NAVSEA
NAVAL SEA SYSTEMS COMMAND

Human Systems Integration Directorate

Shipboard Noise Control

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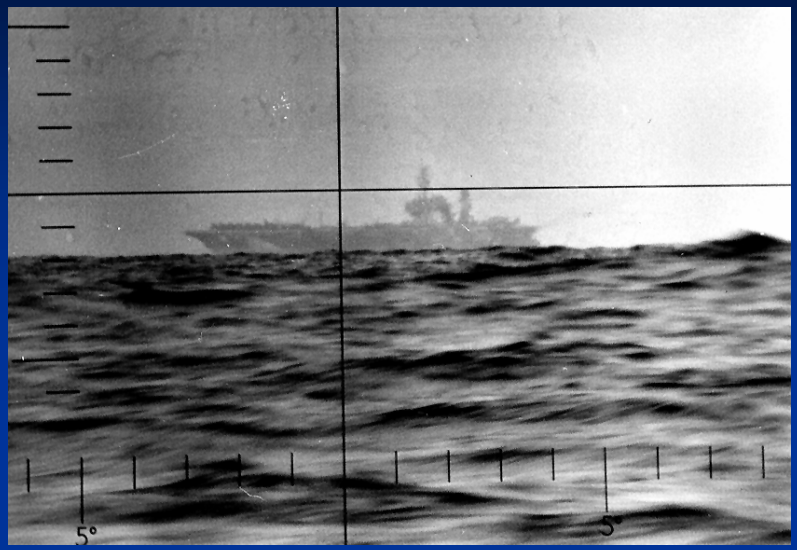
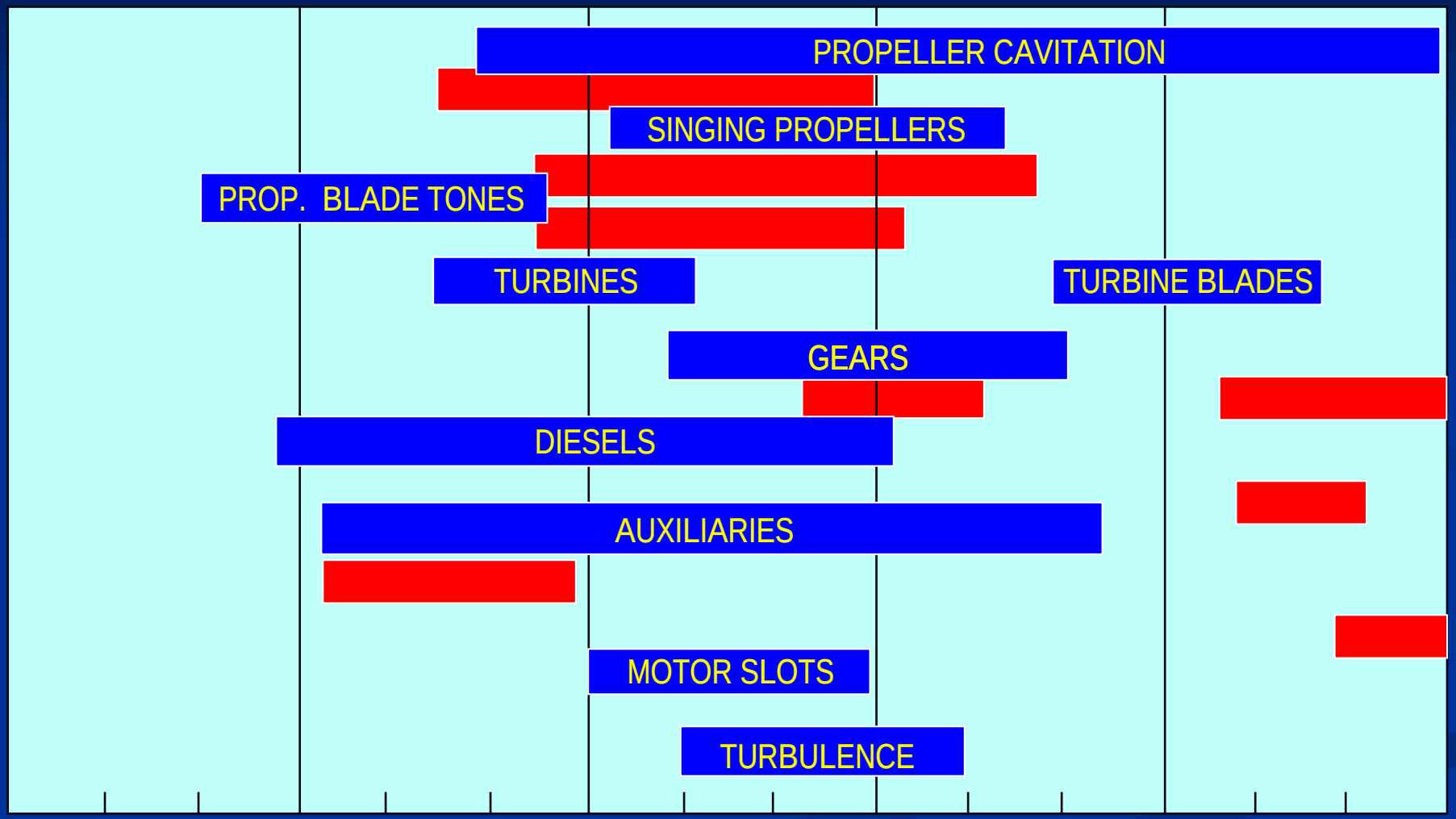
Noise Mitigation: Importance

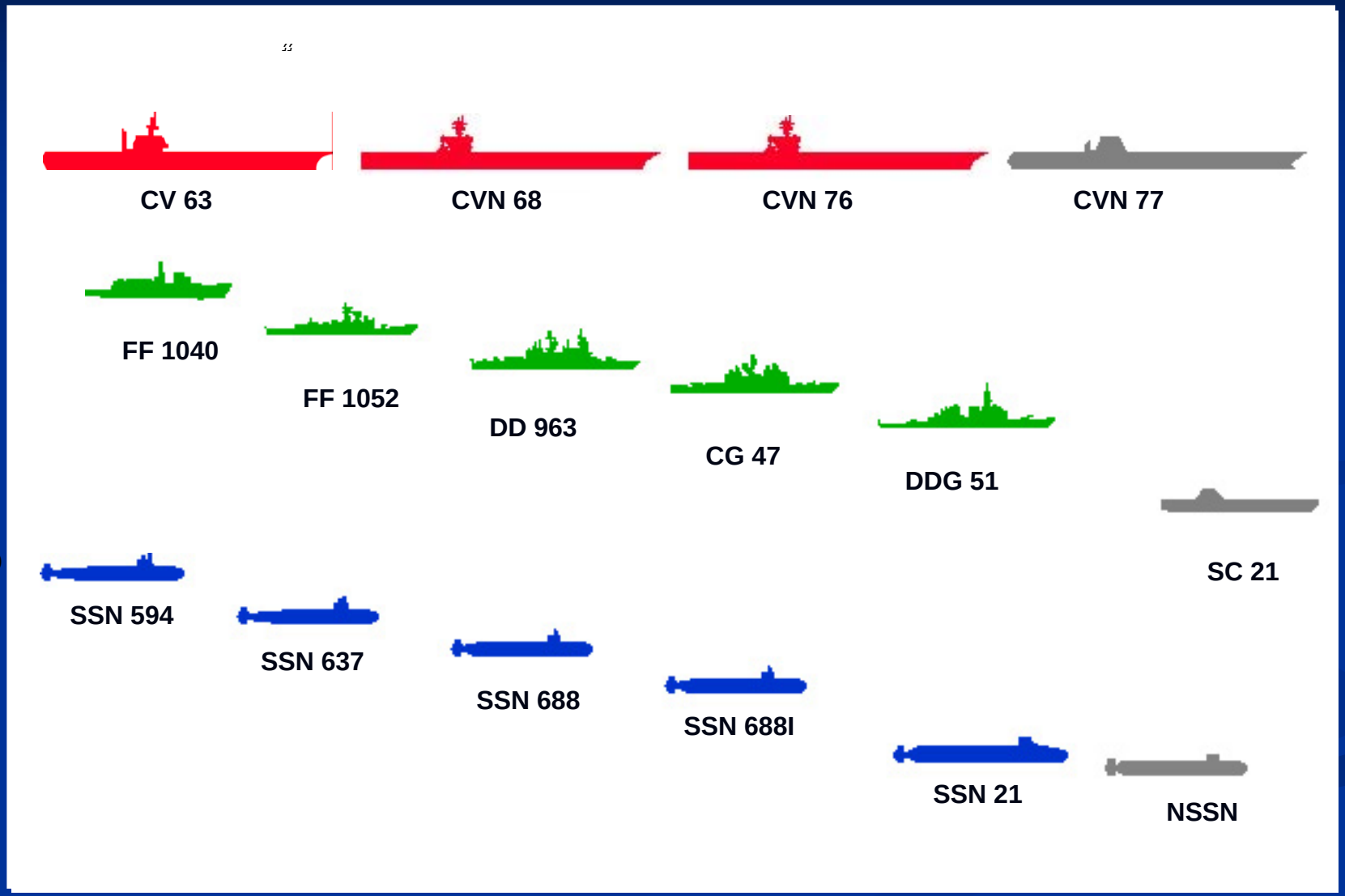


Frequency Distribution of Noise Sources

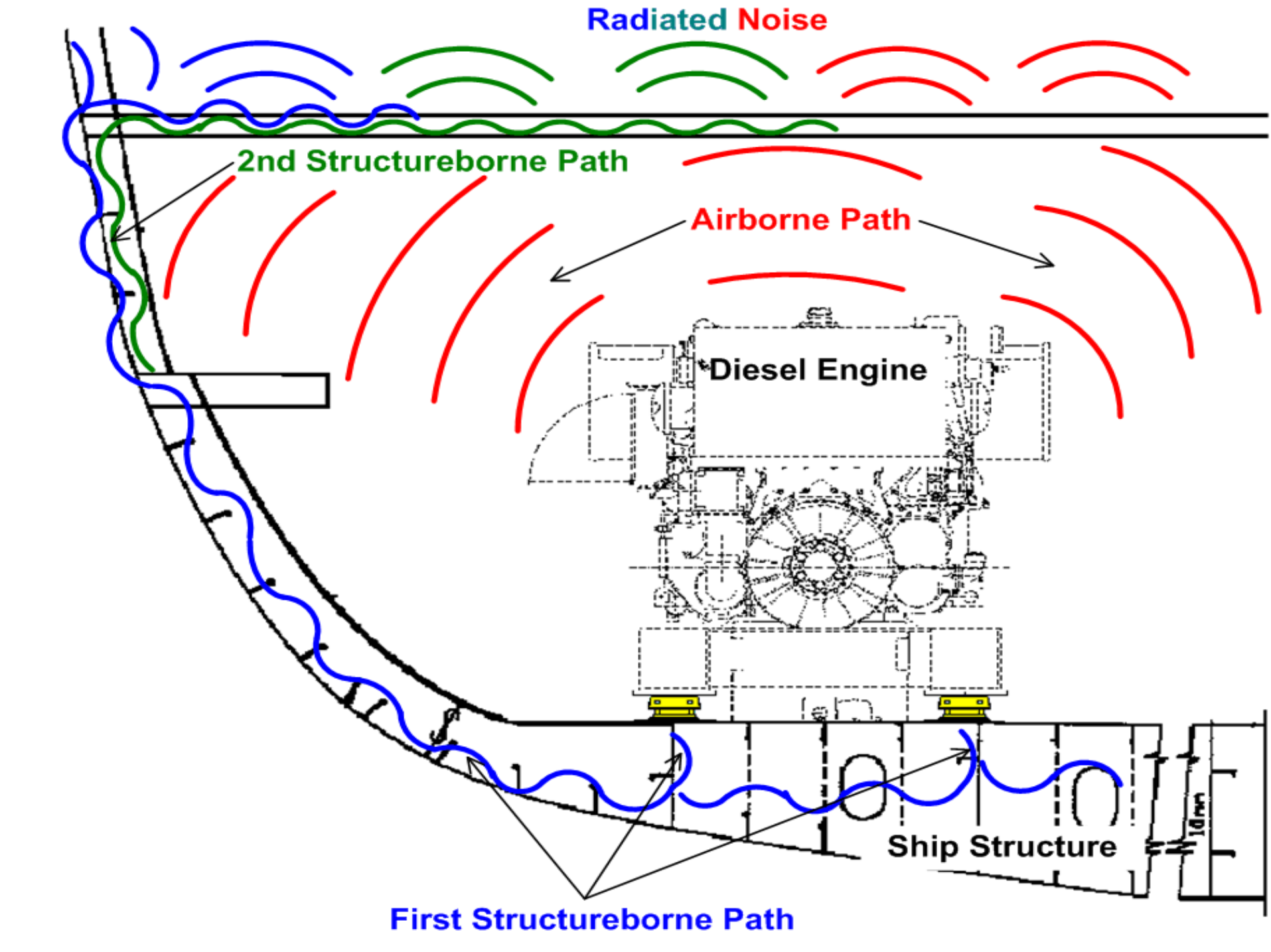


Frequency

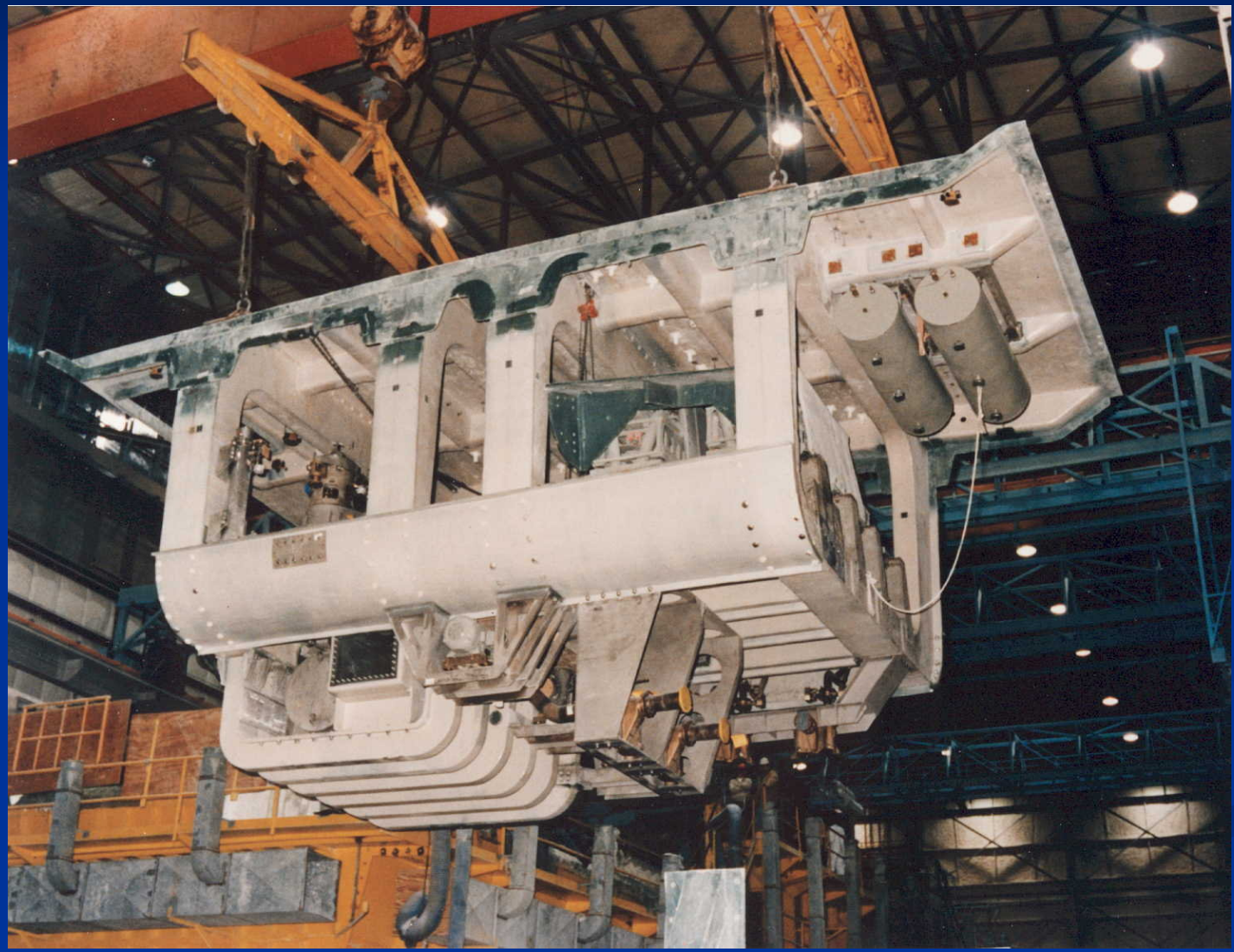
Previous Quieting Investments



Ref: Yankaskas SEA O5T Nov'96


Radiated Noise
2nd Structureborne Path
Airborne Path
Diesel Engine
Ship Structure
First Structureborne Path

AMR Cradle



Integrated Ship Specification: T-AGOS 23

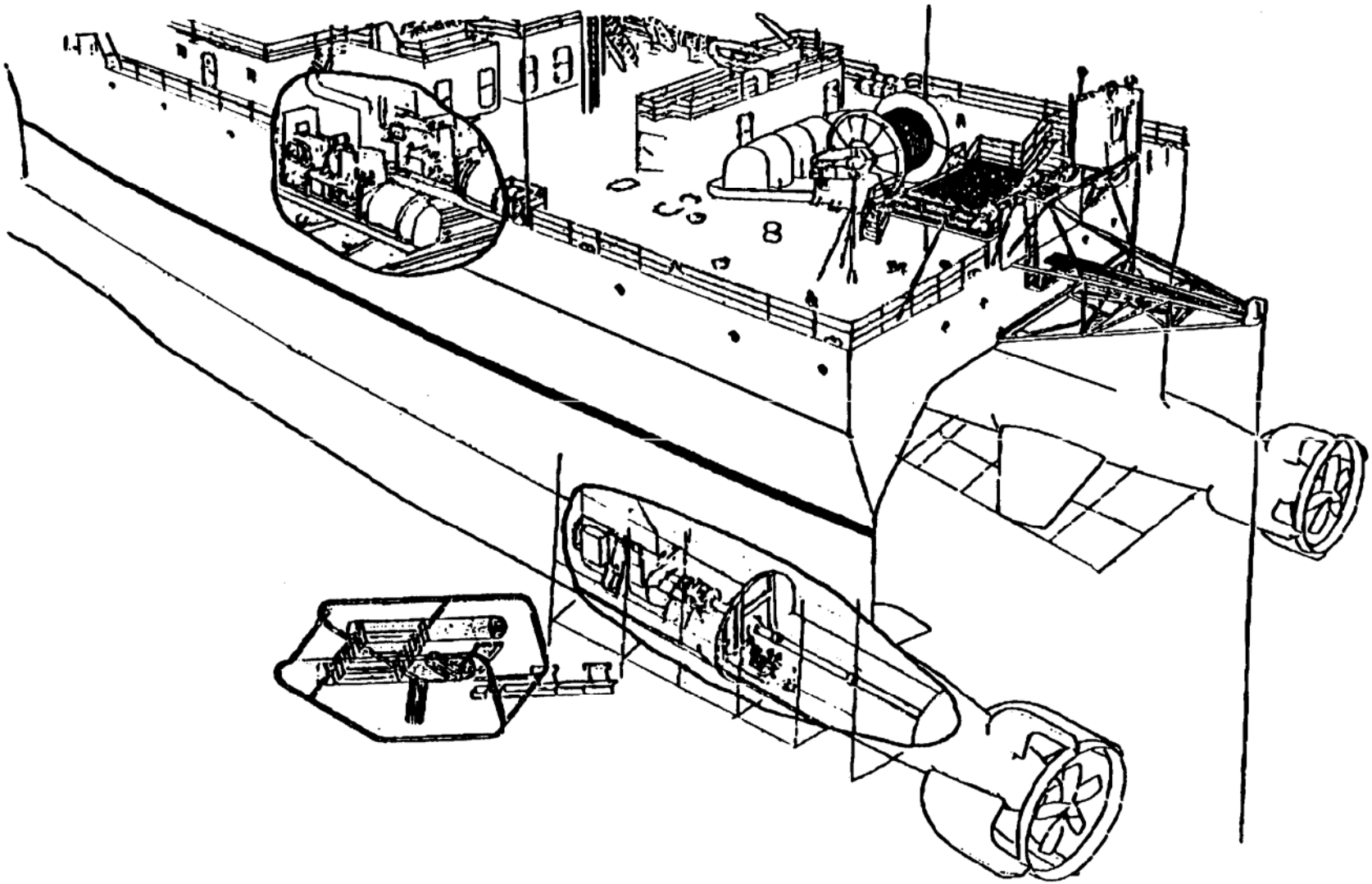


Figure 1. T-AGOS 20 Dockside Acoustic Intensity Evaluation Set Up

A= FOTP SKID LOCATION
B= SWP SKID LOCATION
X= STRAINER LOCATION

PLAN VIEW (looking down)
OF PORT SUBMERGED HULL

RUN 2000-1

168 Hz - 168 Hz

BASELINE LEVEL 48 Db

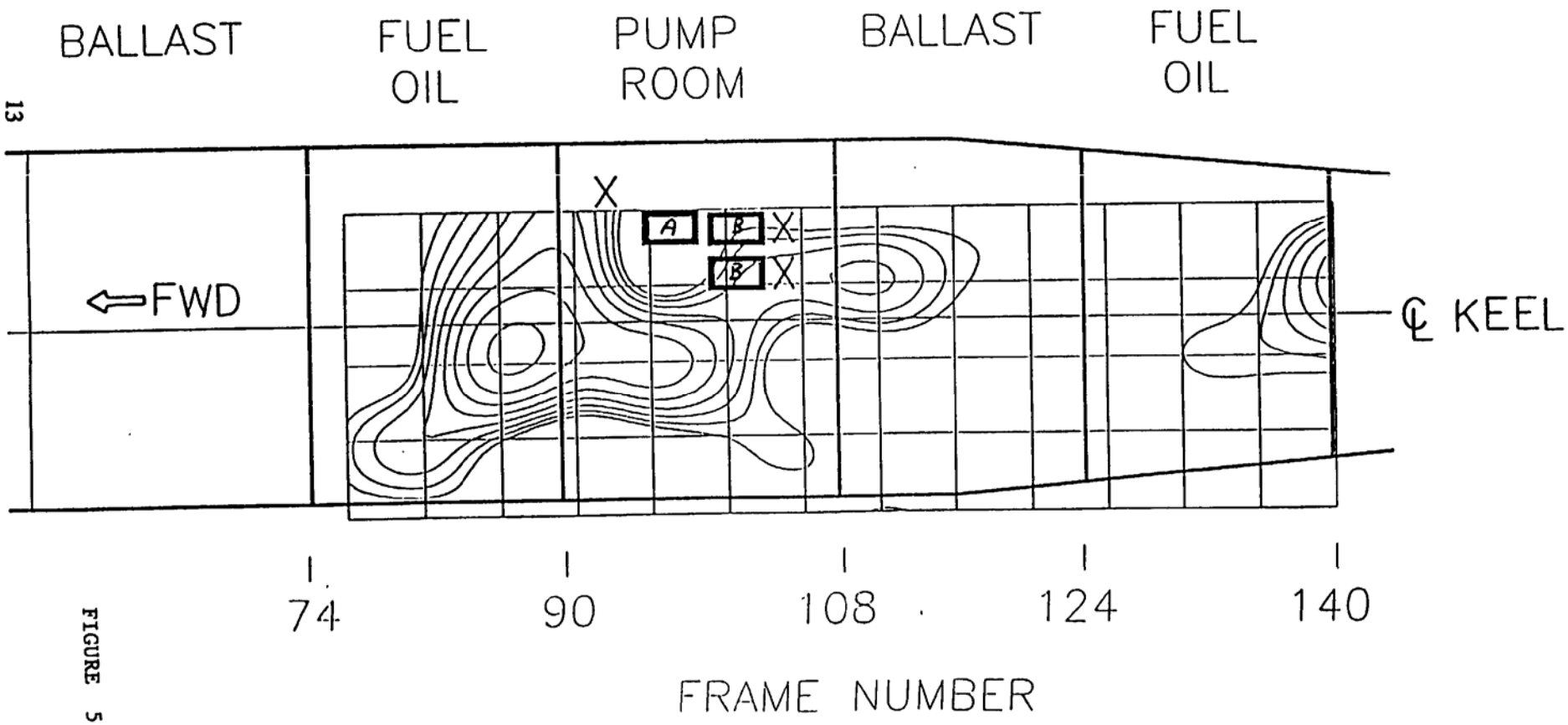
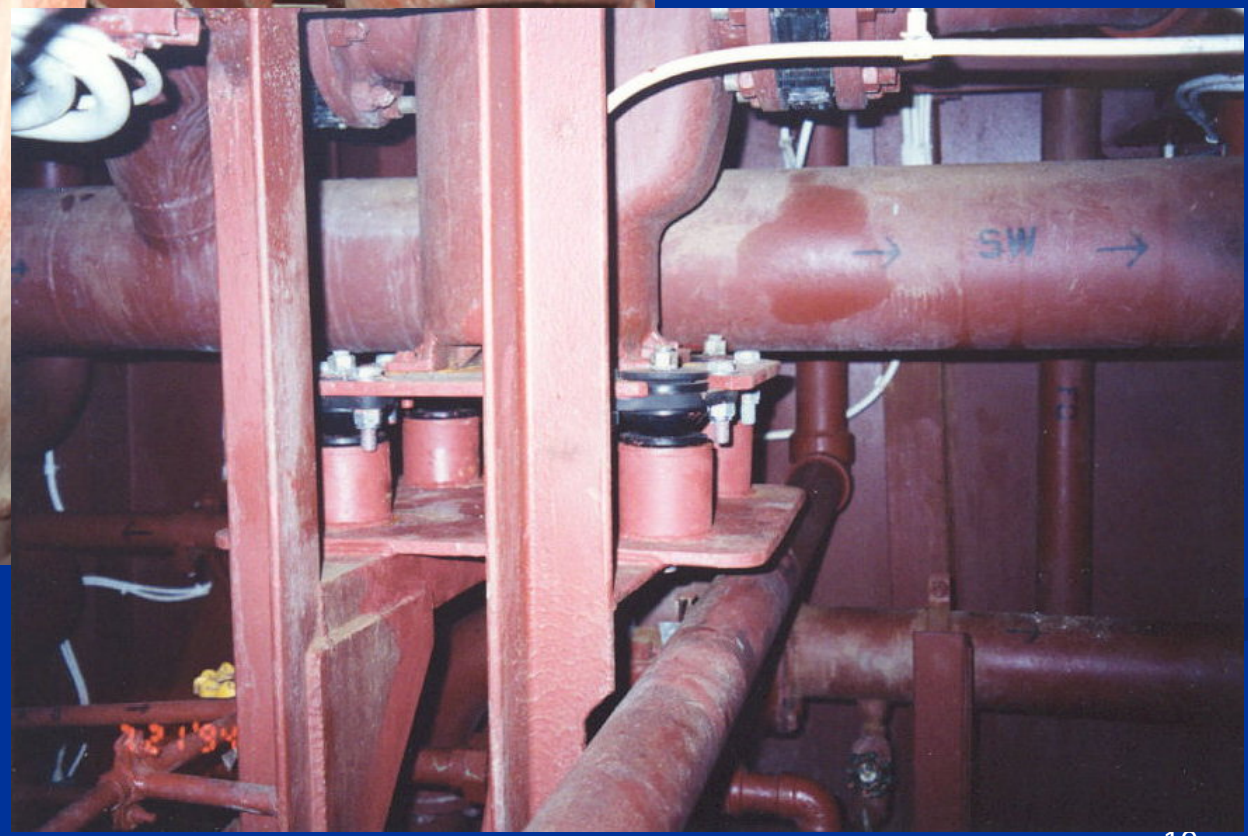


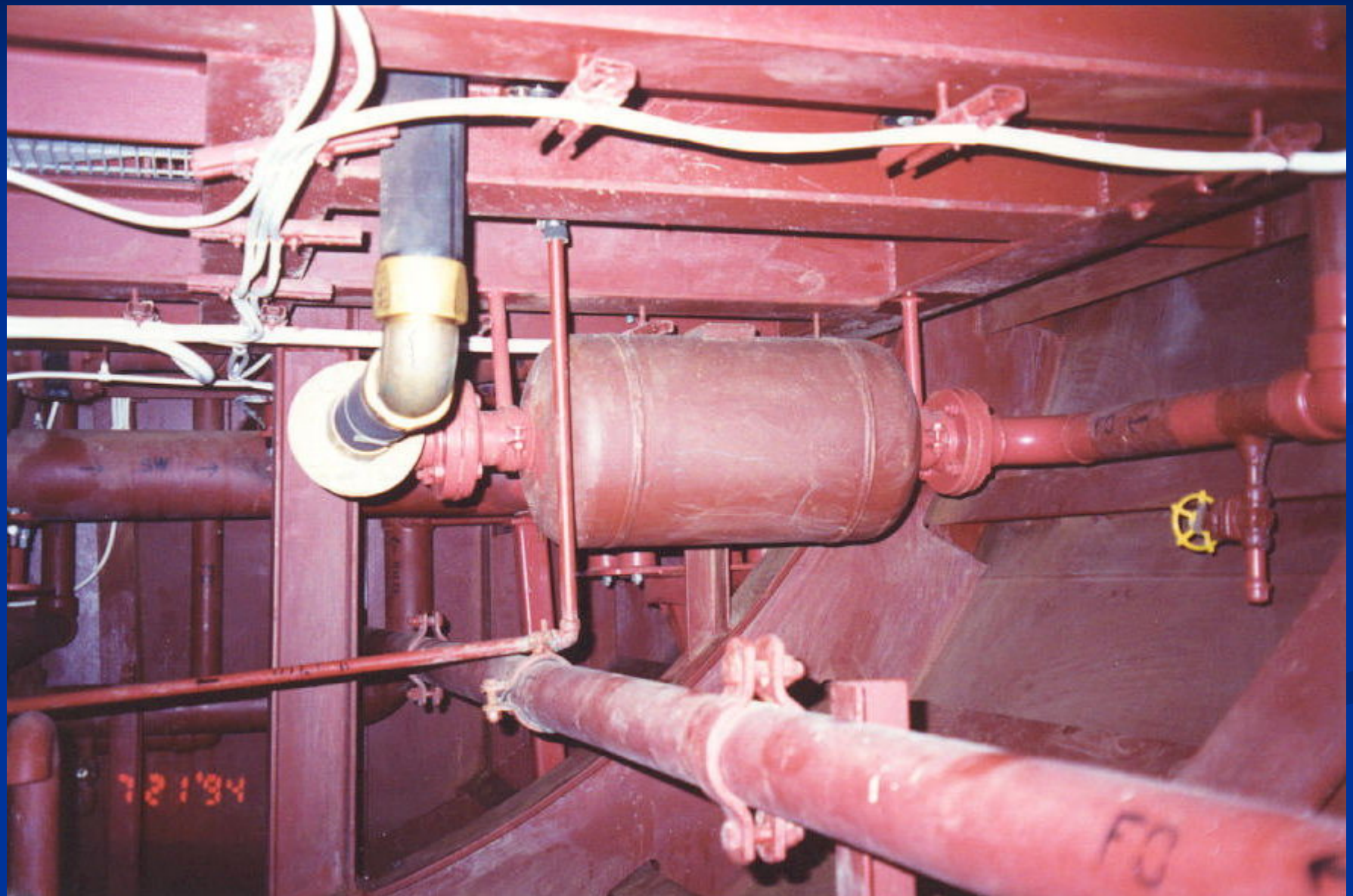
FIGURE 5

Piping System Isolation



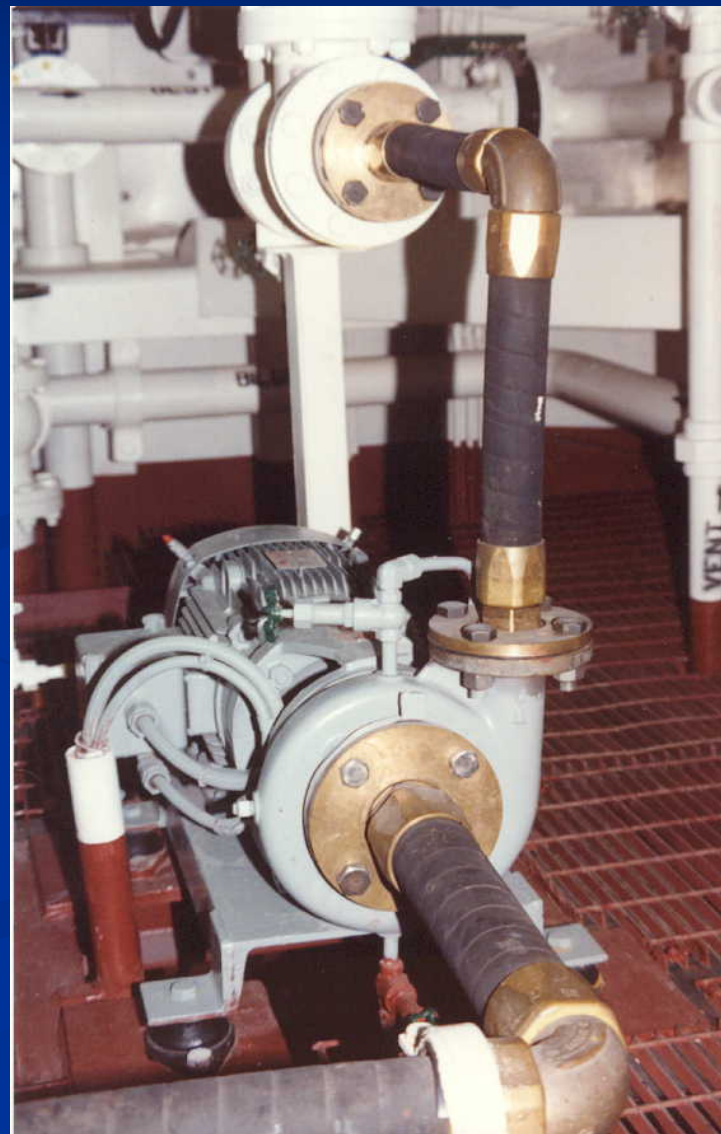
Mount Cost: ~$40

Fuel Oil Pump Isolation and Acoustic Filter

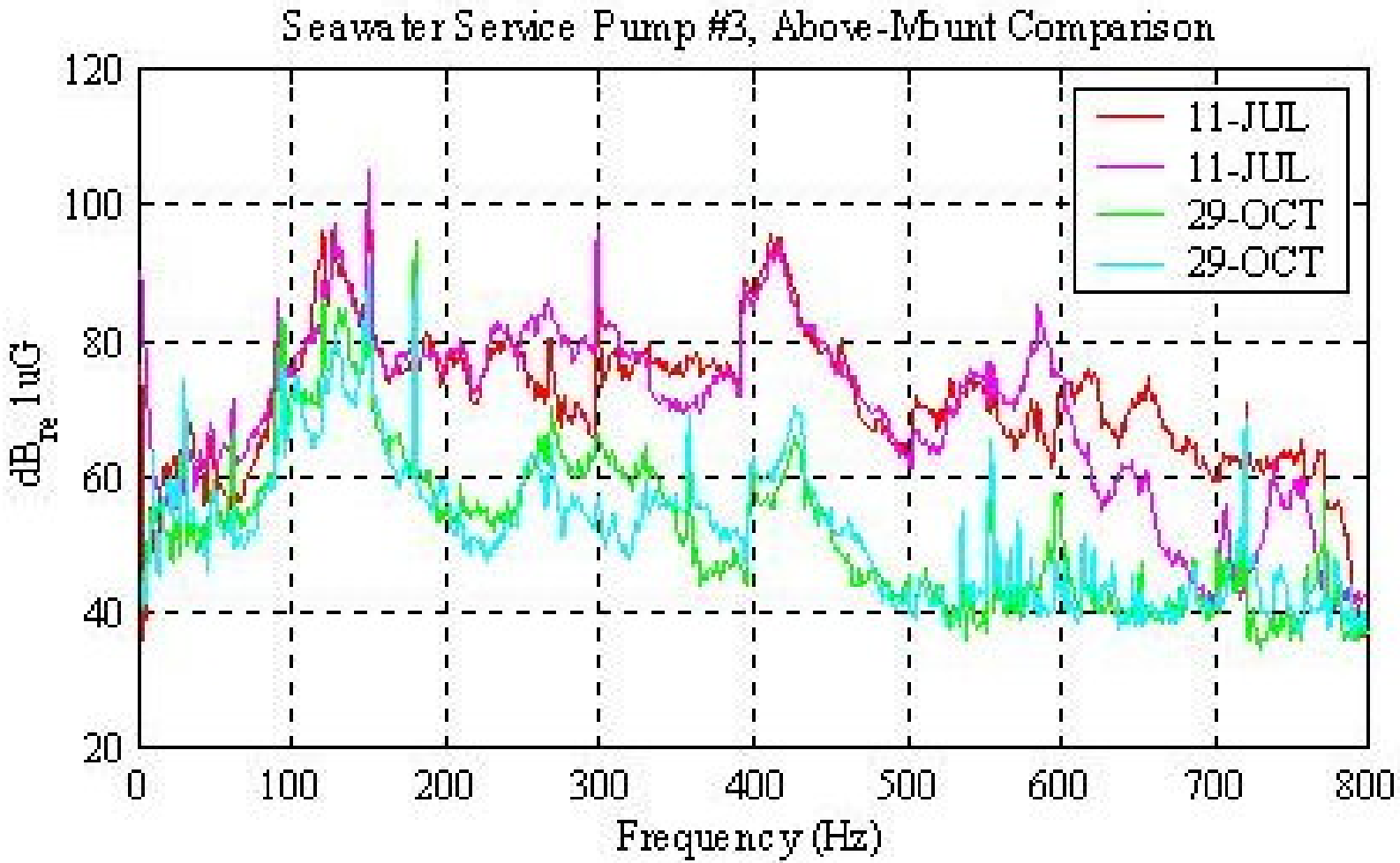


Piping Systems

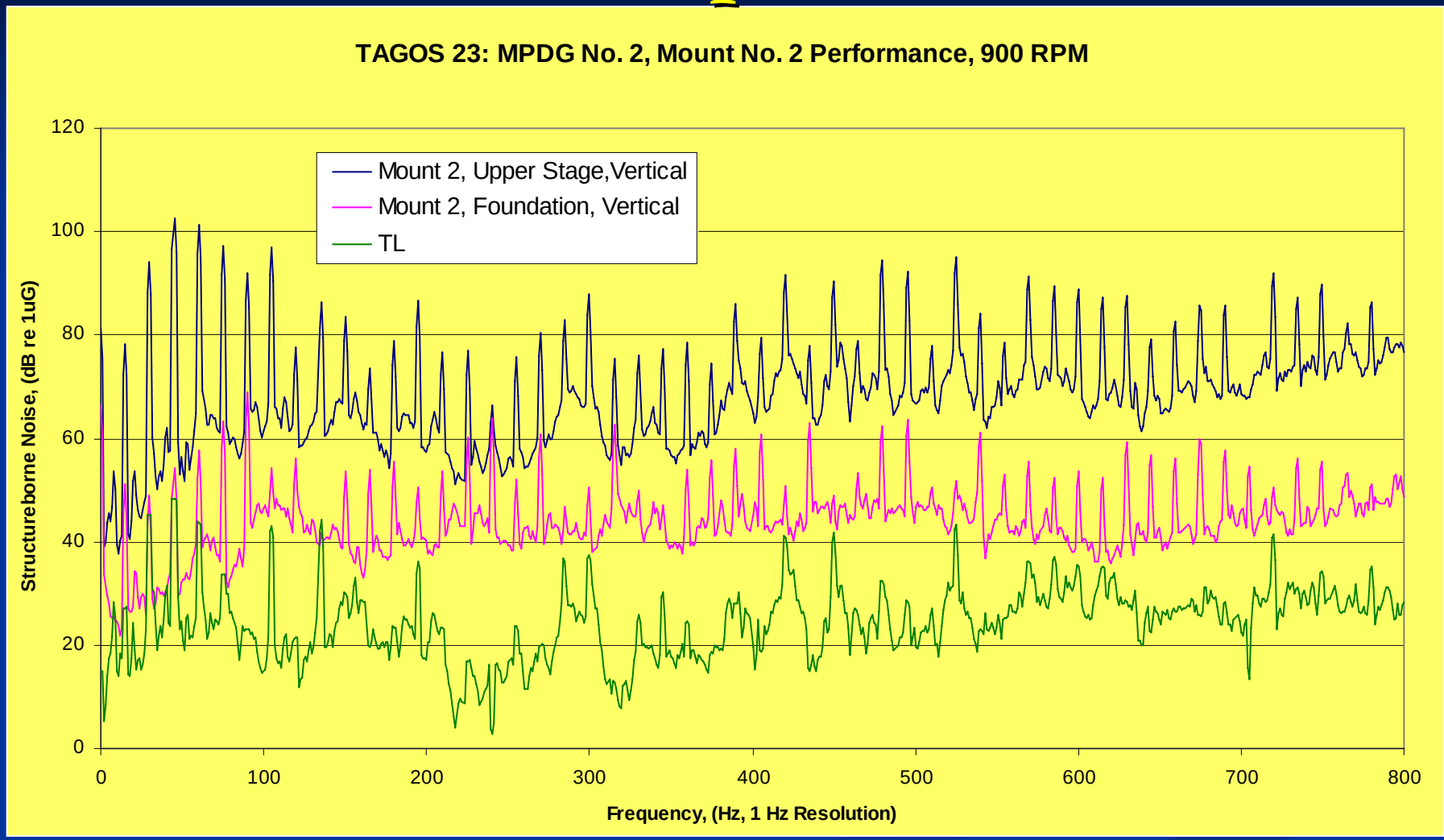
Piping Systems: Dog Legs



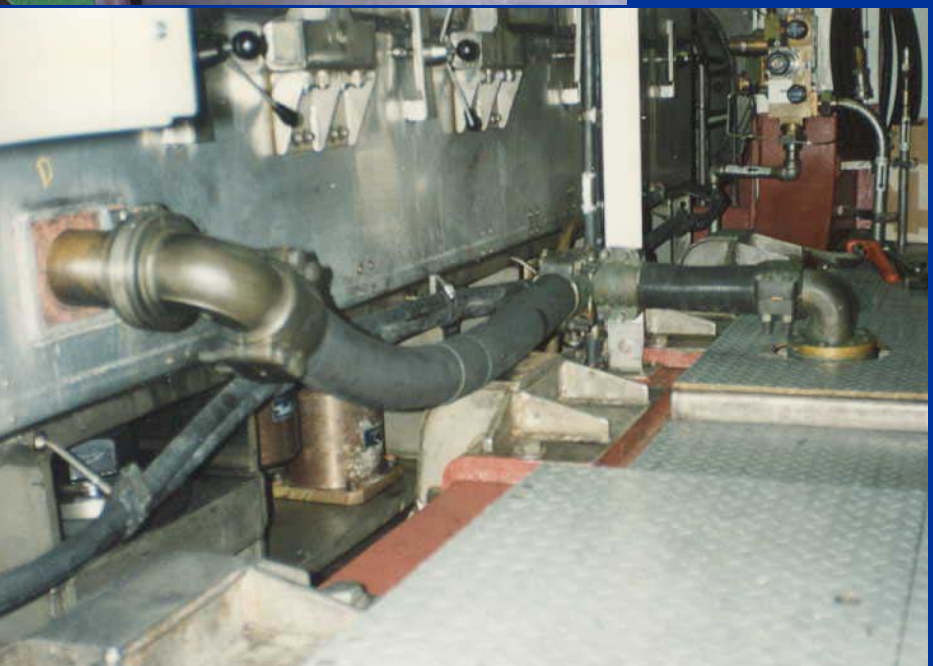
Quiet Pumps


Seawater Service Pump #3, Above-Mount Comparison
11-JUL
11-JUL
29-OCT
29-OCT
dB re 1uG
Frequency (Hz)
120
100
80
60
40
20
0
100
200
300
400
500
600
700
800

Main Diesel Propulsion Isolation



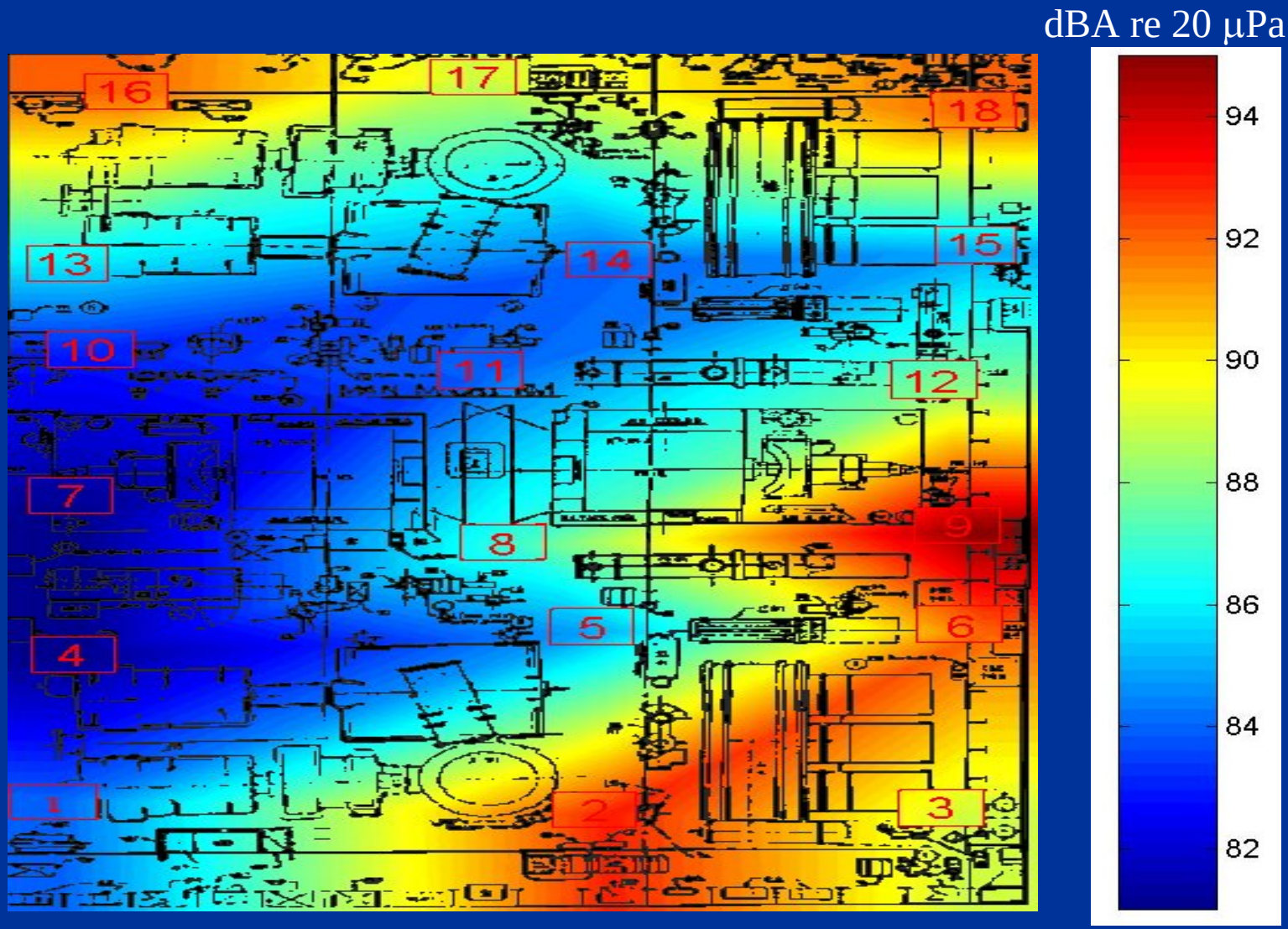
Mounting Deficiencies



Pipe Hangers

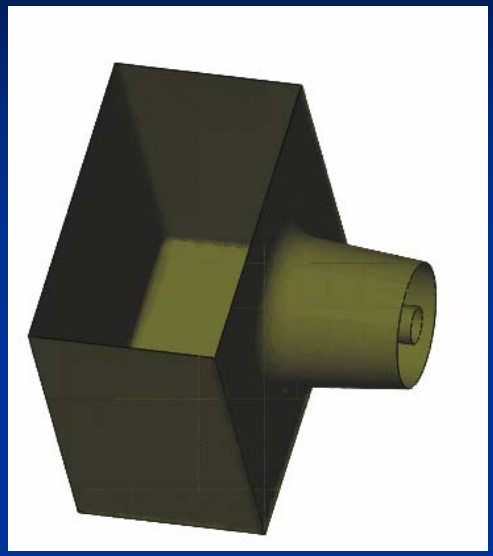
HVAC

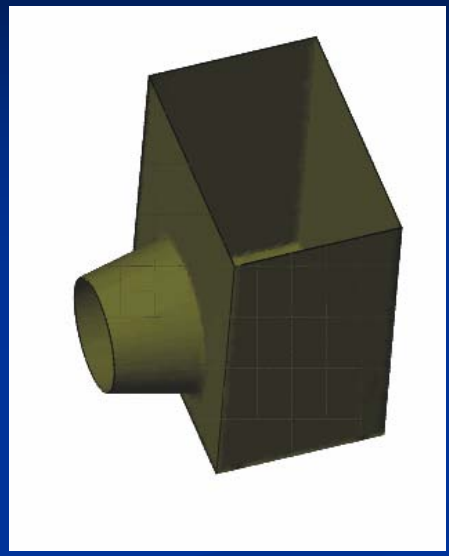
MMR #2, Upper Level, Dockside Ventilation High Speed

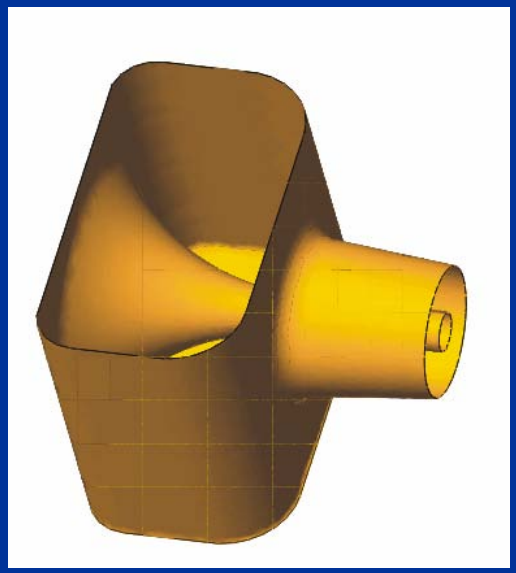


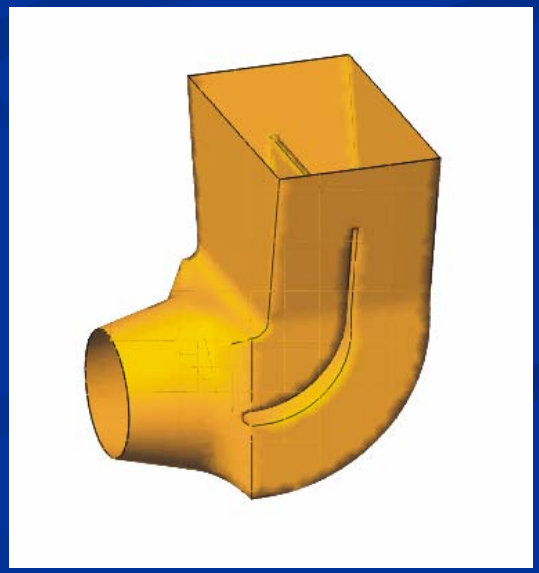
Ref: NNS&DD

Flow Control

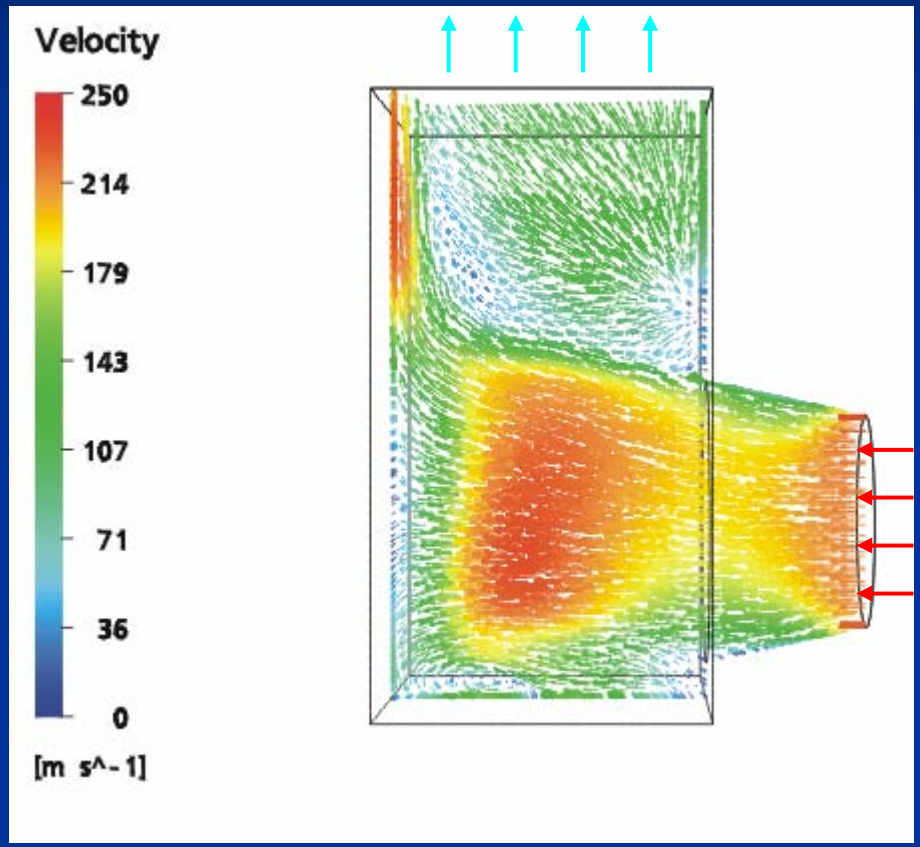


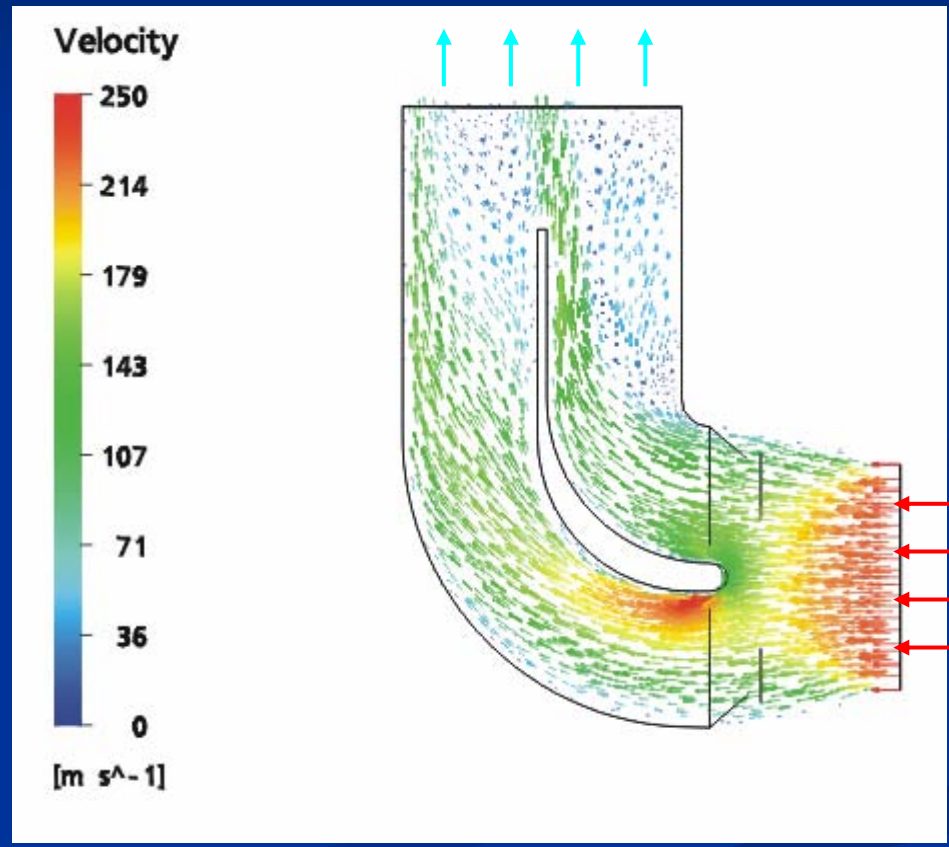




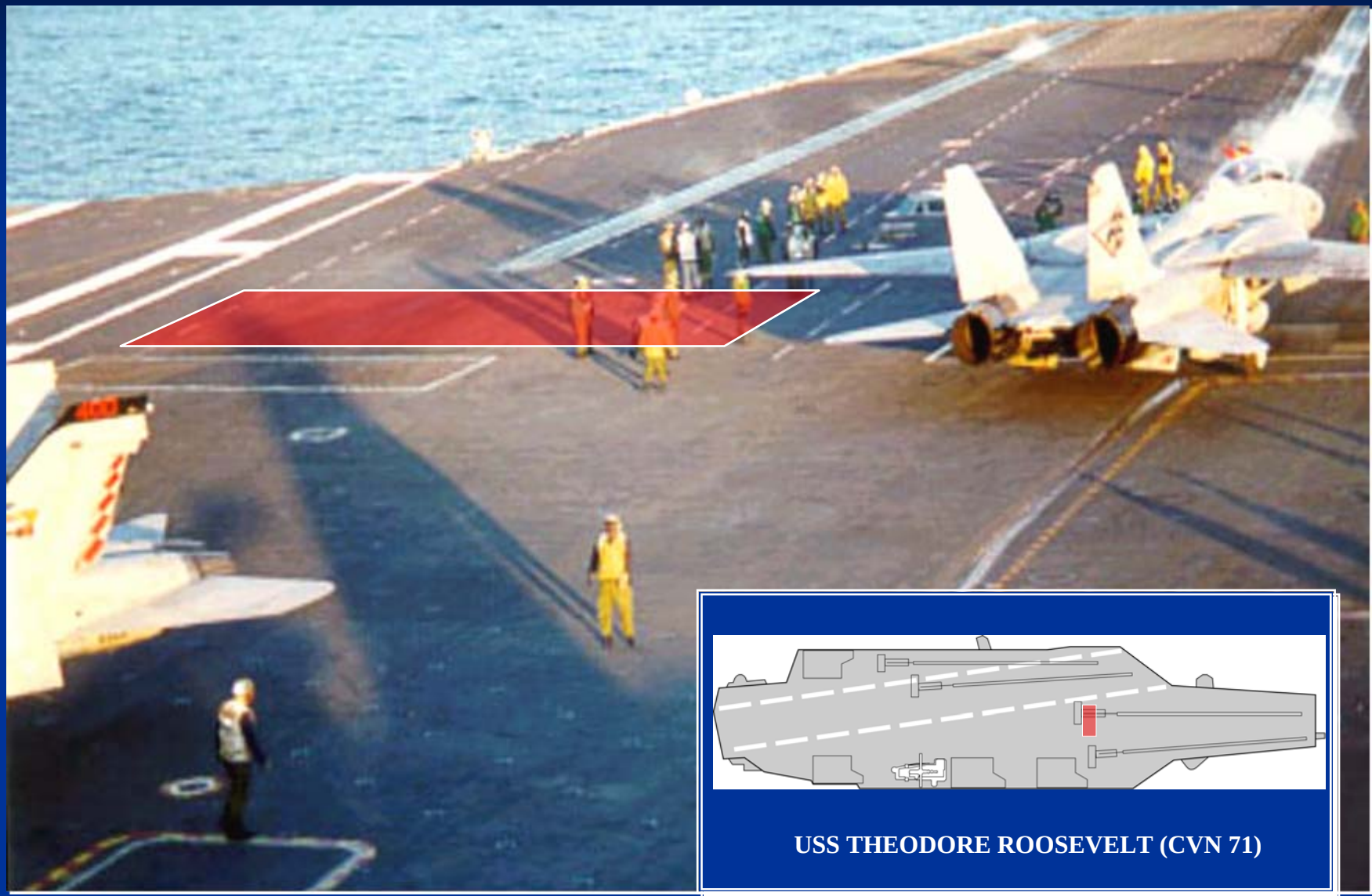


Flow Control





Solutions: “12 Pack” Testbed



USS THEODORE ROOSEVELT (CVN 71)

Solutions: JBD BIMORF Muffler

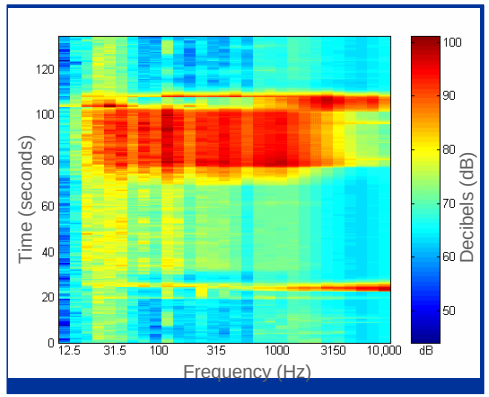
JBD Bimorf Muffler

4 BIMORF mufflers required per JBD

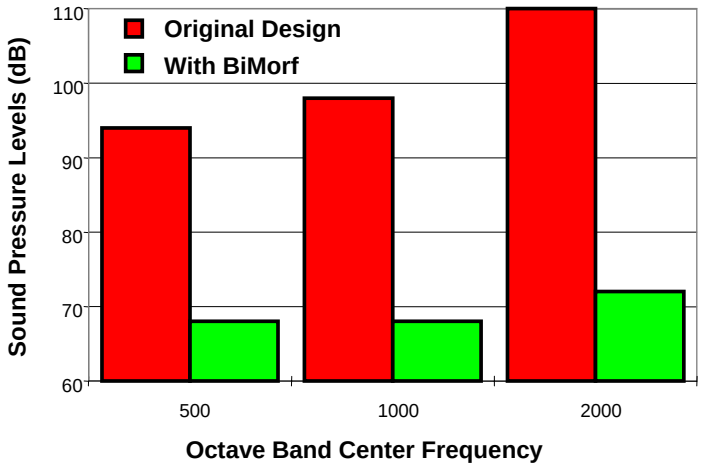
JBD Movement
Waterbrake
Aircraft Power-up

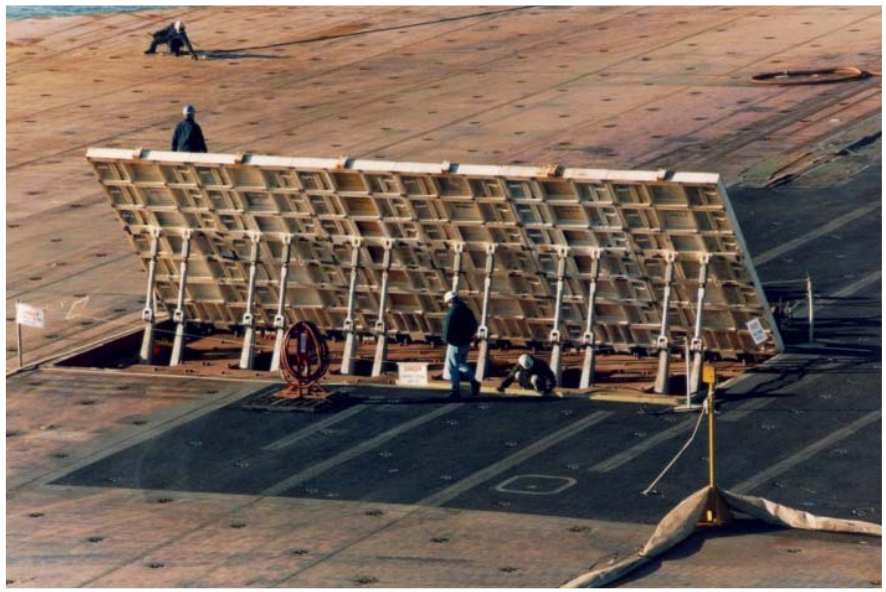
JBD Movement

F-18 Launch



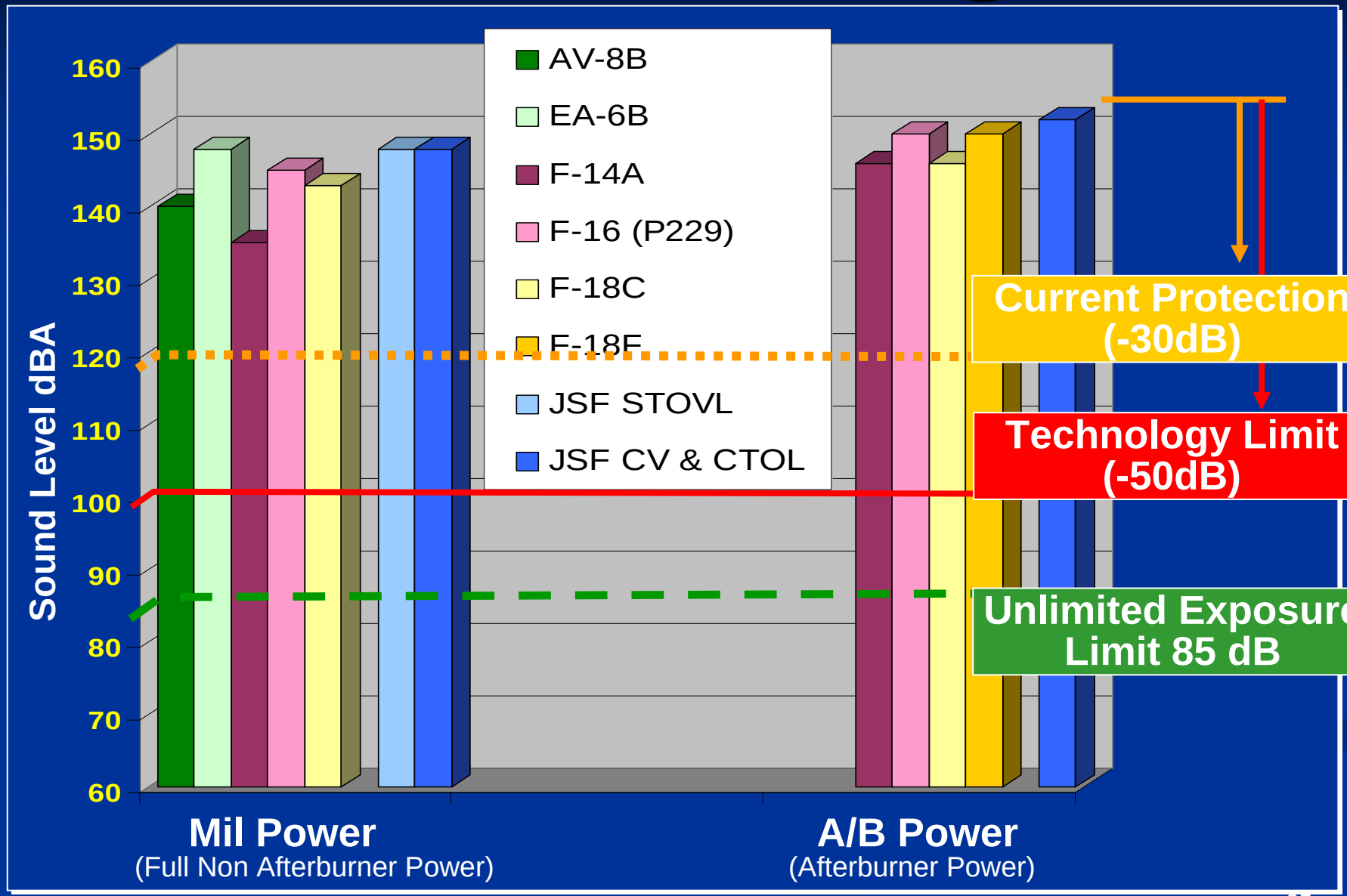
Airborne Noise Levels - CVN 74





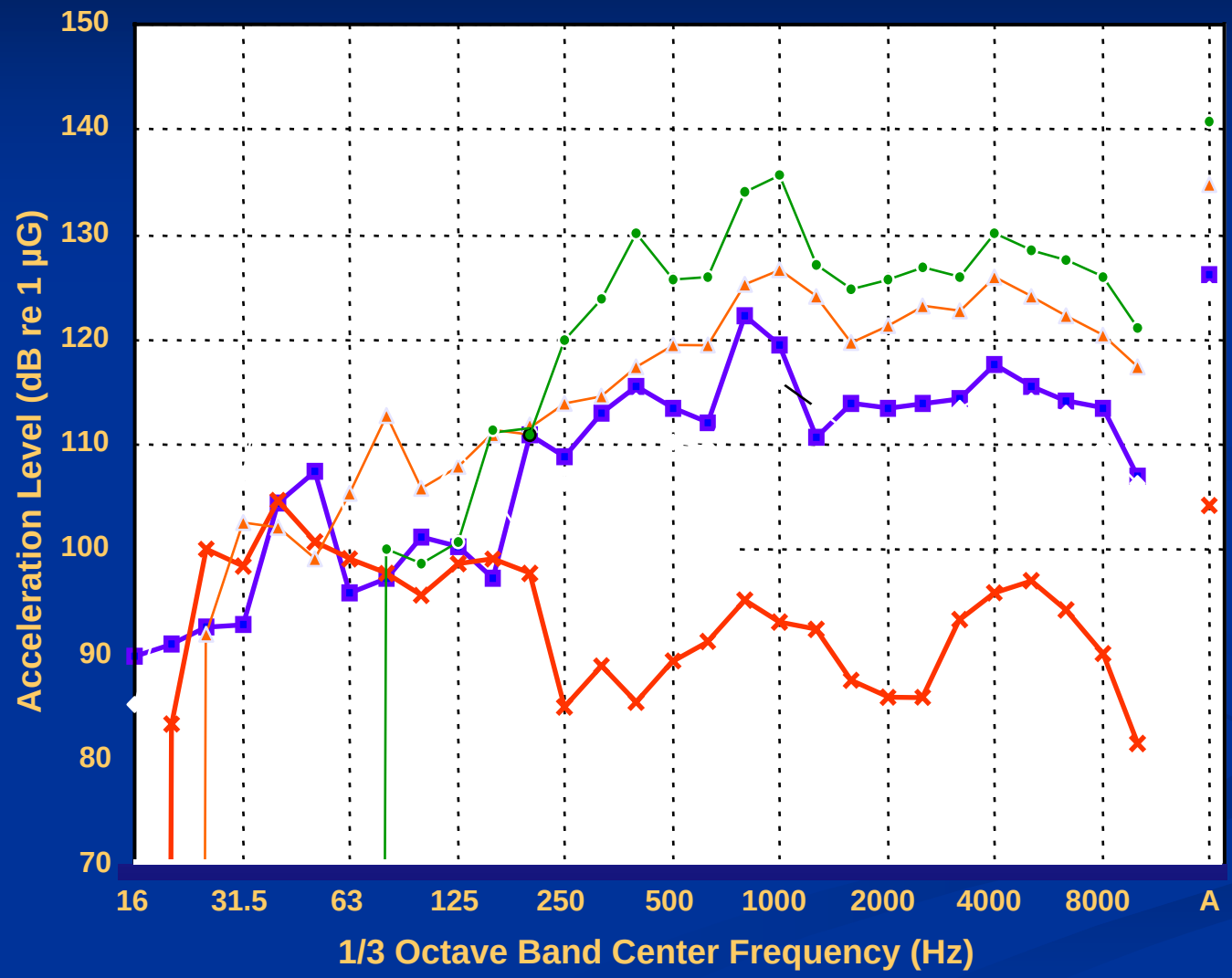
Ref: NNS&DD

Aircraft Noise Levels @ 30 ft.

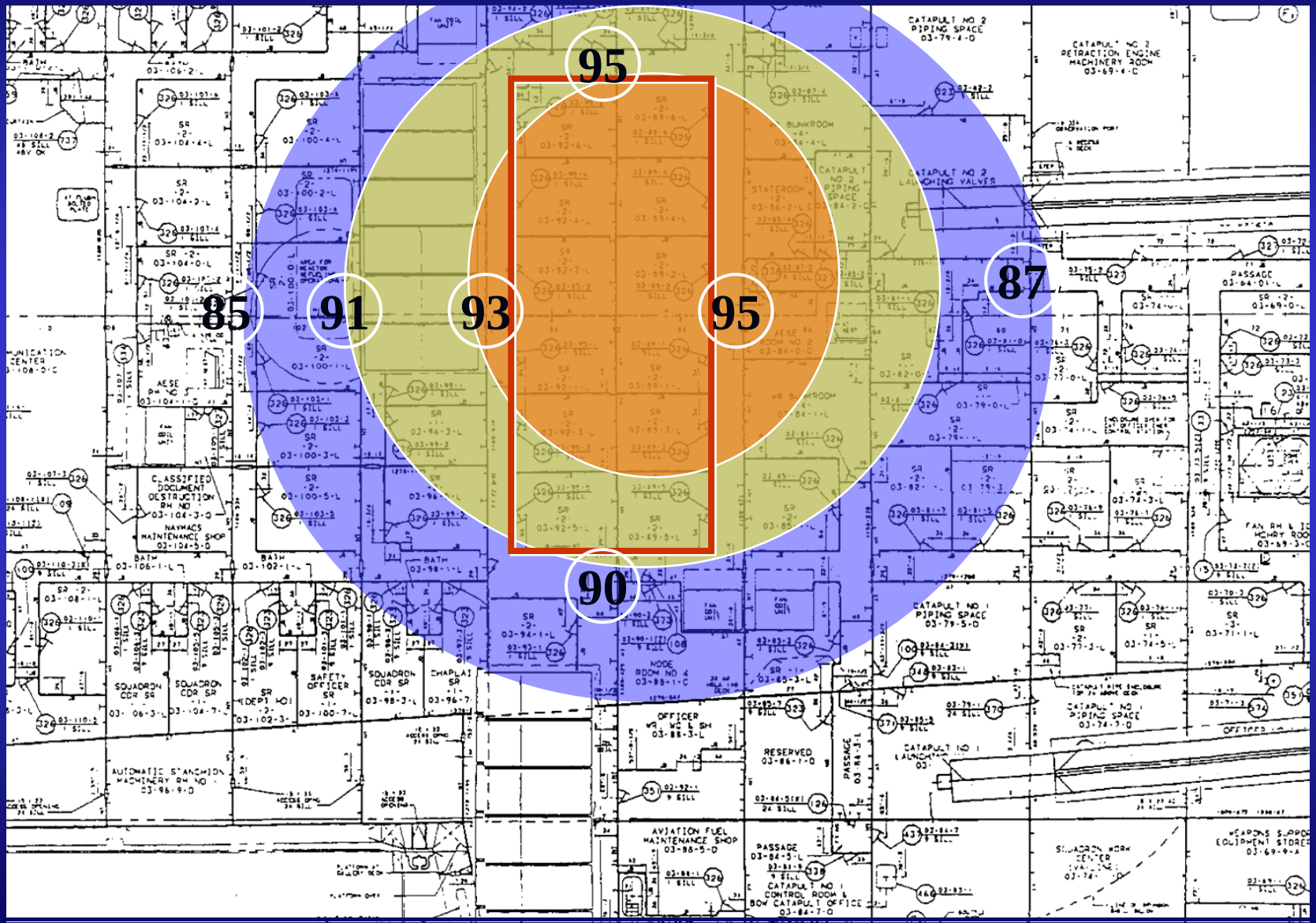


Ref: JSF, OASN S&S

CVN Launch Ops: Structural Vibration in Alternate Training Room (03–128–14–L)



“12 Pack” Sound Level Measurements



Solutions: "12 Pack" Testbed

USS THEODORE ROOSEVELT (CVN 71)

NAVSEA/BuMed Sponsored

12 Pack is Representative of 03 Level

- Control Spaces
- Several Treatment Options

Simultaneous Measurements

- 8 to 12 dB reduction achieved

Producibility

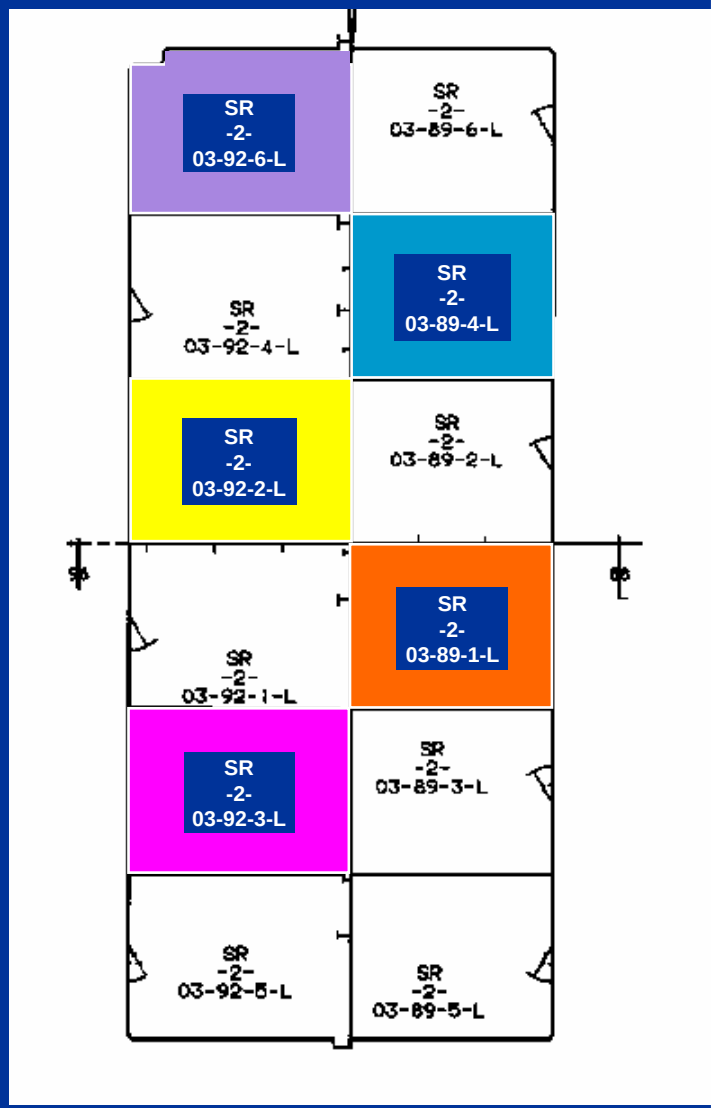
Laminated Sheet Metal

Conventional Insulation

TempCoat

StructoGard Acoustic Material

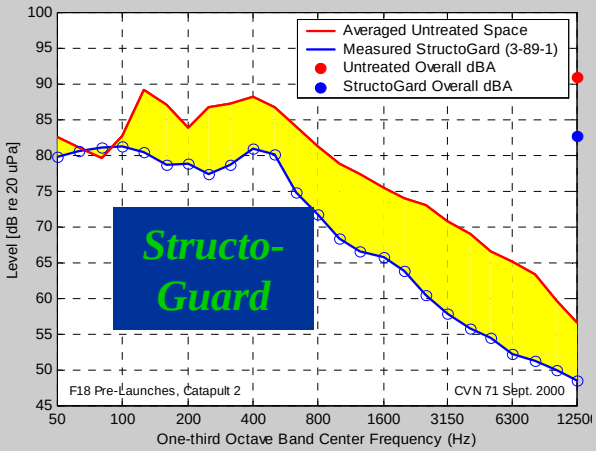
Integrated Joiner Bulkhead System

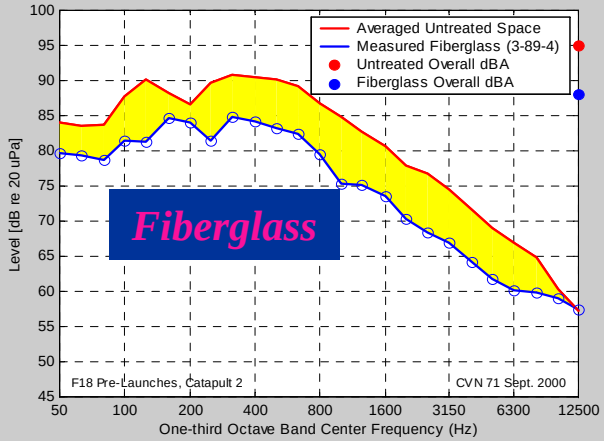


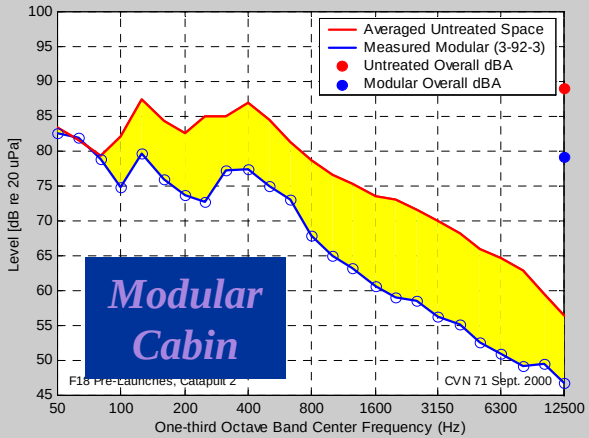
Ref: BuMed FY00 Project

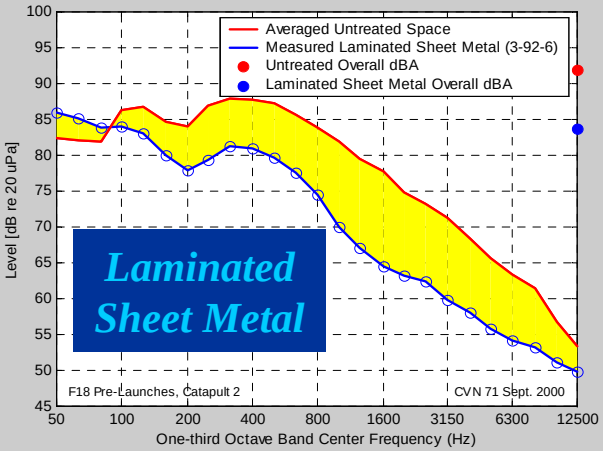
12 Pack Treatments

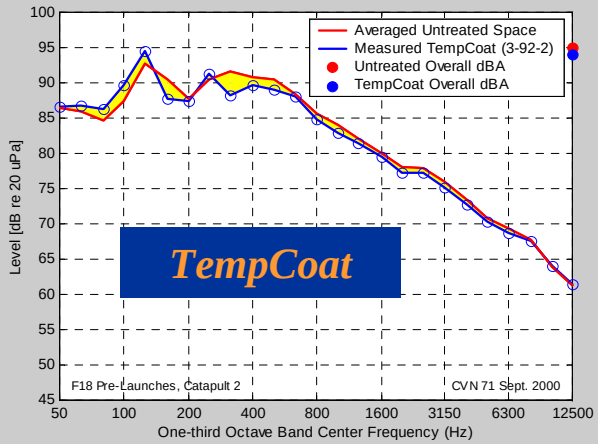
Acoustic Improvement vs. Frequency









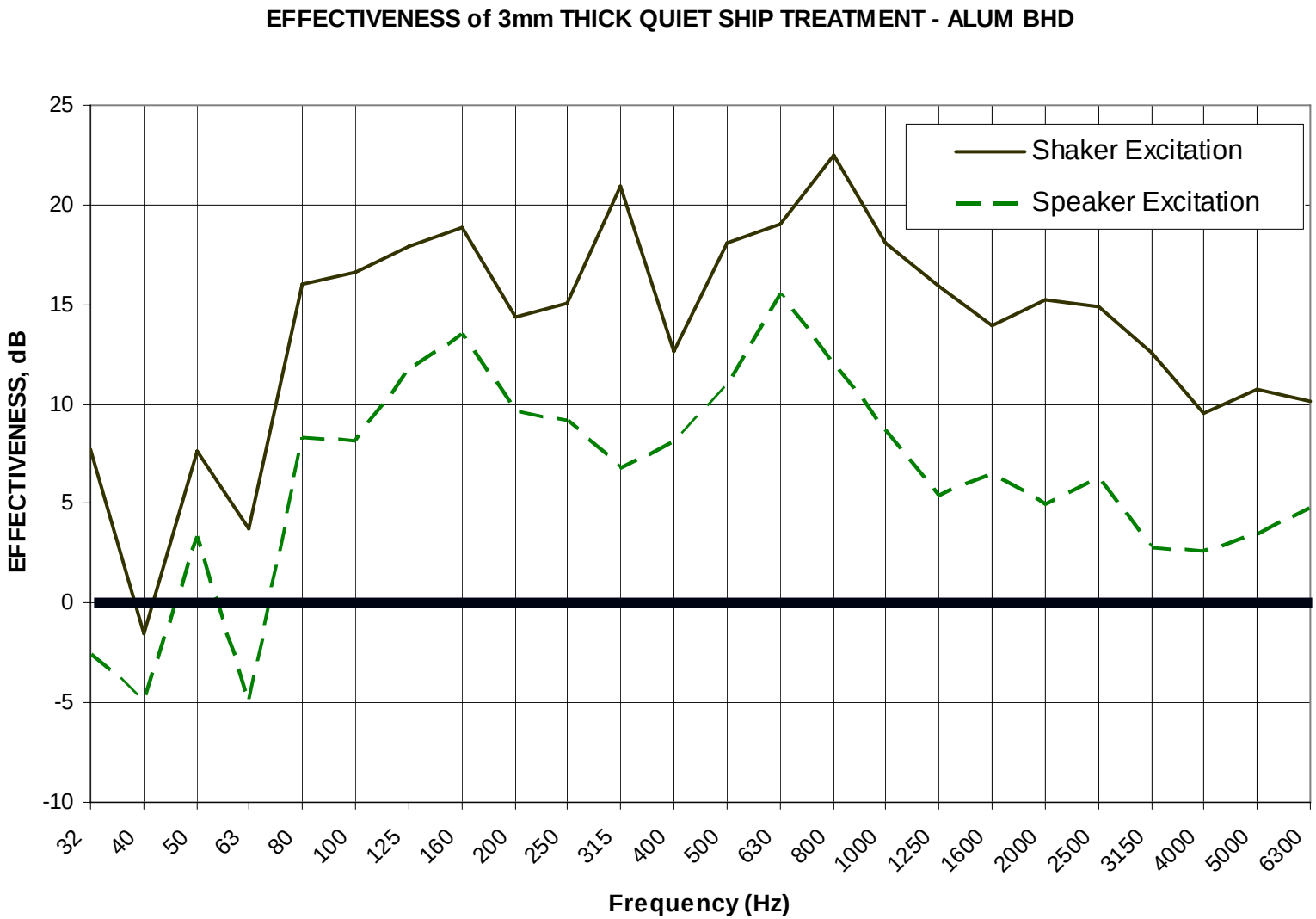


Spray-on Damping Materials

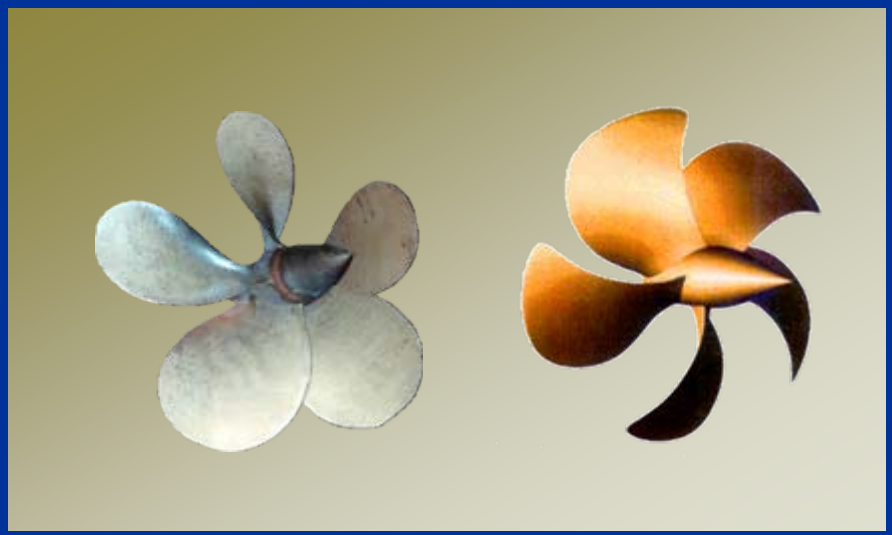
Pins installed prior to damping

Quiet Ship™ Damping Installed

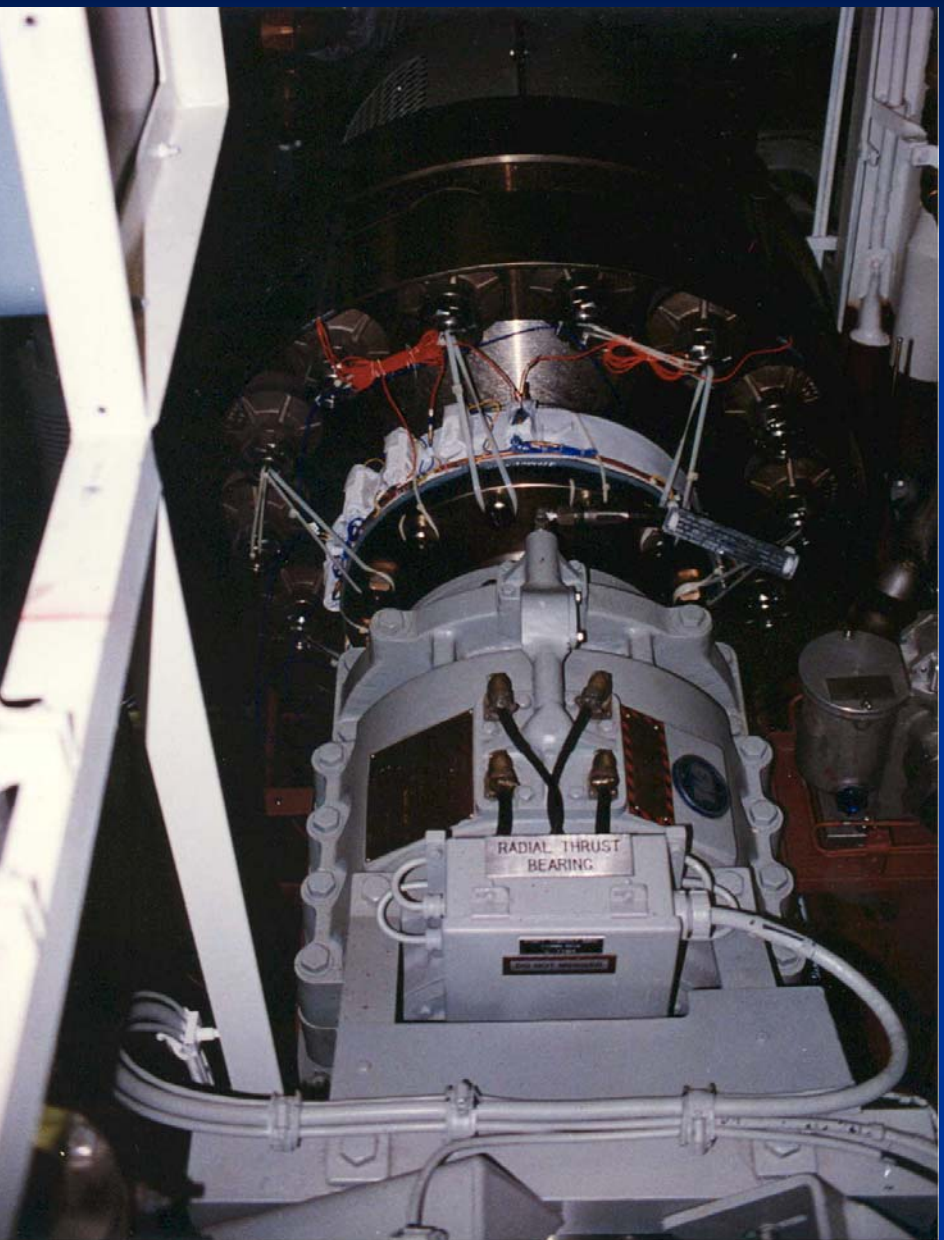
Spray-on easily installed around insulation pins and odd plate sections or forms – 12" x 12" damping tile would need to be custom fit.


EFFECTIVENESS of 3mm THICK QUIET SHIP TREATMENT - ALUM BHD
EFFECTIVENESS, dB
25
20
15
10
5
0
-5
-10
32
40
50
63
80
100
125
160
200
250
315
400
500
630
800
1000
1250
1600
2000
2500
3150
4000
5000
6300
Frequency (Hz)
Shaker Excitation
Speaker Excitation

Propeller Design



Measurement Techniques



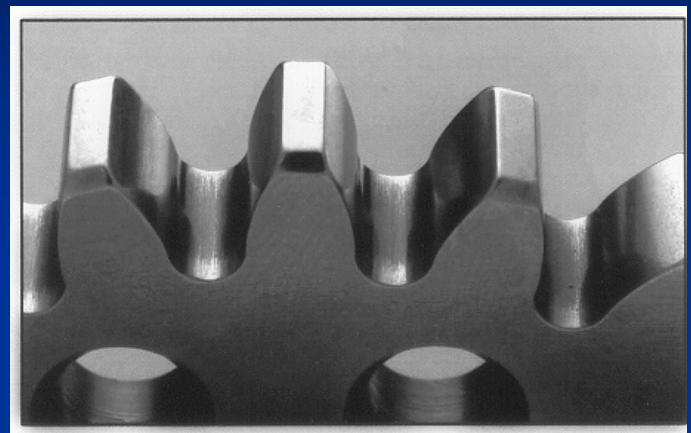
Sikorsky Superfinish/Engineered Gear Surface Program

Manufacturing Benefits

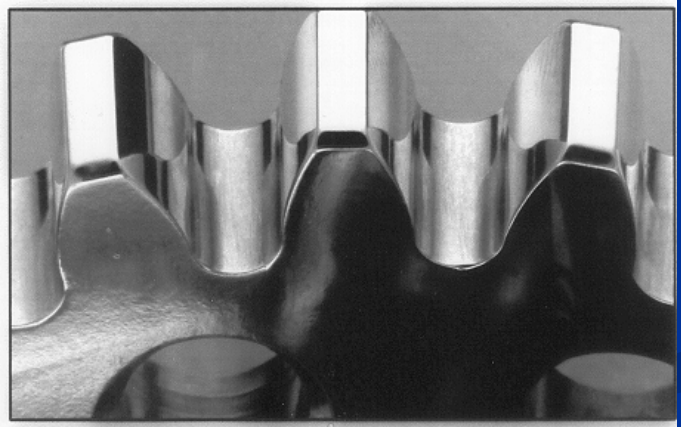
- Edge Break Consistency
  - No Manual Deburring
- Cost Savings

Pitting Fatigue Testing at NASA-Glenn (IITRI/Mantech consortium)

- Spiral Bevel and Spur Gears
- Superfinished using REM Process
- Baseline Ground vs. REM



Gear Filet Starting Condition



REM® Finished Gear Filet

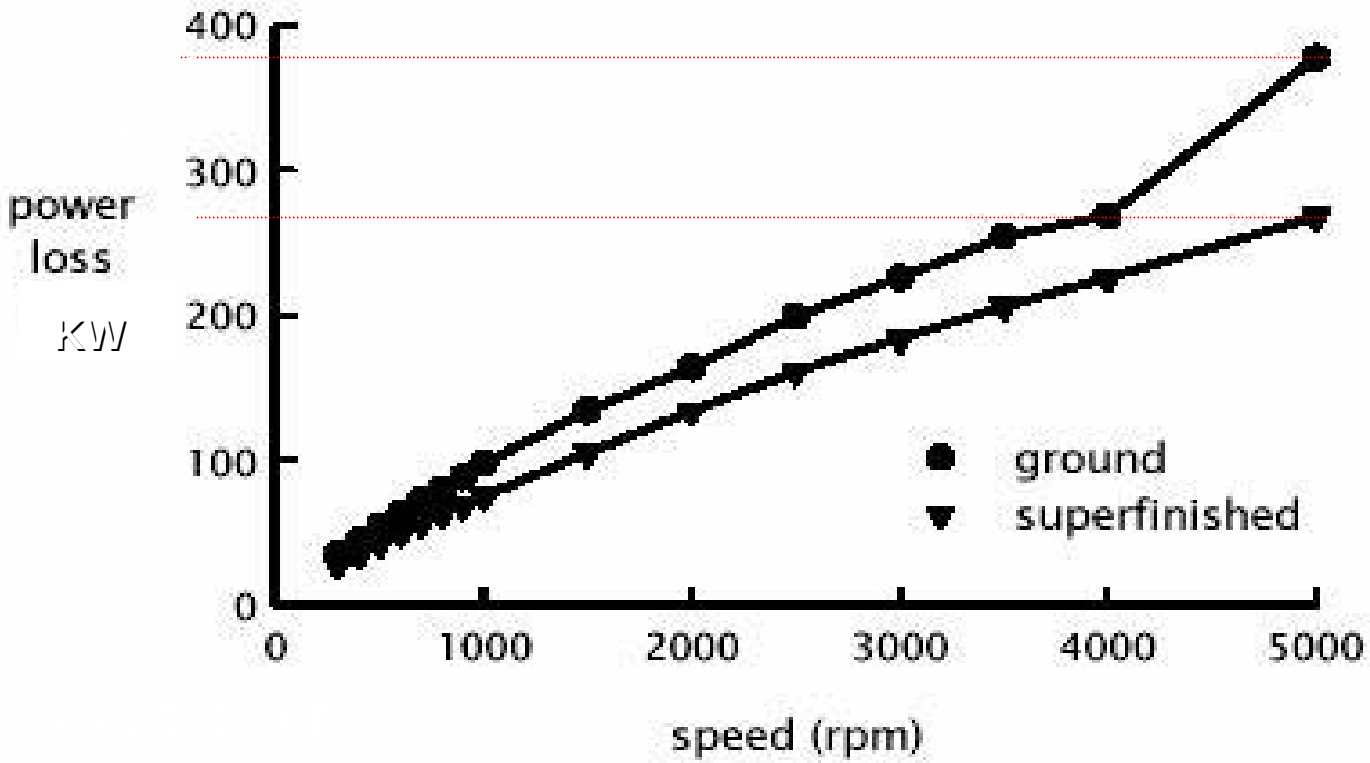
Partnership with AMCOM / NASA / IITRI

Power Transfer Systems Manufacturing

Super Finish Surfaces for Precision Parts Life Extension & Sustainment

U.S. Army ManTech

Reduction in Power Loss

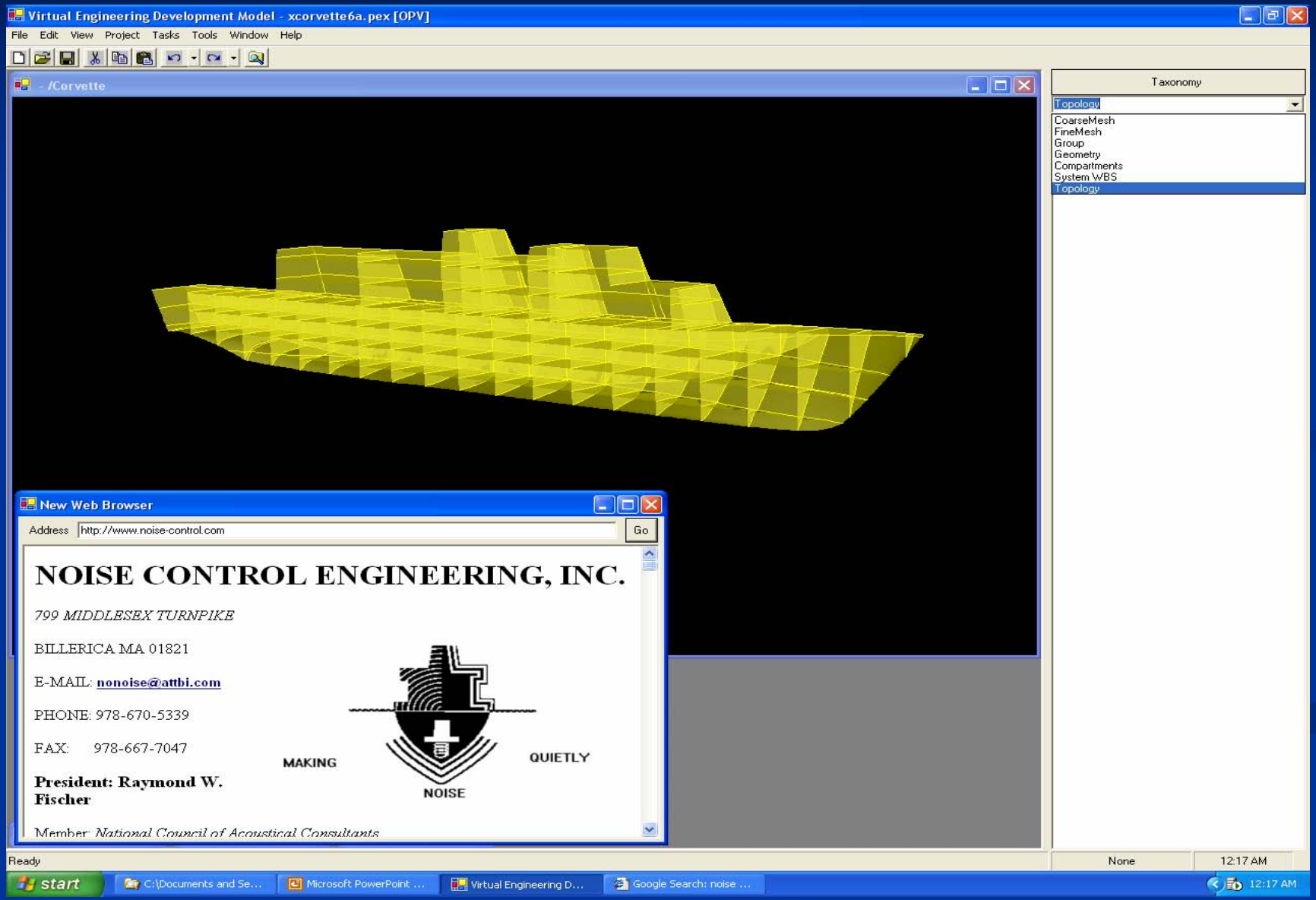


147.5 HP

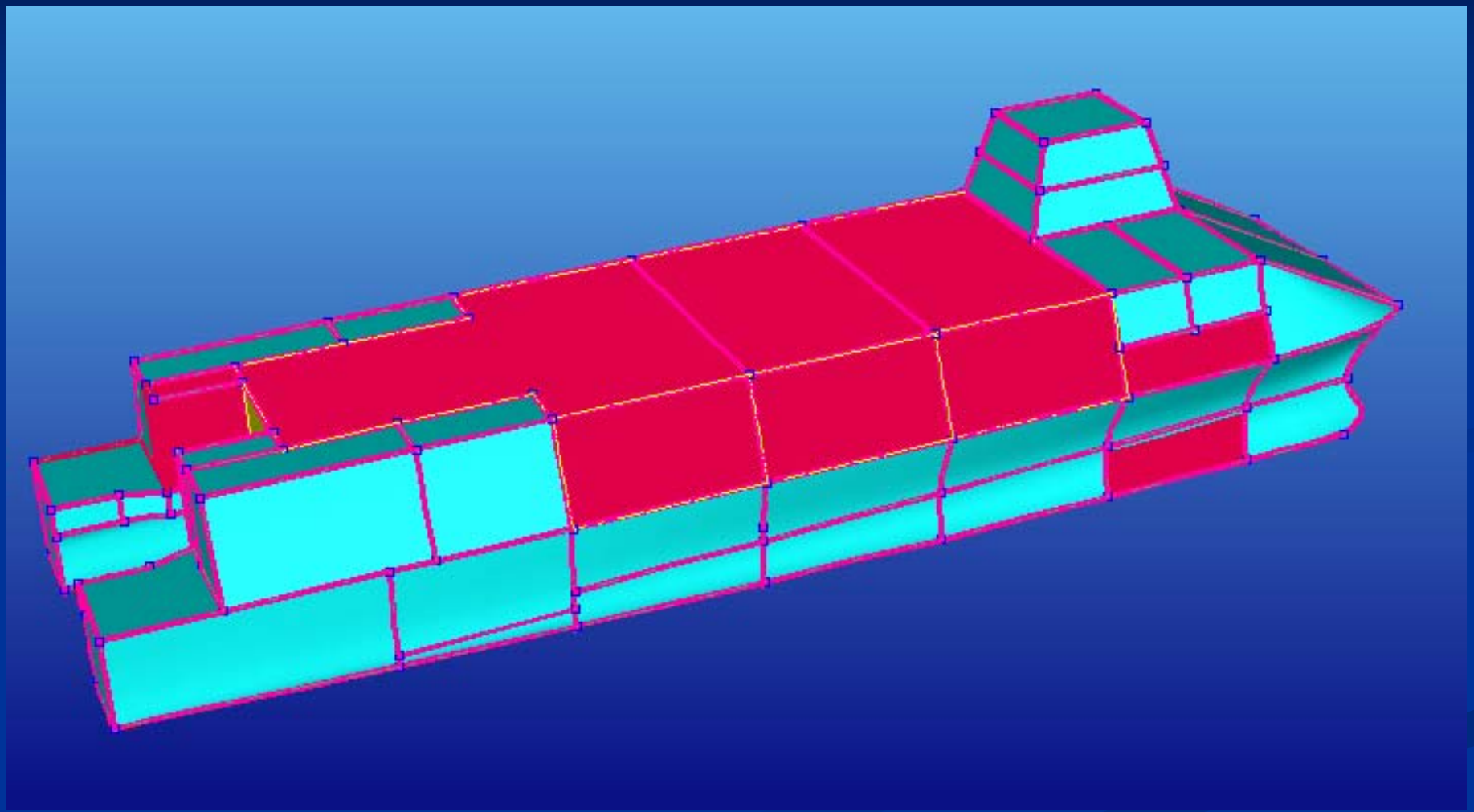
Data Provided by Army Research Lab, NASA Glenn Research Center, Tim Krantz

IITRI

Design Tools: SBIR N98-092



Compartments w/Excesses



SUMMARY

- Noise is Ubiquitous
- It's Solvable
  - System design cost
  - Optimize treatment weight
  - Construction cost
  - Cost of ownership
    - Hearing protection
    - Operational cost
    - Treatment maintenance
- Design Early