

Kecy, Chad

From: Raybould, Keith
Sent: Friday, December 21, 2007 1:47 PM
To: Kirkwood, Bill
Cc: Etchemendy, Steve; Au, Doug; Keczy, Chad; Brewer, Peter; Peltzer, Edward; Birch, James; Shane, Farley; Dawe, Craig; Massion, Gene
Subject: RE: MARS Power Requirements

Hi Bill,

Too many numbers flying around, so here is the power situation in case anyone misinterprets the various flying numbers:

Shore station power supply has been limited to provide only 7.5kW to the node for the temporary MV converters (1A at 7.5kV, I have not taken into account cable losses here)
(Voltronics power supply can operate at 10kV, but Alcatel has asked us to limit the supply voltage to 7.5kV to the prototype MV converters. There will not be this limitation on the production MV converters)

The MV converter operates at 91% efficiency (Alcatel acceptance test data) so MV converters will output will deliver 6.8kW to the LV system (18A at 375V)

Series resistors (1 ohm on 375V bus, other three 1ohm resistors in line with 375V ports) have been added to provide 375V stability and this will generate a maximum of ~450W heat load/loss ($18 \times 18 \times 1$ plus $7.5 \times 7.5 \times 1$ plus $7.5 \times 7.5 \times 1$ plus $3 \times 3 \times 1$). So power available to the LV system with the temporary MV converters is 6.35kW.

Node hotel load (to power Data Comms System and the other low voltage converters) is approx 410W (1.1A at 375V). Drum roll please, this leaves ~6kW for all of the science ports, for both 48V and 375V loads (which is 30% less than the maximum possible power of 8.7kW with the final production MV converters).

Bottom line:

Power limit with the temporary MV converters on any high power port is 2.6kW (7.5A limit; at max node power, the bus voltage drops to 346V)

Total power available for all 8 science ports with temporary MV converters: 6kW

Total power available for all 8 science ports with final [production MV converters will be: 8.7kW (7.5A limit will be lifted)

Keith

-----Original Message-----

From: Kirkwood, Bill
Sent: Friday, December 21, 2007 9:42 AM
To: Massion, Gene; Dawe, Craig; Shane, Farley
Cc: Etchemendy, Steve; Au, Doug; Keczy, Chad; Brewer, Peter; Peltzer, Edward; Birch, James; Raybould, Keith
Subject: RE: MARS Power Requirements

Gene -

I think Farley copied the Eye-in-the-Sea folks so we could get moving. He has to get the order out immediately for us to have any chance at our dive date (May). As for the power, Etch came by and said we've only got 2 to 3 kW maybe for the entire node. I heard elsewhere we are losing only 10% for a temporary fix and since the node was actually 7.5 kW steady state MARS will have something just under 7 kW total which is pretty decent. Stability of the power is the issue I've heard consistently from everyone but I gather we have to wait for Ed to do some testing and define the final specs on the power.

Once MARS power is figured out let me know and we'll meet the specs by definition. I know there will be load sharing like a wall outlet so a number for steady state and momentary/duty cycle would be helpful. Let us know where we can negotiate and where we can not. We can always pull tricks like trickle charging to store power on FOCE if we need momentary power MARS can't support. Right now we don't know enough about the new FOCE design (very different from the previous one) to say what our power needs are. My early proposal thumbnail was 500w wouldn't be enough and 2 kW is more than we need, my guesstimate was something around 1 to 1.2 kW for moments at a minimum. I never considered we wouldn't have that power continuous or what the capacitance might be etc. at that time. We just selected the test volume size this week and the calculations for the new FOCE haven't started. Due to schedule we plan to hold a Concept/quasi-Preliminary review in late January hopefully. The final PDR/CDR will be end of March first week of April-ish... we dive mid-May with the engineering test unit which will be approximately 1/2 the power of the science test unit scheduled for December '08 since the CO2 system will not be installed. That is about all the detail we can give right now. In a month we'll know more but if MARS can say here are the boundary lines we'll design to those numbers.

You now have all the information on FOCE available. We'll publish things as we go, but I wouldn't count on any numbers until we've iterated, held the first review and made some down select decisions. Again, the MARS spec will influence those decisions so the more I can get about the interface the easier it will be for us to pick and choose from our design options.

Thanks for the getting the drawing on the connector. If I could make a suggestion, if you could post the part number on the MARS web page with the drawing it would be helpful to everyone. That was what we were looking for to be sure we ordered the right parts. Same for the cable whip, Craig has a preference for ROV deployment reasons which makes it easy for us to select.

Hope this makes sense to everyone and sorry we can't be more help yet. If there are other questions let me know but I haven't got much more at the moment.

- Bill

-----Original Message-----

From: Massion, Gene

Sent: Friday, December 21, 2007 8:26 AM

To: Kirkwood, Bill; Dawe, Craig; Shane, Farley

Cc: Etchemendy, Steve; Au, Doug; Keczy, Chad; Brewer, Peter; Peltzer, Edward; Birch, James; Raybould, Keith

Subject: RE: MARS Power Requirements

Bill

Nothing we're doing on MARS prevents your team from ordering connectors and cables. The questions we are asking are to help us address the immediate issues we have with the MARS MV converter. I'll get you a couple of ODI drawings for typical science harness assemblies.

Gene Massion

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-----Original Message-----

From: Kirkwood, Bill
Sent: Thursday, December 20, 2007 7:16 PM
To: Massion, Gene; Dawe, Craig; Shane, Farley
Cc: Etchemendy, Steve; Au, Doug; Keczy, Chad; Brewer, Peter; Peltzer, Edward; Birch, James; Raybould, Keith
Subject: RE: MARS Power Requirements

Gene -

We'll have to deal with MARS power issues as they arise I guess. Thanks for making Chad aware but no one can answer your questions today. Once we've made further progress on the project we can take a stab at it. What would be helpful is rather than waiting on us, can't MARS give us a specification? What do you deliver at a 375V connection and what are the parameters anyone using MARS has to meet? I look at this as a consumer, just like my house power... how far can I go before my little traveling gnome blows up? (stolen from the Travelocity.com ads) It would be far better to state a specification than to chase down each user for what they are doing. Craig mentioned a test node before going to sea... what does it do? I thought you'd have that info out by now, but I understand things happen. If you're not ready no worries but we need that info relatively soon.

Either way, does any of this stop Farley from ordering the connector and cable I mentioned earlier? Those are our current drivers since schedule is the issue more than absolute power. Your note didn't say I've got it wrong, but I need to confirm it is safe to proceed with that order? Unfortunately the MARS web page gives info but nothing as simple as an ODI part number. That info would be great to have now. After the new year we'll work with the power specification you provide, hopefully it won't vary too far from what was expected when I proposed the project.

Hopefully this clears it up and we can get moving, thanks - Bill

-----Original Message-----

From: Massion, Gene
Sent: Thu 12/20/2007 5:22 PM
To: Kirkwood, Bill; Dawe, Craig; Shane, Farley
Cc: Etchemendy, Steve; Au, Doug; Keczy, Chad; Brewer, Peter; Peltzer, Edward; Birch, James; Raybould, Keith
Subject: RE: MARS Power Requirements

Bill

As I'm sure you know, we've had a number of issues with the power side of the MARS system. The problem we are addressing right now is making sure the MV converter can drive the science experiments we expect to support in the near future. Unfortunately, we have had to add some resistors in series with the MV converter output that reduces our total power delivery capability significantly and 2 kW is a significant fraction of what we will be able to deliver in the first year or

2 of operation. One of the reasons we sent out our survey was make sure we know what our users need (at least in terms of power) so we can redefine our power allocation procedures appropriately. In addition, there is a limit to the MV converters ability to drive capacitive loads. Even a small driveBlok (like the ones we use for the Tiburon thrusters) is several 100 uFs. We are about to start testing to see what happens when we need to drive something like this and the results are going to be interesting. If you are going to use something similar, it would be better to know about it now so we can evaluate our ability to drive it.

Two critical questions we need to answer in the short term are 1) how much power you need continuously and how much power you need under peak conditions and the duration of the peak loads and 2) If you expect to drive a capacitive load, about how many uFs will it be?

Chad did stop by and we chatted about these issues for awhile. He's aware of this situation and hopefully can help us with our questions and keep your project in the loop about how things are developing on MARS.

Gene Massion
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From: Kirkwood, Bill
Sent: Thursday, December 20, 2007 1:03 PM
To: Dawe, Craig; Shane, Farley; Massion, Gene
Cc: Etchemendy, Steve; Au, Doug; Kecy, Chad; Brewer, Peter; Peltzer, Edward; Birch, James; Raybould, Keith
Subject: RE: MARS Power Requirements

Gene and Craig -

We need to order the connector at the moment. From what I can tell the same configuration connector and cable is used to interface to either voltage and actual voltage delivered is set from the MARS node. Is that correct? If so, then all we need to do today is place the order for the connectors and the appropriate Extreme Green cable. That is what I really need right now.

As for the power use, the reason we went with the bigger voltage is it is doubtful we'll be able to run everything on a full up system with one 48 volt line at the current delivered. I discussed options with Steve back at proposal time and a second 48 volt line was going to cost me double the per month charges. The single 375 volt line was the same as a single 48 volt line (I was told) since it was a per connector charge with no conditions set otherwise. The decision was made to design our system based on the single connection charge and deal with the power down conversion. We have to supply power and comms to collaborator experiments also (my term) and

we will of course suffer some feature creep (I have to keep margin or we'll be screwed from the get go). Bottom line is there is no one to get an answer from at the moment about our system in terms power needs for May, we are working on it. Those needs will not necessarily represent our needs at a later date either just as a heads up. The last point is I didn't price the proposal out paying double for my MARS connection. taken all together, I'm very inclined to stay on the safe side and stick with the single 375 V until I'm certain I'll never need it. As we get through our design reviews we'll publish our expected power budgets and you're welcome to come to the reviews and have that information. Certainly we'll limit ourselves to the 2 kW and I don't think we'll actually use it all but that isn't a promise I can make today.

That's about the best I or the FOCE team can give you for the moment. I realize some issues arose after our proposal was approved and if that imposes soft starts or some prescribed presentation of our load to the interface let us know and we'll do our best. We'll always do what we can to minimize power use since that's in our best interest. Luckily my budget wasn't cut as I had anticipated so unless your requirements are really onerous it is likely we can be smart about our design and match your needs.

Seem fair enough? - Bill

From: Dawe, Craig
Sent: Thursday, December 20, 2007 12:06 PM
To: Dawe, Craig; Kirkwood, Bill
Cc: Massion, Gene
Subject: RE: MARS Power Requirements

Bill

Craig and I are talking to Farley about the FOCE connection to MARS. We weren't aware of your 2 kW power requirement. We are struggling a bit with making sure the MARS system can drive high power capacitive loads like motors. Can we talk to you and your EE if necessary about what your stuff might look like and let you know what we think you'll have to do to hook up to MARS?

Thanks

Gene

From: Dawe, Craig
Sent: Monday, December 10, 2007 2:01 PM
To: McGill, Paul; Raymond, Erika; Widder, Edie; 'howe@apl.washington.edu';
'tmcginnis@apl.washington.edu'; Hobson, Brett; Kirkwood, Bill; Jensen, Scott; Herlien, Bob; 'Tom
Sanford'; 'John K. Horne'
Cc: Raybould, Keith; Massion, Gene; Heller, Ken
Subject: MARS Power Requirements

please see attached