



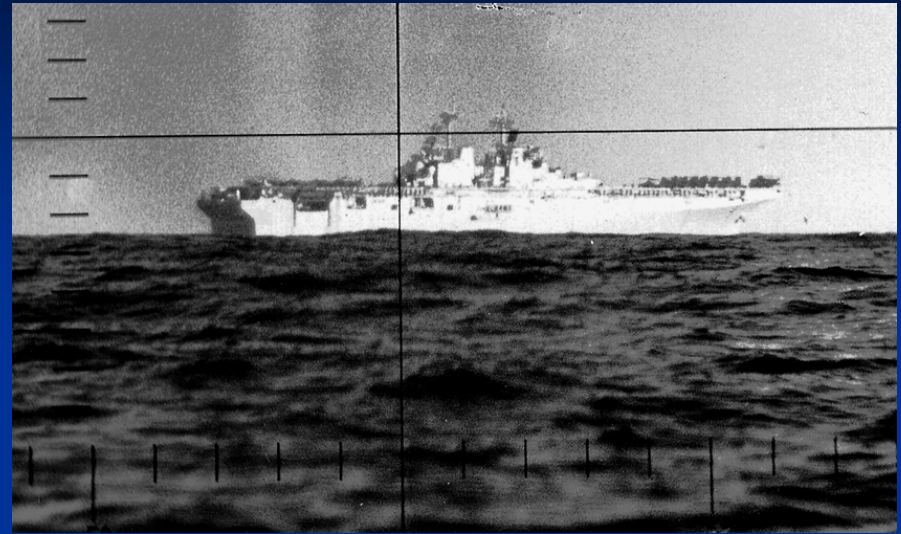
Human Systems Integration Directorate



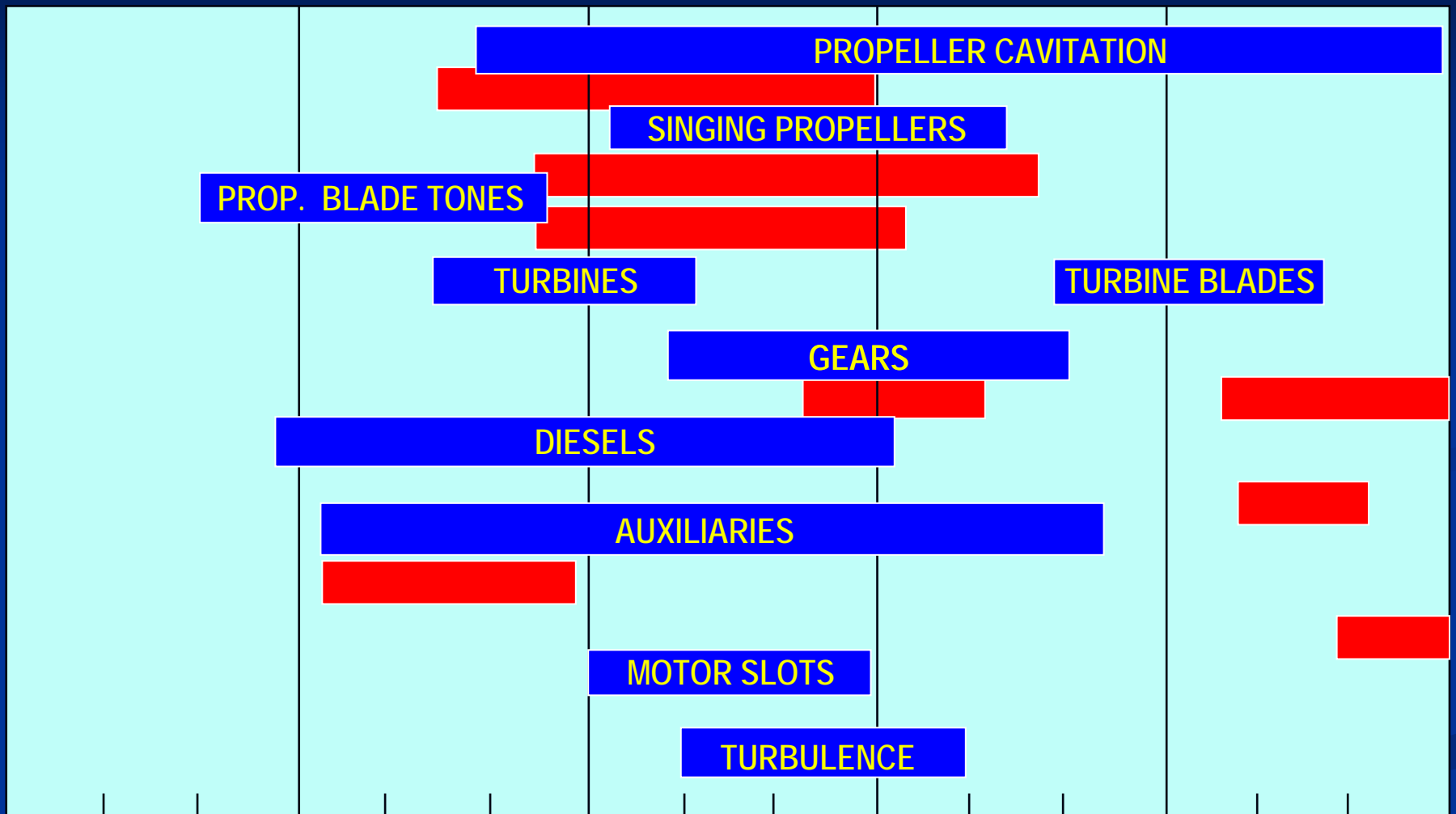
Shipboard Noise Control

Kurt Yankaskas
Naval Sea Systems Command
kurt.d.yankaskas@navy.mil
202-781-4349

Noise Mitigation: Importance



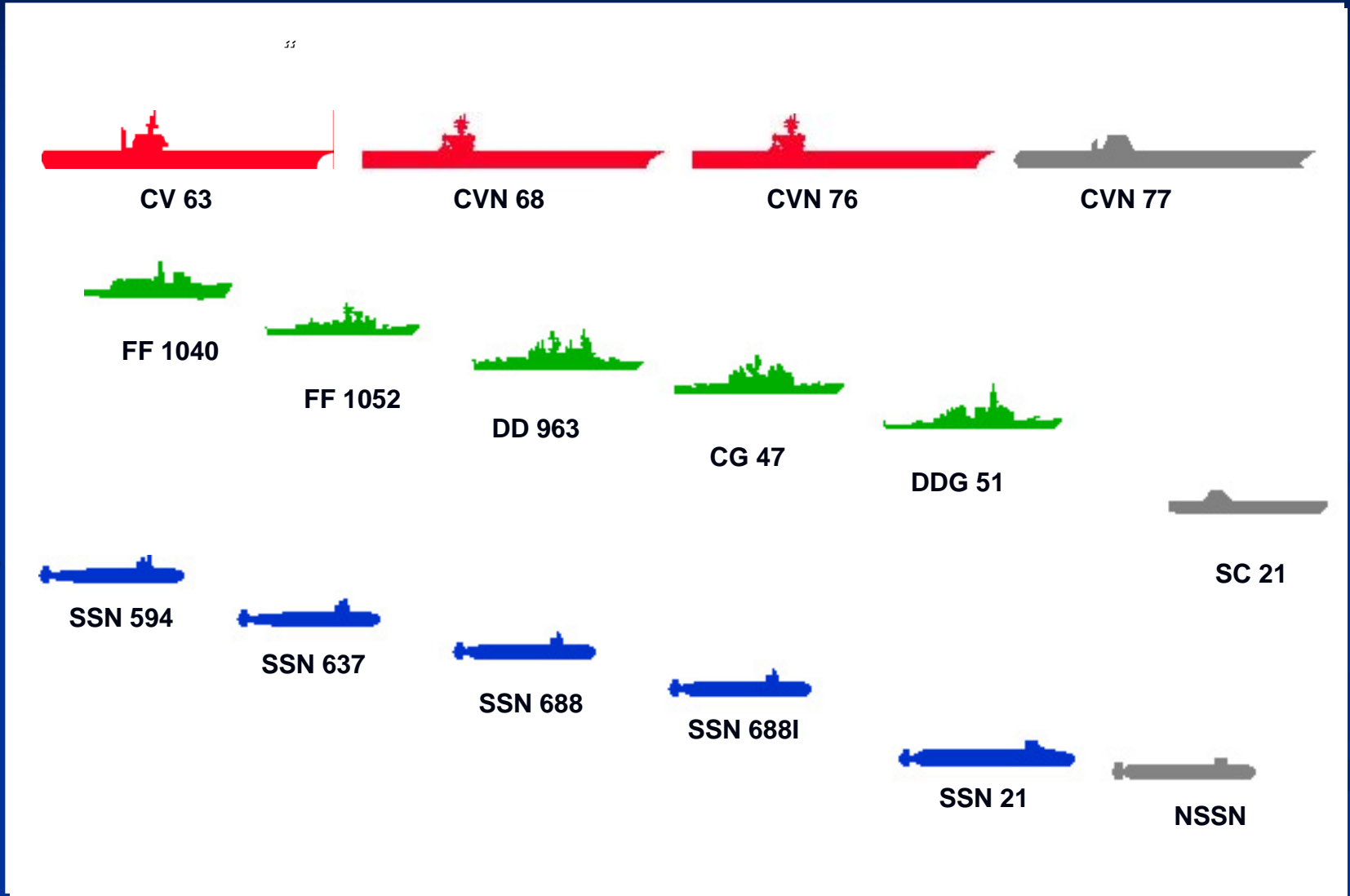
Frequency Distribution of Noise Sources



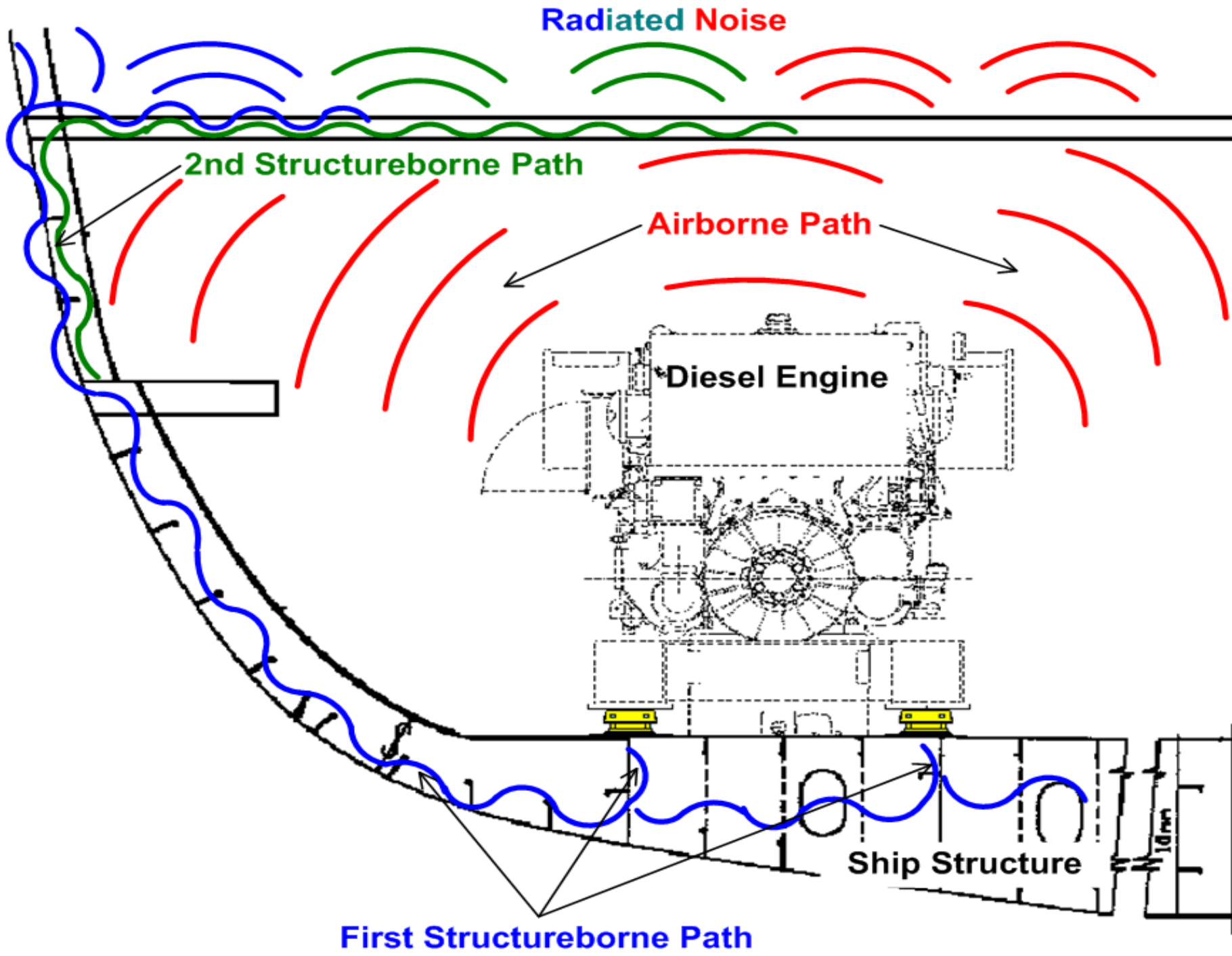
Frequency

Previous Quieting Investments

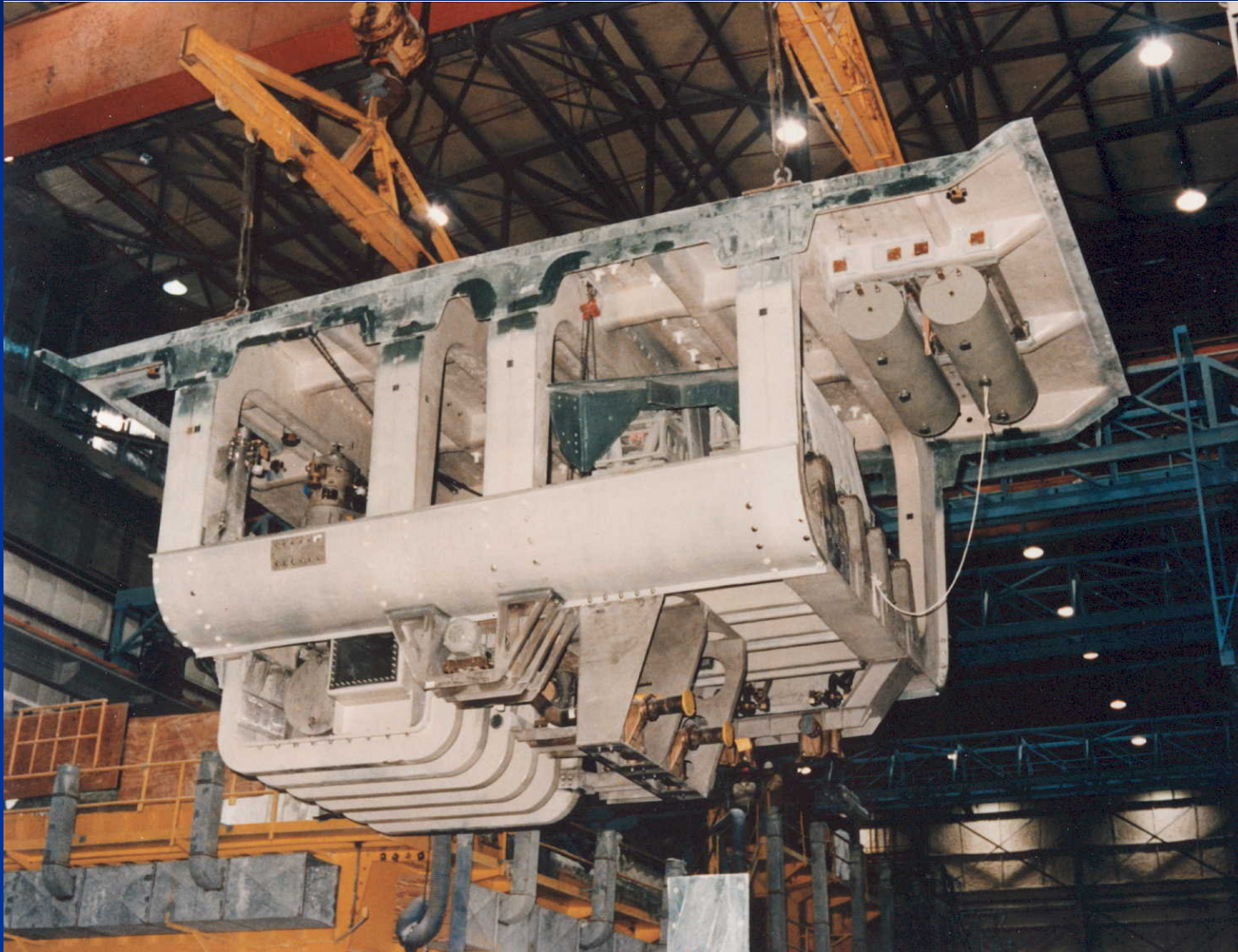
Signature Level



Time



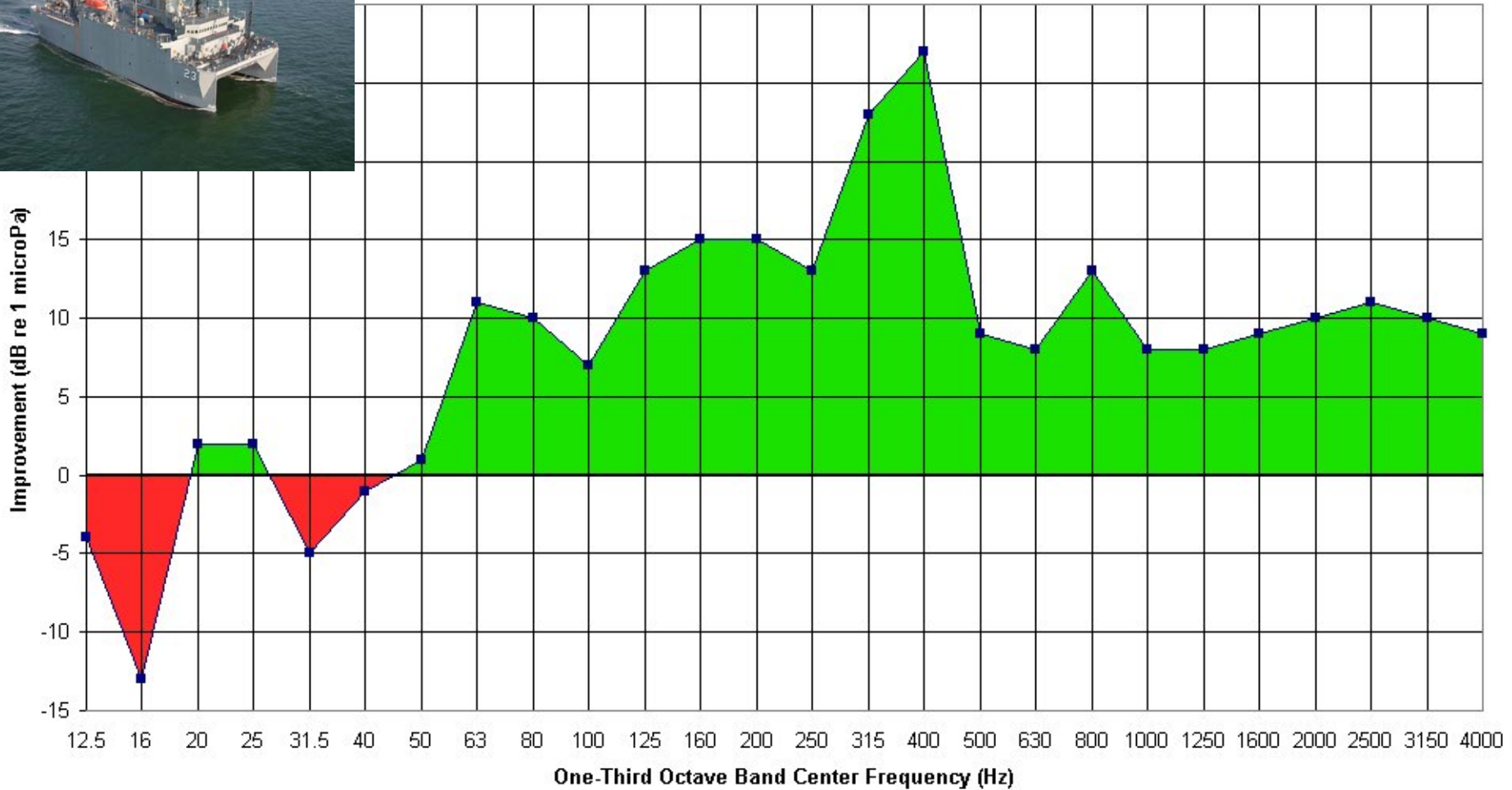
AMR Cradle



Integrated Ship Specification: T-AGOS 23



T-AGOS 23 vs. T-AGOS 19
Post Construction Comparison at 3 knots



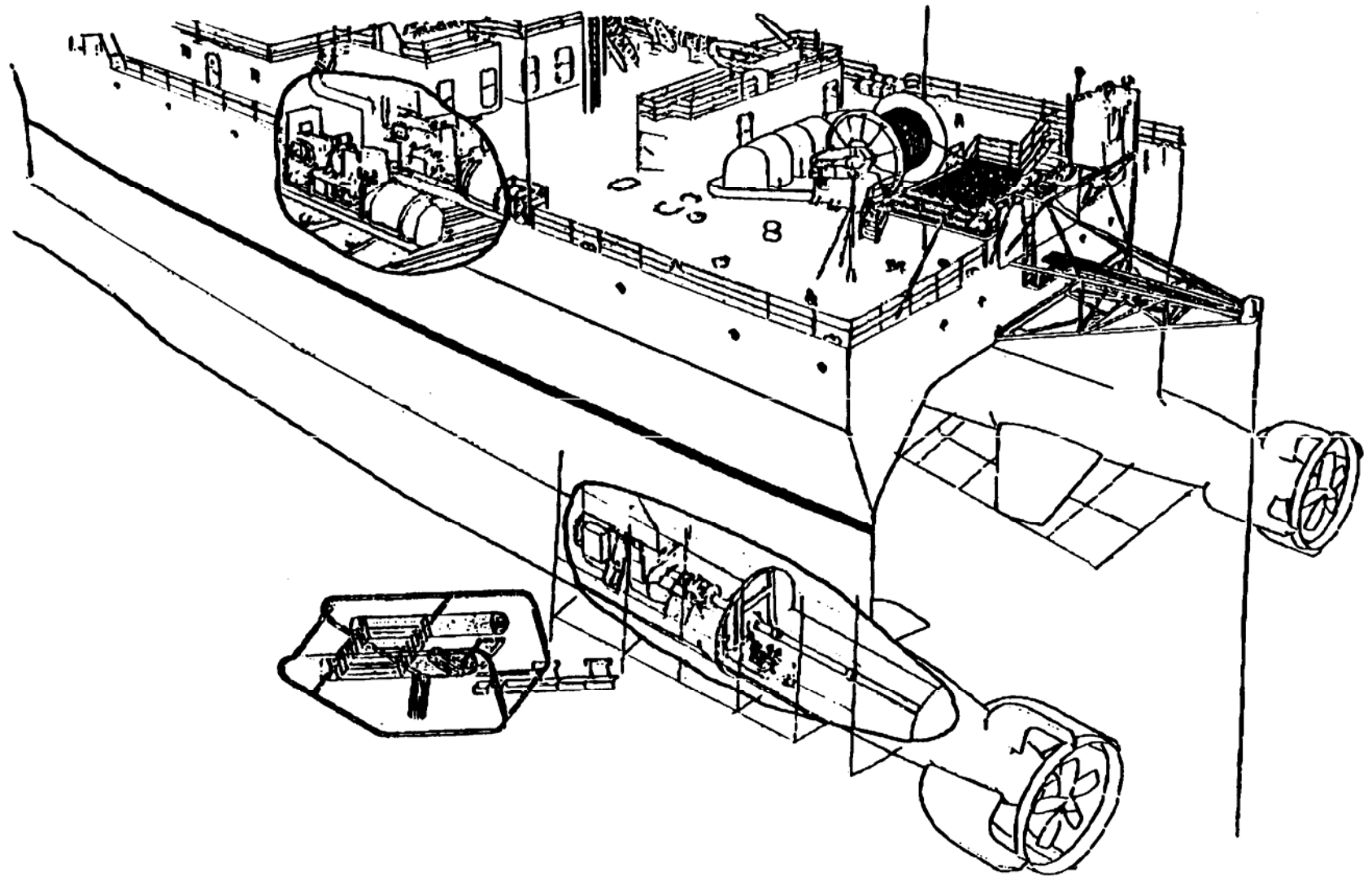


Figure 1. T-AGOS 20 Dockside Acoustic Intensity Evaluation Set Up

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

RUN 2000-1

168 Hz - 168 Hz

BASELINE LEVEL 48 Db

PLAN VIEW (looking down)
OF PORT SUBMERGED HULL

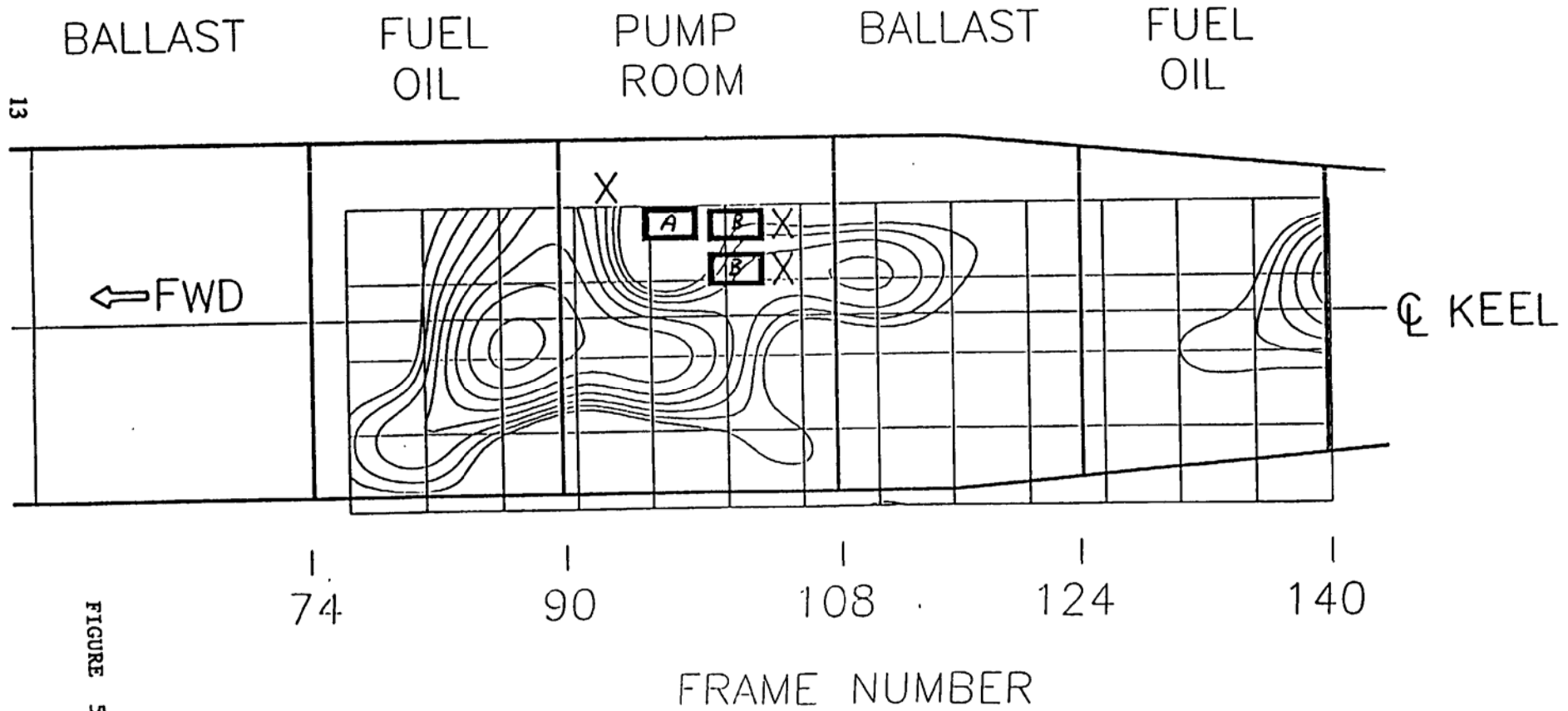
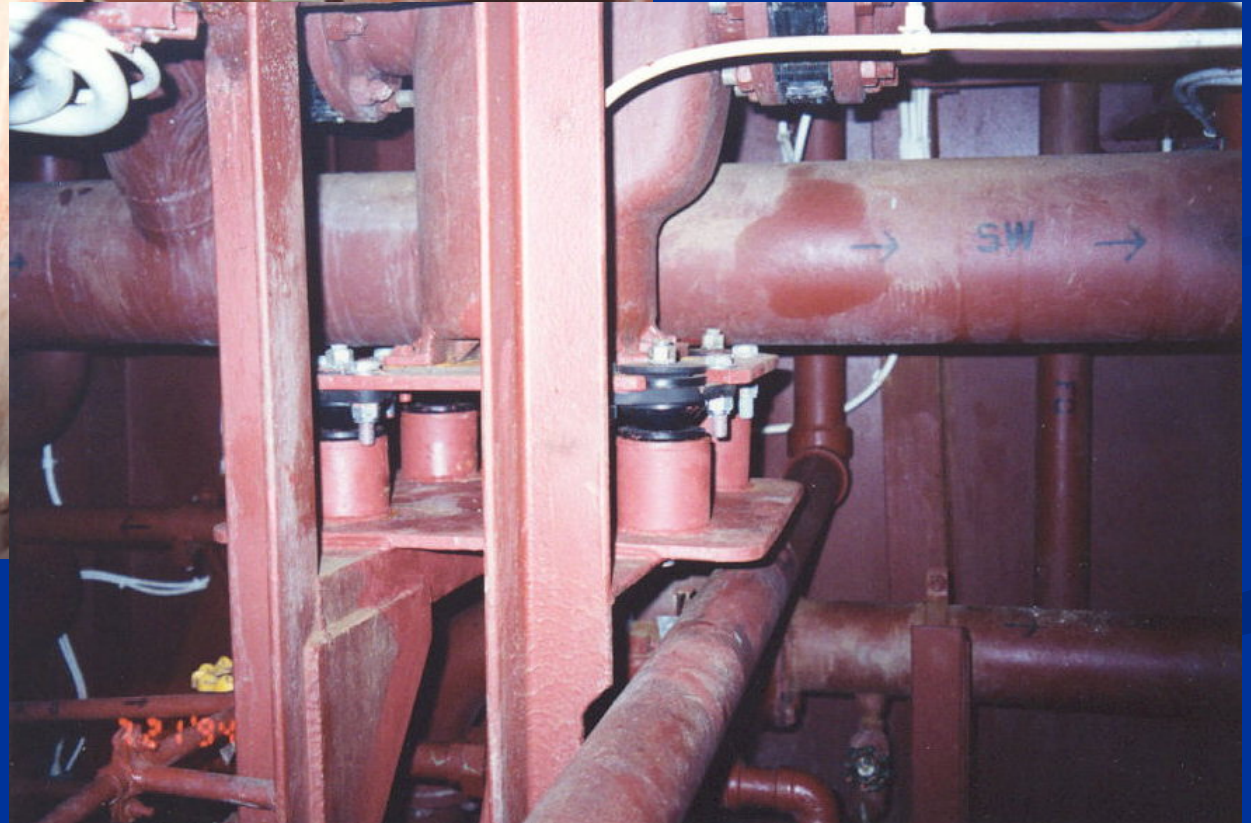


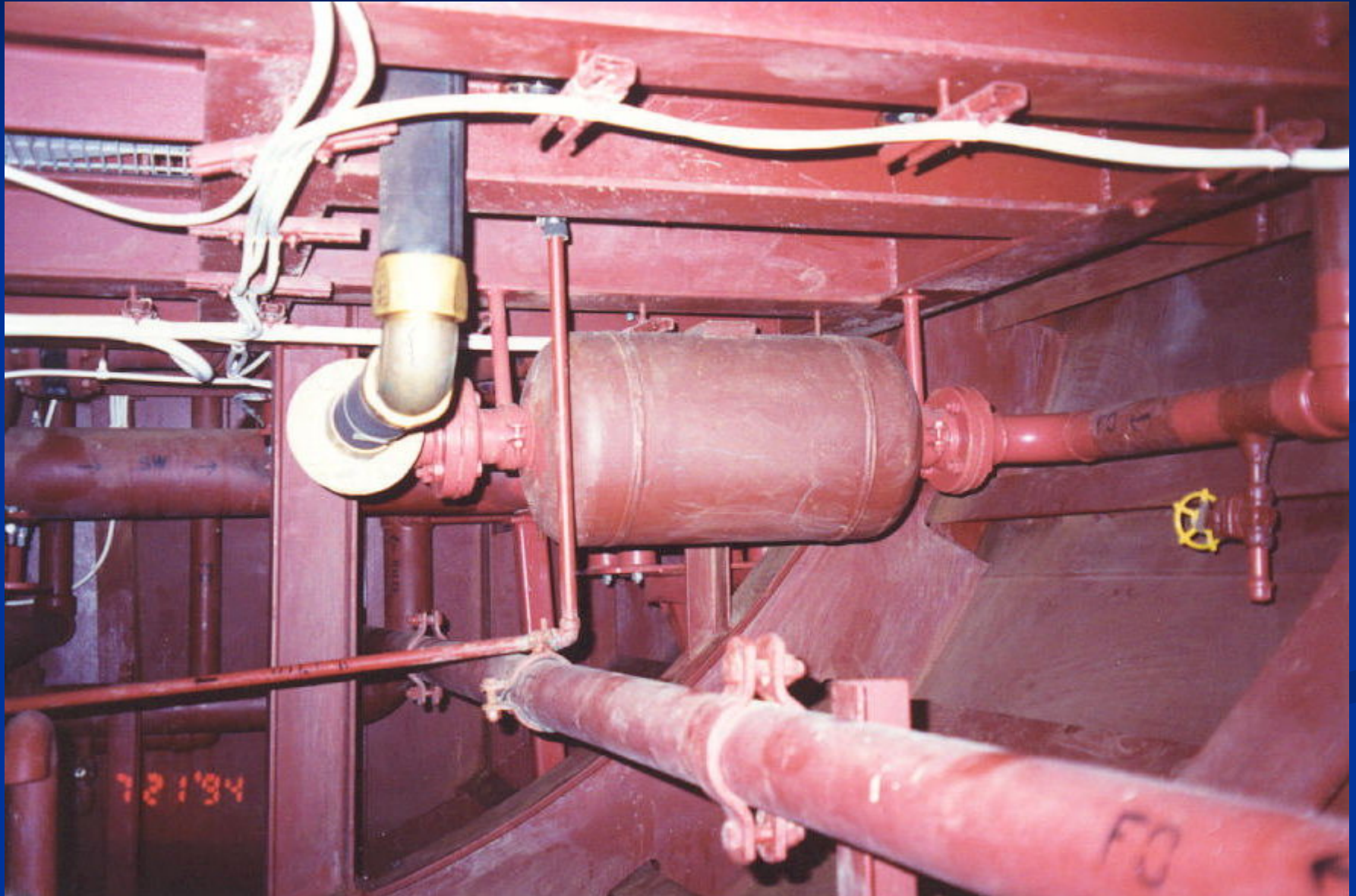
FIGURE 5

Piping System Isolation

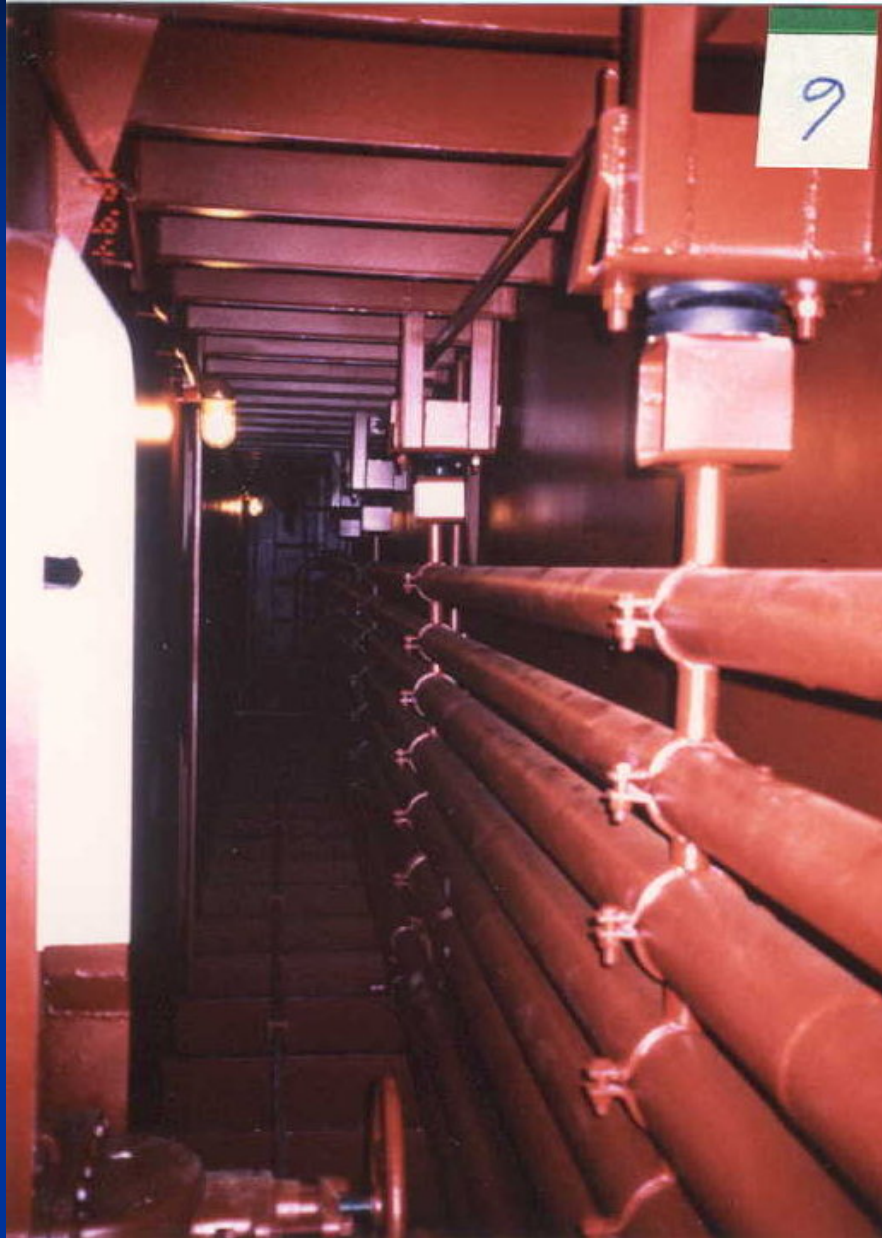


Mount Cost: ~\$40

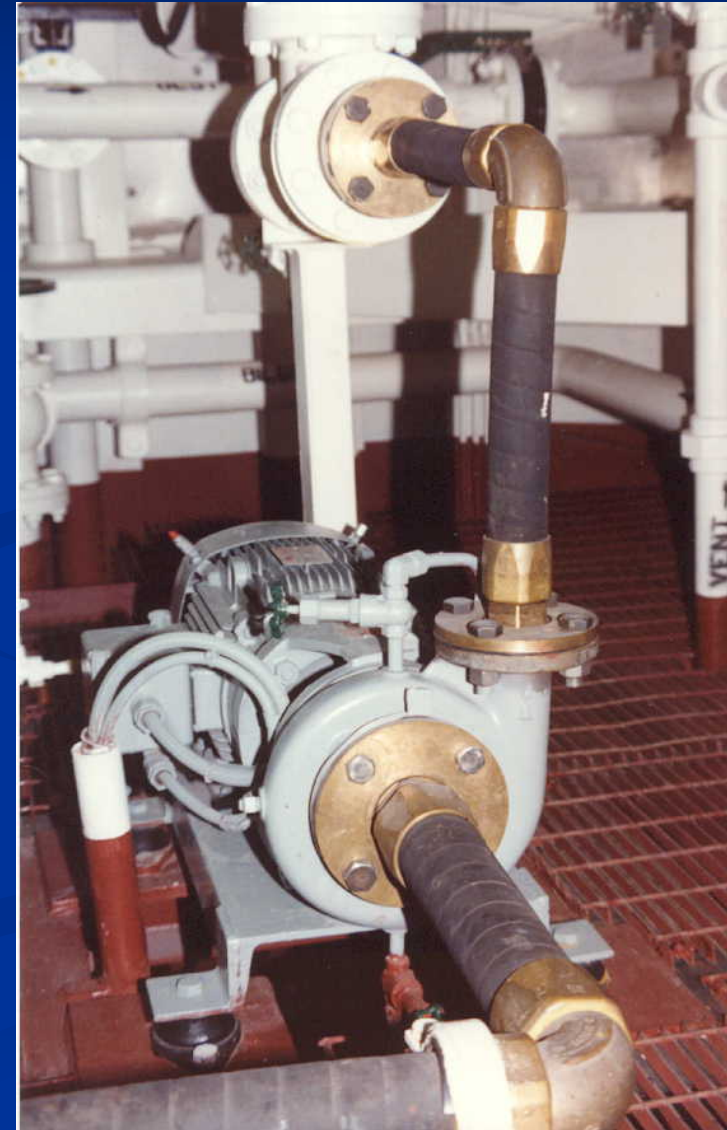
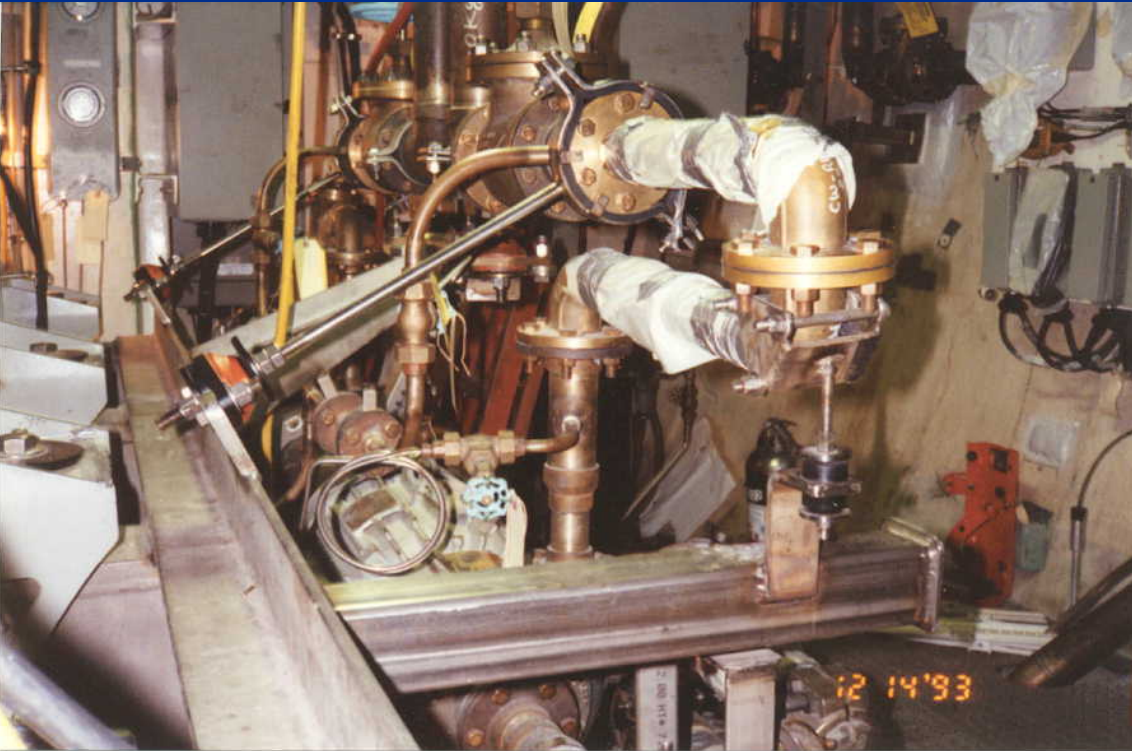
Fuel Oil Pump Isolation and Acoustic Filter



Piping Systems

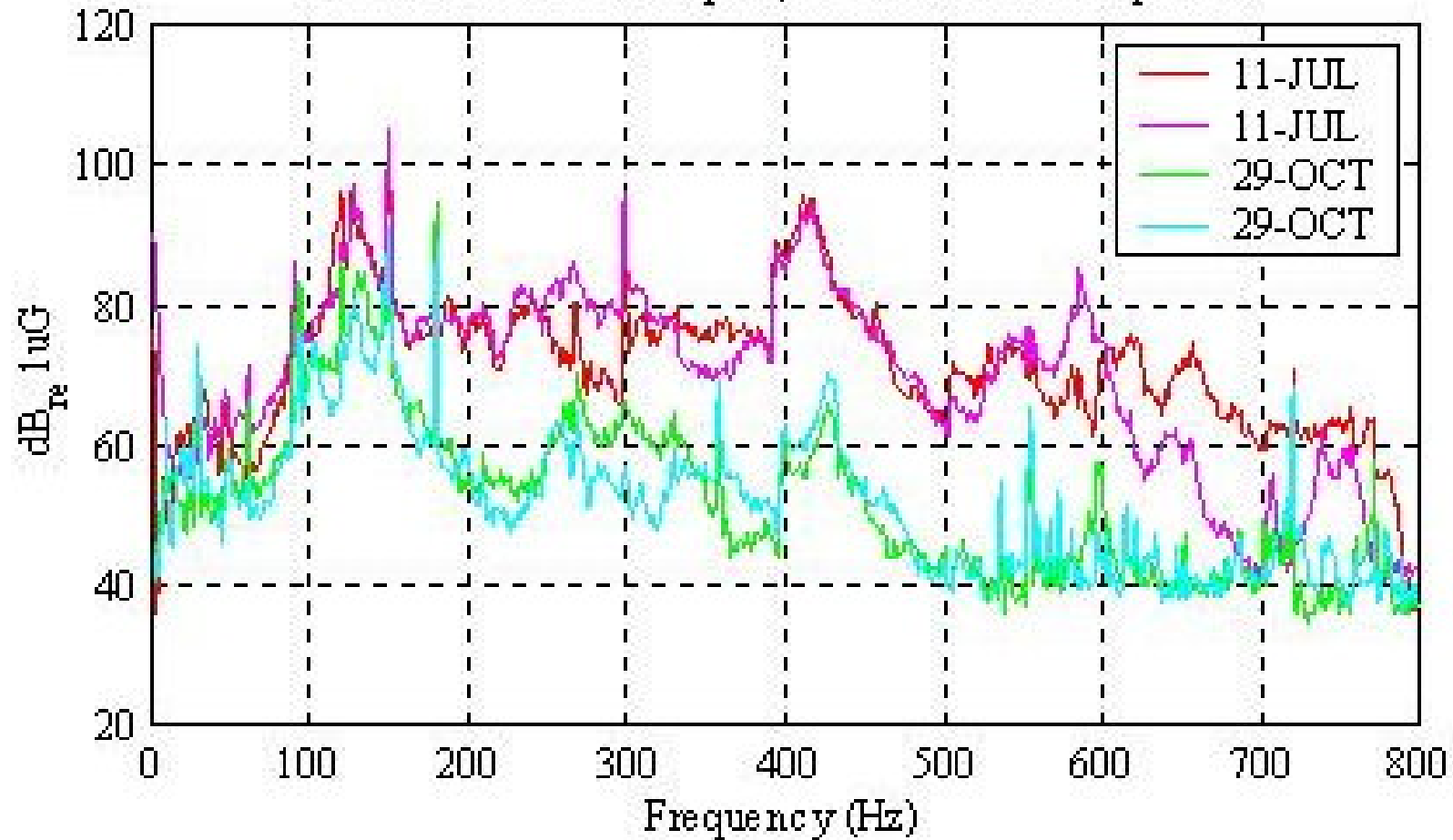


Piping Systems: Dog Legs



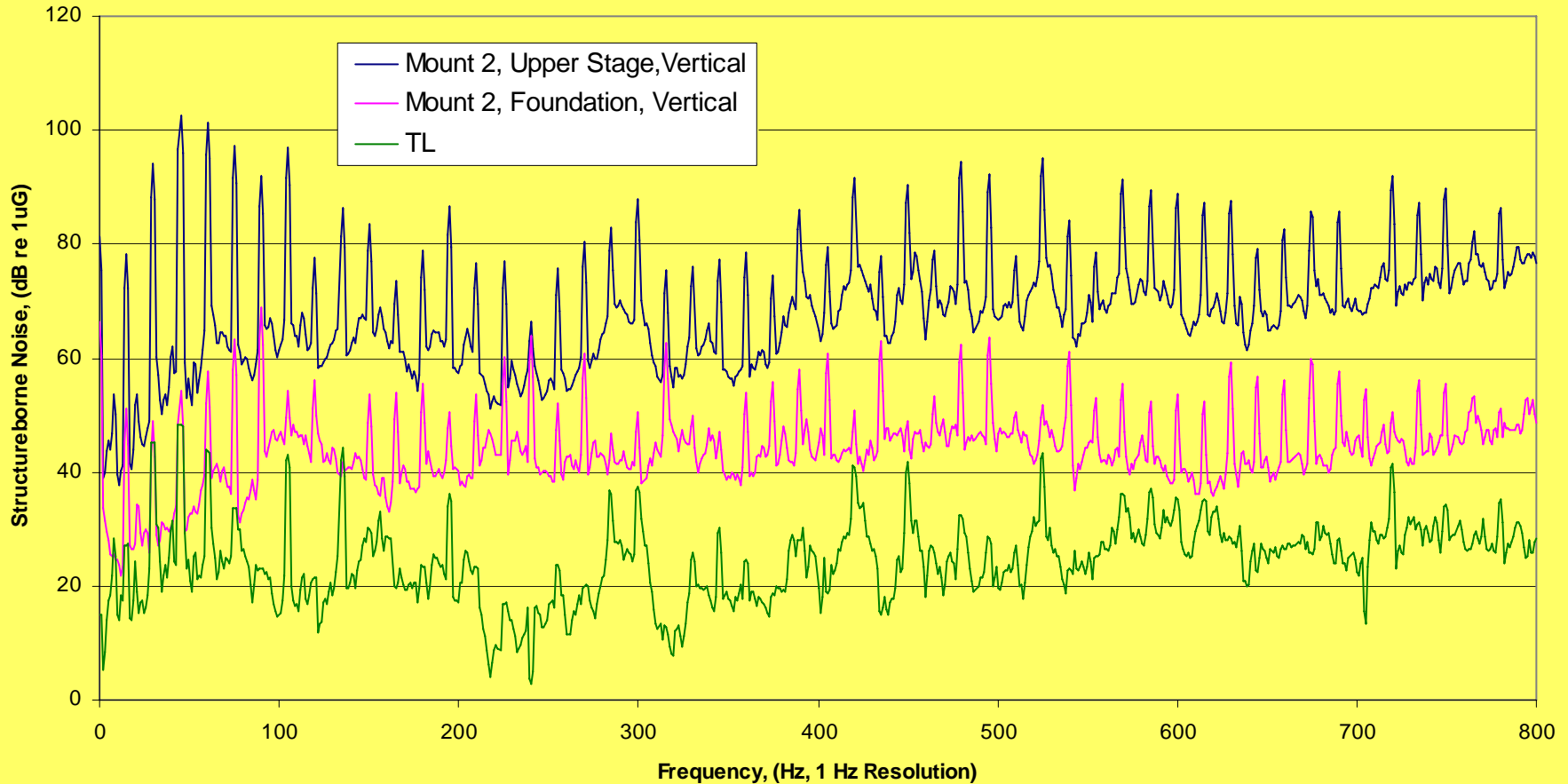
Quiet Pumps

Seawater Service Pump #3, Above-Mbunt Comparison

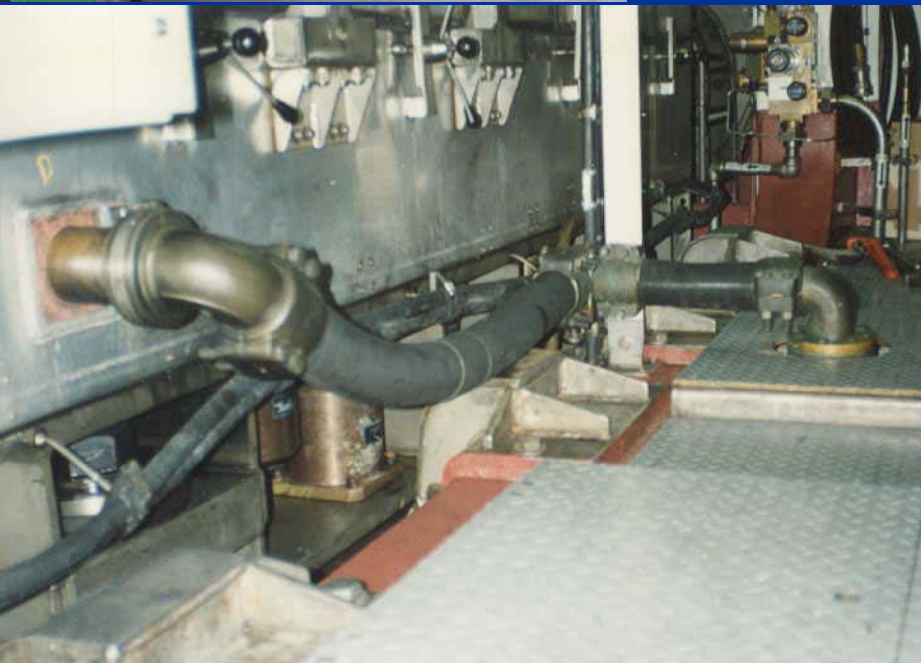
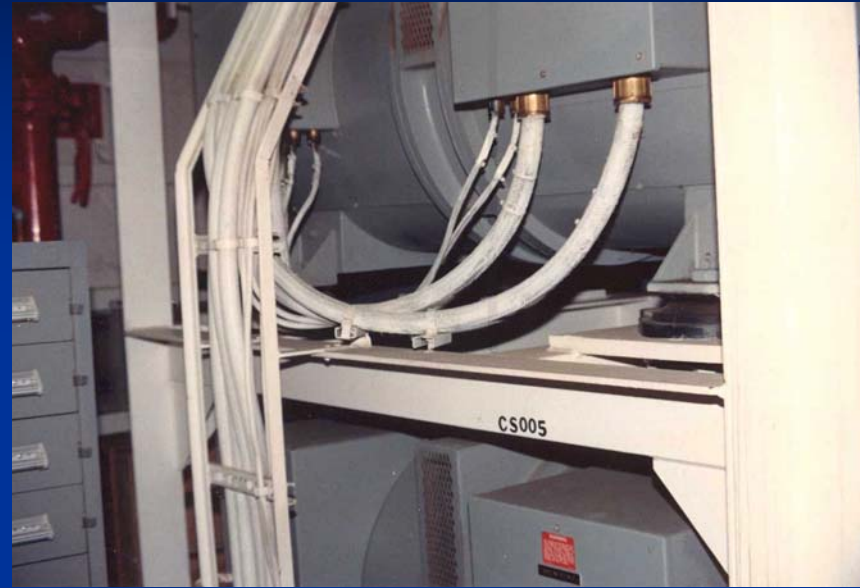


Main Diesel Propulsion Isolation

TAGOS 23: MPDG No. 2, Mount No. 2 Performance, 900 RPM



Mounting Deficiencies



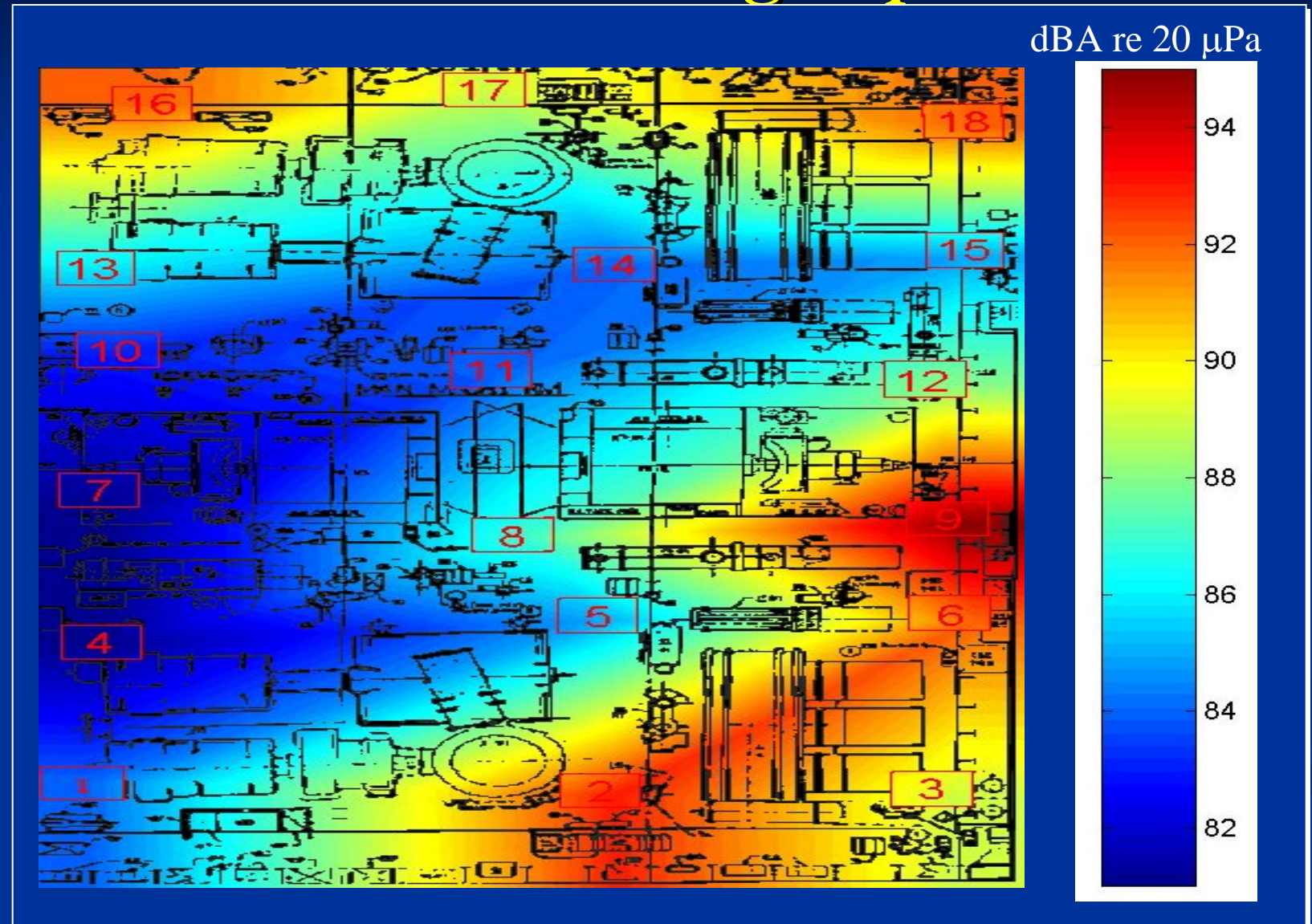
Pipe Hangers



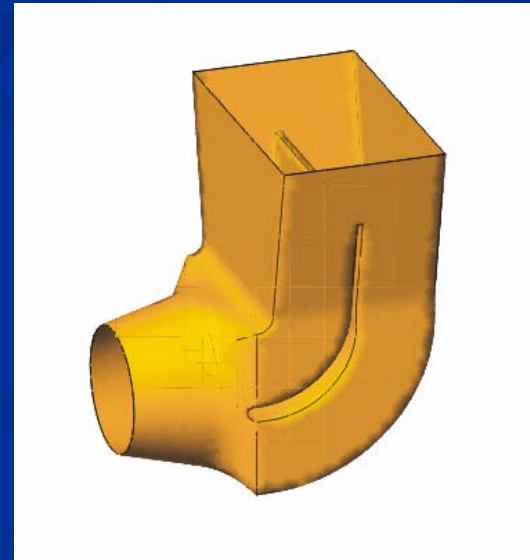
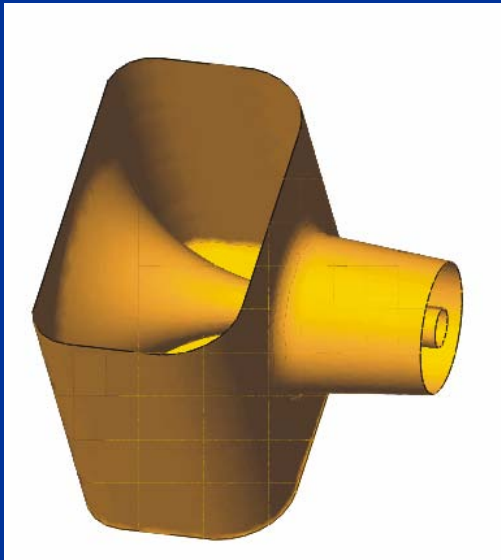
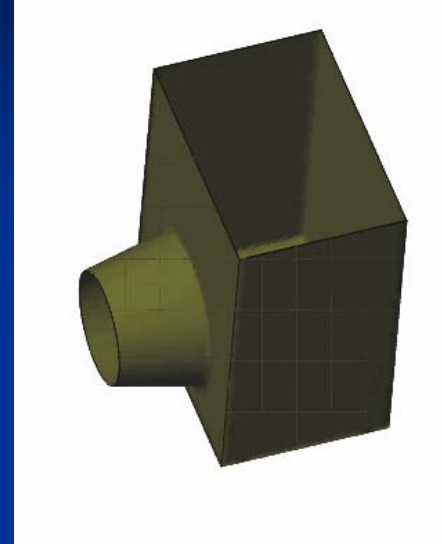
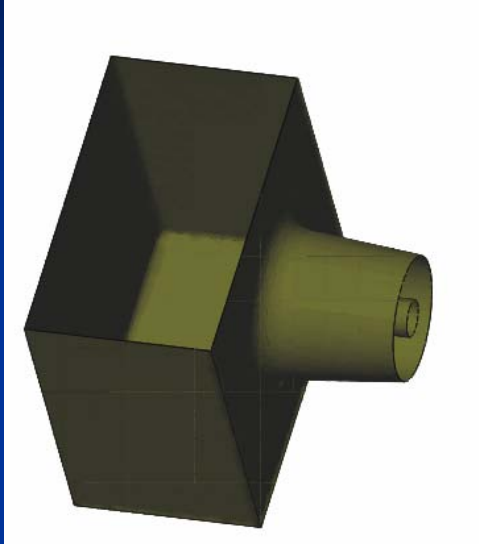
HVAC



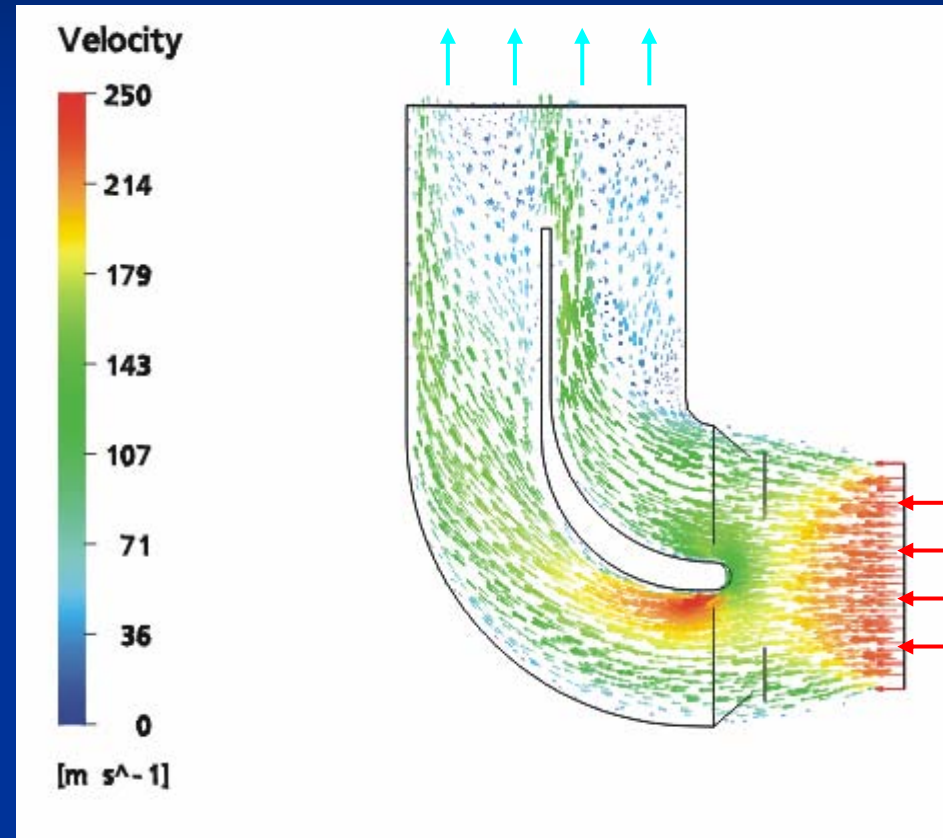
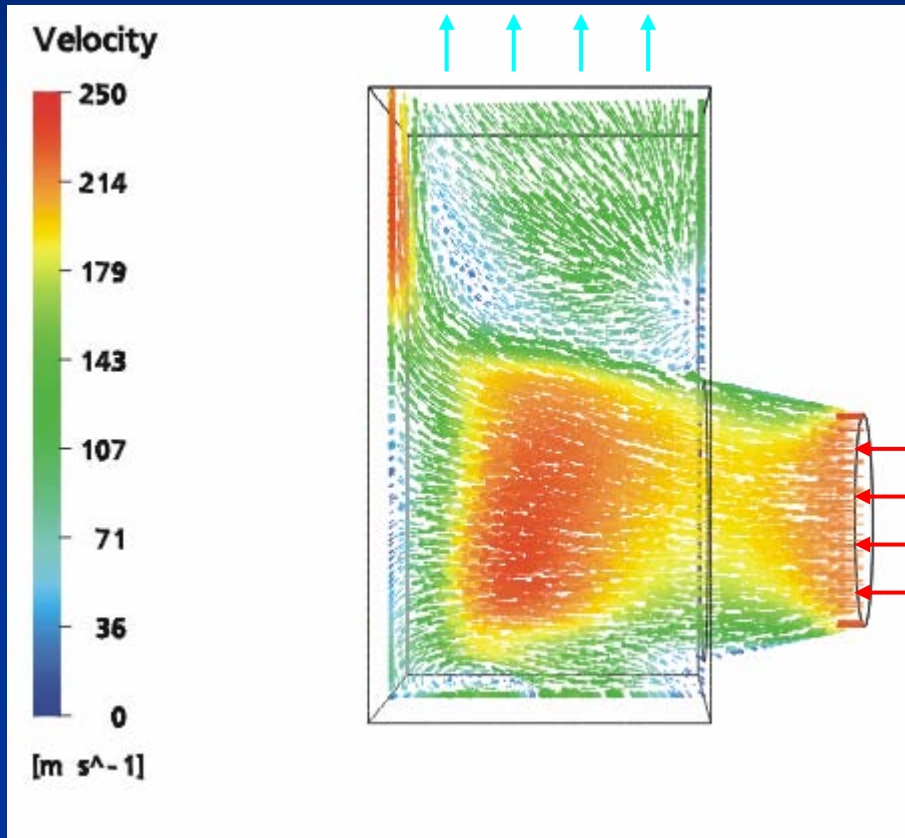
MMR #2, Upper Level, Dockside Ventilation High Speed

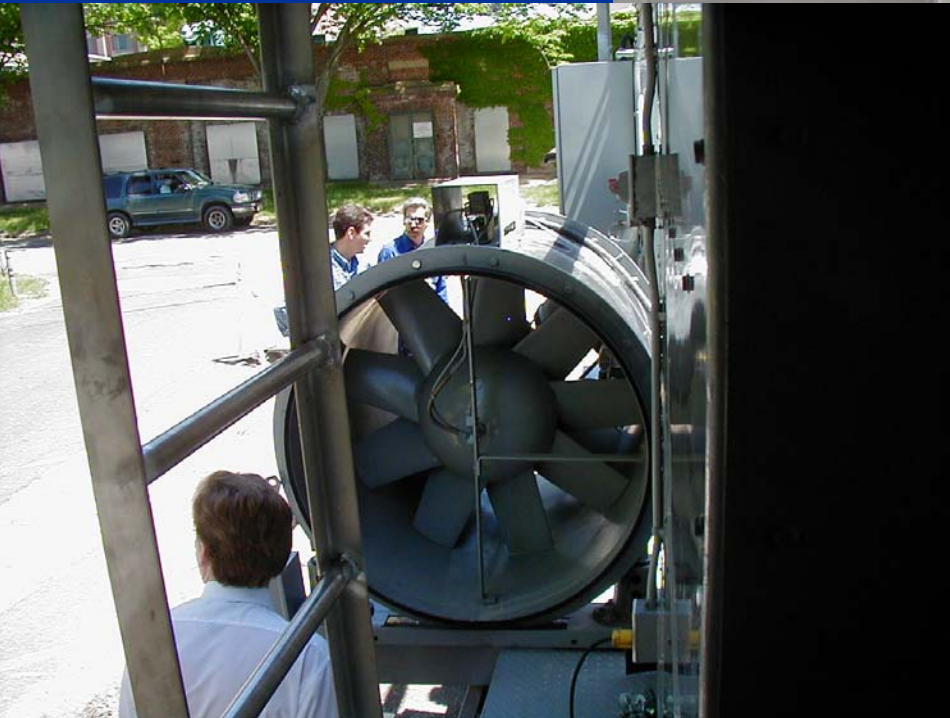


Flow Control



Flow Control





Solutions: “12 Pack” Testbed



USS THEODORE ROOSEVELT (CVN 71)

Solutions: JBD BIMORF Muffler

JBD Bimorf Muffler



4 BIMORF mufflers required per JBD

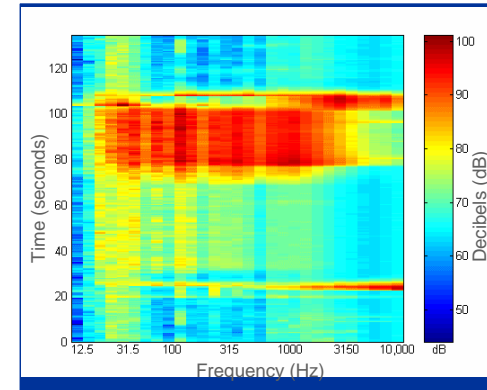
F-18 Launch

JBD Movement

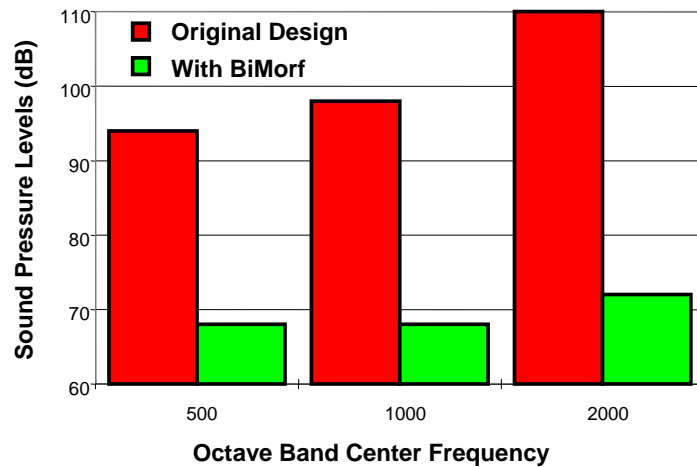
Waterbrake

Aircraft
Power-up

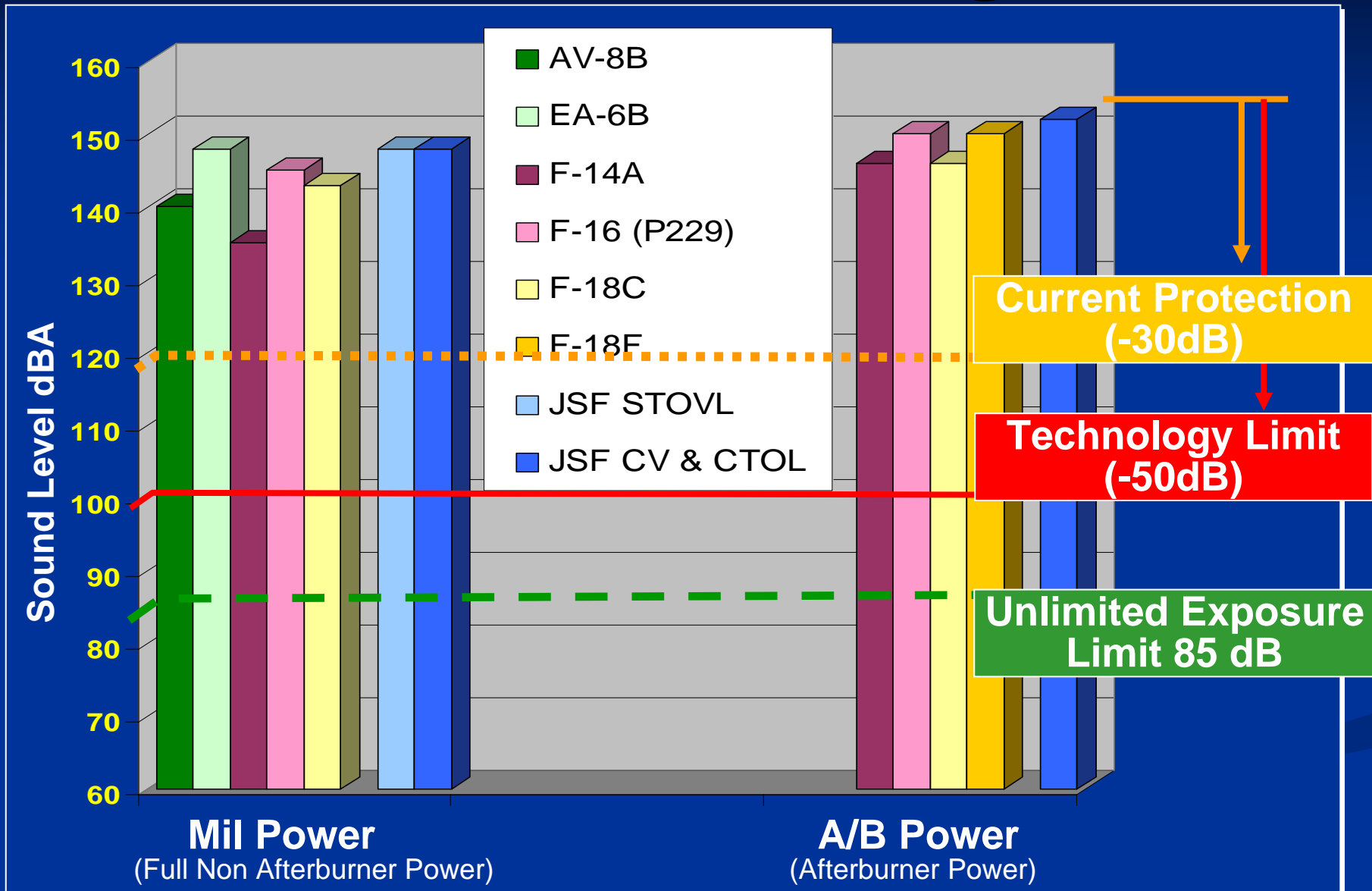
JBD Movement



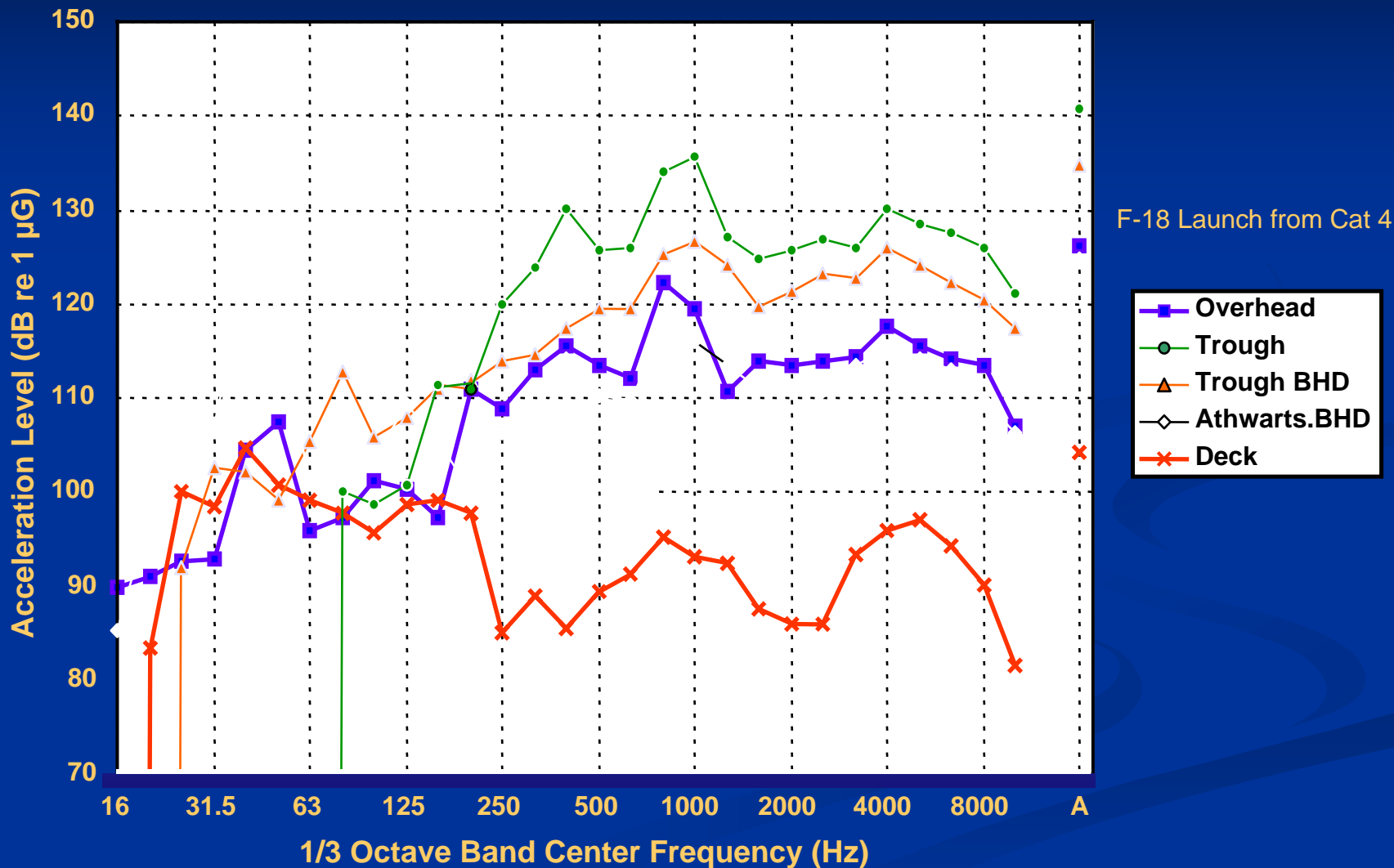
Airborne Noise Levels - CVN 74



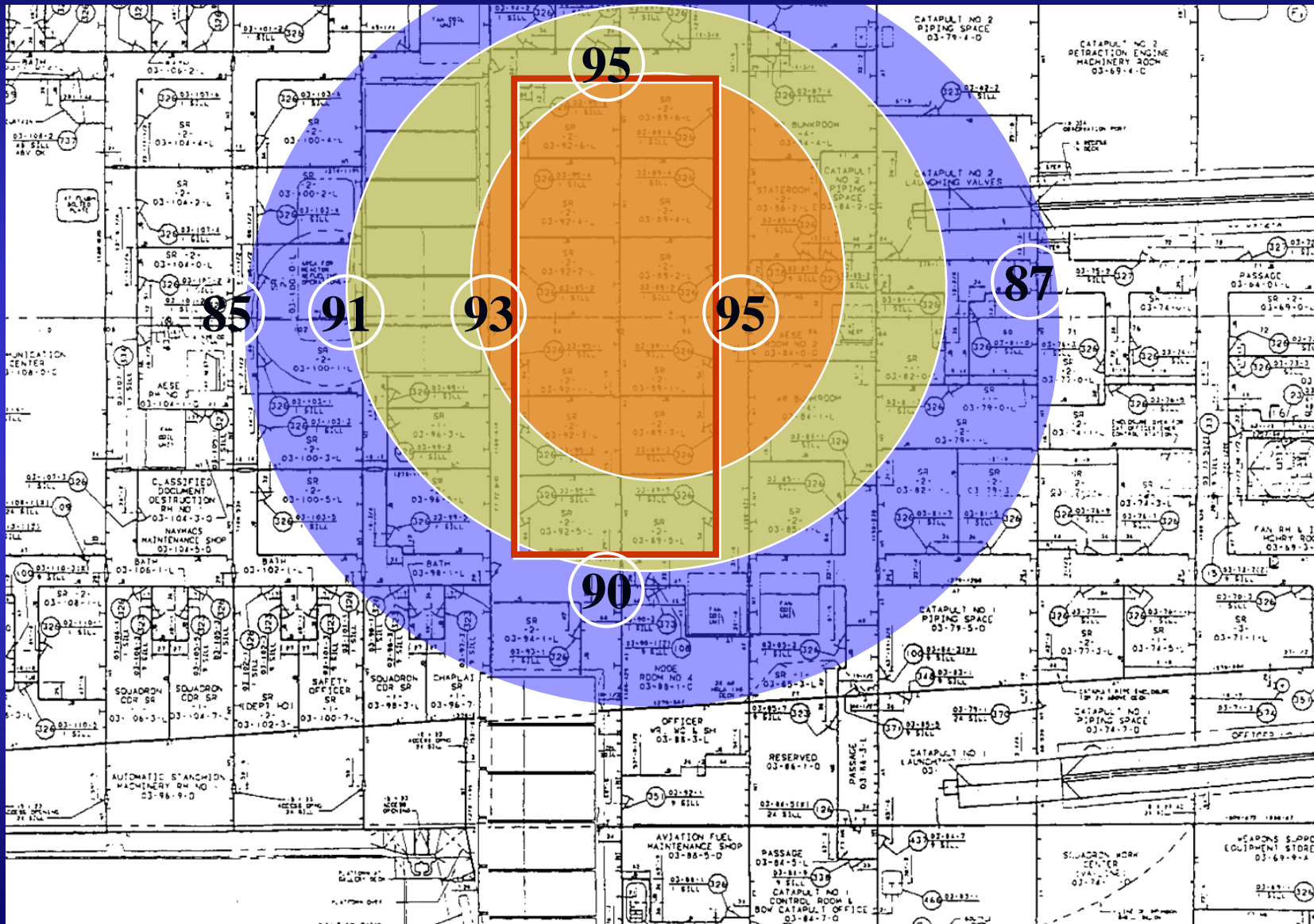
Aircraft Noise Levels @ 30 ft.



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



“12 Pack” Sound Level Measurements



Frame #: 104

100

96

92

88

84

79

74

Solutions: “12 Pack” Testbed

USS THEODORE ROOSEVELT (CVN 71)
NAVSEA/BuMed Sponsored

12 Pack is Representative of 03 Level

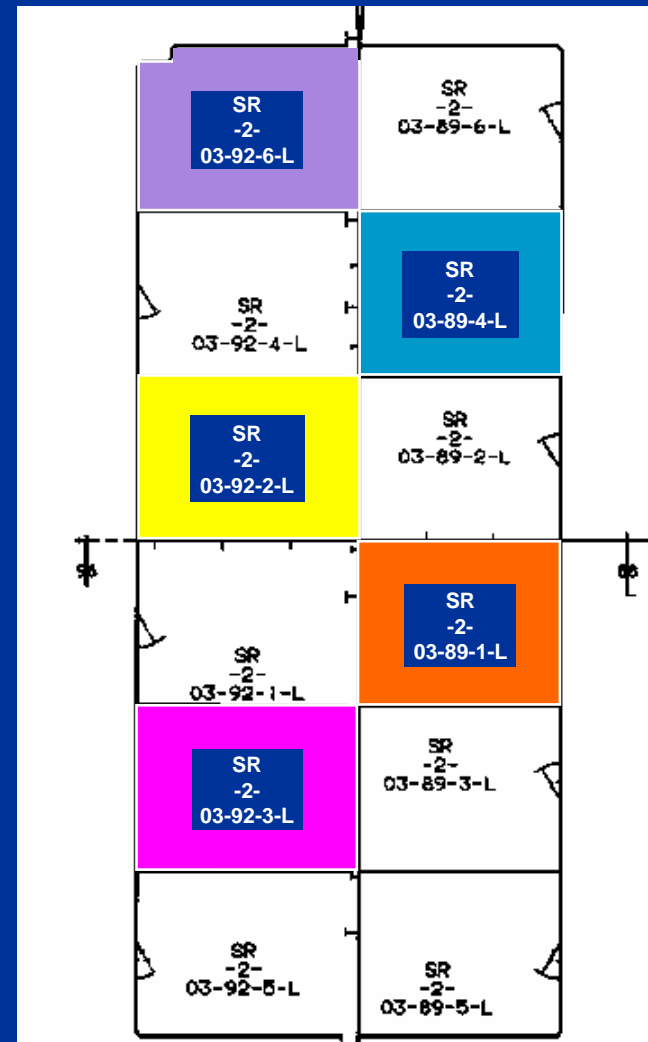
- Control Spaces
- Several Treatment Options

Simultaneous Measurements

- 8 to 12 dB reduction achieved

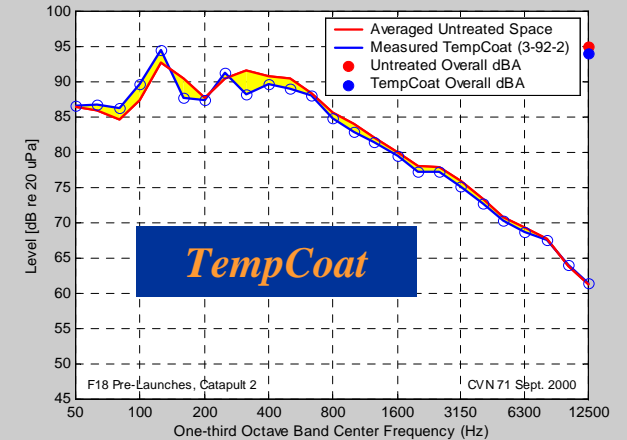
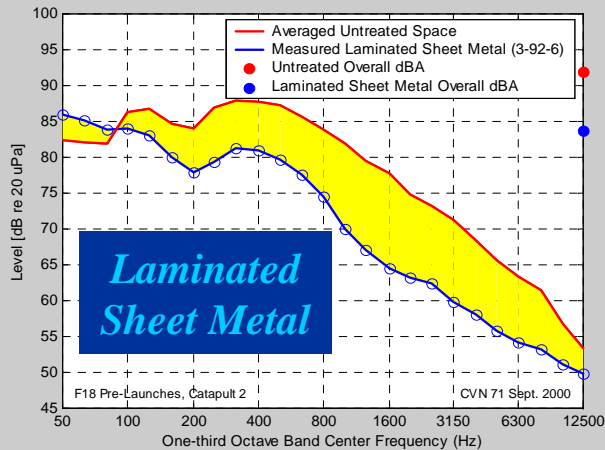
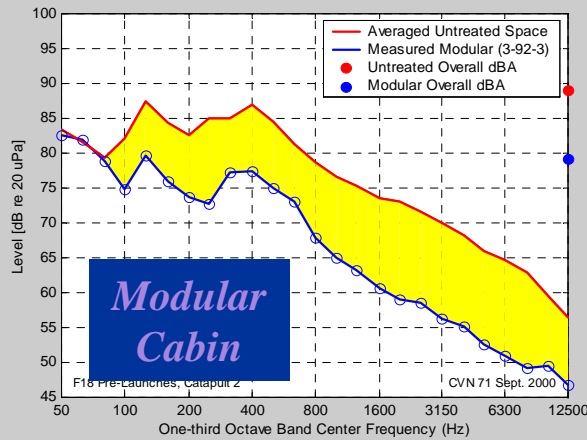
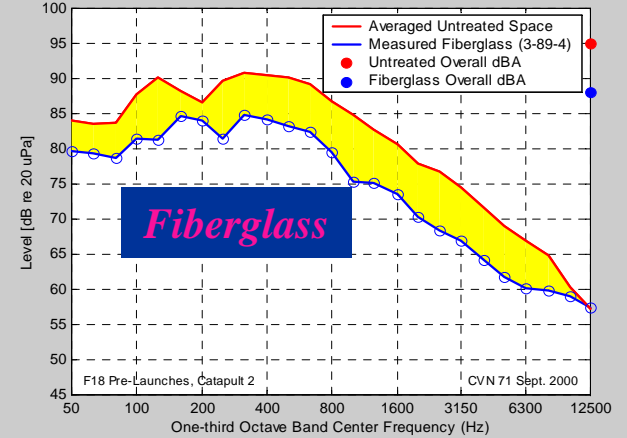
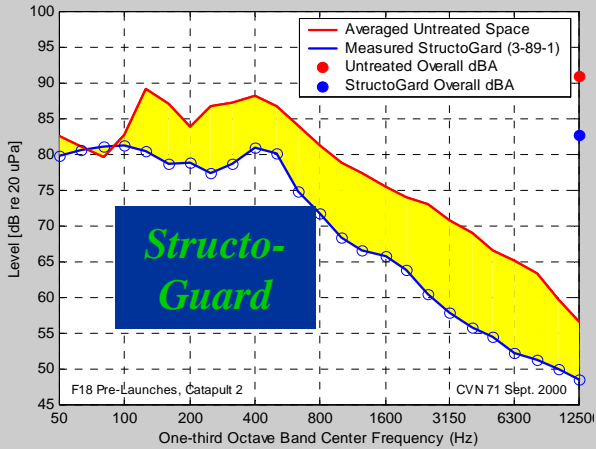
Producibility

-  *Laminated Sheet Metal*
-  *Conventional Insulation*
-  *TempCoat*
-  *StructoGard Acoustic Material*
-  *Integrated Joiner Bulkhead System*



12 Pack Treatments

Acoustic Improvement vs. Frequency



Spray-on Damping Materials





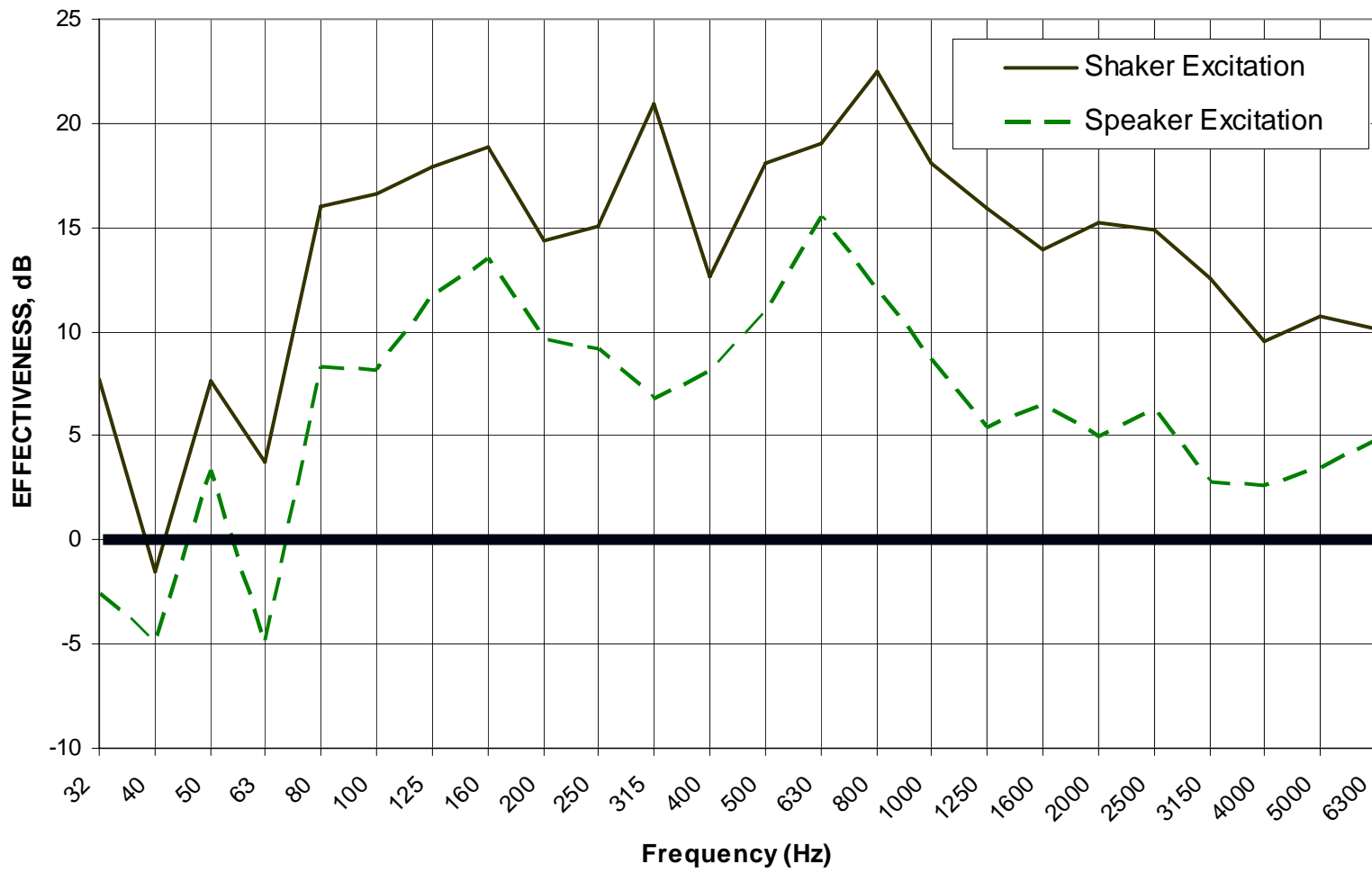
Pins installed prior to damping

Quiet Ship™ Damping Installed

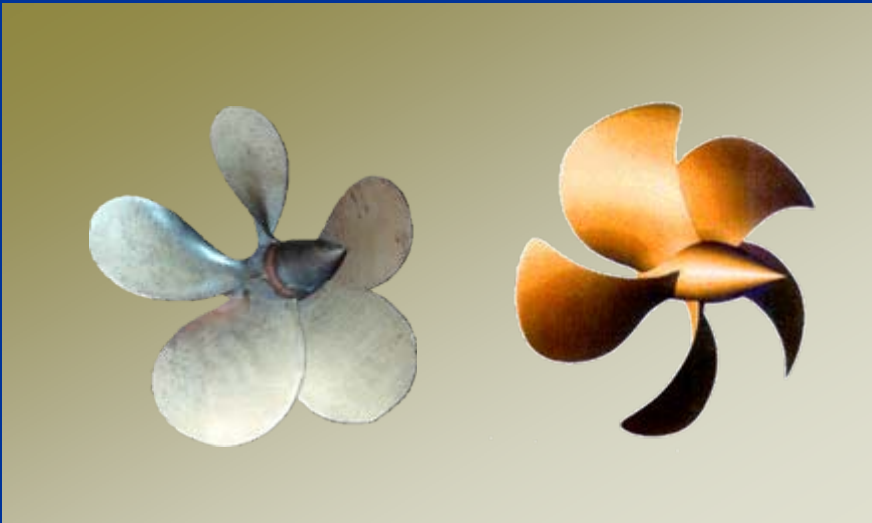
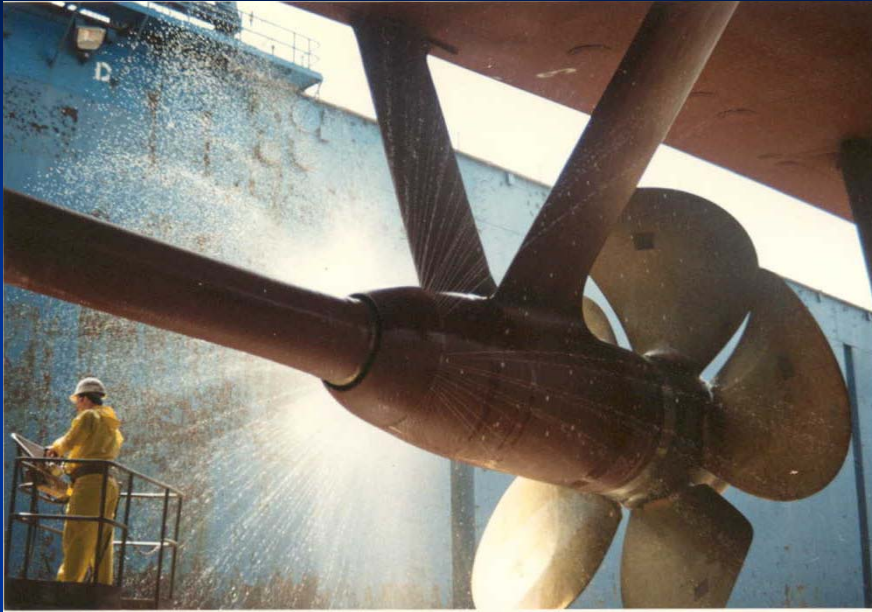


Spray-on easily installed around insulation pins and odd plate sections or forms – 12" x 12" damping tile would need to be custom fit.

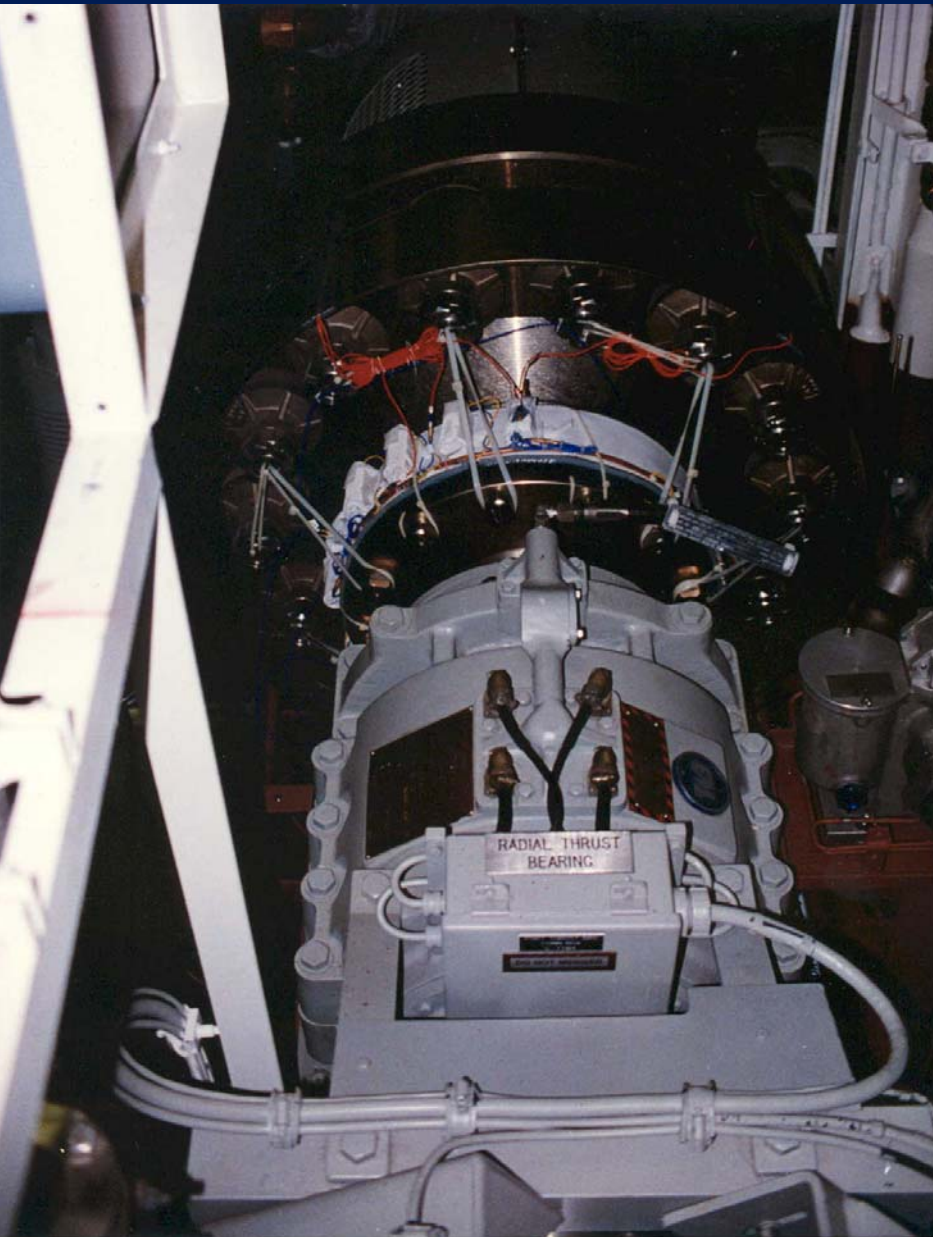
EFFECTIVENESS of 3mm THICK QUIET SHIP TREATMENT - ALUM BHD



Propeller Design



Measurement Techniques



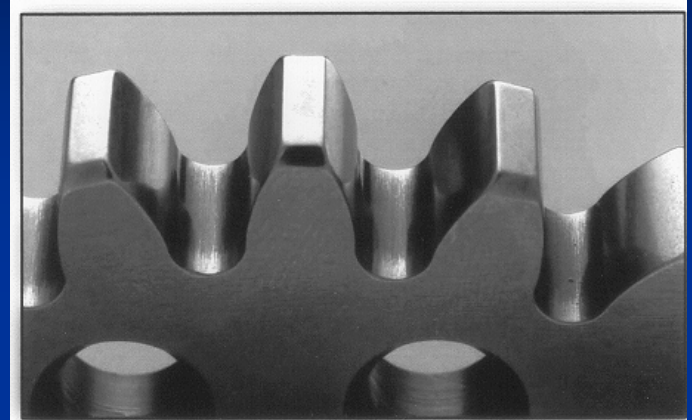
Sikorsky Superfinish/Engineered Gear Surface Program

Manufacturing Benefits

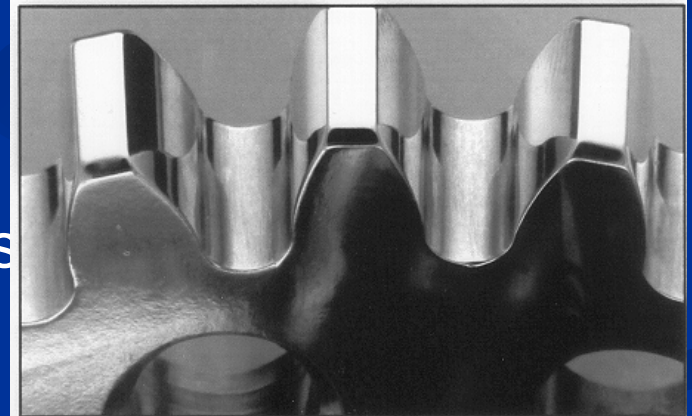
- Edge Break Consistency
 - No Manual Deburring
- Cost Savings

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

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



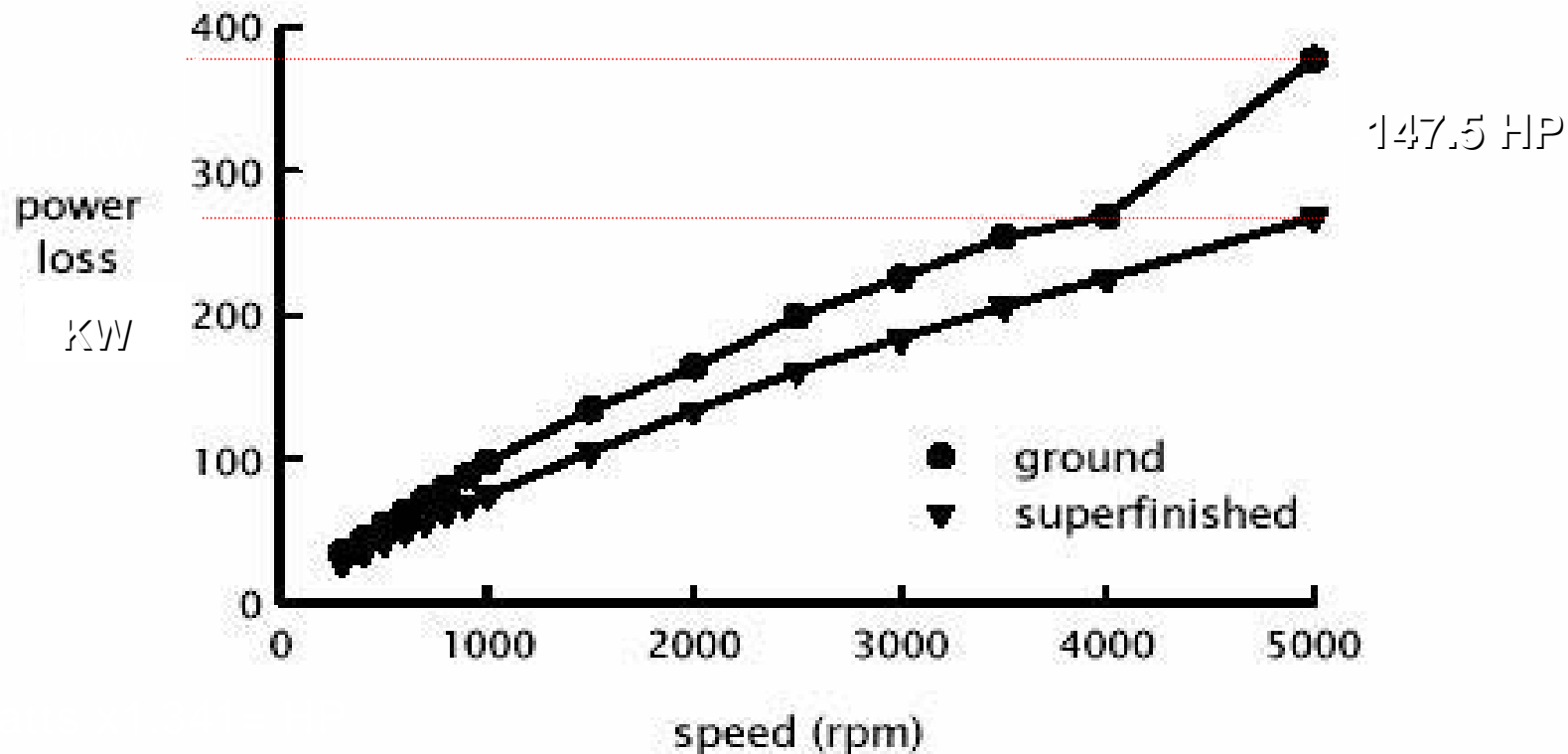
Gear Filet Starting Condition



REM[®] Finished Gear Filet



Reduction in Power Loss



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



WARNING - This document contains technical data whose export is restricted by the Arms Export Control Act (Title 22, U.S.C., App. 2401a et seq.). Violations of these export laws are subject to severe criminal penalties. Information not to be released to U.S. Government Agencies and their Contractors (ITAR/EAR Technology) 15 Jul 2006. Other requests for this document shall be referred to Commander, U.S. Army Armament and Munitions Center, ACTIC: AMS/AM-RD-SG-MT, Redstone Arsenal, AL 35890-5000.



Design Tools: SBIR N98-092

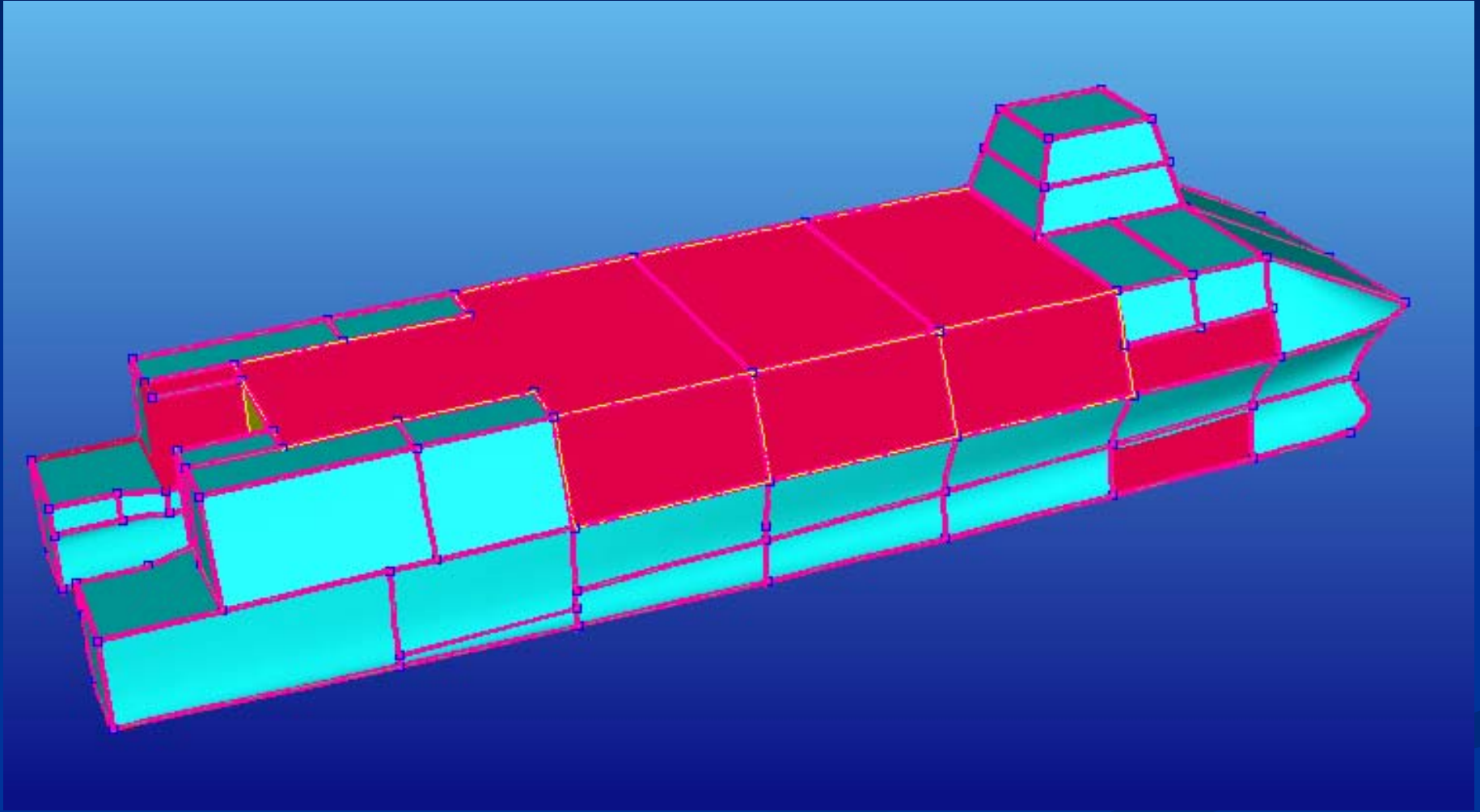
The screenshot displays a Windows XP desktop environment. The primary window is titled "Virtual Engineering Development Model - xcorvette6a.pex [OPV]". It features a menu bar with "File", "Edit", "View", "Project", "Tasks", "Tools", "Window", and "Help". Below the menu is a toolbar with various icons. The main workspace shows a 3D model of a car's interior, rendered in a yellow wireframe mesh. To the right of the workspace is a "Taxonomy" panel with a list of hierarchical items: "Topology", "CoarseMesh", "FineMesh", "Group", "Geometry", "Compartment", "System WBS", and "Topology".

Overlaid on the bottom-left of the main window is a "New Web Browser" window. The address bar shows "http://www.noise-control.com". The page content includes:
NOISE CONTROL ENGINEERING, INC.
799 MIDDLESEX TURNPIKE
BILLERICA MA 01821
E-MAIL: nonoise@attbi.com
PHONE: 978-670-5339
FAX: 978-667-7047
President: Raymond W. Fischer
Member: *National Council of Acoustical Consultants*

The logo for Noise Control Engineering, Inc. is centered, featuring a stylized car silhouette with sound waves emanating from the bottom. The text "MAKING NOISE QUIETLY" is arranged around the logo.

The Windows taskbar at the bottom shows the "start" button, several open applications including "C:\Documents and Se...", "Microsoft PowerPoint ...", "Virtual Engineering D...", and "Google Search: noise ...", and a system tray with the time "12:17 AM".

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**