



# Sierra Automated Systems Broadcast & Communications

## ***Engineering Note Rubicon Console Module Insulator***

### **Synopsis**

This Engineering Note describes a potential difficulty with SAS Rubicon Console Modules and an update to prevent this issue from causing operational problems. The issue is conductive metallic whiskers which can create short circuits between the module metal mounting plate and the processor printed circuit assembly. The solution is to install a mylar insulator between the processor printed circuit assembly and the metal backing plate.

### **Background**

Recently, an unusually high incidence of improper switch operations were reported from two installation sites. SAS tested and analyzed several modules that had demonstrated this fault. SAS Engineering developed a diagnostic version of firmware which helped to reveal the underlying cause. SAS has discovered that, under rare environmental conditions, metallic whiskers can 'grow' between the zinc plated steel back plate and the main electronics printed circuit board (see Discussion section below). These whiskers can create short circuits that can cause the module to malfunction. Problems observed that can be attributed to whisker short circuits are: two or more switches becoming non-functional or 'stuck' due to a shorted switch multiplex line, and communications from one module or from a group of four modules (one data port) halting due to a short on the data direction circuit.

### **Corrective Action**

SAS has tooled and made available a mylar insulator to be placed between the main electronics board and the steel backplate. This will resolve the issue by preventing short circuits between the solder surfaces and the zinc plated steel surface. The procedure to install the insulators is:

1. Remove the Module from the Console using the SAS extraction tool kit.
2. Using a can of compressed air, blow air between the flag board and the metal back plate generously to ensure all metallic dust has been removed.
3. Remove the flag PC board by removing the 4 mounting screws that affix the board to the zinc back plate and insert the mylar film on the metal back plate over the mounting PEM nuts. Optionally, the mylar can be trimmed on all 4 sides inset enough such that the mounting holes become  $\frac{1}{4}$  circles and carefully slide the mylar under the flag board until the mylar snaps into place. The  $\frac{1}{4}$ " circles will hold the mylar to the PEM nuts. This is a quicker method than fully removing the flag board.
4. Re-Install the Module into the console.

SAS has produced a short video which shows how to upgrade a Rubicon module firmware and how to install the insulator under the main electronics board. This video is available for download at [SASaudio.com](http://SASaudio.com), or by email. Insulators are available by request from SAS.

## Discussion

The phenomenon of metallic whisker growth has been studied by the US government and NASA. Tin whisker growth has caused NASA to lose satellites with conductive whiskers shorting out sensitive circuits. Interest in this phenomenon has been high because of recent changes in manufacturing processes mandated by some government organizations. The lead free initiative for electronic devices, known as RoHS (Restriction of Hazardous Substances), calls for elimination of lead in solder formulas. Lead provides an important additive in tin-lead solder alloys to inhibit metallic tin whisker growth. The solder companies have worked diligently to provide lead free alloys which will inhibit tin whisker growth.

The exact environmental conditions and chemistry which promote metallic whisker growth are not fully understood, even today. There are many articles on the NASA web site regarding this (see references below). Zinc is also a metal known to grow metallic whiskers. In some technical environments conductive floor tiles and carpets that use zinc can grow whiskers and get into the air handling system.

It appears that a combination of lead free parts, solder and the zinc plating on the steel of SAS Rubicon modules can combine to create short circuits by whisker growth in certain environments. On Rubicon modules we can provide a physical barrier between surfaces to eliminate any issues. SAS has a mylar insulator available to provide a barrier between the printed circuit and the zinc plated steel back plate. All current and future production of Rubicon Modules will have this insulator installed. SAS will also change to nickel plating in future production, further eliminating zinc from the equation. Contact SAS Engineering for further information or to request insulators.

## References

<http://nepp.nasa.gov/WHISKER/background/index.htm>

[http://nepp.nasa.gov/WHISKER/other\\_whisker/index.htm](http://nepp.nasa.gov/WHISKER/other_whisker/index.htm)

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