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Reducing the Risk of Tin Whisker-Induced Failures in Electronic Equipment

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Reducing the Risk of Tin Whisker- Induced Failures in Electronic Equipment

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**GOVERNMENT ELECTRONICS AND
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We wish to express our sincere appreciation to the NASA Goddard Space Flight Center Tin Whisker Investigation Team for their significant contributions to this Bulletin.

Introduction

As a result of world-wide consumer electronics demand for lead-free products, component manufacturers are increasingly converting to lead-free materials. A popular choice for these finishes is tin.

Tin finishes can be susceptible to the spontaneous growth of single crystal structures known as "*tin whiskers*" which can cause electrical failures, ranging from parametric deviations to catastrophic short circuits, and may interfere with sensitive optical surfaces or the movement of micro-electromechanical systems (MEMS). Though studied and reported for decades, tin whiskers remain a potential reliability hazard, particularly for space applications and for equipment subjected to long term dormant storage and use (e.g. missiles and expendables).

There is no pending US legislation mandating lead-free electronic products, and should such legislation arise, military, aerospace and medical equipment manufacturers would likely be exempt. Nevertheless, Department of Defense and NASA believe that the use, and therefore the risk, of tin finish on electronic components will increase because: 1) commercial industry have stated initiatives to eliminate lead (Pb) from electronics, 2) defense and aerospace industry trends show increasing usage of commercial components, and 3) continuing reductions in circuit geometry and power means that even small whiskers may cause catastrophic failures.

Many factors can contribute to whisker formation, and their relative importance have not been determined. The quantitative risks of whiskers under various sets of material, manufacturing, and application conditions have not been determined. Historically, whiskers have been of greatest risk to space and missile applications. This may be explained in part by: the longer lifetimes, the more destructive effects in low-pressure environments, and higher reliability requirements. However, it is felt by this committee that a wider community may have concerns about whiskers as pure tin plating becomes more common and circuit geometries become smaller.

This Bulletin includes various findings of government and industry experts regarding characteristics of tin whiskers and methods to mitigate future risks associated with them. It is meant to summarize the literature on tin whisker growths, not mandate a particular risk mitigation strategy. The appropriate actions will depend on the specific application, lifetime, and reliability requirements.