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MK-48 MOD 5 Torpedo Maintenance Extension

The Naval Undersea Warfare Center (NUWC) Newport (NPT) called on the RAC for assistance in determining the impact of extending the current Maintenance Due Date (MDD) of the MK-48 MOD 5 Torpedo from 5 years to 6 years. Based on discussions with NPT, RAC derived an approach to determine the reliability effects of the MDD extension. Based on the analysis and summarization of information (literature search, torpedo part review, model parameters) to support MDD model development, RAC has concluded that extending the MK-48 MOD 5 Torpedo MDD an additional year would not have an adverse affect on the torpedo's reliability. Further benefits would be realized are reduced maintenance costs, increased readiness and a reduction in induced failures. The torpedo's reliability in year 6 will be approximately equal to its reliability in year 5.

Continued on Story 1

New Reliability Prediction Methodology Introduced

In today's competitive global environment, it is essential that the reliability techniques that impact life cycle cost planning are effective, efficient, sustainable and repeatable. One such process is the analysis of developing and manufacturing products to prove they are reliable prior to fielding. Equipment reliability is the underlying factor that drives sustainment, affordability, readiness, availability, and life cycle cost.

Continued on Story 2

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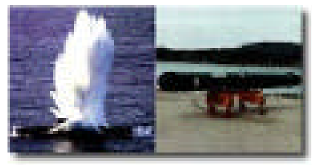
MK-48 MOD 5 Torpedo Maintenance Extension (continued)



The first step in the approach was a literature search on systems involved in storage conditions for long periods with minimal maintenance. The focus was on what is being done in industry to effectively maintain high reliability in similar weapon systems. The investigation identified critical activities. These are—

- Subjecting equipment to environmental conditions
- System testing to determine condition
- Statistical analysis of test data and subsequent corrective action
- System reliability sustainment through maintenance/repair approaches

Next, RAC examined part listings of the MK-48 supplied by Newport. The parts listings were used to determine the effects of hardware technology on MDD extension. Electronic, mechanical and electro-mechanical parts list were examined and to determine any storage or aging effects. Parts lists from Newport included electronic passive and active components, pumps, seals, etc. for all of the parts comprising the MK-48. Explosives were not included in this investigation.

All of the information was then utilized to develop an approach to establishing a MDD Model. The MDD model development was primarily based on environmental factors affecting the reliability of the torpedo during its life cycle using MIL-HDBK-344A, a publication that quantifies the effects of environmental exposure and correlates it to system defects. To properly apply the MIL-HDBK-344A mathematical models, a thorough understanding of the MK-48 life cycle environmental conditions was required. These conditions were characterized in several ways: by direct measurement, through known information, through engineering judgment, or from supplier supplied information. These conditions were then applied to the MIL-HDBK-344A mathematical models and a numeric determination of degradation was calculated. The model concluded that little degradation in reliability would occur from extending the MDD from 5 to 6 years.

The risk associated with extending the MDD an additional year is that the true reliability of the torpedo at the end of the 5th year is not known. RAC has reviewed the reliability data provided by NUWC NPT and found that there are insufficient in-water runs or structured tear-downs to calculate the reliability of the population of Torpedoes at the end of their MDD within any acceptable level of confidence.

Actual reliability data must be incorporated into the model to determine the Torpedo's reliability during the MDD cycle. In-water run tests at the end of MDD are in progress to determine the torpedo's reliability so that this reliability data may be integrated into the model.

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New Reliability Prediction Methodology Introduced (continued)

PRISM

The premise of traditional methods of reliability predictions, such as MIL-HDBK-217, is that the failure rate of a system is primarily determined by the components comprising the system. Historically, a significant number of failures also stem from non-component causes such as design deficiencies, manufacturing defects, inadequate requirements, induced failures, etc., that have not been explicitly addressed in prediction methods.

In 1994, the U.S. Military Specifications and Standards Reform initiative decreed the adoption of performance based specifications for acquiring and modifying weapon systems. This led to the cancellation of many military specifications and standards. This, coupled with the fact the Air Force has re-directed the mission of the Air Force Research Laboratory (the preparing activity for MIL-HDBK-217) away from reliability, resulted in MIL-HDBK-217 becoming obsolete, with no government plans to update it.

In response to this situation, RAC has developed a new methodology, and an associated software tool called PRISM, for estimating the failure rate of electronic systems. This methodology includes new component reliability prediction models and means for assessing the reliability of systems due to non-component variables. The system assessment methodology was developed from an Air Force study performed by the RAC to overcome some of the limitations of MIL-HDBK-217. This methodology is quickly becoming the standard prediction methodology of DOD contractors and is gaining global acceptance. Constant data collection, analysis, training programs and expert staff of the IAC are in place as a matter of routine to sustain the methodology.

Advantages of this new methodology are that it uses all available information to form the best estimate of field reliability, and has sensitivity to the predominant system reliability drivers. The new methodology adopts a broader scope to predicting reliability. It factors in all available reliability data, as it becomes available on the program. It thus integrates test and analysis data, which provides best prediction foundation and a means of estimating variances from different reliability measures.

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