

TIM GATES

IRSO – OCTOBER 2015

**BUILDING AND
MAINTAINING A QUIET
RESEARCH VESSEL**

Strategy

- ① Design it
- ② Build it
- ③ Test and Maintain it

Design considerations

⦿ Radiated Noise

- What are the real requirements – ICES 209?
- Why do you care about radiated noise?
 - Fishery Research
 - Environmental Concerns

⦿ Sonar Self Noise

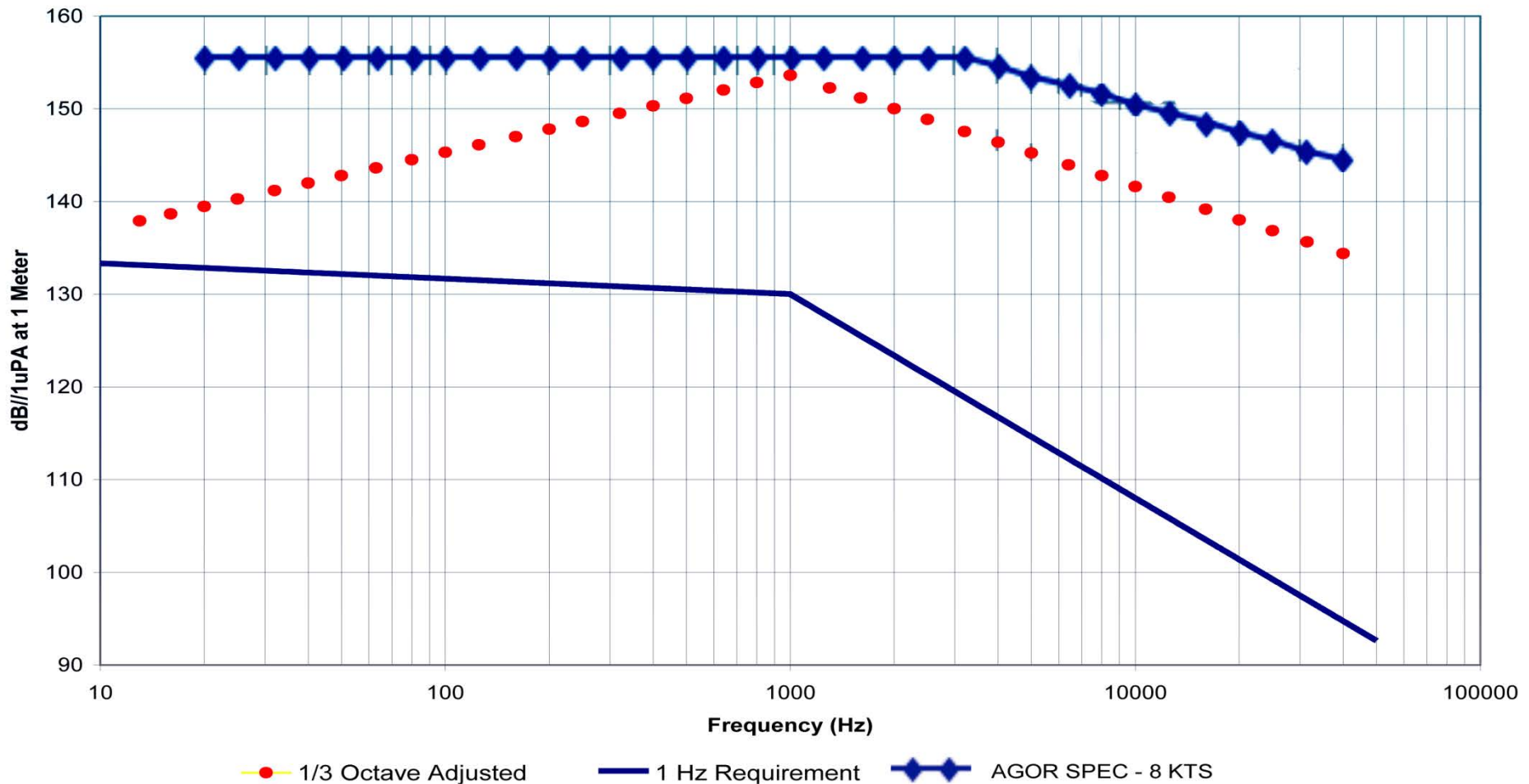
- Should be performance driven
- What are the scientific goals to be accomplished?

Radiated Noise

- Must decide if there will be a radiated noise specification
- If fishery surveys are required, use ICES 209
- If fishery surveys are not part of the plan, consider developing a different, less stringent spec like OCEAN CLASS AGOR

ICES SPECIFICATION AT 11 KNOTS AGOR SPEC AT 8 KNOTS

ICES NOISE SPECIFICATION



Sonar Self Noise

- Must develop scientific mission profiles
- Develop a typical sonar list
- Tabulate operating frequencies of sonars
- Focus design efforts (and funds) on quieting research vessel at particular frequencies

Potential Sonar Acoustic Issues

- ⦿ Machinery Noise
- ⦿ Hydrodynamic Flow Noise
- ⦿ Propeller Cavitation
- ⦿ Appendage Cavitation
- ⦿ Bubble Sweepdown

Develop Construction Spec

- Using active sonar equation, determine what the maximum sonar self noise levels must be at each operating frequency
- Address propeller design
- Address bubble sweepdown
- Document sonar orientation, fairing and location requirements

Examples of Spec Requirements

- ⦿ Do not allow propeller cavitation at any mission speeds
- ⦿ Sound isolate all significant machinery and piping
- ⦿ Have fairness criteria within 6 meters of sonar transducers
- ⦿ Require selection of “quiet” machinery
- ⦿ Require modeling and acoustic predictions

Construction

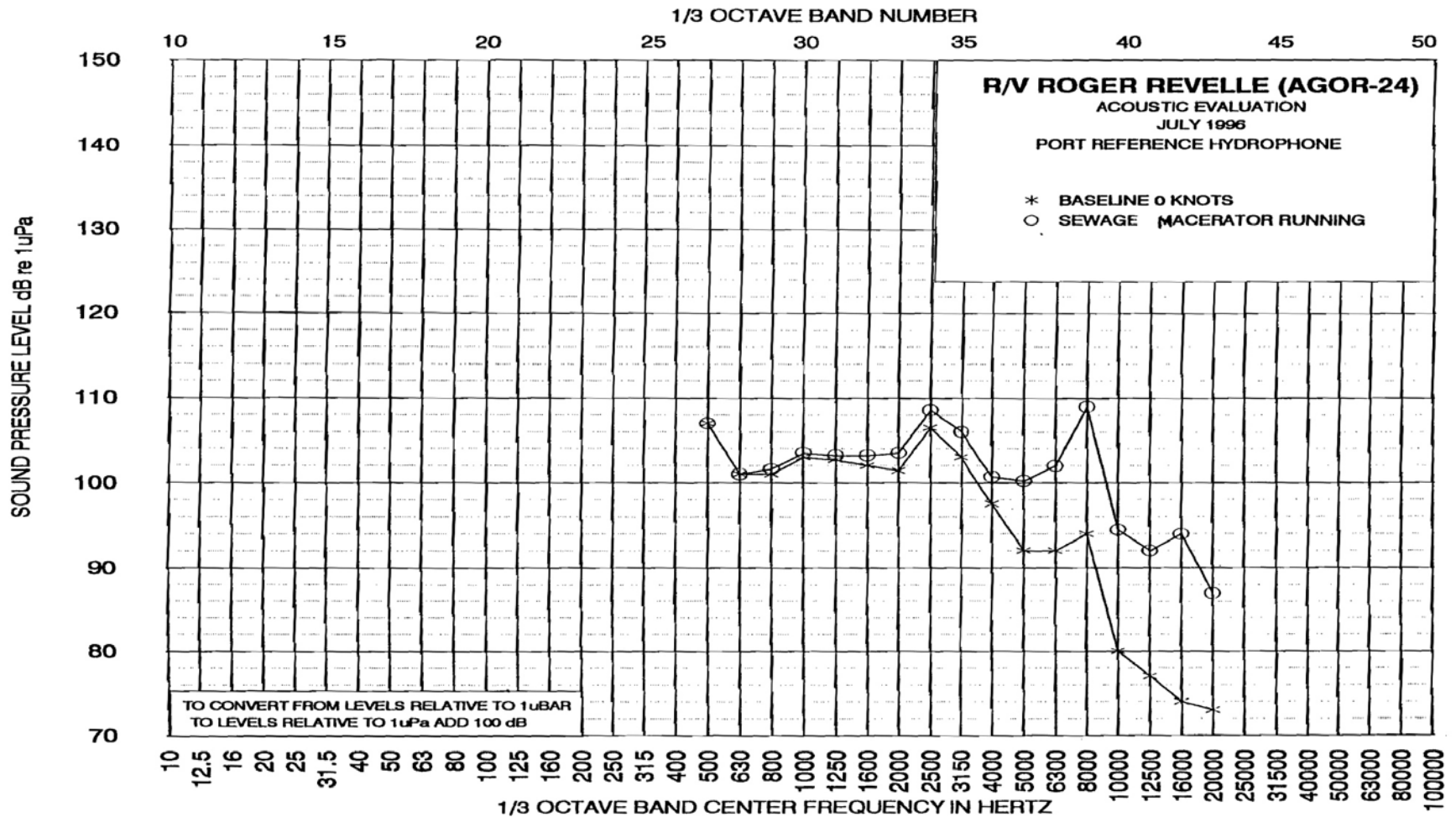
- Using a detailed construction specification, ensure all requirements are met
- On-site supervision is a wise idea to ensure goals are met

Test and Maintain

- At delivery, a total ship acoustic baseline should be performed
- This baseline will allow for verification of all silencing treatments, as well as, future acoustic maintenance efforts
- Maintenance efforts are critical to ensure the vessel continues optimized sonar performance
- Ships do not stay quiet over time!!!

Examples of Noise Problems

Sewage Pump Noise



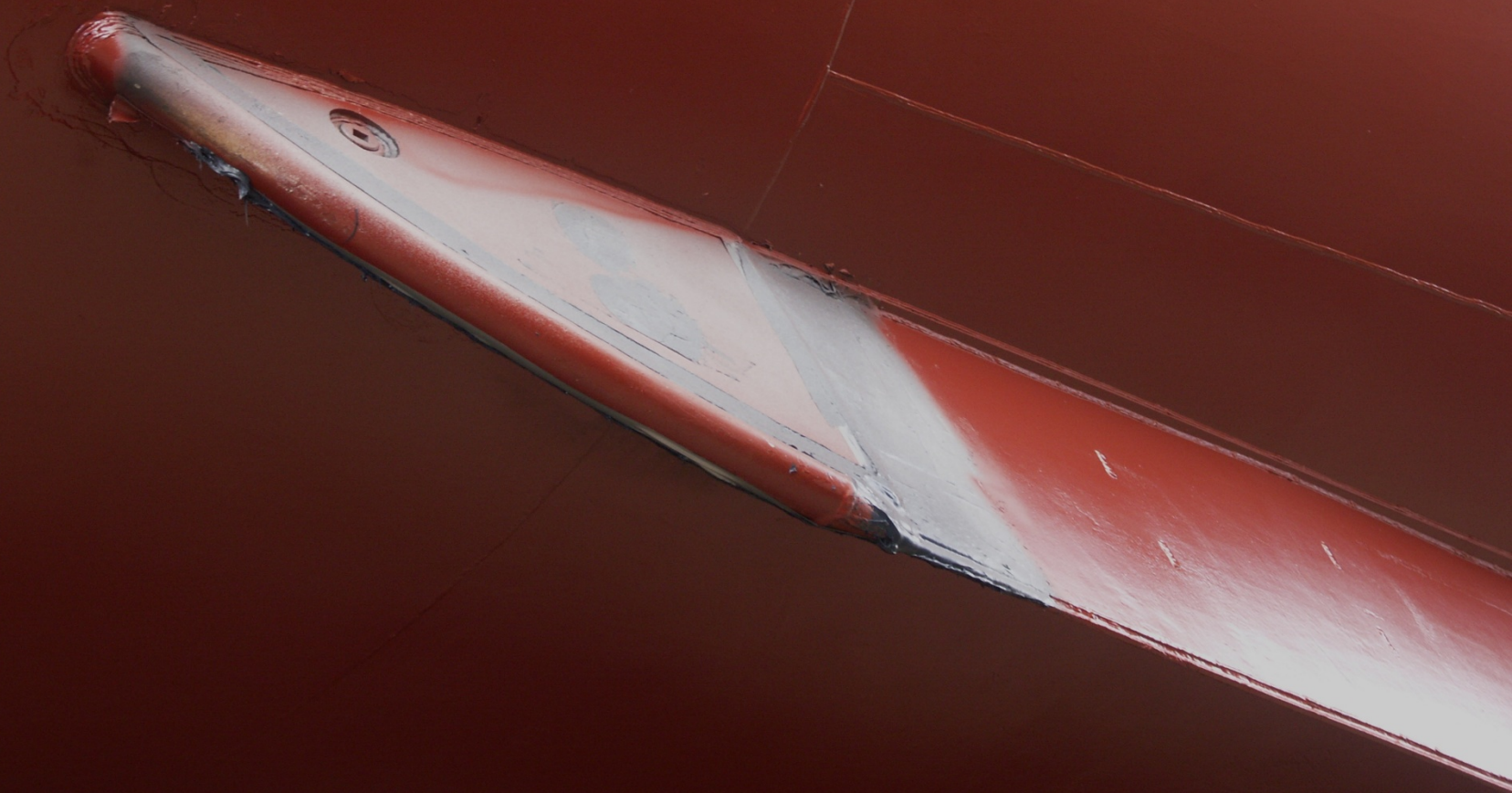
Bilge Keel Cavitation

**Leading Edge
of
Port Bilge Keel
Cavitation Starts**

**600 rpm
11.4 kts.**



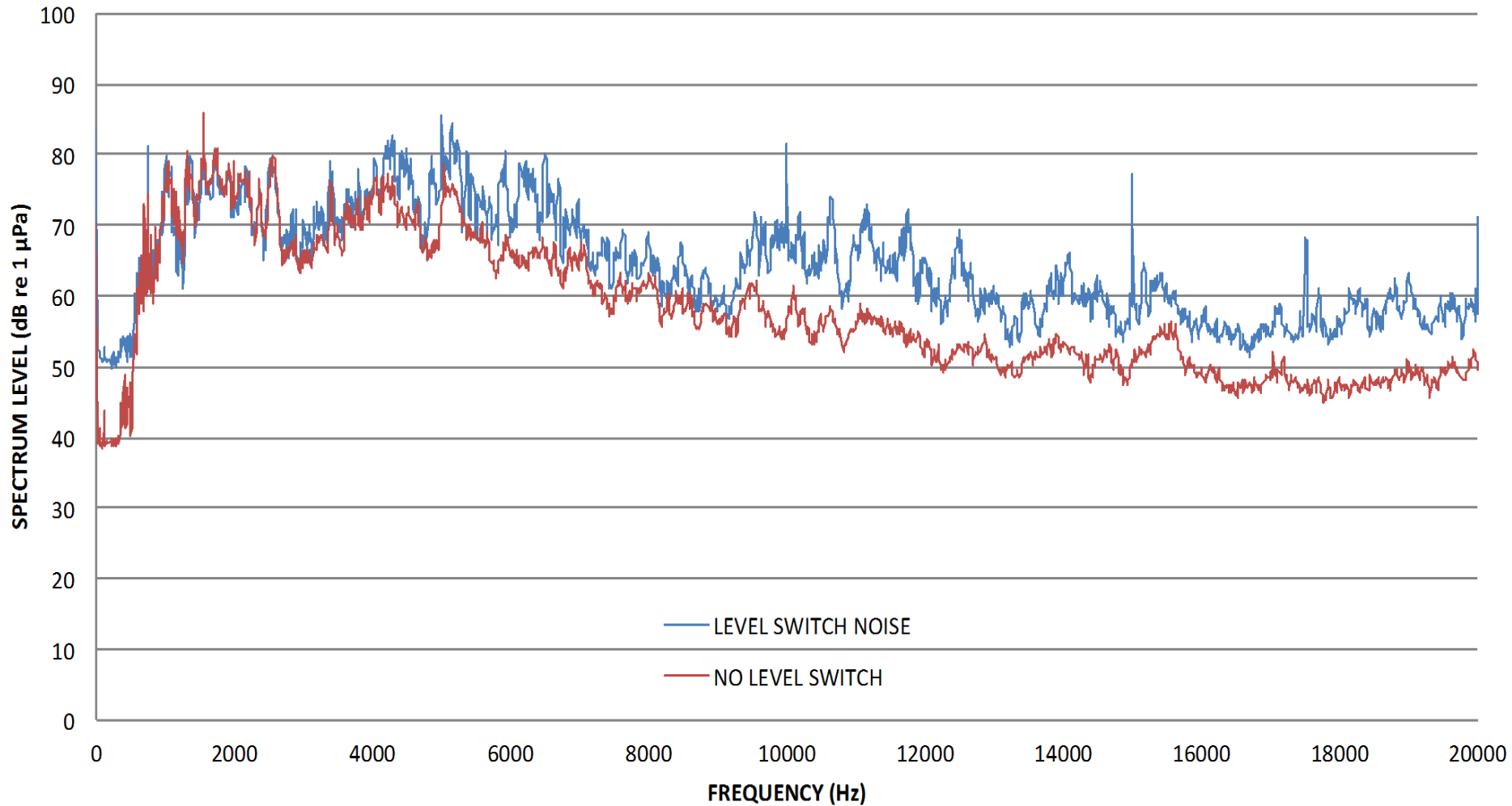
New Design Bilge Keel



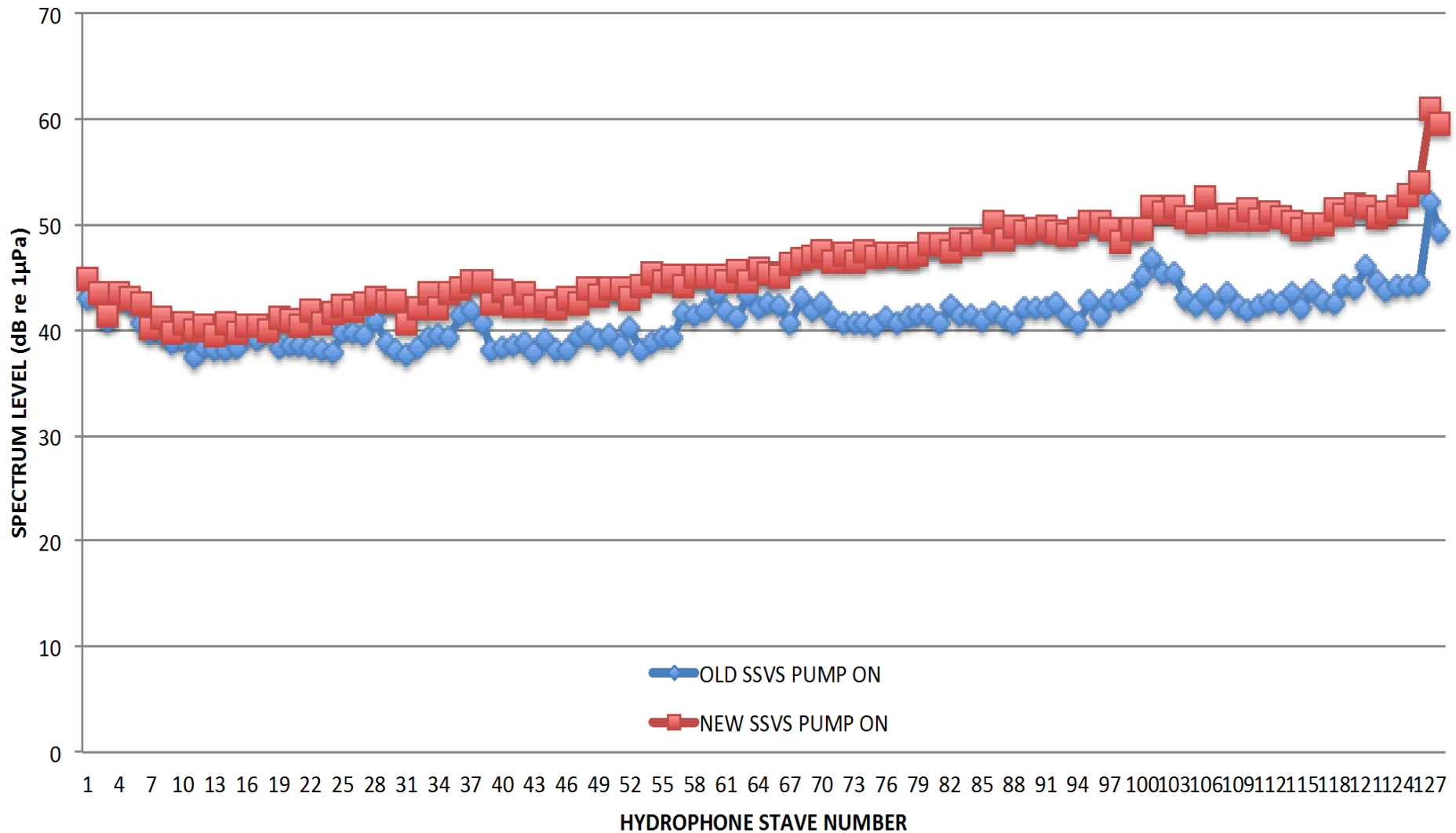
New Design Bilge Keel



R/V NEIL ARMSTRONG (AGOR 27)
STARBOARD REFERENCE HYDROPHONE
30 RPM - 0% PITCH - 0 KTS
SEWAGE TANK LEVEL SWITCH
14 APRIL 2015



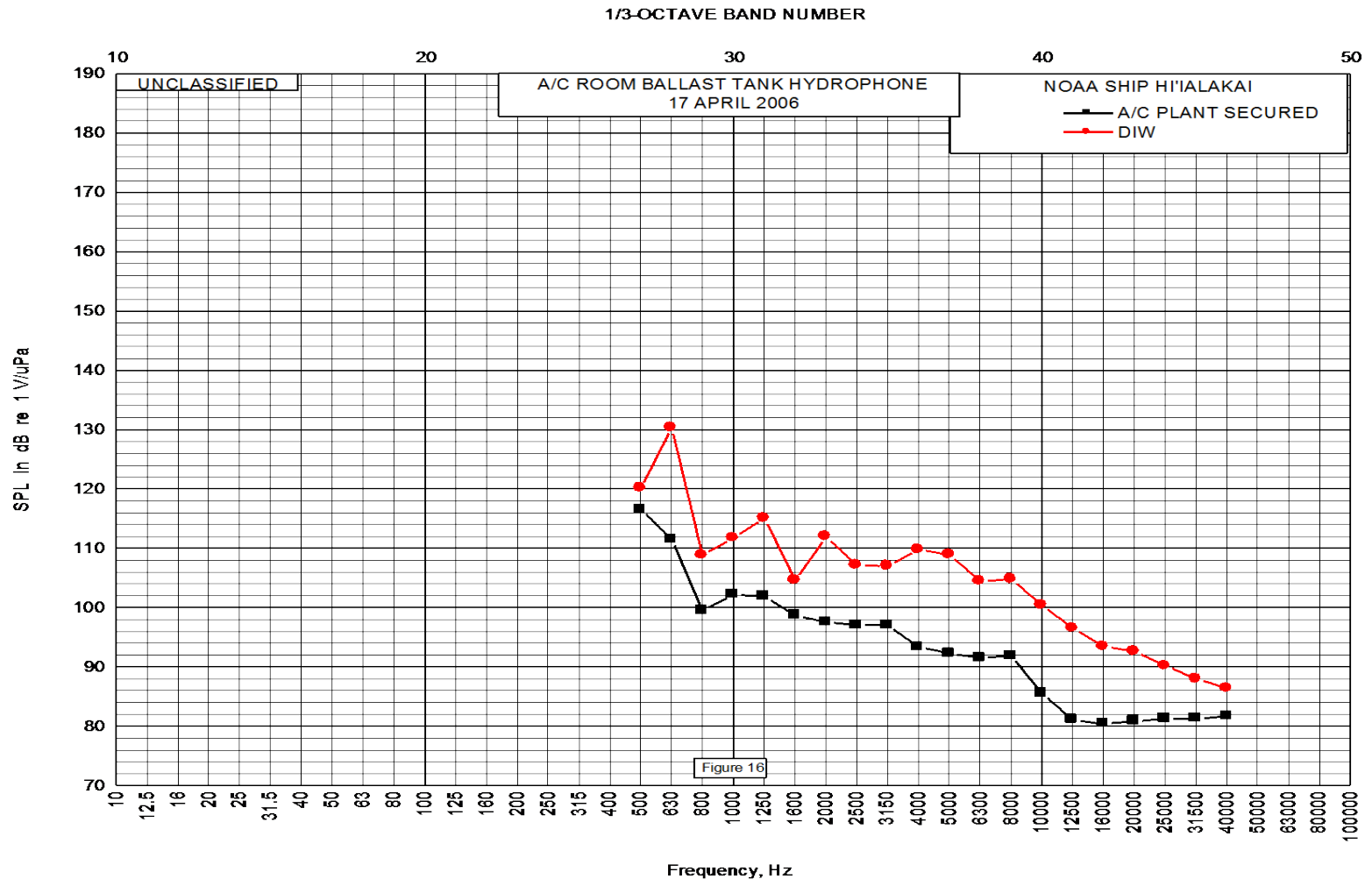
**E/V NAUTILUS
EM 302 RX NOISE LEVEL
OLD VS NEW SSVS PUMP COMPARISON
5 MAY 2014**



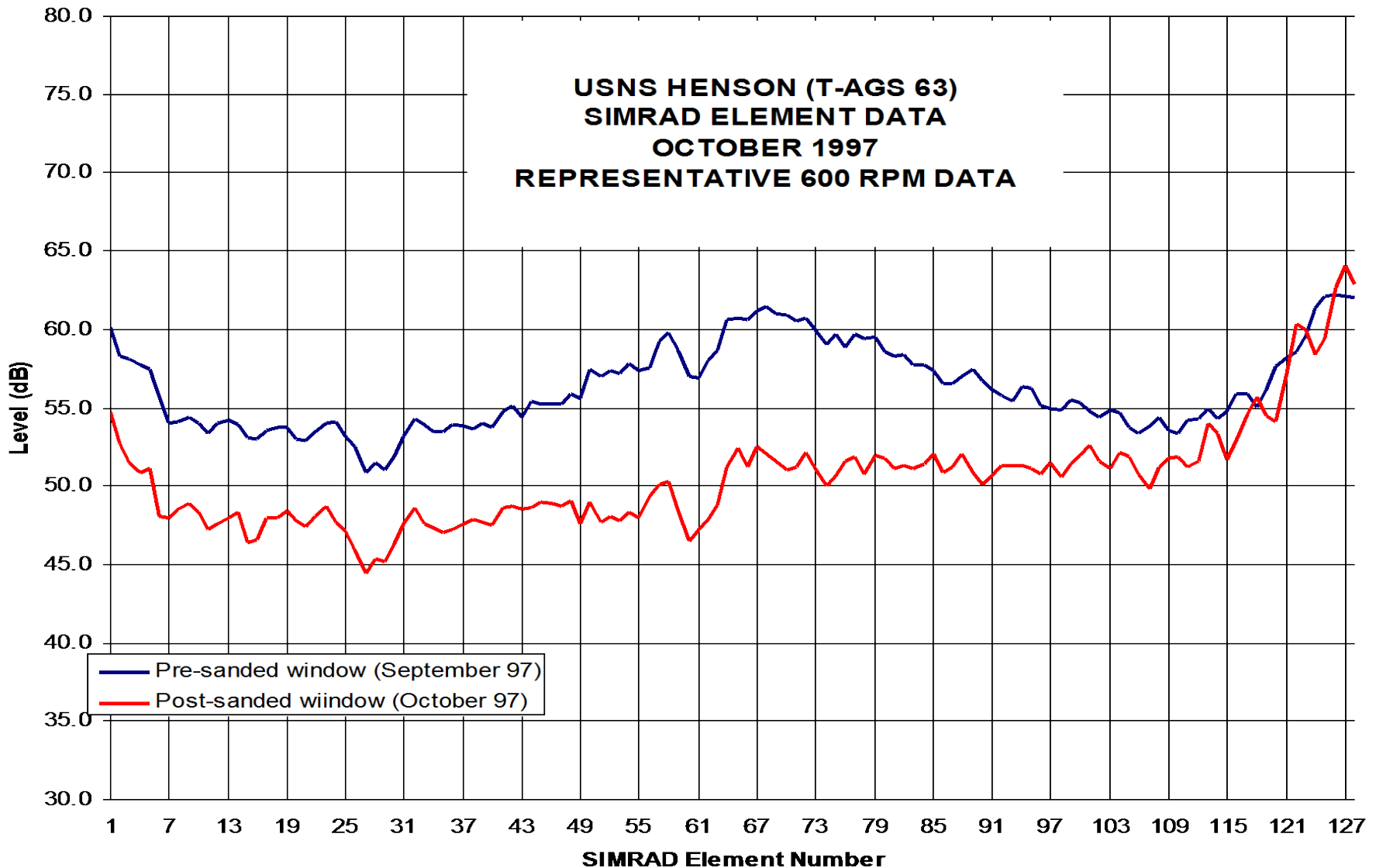
Sound Short Example

UNCLASSIFIED

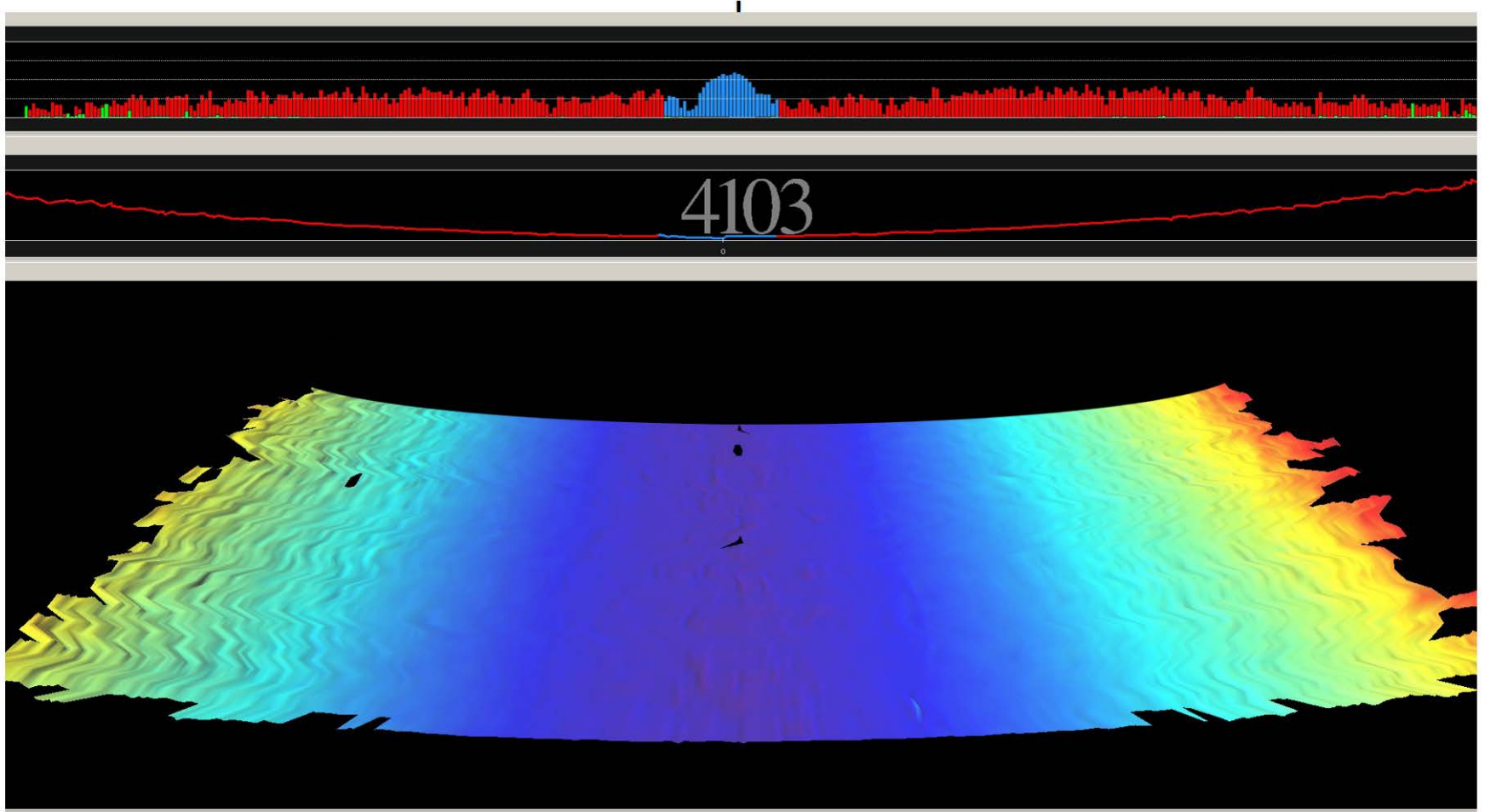
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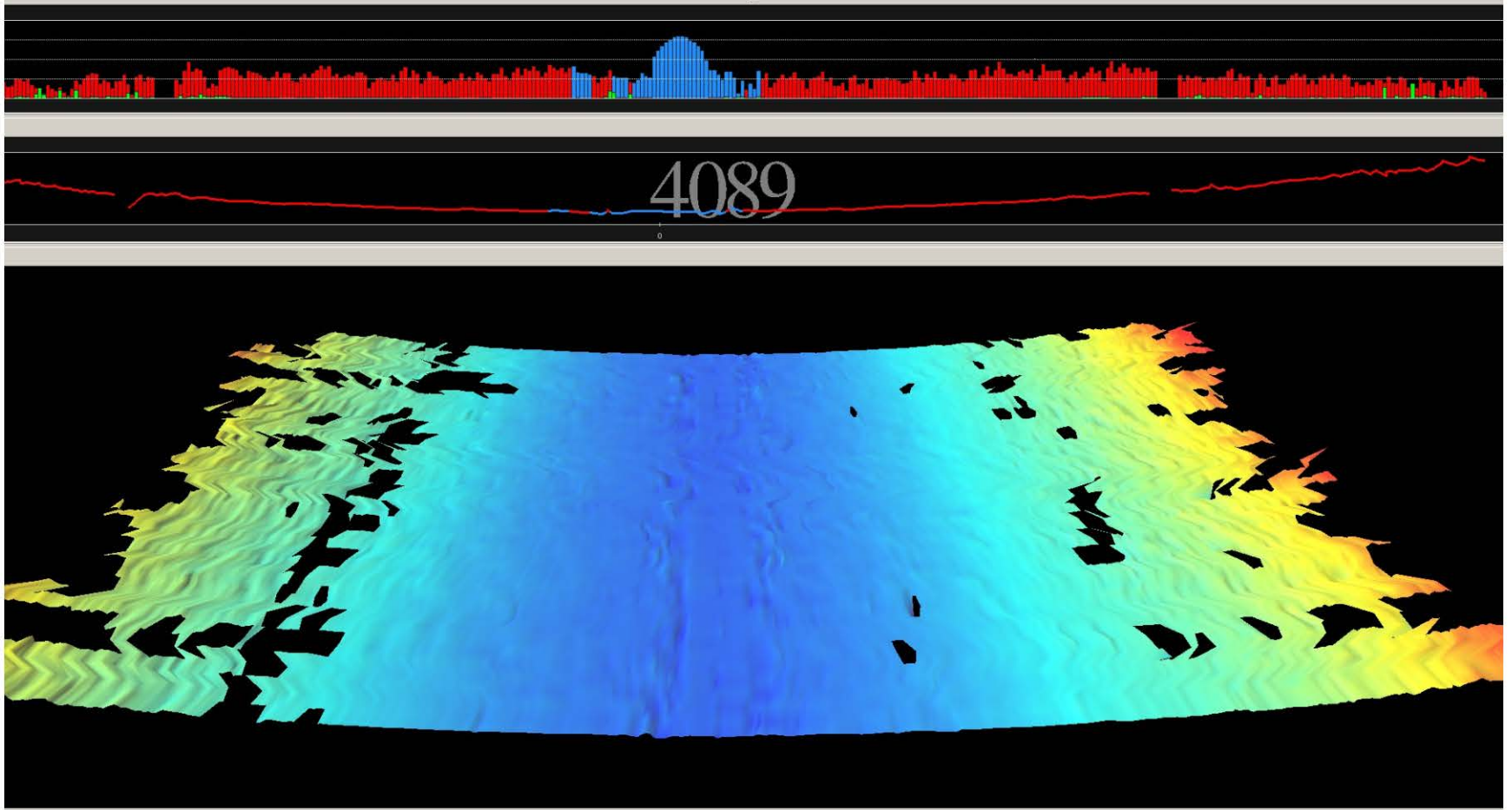
Bad Paint



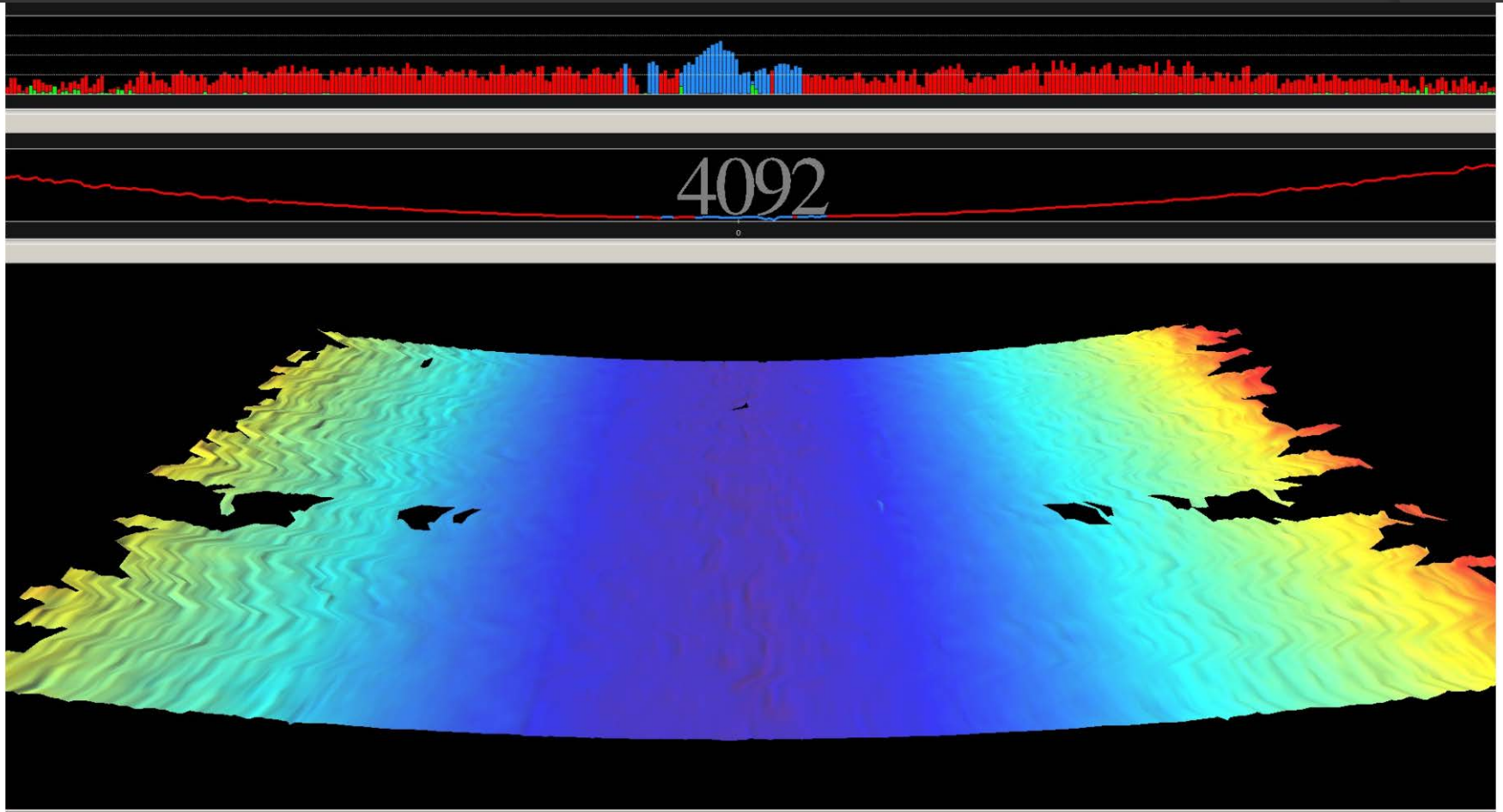
USCG HEALY
EM 122 SCREEN SHOT
QUIET LINE UP



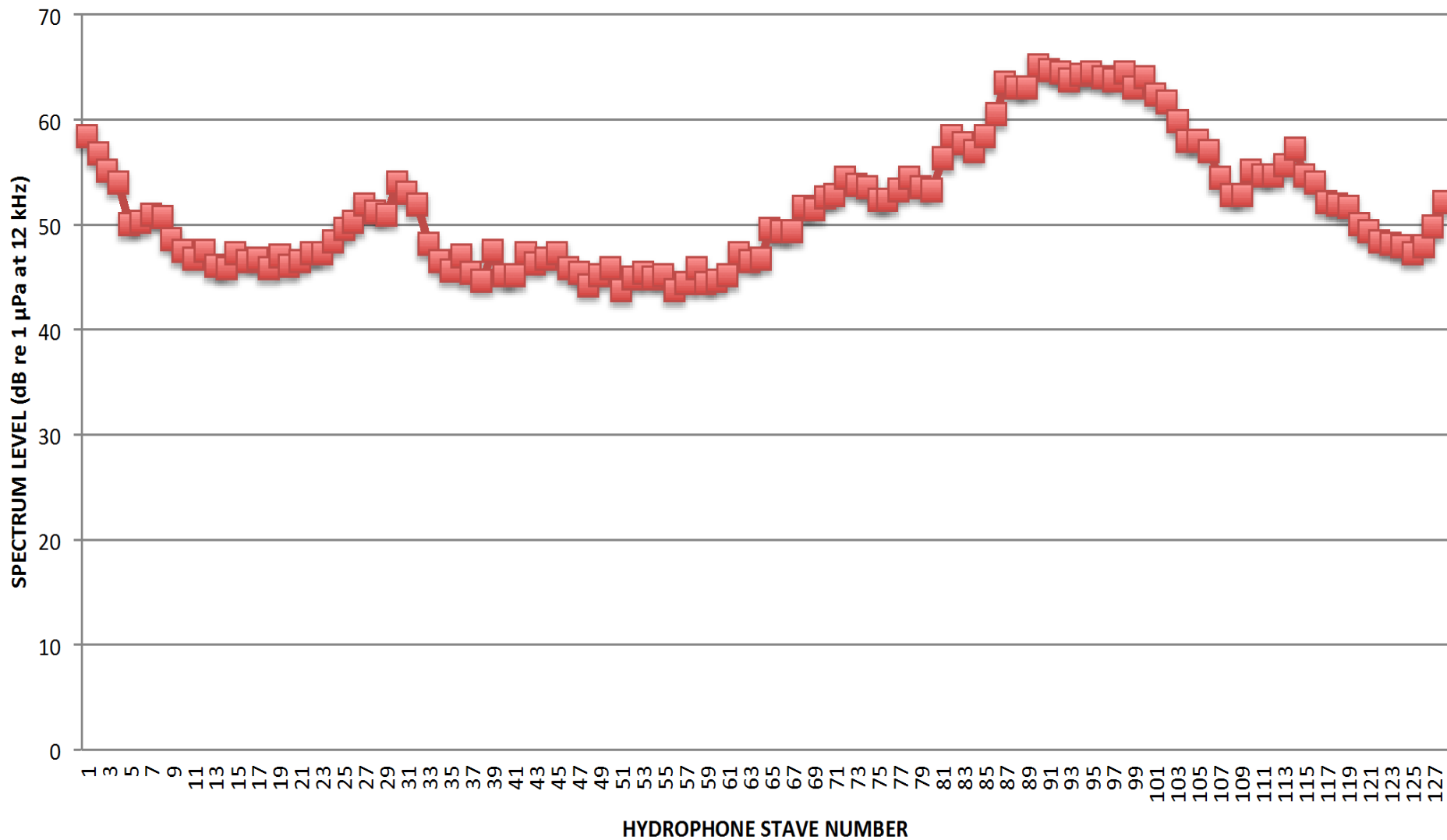
USCG HEALY EM 122 SCREEN SHOT BOILER FEED OPERATION



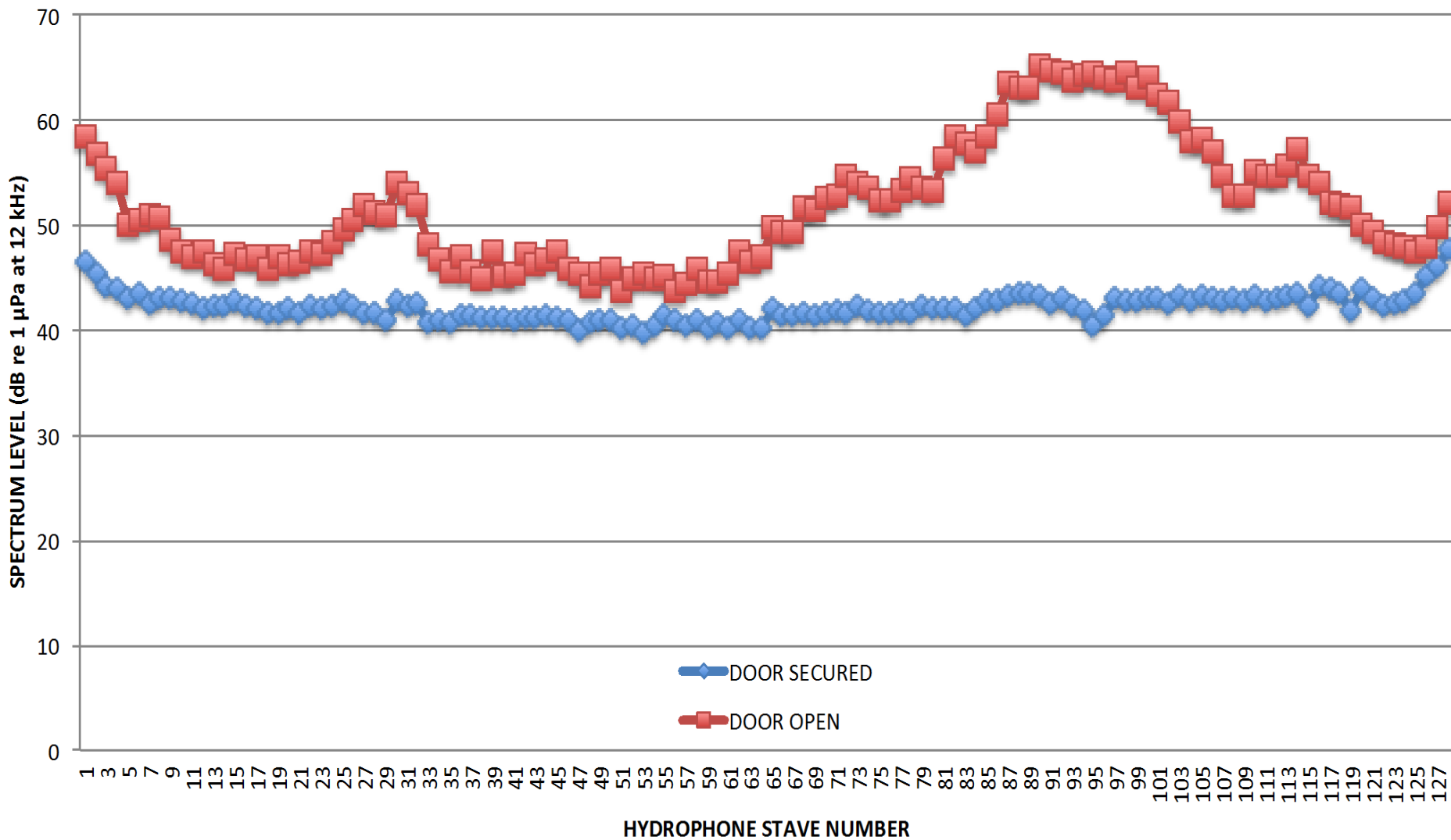
USCGC HEALY EM 122 SCREEN SHOT POTABLE WATER PUMP TRANSIENT

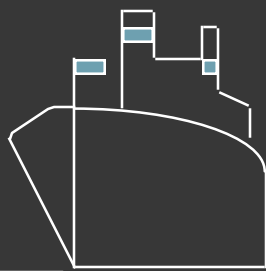


USNS MARY SEARS (T-AGS 65)
EM 121a RX NOISE LEVEL
DOOR TRANSIENT
10 APRIL 2003



USNS MARY SEARS (T-AGS 65)
EM 121a RX NOISE LEVEL
DOOR TRANSIENT
10 APRIL 2003





90 Degrees

6800 Meters (65dB)

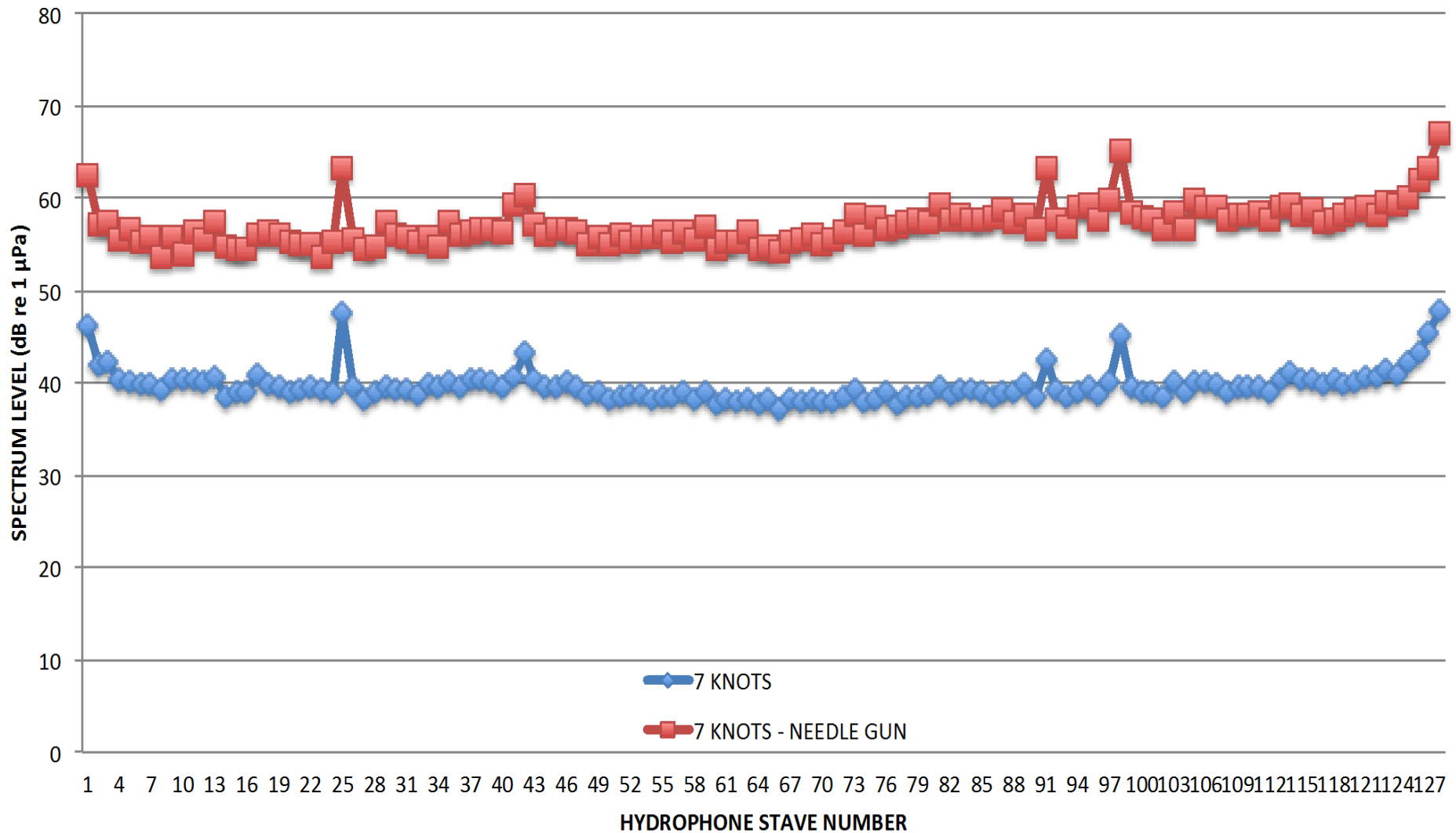


11000 Meters (49 dB)

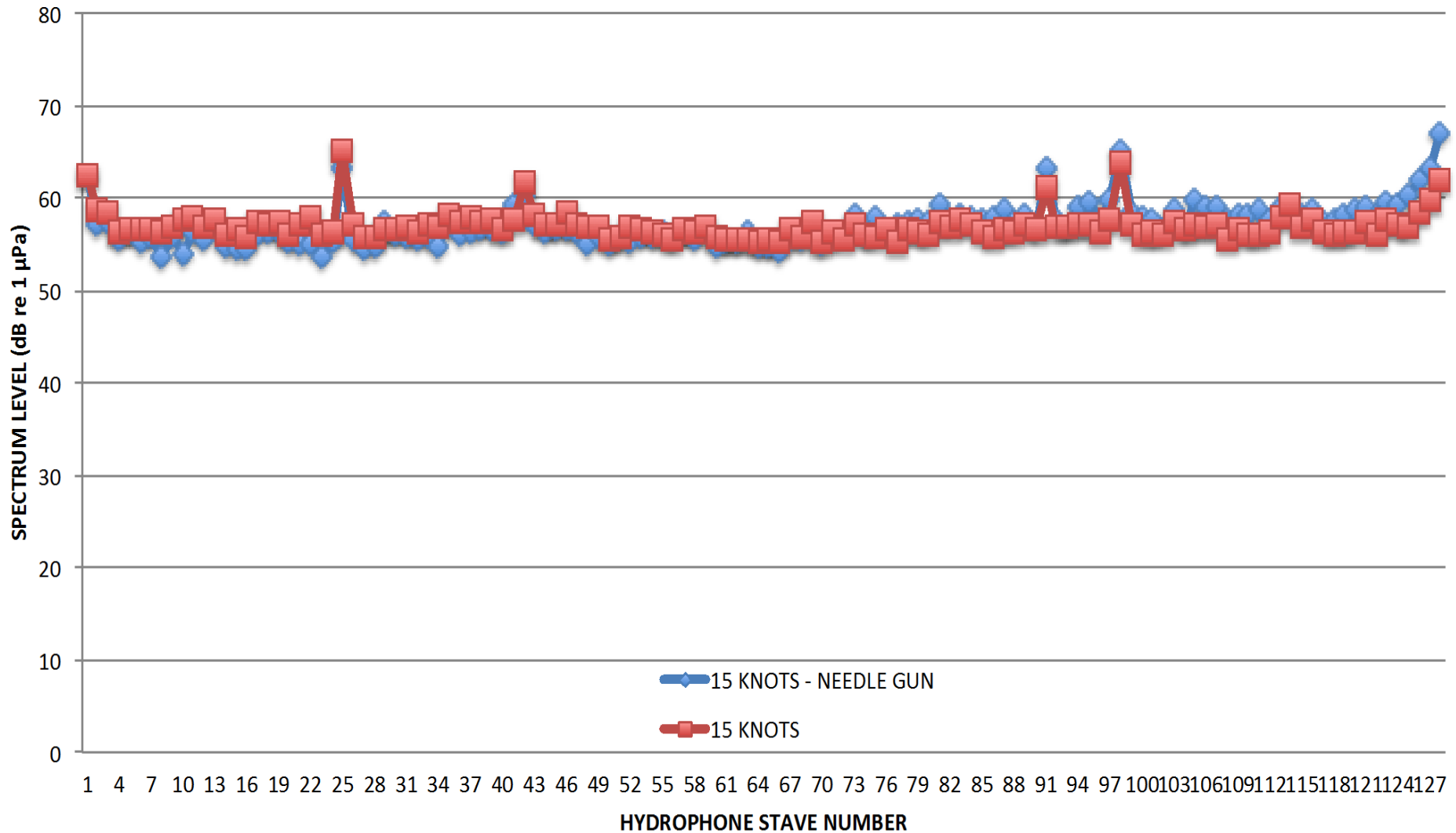


Specification Coverage
(90 Degrees at 11 KM)

USNS BRUCE C. HEEZEN (T-AGS 64)
EM 122 RX NOISE LEVEL
NEEDLE GUN OPERATION IMPACT - 7 KNOTS
14 APRIL 2014



USNS BRUCE C. HEEZEN (T-AGS 64)
EM 122 RX NOISE LEVEL
NEEDLE GUN OPERATION IMPACT - 15 KNOTS
14 APRIL 2014



Conclusions

- ① Design and build it quiet!
- ① Aggressively stay on top of acoustic performance to keep it quiet
- ① Ensure sonar operators are aware of noise issues and have them stay involved in acoustic signature maintenance