

AWT ACOUSTICS DISCUSSION

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*7-2-72*

## AWT ACOUSTIC SYSTEMS TASK TEAM

### OBJECTIVE:

TO DETERMINE THE AWT FEATURES REQUIRED TO PRODUCE TEST SECTION ACOUSTIC PROPERTIES WHICH ALLOW THE ACOUSTIC SIGNATURES OF PROPULSION SYSTEMS TO BE MEASURED.

### APPROACH:

A COMBINATION OF ANALYSES AND EXPERIMENTS WILL BE USED TO:

- o ASSURE AN ANECHOIC TEST SECTION COMPATIBLE WITH THE SOURCE SPECTRA OF THE MOST PROBABLE PROPULSION SYSTEM TEST CANDIDATES.
- o DEFINE ACCEPTABLE LEVELS OF TEST SECTION BACKGROUND NOISE AND TURBULENCE.
- o IDENTIFY SOURCES OF BACKGROUND NOISE AND REQUIRED NOISE REDUCTION DESIGN FEATURES/ ACOUSTIC TREATMENT.
- o CRITIQUE ALL TUNNEL DESIGN FEATURES FOR COMPATIBILITY WITH ACOUSTIC REQUIREMENTS.

AWT ACOUSTIC SYSTEMS TASK TEAM

JOHN F. GROENEWEG - LEADER

MEMBERS

PRIMARY FUNCTION

EDWARD J. RICE

ACOUSTIC TREATMENT DESIGN

KENNETH J. BAUMEISTER

COMPUTATIONAL AEROACOUSTICS

MILO D. DAHL

ACOUSTIC TREATMENT PERFORMANCE  
MEASUREMENT

BRUCE J. CLARK

NOISE SOURCE ANALYSIS

LEONARD HOMYAK

COMPONENT NOISE MEASUREMENT

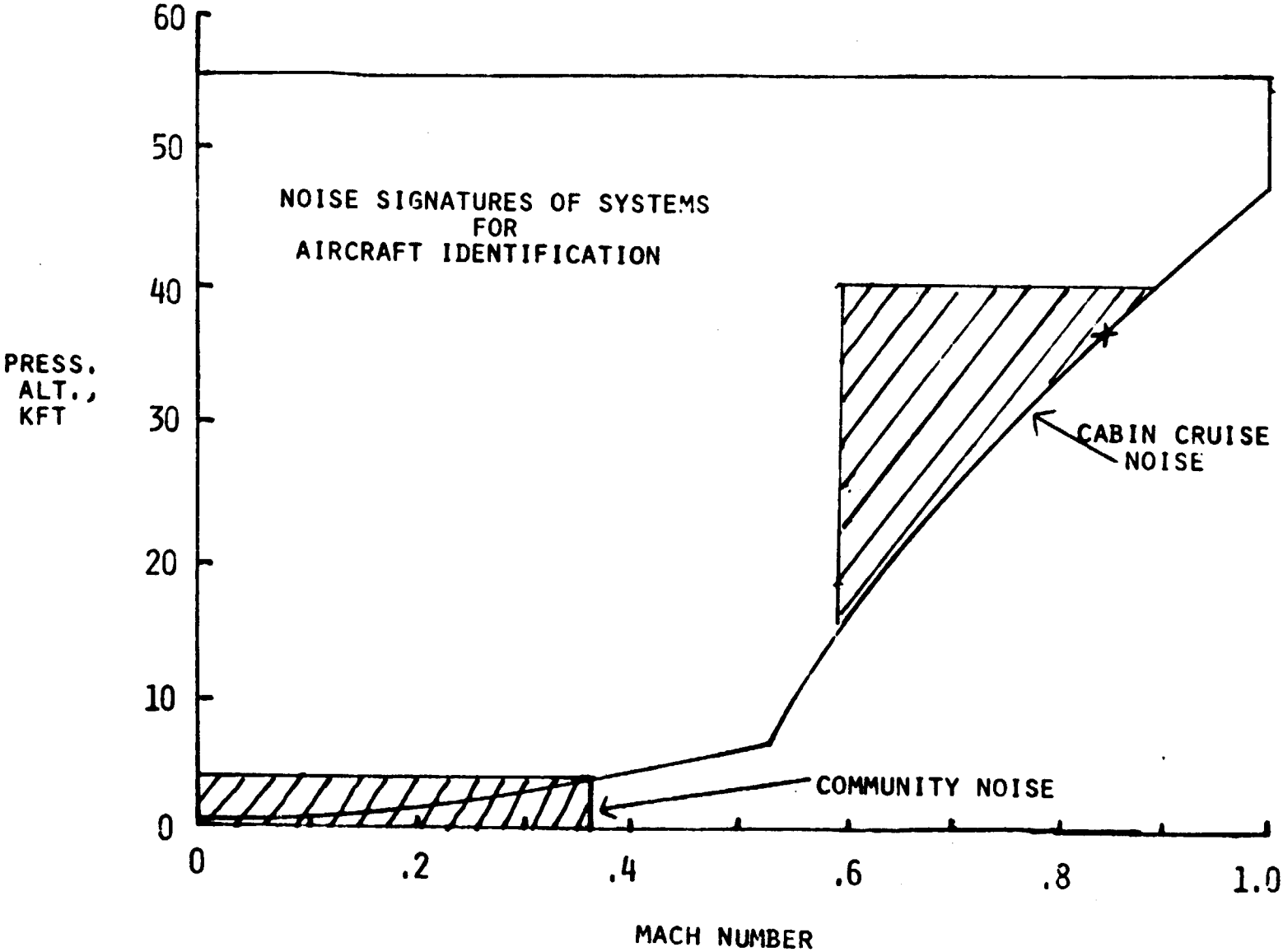
FREDERICK W. GLASER

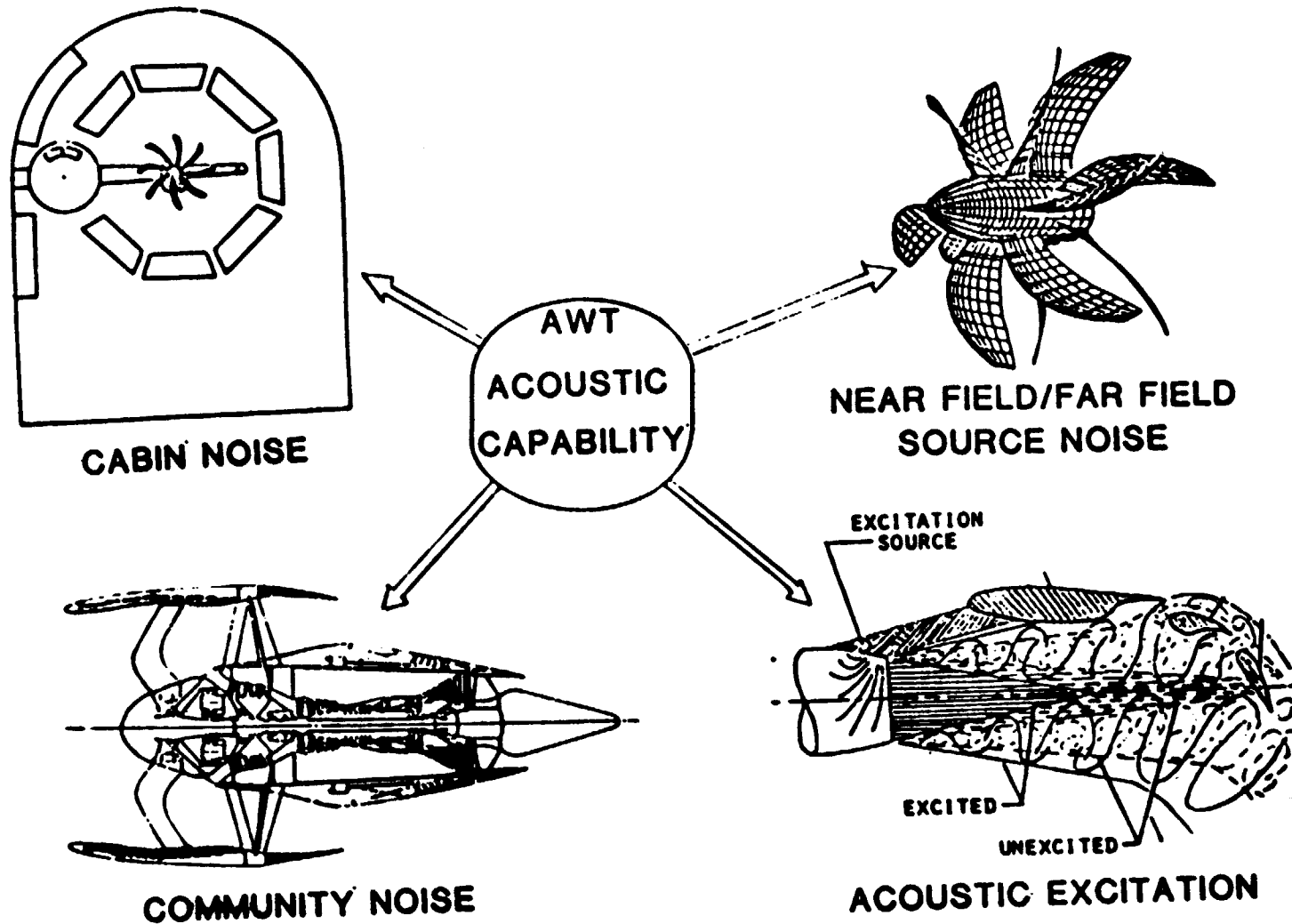
ACOUSTIC TREATMENT INTEGRITY/  
ICING COMPATIBILITY

WILLIAM STEVANS

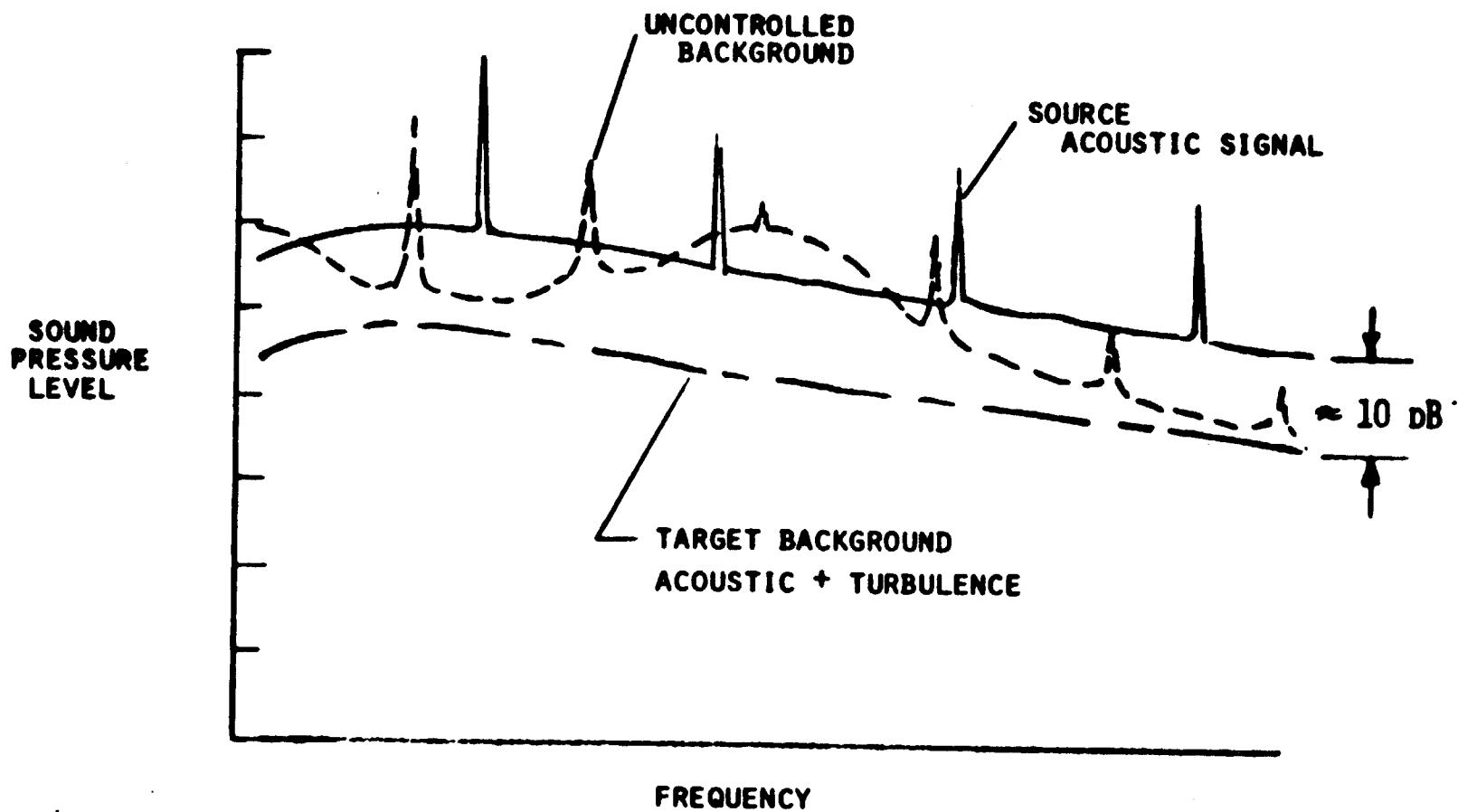
EXPERIMENTAL OPERATIONS

AWT TEST SECTION OPERATING ENVELOPE  
SHOWING REGIONS AND TYPES OF NOISE MEASUREMENTS

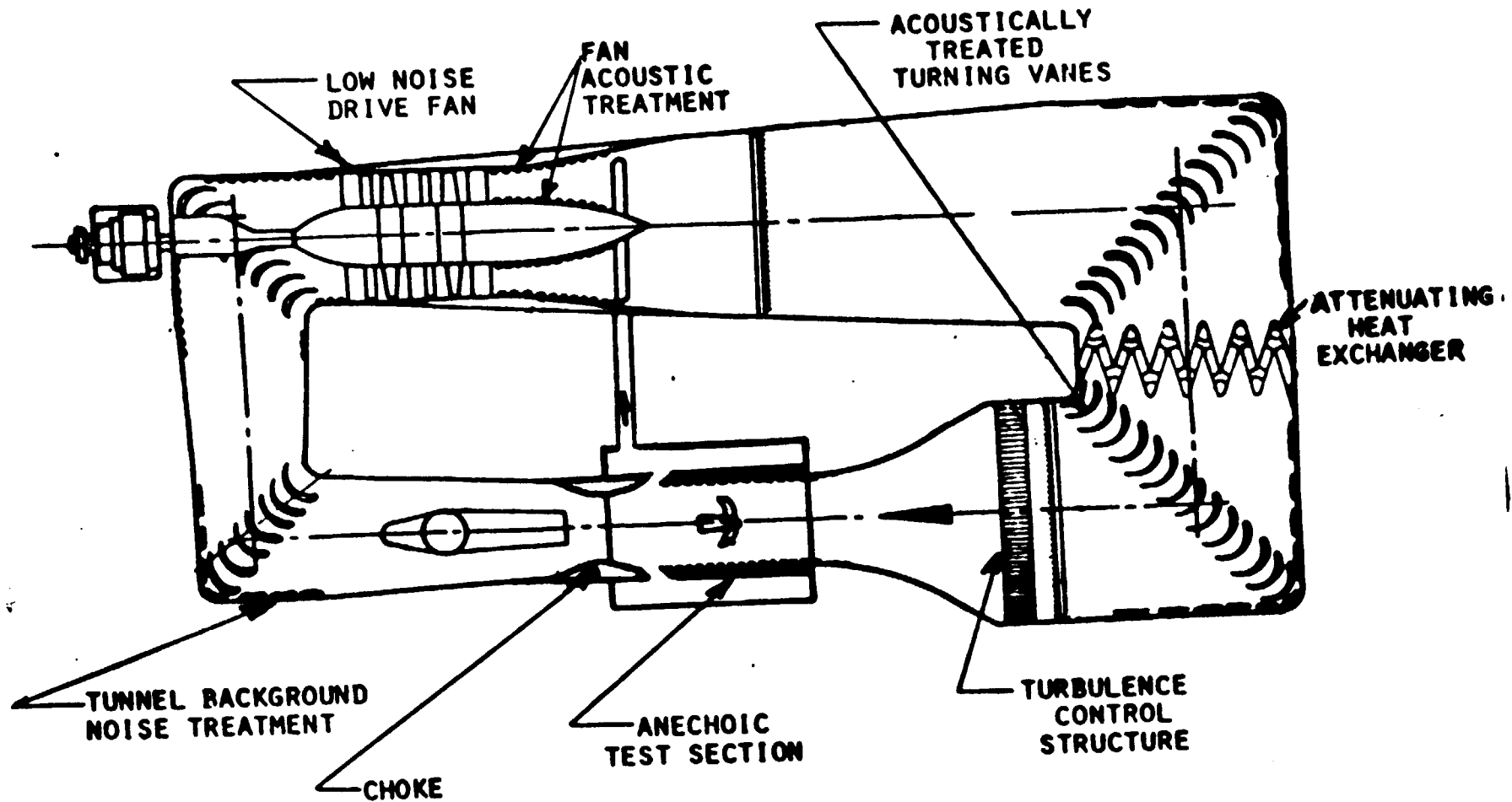




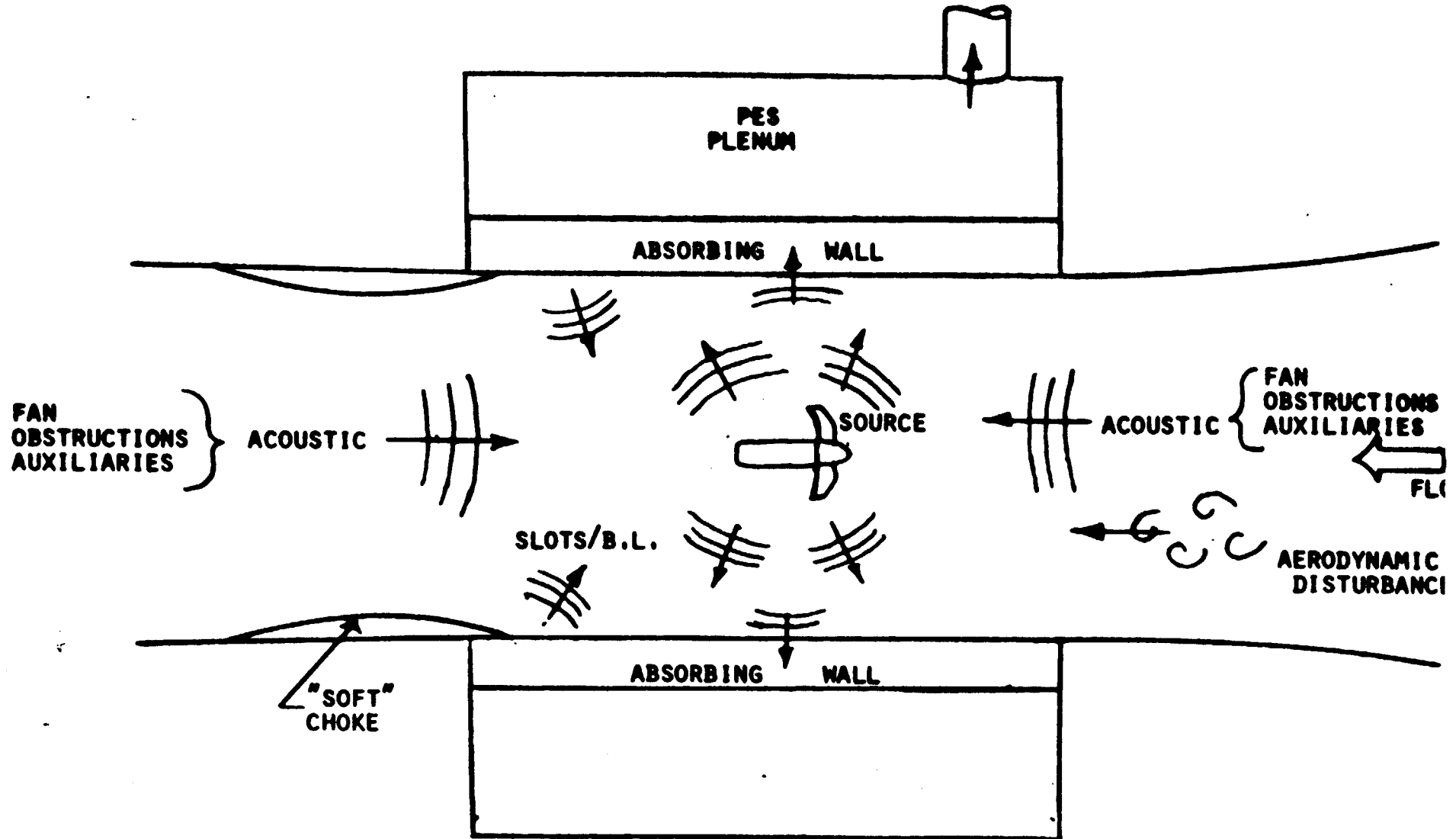
# TEST SECTION SPECTRAL PROPERTIES



# POTENTIAL AWT ACOUSTIC FEATURES



# TEST SECTION PRESSURE FLUCTUATIONS SOURCES AND SINKS





A W T   A C O U S T I C   S Y S T E M S  
M O D E L I N G  
W O R K   B R E A K D O W N   S T R U C T U R E

2.5 ACOUSTICS

2.5.1 ANALYTICAL MODELING

2.5.2 DESIGN AND FABRICATION

2.5.3 PHYSICAL MODELING

2.5.3.1 MODEL SCALE: 5% - 20%, 10% NOMINAL

2.5.3.1.1 HIGH SPEED LEG

2.5.3.1.2 LOW SPEED LEG

2.5.3.1.3 HEAT EXCHANGER/TURNING VANES

2.5.3.1.4 TUNNEL LOOP

2.5.3.2 FULL SCALE:  $\geq$  50%

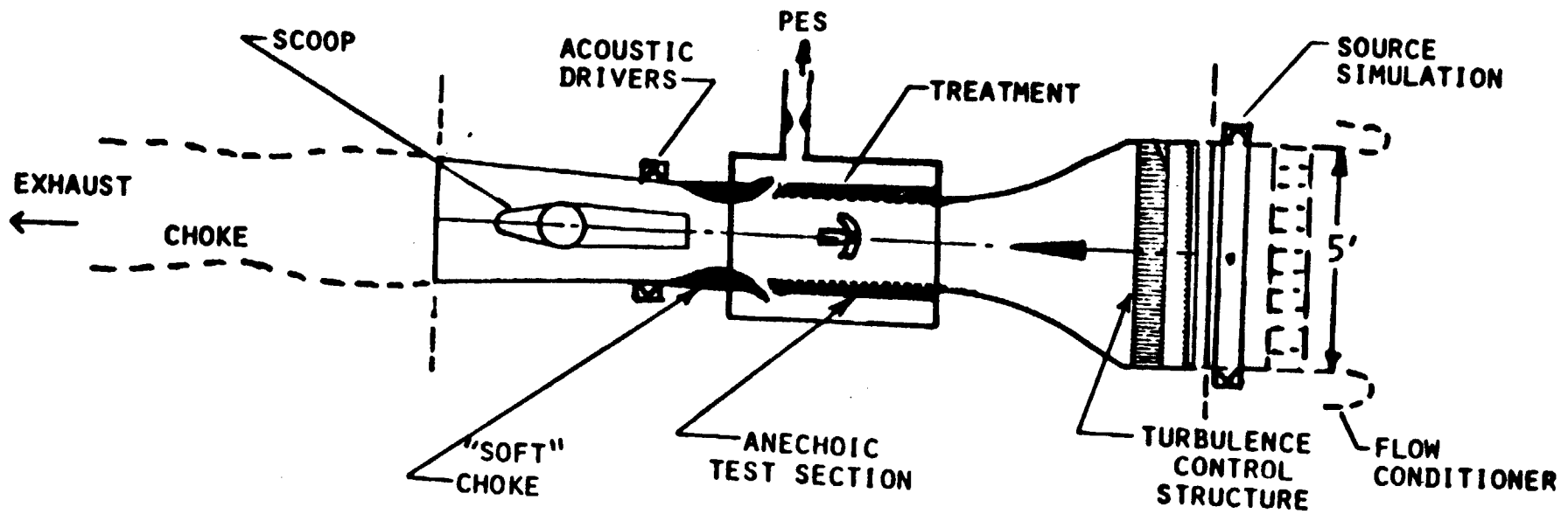
2.5.3.2.1 TEST SECTION ACOUSTIC TREATMENT

2.5.3.2.2 HEAT EXCHANGER

2.5.3.2.3 TREATED TURNING VANES

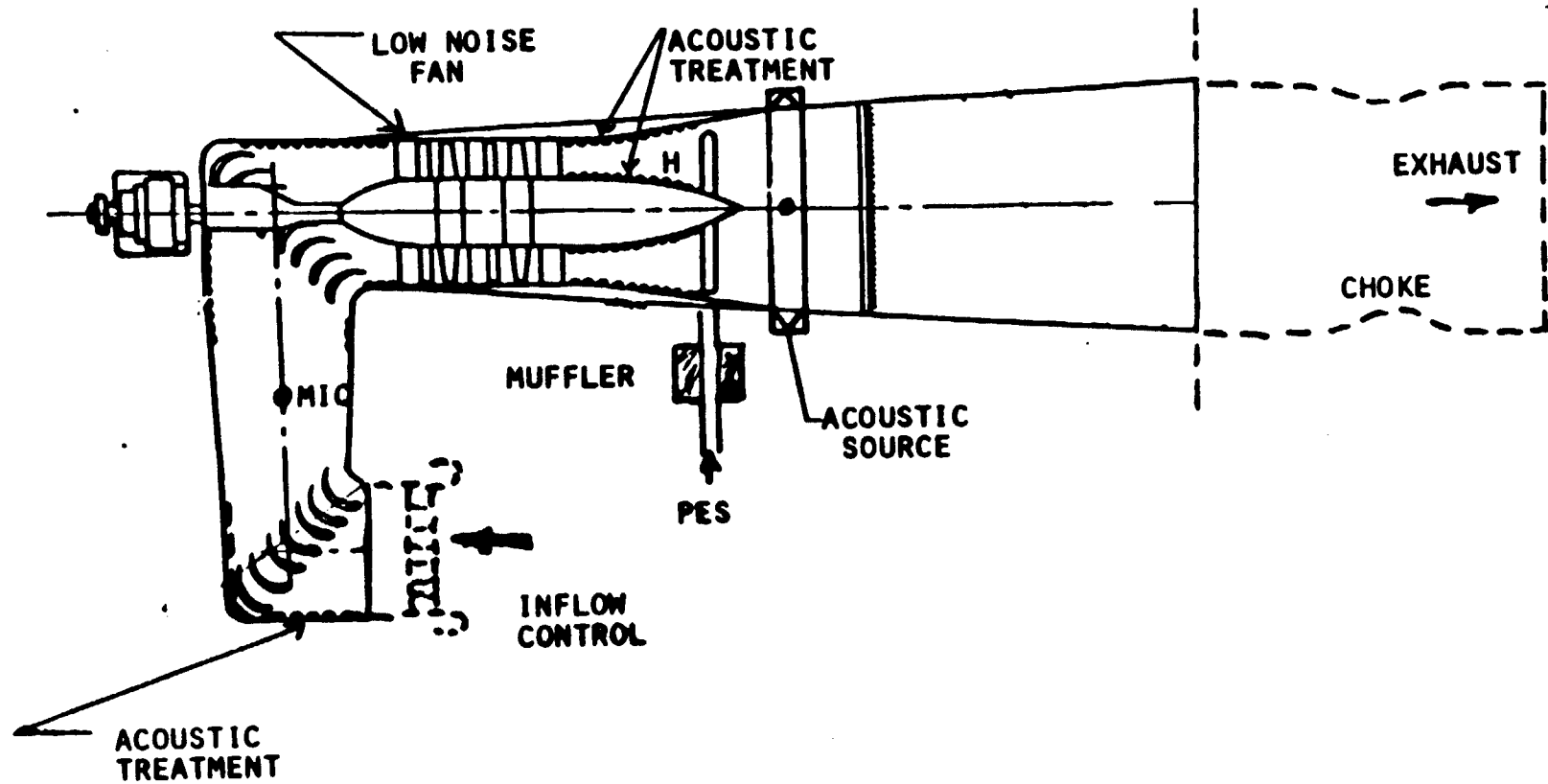
2.5.3.1.1. HIGH SPEED LEG

NOMINAL 10% SCALE



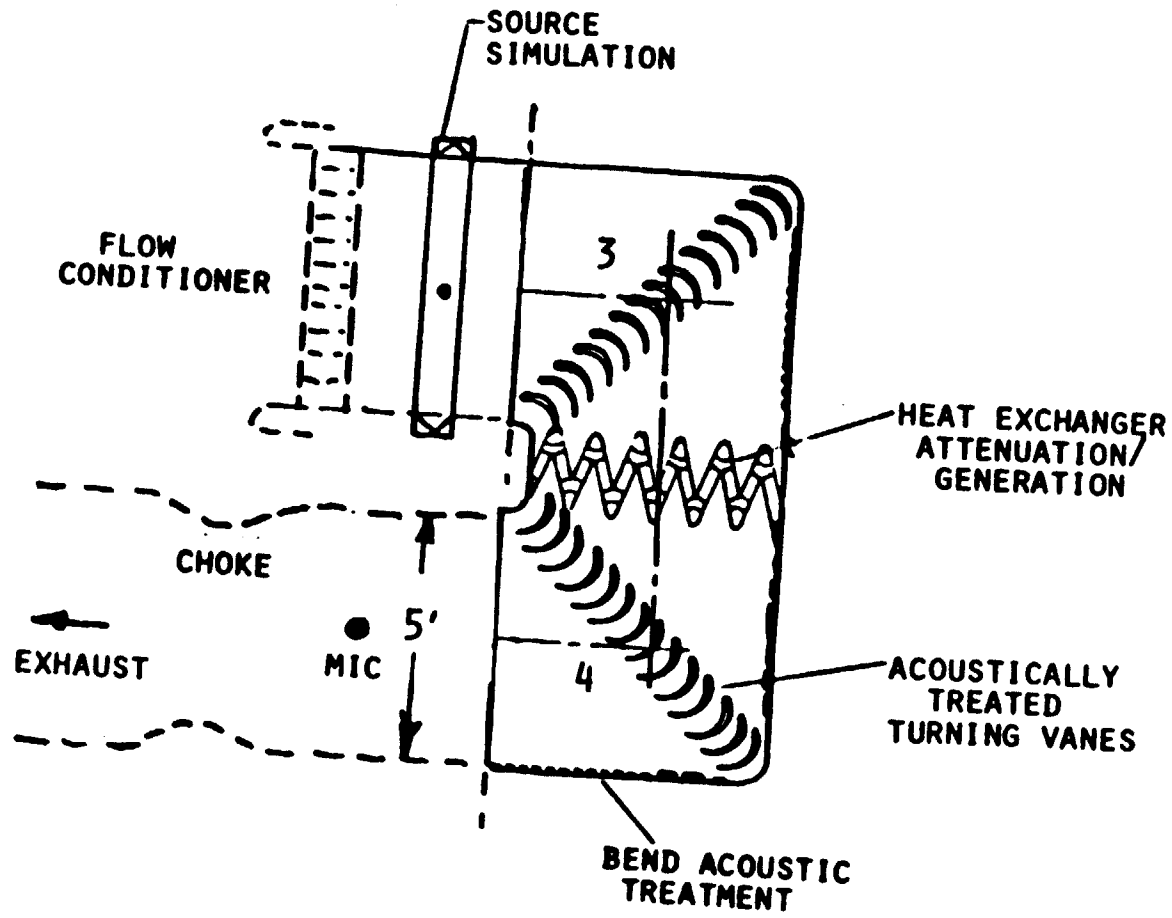
### 2.5.3.1.2 LOW SPEED LEG

NOMINAL 10% SCALE



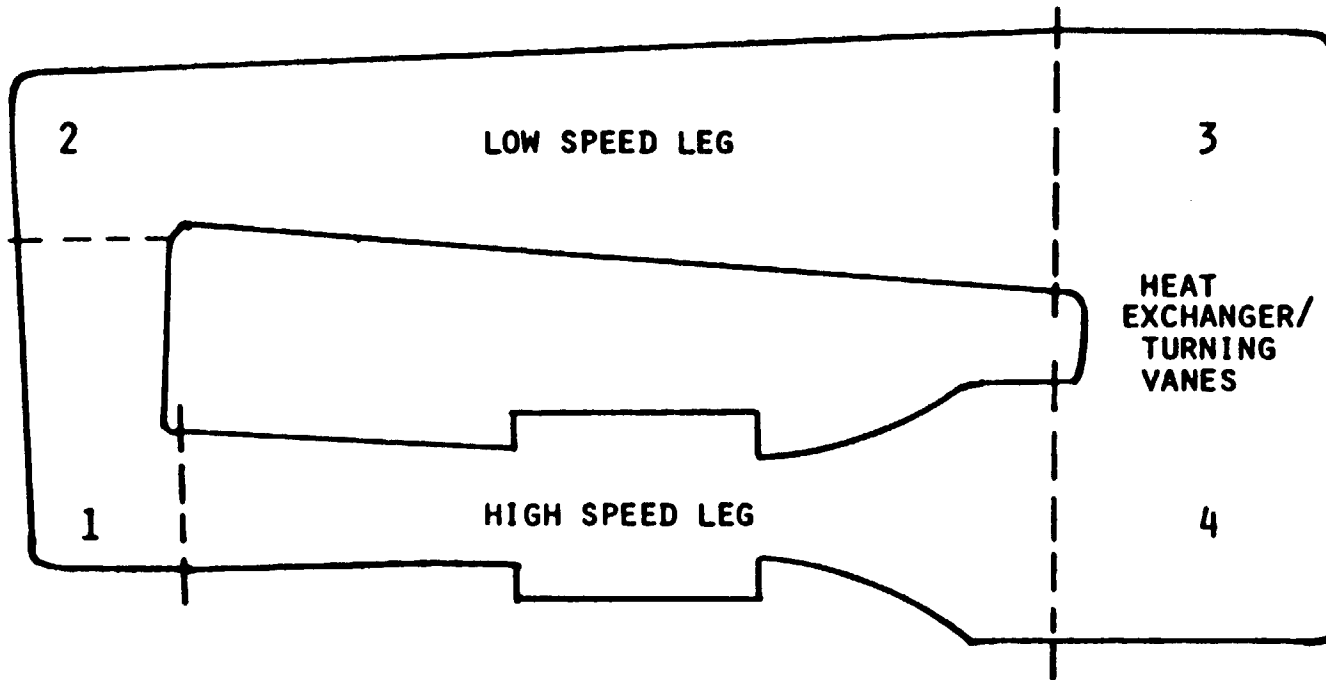
### 2.5.3.1.3 HEAT EXCHANGER/TURNING VANES

NOMINAL 10% SCALE



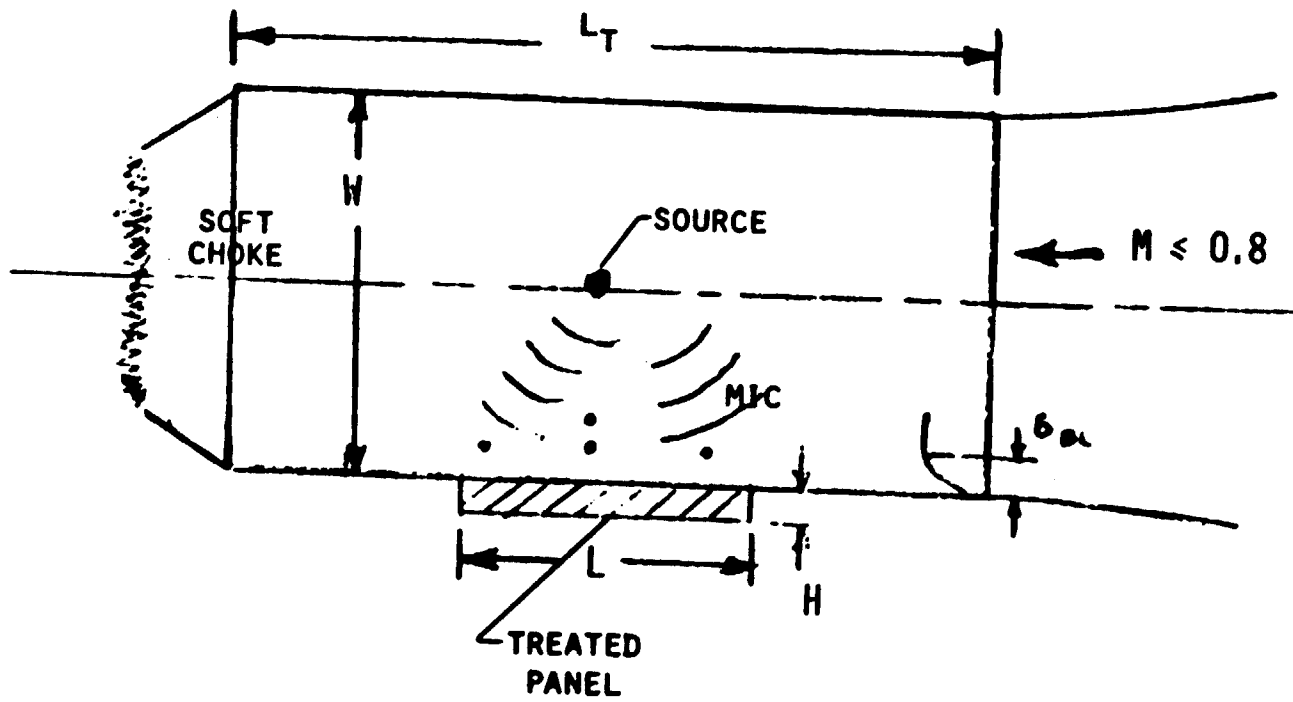
2.5.3.1.4 TUNNEL LOOP

NOMINAL SCALE 10%



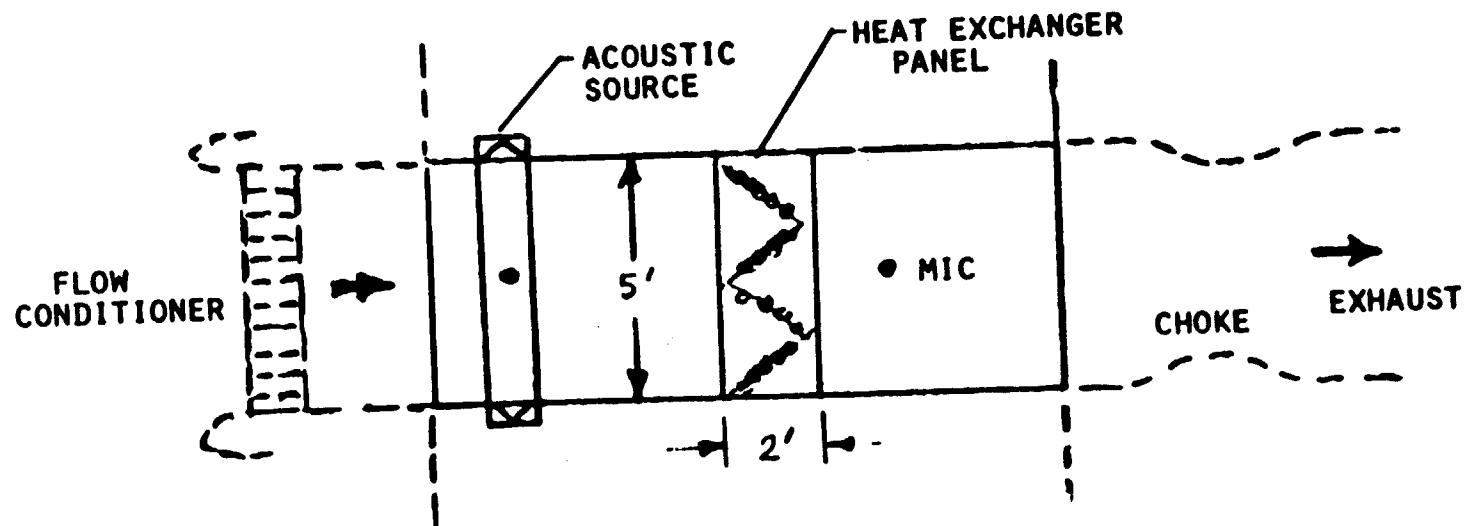
### 2.5.3.2.1 ACOUSTIC TREATMENT

#### FULL SCALE SEGMENT IN WIND TUNNEL



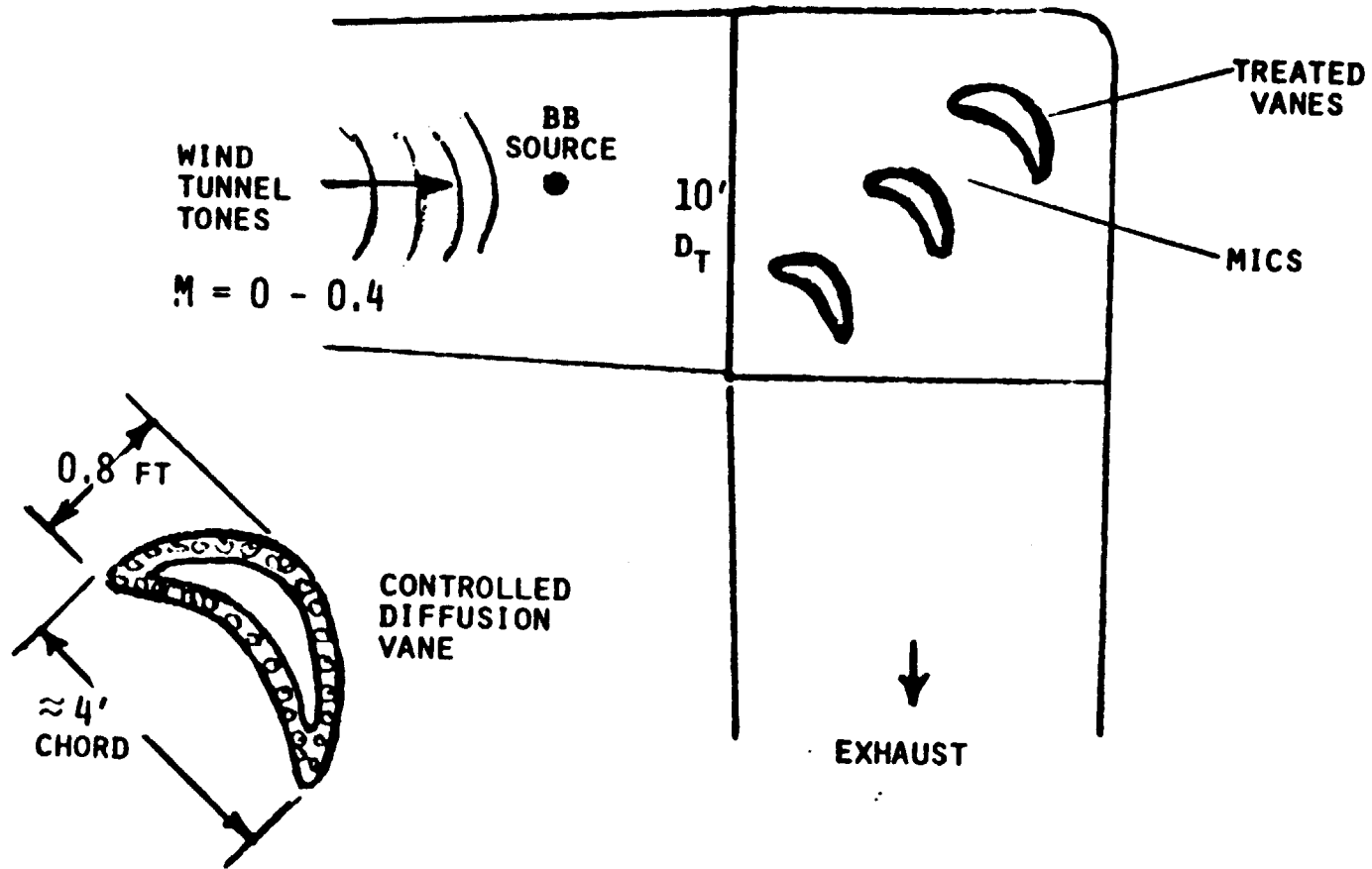
### 2.5.3.2.2 HEAT EXCHANGER

#### FULL SCALE SEGMENT



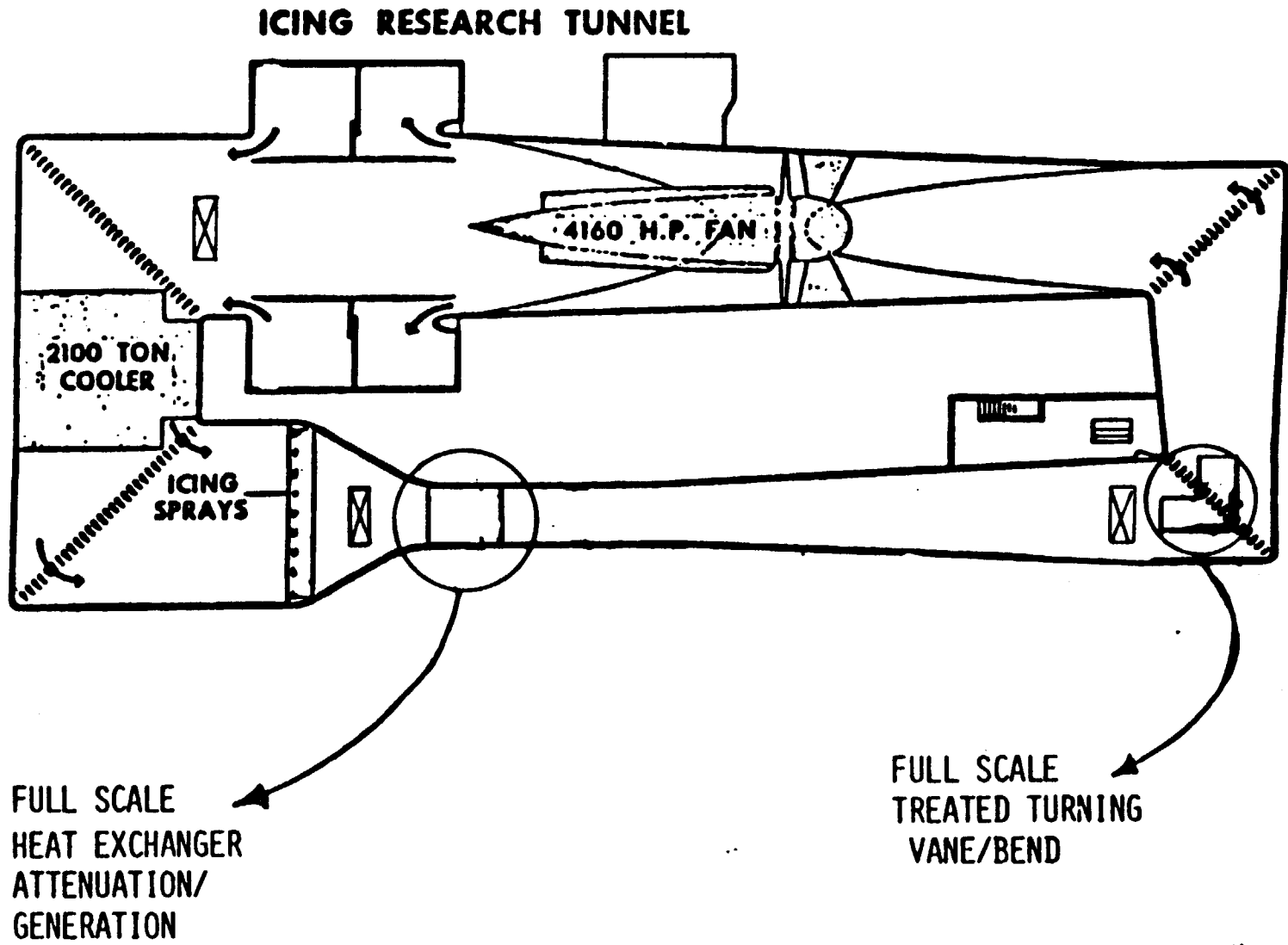
### 2.5.3.2.3 TREATED TURNING VANES

#### FULL SCALE SEGMENT





FULL SCALE HEAT EXCHANGER  
AND TURNING VANE ACOUSTIC TESTS



## KEY TECHNICAL ISSUES IDENTIFIED

### ACOUSTIC TREATMENT

- o HIGH ABSORPTION AT HIGH MACH NUMBER WITH A WALL BOUNDARY LAYER
- o LOW FREQUENCY ABSORPTION WITH MINIMUM TREATMENT THICKNESS
- o ICING COMPATIBILITY/PERMANENT INSTALLATION

### BACKGROUND NOISE

- o FAN TONE REDUCTION
- o INTERDEPENDENCE OF NOISE AND FLOW QUALITY