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A Case Study on the Improper Use of the Weibull Distribution in Electronics Reliability Studies

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Author's Note: Barry Berger recently finished his master's degree in Industrial and Systems Engineering at Binghamton University's Watson School of Engineering and Applied Science. His master's thesis focuses on the analysis of reliability data in advanced electronics packaging. Dr. Santos is a Professor in the SSIE Department, Undergraduate Director of the BSISE program, and is an Assistant Director of the WISE research center. WISE, with its origin dating to around 1990, has a long history of electronics packaging research and development and regularly garners over \$2M, annually, in external research funding from industrial and federal sources. Dr. Santos is also the founding Editor of the newly created journal – *Industrial and Systems Engineering Review* (ISER).

Abstract: This work addresses the reliability of lead-free solder in accelerated thermal cycling to reevaluate the use of the two-parameter Weibull distribution as used in electronics reliability studies. It is not uncommon for electronics reliability researchers to make comparisons among multiple data sets solely on the scale parameter. Perhaps they assume, without providing evidence, that the shape parameters are identical or, worse, it may be the case that the scale parameters are different but they do not realize the importance of considering the scale parameter in calculations. In short, it is typical practice, as will be demonstrated, that electronics researchers make most of their conclusions on reliability comparisons based upon the N63 values of the different data sets. The purpose of this work is to bring awareness to the potentially erroneous types of conclusions that can be made when only one parameter of the two-parameter Weibull distribution is used in electronics reliability comparative assays.

Keywords: Weibull Distribution, Electronics Packaging, Reliability