Contribution ID: **361** Type: **Oral presentation (15min)**

Development of a passive, adaptive and autonomous heat switch

Tuesday 8 July 2014 17:15 (15 minutes)

We report on the development of a heat switch for autonomous temperature control of electronic components in a satellite. A heat switch can modulate when needed between roles of a good thermal conductor and a good thermal insulator. Electronic boxes on a satellite should be maintained within a typical optimum temperature range of 260 to 310 K. The heat sinking is usually by means of a radiator. When the operating temperature of the electronic box increases beyond 310 K, a good contact to the radiator is desired for maximum cooling. On the other hand, when the satellite is in a cold dormant state, the electronics box should be heated by the onboard batteries. In this state a weak thermal contact is desired between the electronic box and the heat sink. In the present study, we are developing a gas gap heat switch in which the sorber material is thermally anchored to the electronic box. A temperature change of the electronic box triggers the (de-)sorption of gas from the sorber material and subsequently the gas pressure in the gas gap. This talk will describe the physical principles and current status of this technology and our goals for the near future. One immediate goal is selecting a suitable sorber material with the appropriate pressure and temperature characteristics. The talk will also describe our approaches in developing a technology to improve the ON-OFF conductance ratio of the gas gap.

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Session Classification: Tue-Af-Orals Session 5

Track Classification: C-14: New devices and novel concepts