Predictive Condition Based Maintenance Software for Managing Corrosion Prevention on Naval Systems

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The objective of the software is assessment of future maintenance requirements for 5000 series aluminum ship structures. Navy ships experiencing grain boundary sensitization, quantified by Degree of Sensitization (DoS), leading to intergranular corrosion (IGC), leading to stress corrosion cracking (SCC). A ship is simulated as a system of many critical locations where damage can occur (Figure 1). The deployment-maintenance-deployment cycle is simulated for each location. Software modules are used to predict IGC damage and SCC size versus time based on the DoS, corrosion environment, material, load, and geometry at that location. An inspection software module simulates inspection schedules and detection accuracies to update the damage prediction with actual data. The software predicts Time-to-Repair and provides maintenance planning categories ranging from No Action to Replace Material. The main features of this simulation methodology and software are:

a) Physics based – use DOS, IGC and SCC to predict damage accumulation
b) Probabilistic based – consider uncertainties to predict probability of failure (POF) to determine maintenance action based on reliability requirements
c) System based – global ship structure is modeled as a system of individual potential damage location providing a holistic assess of risk
d) Fleet based – fleet is modeled as a system of global ship structures providing an overall assessment of risk
e) Simulation based – use virtual computer model of ship to simulate environment, usage, damage growth, inspections and repair/mitigation as a function of time
f) Computation based – the effect of changes in environment usage, inspections and repair/mitigation on POF are predicted before enacted, optimizing maintenance dollars

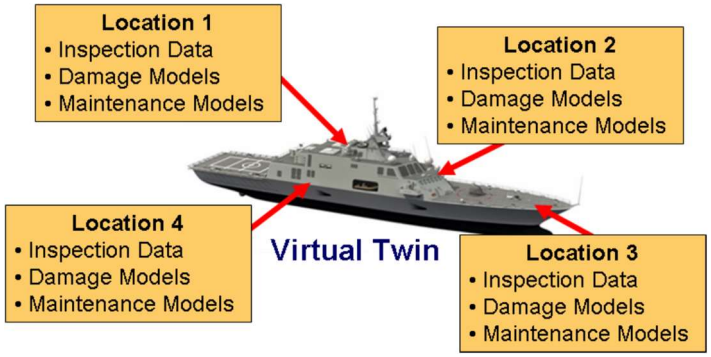

Figure 1: Simulation of a ship as a virtual system of multiple locations