“Cable Tray #1”
Zinc Whiskers Detected on Zinc-Coated Steel Cable Tray

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November 1, 2012
Executive Summary

• “Cable Tray #1” was examined at NASA Goddard Space Flight Center (GSFC) to determine if zinc whiskers are growing out of the zinc-coated iron-based wire used in its construction.

• Methods of analysis included:
  – X-Ray Fluorescence (XRF) Spectroscopy
    • Determine composition of surface finish on cable tray from which whiskers are growing.
  – Optical Microscopy - 1x to ~100x
    • Document filament/whisker shapes and dimensions.
  – Scanning Electron Microscopy (SEM) - ~50x to 5000x
    • Document filament/whisker shapes and dimensions.

• CONFIRMED: Zinc whiskers are growing from this cable tray.
  – Dimensions (i.e., lengths and thicknesses) and morphology of growths are consistent with zinc whiskers. *Whiskers in excess of 0.6 mm in length were observed.*
  – Composition analysis confirmed both the metal whiskers & surface finish are ZINC.
Two distinctly different cable tray samples were provided by G. Camburn to J. Brusse in September 2012

- Hereafter referred to as “Cable Tray #1” and “Cable Tray #2”
- Based on naked eye inspection G. Camburn suspected each cable tray may exhibit zinc whisker growth, but he lacked access to analysis tools for confirmation
- G. Camburn reports that each cable tray is made from “pre-galvanized” iron where a zinc coating has been applied to the iron-based wire by immersing the wire into molten zinc
- G. Camburn suggests the following reference is representative of process used in making the wire: http://www.youtube.com/watch?v=J3aLT2B2m3Y

J. Brusse agreed to have the cable trays inspected to confirm and document any metal whiskers

L. Panashchenko performed optical microscopy, scanning electron microscopy (SEM) and X-ray fluorescence (XRF) spectroscopy to confirm that this cable tray has developed zinc whisker growths
Cable Tray #1

Cable Tray #1 “As-Shipped”

Piece of Cable Tray #1 Removed by J. Brusse for Detailed Analyses Documented Herein

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X-ray Fluorescence (XRF) Spectroscopy Confirms Cable Tray is Zinc-Coated Iron Alloy Wire

XRF Results Confirm Cable Tray is Made of Zn-Coated Iron Alloy Wire

Zinc Coating ~6.5 microns Thick

Side note: the base metal here is referred to as iron, but other variations, such as steel, are likely. XRF is not able to detect carbon which would further identify the material as steel.
Optical Microscopy
Identifies Filamentary Growths on Cable Tray Surface
Optical Microscopy
Identifies Filamentary Growths on Cable Tray Surface
Scanning Electron Microscopy (SEM) of ZINC WHISKERS on **Cable Tray #1**

**ThickTray-Sample1_37**

**ThickTray-Sample1_36**

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Scanning Electron Microscopy (SEM) of ZINC WHISKERS on **Cable Tray #1**

ThickTray-Sample1_09

ThickTray-Sample1_10

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Scanning Electron Microscopy (SEM) of ZINC WHISKERS on Cable Tray #1

Debris on this whisker is not metal, but dust collected on whisker

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Scanning Electron Microscopy (SEM) of ZINC WHISKERS on **Cable Tray #1**

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Scanning Electron Microscopy (SEM) of ZINC WHISKERS on **Cable Tray #1**
Scanning Electron Microscopy (SEM) of ZINC WHISKERS on **Cable Tray #1**

![Microscope images](ThickTray-Sample1_19, ThickTray-Sample1_20)

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Scanning Electron Microscopy (SEM) of ZINC WHISKERS on **Cable Tray #1**

ThickTray-Sample1_22

ThickTray-Sample1_21

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Scanning Electron Microscopy (SEM) of ZINC WHISKERS on *Cable Tray #1*

ThickTray-Sample1_22

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Scanning Electron Microscopy (SEM) of ZINC WHISKERS on **Cable Tray #1**

ThickTray-Sample1_24

ThickTray-Sample1_23

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Scanning Electron Microscopy (SEM) of ZINC WHISKERS on Cable Tray #1

ThickTray-Sample1_26

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Scanning Electron Microscopy (SEM) of ZINC WHISKERS on **Cable Tray #1**

ThickTray-Sample1_28  

ThickTray-Sample1_27
Scanning Electron Microscopy (SEM) of ZINC WHISKERS on Cable Tray #1

ThickTray-Sample1_30

ThickTray-Sample1_29
Scanning Electron Microscopy (SEM) of ZINC WHISKERS on **Cable Tray #1**

**ThickTray-Sample1_34**

**ThickTray-Sample1_33**

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Scanning Electron Microscopy (SEM) of ZINC WHISKERS on *Cable Tray #1*

ThickTray-Sample1_39  
ThickTray-Sample1_38

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Scanning Electron Microscopy (SEM) of ZINC WHISKERS on **Cable Tray #1**

**ThickTray-Sample1_05**

**ThickTray-Sample1_06**
Scanning Electron Microscopy (SEM) of ZINC WHISKERS on Cable Tray #1

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November 1, 2012