# Non-Intrusive Vibration Monitoring in US Naval and US Coast Guard Ships

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In 2011, the Laboratory for Electromagnetic and Electronic Systems proposed a new type of vibration monitoring system, entitled vibration assessment monitoring point with integrated recovery of energy or VAMPIRE, in their work entitled *VAMPIRE: Accessing a Life-Blood of Information for Maintenance and Damage Assessmen*t [1]. The proposed monitoring system includes a self-power harvesting accelerometer installed in motors on US Navy and US Coast Guard vessels used to monitor equipment vibration and diagnose the source of the high vibrations.

Utilizing the observations and tools designed by the VAMPIRE project as a foundation, this thesis takes the LEES lab-designed CAPTCHA accelerometers to the US Navy and US Coast Guard fleets to test the lab-designed tool, collect ship equipment data, and verify the VAMPIRE concepts. The CAPTCHA's ability to monitor the vibrations of these systems could be used to immediately diagnose system casualties, aid in parts repair, and ultimately, become a tool to promote Condition-Based Maintenance (CBM). Measurements and experimentation were conducted on two USCG ventilation fans in the lab as well as onboard the USCGC SENECA (WMEC-906), USCGC BERTHOLF (WMSL 750), USCGC STRATTON (WMSL 752), USS MICHAEL MURPHY (DDG 112), USS INDEPENDENCE (LCS 2), and USS SAN DIEGO (LPD 22).

Data was collected and analyzed using a MATLAB program developed to diagnose the types of vibrations seen in various experiments and observe high vibrations in the commissioned ships. The combined results of the CAPTCHA-recorded lab tests and ship testing corroborate the theories proposed in the VAMPIRE paper; however, additional studies could make the VAMPIRE proposal a robust solution to a fleet-wide vibration-induced maintenance problem.

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