

Tin Whisker Update

June 2003

Hi-Rel User Situation

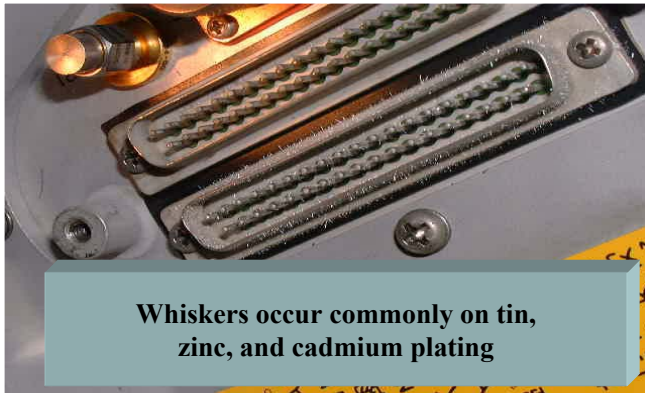
- **Hi-Rel User Community is Concerned**
 - Pure Sn finishes are already showing up from our suppliers
 - We have been burned before by tin whiskers!
 - Refer to NASA Goddard site and CALCE site for “horror stories”
 - We have very long storage and use life
 - Measured in decades rather than in years
 - Complicates testing validation
 - Provides a risk that most commercial users don’t face
 - Misconceptions abound

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Normally, whiskers are so tiny that they are difficult to see without a microscope



Whiskers occur commonly on tin, zinc, and cadmium plating

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Don't Worry - Be Happy???

- **Suppliers and metal finishers often opine that our concerns are overblown for several reasons**
 - “We ran a test and our parts didn’t form whiskers!”
 - What test? There is no standard test, and current work indicates that a series of tests will be required.
 - “We only use Matte Tin, whiskers only form on Bright Tin!”
 - “We use a nickel underplate, this prevents whiskering!”

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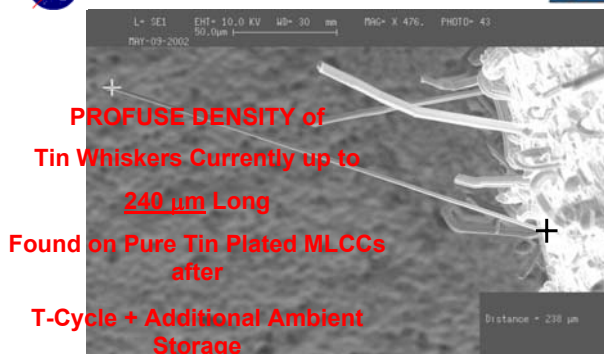
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Tin whiskers growing over nickel underplate



Data from J. Brusse, Presented at Sur/Fin June 2002



PROFUSE DENSITY of Tin Whiskers Currently up to 240 μ m Long

Found on Pure Tin Plated MLCCs after

T-Cycle + Additional Ambient Storage

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Don't Worry - Be Happy???

- **We sometimes are also told**
 - “You can avoid tin whiskers by proper control of the plating process!”
 - The reality of the supply chain is that an OEM can’t even determine who performed plating, let alone attempt to control the process!
 - Components are often purchased from distributors
 - Most device packaging is performed offshore
 - Component packagers utilize multiple metal finishers, with a roster that changes over time

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What are we doing?

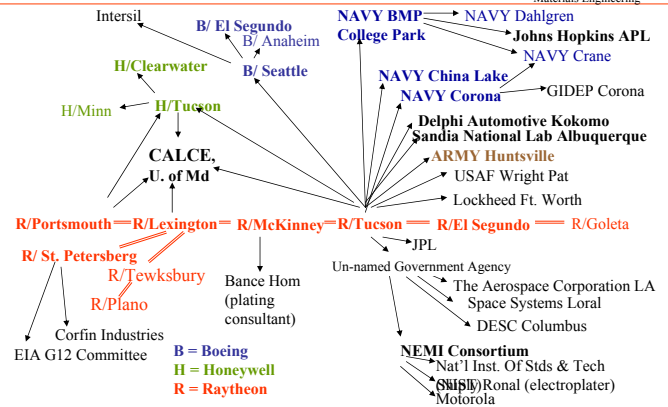
- **Tin Whisker Alert Group formed**
 - Tin is here now. Can't wait for test in 2004-2005?
 - Focus on how to survive until NEMI et al comes through
 - Started in May 2002
 - Working with CALCE at U. of MD for collection and dissemination of data
 - Participation in TWAG does not require CALCE membership
 - CALCE TWAG webpage is accessible publicly
 - Group membership grew quickly and continues to expand
 - All hi-rel users face this issue
 - Common approaches sought

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TWAG Networking Chart



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TWAG Activities - 2002

- **Alert Document**
 - Notification of the situation to the Hi-Rel community - posted to website in August 2002
 - Issued as a GIDEP fall 2002
- **Risk Mitigation Guide**
 - Prepared by academic members of the group
 - Posted to site in September 2002
- **Tin Whisker Case Histories**
 - Ongoing - posted to site
- **Supplier Survey**
 - Ongoing (Results not distributed outside group)

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TWAG Activities - current

- **Performing tests to evaluate Conformal Coat**
 - Previous testing has been performed by NASA Goddard on Urethane coating
 - Current TWAG tests on other coating types, and on various coating thickness
 - Not all perform the same!
- **Risk Assessment Metric and Tool**
 - Algorithm developed to assess the application-specific risk of tin whisker failures
 - Details to be presented at "Hakim" Conference in August

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TWAG Activities - planned

- **Actively pursuing funds for multi-year research, development, and implementation activities**
- **Areas of proposed future work**
 - Refinements of risk assessment algorithm
 - Expanded CC efficacy testing
 - Evaluation of techniques to add Pb to pure tin finishes
 - Definition of inspection and surveillance protocols when pure Sn must be precluded

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Links and Contact Information

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<http://www.reliabilityanalysislab.com/>

CALCE/TWAG website
<http://www.calce.umd.edu/lead-free/tin-whiskers/>

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