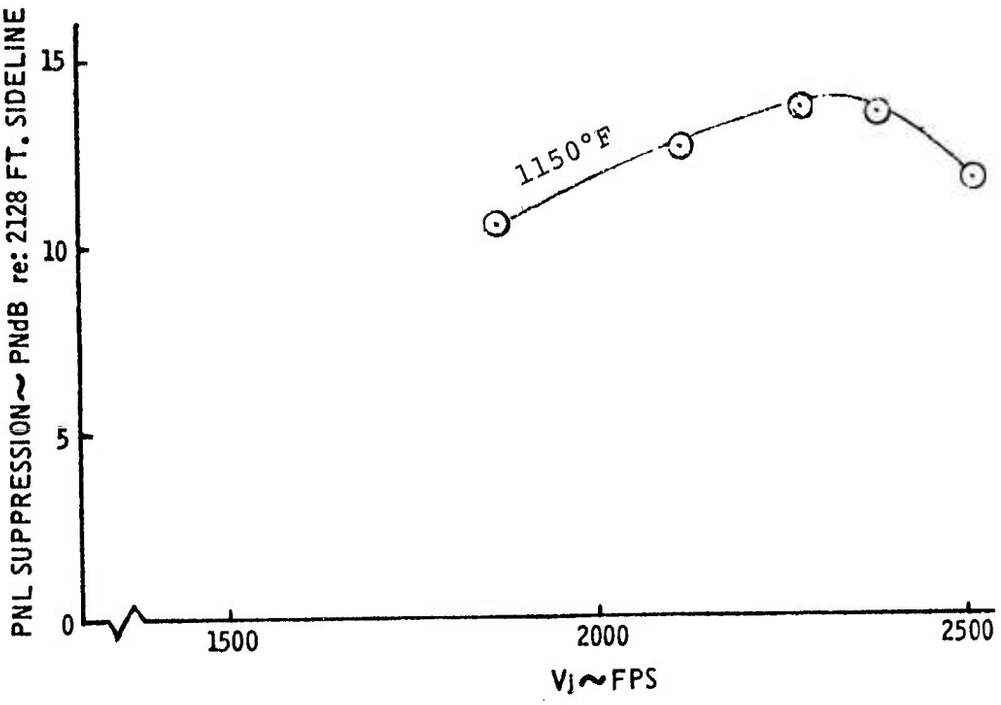
FREE FIELD VALUES



PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	87	2.00	1150 °F
◇	87	2.50	1150
⊙	87	3.00	1150
▽	87	3.40	1150
⊡	87	3.70	1150
◎	87	4.00	1150

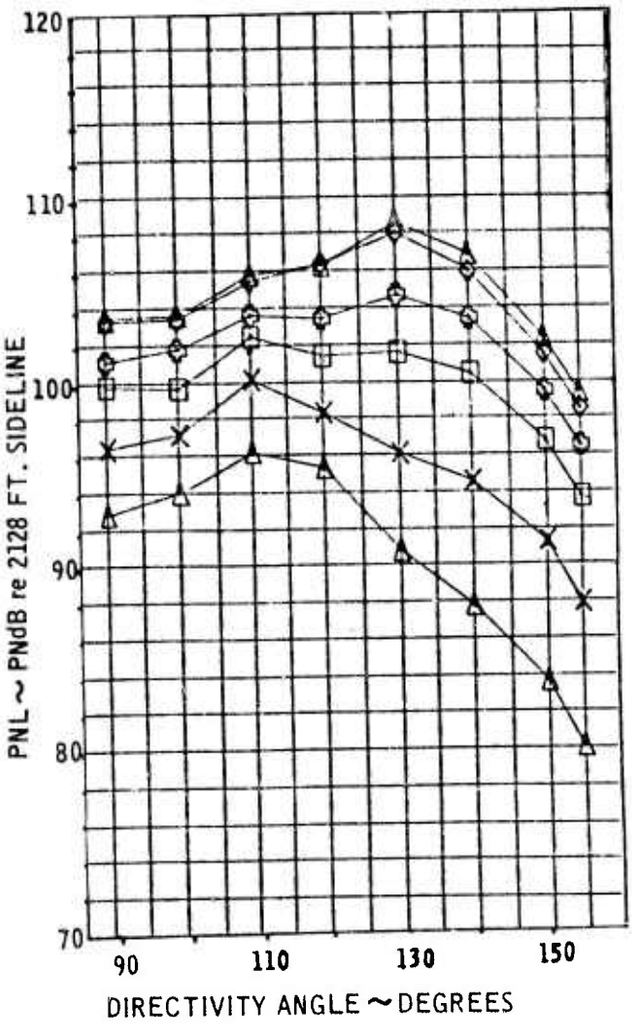

31T-2.75AR-RA-ET/RC WITH 3.1AR EJECTOR
1000' ALTITUDE
20° ENGINE ATTITUDE
4 ENGINES
FAR 36 STD DAY (77° F, 70% RH)
3 PNdB ABOVE FREE FIELD
SCALE FACTOR = 8
FULL SCALE A_8 = 6.05 FT^2
SAE RC NOZZLE
A_8 = 12.6 FT.^{2}
AVERAGE RC NOZZLE
1150°F
PNL_{MAX} — 10 Log $\rho^2 A$ ~ PNdB re 2128 FT. SIDELINE
145
140
135
130
125
120
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
V_j ~ FPS

31T-2.75AR-RA-ET/RC WITH 3.1AR EJECTOR



PEAK PNL SUPPRESSION VALUES

NOZZLE: 31T-2.75AR-RA-ET/RC
WITH 3.1AR EJECTOR



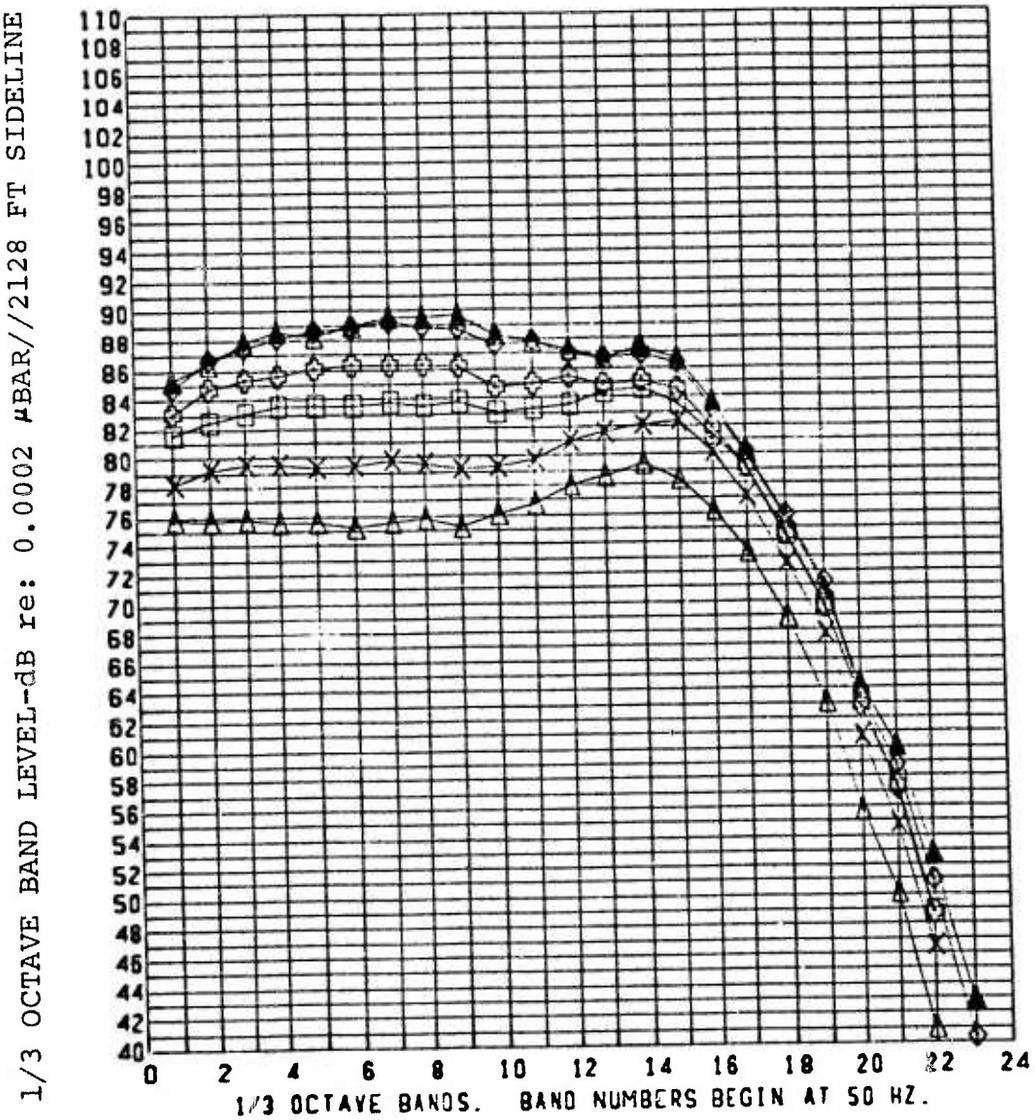
T_T = 1150°F A_8 = 6.05 FT^2 RUN: 87

PR = △ 2.0, × 2.5, □ 3.0, ✣ 3.4, ◇ 3.7, ▲ 4.0

PNL BEAM PATTERNS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 110 DEG TEMP = 77 DEG R.H. = 70 PER CENT

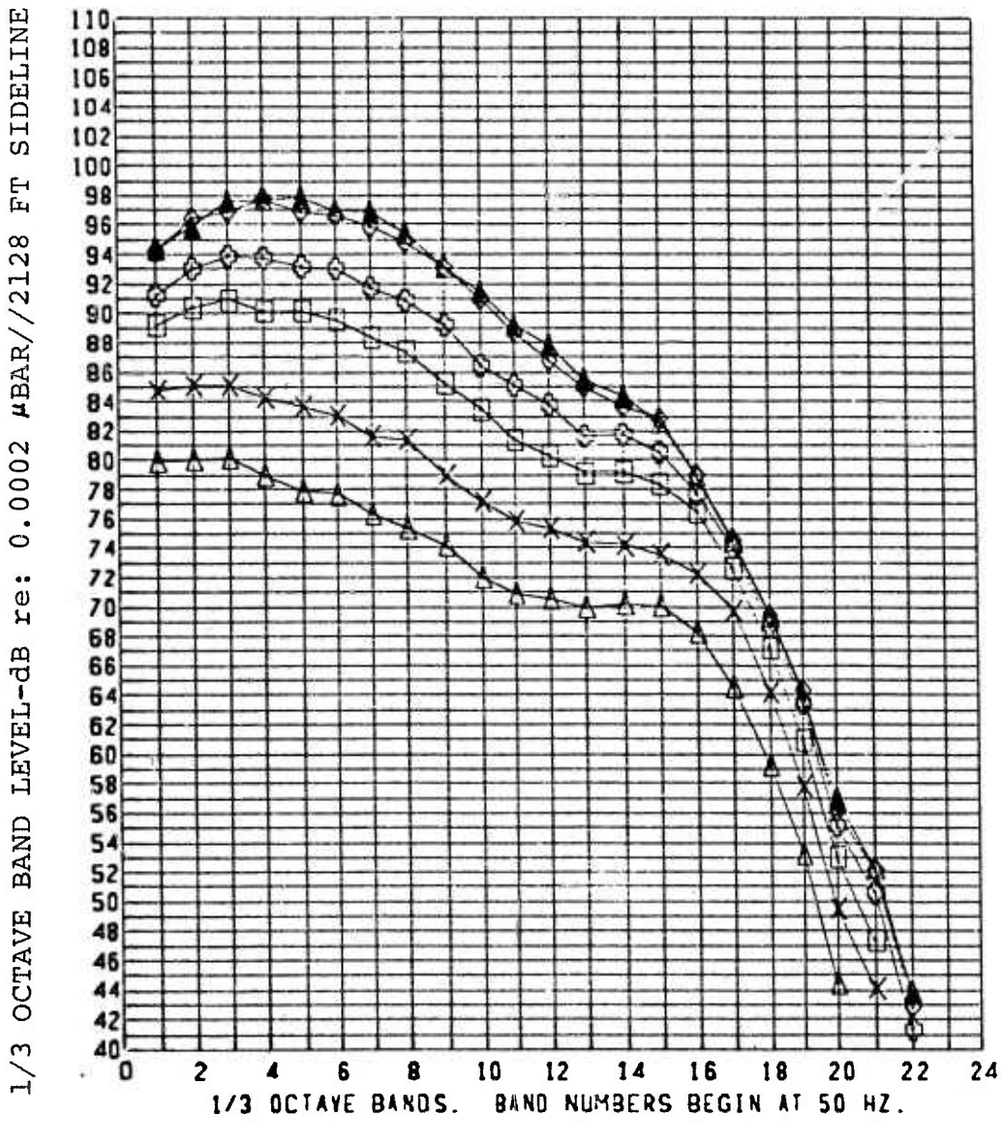


T_T = 1150°F A_8 = 6.05 FT^2 RUN: 87

PR = △ 2.0, X 2.5, □ 3.0, ✣ 3.4, ◇ 3.7, ▲ 4.0

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 130 DEG TEMP = 77 DEG R.H. = 70 PER CENT



T_T = 1150°F A_8 = 6.05 FT^2 RUN: 87

PR = △ 2.0, X 2.5, □ 3.0, ✣ 3.4, ◇ 3.7, ▲ 4.0

TEST CONDITIONS

NOZZLE: 31T-2.75AR-RA-ET/RC
with 3.7AR Ejector

FACILITY: HNTF

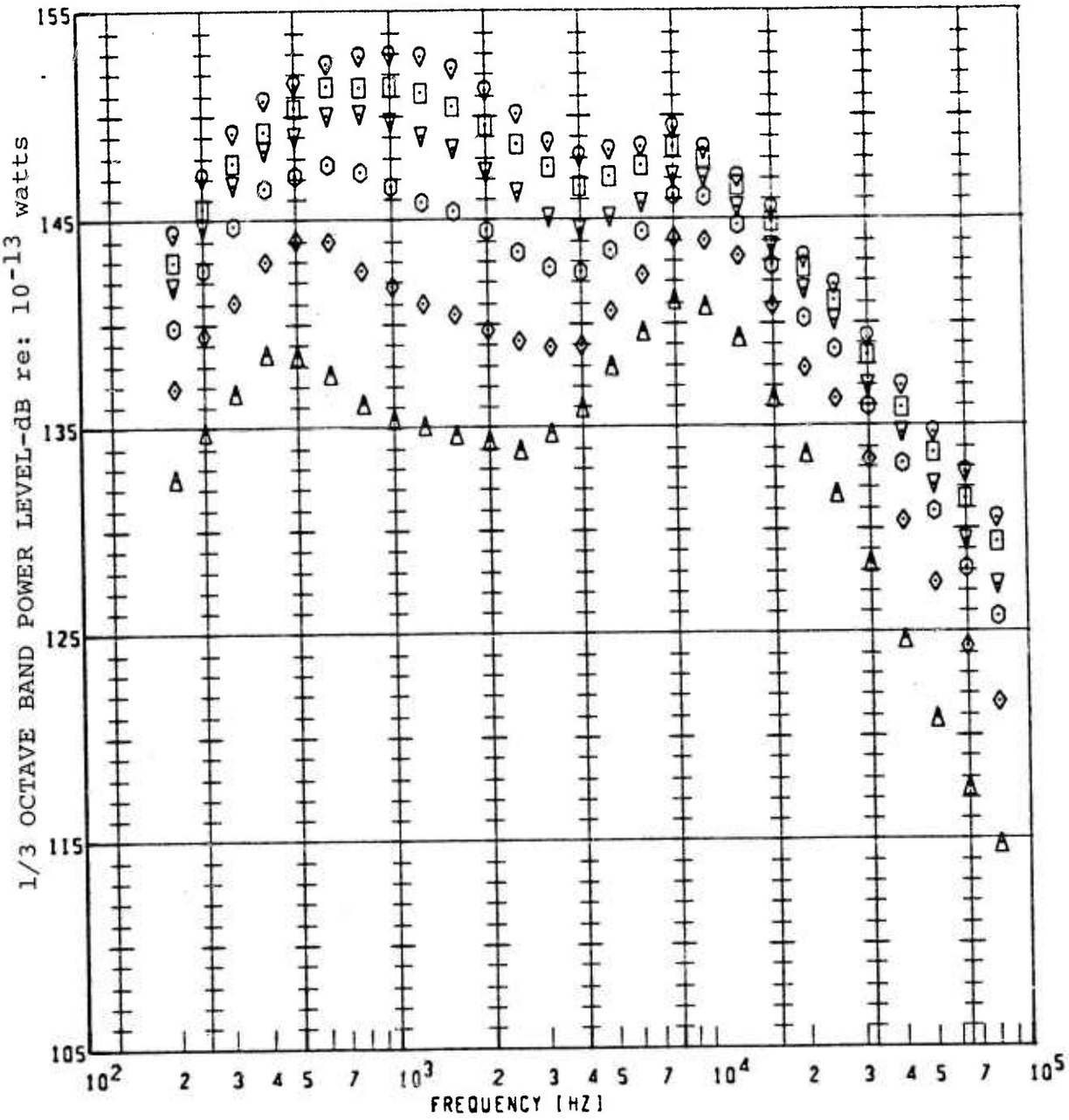
DATE: 9-18-73 T_{AMB} = 66°F **R.H.** = 66%

SCALE MODEL A_8 = 13.6 in.^{2}

RUN NO.	NPR	T_T	V_J (IDEAL)	REMARKS	REF
81	2.0	1150°F	1875 fps		
"	2.5	"	2126		
"	3.0	"	2303		
"	3.4	"	2413		
"	3.7	"	2483		
"	4.0	"	2544		

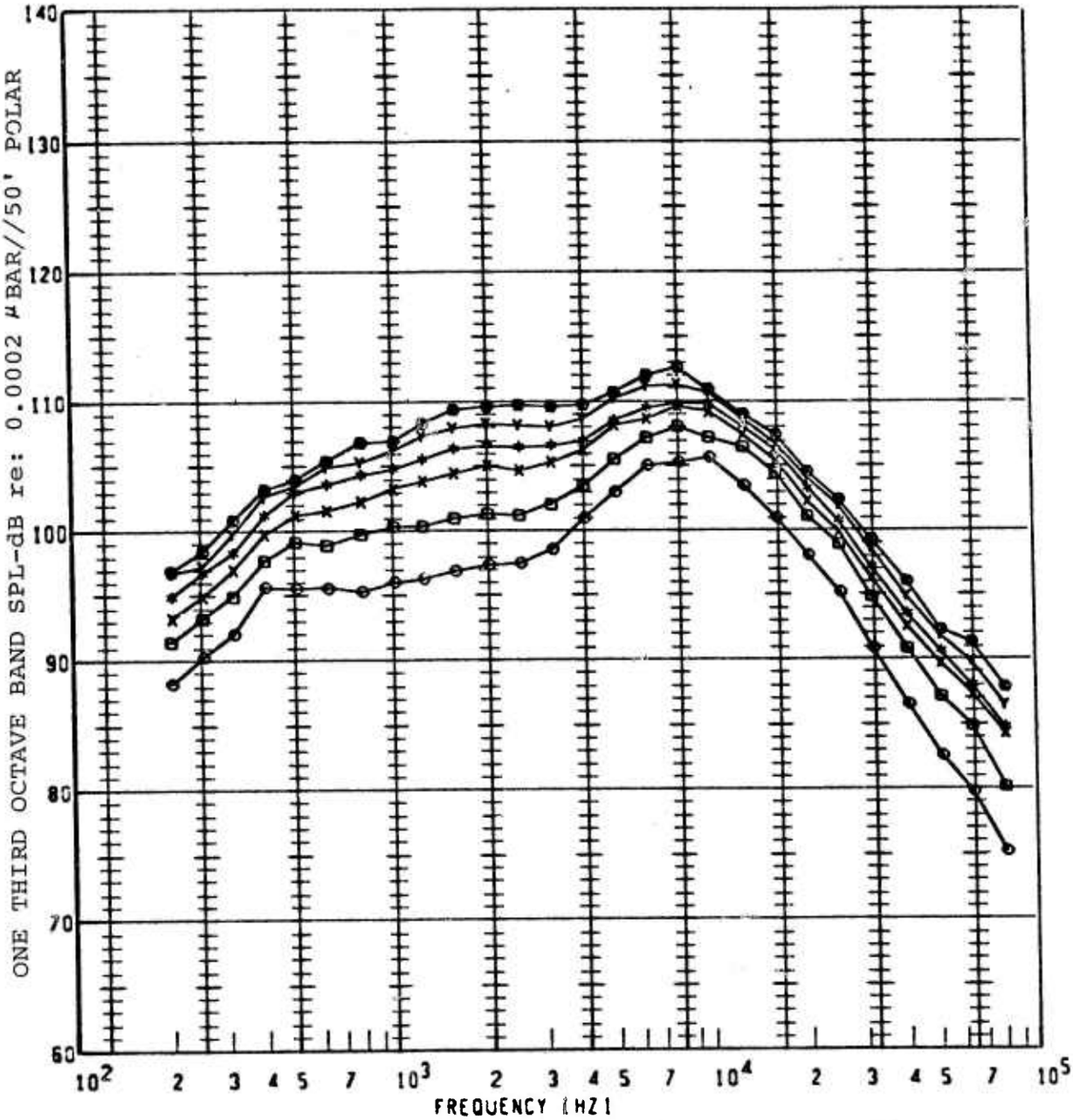
MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH CONCRETE GROUND SURFACE. MEASURED ACOUSTIC DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.

FREE FIELD VALUES



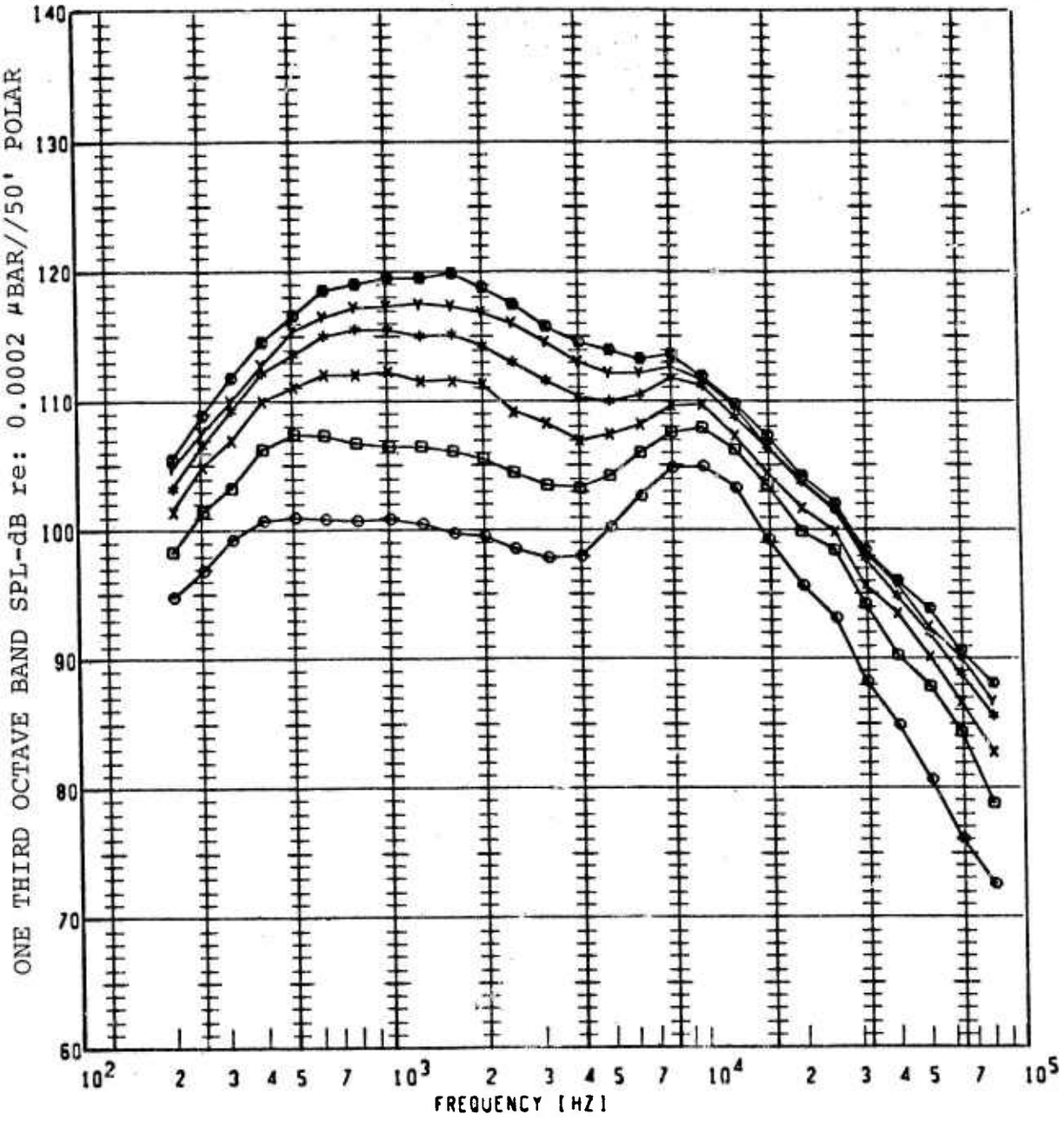
PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	81	2.00	1150°F
◇	81	2.50	1150
⊙	81	3.00	1150
▽	81	3.40	1150
⊡	81	3.70	1150
⍜	81	4.00	1150

SPECTRA ARE FREE FIELD + 6dB



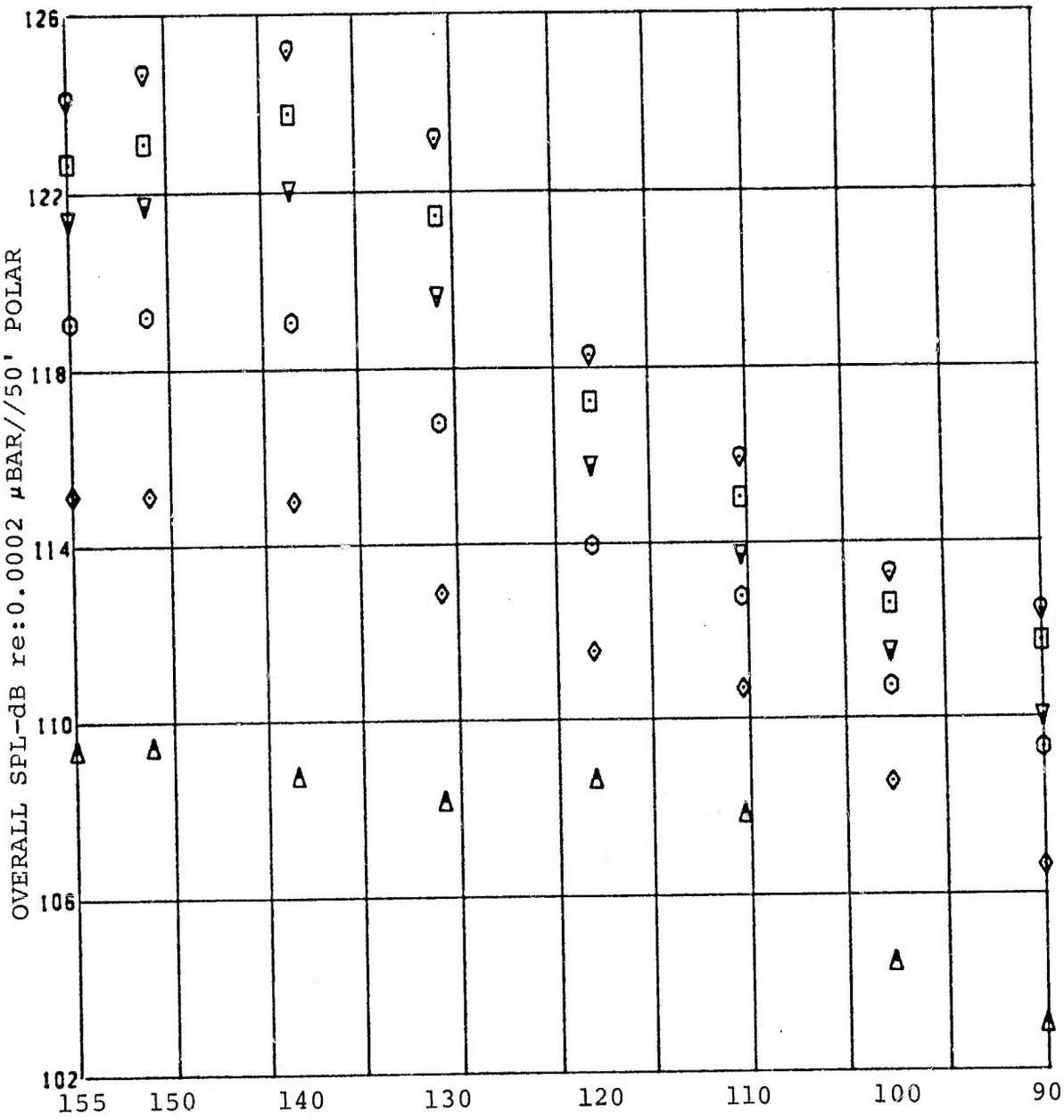
PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL (OB)
●	81G	1150°F	2.000	110°	50FP	113.6
■	81G	1150	2.500	↓	50FP	116.4
×	81G	1150	3.000	↓	50FP	118.5
*	81G	1150	3.400	↓	50FP	119.5
Y	81G	1150	3.700	↓	50FP	120.9
●	81G	1150	4.000	↓	50FP	121.8

SPECTRA ARE FREE FIELD + 6dB

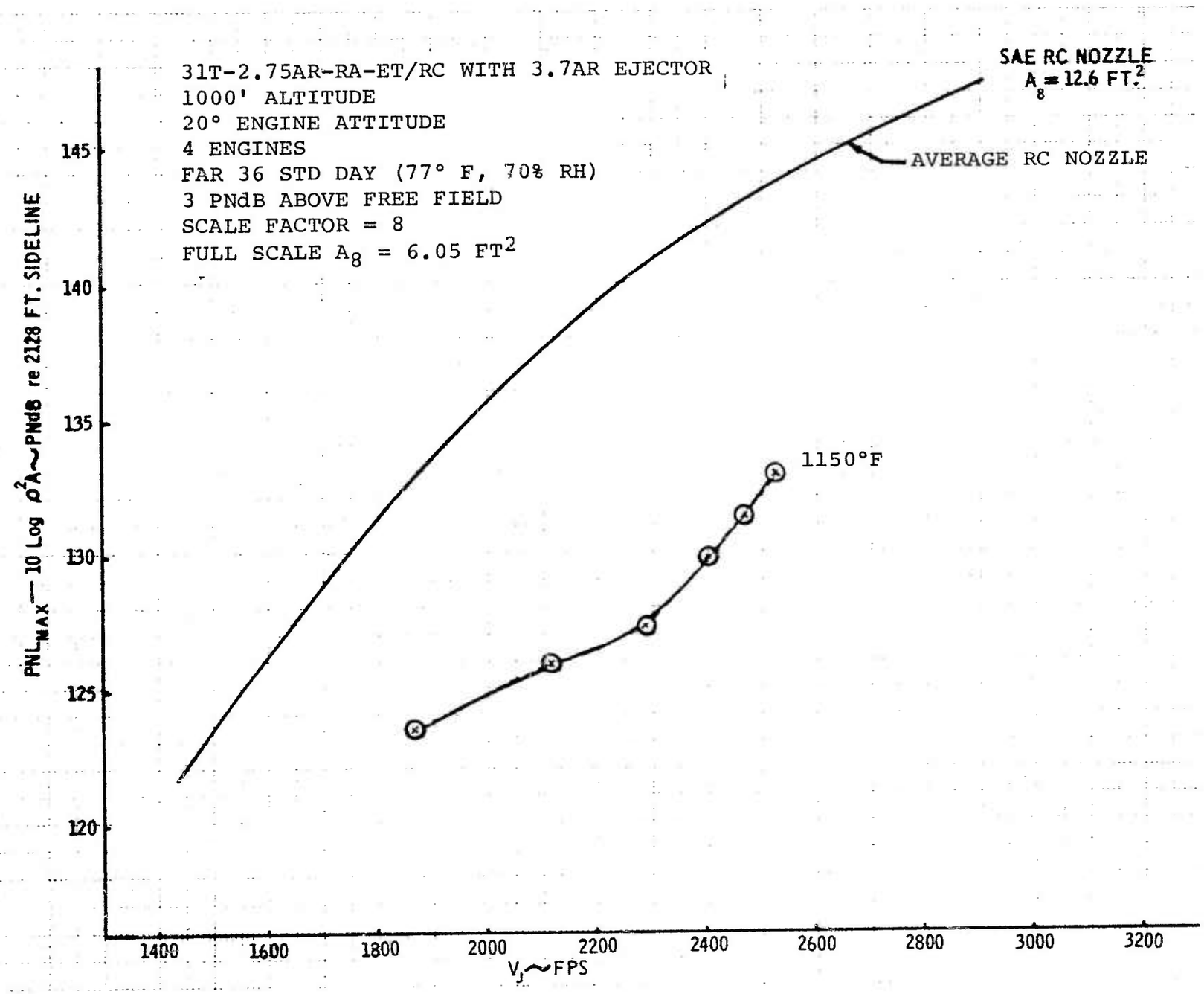


PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL (OB)
●	81G	1150°F	2.000	130°	50FP	114.0
■	81G	1150	2.500	↓	50FP	118.7
x	81G	1150	3.000	↓	50FP	122.7
*	81G	1150	3.400	↓	50FP	125.6
Y	81G	1150	3.700	↓	50FP	127.4
●	81G	1150	4.000	↓	50FP	129.2

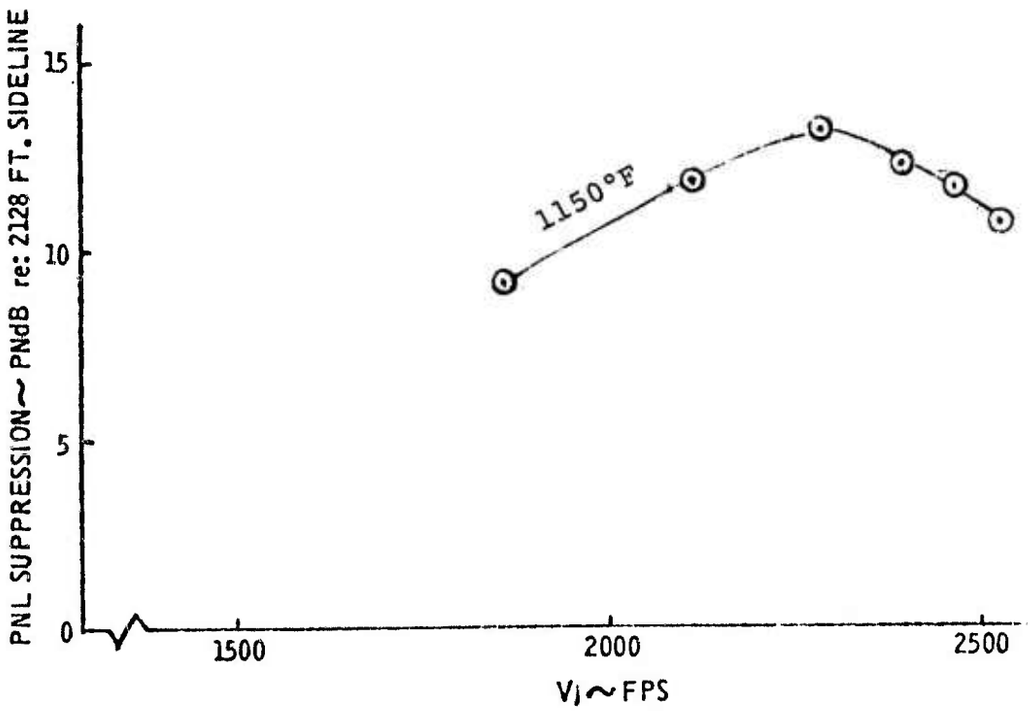
FREE FIELD VALUES



PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	81	2.00	1150 °F
◇	81	2.50	1150
⊙	81	3.00	1150
▽	81	3.40	1150
⊡	81	3.70	1150
♀	81	4.00	1150

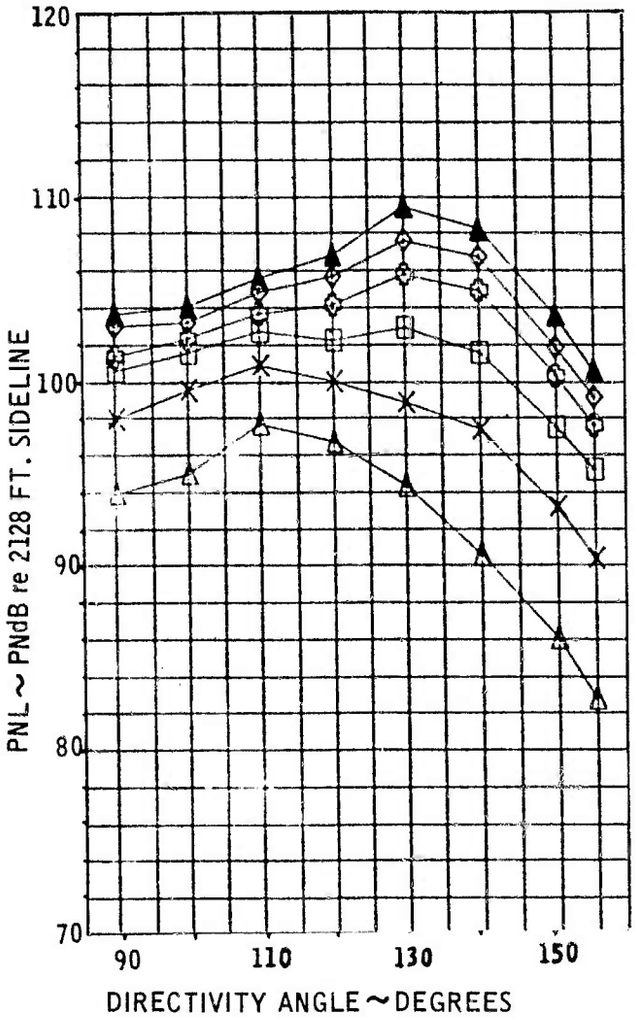

31T-2.75AR-RA-ET/RC WITH 3.7AR EJECTOR
1000' ALTITUDE
20° ENGINE ATTITUDE
4 ENGINES
FAR 36 STD DAY (77° F, 70% RH)
3 PNdB ABOVE FREE FIELD
SCALE FACTOR = 8
FULL SCALE A_8 = 6.05 FT^2
SAE RC NOZZLE
A_8 = 12.6 FT.^{2}
AVERAGE RC NOZZLE
1150°F
PNL_{MAX} — 10 Log D^2A ~ PNdB re 2128 FT. SIDELINE
145
140
135
130
125
120
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
V_j ~ FPS

31T-2.75AR-RA-ET/RC WITH 3.7AR EJECTOR



PEAK PNL SUPPRESSION VALUES

NOZZLE: 31T-2.75AR-RA-ET/RC
WITH 3.7AR EJECTOR



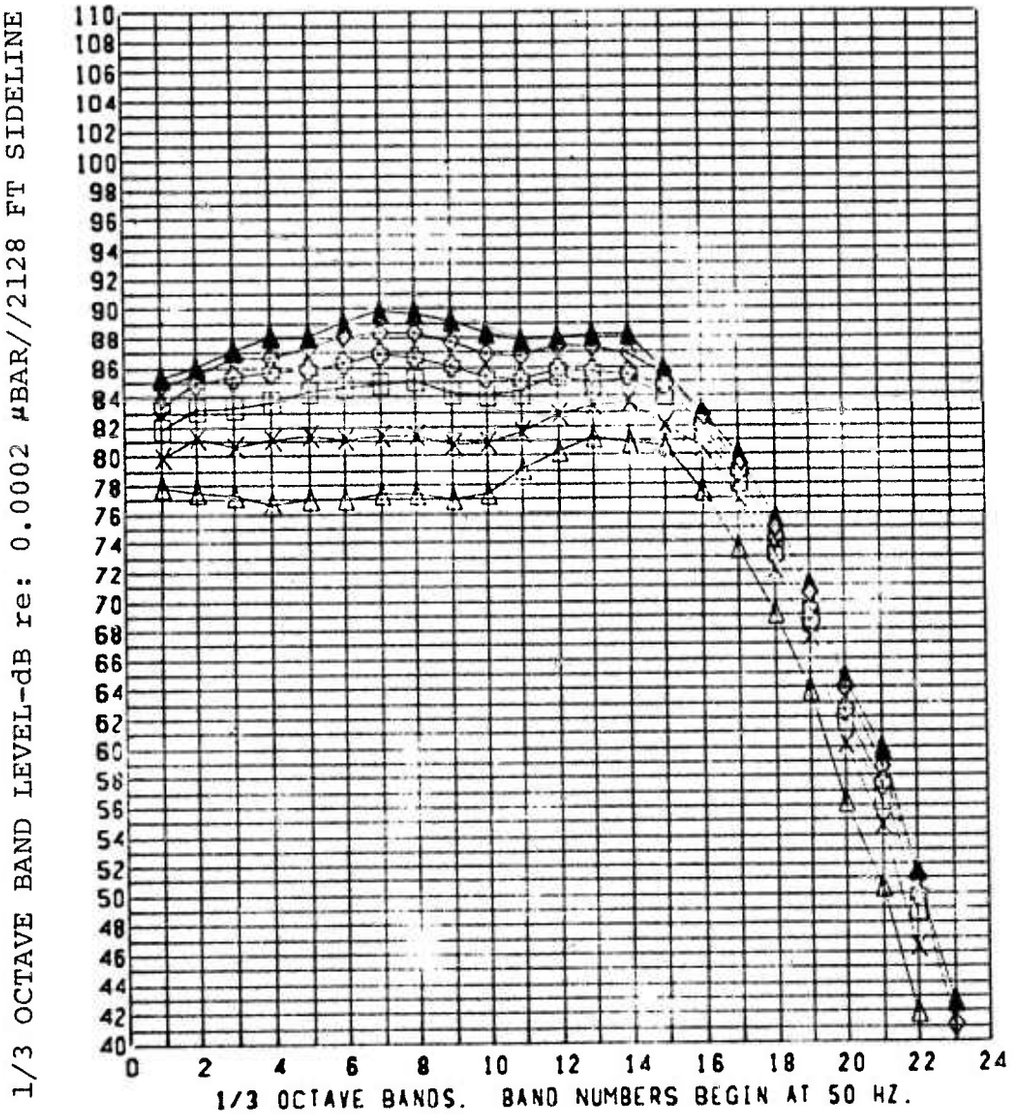
T_T = 1150°F A_8 = 6.05 FT^2 RUN: 81

PR = △ 2.0, X 2.5, □ 3.0, ✣ 3.4, ◇ 3.7 ▲ 4.0

PNL BEAM PATTERNS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 110 DEG TEMP = 77 DEG R.H. = 70 PER CENT

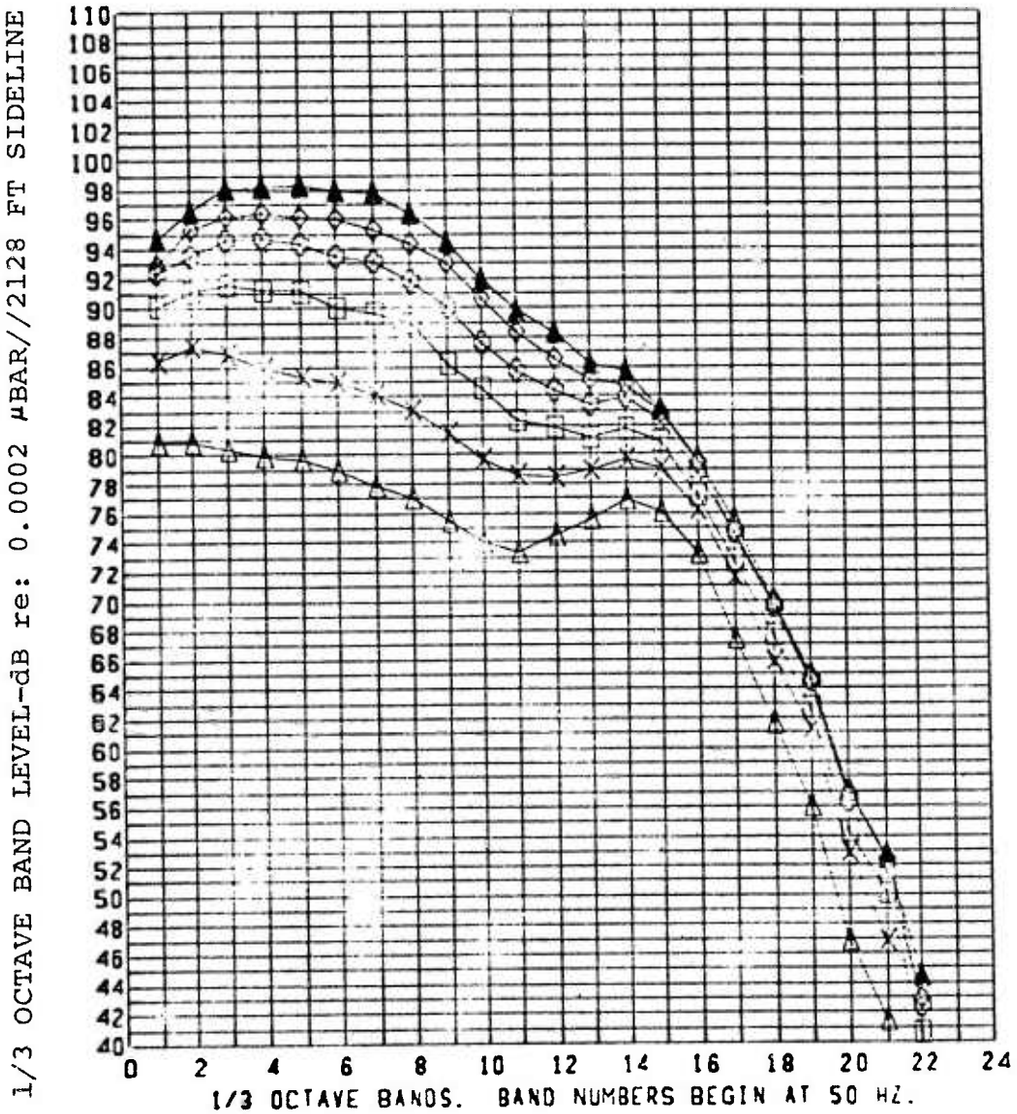


T_T = 1150°F A_8 = 6.05 FT^2 RUN: 81

PR = △ 2.0, X 2.5, □ 3.0, ✣ 3.4, ◇ 3.7, ▲ 4.0

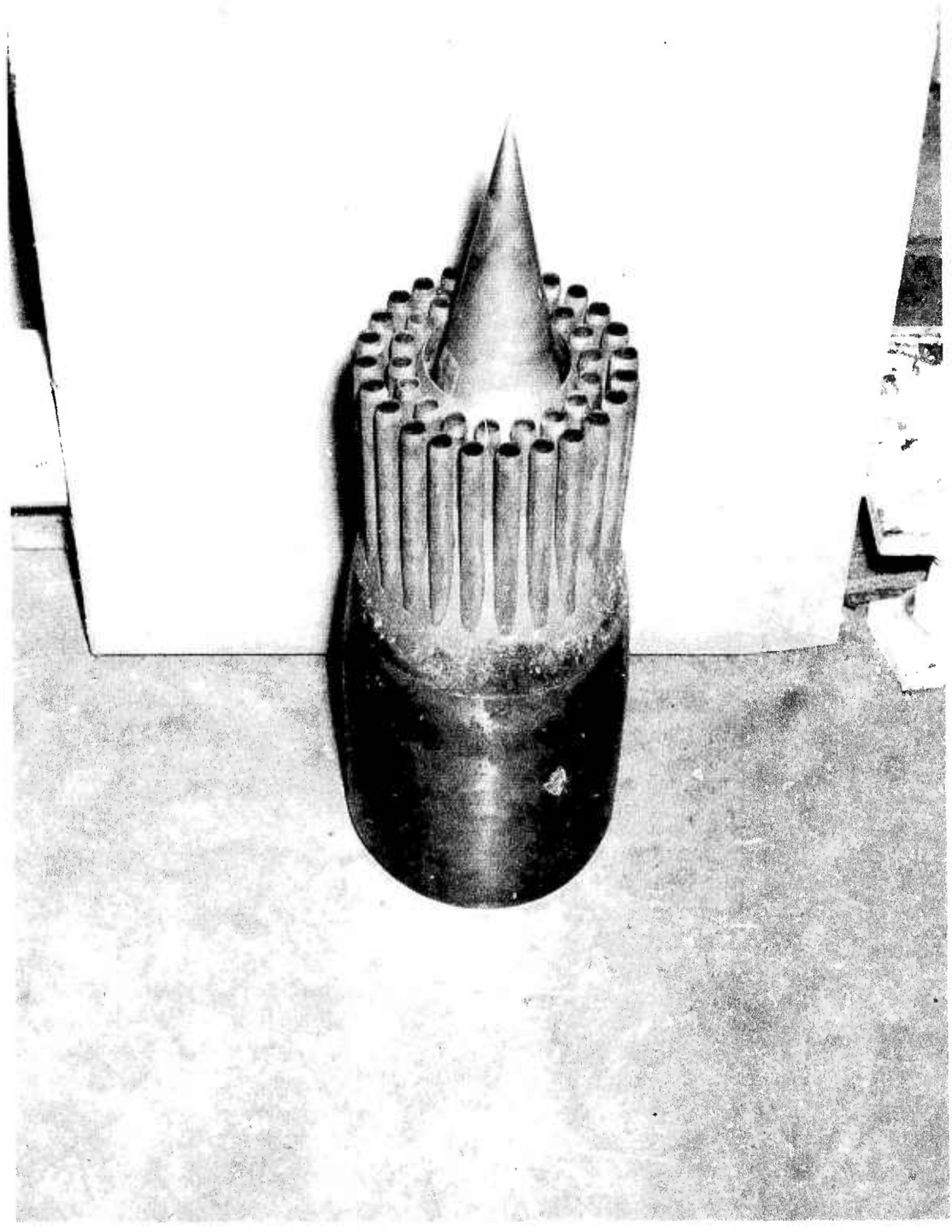
ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 130 DEG TEMP = 77 DEG R.H. = 70 PER CENT

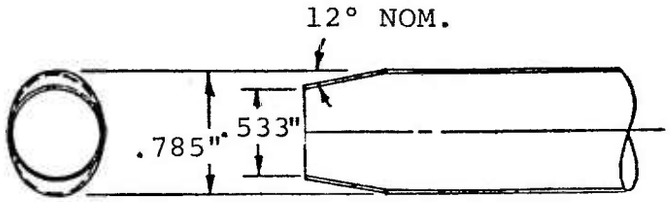


T_T = 1150°F A_8 = 6.05 FT^2 RUN: 81

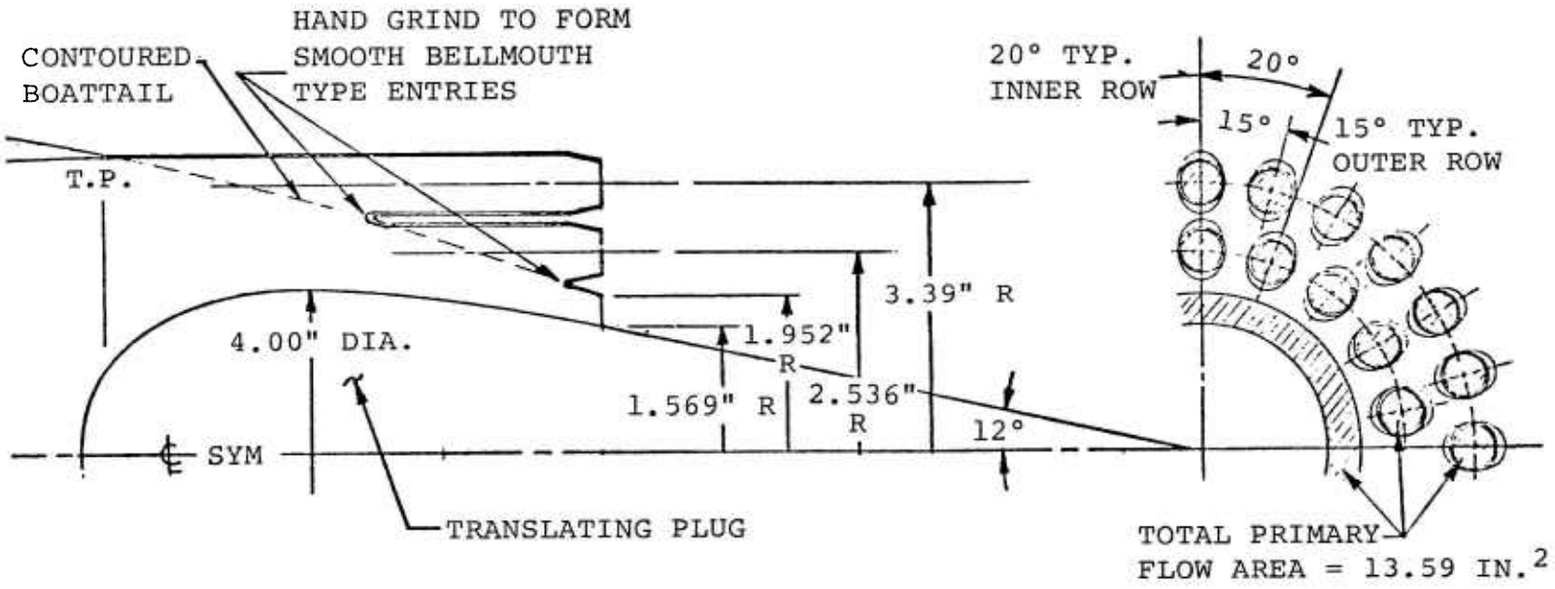
PR = △2.0, X 2.5, □ 3.0, ✣3.4, ◇ 3.7, ▲4.0



42T/ANNULUS-3.3AR-CPA-ET/RC NOZZLE
(0.383" WIDE ANNULUS)



TUBE MAT'L-.035 WALL, 321 CRES
(FULL SIZE)



42 TUBE - ANNULAR-PLUG NOZZLE

TEST CONDITIONS

NOZZLE: 42T/Annulus-3.3AR-CPA-ET/RC

FACILITY: HNTF

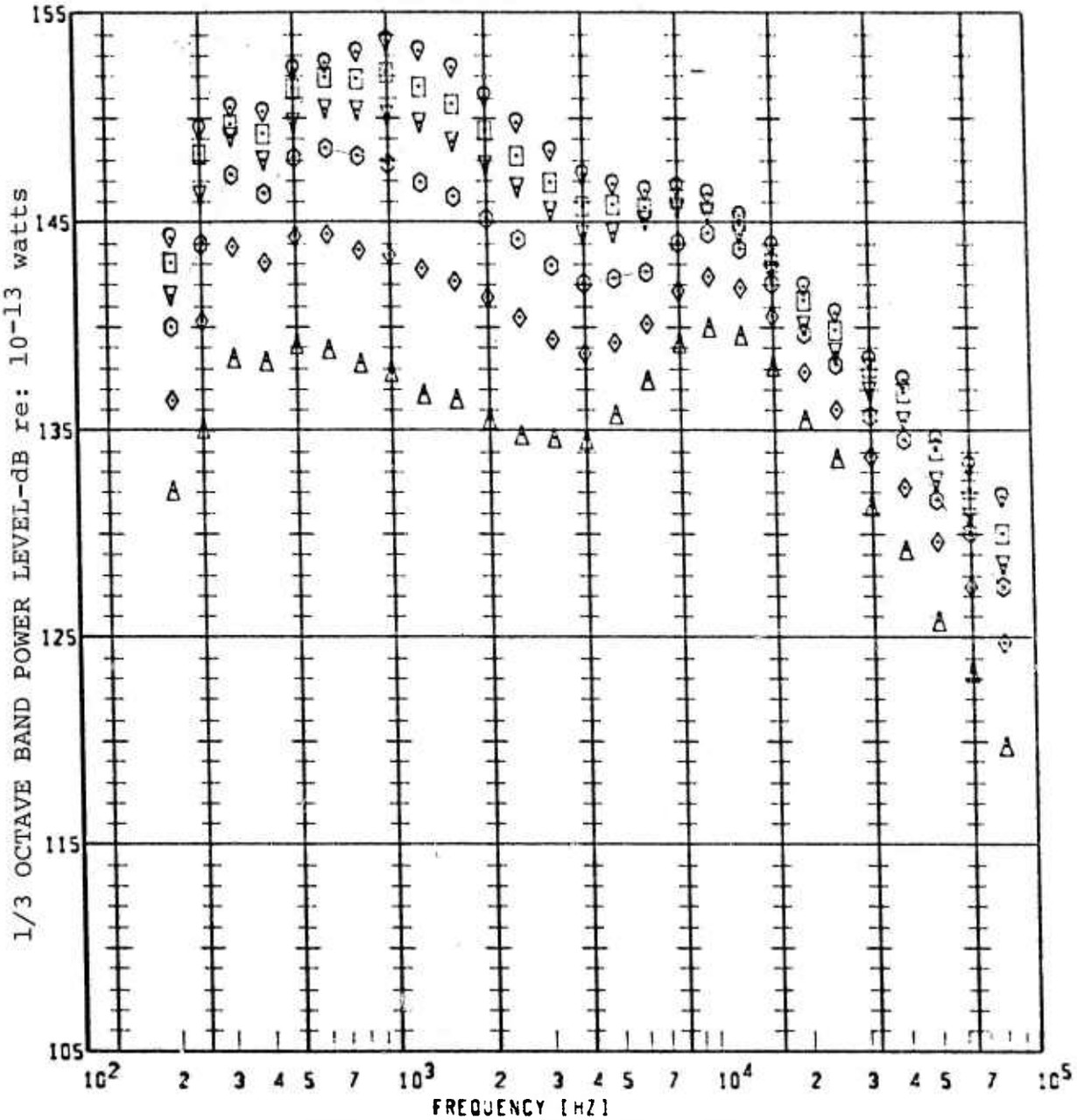
DATE: 10-19-73 T_{AMB} = 65°F **R.H.** = 62%

SCALE MODEL A_8 = 13.6 in.^{2}

RUN NO.	NPR	T_T	V_J (IDEAL)	REMARKS	REF
189	2.0	1150°F	1875 fps	Annulus width = 0.383"	
"	2.5	"	2126		
"	3.0	"	2303		
"	3.4	"	2413		
"	3.7	"	2483		
"	4.0	"	2544		

MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH CONCRETE GROUND SURFACE. MEASURED ACOUSTIC DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.

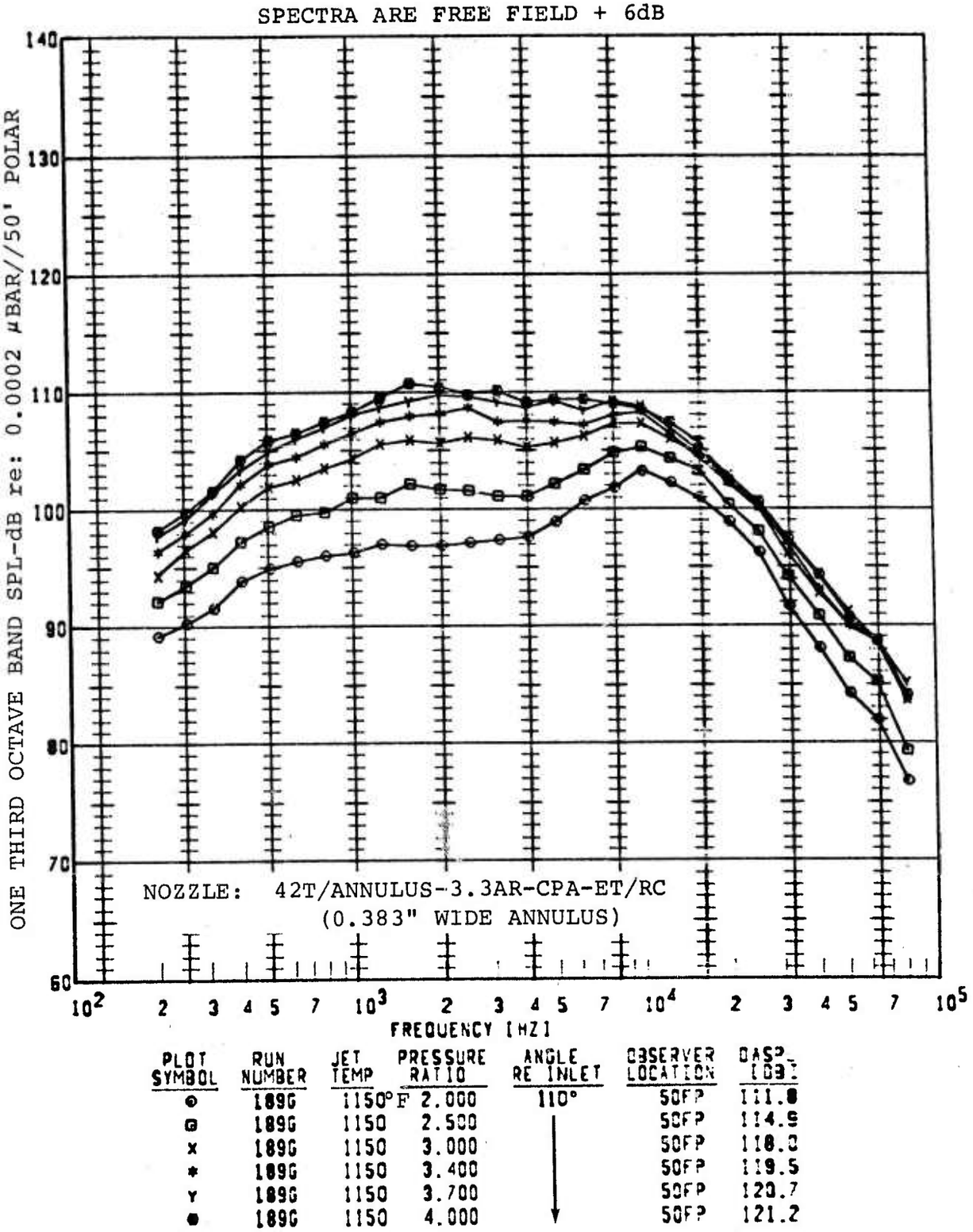
FREE FIELD VALUES



PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	189	2.00	1150 °F
◇	189	2.50	1150
○	189	3.00	1150
▽	189	3.40	1150
□	189	3.70	1150
◇	189	4.00	1150

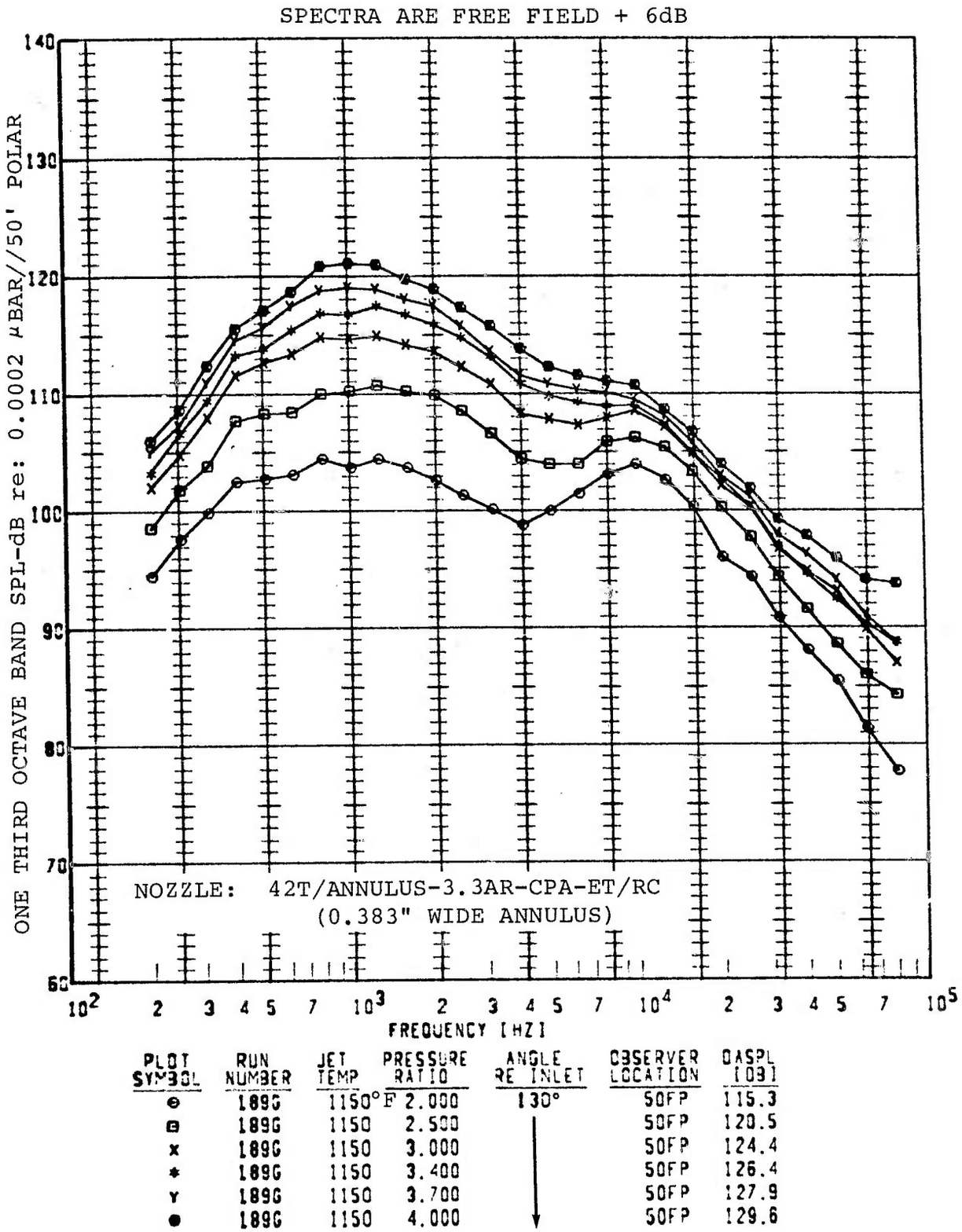
NOZZLE: 42T/ANNULUS-3.3AR-CPA-ET/RC
(0.383" WIDE ANNULUS)

JET NOISE POWER SPECTRA



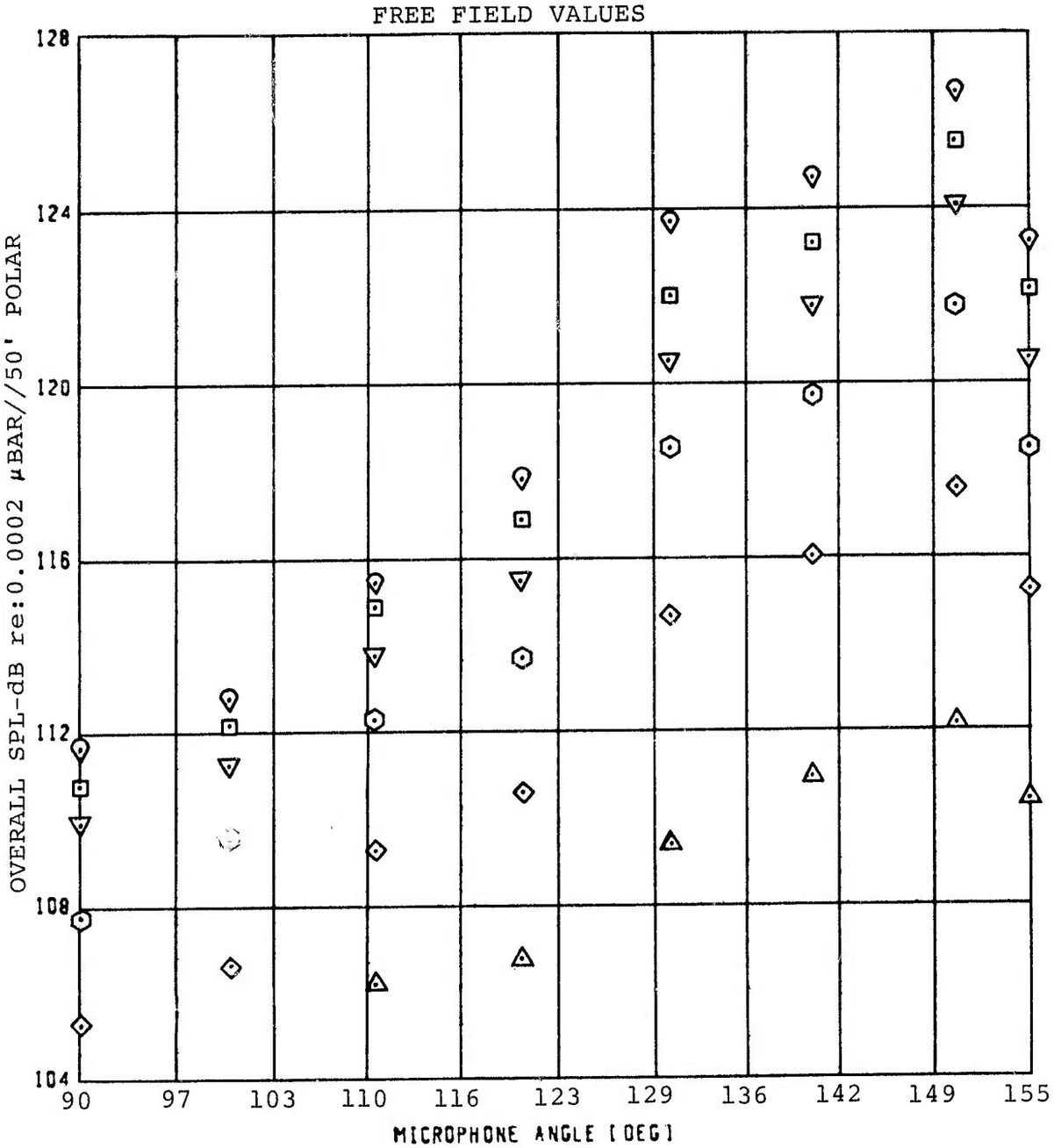
PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASP [DB]
⊙	189G	1150°F	2.000	110°	50FP	111.8
⊡	189G	1150	2.500		50FP	114.9
x	189G	1150	3.000		50FP	118.0
*	189G	1150	3.400		50FP	119.5
Y	189G	1150	3.700		50FP	120.7
●	189G	1150	4.000		50FP	121.2

MEASURED NOISE SPECTRA AT 110° re: NOZZLE INLET AXIS



PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL [DB]
⊖	189G	1150°F	2.000	130°	50FP	115.3
⊟	189G	1150	2.500		50FP	120.5
x	189G	1150	3.000		50FP	124.4
*	189G	1150	3.400		50FP	126.4
Y	189G	1150	3.700		50FP	127.9
●	189G	1150	4.000		50FP	129.6

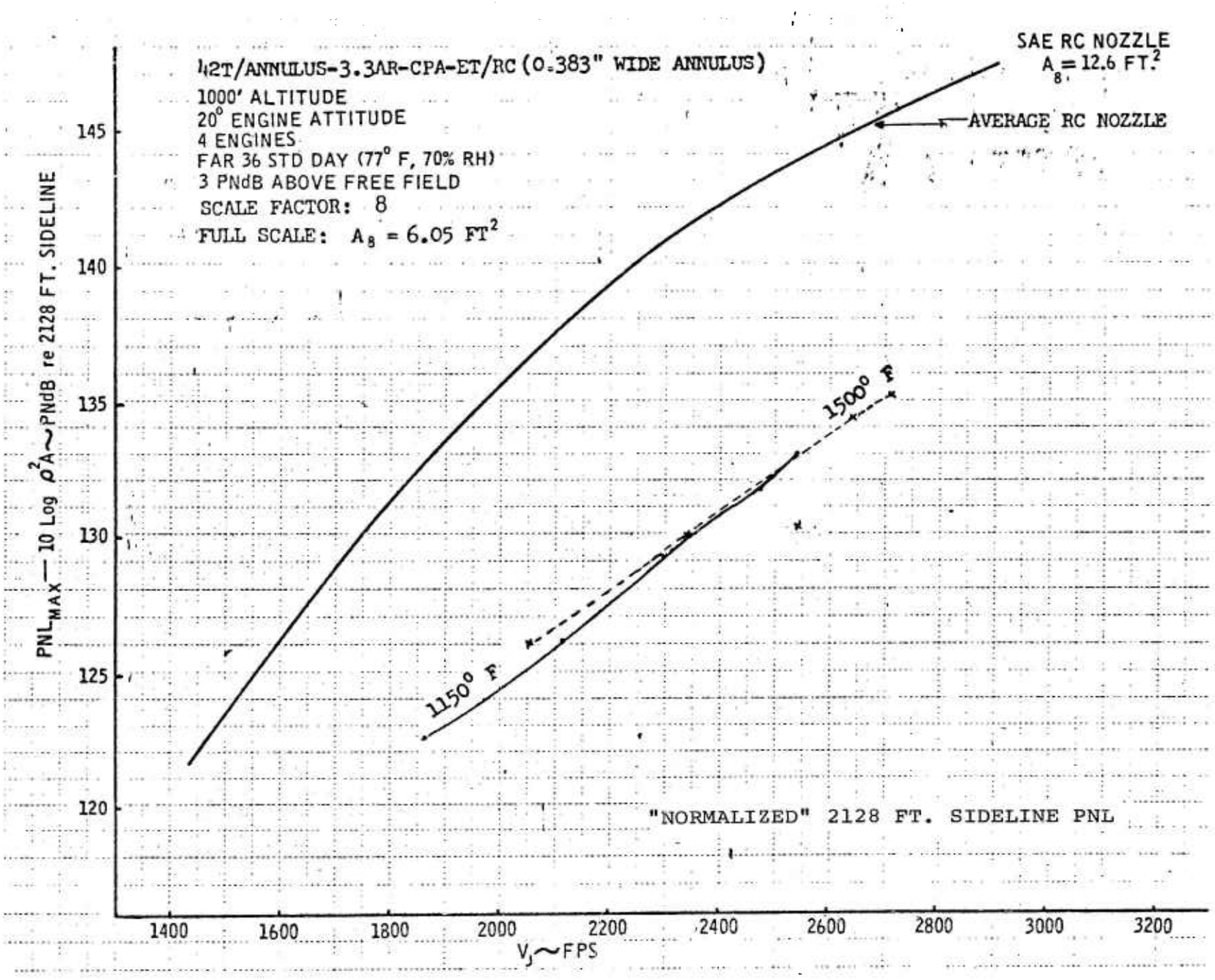
MEASURED NOISE SPECTRA AT 130° re: NOZZLE INLET AXIS

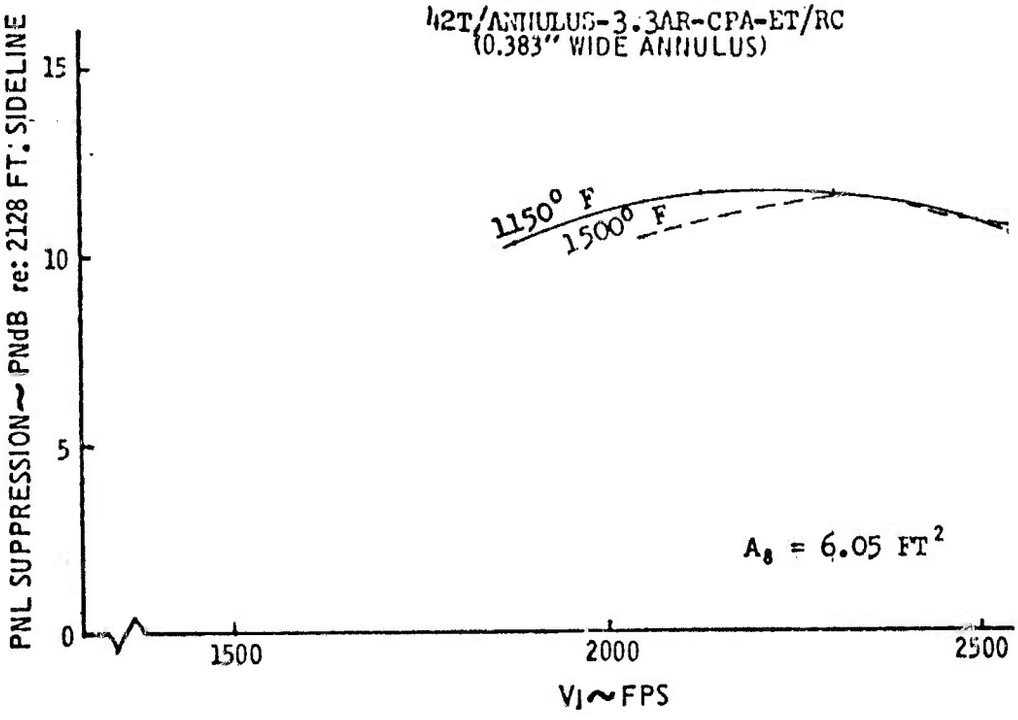


PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	189	2.00	1150°F
◇	189	2.50	1150
○	189	3.00	1150
▽	189	3.40	1150
□	189	3.70	1150
⬡	189	4.00	1150

NOZZLE: 42T/ANNULUS-3.3AR-CPA-ET/RC
(0.383" WIDE ANNULUS)

OASPL BEAM PATTERNS


42T/ANNULUS-3.3AR-CPA-ET/RC (0.383" WIDE ANNULUS)
1000' ALTITUDE
20° ENGINE ATTITUDE
4 ENGINES
FAR 36 STD DAY (77° F, 70% RH)
3 PNdB ABOVE FREE FIELD
SCALE FACTOR: 8
FULL SCALE: A_8 = 6.05 FT^2
SAE RC NOZZLE
A_8 = 12.6 FT.^{2}
AVERAGE RC NOZZLE
1500° F
1150° F
"NORMALIZED" 2128 FT. SIDELINE PNL
PNL_{MAX} — 10 Log $\rho^2 A$ ~ PNdB re 2128 FT. SIDELINE
145
140
135
130
125
120
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
V_j ~ FPS

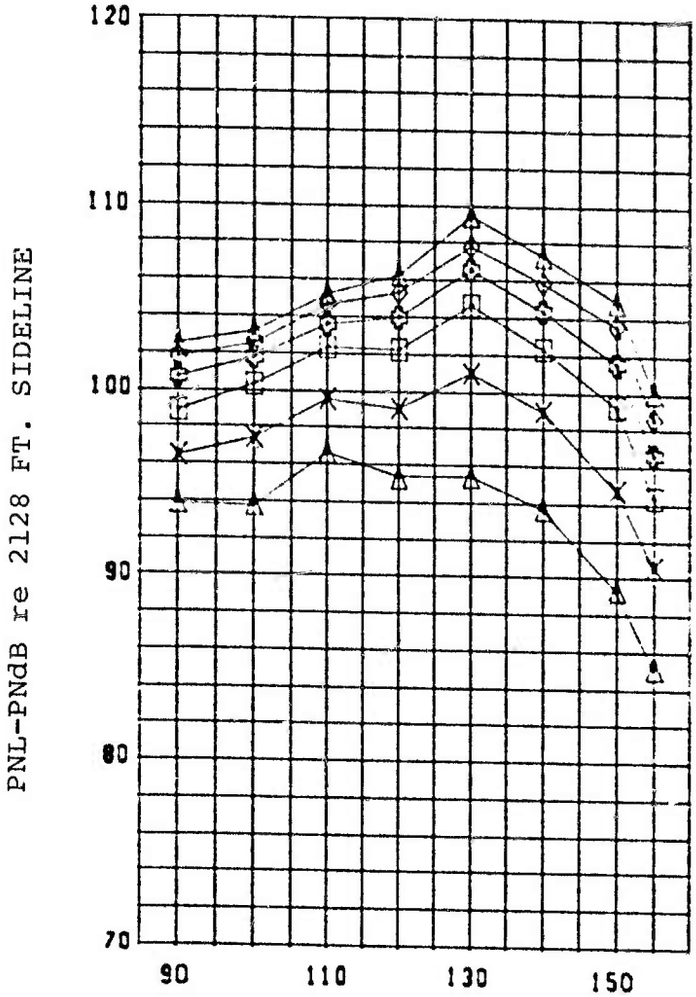


PEAK PNL SUPPRESSION VALUES

NOZZLE: 42T/ANNULUS-3.3AR-CPA-ET/RC
(0.383" WIDE ANNULUS)

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = TEMP = 77 DEG R.H. = 70 PER CENT



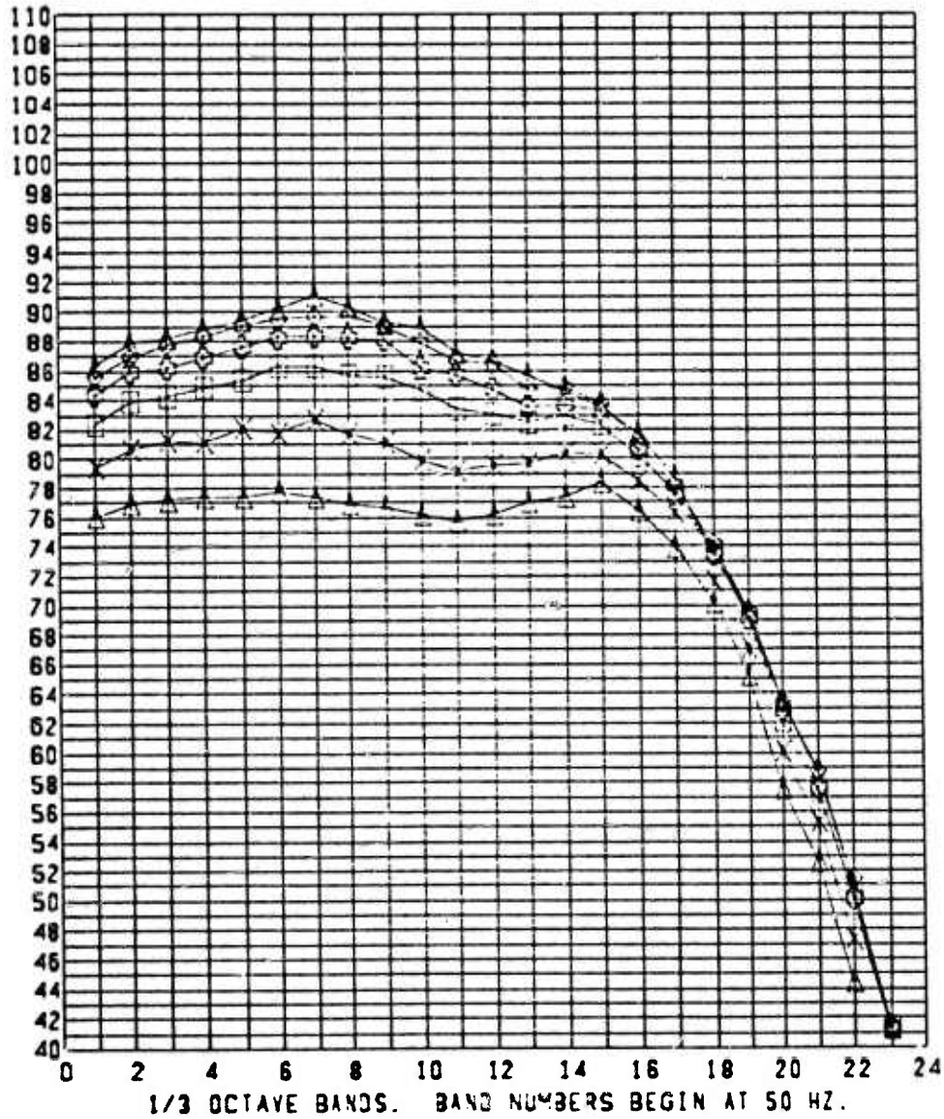
T_T = 1150°F A_8 = 6.05 FT^2 RUN: 189

PR = △2.0, ×2.5, □3.0, ✣3.4, ◇3.7, ▲4.0

PNL BEAM PATTERNS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 110 DEG TEMP = 77 DEG R.H. = 70 PER CENT



T_T = 1150°F A_8 = 6.05 FT^2 RUN: 189

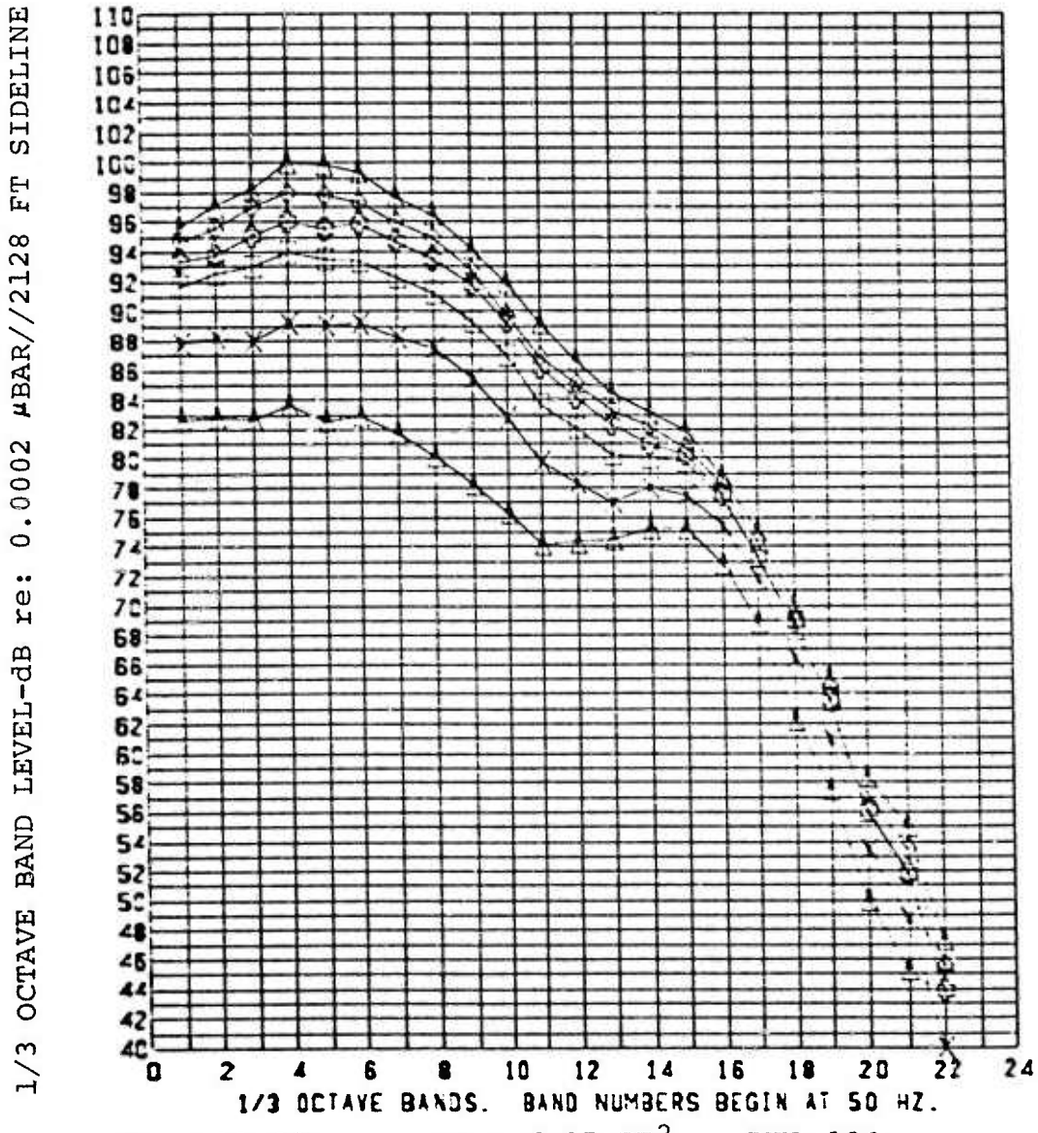
PR = △ 2.0, X 2.5, □ 3.0, ✣ 3.4, ◇ 3.7, ▲ 4.0

NOZZLE: 42T/ANNULUS-3.3AR-CPA-ET/RC
(0.383" WIDE ANNULUS)

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 110°
re: NOZZLE INLET AXIS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 130 DEG TEMP = 77 DEG R.H. = 70 PER CENT



T_T = 1150°F A_8 = 6.05 FT^2 RUN: 189

PR = △ 2.0, X 2.5, □ 3.0, ✣ 3.4, ◇ 3.7, ▲ 4.0

NOZZLE: 42T/ANNULUS-3.3AR-CPA-ET/RC
(0.383" WIDE ANNULUS)

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 130°
re: NOZZLE INLET AXIS

TEST CONDITIONS

NOZZLE: 42T/ANNULUS-3.3AR-ET/RC
(0.383" WIDE ANNULUS AND CENTER BODY)

FACILITY: WALL ISOLATION FACILITY

DATE: December 21, 1973

P_{AMB} = 29.62 in Hg T_{AMB} = 45°F **R.H.** = 86%

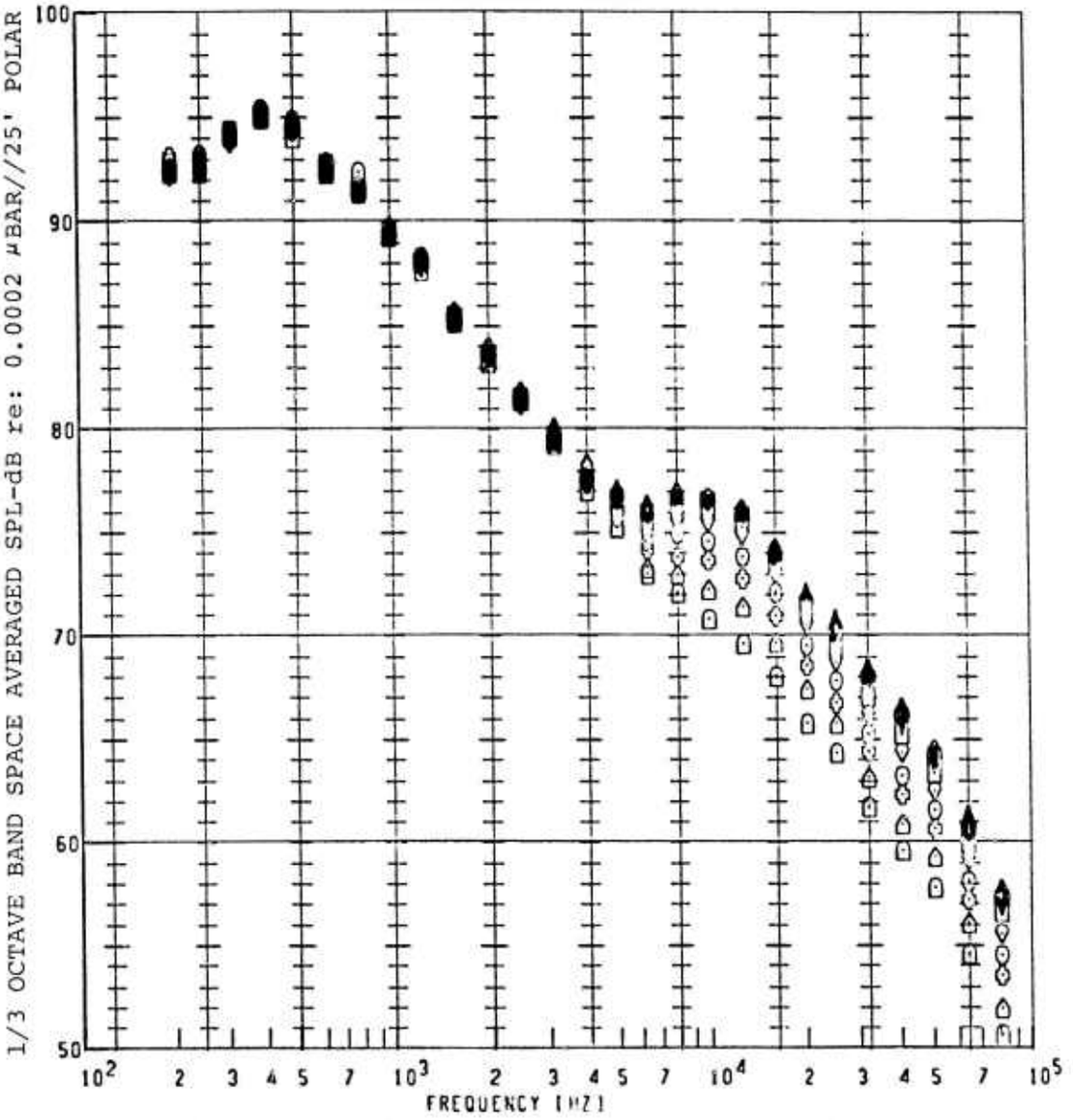
NPR = 3.0 T_T = 1150°F V_J (**IDEAL**) = 2300 FPS

SCALE MODEL A_8 = 13.6 in.^{2}

RUN NO.	AXIAL LOCATION	IRIS DIA.	REMARKS	REF.
251	0.0 x/D	9.4 in.		
254	0.25	9.6		
257	0.50	9.8		
260	0.75	10.0		
263	1.00	10.4		
266	1.25	10.6		
269	1.50	10.8		
272	1.75	11.2		
275	2.0	11.6		
278	2.5	12.0		
281	3.0	12.4		
284	3.5	13.2		
287	4.0	13.6		
290	5.0	14.4		
293	6.0	15.6		
296	7.0	16.4		
299	8.0	17.8		
302	10.0	19.8		
305	12.0	22.0		
308	14.0	24.0		

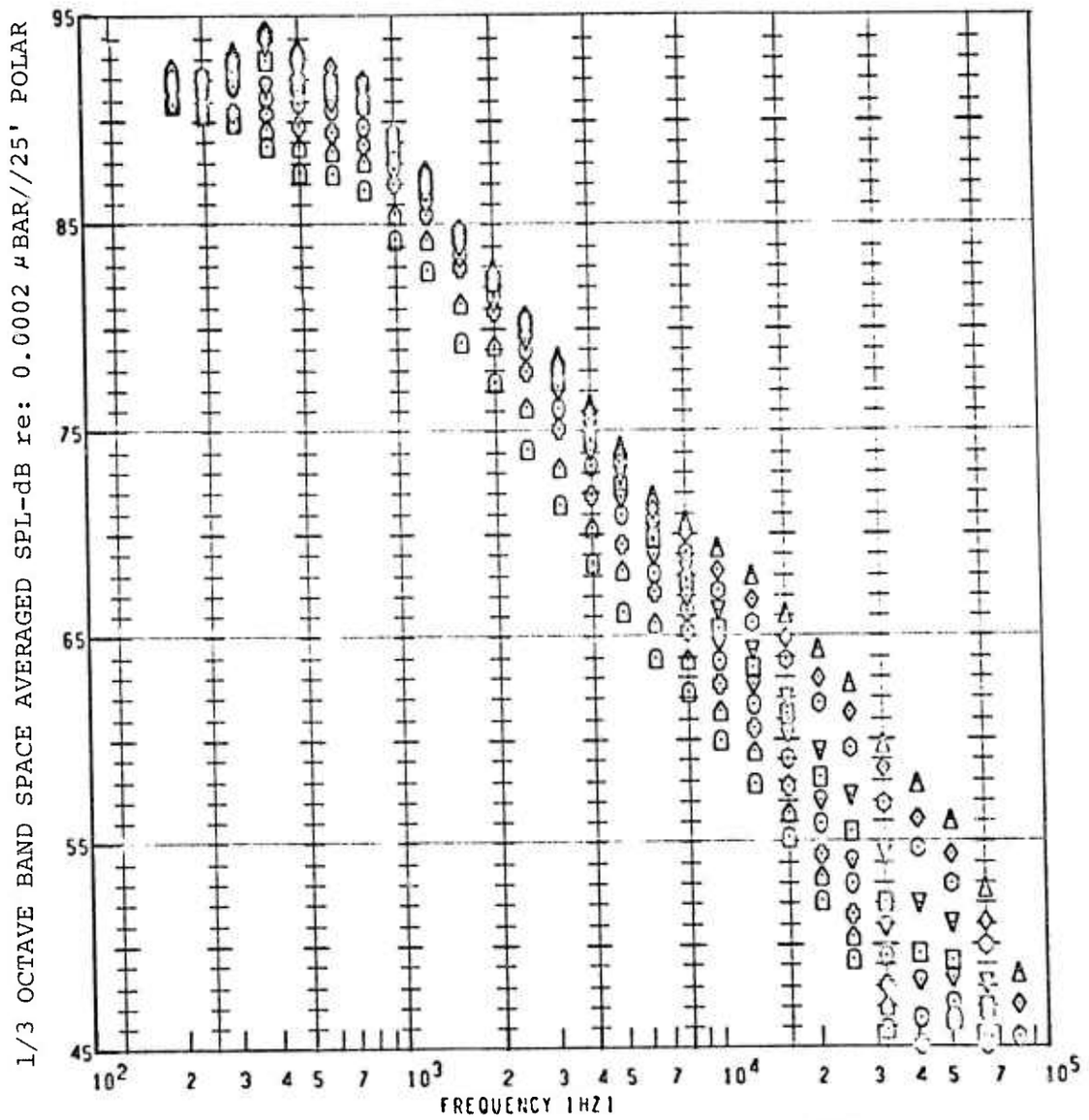
MICROPHONE LAYOUT: 25 FOOT VERTICAL POLAR ARC

FREE FIELD VALUES

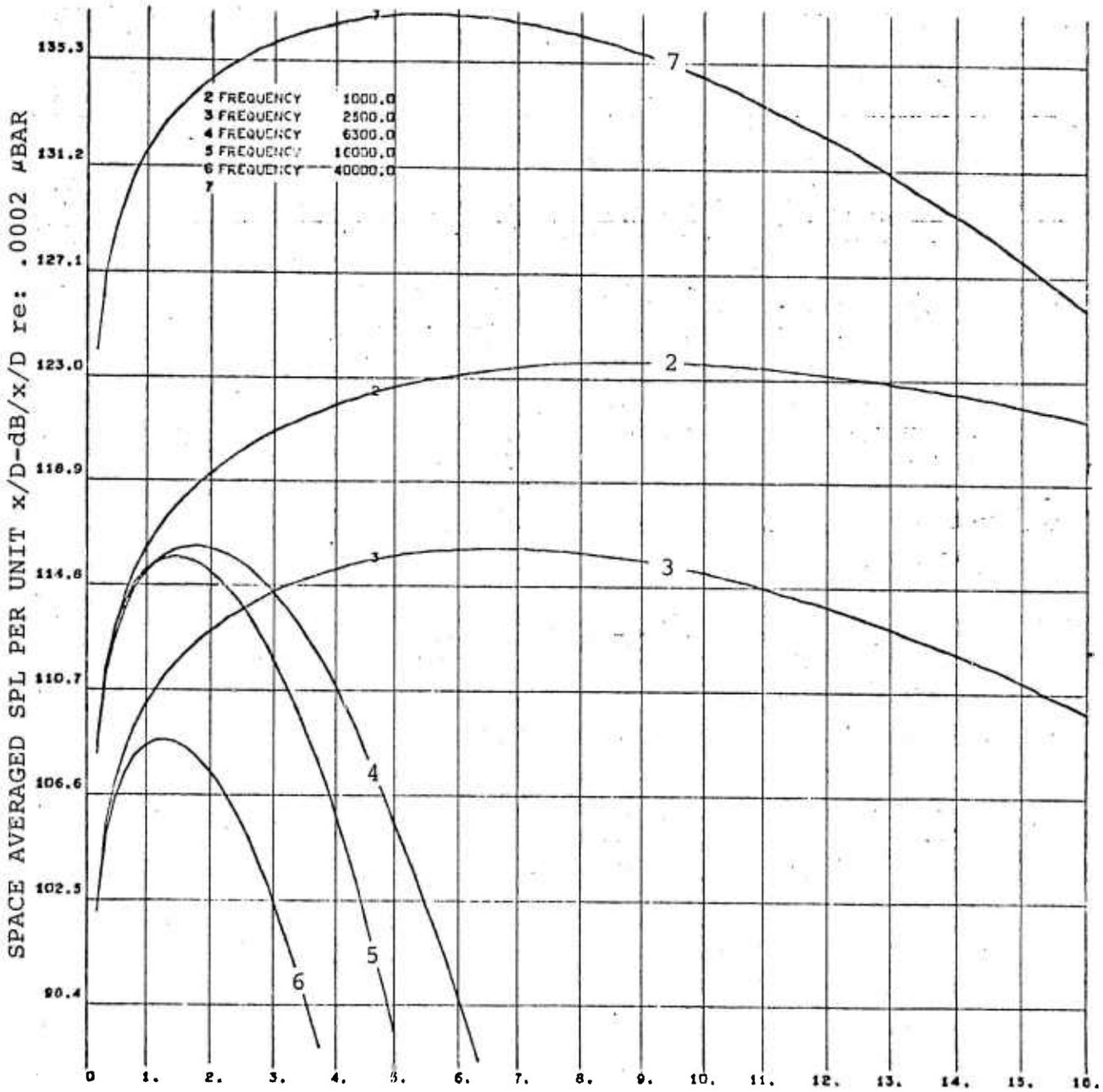


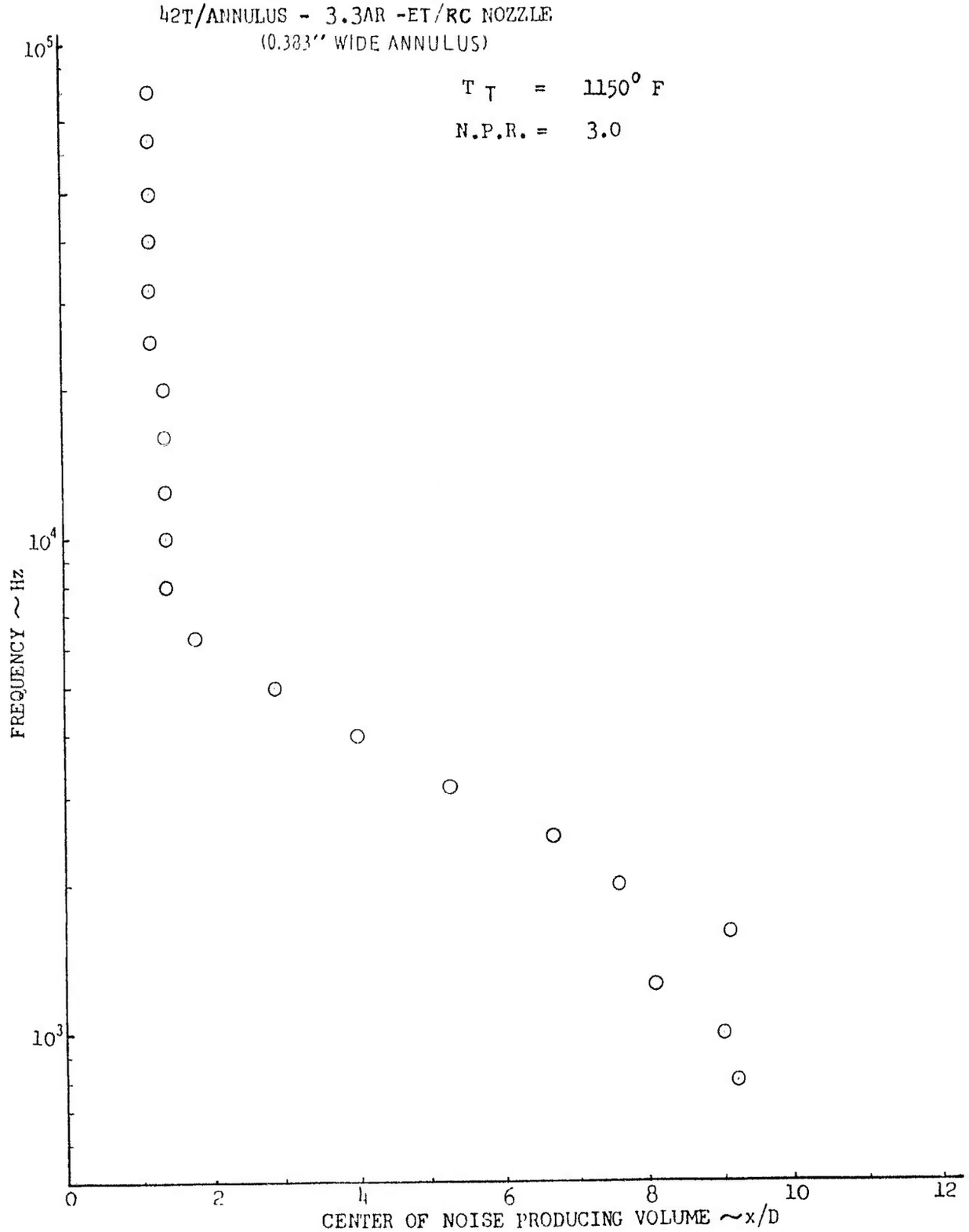
PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP	AXIAL LOCATION, x/D
△	251	3.00	1150°F	0
◇	254	3.00	1150	.25
○	257	3.00	1150	.50
▽	260	3.00	1150	.75
□	263	3.00	1150	1.0
▽	266	3.00	1150	1.2
○	269	3.00	1150	1.5
◇	272	3.00	1150	1.7
△	275	3.00	1150	2.0
□	278	3.00	1150	2.5

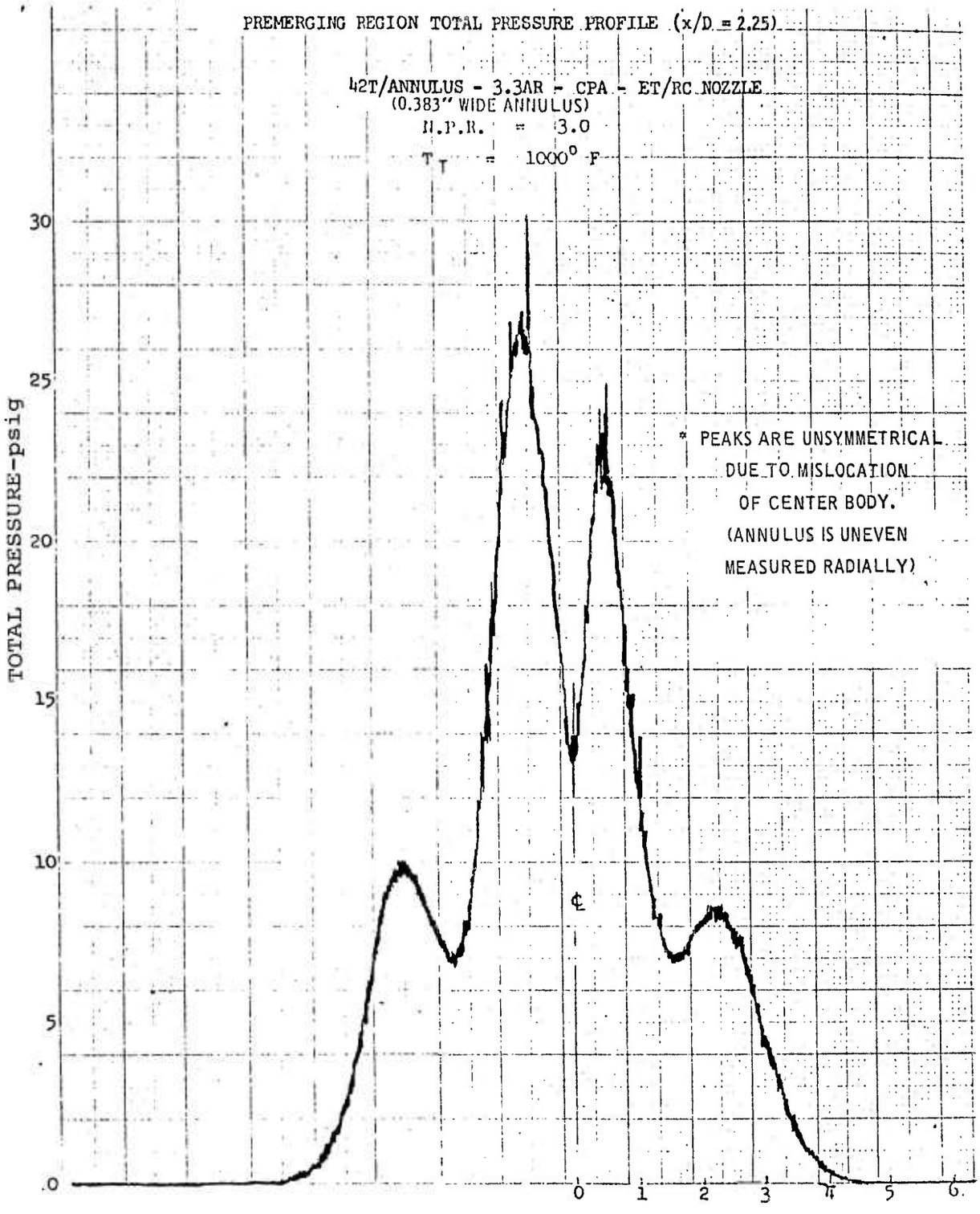
FREE FIELD VALUES

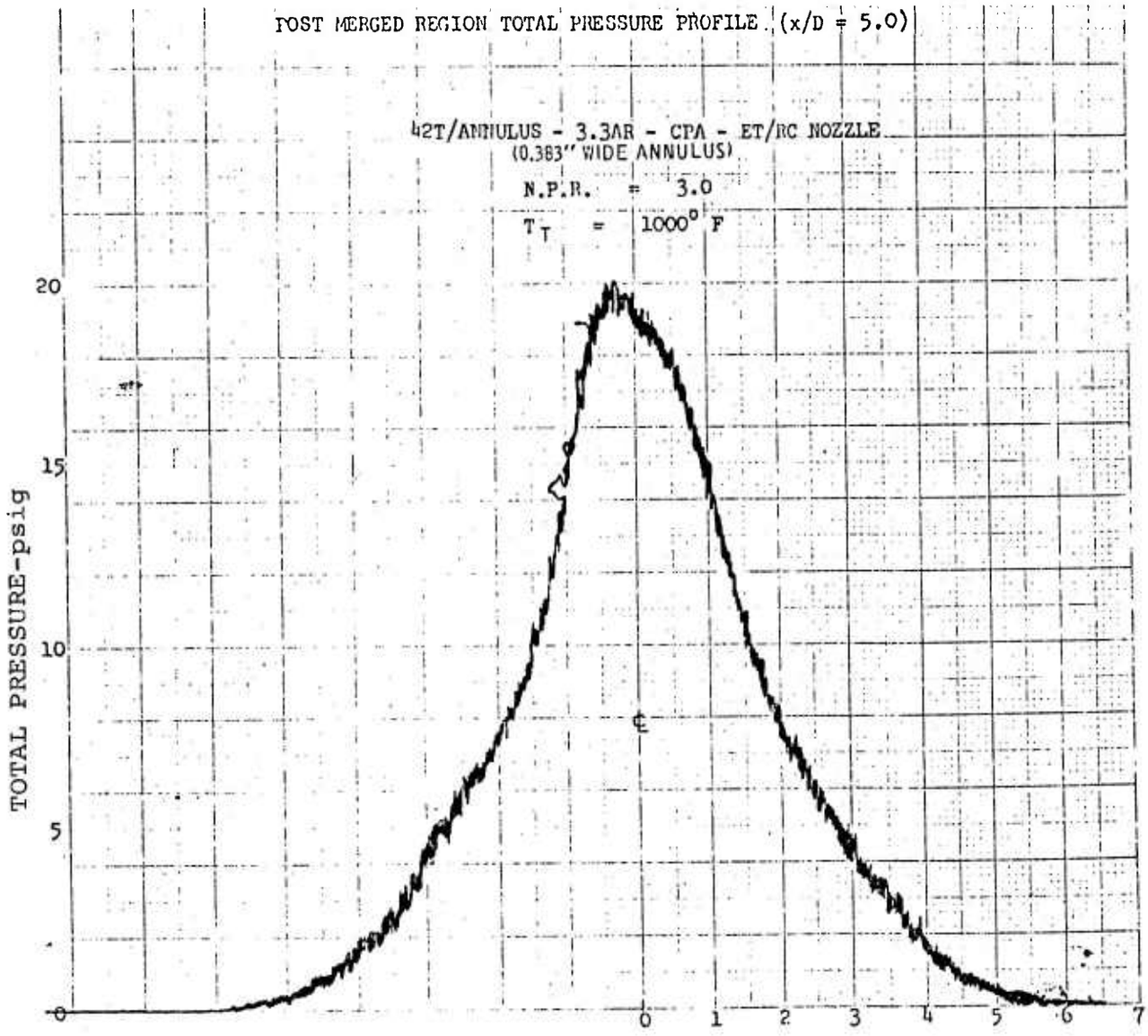


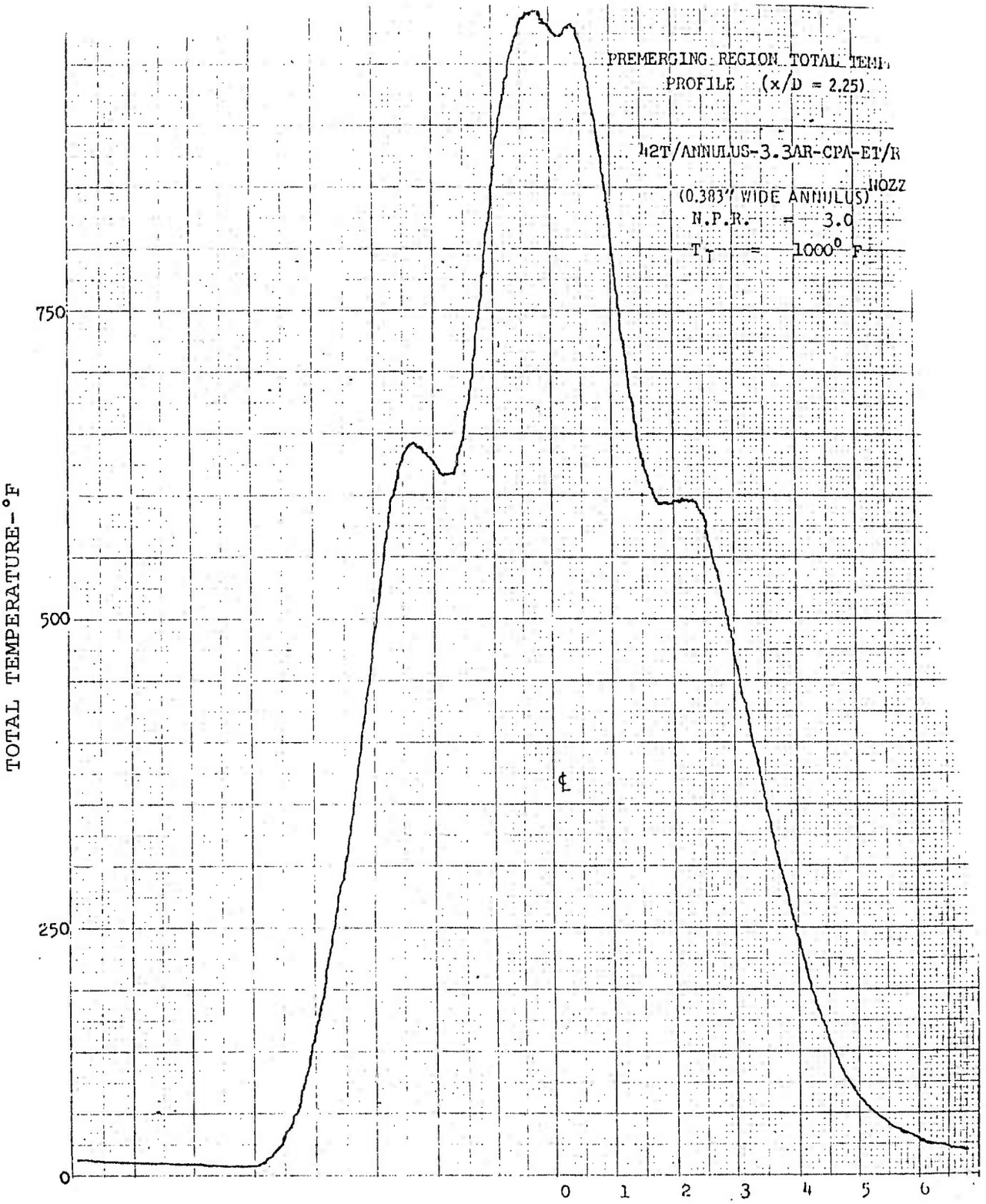
PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP	AXIAL LOCATION, x/D
△	281	3.00	1150°F	3.0
◇	284	3.00	1150	3.5
○	287	3.00	1150	4.0
▽	290	3.00	1150	5.0
□	293	3.00	1150	6.0
☆	296	3.00	1150	7.0
⊙	299	3.00	1150	8.0
◈	302	3.00	1150	10.0
⬠	305	3.00	1150	12.0
⊡	308	3.00	1150	14

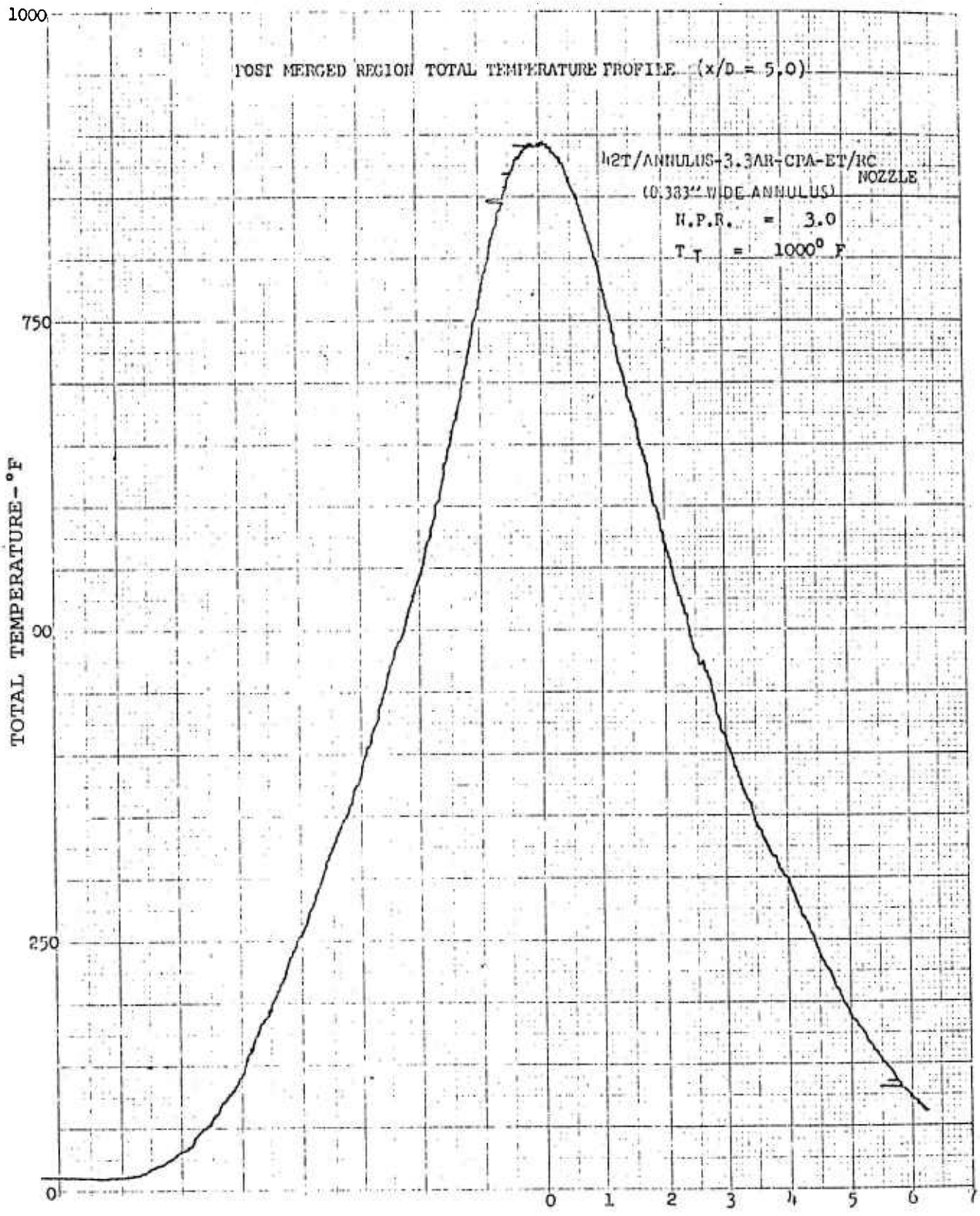

2 FREQUENCY 1000.0
3 FREQUENCY 2500.0
4 FREQUENCY 6300.0
5 FREQUENCY 16000.0
6 FREQUENCY 40000.0
7
135.3
131.2
127.1
123.0
118.9
114.8
110.7
106.6
102.5
98.4
SPACE AVERAGED SPL PER UNIT x/D-dB/x/D re: .0002 μBAR
0
1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.
13.
14.
15.
16.
NOZZLE TO WALL SPACING-x/D

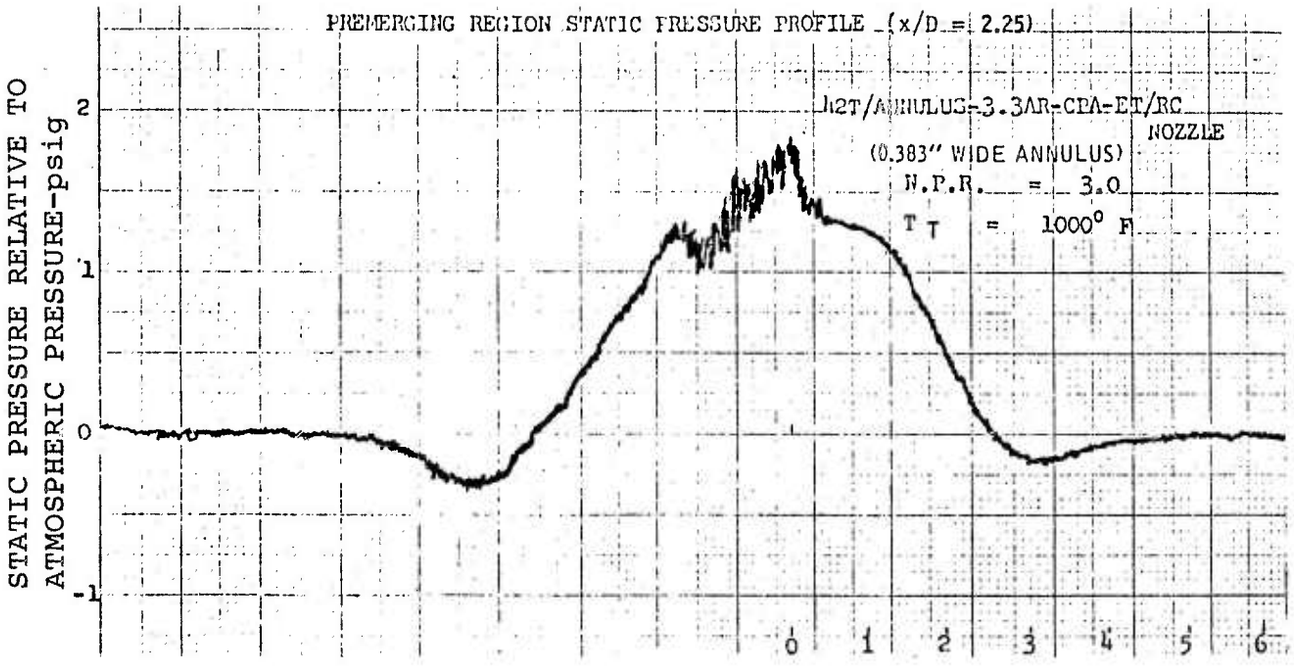

42T/ANNULUS - 3.3AR -ET/RC NOZZLE
(0.383" WIDE ANNULUS)
T_T = 1150° F
N.P.R. = 3.0
10^5
10^4
10^3
FREQUENCY ~ Hz
0
2
4
6
8
10
12
CENTER OF NOISE PRODUCING VOLUME ~x/D

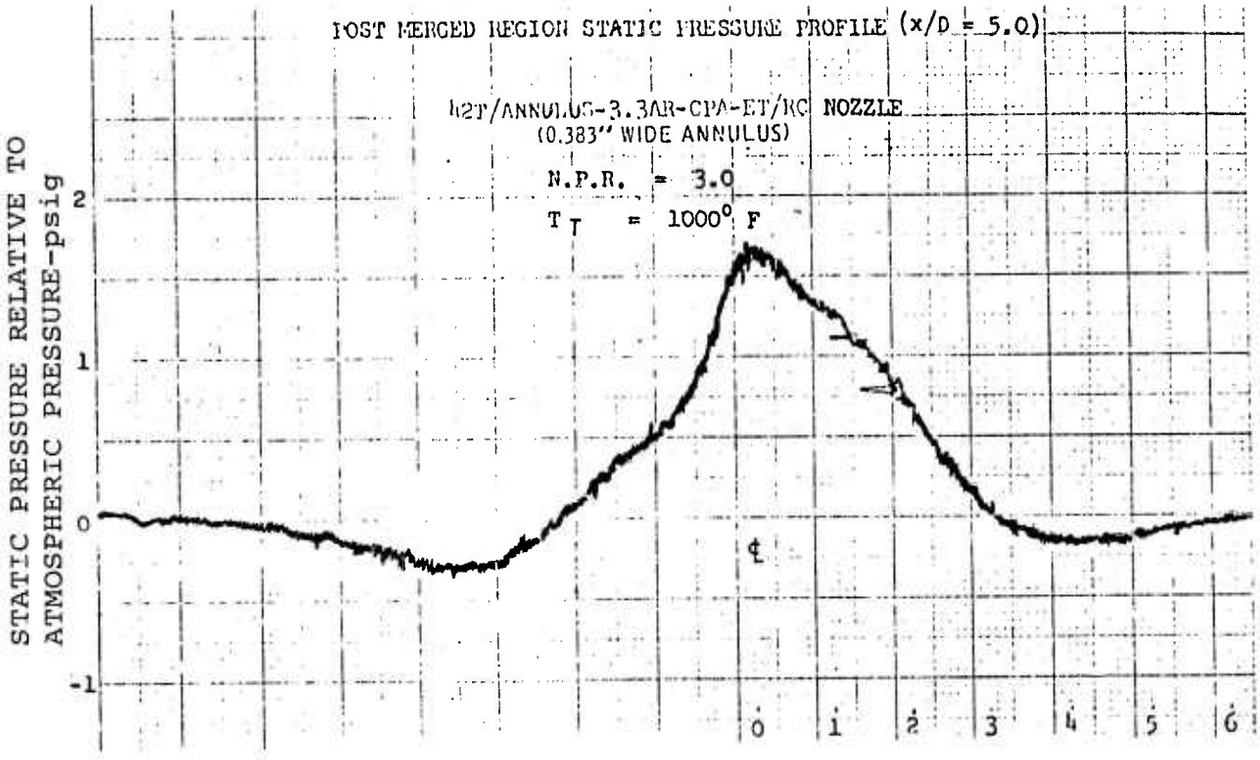

PREMERGING REGION TOTAL PRESSURE PROFILE (x/D = 2.25)
42T/ANNULUS - 3.3AR - CPA - ET/RC NOZZLE
(0.383" WIDE ANNULUS)
N.P.R. = 3.0
T_T = 1000° F
* PEAKS ARE UNSYMMETRICAL DUE TO MISLOCATION OF CENTER BODY. (ANNULUS IS UNEVEN MEASURED RADIALLY)
TOTAL PRESSURE-psig
30
25
20
15
10
5
0
℄
0
1
2
3
4
5
6
RADIAL DISTANCE FROM JET ℄-in.


POST MERGED REGION TOTAL PRESSURE PROFILE (x/D = 5.0)
42T/ANNULUS - 3.3AR - CPA - ET/RC NOZZLE
(0.383" WIDE ANNULUS)
N.P.R. = 3.0
T_T = 1000° F
TOTAL PRESSURE-psig
20
15
10
5
0
0
1
2
3
4
5
6
7
RADIAL DISTANCE FROM JET ℄-in.


PREMERGING REGION TOTAL TEMP. PROFILE (x/D = 2.25)
42T/ANNULUS-3.3AR-CPA-ET/R
NOZZ
(0.383" WIDE ANNULUS)
N.P.R. = 3.0
T_T = 1000° F
TOTAL TEMPERATURE-°F
750
500
250
0
0
1
2
3
4
5
6
℄
RADIAL DISTANCE FROM JET ℄-in.


POST MERGED REGION TOTAL TEMPERATURE PROFILE (x/D = 5.0)
H2T/ANNULUS-3.3AR-CPA-ET/RC NOZZLE
(0.383" WIDE ANNULUS)
N.P.R. = 3.0
T_T = 1000° F
TOTAL TEMPERATURE - °F
1000
750
00
250
0
0 1 2 3 4 5 6 7
RADIAL DISTANCE FROM JET ℄ -in.


PREMERGING REGION STATIC PRESSURE PROFILE (x/D = 2.25)
J2T/ANNULUS-3.3AR-CDA-ET/RC NOZZLE
(0.383" WIDE ANNULUS)
N.P.R. = 3.0
T_T = 1000° F
STATIC PRESSURE RELATIVE TO ATMOSPHERIC PRESSURE-psig
2
1
0
-1
0
1
2
3
4
5
6
RADIAL DISTANCE FROM JET ℄-in.


POST MERGED REGION STATIC PRESSURE PROFILE (x/D = 5.0)
N2T/ANNULUS-3.3AR-CPA-ET/RC NOZZLE
(0.383" WIDE ANNULUS)
N.P.R. = 3.0
T_T = 1000° F
STATIC PRESSURE RELATIVE TO ATMOSPHERIC PRESSURE-psig
2
1
0
-1
℄
0
1
2
3
4
5
6
RADIAL DISTANCE FROM JET ℄-in.

TEST CONDITIONS

NOZZLE: 42T/Annulus-3.0AR-CPA-ET/RC

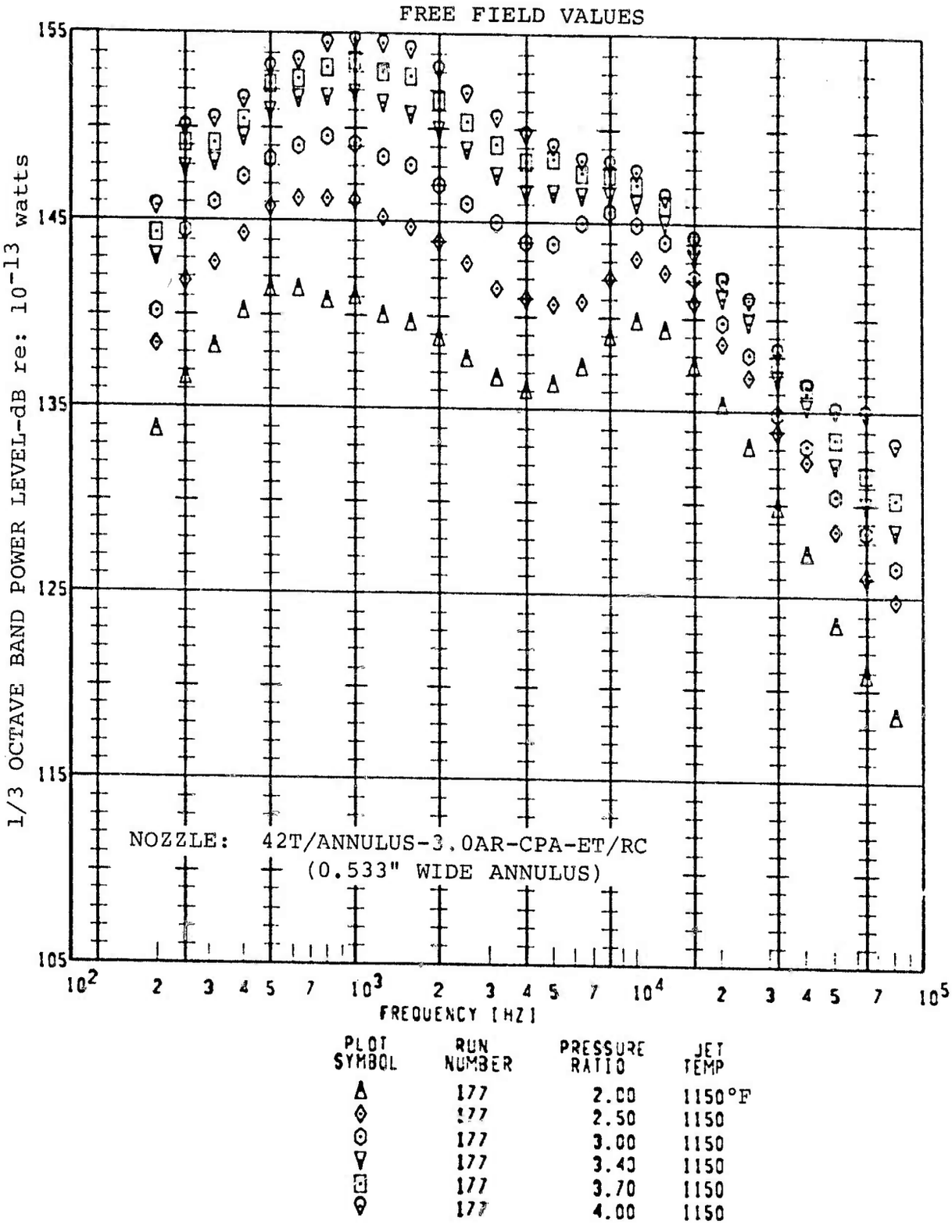
FACILITY: HNTF

DATE: 10-17-73 T_{AMB} = 70°F **R.H.** = 52°

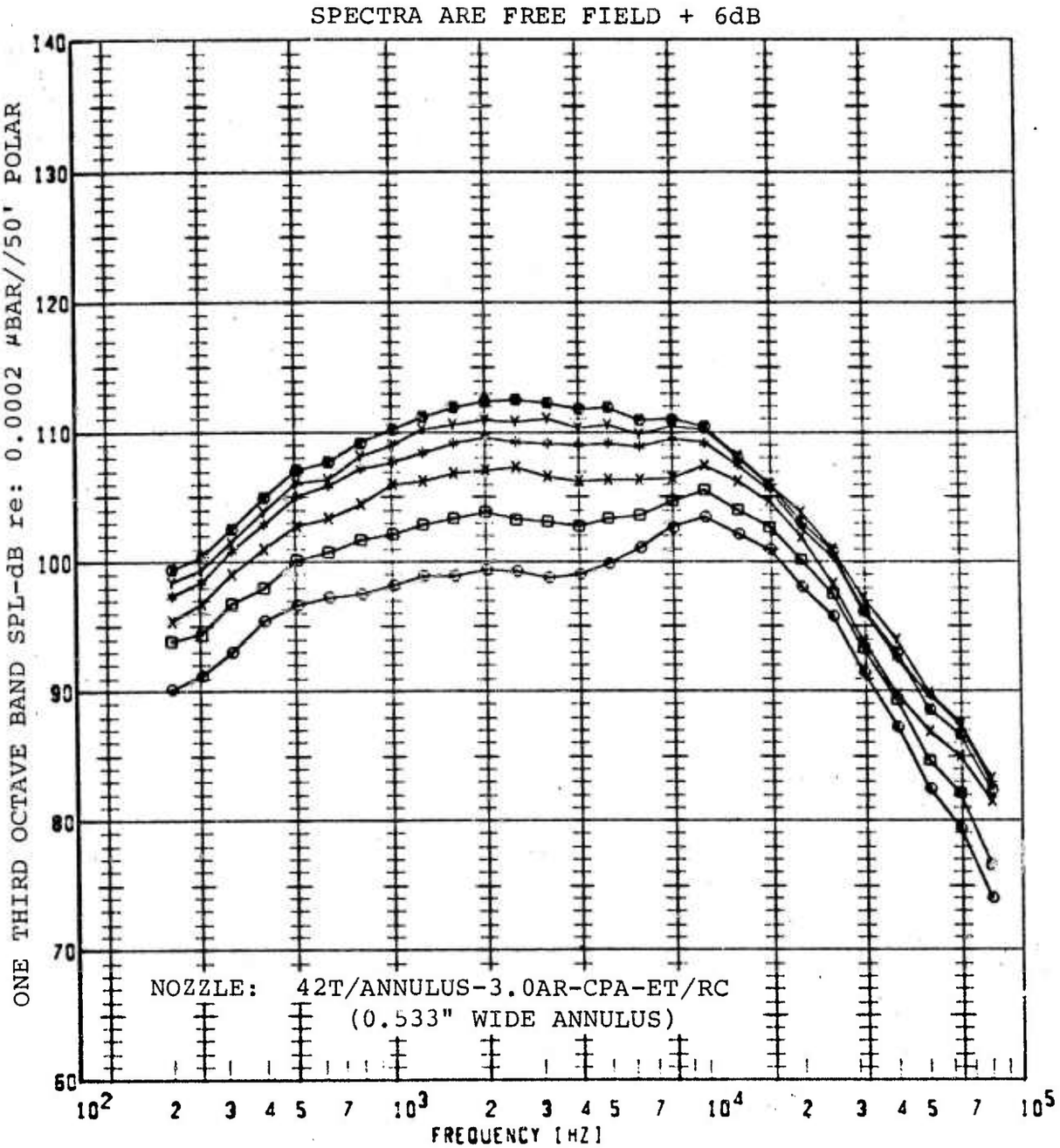
SCALE MODEL A_8 = 15.0 in.^{2}

RUN NO.	NPR	T_T	V_J (IDEAL)	REMARKS	REF
177	2.0	1150°F	1875 fps	Annulus width = 0.533"	
"	2.5	"	2126		
"	3.0	"	2303		
"	3.4	"	2413		
"	3.7	"	2483		
"	4.0	"	2544		

MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH CONCRETE GROUND SURFACE. MEASURED ACOUSTIC DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.

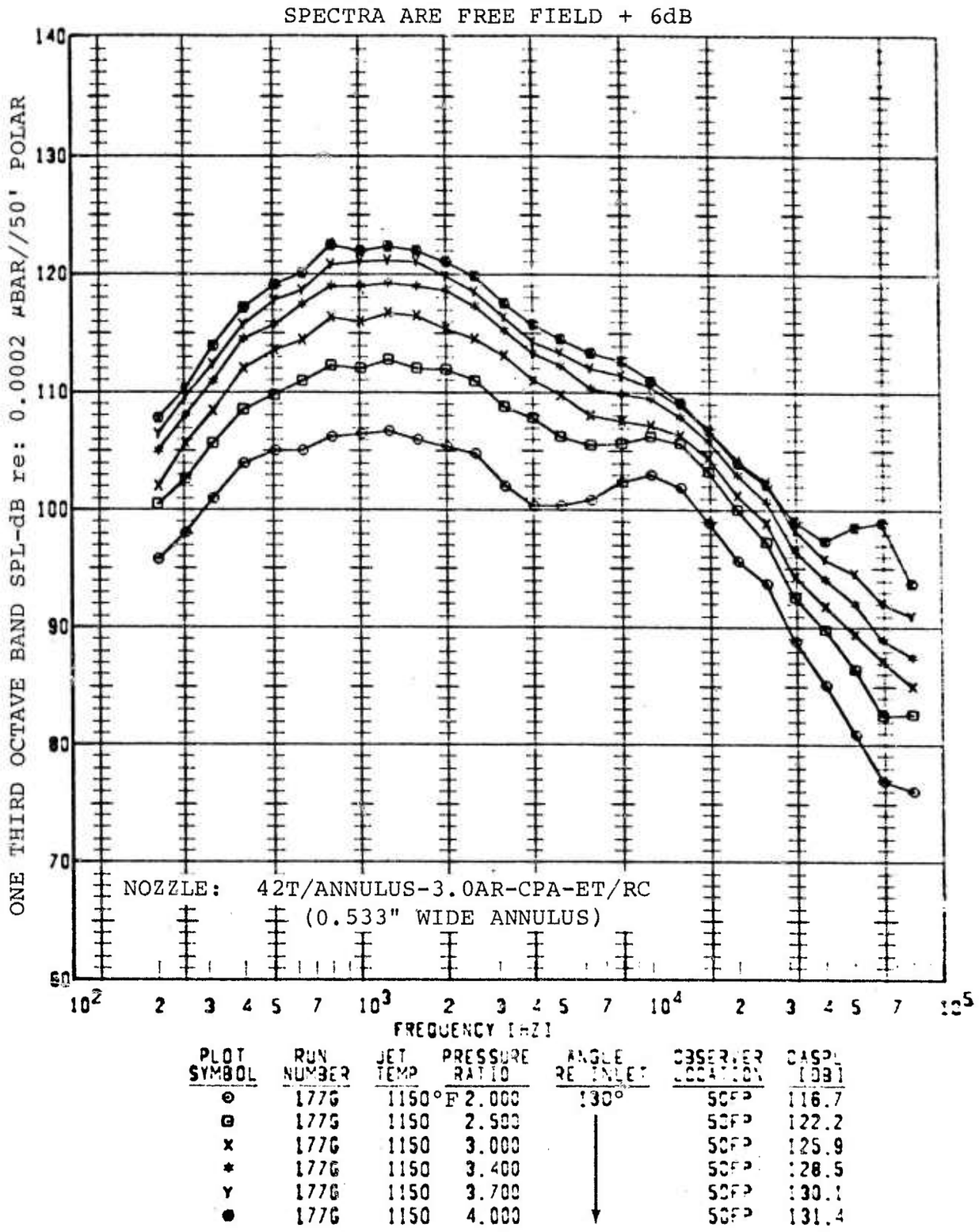


JET NOISE POWER SPECTRA



PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL (DB)
⊖	177G	1150°F	2.000	110°	50FP	112.6
⊡	177G	1150	2.500		50FP	115.7
x	177G	1150	3.000		50FP	118.5
*	177G	1150	3.400		50FP	120.7
Y	177G	1150	3.700		50FP	121.9
●	177G	1150	4.000		50FP	123.0

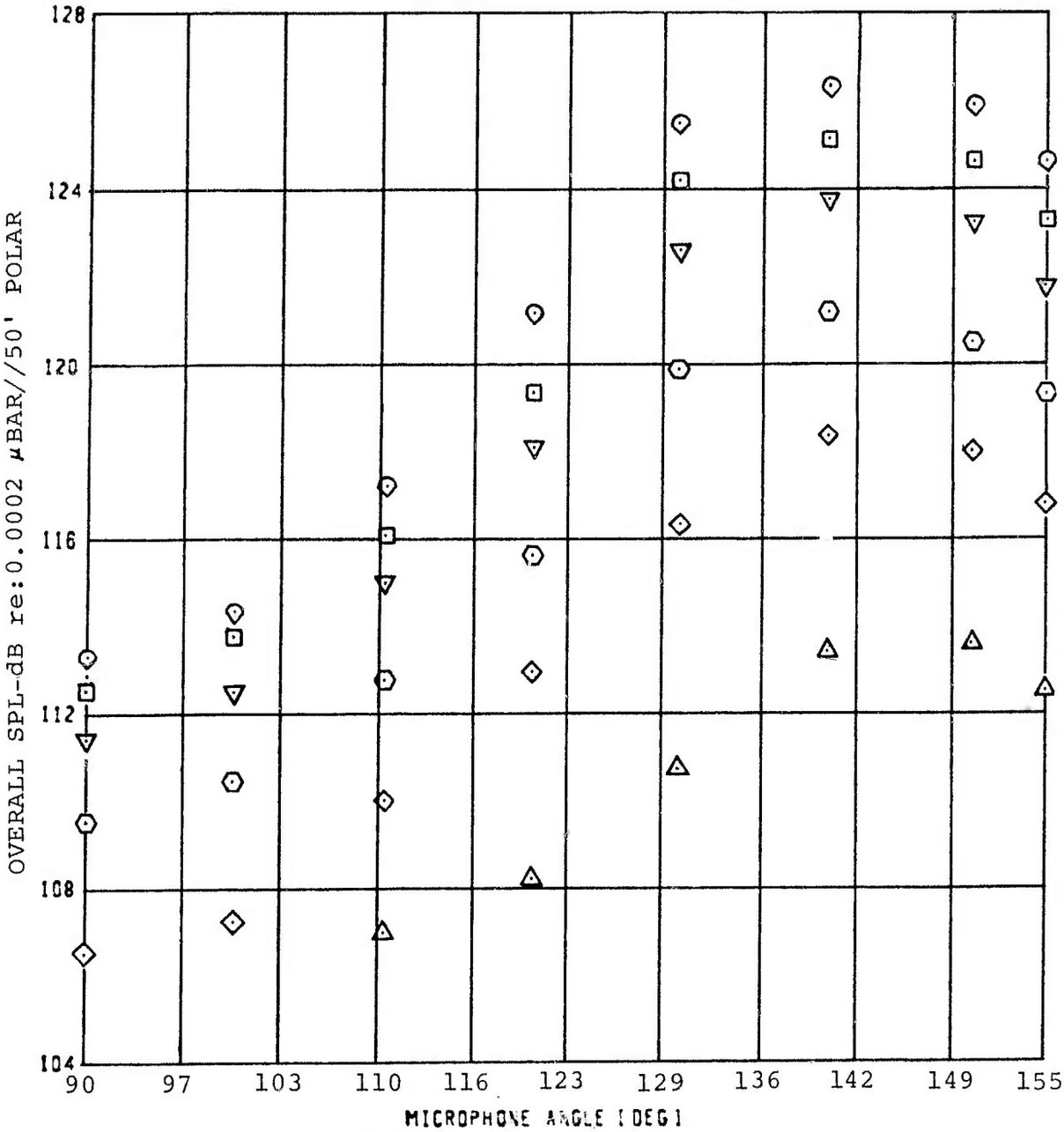
MEASURED NOISE SPECTRA AT 110° re: NOZZLE INLET AXIS



PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL [DB]
⊙	177G	1150°F	2.000	130°	50FP	116.7
⊡	177G	1150	2.500		50FP	122.2
x	177G	1150	3.000		50FP	125.9
*	177G	1150	3.400		50FP	128.5
Y	177G	1150	3.700		50FP	130.1
●	177G	1150	4.000		50FP	131.4

MEASURED NOISE SPECTRA AT 130° re: NOZZLE INLET AXIS

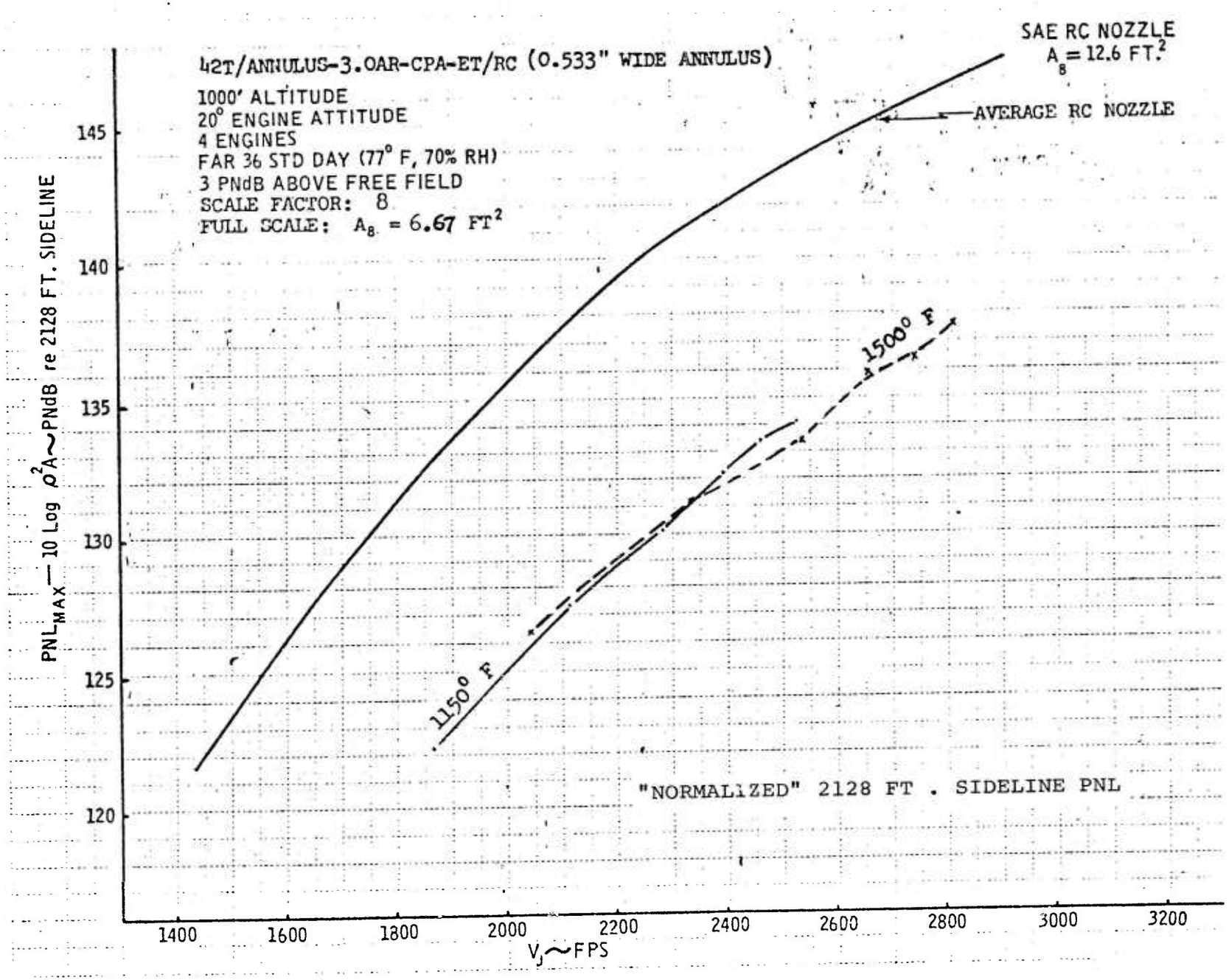
FREE FIELD VALUES

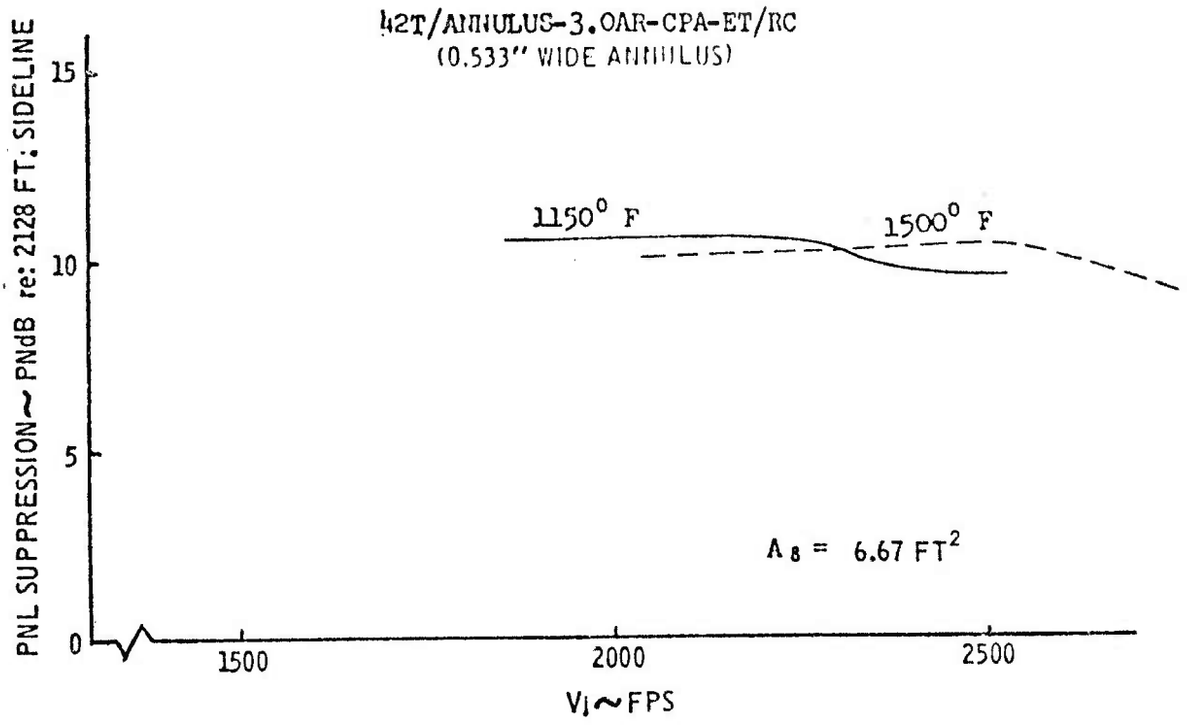


PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	177	2.00	1150°F
◇	177	2.50	1150
○	177	3.00	1150
▽	177	3.40	1150
□	177	3.70	1150
⬡	177	4.00	1150

NOZZLE: 42T/ANNULUS-3.0AR-CPA-ET/RC
(0.533" WIDE ANNULUS)

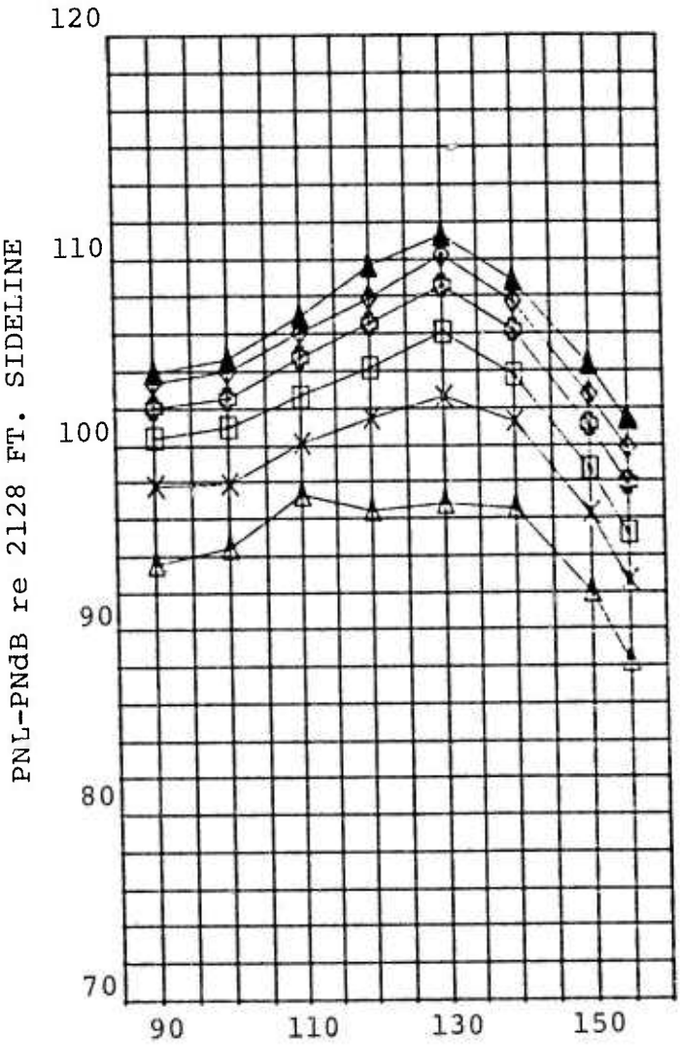
OASPL BEAM PATTERNS


42T/ANNULUS-3.OAR-CPA-ET/RC (0.533" WIDE ANNULUS)
1000' ALTITUDE
20° ENGINE ATTITUDE
4 ENGINES
FAR 36 STD DAY (77° F, 70% RH)
3 PNdB ABOVE FREE FIELD
SCALE FACTOR: 8
FULL SCALE: A_8 = 6.67 FT^2
SAE RC NOZZLE
A_8 = 12.6 FT.^{2}
AVERAGE RC NOZZLE
1500° F
1150° F
"NORMALIZED" 2128 FT . SIDELINE PNL
PNL_{MAX} — 10 Log $\rho^2 A$ ~ PNdB re 2128 FT. SIDELINE
145
140
135
130
125
120
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
V_j ~ FPS



PEAK PNL SUPPRESSION VALUES

NOZZLE: 42T/ANNULUS-3.0AR-CPA-ET/RC
(0.533" WIDE ANNULUS)



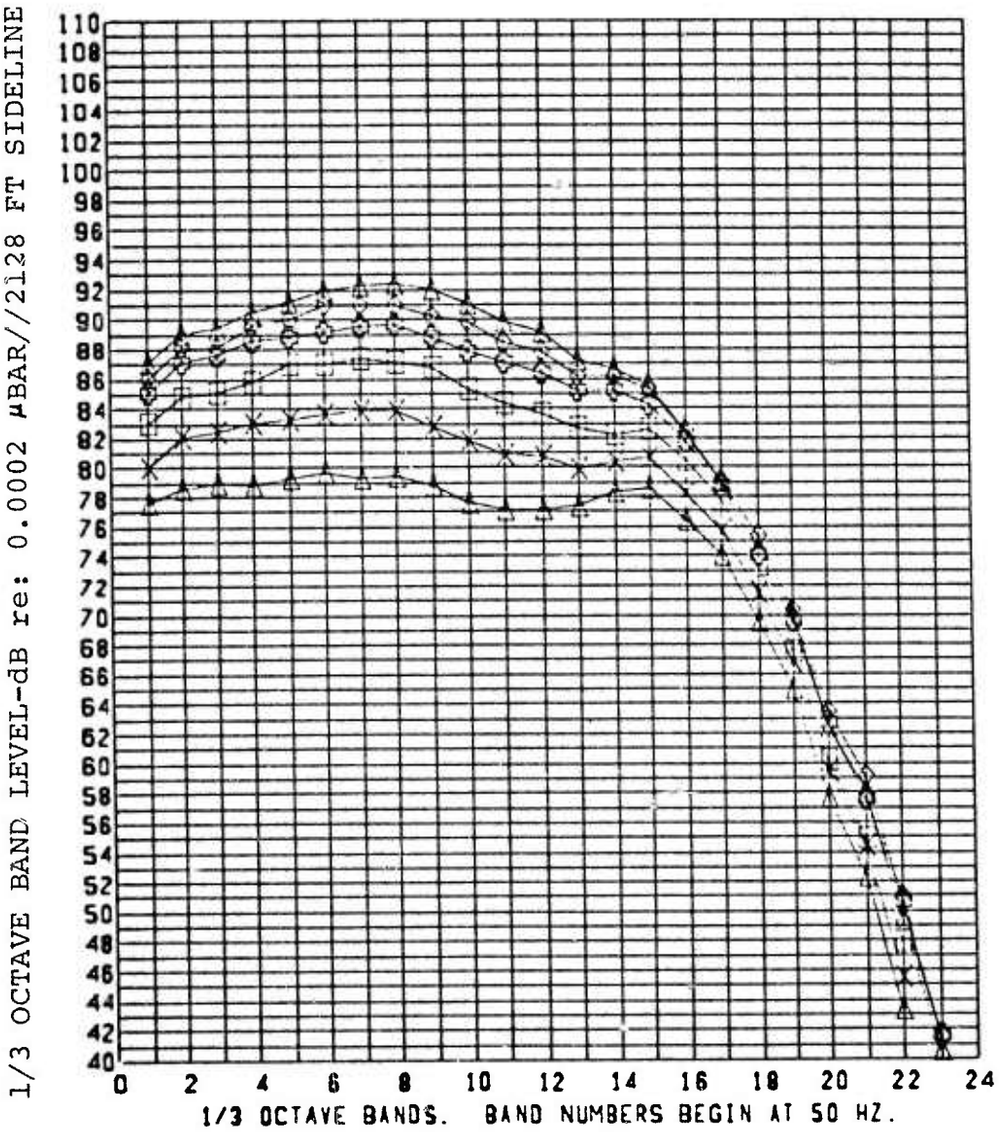
PR = △ 2.0, × 2.5, □ 3.0, ✣ 3.4, ◇ 3.7, ▲ 4.0

T_T = 1150°F A_8 = 6.67 FT^2 RUN: 177

PNL BEAM PATTERNS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 110 DEG TEMP = 77 DEG R.H. = 70 PER CENT



T_T = 1150°F A_8 = 6.67 FT^2 RUN: 177

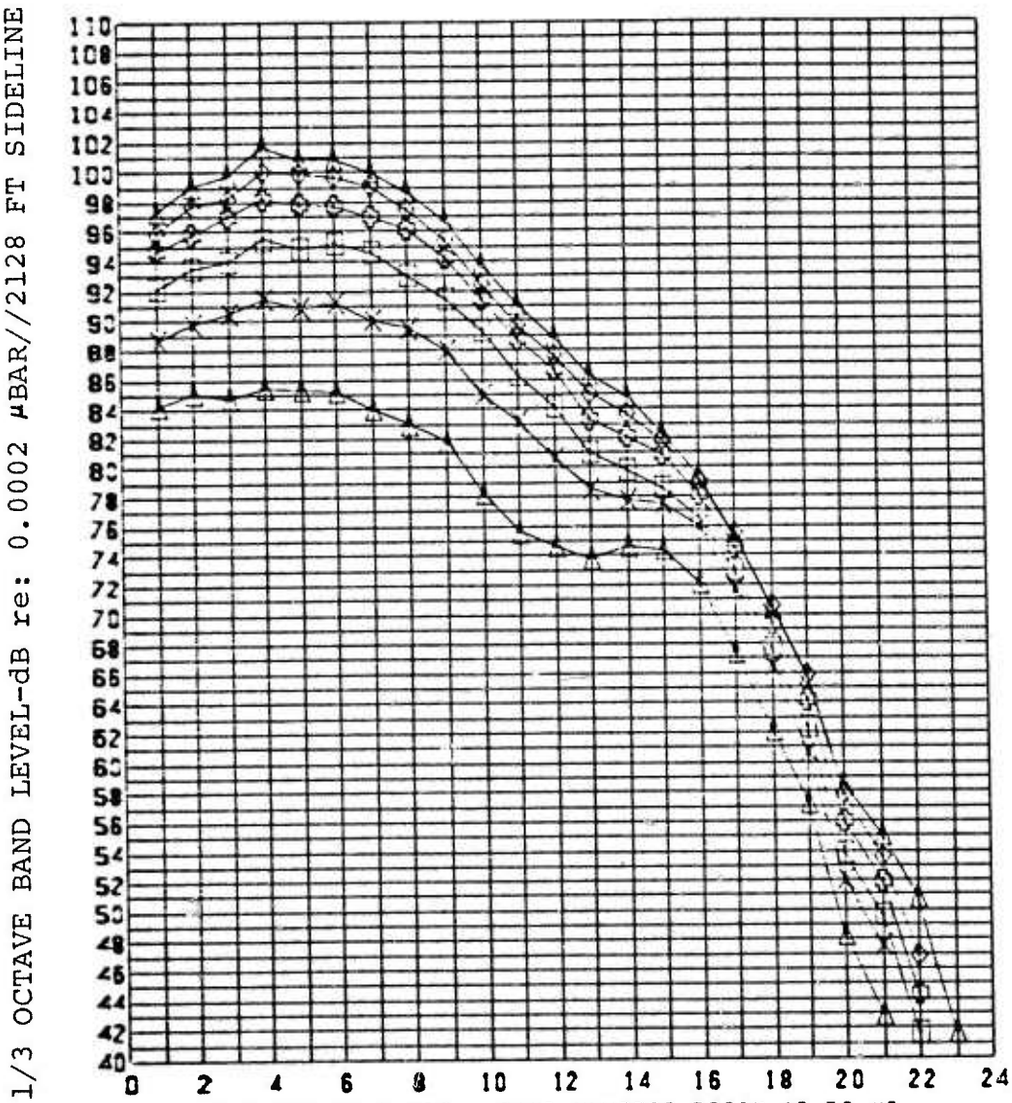
PR = △2.0, X 2.5, □3.0, ✣3.4, ◇3.7, ▲4.0

NOZZLE: 42T/ANNULUS-3.0AR-CPA-ET/RC
(0.533" WIDE ANNULUS)

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 110°
re: NOZZLE INLET AXIS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 130 DEG TEMP = 77 DEG R.H. = 70 PER CENT



T_T = 1150°F A_8 = 6.67 FT^2 RUN: 177

PR = △ 2.0, X 2.5, □ 3.0, ✣ 3.4, ◇ 3.7, ▲ 4.0

NOZZLE: 42T/ANNULUS-3.0AR-CPA-ET/RC
(0.533" WIDE ANNULUS)

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 130°
re: NOZZLE INLET AXIS

TEST CONDITIONS

NOZZLE: 42T/Annulus-2.6AR-CPA-ET/RC

FACILITY: HNTF

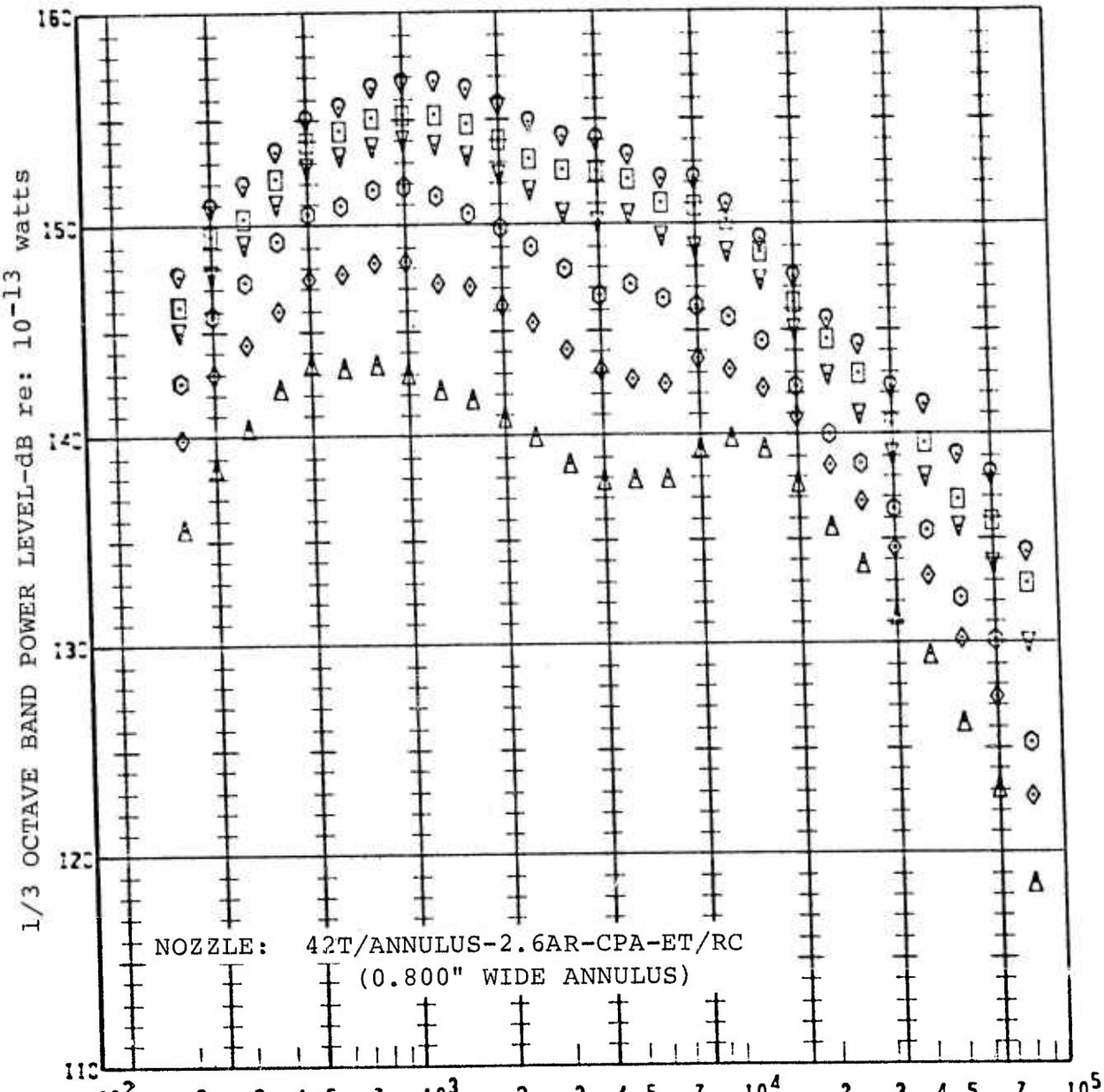
DATE: 10-17-73 T_{AMB} = 55°F **R.H.** = 77%

SCALE MODEL A_8 = 17.2 in.^{2}

RUN NO.	NPR	T_T	V_J (IDEAL)	REMARKS	REF
175	2.0	1150°F	1875 fps	Annulus width = 0.8"	
"	2.5	"	2126		
"	3.0	"	2303		
"	3.4	"	2413		
"	3.7	"	2483		
"	4.0	"	2544		

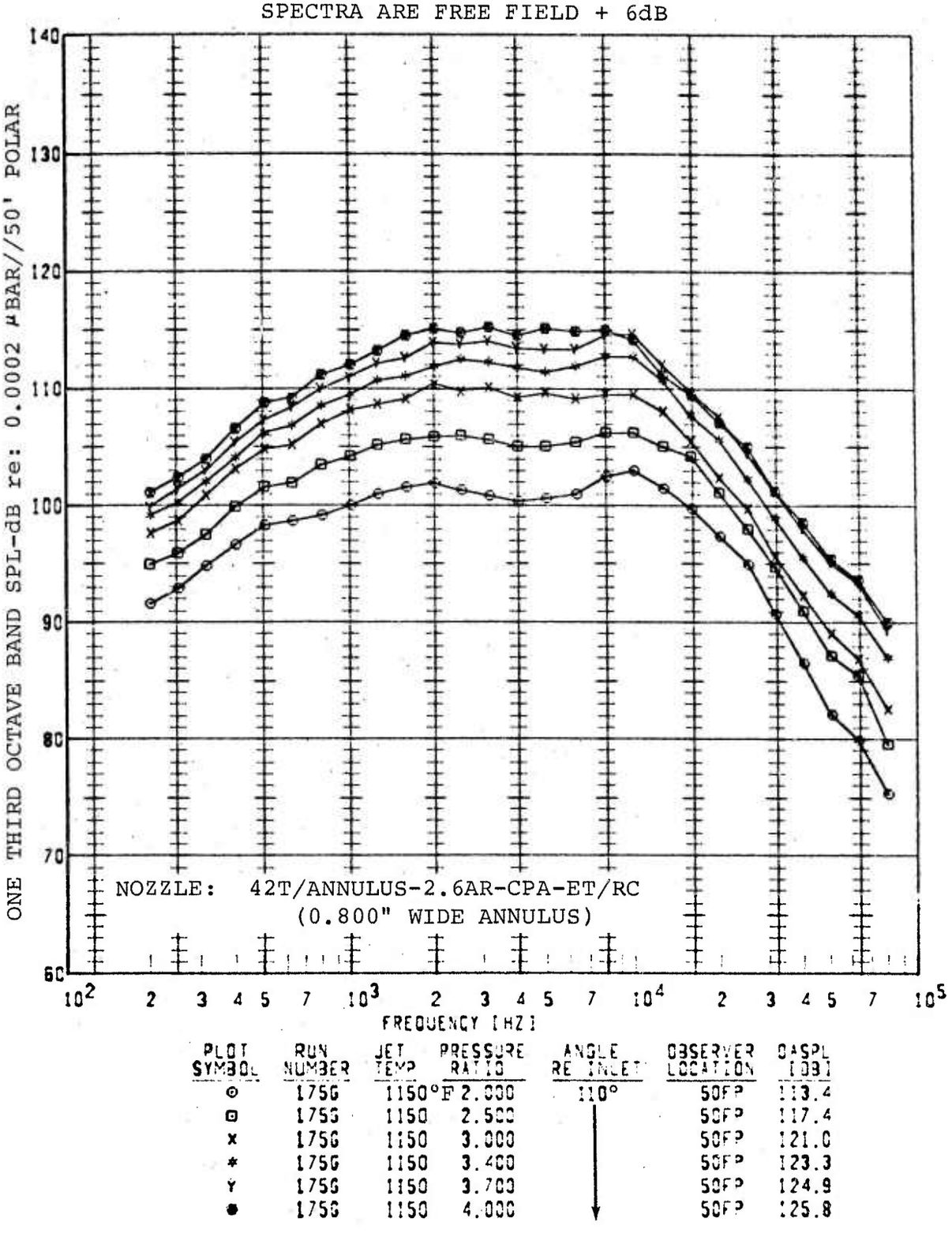
MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH CONCRETE GROUND SURFACE. MEASURED ACOUSTIC DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.

FREE FIELD VALUES

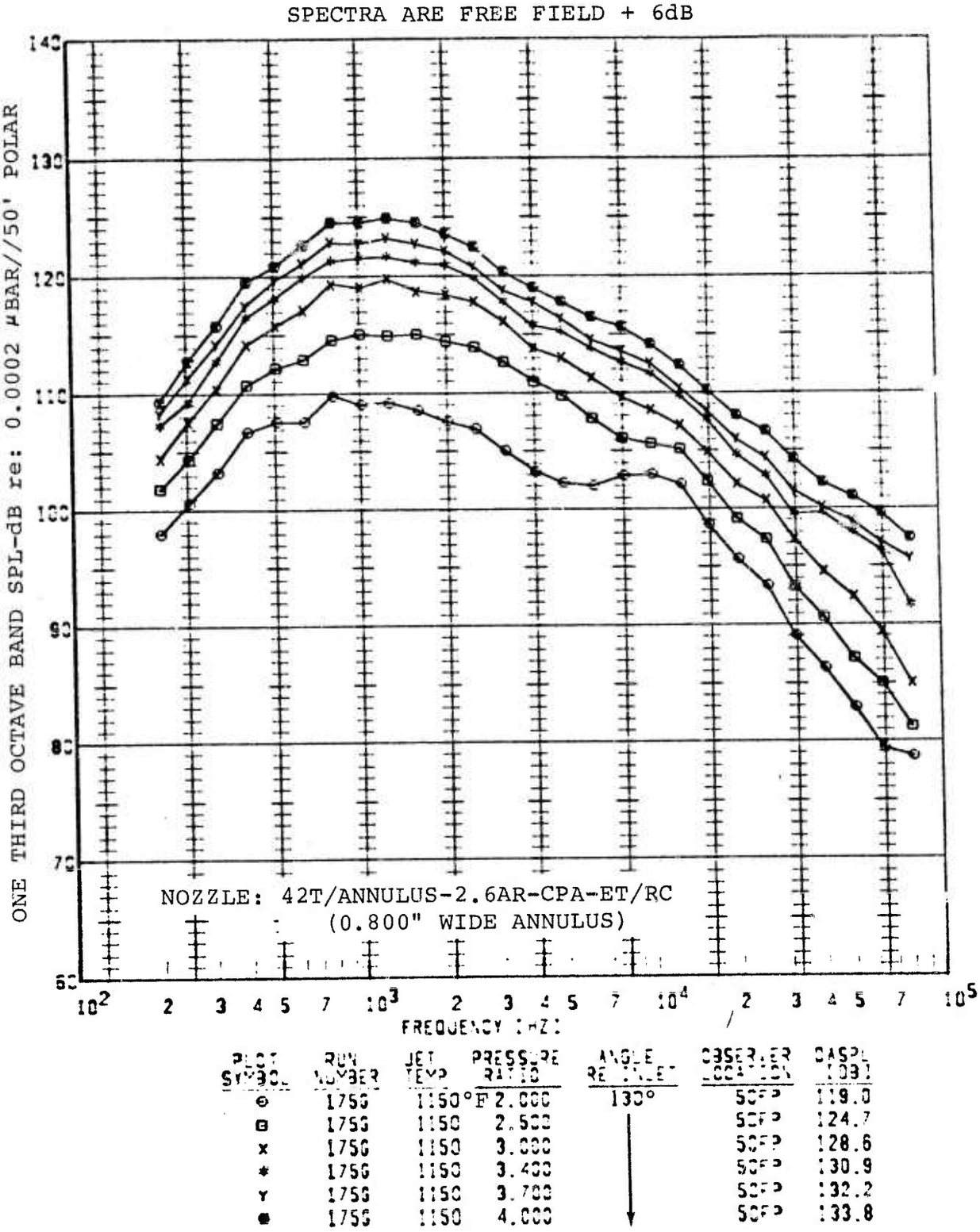


PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	175	2.00	1150°F
◇	175	2.50	1150
○	175	3.00	1150
▽	175	3.40	1150
□	175	3.70	1150
☆	175	4.00	1150

JET NOISE POWER SPECTRA

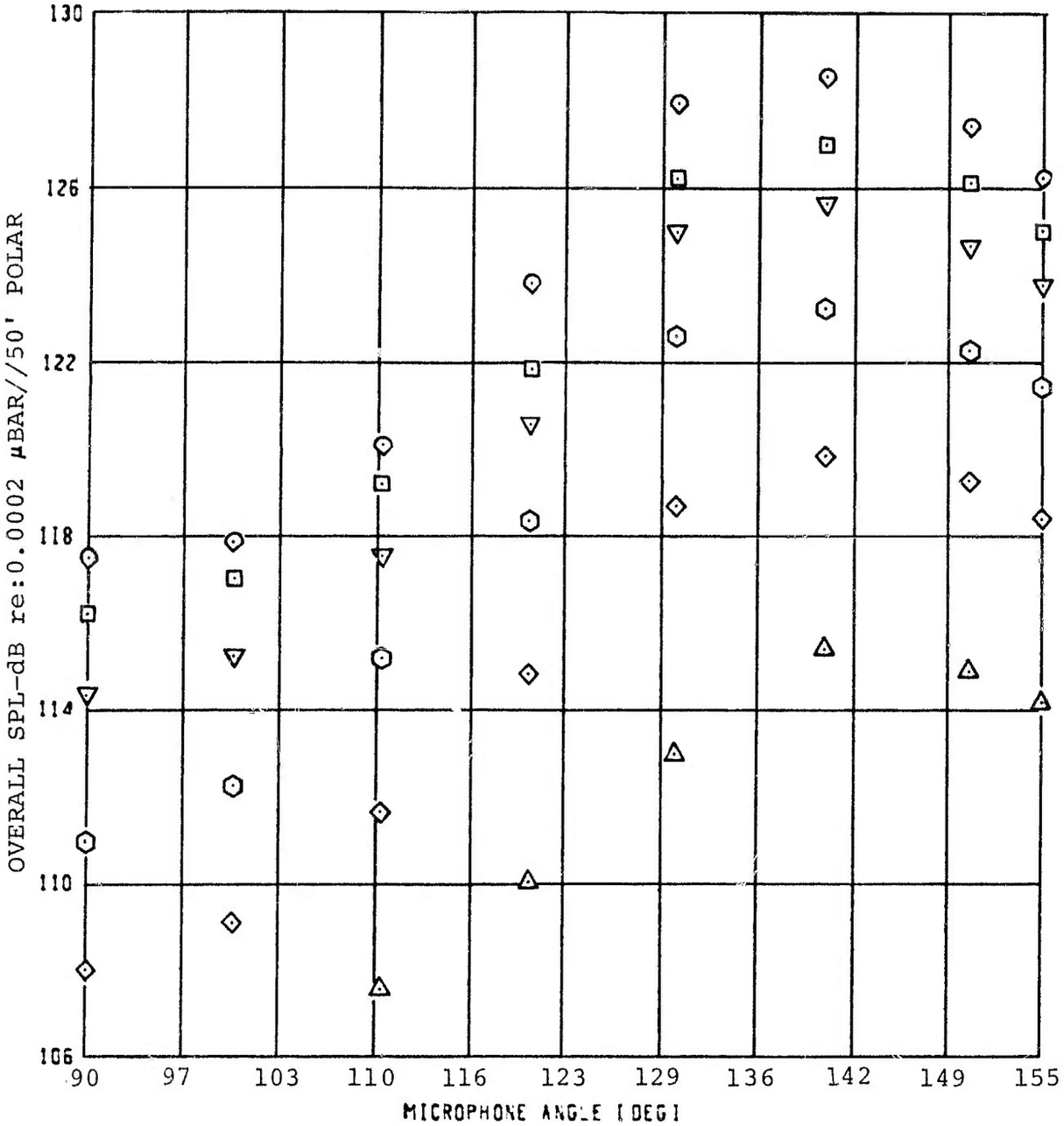


MEASURED NOISE SPECTRA AT 110° re: NOZZLE INLET AXIS



MEASURED NOISE SPECTRA AT 130° re: NOZZLE INLET AXIS

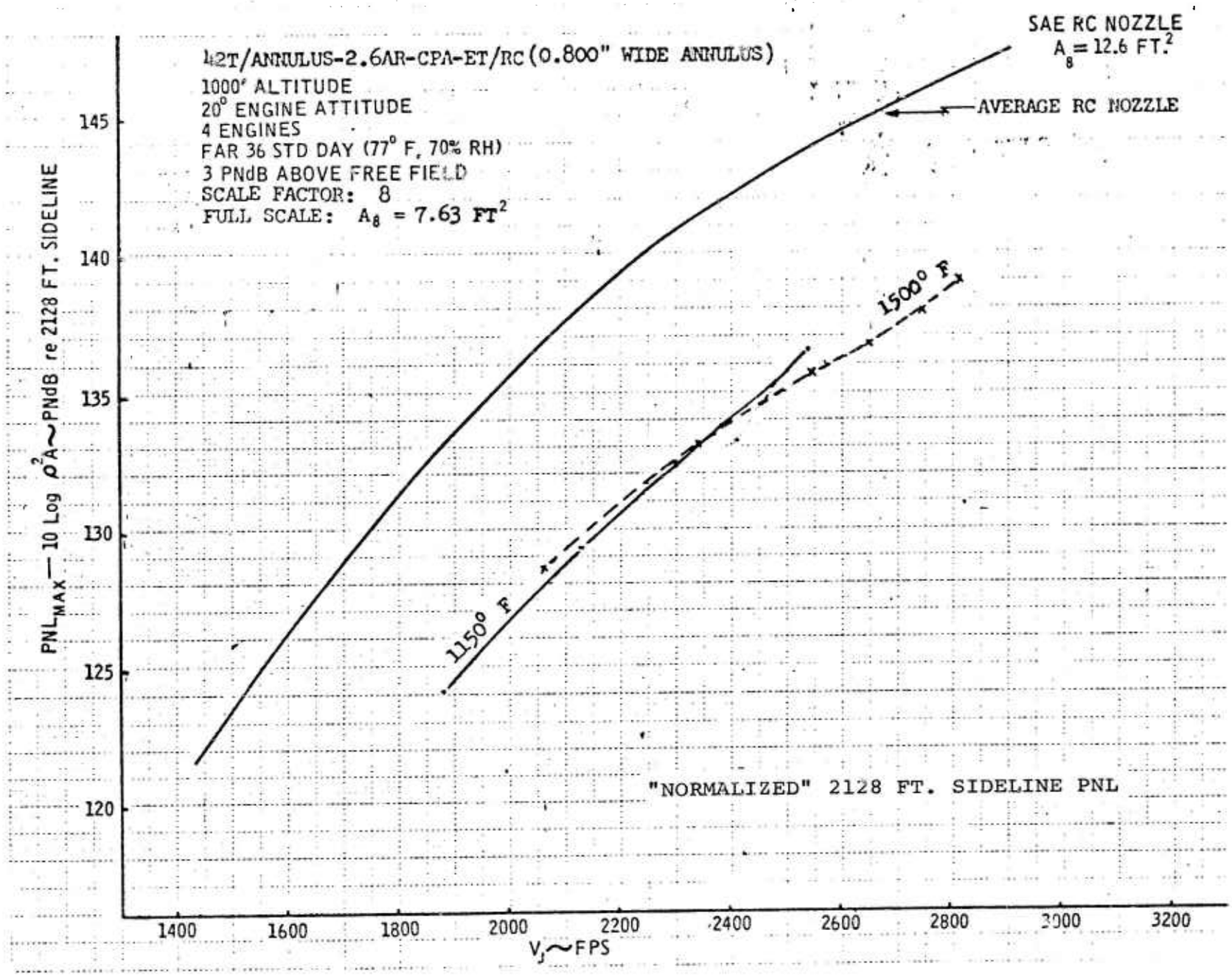
FREE FIELD VALUES

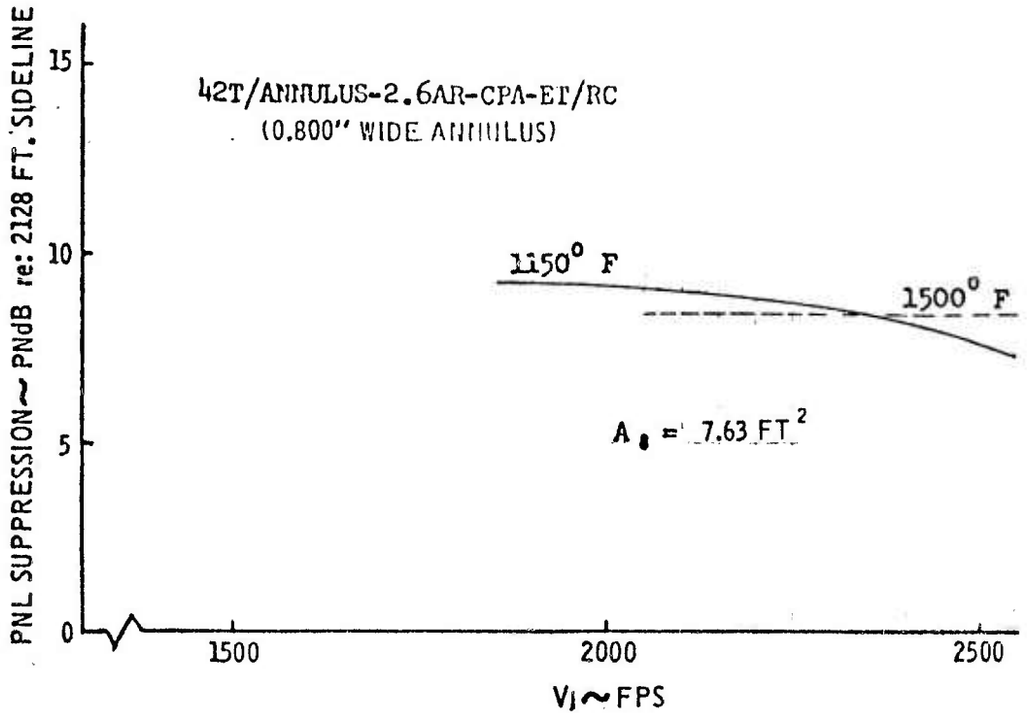


PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	175	2.00	1150
◇	175	2.50	1150
○	175	3.00	1150
▽	175	3.40	1150
□	175	3.70	1150
⬡	175	4.00	1150

NOZZLE: 42T/ANNULUS-2.6AR-CPA-ET/RC
(0.800" WIDE ANNULUS)

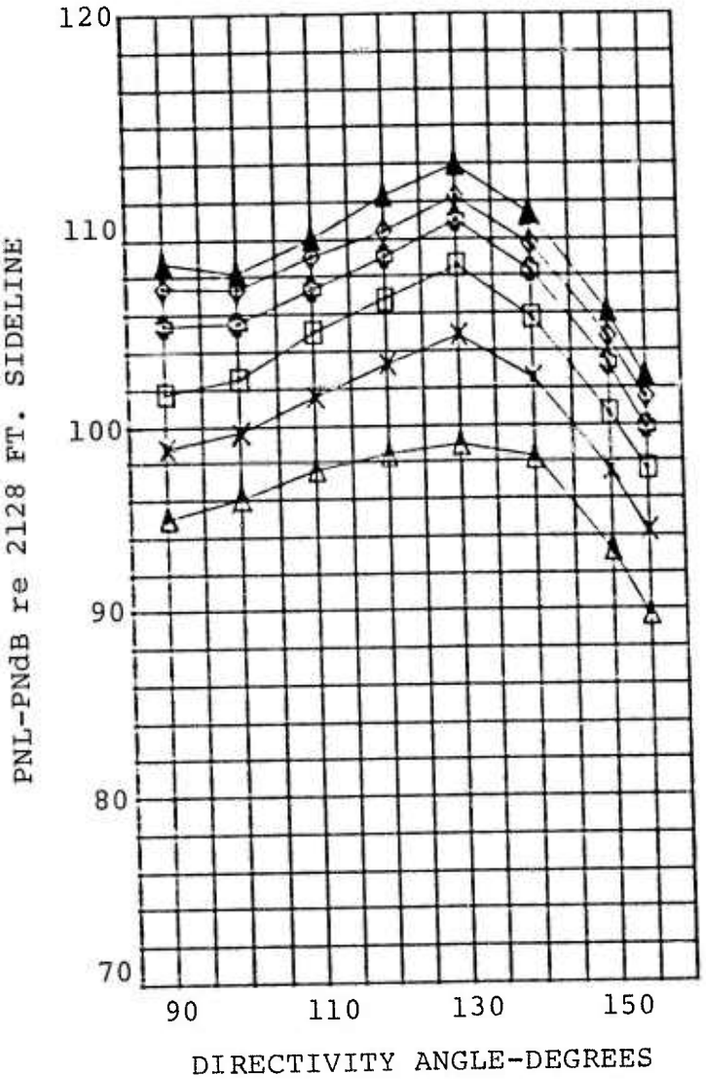
OASPL BEAM PATTERNS


42T/ANNULUS-2.6AR-CPA-ET/RC (0.800" WIDE ANNULUS)
1000' ALTITUDE
20° ENGINE ATTITUDE
4 ENGINES
FAR 36 STD DAY (77° F, 70% RH)
3 PNdB ABOVE FREE FIELD
SCALE FACTOR: 8
FULL SCALE: A_8 = 7.63 FT^2
SAE RC NOZZLE
A_8 = 12.6 FT.^{2}
AVERAGE RC NOZZLE
1500° F
1150° F
"NORMALIZED" 2128 FT. SIDELINE PNL
PNL_{MAX} — 10 Log $\rho^2 A$ ~ PNdB re 2128 FT. SIDELINE
145
140
135
130
125
120
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
V_j ~ FPS



PEAK PNL SUPPRESSION VALUES

NOZZLE: 42T/ANNULUS-2.6AR-CPA-ET/RC
(0.800" WIDE ANNULUS)



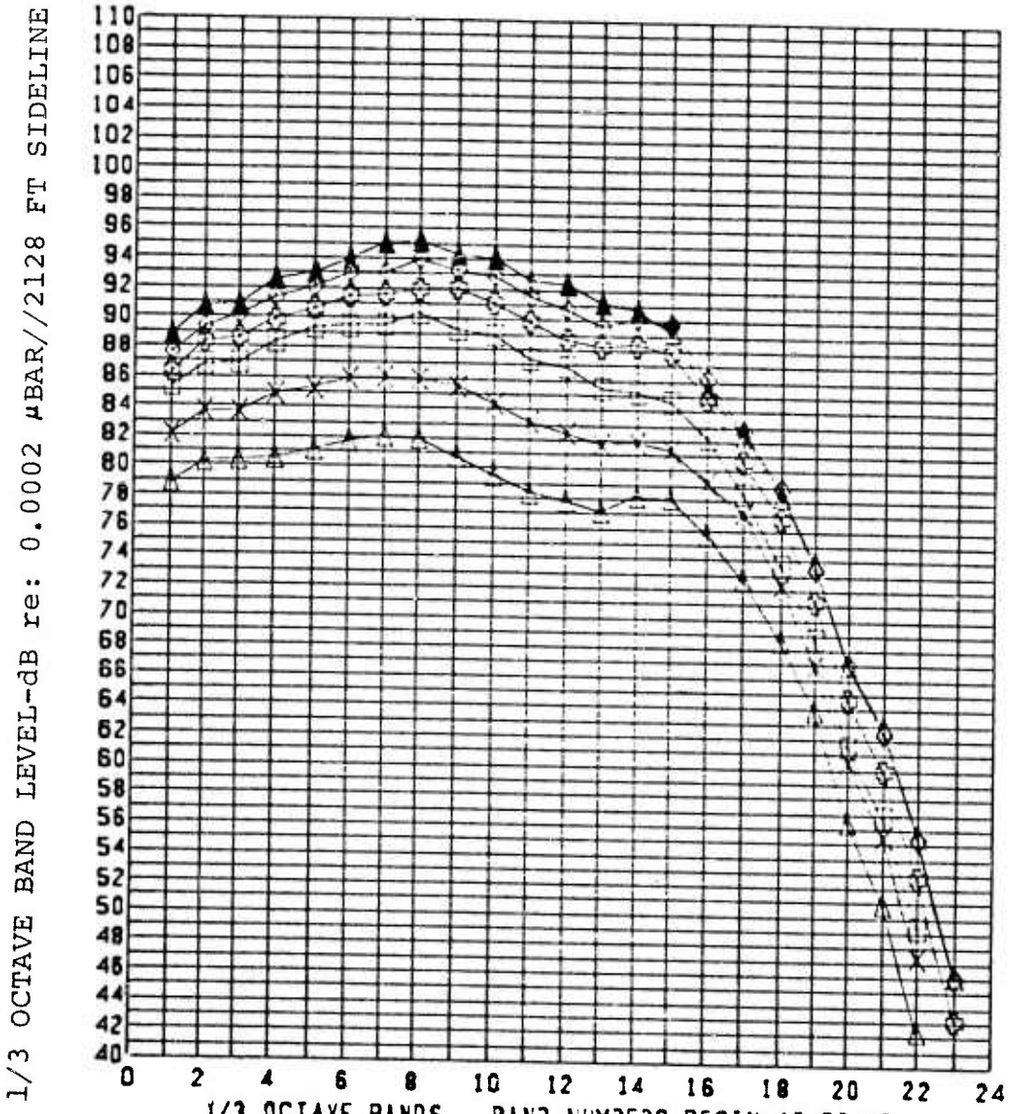
T_T = 1150°F A_8 = 7.63 FT^2 RUN: 175

PR = △2.0, ×2.5, □3.0, ✣3.4, ◇3.7, ▲4.0

PNL BEAM PATTERNS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 110 DEG TEMP = 77 DEG R.H. = 70 PER CENT



T_T = 1150°F A_8 = 7.63 FT^2 RUN: 175

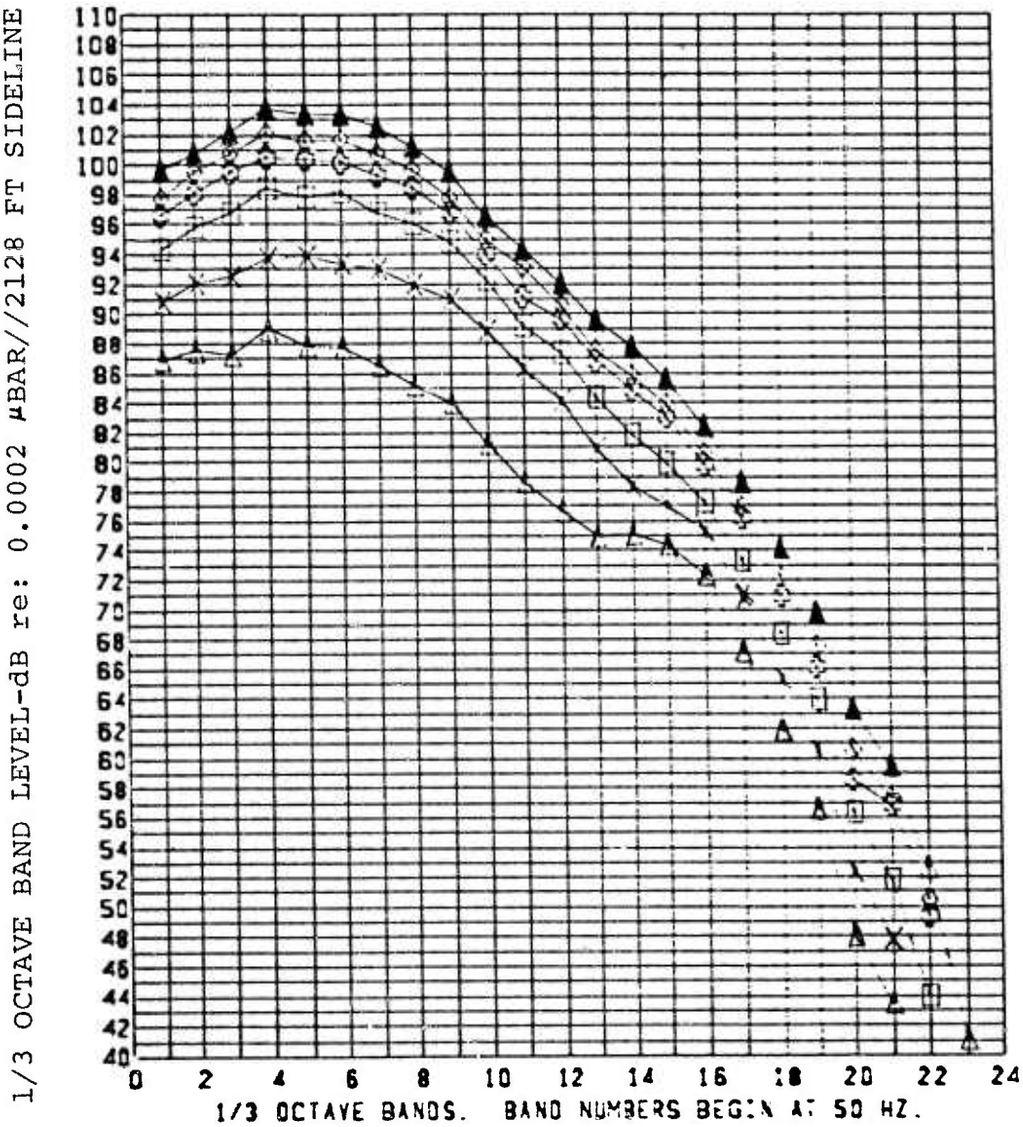
PR = △2.0, X2.5, □3.0, ✣3.4, ◇3.7, ▲4.0

NOZZLE: 42T/ANNULUS-2.6AR-CPA-ET/RC
(0.800" WIDE ANNULUS)

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 110°
re: NOZZLE INLET AXIS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 130 DEG TEMP = 77 DEG R.H. = 70 PER CENT



T_T = 1150°F A_8 = 7.63 FT^2 RUN: 175

PR = △ 2.0, X 2.5, □ 3.0, ✣ 3.4, ◇ 3.7, ▲ 4.0

NOZZLE: 42T/ANNULUS-2.6AR-CPA-ET/RC
(0.800' WIDE ANNULUS)

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 130°
re: NOZZLE INLET AXIS

TEST CONDITIONS

NOZZLE: 42T/Annulus-2.4AR-CPA-ET/RC

FACILITY:

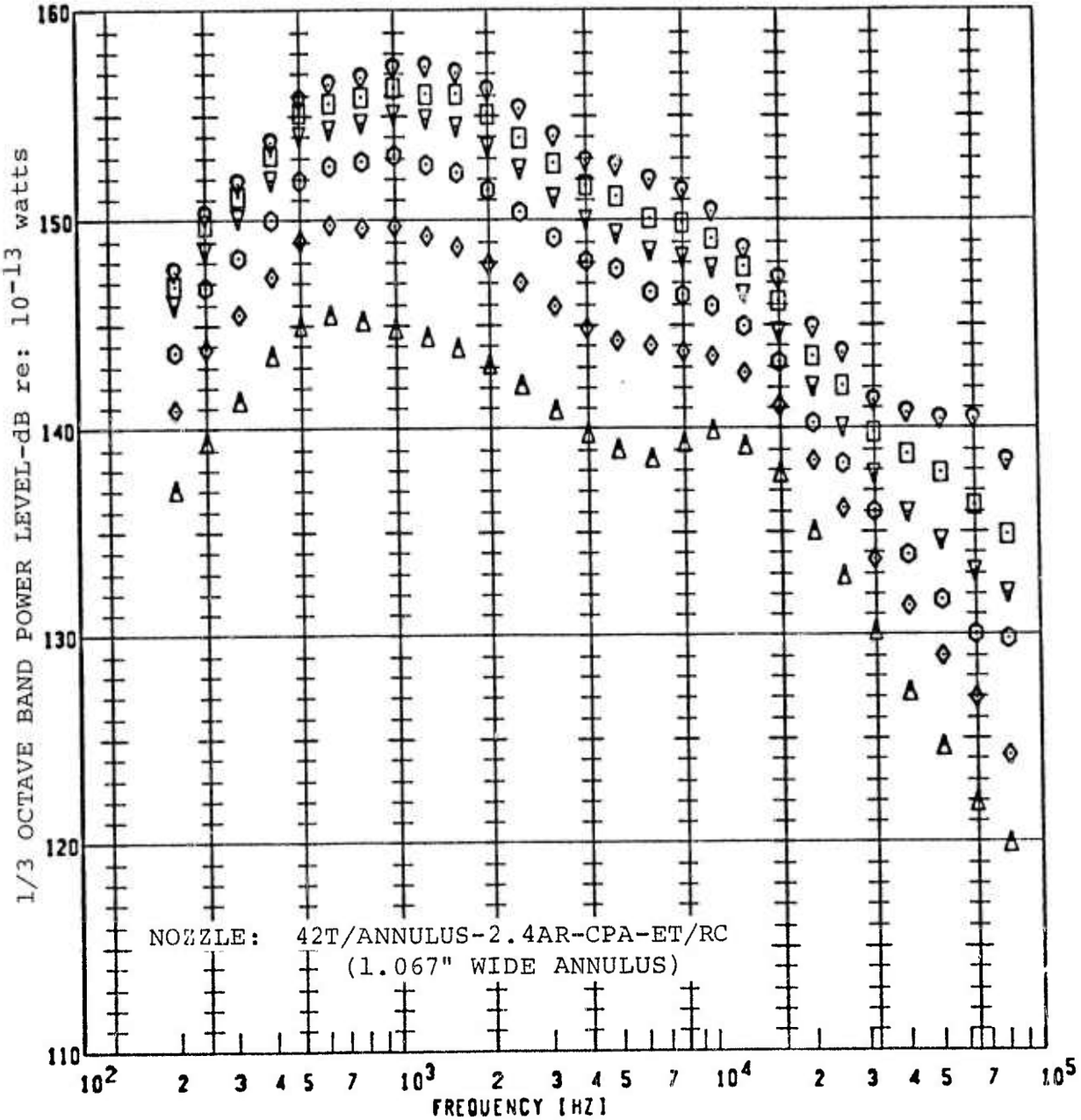
DATE: 10-15-73 T_{AMB} = 61°F **R.H.** = 82%

SCALE MODEL A_8 = 18.9 in.^{2}

RUN NO.	NPR	T_T	V_J (IDEAL)	REMARKS	REF
167	2.0	1150°F	1875 fps	Annulus width = 1.067"	
"	2.5	"	2126		
"	3.0	"	2303		
"	3.4	"	2413		
"	3.7	"	2483		
"	4.0	"	2544		

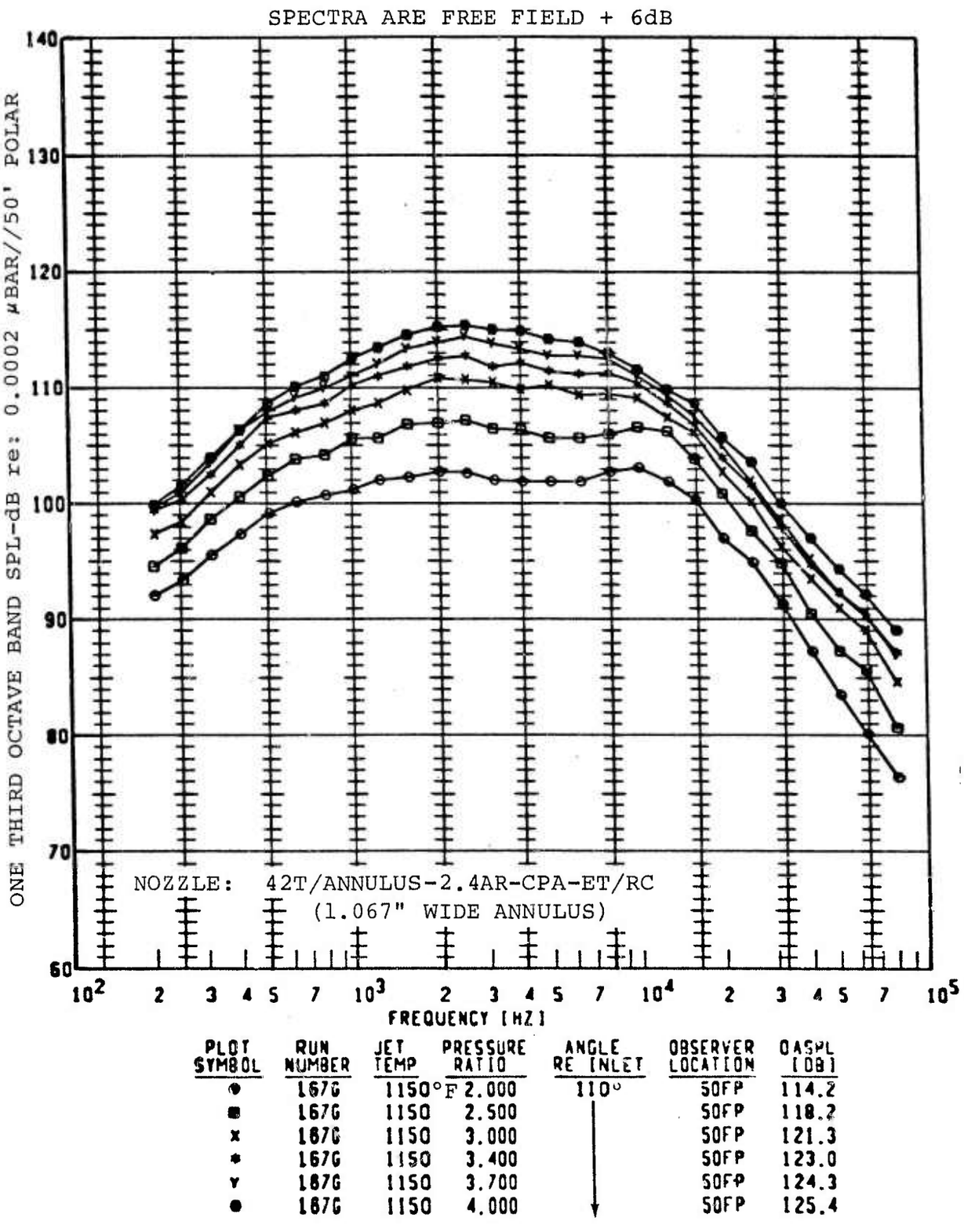
MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH CONCRETE GROUND SURFACE. MEASURED ACOUSTIC DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.

FREE FIELD VALUES



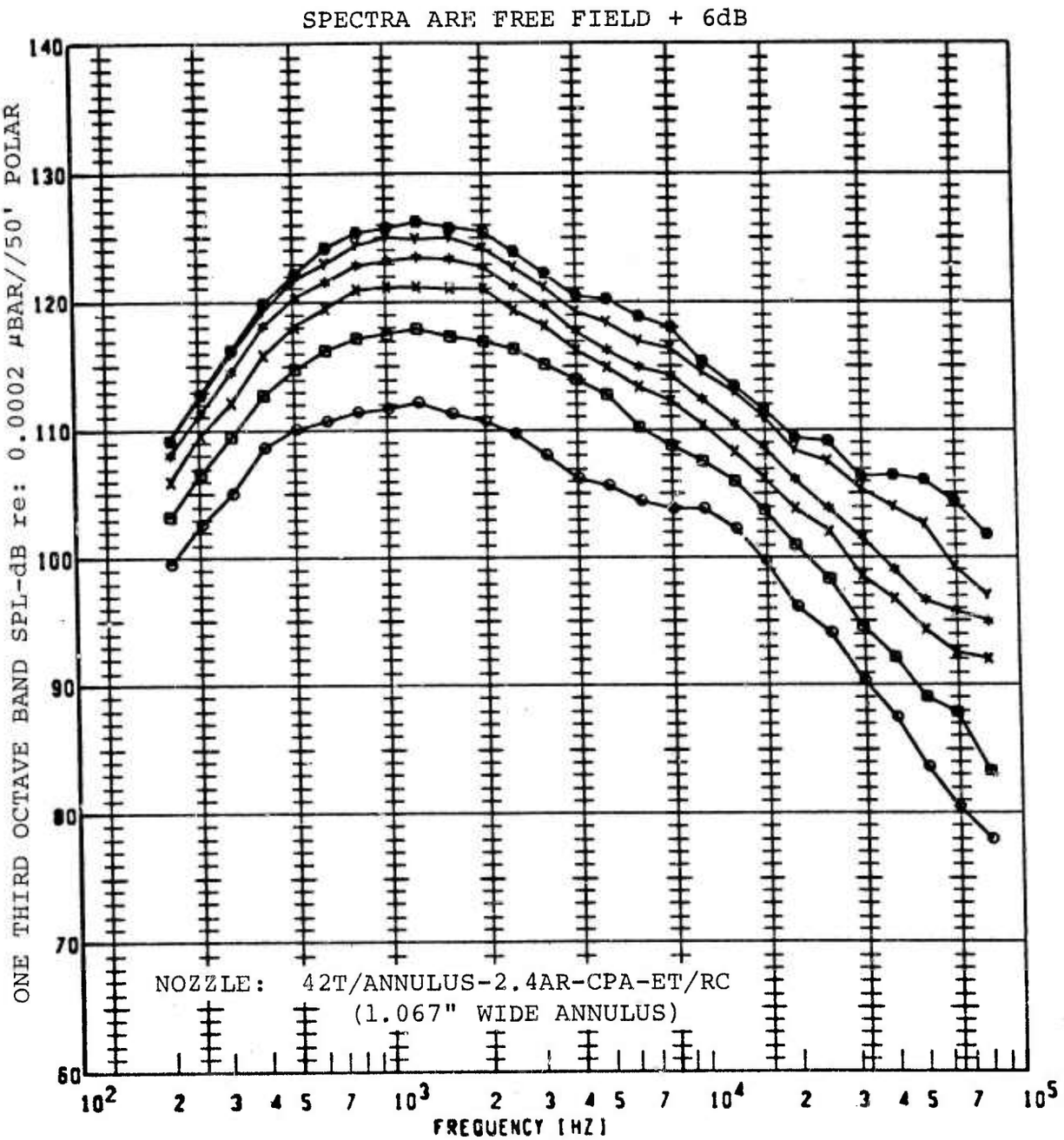
PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	167	2.00	1150°F
◇	167	2.50	1150
○	167	3.00	1150
▽	167	3.40	1150
□	167	3.70	1150
◇	167	4.00	1150

JET NOISE POWER SPECTRA



PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL [DB]
●	167G	1150°F	2.000	110°	50FP	114.2
■	167G	1150	2.500	↓	50FP	118.2
x	167G	1150	3.000	↓	50FP	121.3
*	167G	1150	3.400	↓	50FP	123.0
▼	167G	1150	3.700	↓	50FP	124.3
●	167G	1150	4.000	↓	50FP	125.4

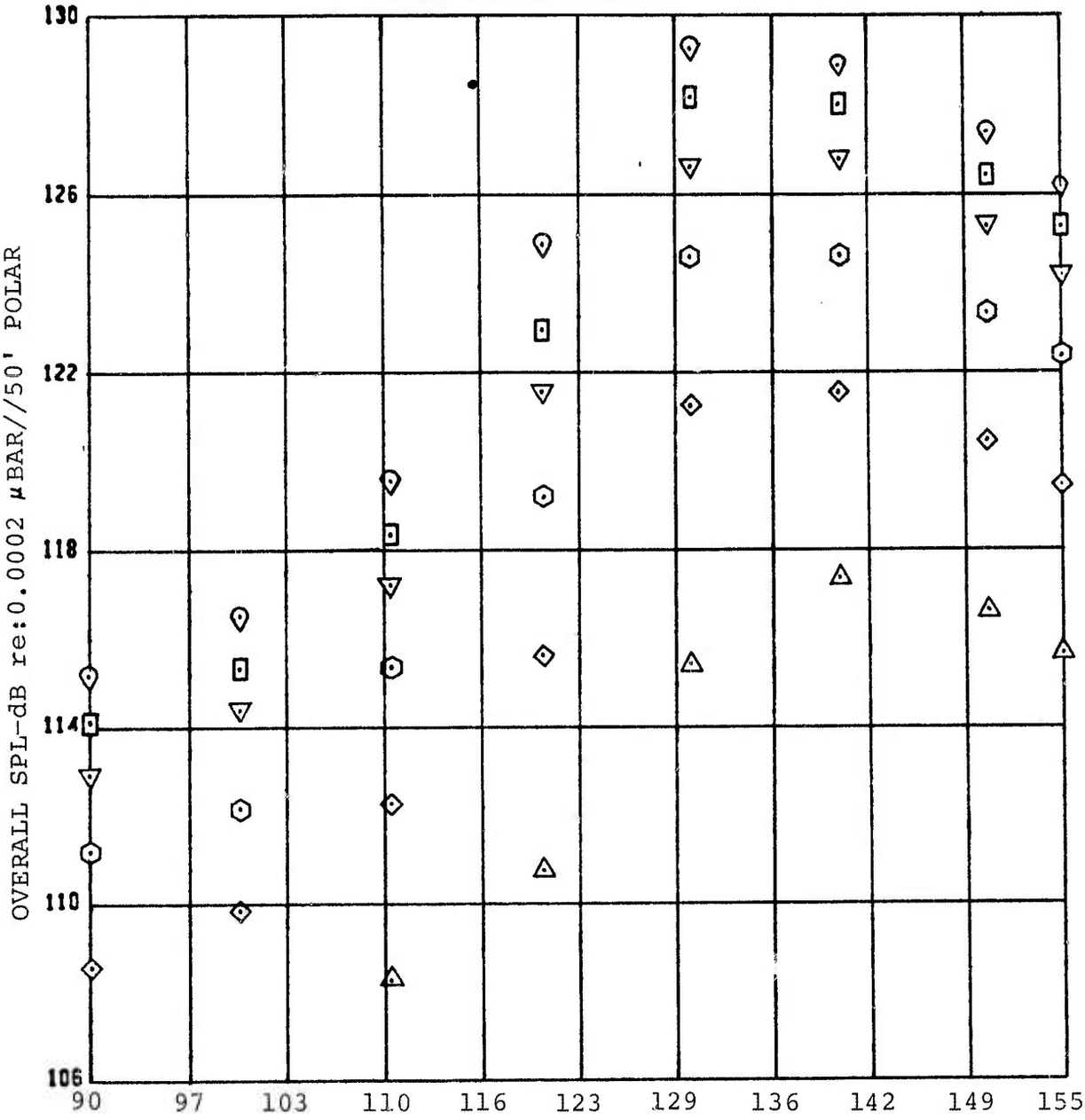
MEASURED NOISE SPECTRA AT 110° re: NOZZLE INLET AXIS



PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL [DB]
●	167G	1150°F	2.000	130°	50FP	121.5
■	167G	1150	2.500	|	50FP	127.3
x	167G	1150	3.000	|	50FP	130.6
*	167G	1150	3.400	|	50FP	132.6
Y	167G	1150	3.700	|	50FP	134.2
●	167G	1150	4.000	↓	50FP	135.2

MEASURED NOISE SPECTRA AT 130° re: NOZZLE INLET AXIS

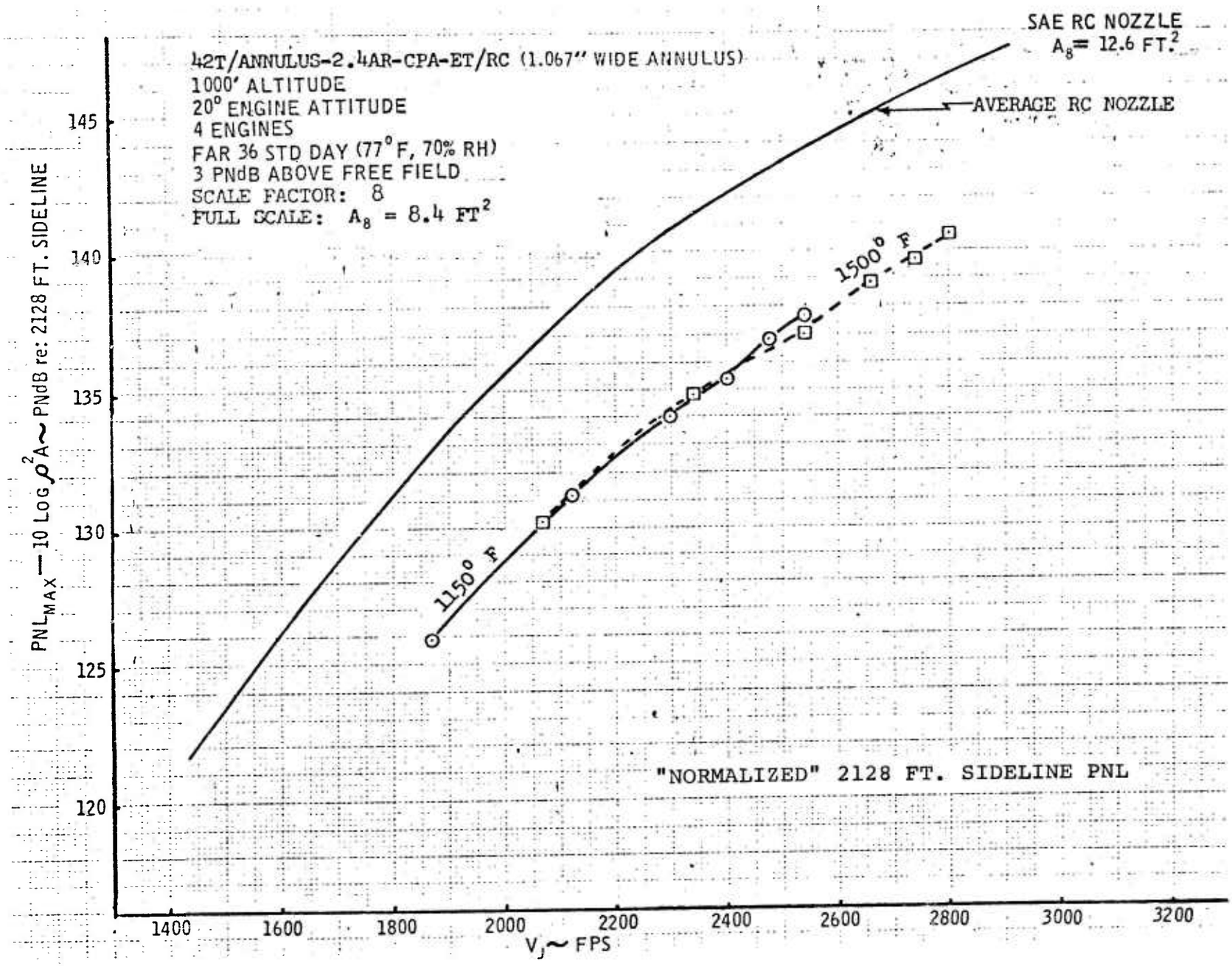
FREE FIELD VALUES

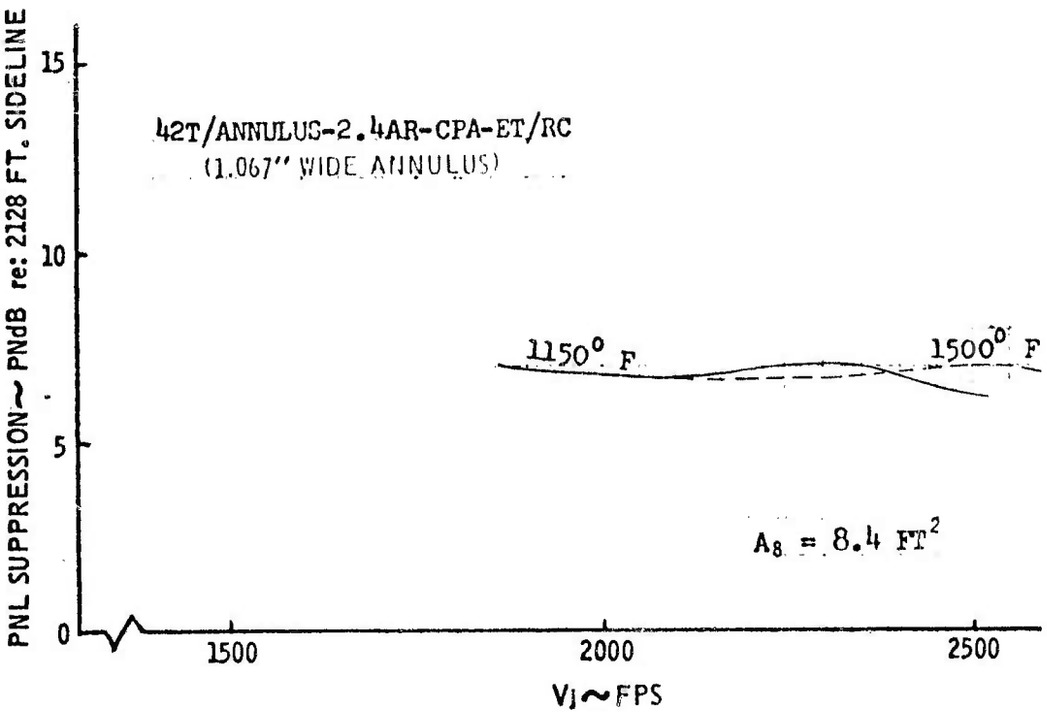


PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	167	2.00	1150°F
◇	167	2.50	1150
○	167	3.00	1150
▽	167	3.40	1150
□	167	3.70	1150
⬡	167	4.00	1150

NOZZLE: 42T/ANNULUS-2.4AR-CPA-ET/RC
(1.067" WIDE ANNULUS)

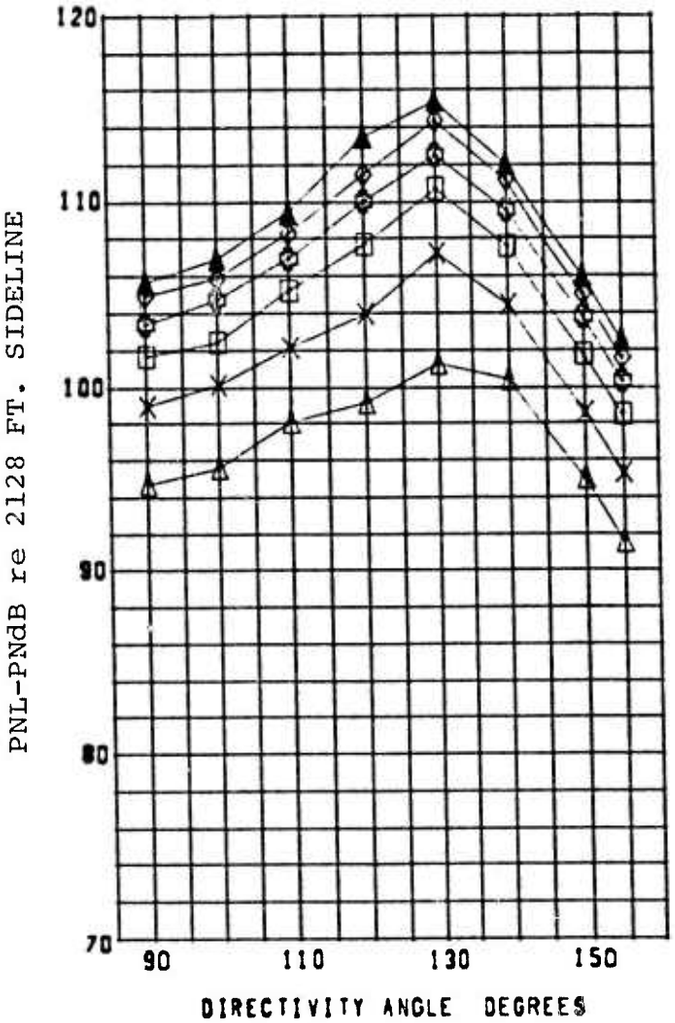
OASPL BEAM PATTERNS


42T/ANNULUS-2.4AR-CPA-ET/RC (1.067" WIDE ANNULUS)
1000' ALTITUDE
20° ENGINE ATTITUDE
4 ENGINES
FAR 36 STD DAY (77° F, 70% RH)
3 PNdB ABOVE FREE FIELD
SCALE FACTOR: 8
FULL SCALE: A_8 = 8.4 FT^2
SAE RC NOZZLE
A_8= 12.6 FT.^{2}
AVERAGE RC NOZZLE
1500° F
1150° F
"NORMALIZED" 2128 FT. SIDELINE PNL
PNL_{MAX} — 10 Log $\rho^2 A$ ~ PNdB re: 2128 FT. SIDELINE
V_j ~ FPS
145
140
135
130
125
120
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200



PEAK PNL SUPPRESSION VALUES

NOZZLE: 42T/ANNULUS-2.4AR-CPA-ET/RC
(1.067" WIDE ANNULUS)



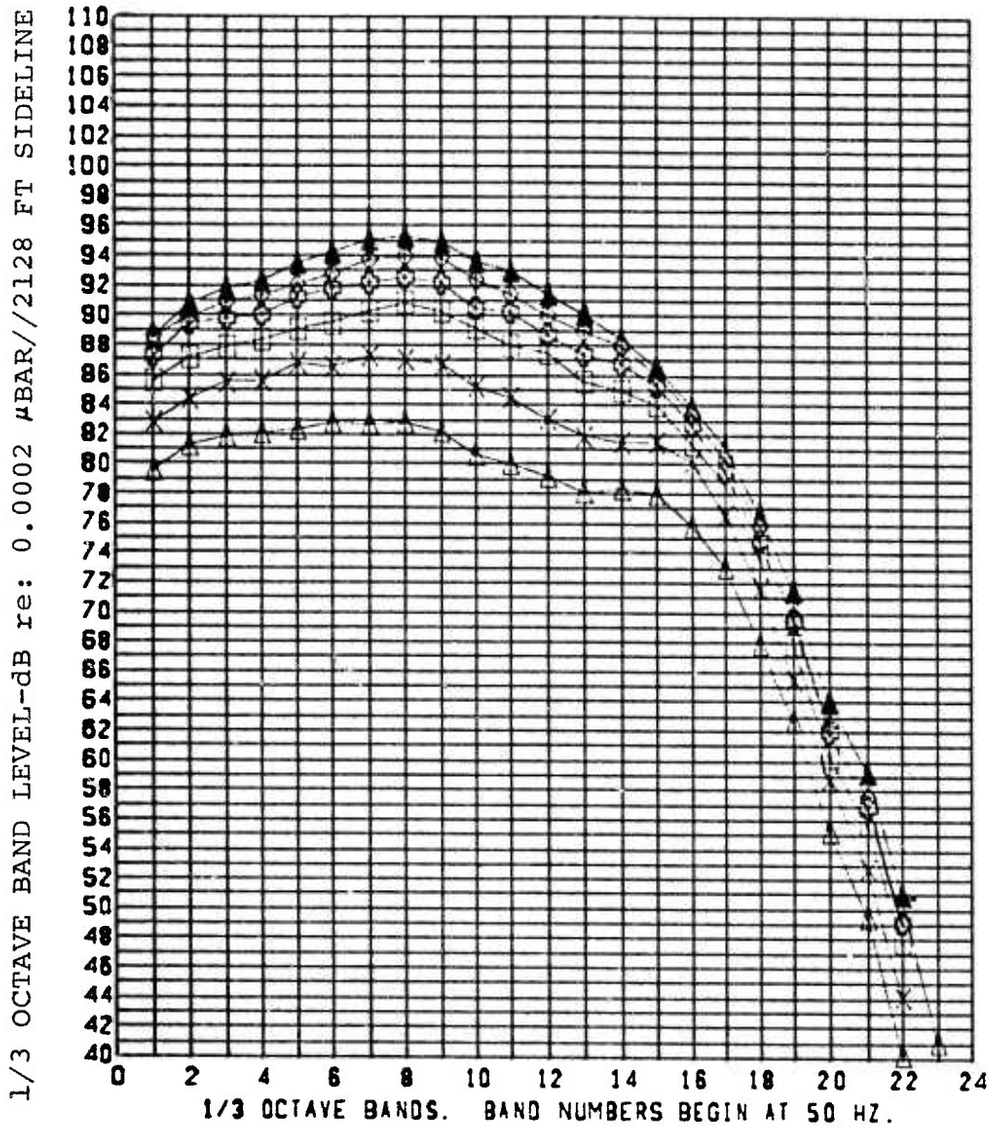
T_T = 1150°F A_8 = 8.4 FT^2 RUN: 167

PR = △2.0, ×2.5, □3.0, ✣3.4, ◇3.7, ▲4.0

PNL BEAM PATTERNS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 110 DEG TEMP = 77 DEG R.H. = 70 PER CENT



T_T = 1150°F A_8 = 8.4 FT^2 RUN: 167

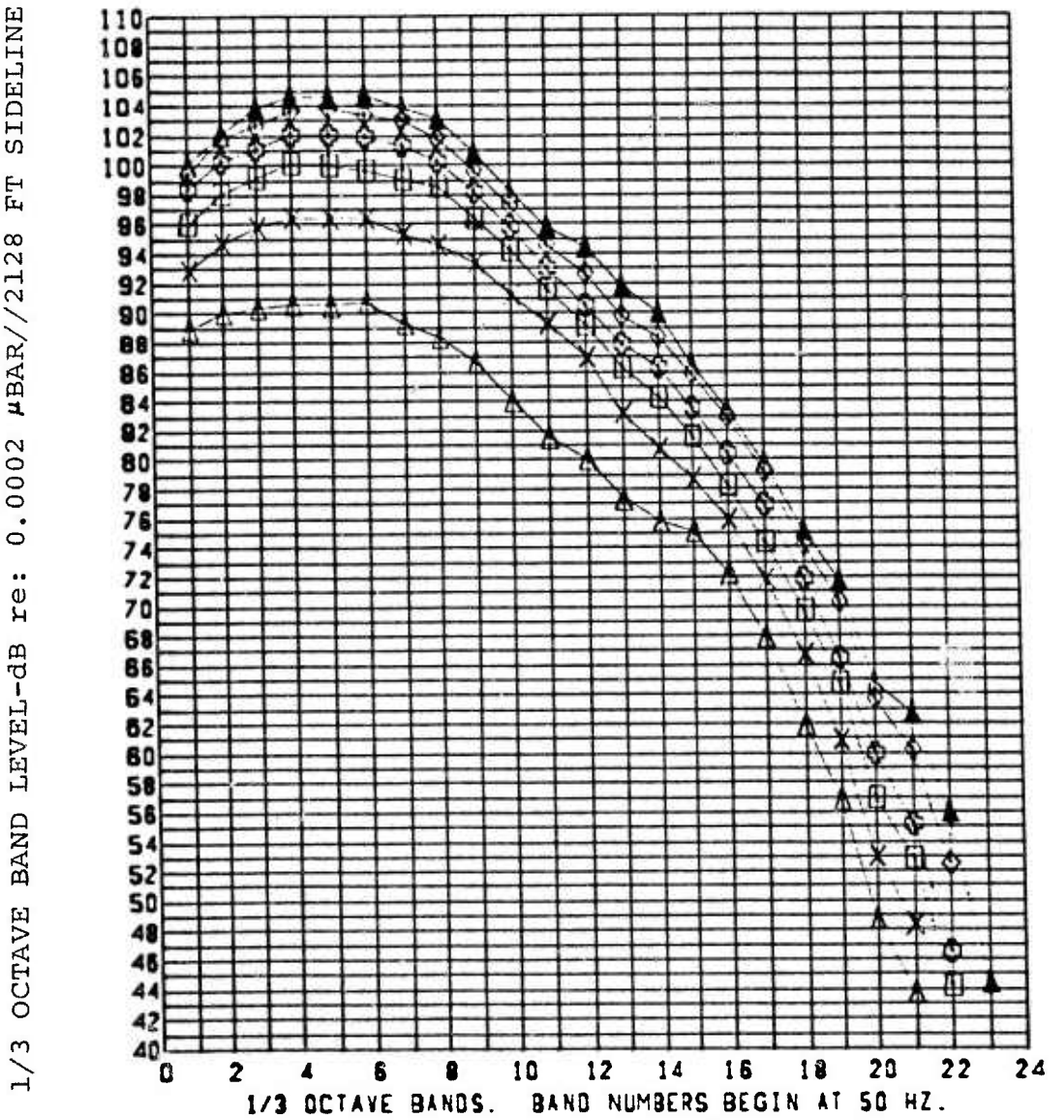
PR = △2.0, X 2.5, □ 3.0, ✣3.4, ◇ 3.7, ▲4.0

NOZZLE: 42T/ANNULUS-2.4AR-CPA-ET/RC
(1.067" WIDE ANNULUS

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 110°
re: NOZZLE INLET AXIS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 130 TEMP = 77 DEG R.H. = 70 PER CENT



T_T = 1150°F A_8 = 8.4 FT^2 RUN: 167

PR = △ 2.0, X 2.5, □ 3.0, ✣ 3.4, ◇ 3.7, ▲ 4.0

NOZZLE: 42T/ANNULUS-2.4AR-CPA-ET/RC
(1.067" WIDE ANNULUS)

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 130°
re: NOZZLE INLET AXIS

TEST CONDITIONS

NOZZLE: 42T/Annulus-2.1AR-CPA-ET/RC

FACILITY: HNTF

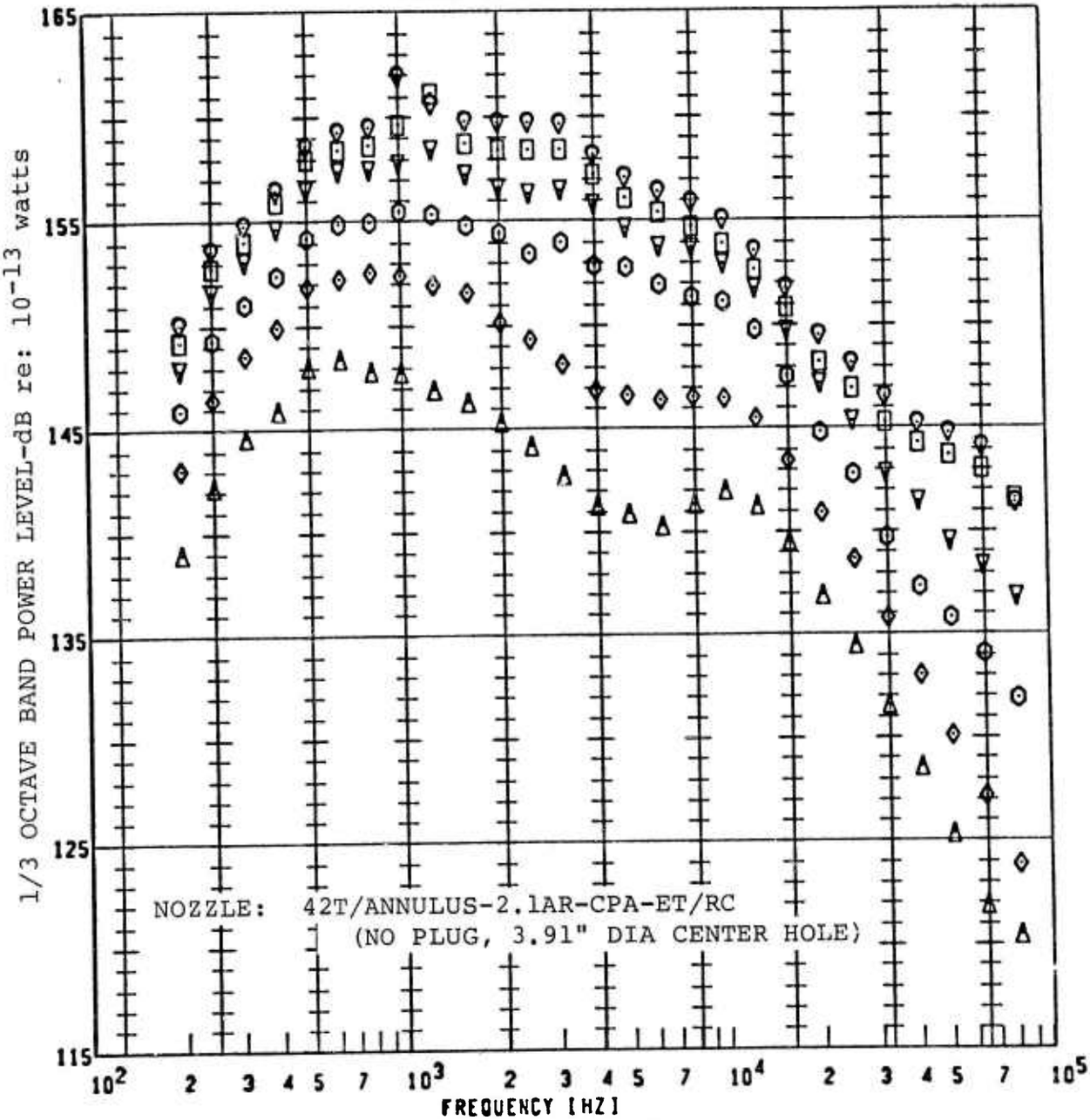
DATE: 10-16-73 T_{AMB} = 58°F **R.H.** = 83%

SCALE MODEL A_8 = 21.3 in.^{2}

RUN NO.	NPR	T_T	V_J (IDEAL)	REMARKS	REF
171	2.0	1150°F	1875 fps	No Plug,	
"	2.5	"	2126	3.91" Dia. center hole	
"	3.0	"	2303		
"	3.4	"	2413		
"	3.7	"	2483		
"	4.0	"	2544		

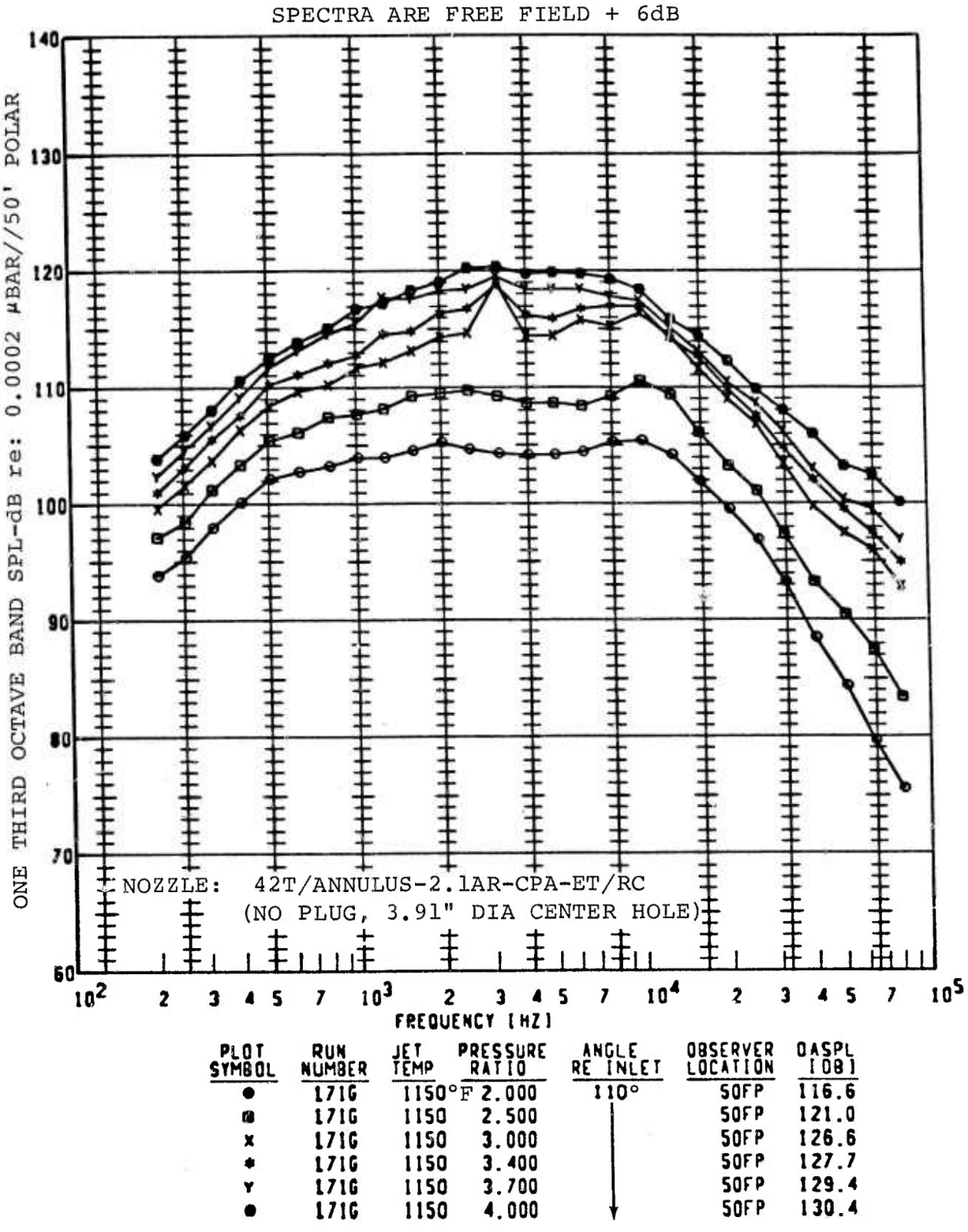
MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH CONCRETE GROUND SURFACE. MEASURED ACOUSTIC DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.

FREE FIELD VALUES



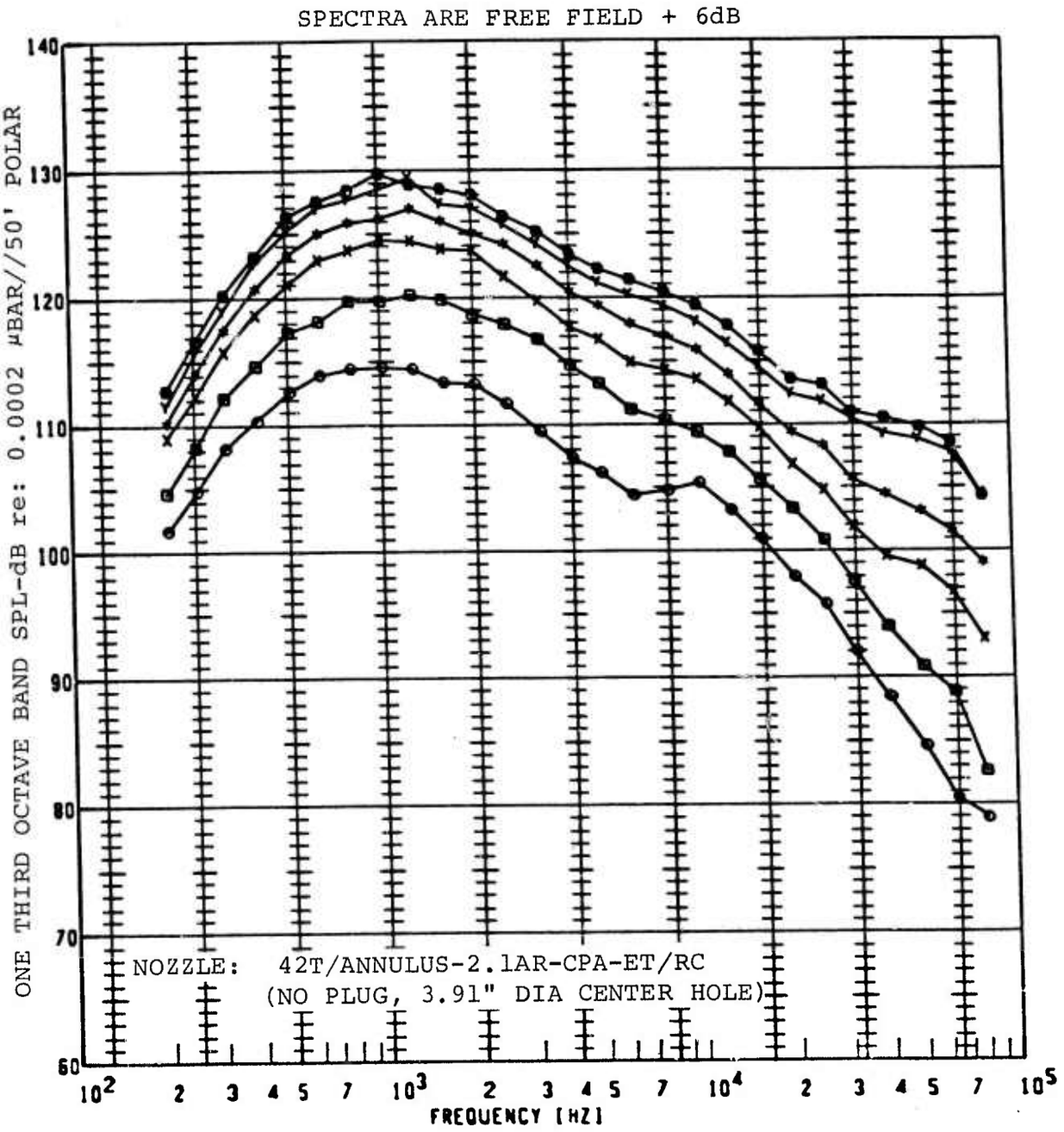
PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	171	2.00	1150°F
◇	171	2.50	1150
○	171	3.00	1150
▽	171	3.40	1150
□	171	3.70	1150
◇	171	4.00	1150

JET NOISE POWER SPECTRA



PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL [DB]
●	171G	1150°F	2.000	110°	50FP	116.6
▣	171G	1150	2.500		50FP	121.0
x	171G	1150	3.000		50FP	126.6
*	171G	1150	3.400		50FP	127.7
Y	171G	1150	3.700		50FP	129.4
●	171G	1150	4.000		50FP	130.4

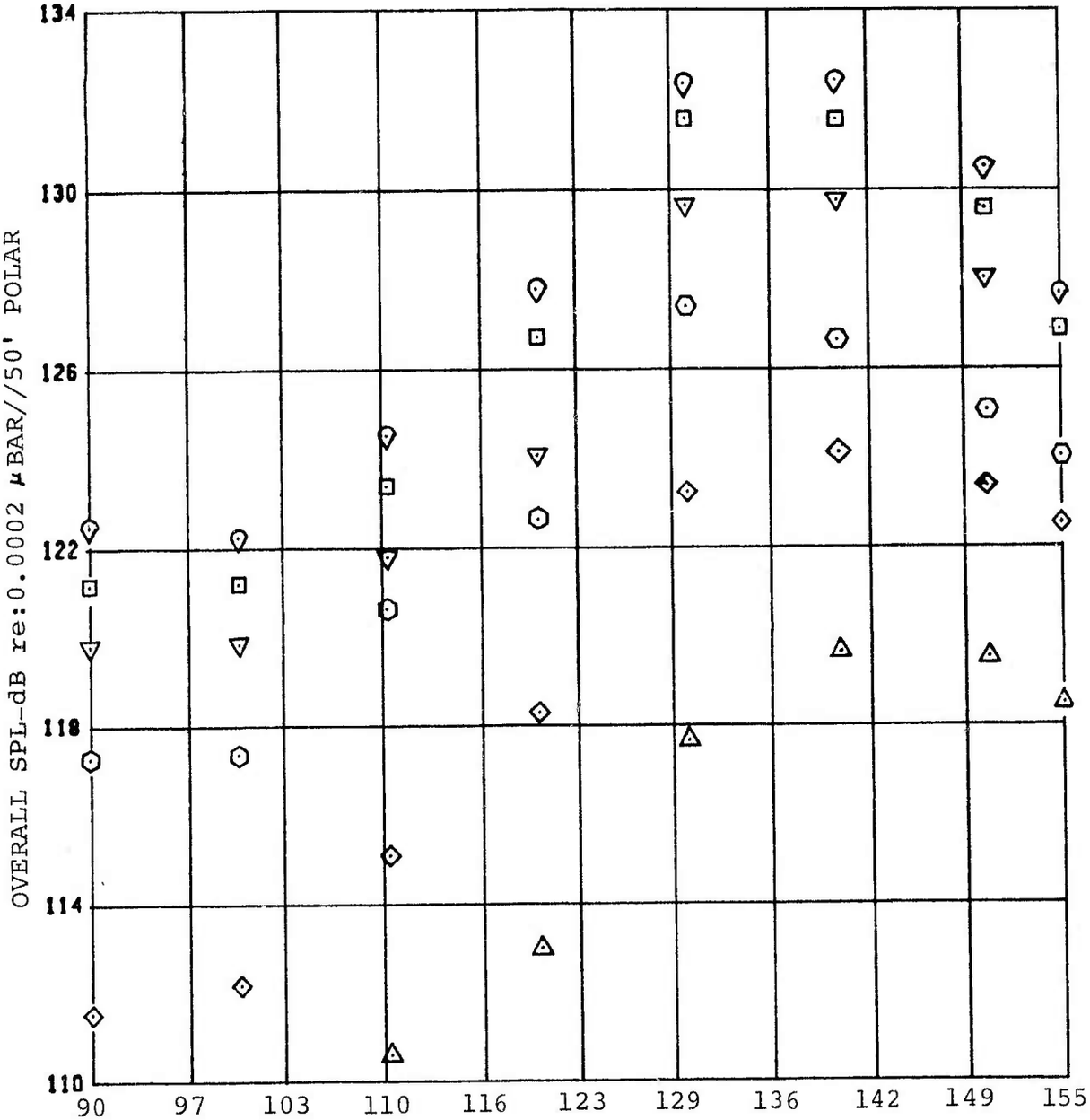
MEASURED NOISE SPECTRA AT 110° re: NOZZLE INLET AXIS



PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL [DB]
●	171G	1150°F	2.000	130°	50FP	123.8
■	171G	1150	2.500	↓	50FP	129.3
x	171G	1150	3.000	↓	50FP	133.4
*	171G	1150	3.400	↓	50FP	135.6
▼	171G	1150	3.700	↓	50FP	137.6
●	171G	1150	4.000	↓	50FP	138.3

MEASURED NOISE SPECTRA AT 130° re: NOZZLE INLET AXIS

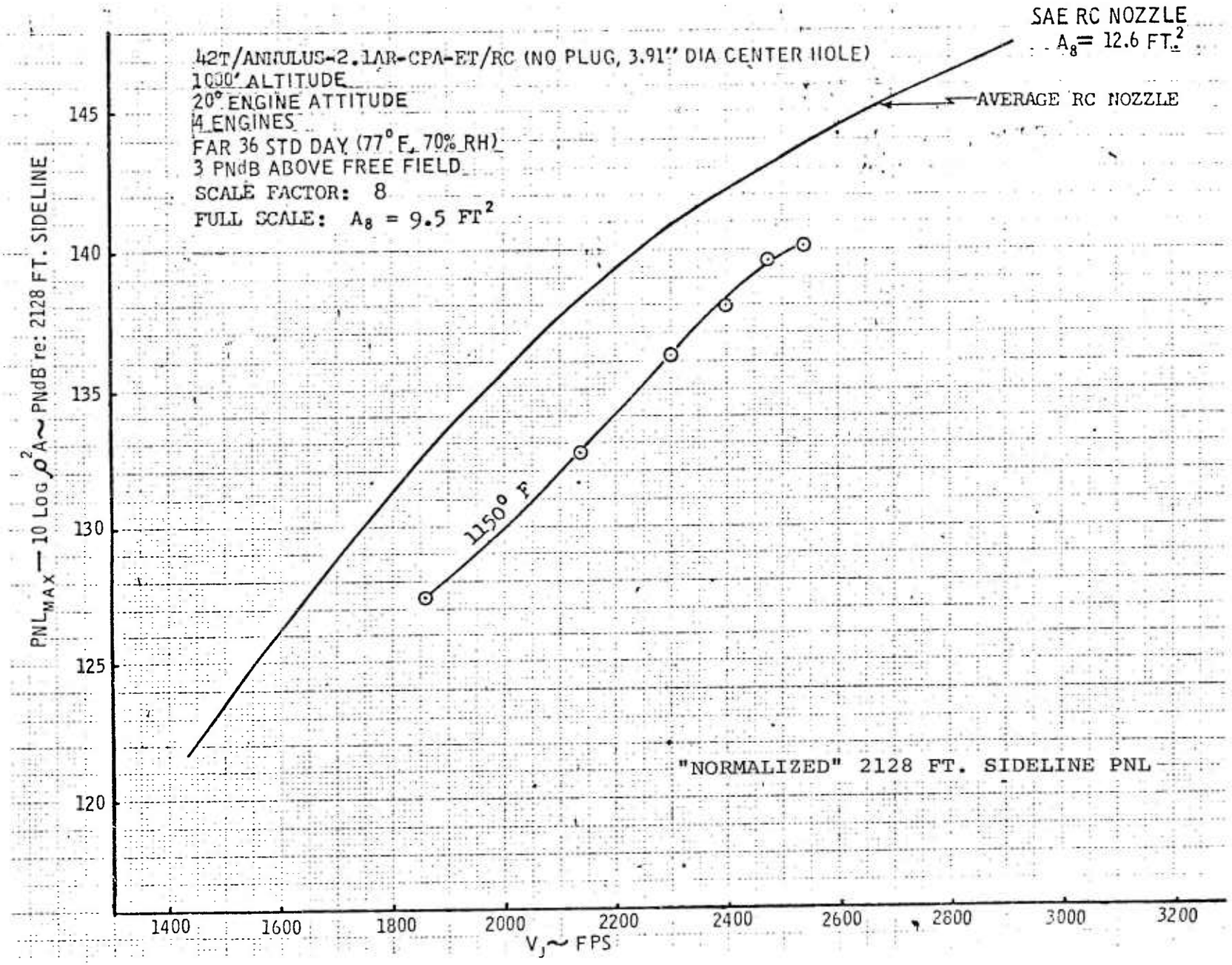
FREE FIELD VALUES

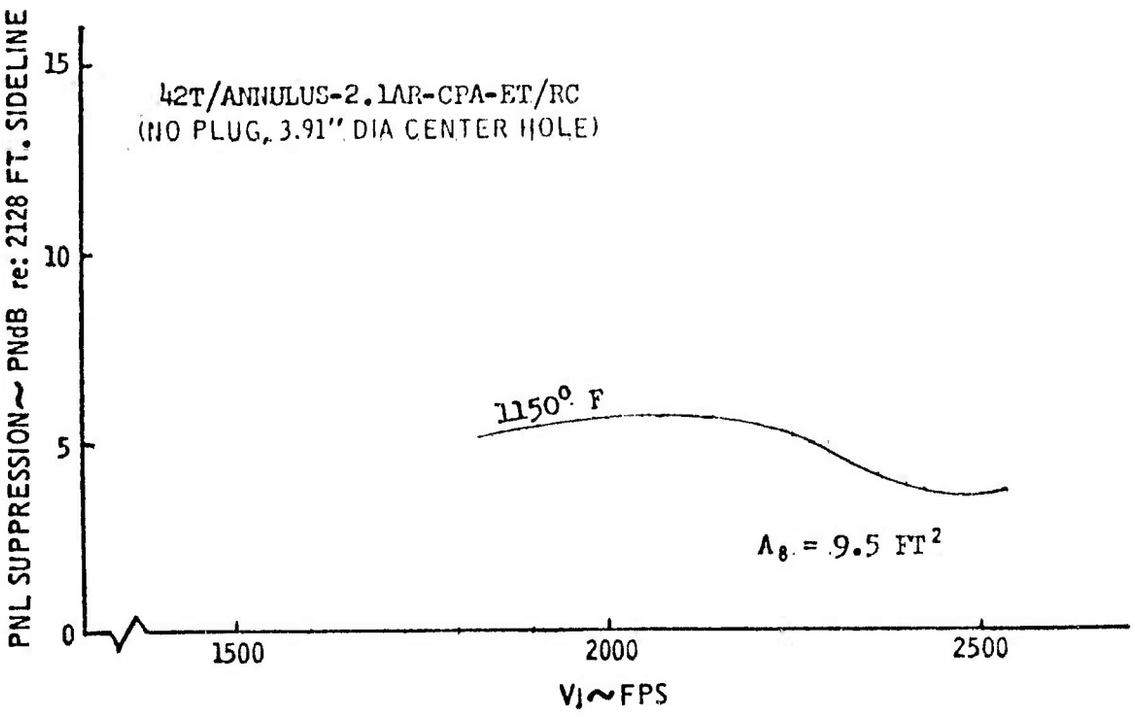


PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	171	2.00	1150°F
◇	171	2.50	1150
○	171	3.00	1150
▽	171	3.40	1150
□	171	3.70	1150
◇	171	4.00	1150

NOZZLE: 42T/ANNULUS-2.1AR-CPA-ET/RC
(NO PLUG, 3.91" DIA CENTER HOLE)

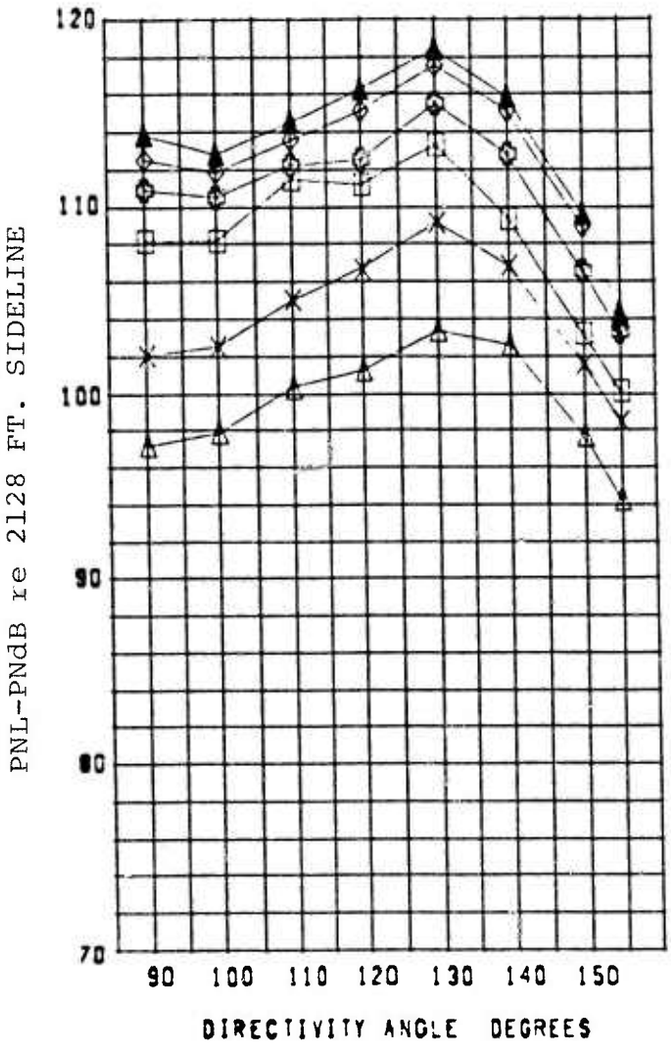
OASPL BEAM PATTERNS


42T/ANNULUS-2.1AR-CPA-ET/RC (NO PLUG, 3.91" DIA CENTER HOLE)
1000' ALTITUDE
20° ENGINE ATTITUDE
4 ENGINES
FAR 36 STD DAY (77° F, 70% RH)
3 PNdB ABOVE FREE FIELD
SCALE FACTOR: 8
FULL SCALE: A_8 = 9.5 FT^2
SAE RC NOZZLE
A_8 = 12.6 FT.^{2}
AVERAGE RC NOZZLE
1150° F
"NORMALIZED" 2128 FT. SIDELINE PNL
PNL_{MAX} — 10 Log $\rho^2 A$ ~ PNdB re: 2128 FT. SIDELINE
145
140
135
130
125
120
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
V_j ~ FPS



PEAK PNL SUPPRESSION VALUES

NOZZLE: 42T/ANNULUS-2.1AR-CPA-ET/RC
(NO PLUG, 3.910" CENTER HOLE)



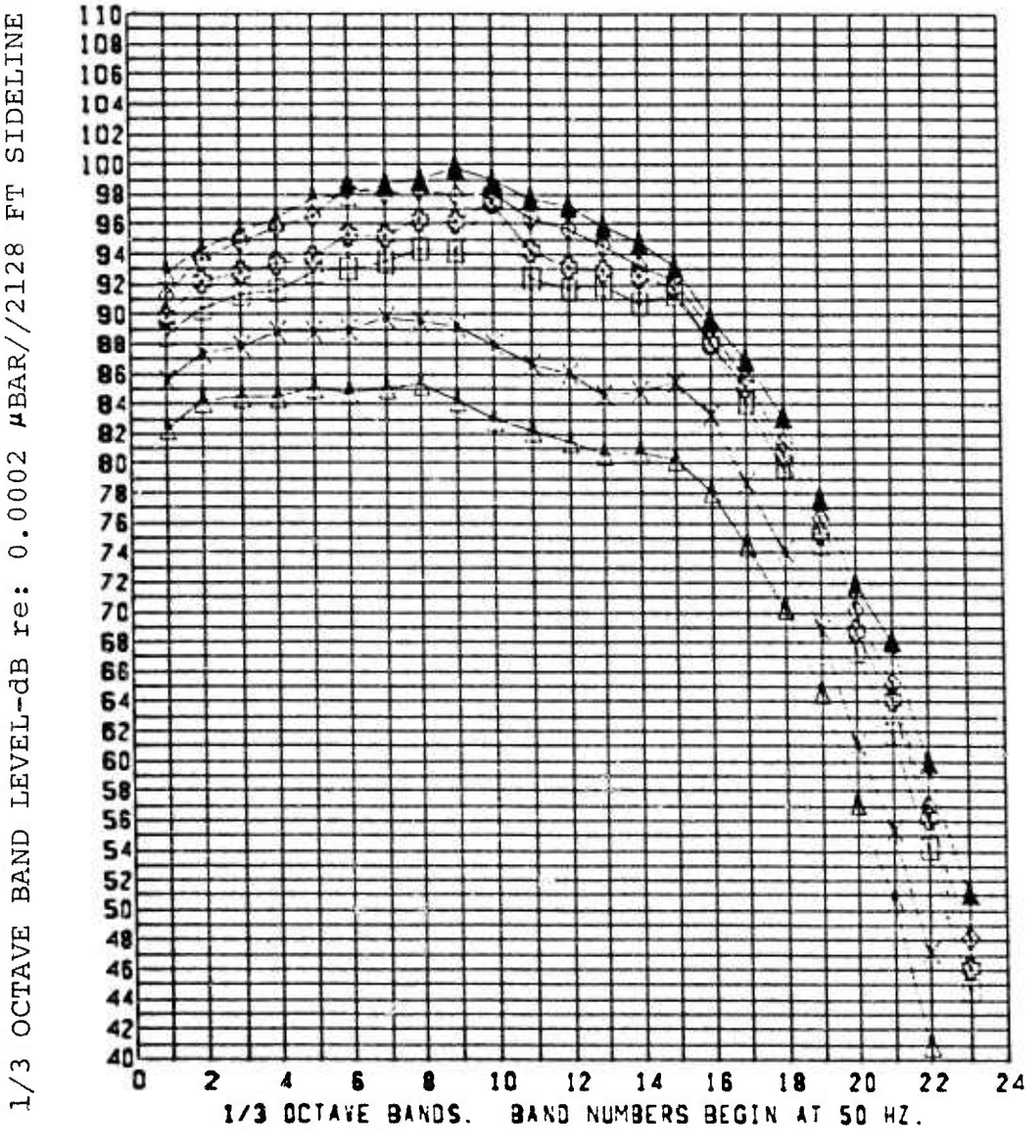
T_T = 1150°F A_8 = 9.5 FT^2 RUN: 171

PR = △ 2.0, × 2.5, □ 3.0, ✣ 3.4, ◇ 3.7, ▲ 4.0

PNL BEAM PATTERNS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 110 DEG TEMP = 77 DEG R.H. = 70 PER CENT



T_T = 1150°F A_8 = 9.5 FT^2 RUN: 171

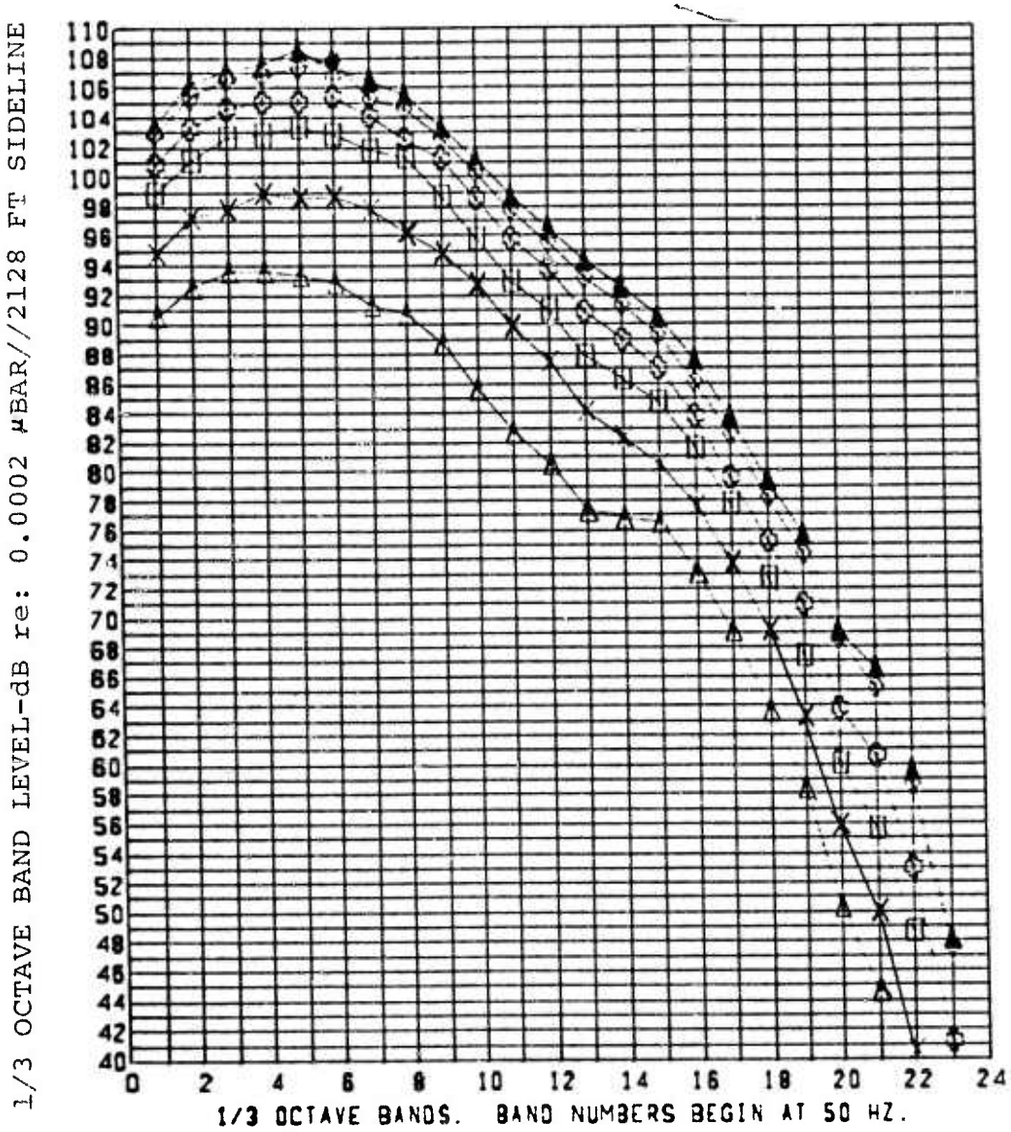
PR = △ 2.0, X 2.5, □ 3.0, ✣ 3.4, ◇ 3.7, ▲ 4.0

NOZZLE: 42T/ANNULUS-2.1AR-CPA-ET/RC
(NO PLUG, 3.91" DIA CENTER HOLE)

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 110°
re: NOZZLE INLET AXIS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 130 DEG TEMP = 77 DEG R.H. = 70 PER CENT



T_T = 1150°F A_8 = 9.5 FT^2 RUN: 171

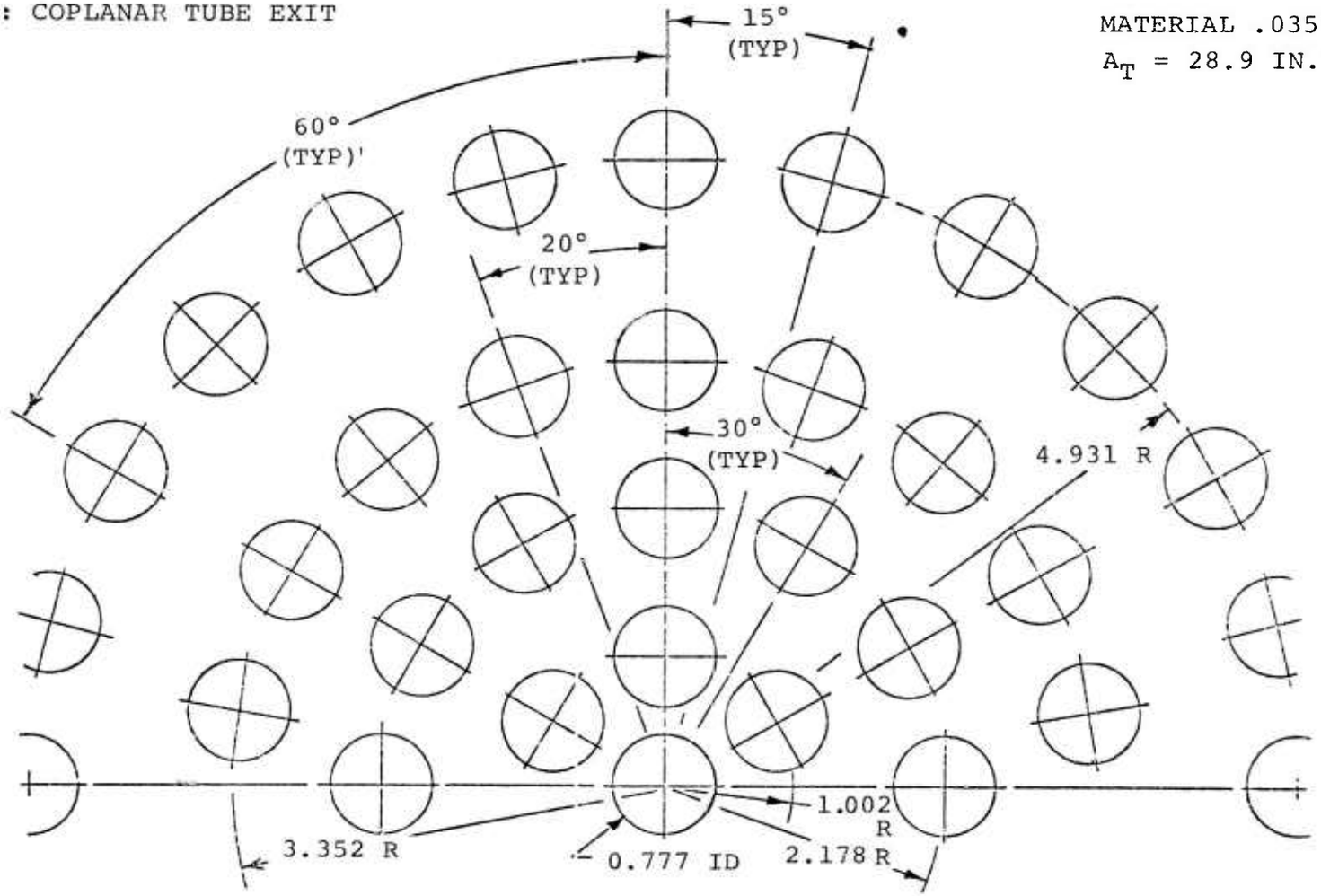
PR = △ 2.0, X 2.5, □ 3.0, ✣ 3.4, ◇ 3.7, ▲ 4.0

NOZZLE: 42T/ANNULUS-2.1AR-CPA-ET/RC
(NO PLUG, 3.91" DIA CENTER HOLE)

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 130°
re: NOZZLE INLET AXIS

NOTE: COPLANAR TUBE EXIT

MATERIAL .035"
A_T = 28.9 IN.^{2}



61 TUBE AR 3.07 NOZZLE EXIT FLOW PATTERN

TEST CONDITIONS

NOZZLE: 61T-3.1AR-CPA-RT/NC

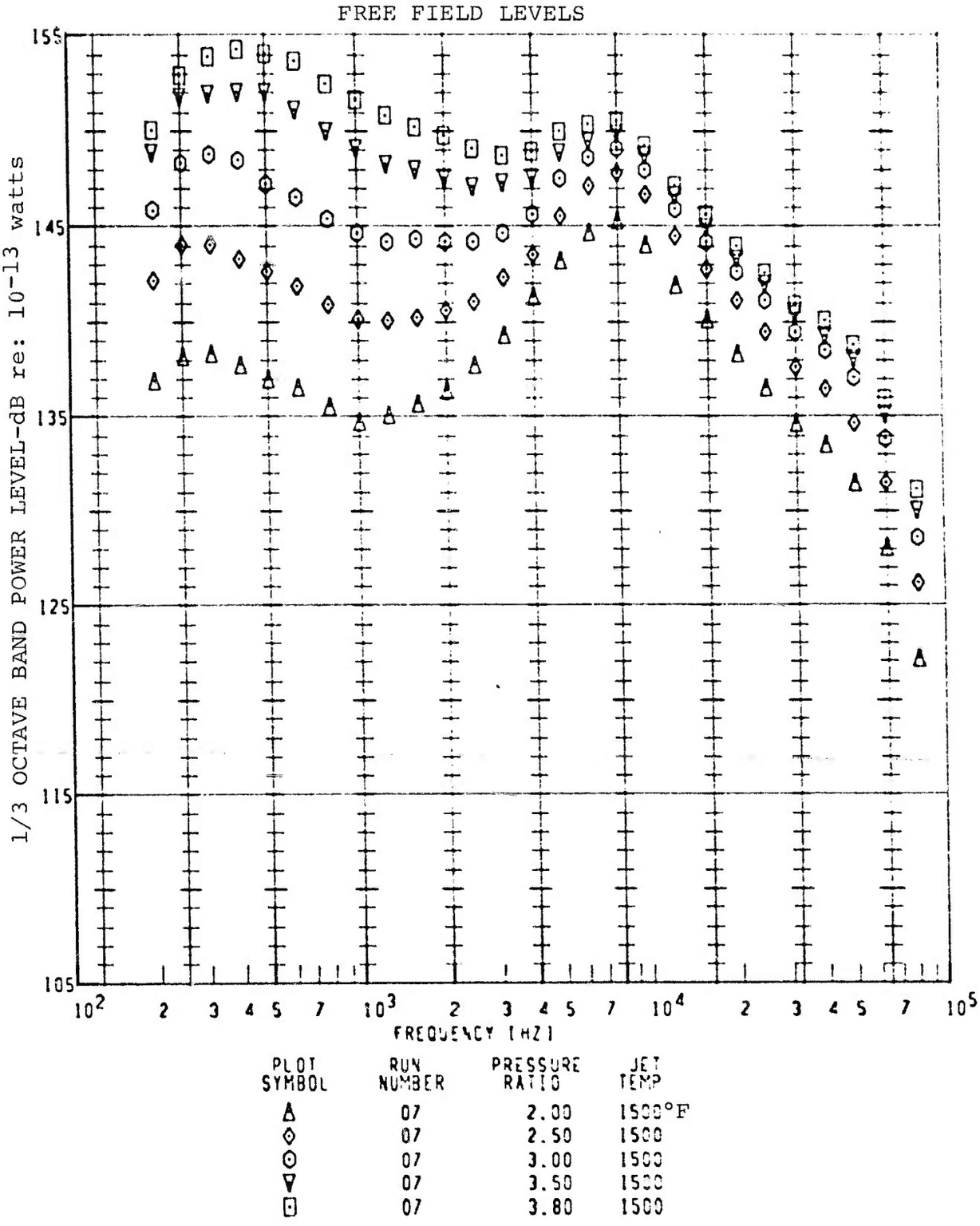
FACILITY: HNTF

DATE: 11-26-73 T_{AMB} = 41°F **R.H.** = 91%

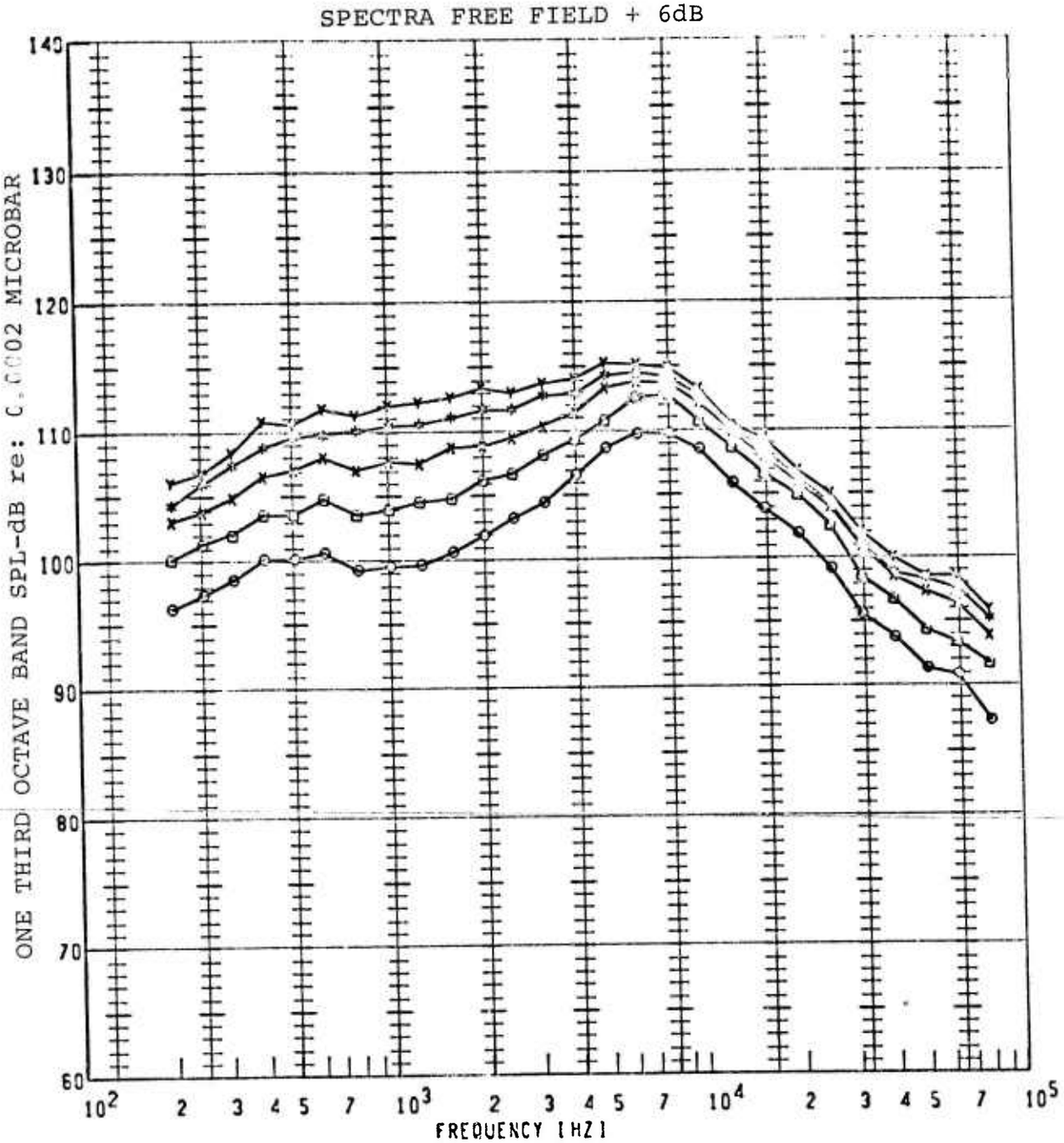
SCALE MODEL A_8 = 28.9 in.^{2}

RUN NO.	NPR	T_T	V_J (IDEAL)	REMARKS	REF
07	2.0	1500°F	2072 fps	11-26-73	
"	2.5	"	2351	"	
"	3.0	"	2548	"	
"	3.5	"	2697	"	
"	3.8	"	2771	"	

MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH CONCRETE GROUND SURFACE. MEASURED ACOUSTIC DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.



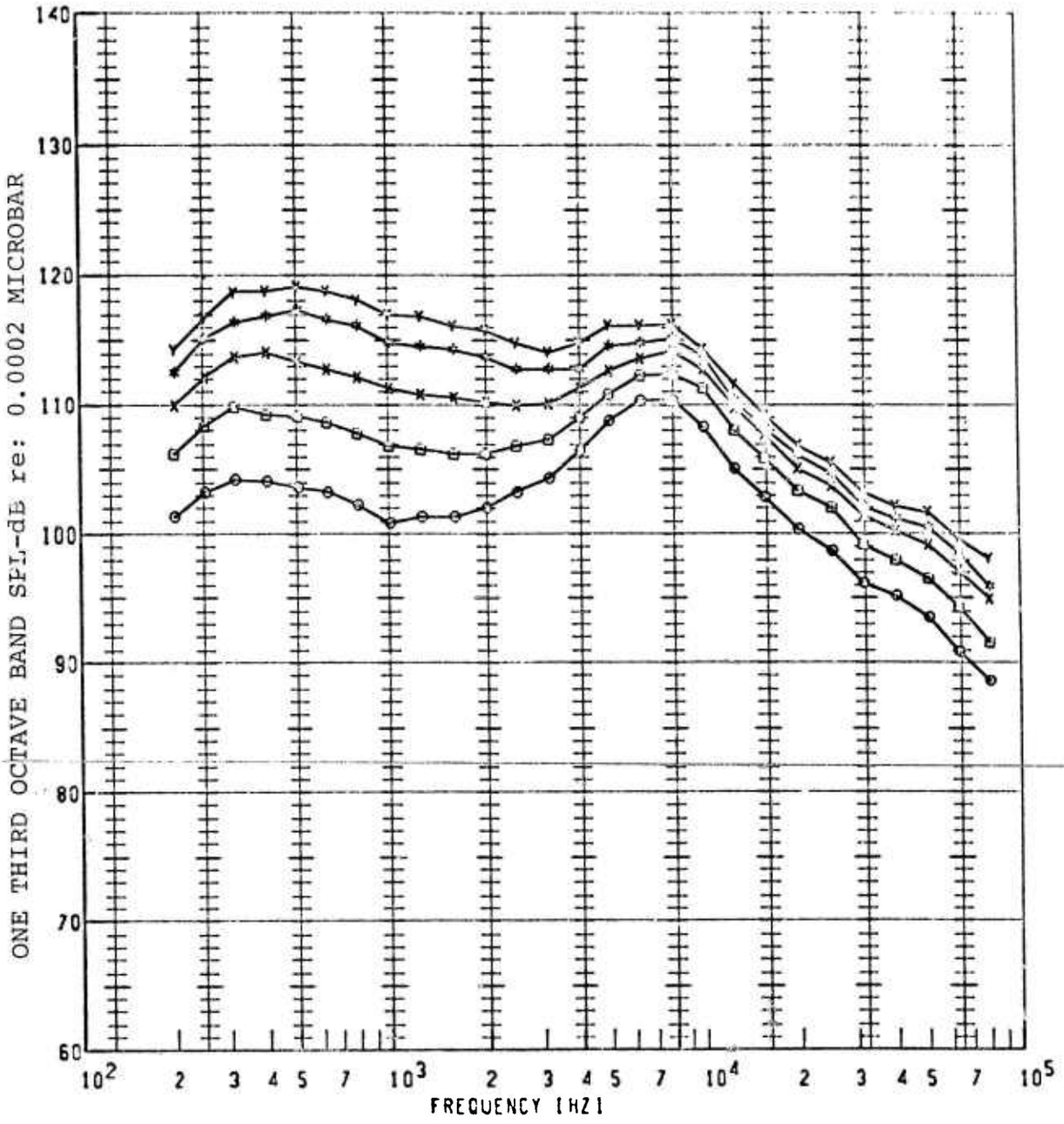
61T-3.1AR-CPA-RT/NC NOZZLE



PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL (DB)
⊙	076	1500°F	2.000	110	50FP	118.0
⊡	076	1500	2.500	110	50FP	121.0
x	076	1500	3.000	110	50FP	123.0
*	076	1500	3.500	110	50FP	124.5
Y	076	1500	3.800	110	50FP	125.6

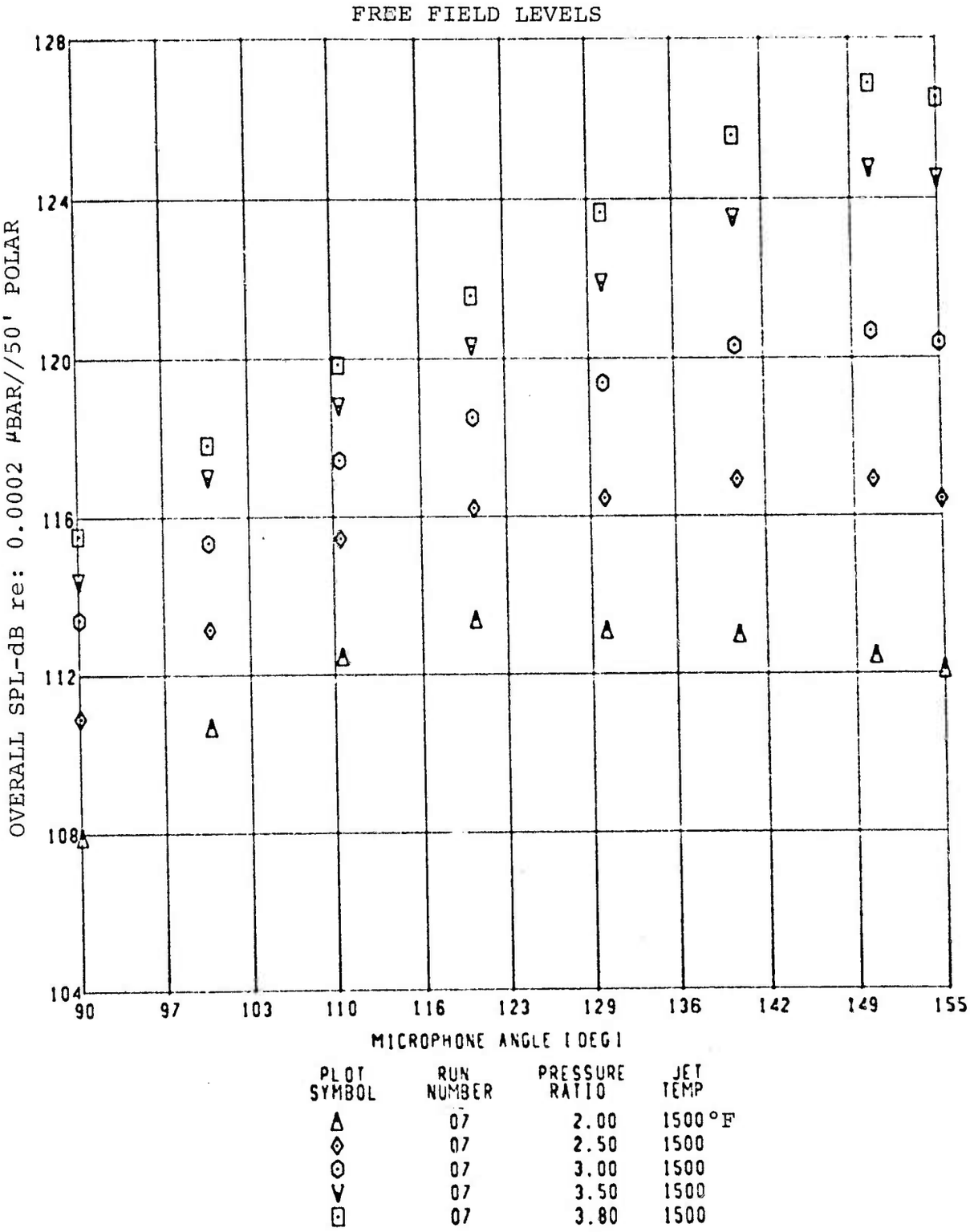
61T-3.1AR-CPA-RT/NC NOZZLE

SPECTRA FREE FIELD + 6dB

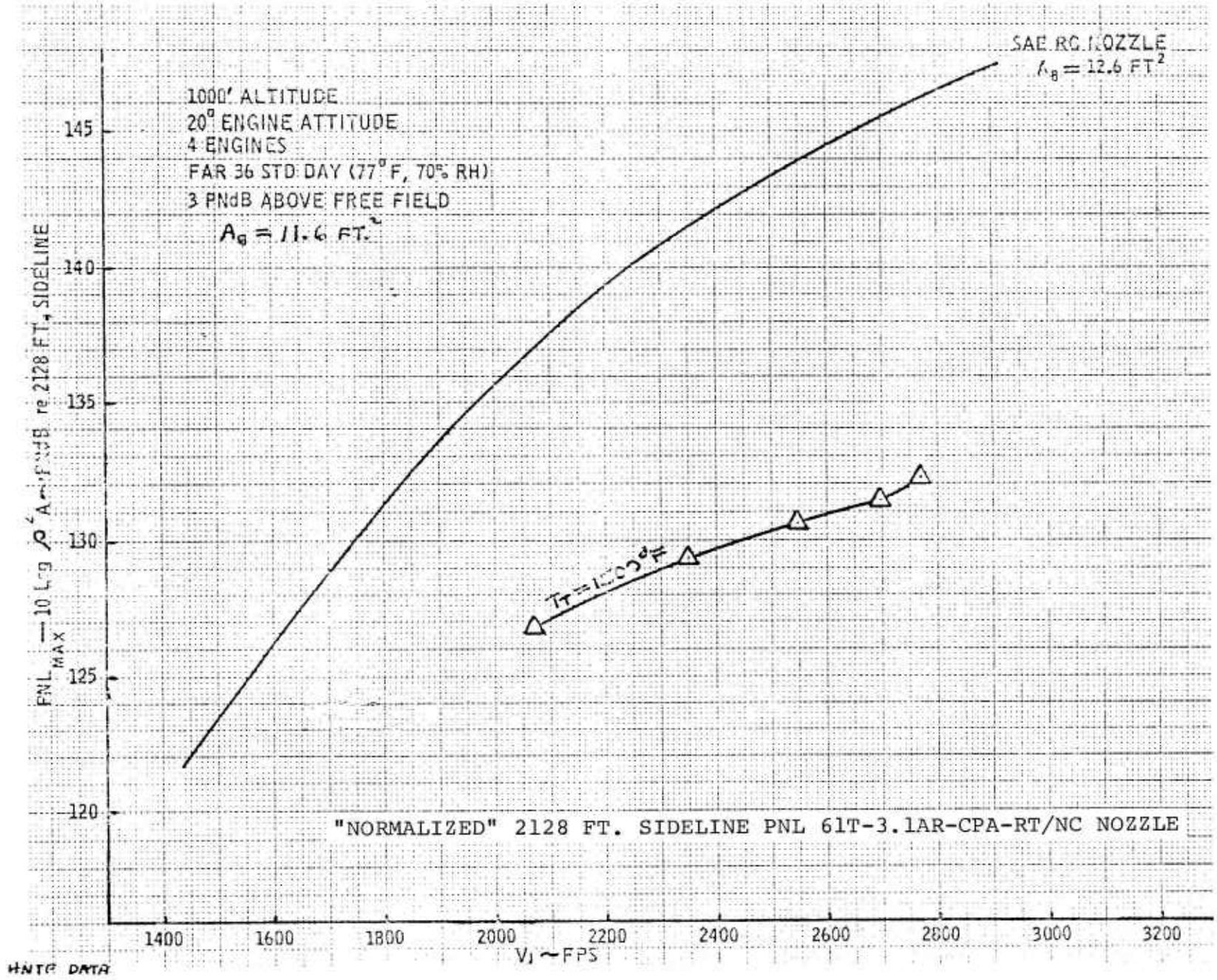


PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL (DB)
⊙	076	1500°F	2.000	130	50FP	118.7
⊡	076	1500	2.500	130	50FP	122.1
x	076	1500	3.000	130	50FP	125.1
*	076	1500	3.500	130	50FP	127.7
Y	076	1500	3.800	130	50FP	129.5

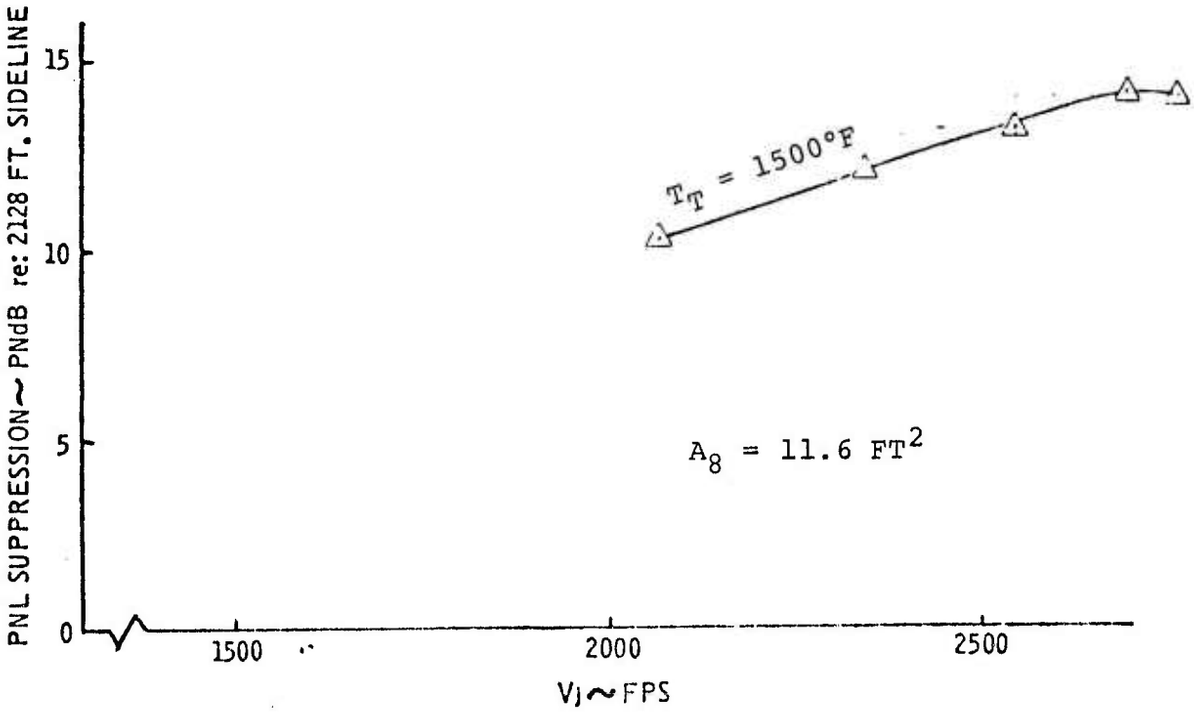
61T-3.1AR-CPA-RT/NC NOZZLE



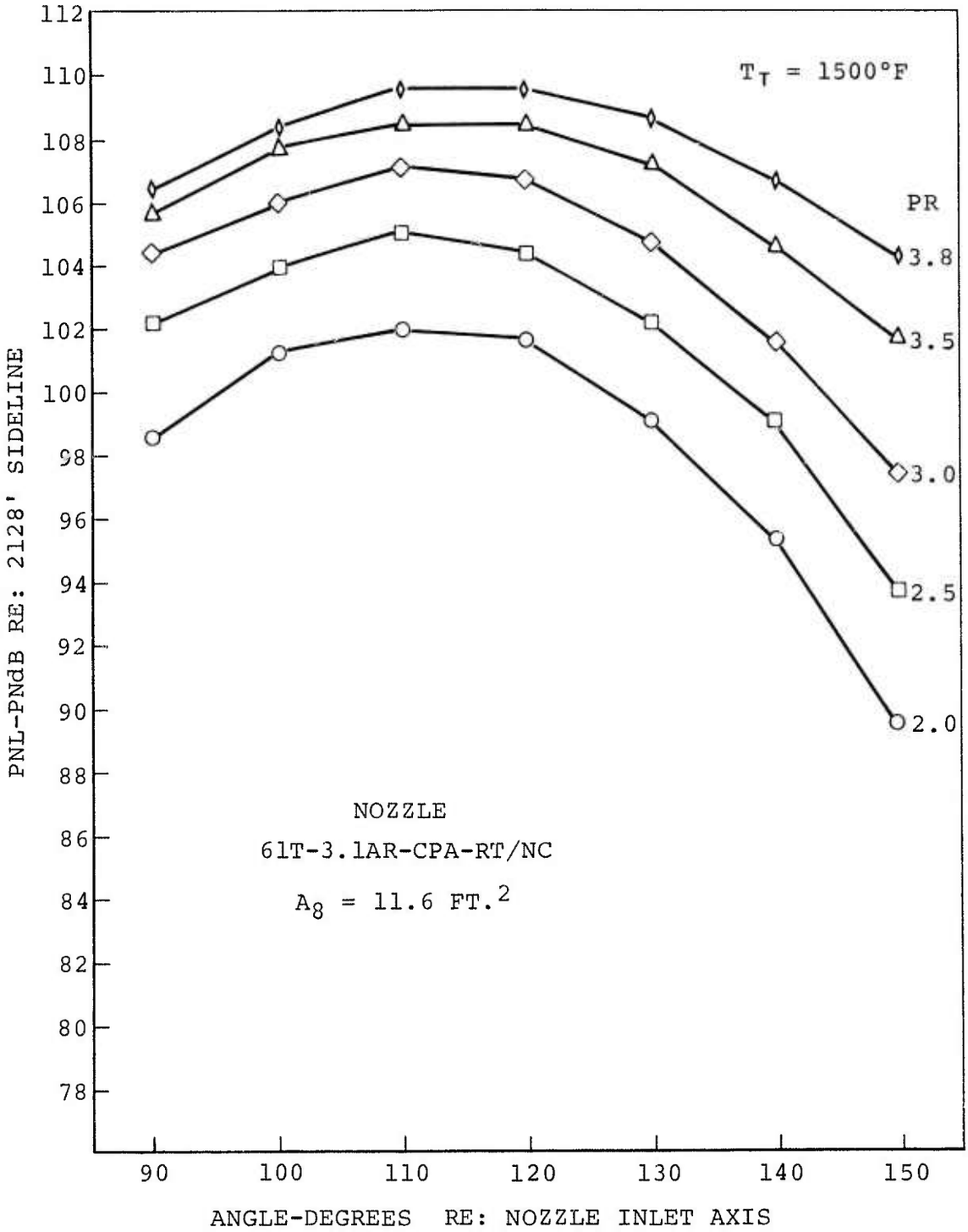
61T-3.1AR-CPA-RT/NC NOZZLE


SAE RC NOZZLE
$A_8 = 12.6\ FT^2$
1000' ALTITUDE
20° ENGINE ATTITUDE
4 ENGINES
FAR 36 STD DAY (77° F, 70% RH)
3 PNdB ABOVE FREE FIELD
$A_8 = 11.6\ FT.^2$
$T_T = 1100°F$
"NORMALIZED" 2128 FT. SIDELINE PNL 61T-3.1AR-CPA-RT/NC NOZZLE
FNL_{MAX} — 10 Log ρ^2 A-PNdB re 2128 FT. SIDELINE
145
140
135
130
125
120
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
V_j ~ FPS
HNTB DATA

61T-3.1AR-CPA-RT/NC NOZZLE



PEAK PNL SUPPRESSION VALUES

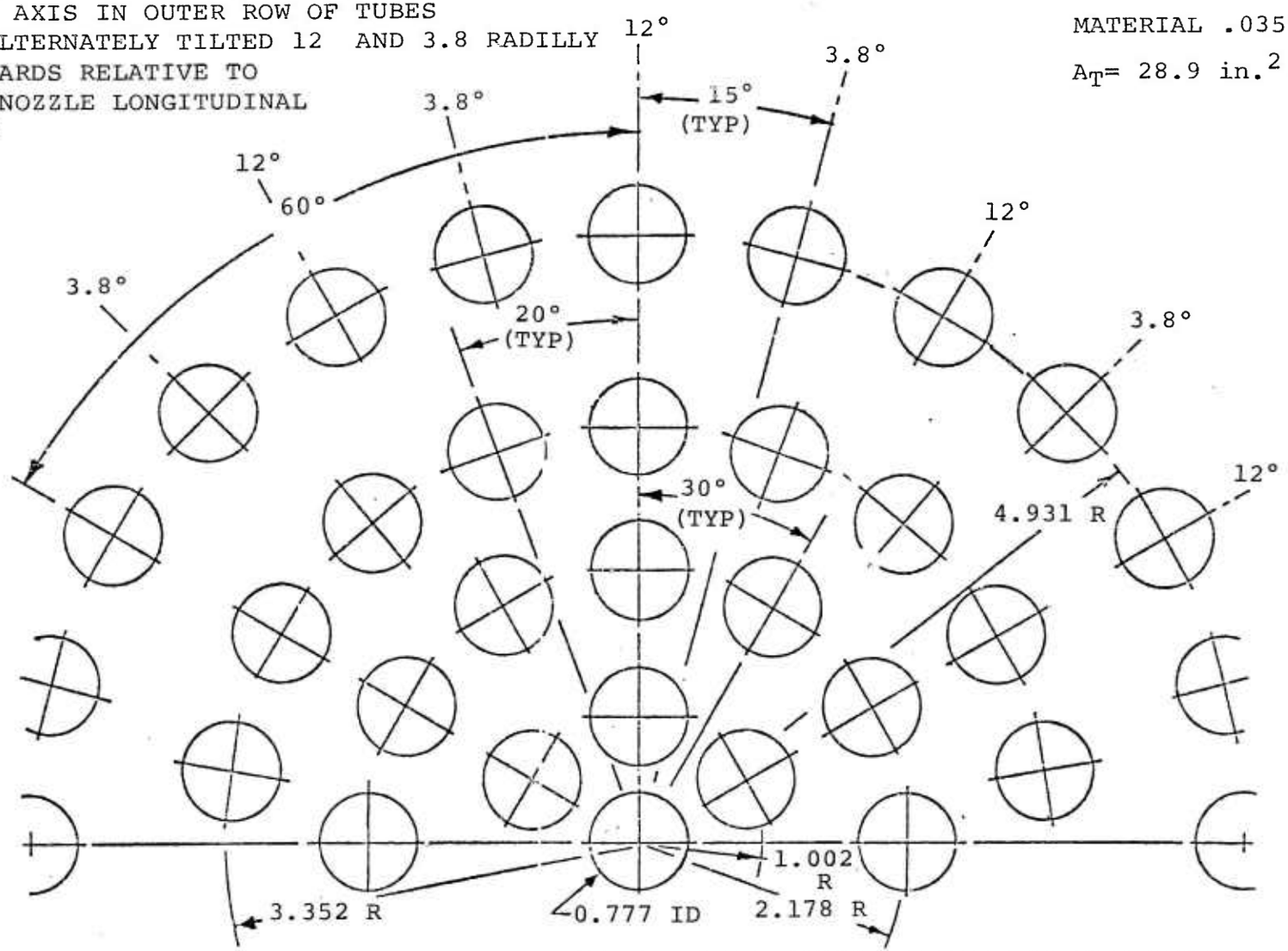


61 TUBE 3.1AR NOZZLE PERCEIVED NOISE LEVEL BEAM PATTERN

FLOW AXIS IN OUTER ROW OF TUBES
IS ALTERNATELY TILTED 12 AND 3.8 RADILLY
OUTWARDS RELATIVE TO
THE NOZZLE LONGITUDINAL
AXIS

MATERIAL .035"

A_T= 28.9 in.^{2}



61 TUBE AR 3.07 NOZZLE EXIT FLOW PATTERN (WITH TILTED OUTER ROW OF TUBES)

TEST CONDITIONS

NOZZLE: 61T-(CANTED)-3.1AR-CPA-RT/NC

FACILITY: HNTF

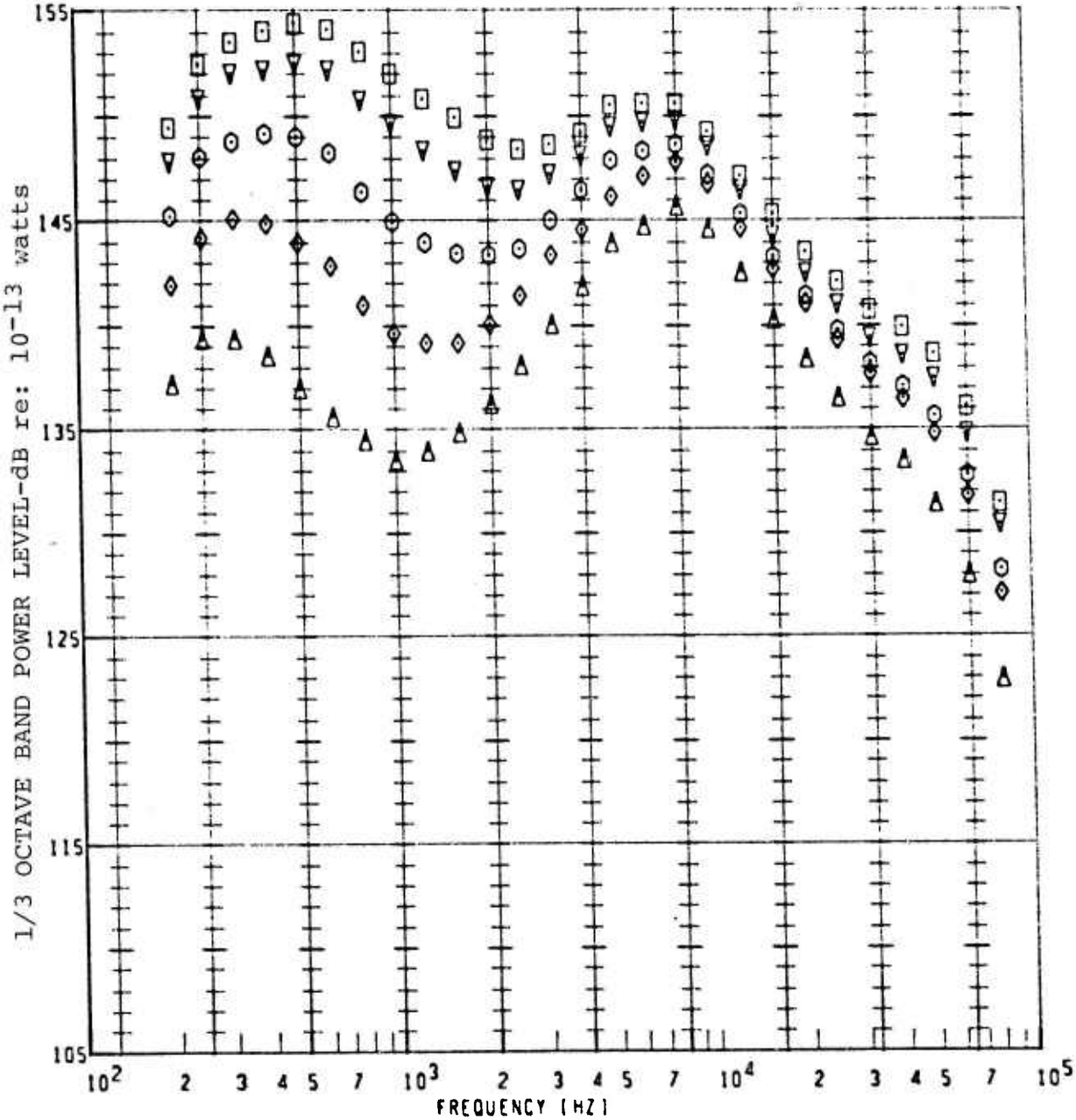
DATE: 12-3-73 T_{AMB} = 50°F **R.H.** = 67%

SCALE MODEL A_8 = 28.9 in.^{2}

RUN NO.	NPR	T_T	V_J (IDEAL)	REMARKS	REF
18	2.0	1500°F	2072 fps	12-3-73	
"	2.5	"	2351	"	
"	3.0	"	2548	"	
"	3.5	"	2697	"	
"	3.8	"	2771	"	

MICROPHONE LAYOUT: (HNTF) 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH CONCRETE GROUND SURFACE. MEASURED ACOUSTIC DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.

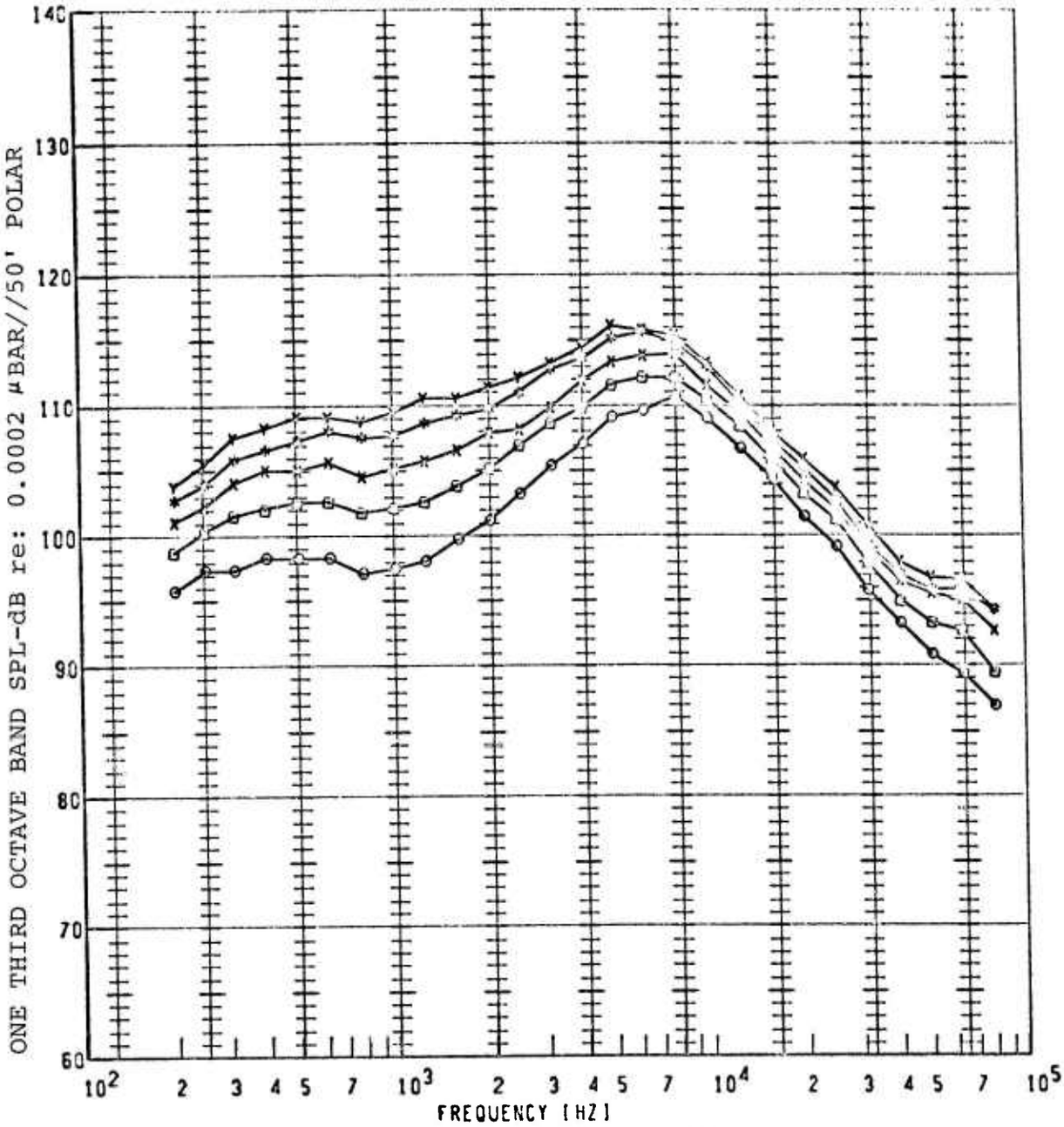
FREE FIELD VALUES



PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	18	2.00	1500°F
◇	18	2.50	1500
○	18	3.00	1500
▽	18	3.50	1500
□	18	3.80	1500

61T-(CANTED)-3.1AR-CPA-RT/NC NOZZLE

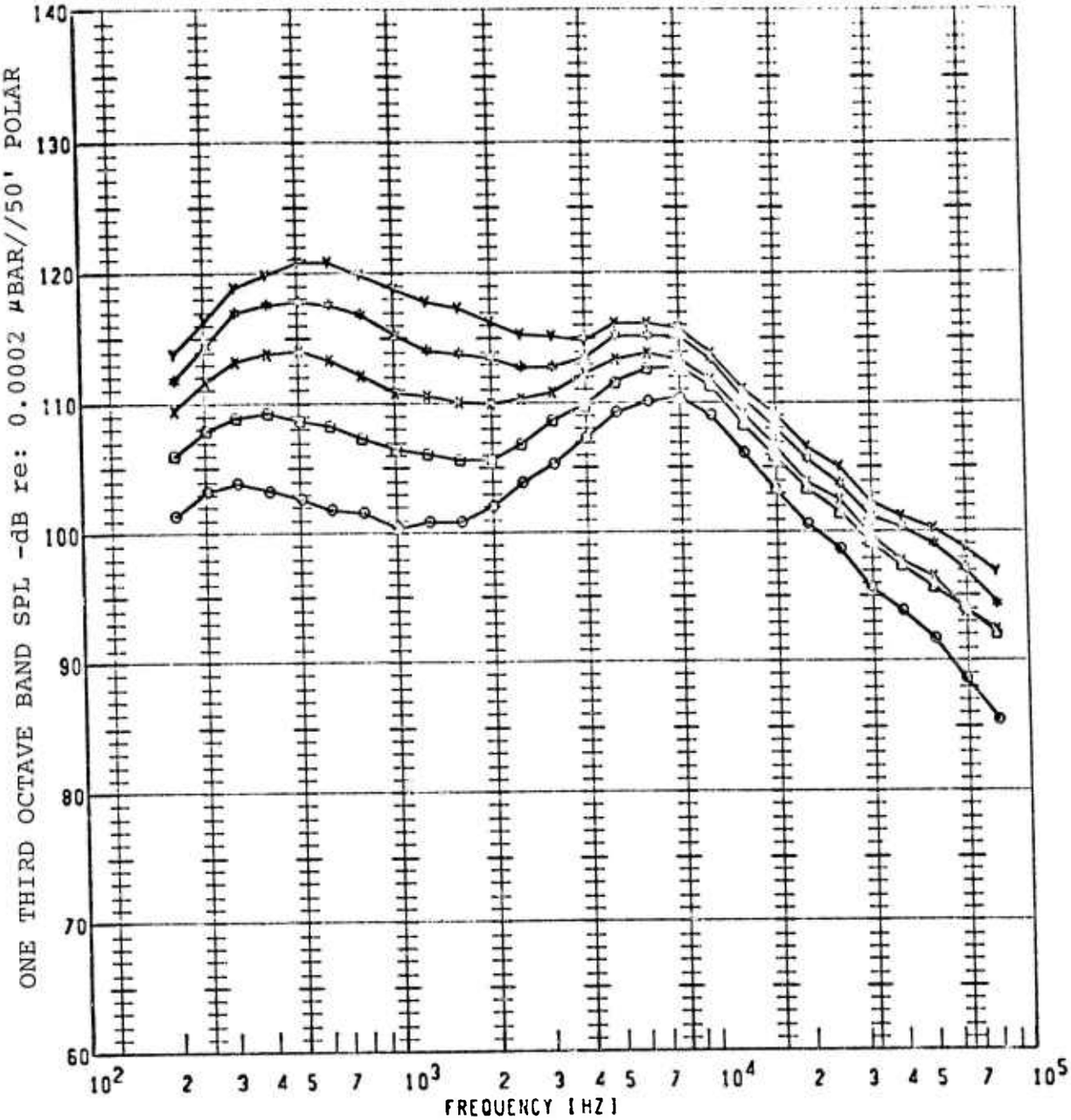
SPECTRA ARE FREE FIELD + 6dB



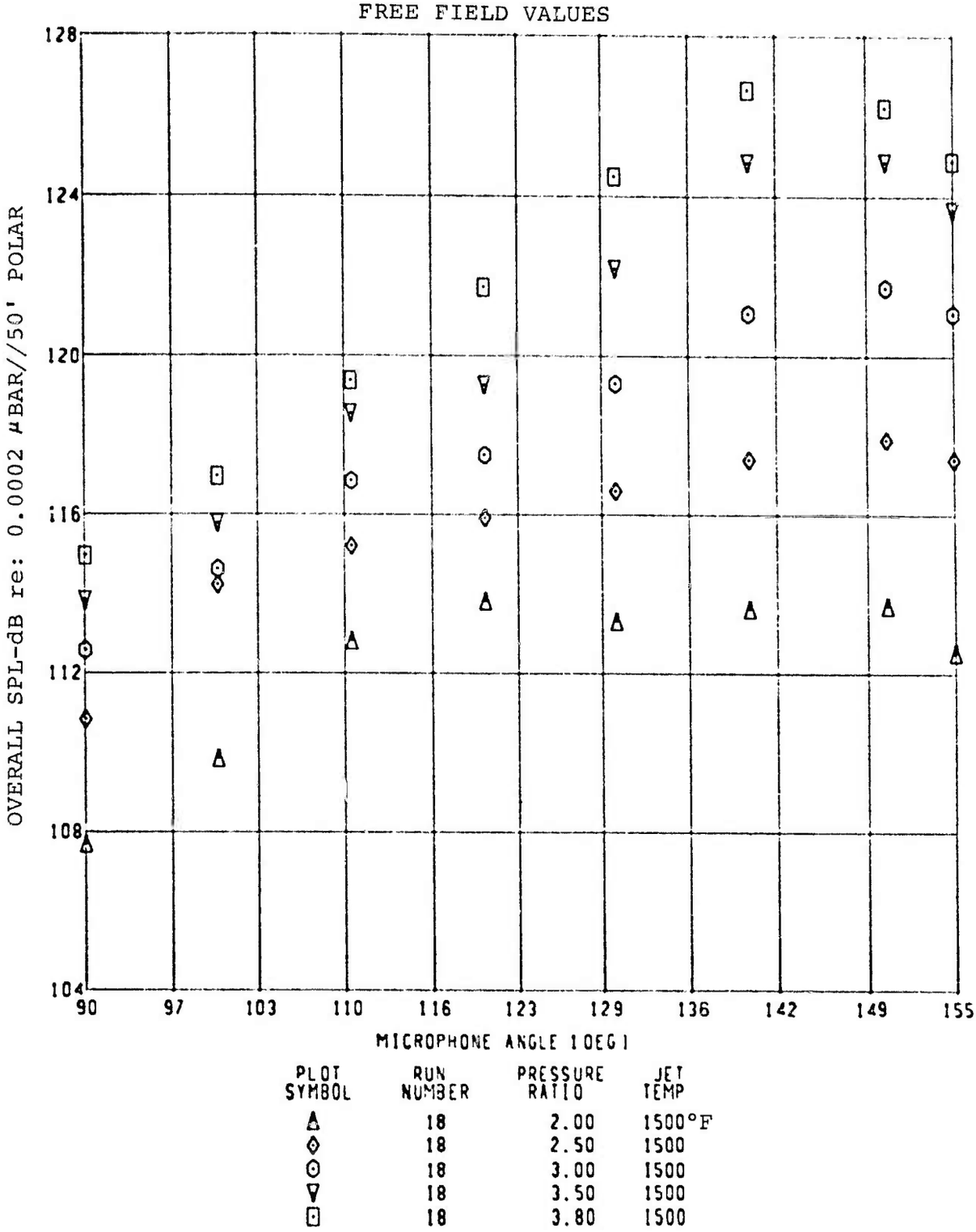
PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL [DB]
⊙	186	1500°F	2.000	110	50FP	118.2
⊡	186	1500	2.500	110	50FP	120.6
x	186	1500	3.000	110	50FP	122.4
*	186	1500	3.500	110	50FP	124.1
Y	186	1500	3.800	110	50FP	125.0

61T-(CANTED)-3.1AR-CPA-RT/NC NOZZLE

SPECTRA ARE FREE FIELD + 6dB

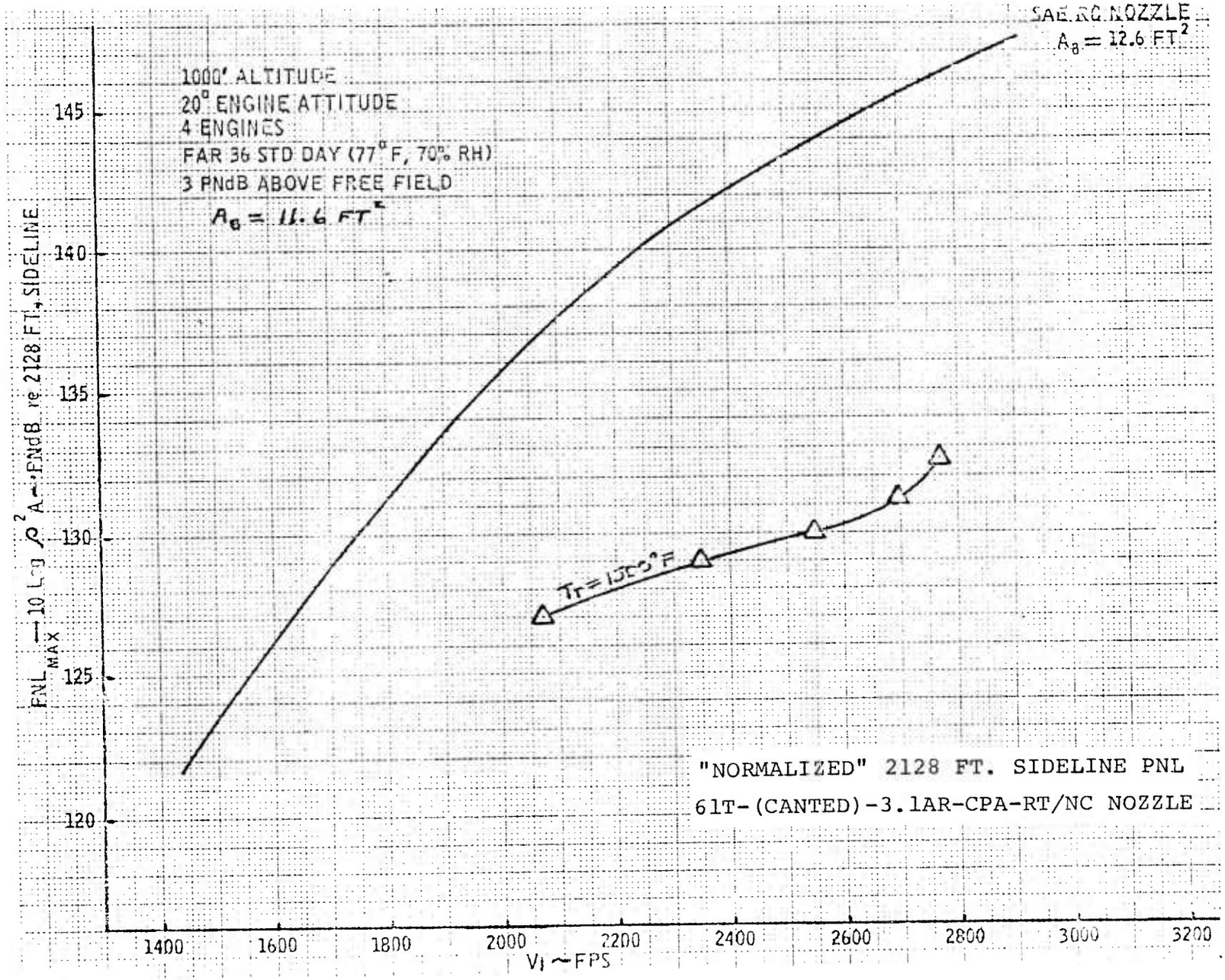


PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL [DB]
⊙	186	1500°F	2.000	130	50FP	118.8
⊞	186	1500	2.500	130	50FP	122.2
x	186	1500	3.000	130	50FP	125.0
*	186	1500	3.500	130	50FP	128.0
Y	186	1500	3.800	130	50FP	130.3

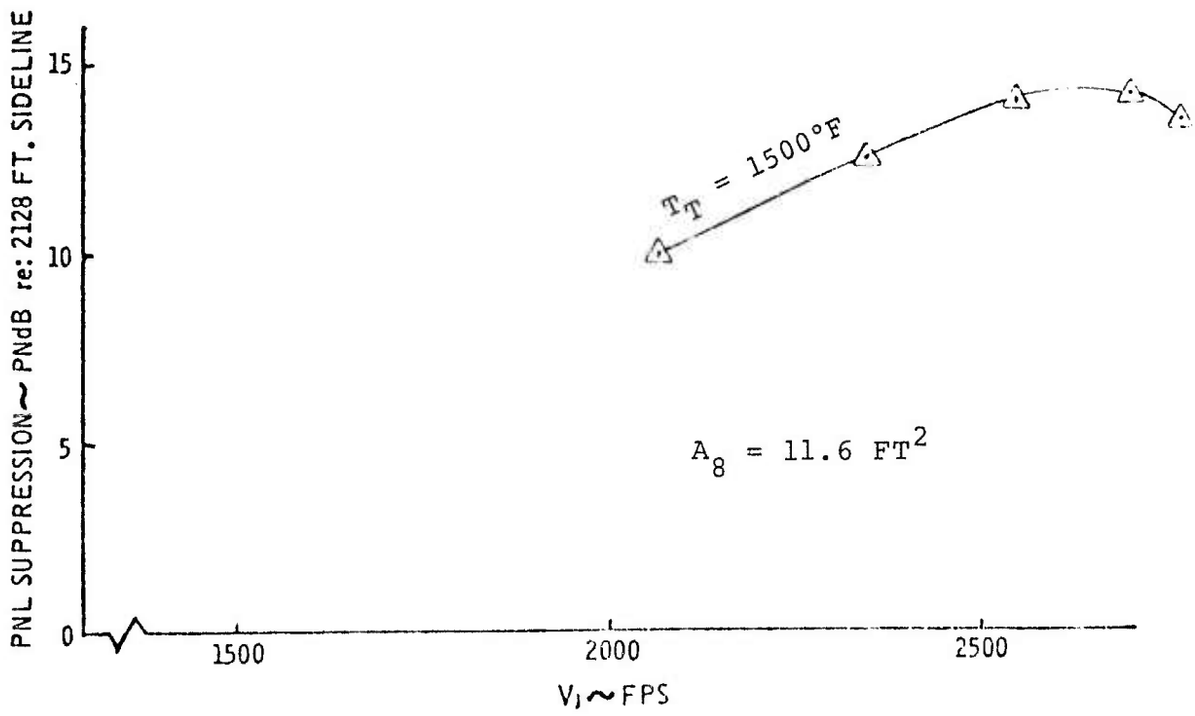


PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	18	2.00	1500°F
◇	18	2.50	1500
⊙	18	3.00	1500
▽	18	3.50	1500
⊡	18	3.80	1500

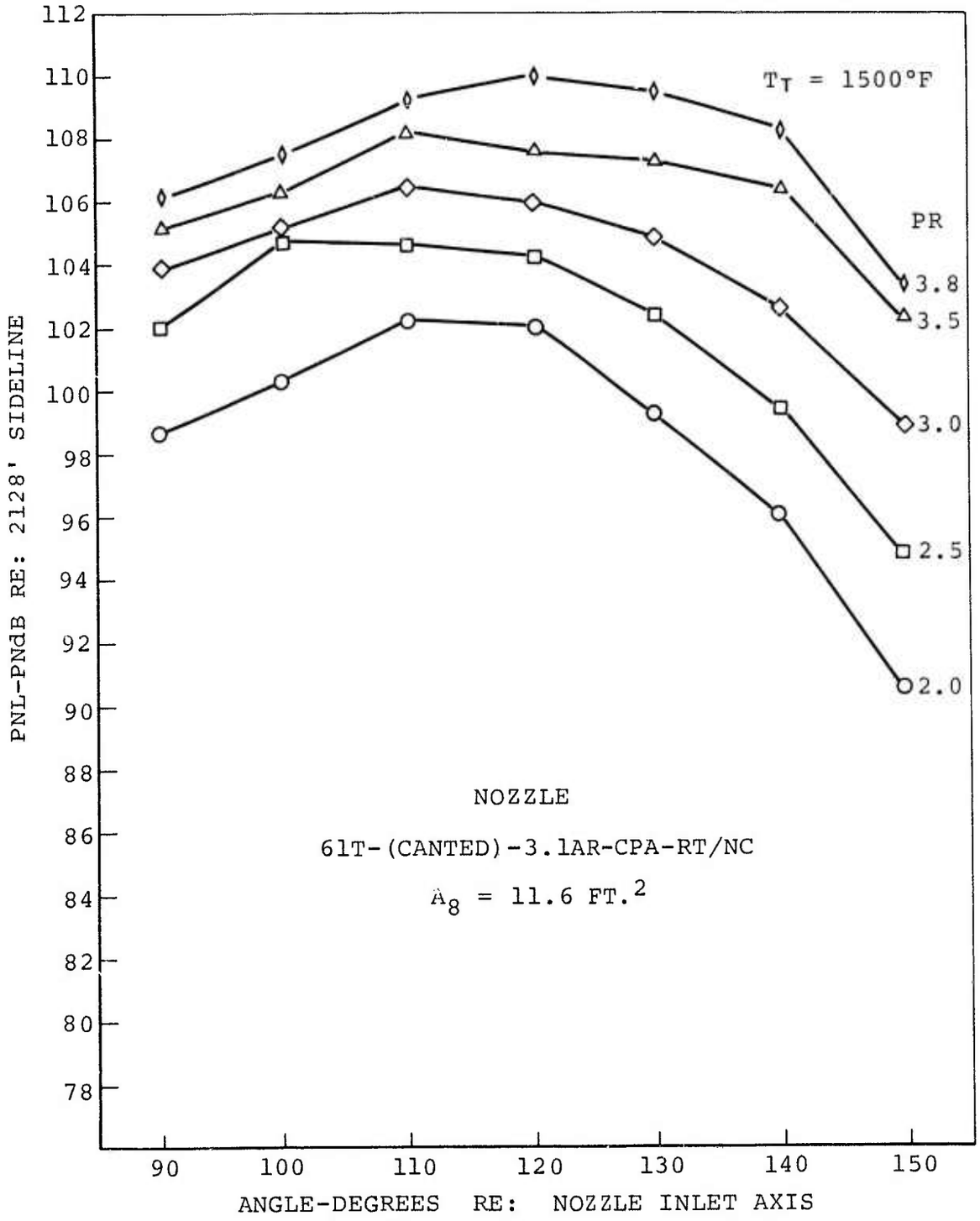
61T-(CANTED)-3.1AR-CPA-RT/NC NOZZLE


SAE RQ NOZZLE
$A_a = 12.6\ FT^2$
1000' ALTITUDE
20° ENGINE ATTITUDE
4 ENGINES
FAR 36 STD DAY (77° F, 70% RH)
3 PNdB ABOVE FREE FIELD
$A_a = 11.6\ FT^2$
$T_T = 1350°F$
"NORMALIZED" 2128 FT. SIDELINE PNL
61T-(CANTED)-3.1AR-CPA-RT/NC NOZZLE
$PNL_{MAX} - 10 \log \rho^2 A$ ~ PNdB re 2128 FT. SIDELINE
145
140
135
130
125
120
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
V_I ~ FPS

61T-(CANTED)-3.1AR-CPA-RT/NC NOZZLE



PEAK PNL SUPPRESSION VALUES

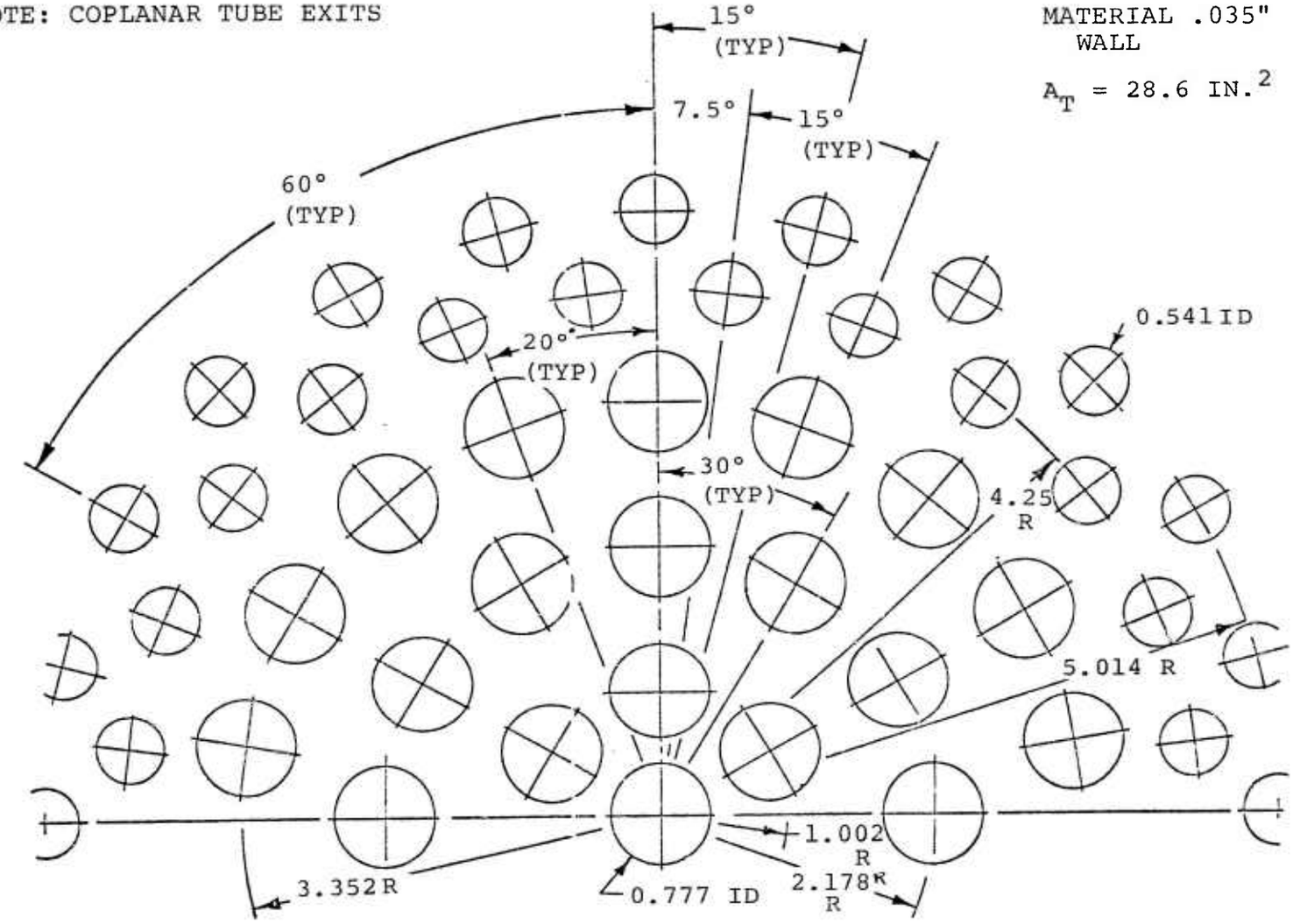


61 TUBE (CANTED) 3.1AR NOZZLE PERCEIVED NOISE LEVEL BEAM PATTERN

NOTE: COPLANAR TUBE EXITS

MATERIAL .035" WALL

A_T = 28.6 IN.^{2}



85 TUBE AR 3.07 NOZZLE EXIT FLOW PATTERN

TEST CONDITIONS

NOZZLE: 85T-3.1AR-CPA-RT/NC

FACILITY: HNTF

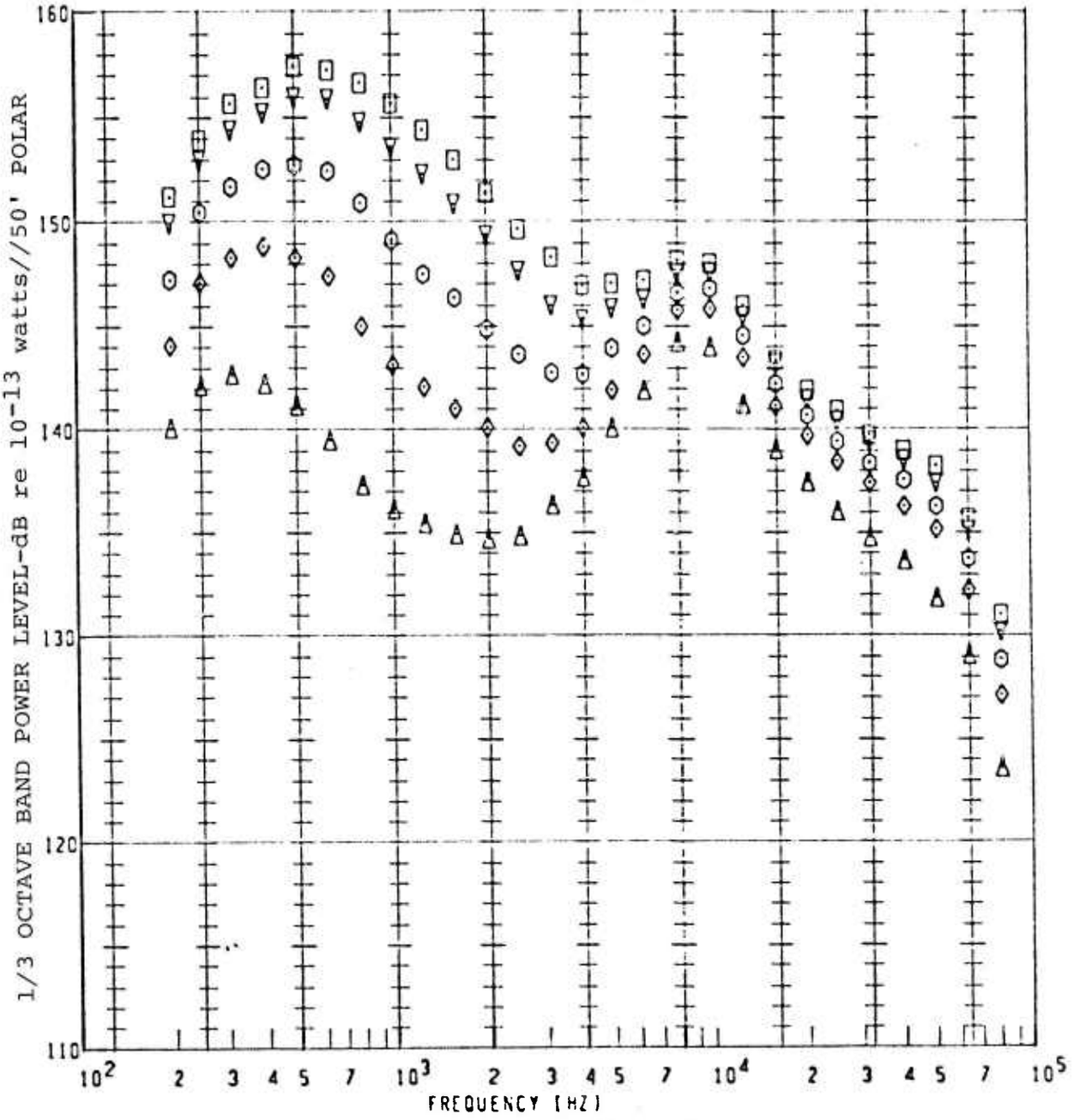
DATE: 12-4-73 T_{AMB} = **R.H.** =

SCALE MODEL A_8 =

RUN NO.	NPR	T_T	V_J (IDEAL)	REMARKS	REF
21	2.0	1500°F	2072 fps	12-4-73	
"	2.5	"	2351	"	
"	3.0	"	2548	"	
"	3.5	"	2697	"	
"	3.8	"	2771	"	

MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH CONCRETE GROUND SURFACE. MEASURED ACOUSTIC DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.

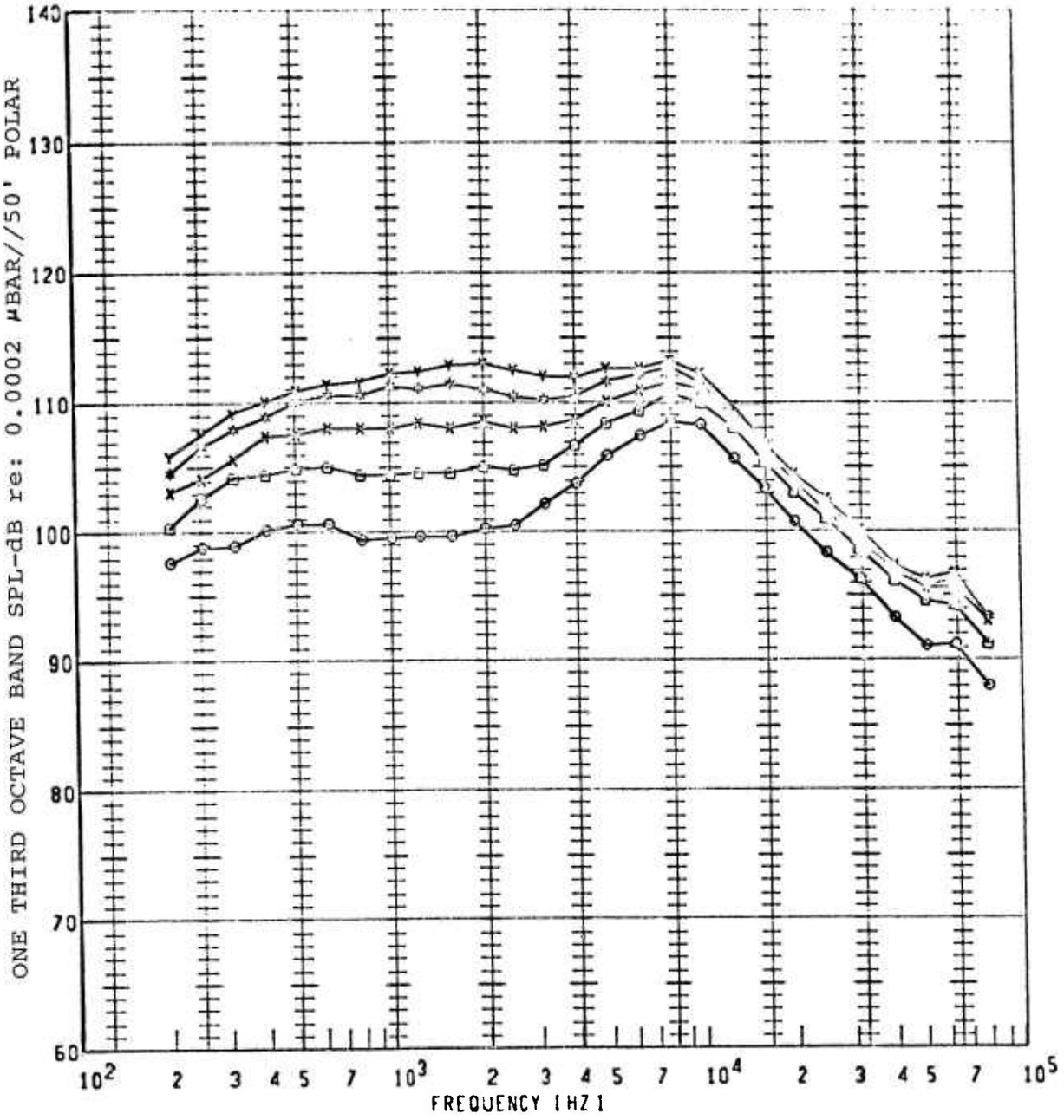
FREE FIELD VALUES



PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	21	2.00	1500°F
◇	21	2.50	1500
○	21	3.00	1500
▽	21	3.50	1500
□	21	3.80	1500

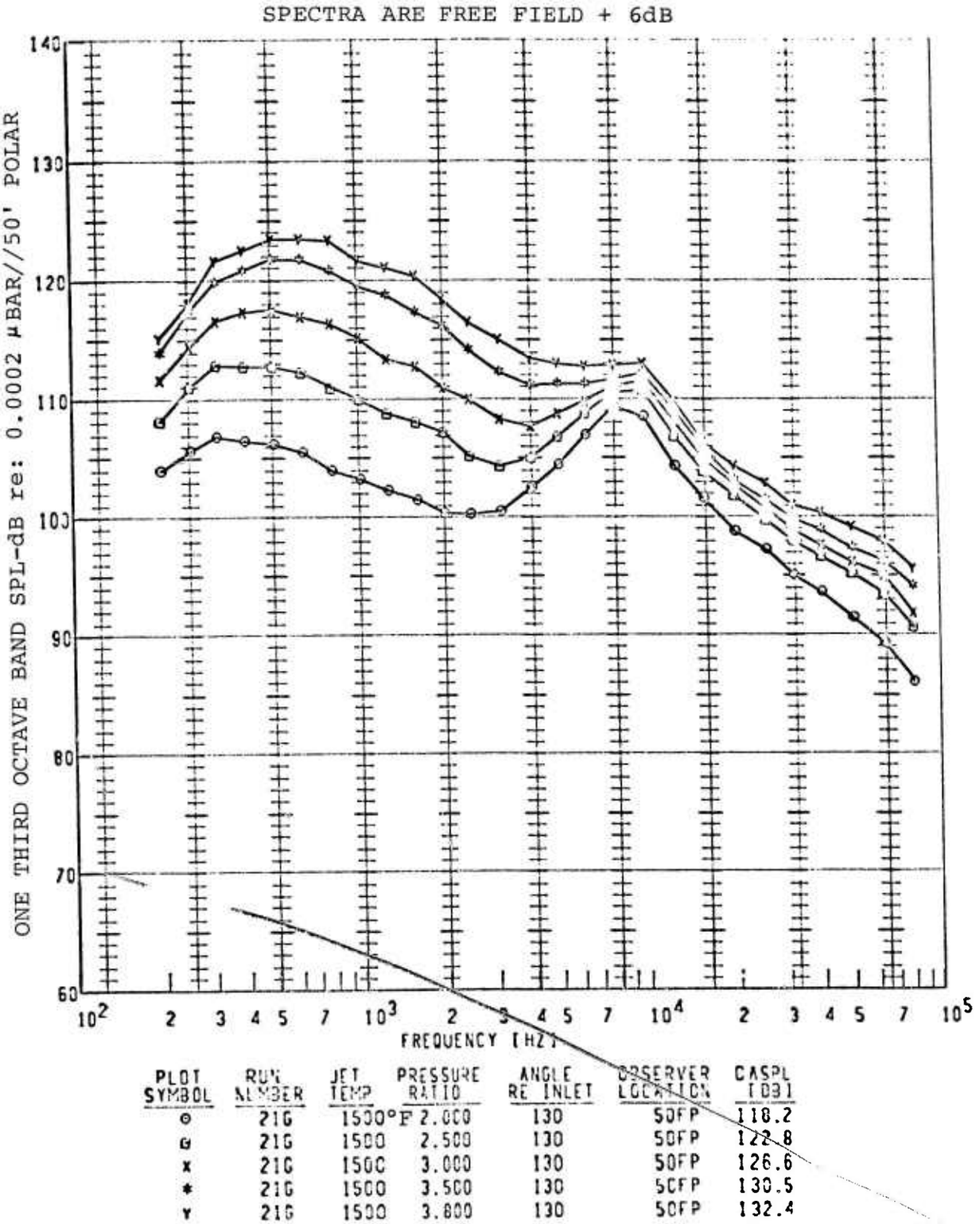
85T-3.1AR-CPA-RT/NC NOZZLE

SPECTRA ARE FREE FIELD + 6dB



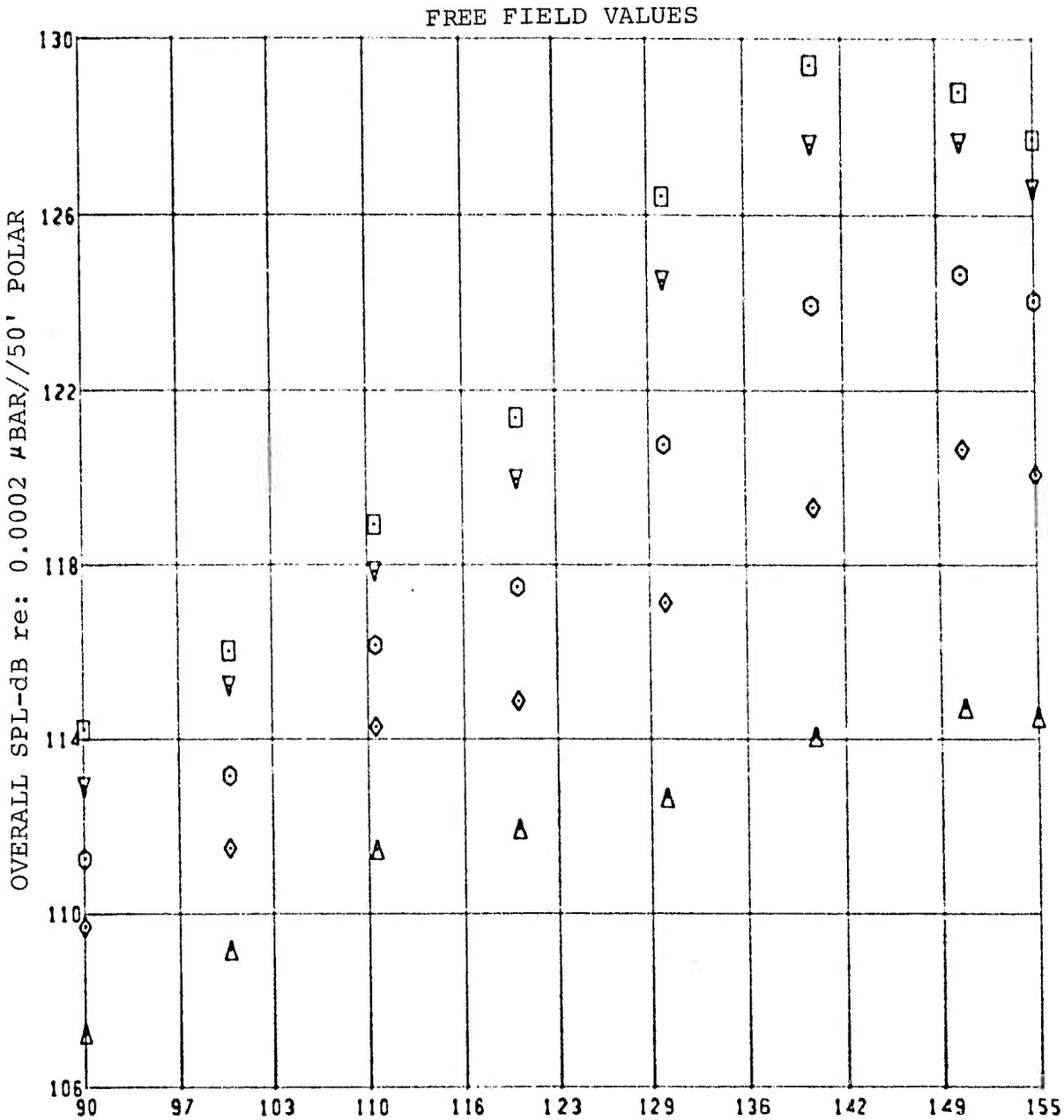
PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL (DB)
⊙	216	1500°F	2.000	110	50FP	116.7
⊡	216	1500	2.500	110	50FP	119.7
x	216	1500	3.000	110	50FP	121.7
*	216	1500	3.500	110	50FP	123.5
Y	216	1500	3.800	110	50FP	124.6

85T-3.1AR-CPA-RT/NC NOZZLE



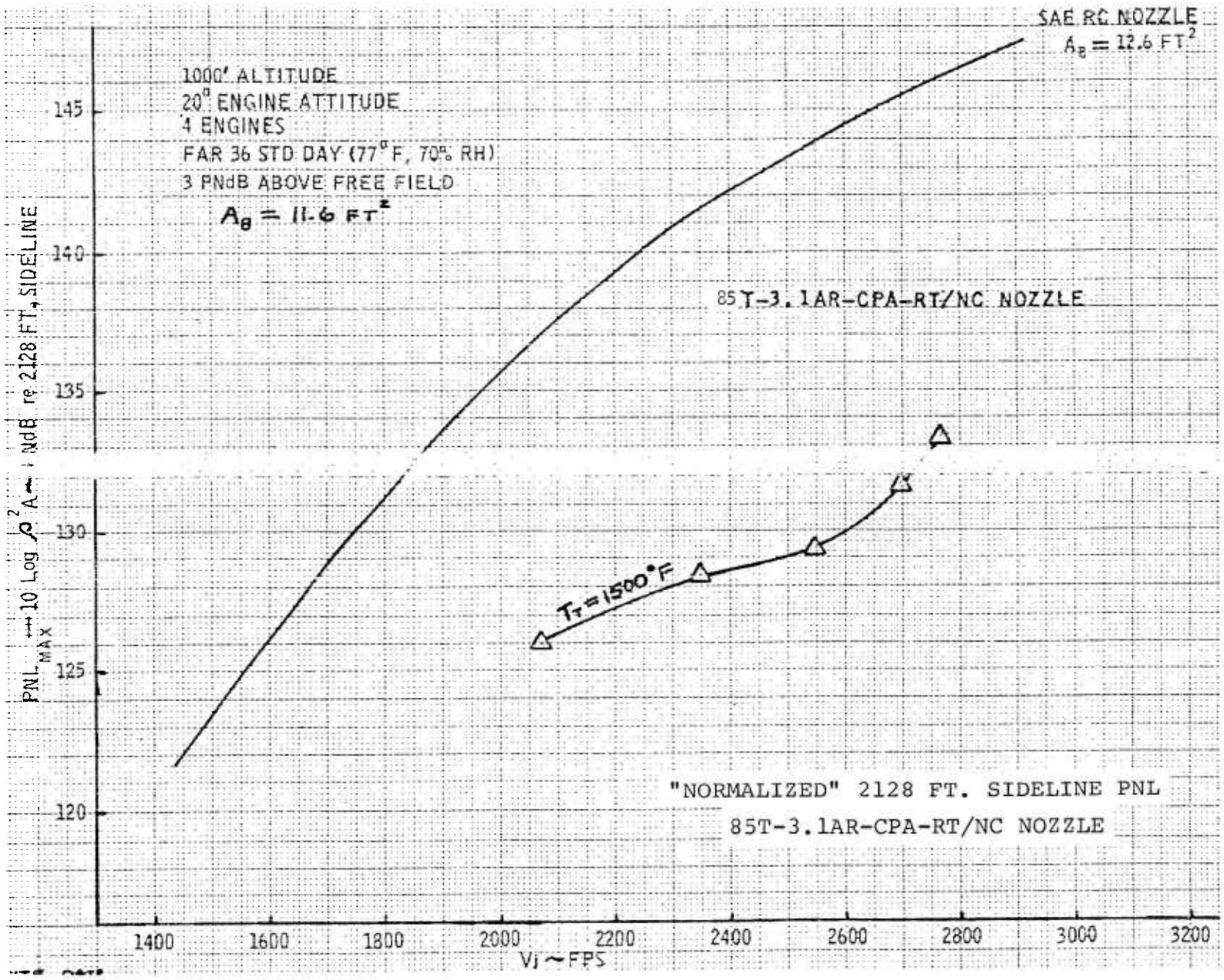
PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL [DB]
⊙	216	1500°F	2.000	130	50FP	118.2
G	216	1500	2.500	130	50FP	122.8
x	216	1500	3.000	130	50FP	126.6
*	216	1500	3.500	130	50FP	130.5
Y	216	1500	3.800	130	50FP	132.4

85T-3.1AR-CPA-RT/NC NOZZLE

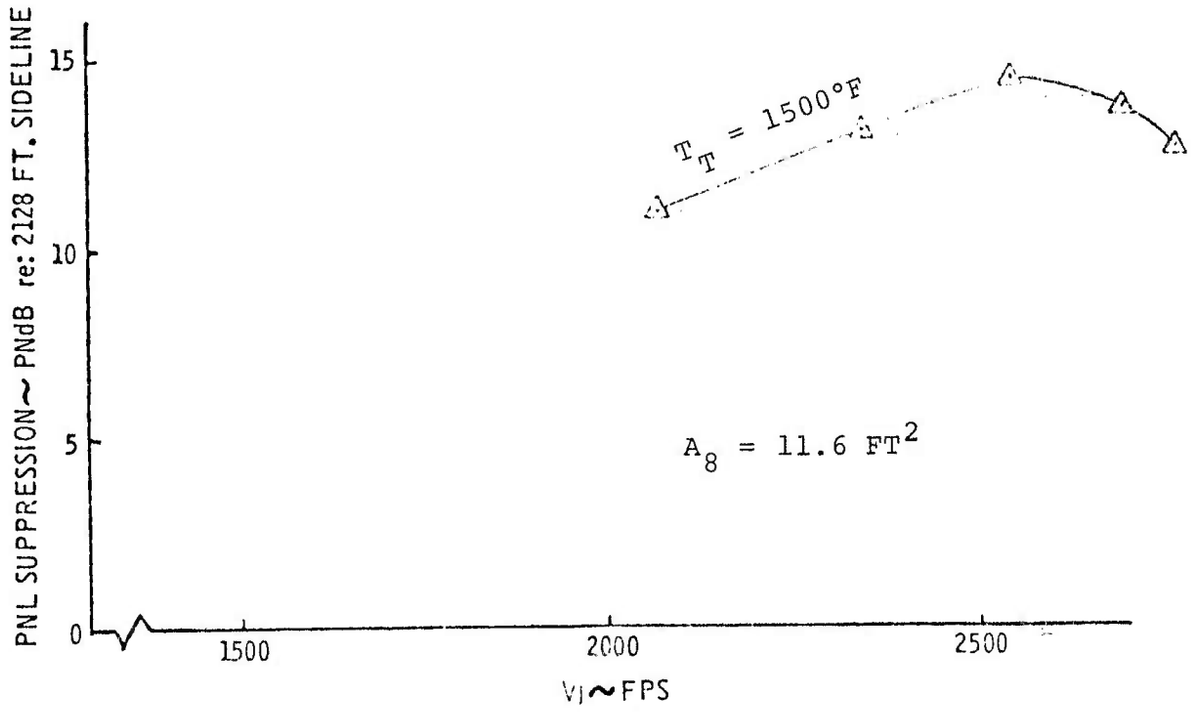


PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	21	2.00	1500°F
◇	21	2.50	1500
○	21	3.00	1500
▽	21	3.50	1500
□	21	3.80	1500

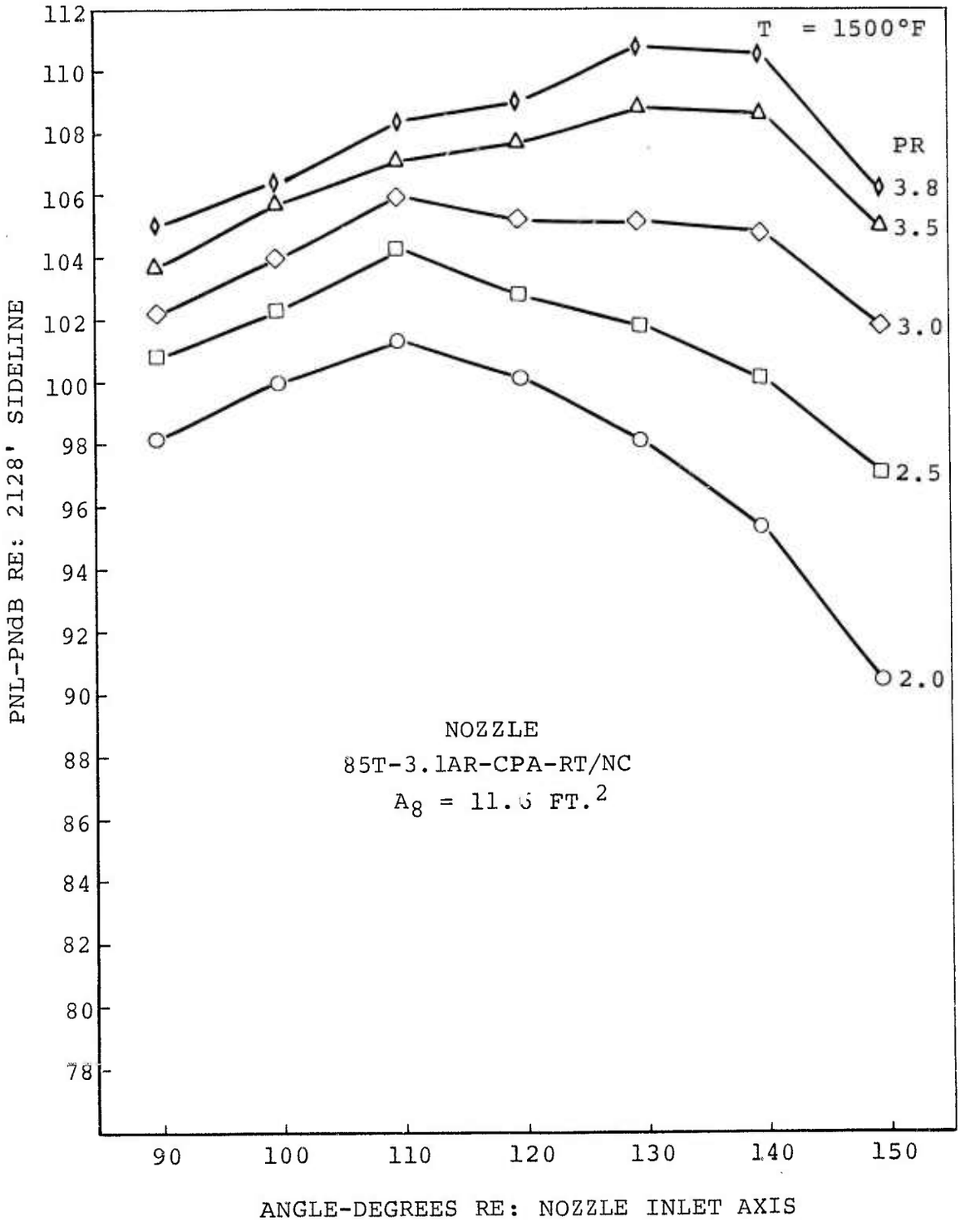
85T-3.1AR-CPA-RT/NC NOZZLE


SAE RC NOZZLE
$A_8 = 12.6\ FT^2$
1000' ALTITUDE
20° ENGINE ATTITUDE
4 ENGINES
FAR 36 STD DAY (77°F, 70% RH)
3 PNdB ABOVE FREE FIELD
$A_8 = 11.6\ FT^2$
85T-3.1AR-CPA-RT/NC NOZZLE
$T_T = 1500°F$
"NORMALIZED" 2128 FT. SIDELINE PNL
85T-3.1AR-CPA-RT/NC NOZZLE
PNL_{MAX} ~ PNdB re 2128 FT, SIDELINE
$= 10 \log \rho^2 A_8$
145
140
135
130
125
120
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
Vj ~ FPS

85 T -3.1AR-CPA-RT/NC NOZZLE



PEAK PNL SUPPRESSION VALUES



85 TUBE 3.1AR NOZZLE PERCEIVED NOISE LEVEL BEAM PATTERN