



NAVSEA Approved Condenser Cleaning and Eddy Current Testing

Presented by

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Fleet Maintenance and Modernization Symposium 2016

Introduction

- NAVSEA: *It's all about the ships*
- U.S. Fleet must be prepared; proper maintenance is part of that preparation
- Fouled condenser and heat exchanger tubes result in:
 - loss of heat transfer
 - under-deposit corrosion
 - compromised power generation onboard the vessel
- Tube integrity must be monitored with cleaning and eddy current testing



Conco and NAVSEA Since 2004

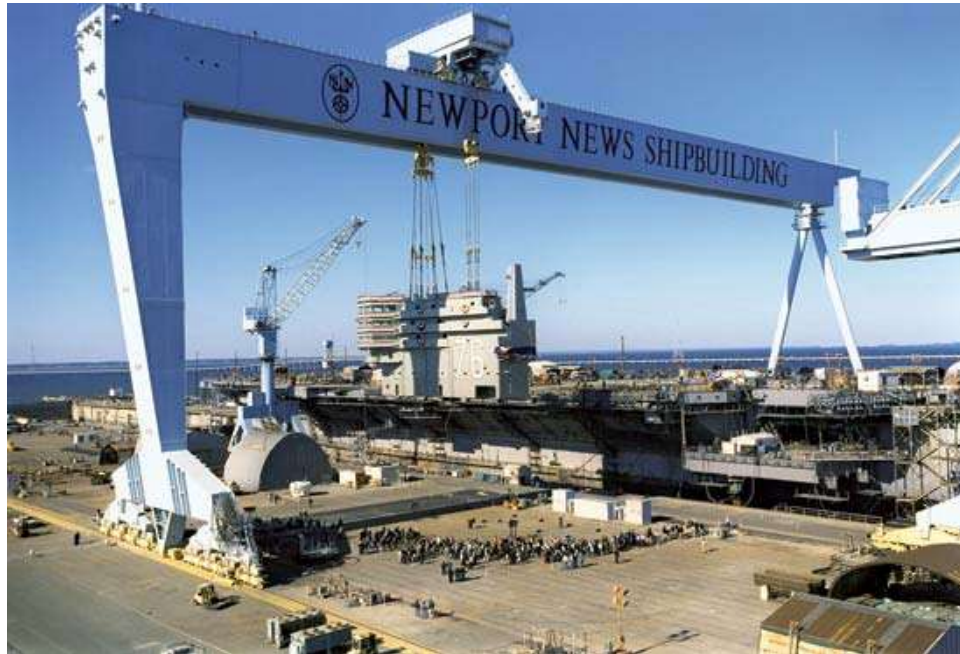
- How a relationship formed between Conco and the U.S. Navy
- Old cleaning methods compared to new
- Alpha project on the USS Enterprise in Norfolk, VA 2004



- Conco demonstrated that its method could clean in one day what was taking the in-house crew several weeks

NAVSEA Approval

- Following the USS Enterprise, Conco method is NAVSEA approved
- The Navy commissioned Conco to clean and test at Newport News and Puget Sound
- The U.S. Navy continues to use both practices



What is Conco's ProSeries™ Tube Cleaning System?

- Propels uniquely manufactured TruFit™ cleaner
- Utilizes low-pressure, high volume water
- Increases water pressure to the 300 PSI necessary for a 35 gpm flow rate
- Results in effective cleaning and flushing of the tubes
- Is portable and easily maneuvered through the ship and lowered into the hull



Advantages of Low Pressure Water

Safety

- No exposure to harmful high-pressure water lances or chemicals
- No time, effort or money spent to dispose of harsh chemicals

Efficiency

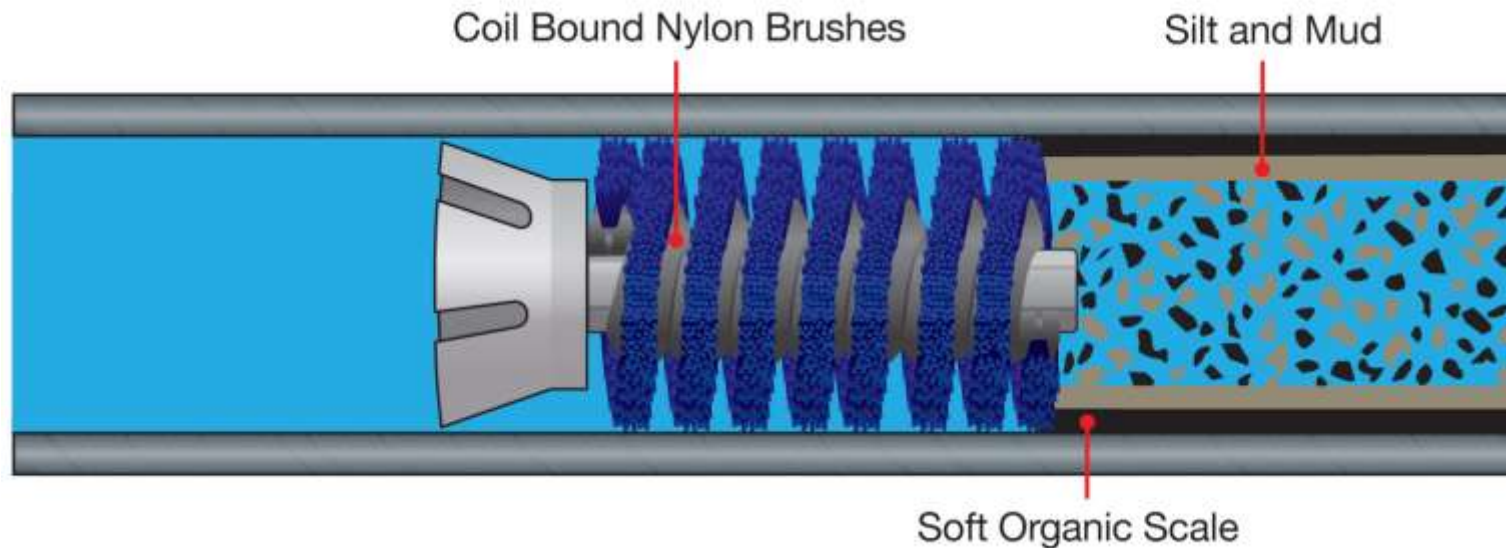
- High volume, low pressure = greater success on looser deposits and obstructed tubes

Smaller Footprint

- Cleaning space is extremely limited on vessels

TCDUSN Nylon Brush

- In 2004, Conco designed a nylon brush cleaner specifically for use in exchangers on naval ships
- Constructed of a coil-bound nylon bristle with a nylon shaft
- Ideal for removing: micro/macro fouling, soft organic deposits, some corrosion by-products, mud and silt and most types of obstructions
- Safe on all inserts and epoxy coatings
- Water propels cleaners travel through tubes at 10 to 20 feet per second (at 200-300 PSI), removing deposits, corrosion product and obstructions.

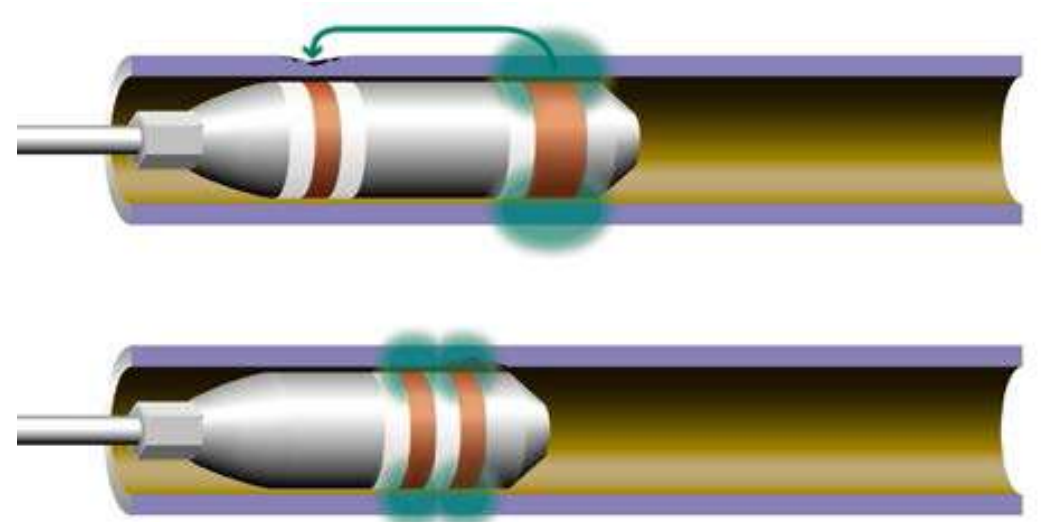


USS Enterprise hosts first Conco Cleaning

- “Alpha Project” onboard USS Enterprise in Norfolk, Virginia
- Prior efforts to clean this condenser took several weeks
- Conco estimate for duration of cleaning: “Not days, but hours.”
- First Conco cleaning, “Alpha Project”, was big success
- Conco awarded complete Carrier condenser and heat exchanger cleaning
- All units onboard Enterprise cleaned within 28 days
- Today, more than half of all Navy Carriers use Conco cleaning method

What is Eddy Current Testing?

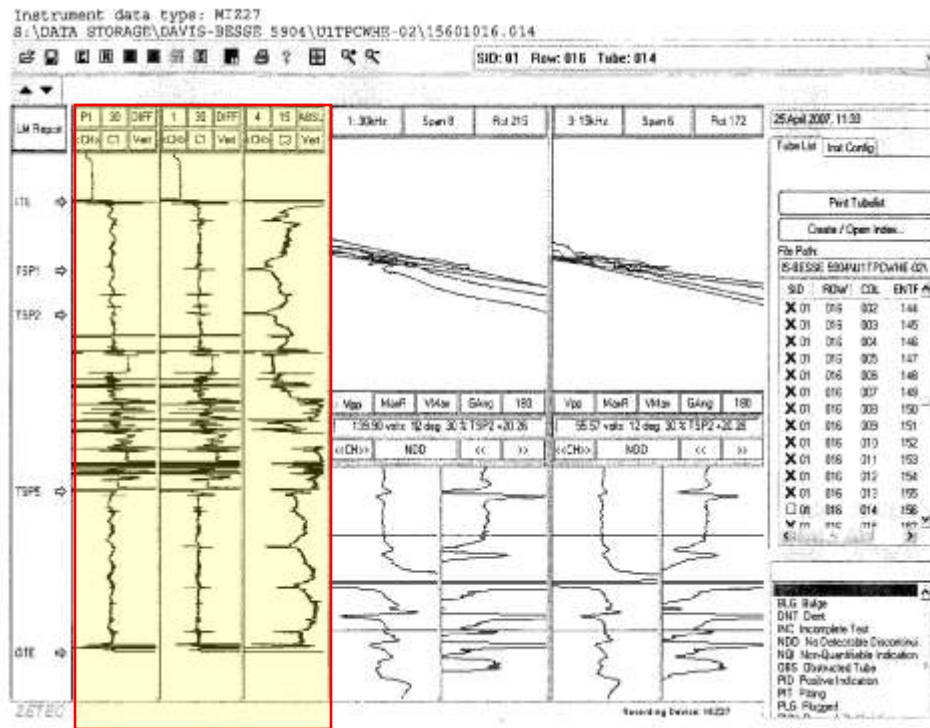
- Eddy Current Testing (ECT) is well-established
- ECT determines lifespan of tubes
- Before long deployments, identifies tubes which need to be plugged
- Uses electromagnetic field to identify defects in tubing
- Electron flow generates electromagnetic field; defects are identified when anomalies in tube material disrupt the magnetic field
- Defects include: pitting, tube wall thinning, cracking, grooving and denting
- Enables identification of failure or corrosion mechanisms



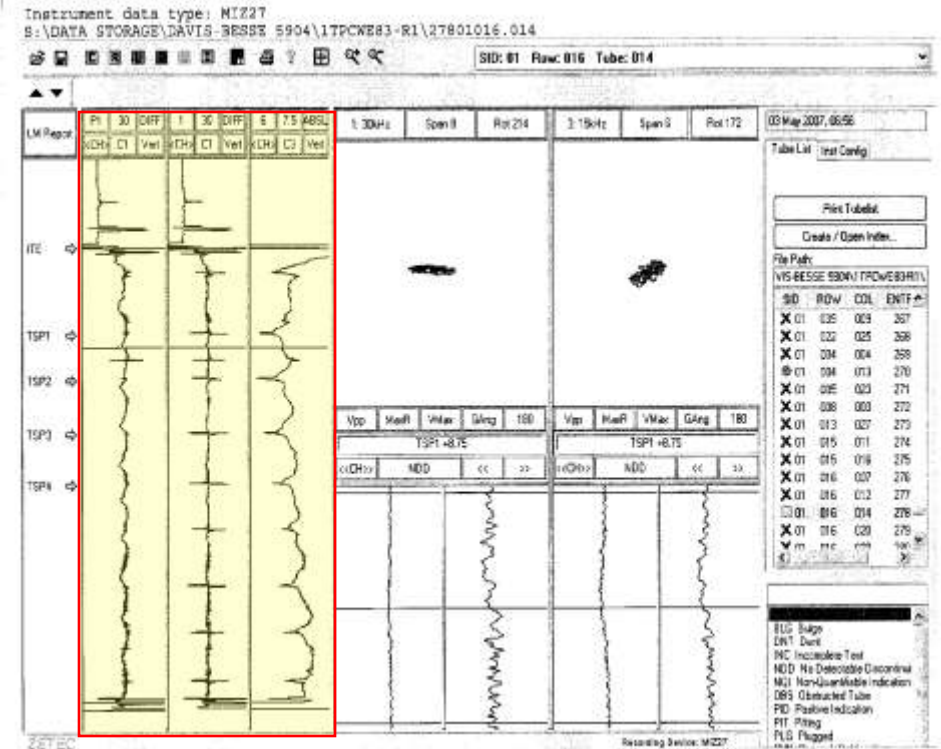
Tube Cleanliness



Side-by-Side Comparison of Fouling Impact on Data Quality



Ineffective Cleaning



Effective Cleaning

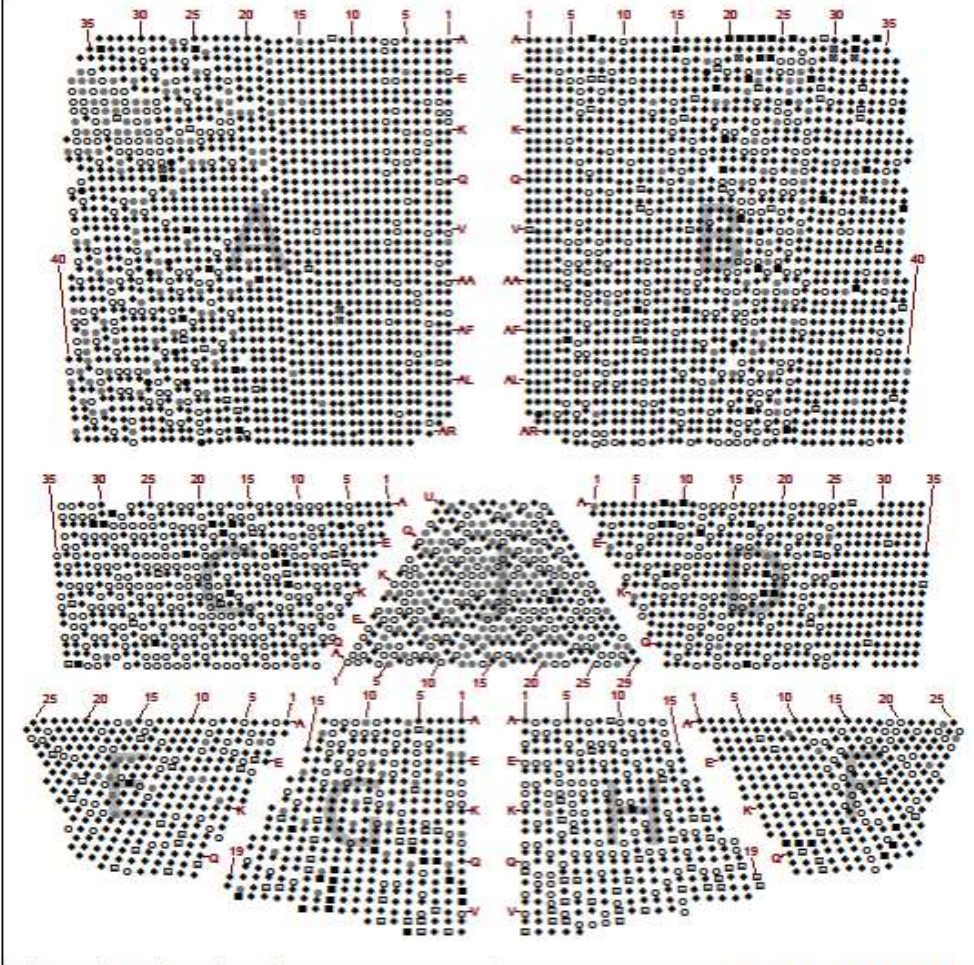
Eddy Current Test Results

- Data collection speed depends on tube length, material, defects
- Analysis of data results in tube plugging criteria
- Proactive action on questionable tubes means less tube failure
- Analysis report includes tube sheet map for easy identification
- NAVSEA – grayscale tube sheet map and plug map

RESULTS MAP

SS MINNOW
MAIN CONDENSER A

VIEW FROM INTLET END

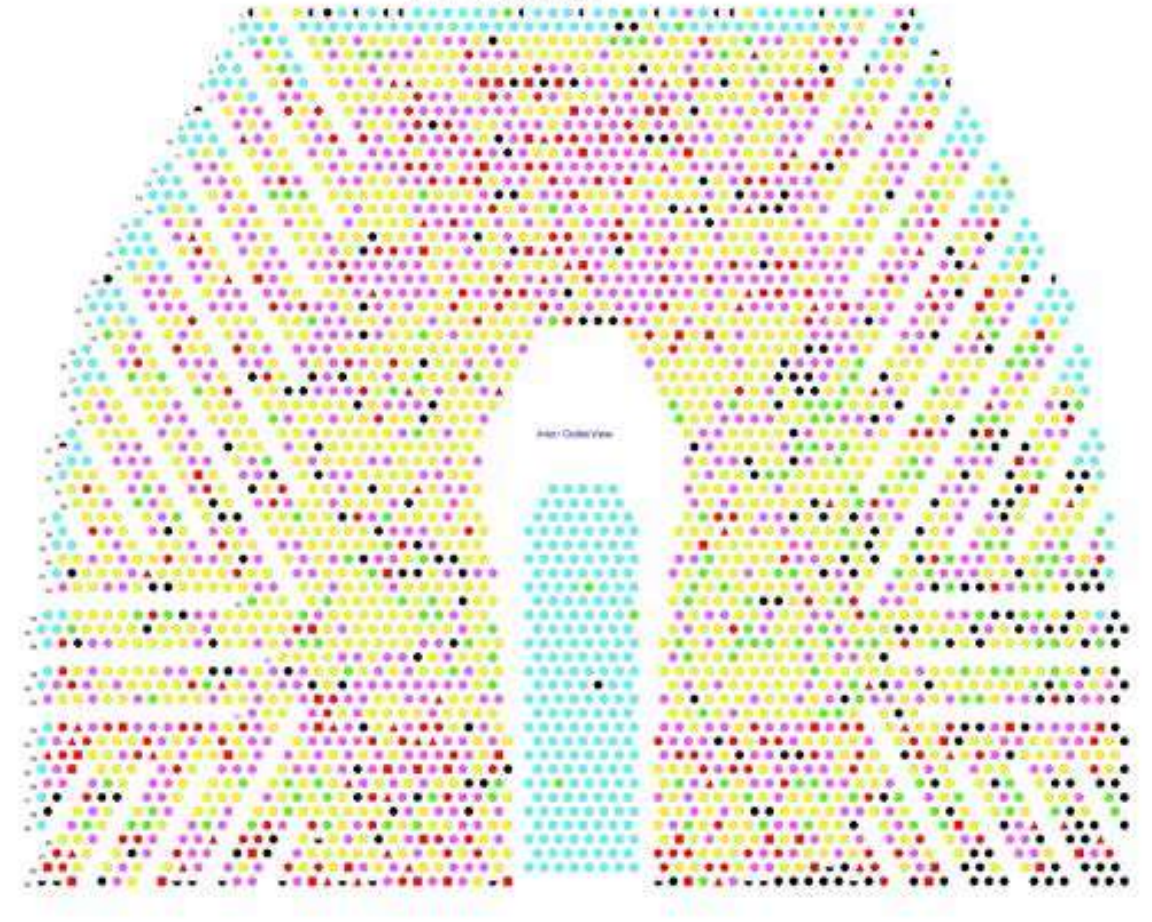


SYM	RITS	TUBES	VIS	TYPE	DESCRIPTION
●	41	40	16	QUERY	DENT CALLS.qry
○	1073	1072	1071	QUERY	NRD CALLS.qry
▲	3	3	3	QUERY	OBS CALLS.qry
◆	312	311	311	QUERY	Recordable A (20-30).qry
◆	4146	4139	4137	QUERY	Recordable B (31-59).qry
◆	132	128	128	QUERY	Rejectable (60-100).qry
■	92	92	92	QUERY	PLUG CALLS.qry
■	8	8	8	QUERY	OTH CALLS.qry
					Model Main Cond A (5,766 tubes) 0 open tubes
5,807	5,793	5,766			

Grayscale Map

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Unit 1 Main Condenser Results



Color Map

Eddy Current Testing with Multiple Frequencies

- Conco Eddy Current Testing more accurate than competitors
- Multiple frequencies has most significant impact on results
- Frequencies include: low, midrange and high; sometimes a fourth frequency is needed
- Accurate identification of defects or trends will affect the operating and maintenance plan
- This important maintenance practice will result in reliable and well-functioning propulsion units onboard

Summary

- Conco is NAVSEA certified to clean and Eddy Current test
- Tube integrity must be monitored with cleaning and testing
- Numerous projects have been completed with NNS-HII
- Cleaning and testing projects proceed with a comprehensive understanding of NAVSEA expectations and specifications
- Naval surface ship propulsion plant integrity significantly improved as a result of procedures developed for cleaning and testing

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