

# STATISTICAL BULLETIN

Reliability & Variation Research

LEONARD G. JOHNSON  
EDITOR

**DETROIT RESEARCH INSTITUTE**  
P.O. Box 36504 • Grosse Pointe, MI 48236 • (313) 886-8435

WANG H. YEE  
DIRECTOR

Volume 26  
Bulletin 1

April, 1996  
Page 1

---

## FIVE CRITICAL QUESTIONS IN ACCELERATED TESTING

QUESTION #1: What does it mean to accelerate a test on a product's reliability?

ANSWER #1: It means that we shorten the test time it takes to reach a valid decision about a product's reliability.

QUESTION #2: What different procedures are there for shortening test time?

### ANSWER #2:

- I: By using fewer test specimens in a reduced sample size which still yields the required reliability and confidence.
- II: Making a test more severe by increased stress so as to produce failures in a shorter time by increasing the entropy accumulated per test cycle or time unit.
- III: By using "Sudden Death" testing when the specimens are inexpensive and affordable.  
In a "Sudden Death" sample we run a whole set of specimens simultaneously until one of them fails. This cuts down on the running time needed.

# DRI STATISTICAL BULLETIN

Volume 26  
Bulletin 1

April, 1996  
Page 2

---

QUESTION #3: What are some valid techniques for reducing test sample size?

ANSWER #3:

- I: Making use of prior information about the minimum reliability being above zero. This is in contrast to the classical approach of assuming that the reliability could be as low as zero due to a total lack of prior knowledge about the product.
- II: Using sequential analysis with a sequence of small samples until the desired level of confidence of meeting a life goal is reached by the superposition of confidence indices.
- III: By having a high safety factor in design, i.e., making the design so durable that it beats the required life by a large multiple. Then just a few specimens run to failure will produce a Weibull plot so far to the right of what is required that the confidence of meeting the required life goal will be fully adequate to guarantee excellent compliance.

QUESTION #4: What do product life improvements generated by design changes in severe accelerated tests imply about field life improvements generated by the same design changes?

ANSWER #4: Life improvements due to design changes in the field be at least as great as those observed in accelerated tests.  
This is due to the theoretical shape of an S - N diagram, which approaches a horizontal position near the endurance limit. The endurance limit is the stress level low enough to allow a theoretically infinite life ----- it might be zero stress or something greater.

# DRI STATISTICAL BULLETIN

Volume 26  
Bulletin 1

April, 1996  
Page 3

---

QUESTION #5: What type of life tests give us the most information for a given sample size?

ANSWER #5: The most powerful life tests information-wise are tests in which every specimen in a sample is run to failure. Then there is no guess work about how long an item can last.

## CONCLUSION

We have presented what we consider to be five critical questions about accelerated life testing programs and their corresponding answers in simple plain English. There are without doubt many other questions which could be raised about this very broad subject, but they must be dealt with on an individual basis for those special situations which might be encountered in dealing with special problems dealing with tests outside the usual types which we have discussed in this bulletin.