

From Lab to the Deck-plate

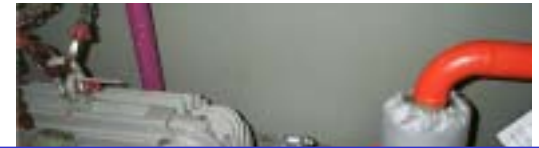
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“Common Ship”

- Paints, deck coverings, fuel control, couplings, are improving quality of life aboard ship
- Some are high tech and some not – but they all solve an existing Fleet problem



Savings To-Date

\$27M and more than 2,150 Sailor Man-Years



Problem Identification

- ✓ Shipboard material readiness issues show up as equipment down-time caused by material failure.
- ✓ To solve why equipment is not available requires identification of the root causes of failure.

The TMA (Top Management Attention) process within NAVSEA is used to identify the problems and *root causes* of equipment failure.



Getting Technology to the Fleet

Solution Investigation – Short Term

- Fleet is focused on near term solutions for current problems
 - This forces an industry search for technologies that are mature to answer their needs
 - Industry technologies may have to be
 - Adapted to meet military specifications
 - Adapted to meet specific use
 - Tested to meet military standards
 - Industry technologies will then be prototyped to validate that root causes are solved/eliminated
 - Based on preliminary business case analysis
 - Develop solution
 - Shipboard demonstration



Solution Investigation – Long Term

- Technical and Life Cycle Managers have a longer term view
 - Focus on solutions that can take longer to develop
 - Longer term view allows lab R&D to solve long term Fleet problems
 - Lab solutions must be
 - Focused on solving root causes
 - Sensitive to time and money constraints
 - Lab tested to ensure that they're viable
 - Refocused to ensure they remain on track to solve root causes
 - Adapted to meet military specifications
 - Tested to meet military standards



Getting Technology to the Fleet

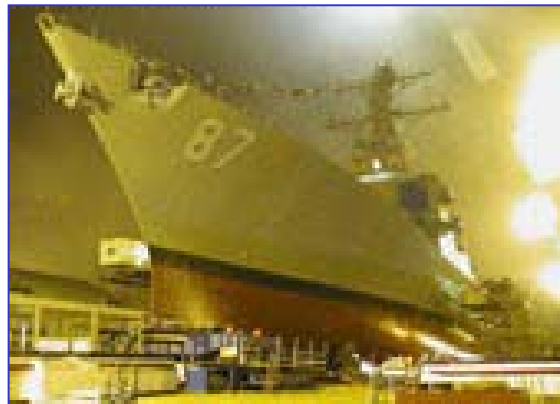
Solution Investigation – Long Term

- Lab solutions will then be prototyped and tested onboard a ship to validate that root causes are solved/eliminated and that they survive in a shipboard environment
- After a successful prototype
- Refined business case to determine if the original was valid
 - Solution approval process runs concurrently with funding for full Fleet implementation plan



- Solution approval process involves *Implementation*
 - Meeting military specs (testing)
 - Delivery method (AER, SHIPALT, MACHALT)
 - Planning for funding

Solution idea → Solution approval
In less than 12 months using this process

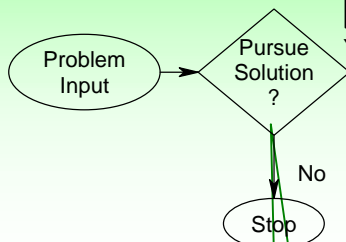


Problem Resolution Steps

Problem Identification

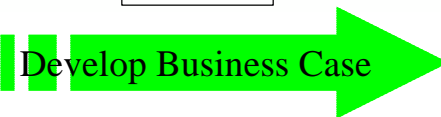
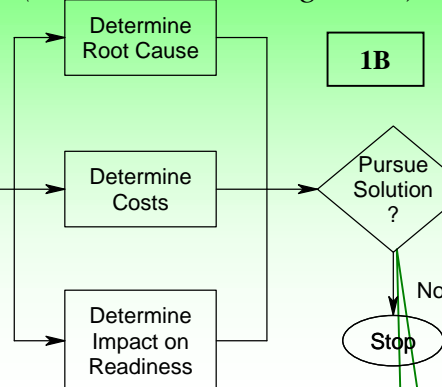
Identification
And Priority

1A



Impact
(readiness, Training, Cost)

1B



**TMA
Panel**

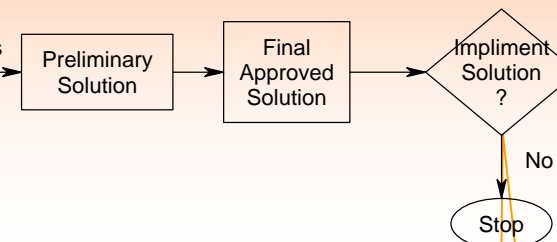


**TMA
Panel**

Solution Identification

2A

2B

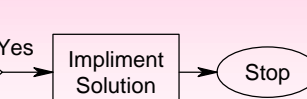


**TMA
Panel**



Solution Implementation

3A



Problem:

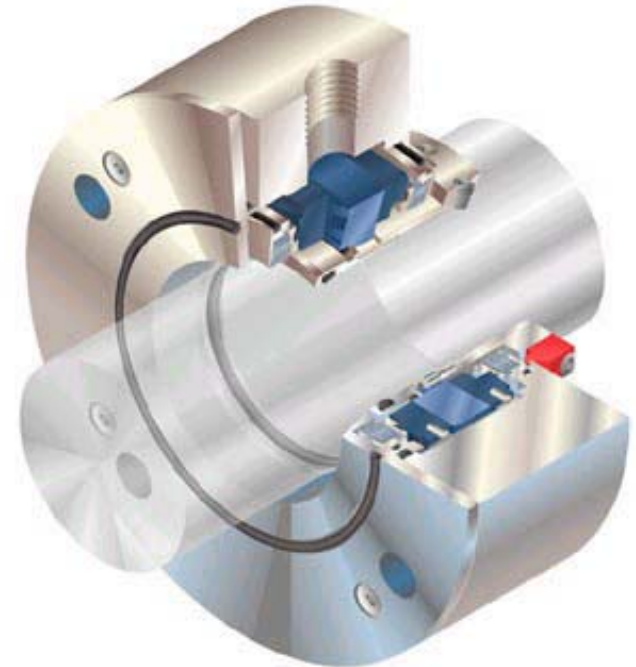
- 85% of of installed mechanical seals fail with 6 – 12 months
- Sailors currently spend 12 Sailor-days per year per pump repairing and replacing seals.

Mechanical Seals



Solution:

- Use of improved Mechanical Seals allows easier replacement, better reliability and longer life to cut maintenance costs.
- Installation of commercial off-the-shelf split, cartridge, and gas seals can increase service life up to five years.
- Cartridge or split seals decrease installation difficulties to reduce Sailor pump maintenance burden.
- Gas seals provide the first true zero-leakage seal



Testing:

- Despite widespread commercial application each seal type went through:
 - Shock testing
 - Prototype shipboard testing of 6 months for each application
 - An economic analysis

Implementation:

- Split seals now approved for use in fresh and seawater applications (24 prototype apps; 2 approved MACHALTs)
- Gas seals now approved for use in lube oil and fuel oil applications (16 prototype apps; 2 approved MACHALTs)

Mechanical Seals



Solution idea → Solution approval
8 months using this process for the gas seal

Problem:

Shipboard alignments between pumps and motors are time consuming and difficult. Misalignments cause premature bearing and seal failure and lead to motor winding and coupling failures.

Solution:

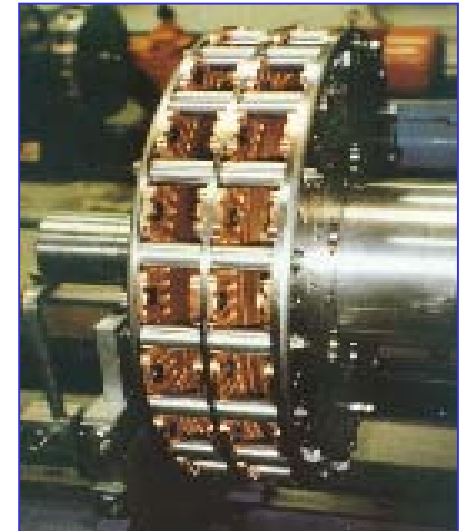
Magnetic couplings eliminate precision alignments, eliminate coupling maintenance, increase bearing and seal life and lower starting currents for electric motors.



Magnetic Couplings



Old Style Coupling



New Magnetic Coupling

Testing:

- Despite widespread commercial application testing included:
 - Shock & vibration testing
 - Electro-magnetic interference testing
 - Prototype shipboard testing of 6 months for each application
 - An economic analysis

Implementation:

- Funding in place for purchase and installation of 700 couplings in 10 applications using the MACHALT program from FY03-FY06
- Other applications undergoing economic analysis

Magnetic Couplings

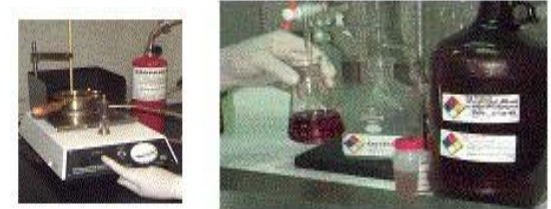


Solution idea → Solution approval
7 months using this process for the mag coupling

Automated Oil Analysis

Problem:

- Lab oil analysis information unavailable for daily maintenance decisions
- "Clear and Bright" samples must be performed daily on most equipment
- Perform more extensive onboard manual testing for diesel engines



Two current manual tests in use at NOAP Labs.

Solution:

- Installation of in-line oil condition and debris monitors
- In-line monitor didn't really exist when project started
- Intent is not to turn Sailors into chemists



Testing:

- Each sensor went through extensive:
 - Oil lab and operational engine testing
 - Prototype shipboard testing of more than 12 months for each application
 - Shock testing
 - An economic analysis

Implementation:

- Low-end capability sensor in rework by the vendor
- 1 high-end capability sensor in final shipboard testing (4 installations in 2 applications)
- 1 high-end capability sensor in initial shipboard testing (1 installation)

Automated Oil Analysis



Low End Sensor



Display Screens

Solution idea → Solution prototype
10 months using this process for the oil monitor

Problem:

Shipboard marine environments lead to significant corrosion and erosion problems both topside and internal to the ship.

Solution:

Composite materials provide a strong, lightweight and comparatively priced alternative to standard metal products for a variety of applications:

- Pumps and valves
- Grating and screens
- Topside electrical boxes
- Ladders, vent ducts and fans

Composites



Testing:

- Despite widespread commercial application each new application type went through:
 - Shock testing
 - Prototype lab and shipboard testing of 6 months or greater for each application
 - An economic analysis

Implementation:

- Composite grating approved for topside use (10,393 sqft on 6 ships)
- Composite electrical boxes approved for topside use (38 boxes on 6 ships)
- Composite valves approved for use (57 valves on 5 ships)
- Composite pumps approved for use (7 pumps on 4 ships)

Composites



Solution idea → Solution prototype
10 months using this process for composites

Fleet Testimonial



Summary

- Mature commercial technology solutions can transition in just over 6 months
- Industry or service labs that focus on longer term solutions can be tested shipboard in less than 12 months
- When successful lab solutions are ready, they can be transitioned in very short periods
- Lab and mature commercial technology solutions still need to make good economic sense

