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Geoscientific Instrumentation Methods and Data Systems
Discussions

Interactive comment on "Autonomous Adaptive Low-Power Instrument Platform (AAL-PIP) for remote high latitude geospace data collection" *by* C. R. Clauer et al.

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Reply to Referee 1

We thank the reviewer for the careful reading of our paper and the thoughtful comments. The modifications of the paper that we have made in response to the comments are discussed below:

Comment: The BAS LPM is described but no reference is given. doi:10.1016/j.polar.2008.04.002 Yamagishi et al. would be appropriate.

Response: Reference to this paper has been added to the text.

Comment: The size of the Photovoltaic panels is not given.

Response: There are six panels, 40 Watts each. The text has been modified.

Comment: The Power budget of the system is not presented, and this seems to be of major importance both in the design and performance of the system, for instance in the in-ability to continue measurements through winter.

Response: The individual instrument power requirements are listed. It is difficult to present an overall power budget because it depends on the how the instruments are operated and that varies with time of year and experimental requirements. The text has not been modified.

Comment: It is not explained why the electronics require heating but the sensors can be operated at ambient temperature. This leaves many open questions, is it because some electronics was not available in low temperature versions, why were approaches that use low temperature electronics not used?

Response: The electronics box operates above -40 degrees C because industrial grade electronics are used for the control electronics, modem and instrument controllers. The sensors are all rated to operate at ambient temperature. It turns out that the heat dissipated by the components within the electronics box is sufficient to maintain the temperature above -40 degrees C with no additional heat required. The power electronics in the battery box are designed to operate at ambient temperature because the low voltage disconnect and springtime startup circuits must operate at ambient temperature. We use industrial grade components in the power electronics and test them down to the expected ambient temperature. The text been modified to indicate that the induction and fluxgate magnetometer sensors are rated to operate at the ambient Antarctic temperatures.

Comment: The paper states that "As the batteries warm up their capacity increases and their remaining energy stored energy becomes available", this is not exactly correct – the only thing that changes with increasing temperature is the rate that charge can be taken out of the batteries.

Response: The reviewer is correct and the text has been modified.

Comment: Page 281, line 10 quotes that the rated capacity of a the selected batteries is 48% while powering a 1.4W load, it is not clear whether this is for one battery or for the 16 batteries which is obviously quite a difference.

Response: The test was conducted with a single 100 amp-hour battery connected to a 1.4W load. The text is modified to make this clear.

Comment:

It is not explained why when the PV power comes back this is all used to heat the batteries rather than power the instrument - is it because as well as the batteries needing warming so does the instrument electronics?

Response: This design decision was made to simplify the power electronics design and increase reliability. An unanticipated beneficial side effect of the current design is that the system powers up cleanly and only once per year.

The battery temperature is typically -60 degrees C when the low voltage disconnect powers down the electronics box in the Austral winter. In this state, the batteries are still partially charged, but they cannot deliver enough current to power the electronics. The batteries can once again power the electronics when they are heated to approximately -45 degrees C. The springtime startup sequence of events is:

1. The sun rises. All PV power is used to warm the batteries.

2. The battery voltage reaches 11.8 V when the battery temperature reaches approximately -45 degrees C

3. The low voltage disconnect powers up the electronics box. The startup thermostat

in the electronics box energizes a 5 W heater.

4. The electronics box reaches operating temperature. The thermostat turns the heater off and powers up the electronics.

5. The batteries reach -15 degrees C. From then until the Austral winter, the battery temperature is maintained between -15 and -20 degrees C and the batteries are charged.

We have not made any changes to the text regarding this comment.

Comment: The LVD voltages are given but without any temperature coefficient - is this because no temperature coefficient was applied? If not why not.

Response: No temperature coefficient is used. The LVD design assumes that the battery temperature is approximately -60 degrees C at disconnection and -45 degrees C at reconnection. The text has not been modified.

Comment:

A version number of the Linus running was given but not the distribution name.

Response: A Linux distribution customized by Todd Valentic of SRI International is used. For more information contact Todd at todd.valentic@sri.com. The text has not been modified.

Interactive comment on Geosci. Instrum. Method. Data Syst. Discuss., 4, 271, 2014.