

LLNL MBARI ASTEP project update

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Background

LLNL is working for MBARI on a NASA-sponsored project “An Environmental Sample Processor for Deep-Sea Seep and Hydrothermal Vent Applications” from the solicitation “Astrobiology Science and Technology for Exploring Planets” (ASTEP). The goal is to develop a polymerase chain reaction module for oceanographic microbiology in MBARI’s ESP by 3/2008. The work areas are:

Task 1: Design the PCR module, 4/2006 – 9/2006.

Task 2: Fabricate and test a prototype, 10/2006 – 3/2007.

Task 3a: Fabricate and integrate production modules into the ESP, 4/2007 – 9/2007.

Task 3b: Support production modules, 10/2007 – 3/2008.

Summary of recent activity (4/7/2007 – 6/20/2007)

Most of the activity in April was included in the Prototype test report on 4/25/2007 (prototestreport20070425.pdf). We also included status information in the CDR held 5/4/2007 (astep_cdr20070504.pdf). The technical issues that have since been addressed and resolved are immediately below. The items that still need to be addressed are later in the Upcoming Activity section.

- *Temperature measurement sensitive to electronics board temperature, possible calibration drift.* We determined that this was mainly due to a drift in the 9 V supply as the electronics board warmed up. This was fixed by using low-ppm (temperature insensitive) resistors and improving the heat-sinking of the inductors. Additionally, since the temperature stability is so critical, we are going to add a precision voltage supply to the analog board. This was our biggest technical concern, so it is great to get it out of the way.
- *Heater and RTD design not finalized.* This design is completed and fabrication is underway.
- *Heating rate low; go to higher power.* This was part of the new design but has not yet been tested in the production module.
- *Board interference problems; fix design.* Completed as part of the new design.
- *RS232 handshaking not yet implemented.* Completed and tested.
- *Serial numbering not defined.* We defined this in changereq20070521.doc but MBARI has not approved it yet.
- *Some life testing needs to be done.* We ran about 200 PCR thermal protocols (each hot-start and 45 cycles) with water in the prototype module.
- *Gains and offsets need to be selected.* Completed for all but the two new optical channels.

In addition, we also provided technical support to MBARI on software usage and on fluidics.

Upcoming activity

There are still some technical issues remaining from the CDR:

- *Possible optics reading drift on some channels.* This is likely to be a result of the 9 V supply drift that has been corrected as discussed above, but that has not yet been verified.
- *610 and 670 nm optics not yet implemented.* We have the parts but have not had the time to try them yet. This will also involve setting these gains and offsets.
- *Optical cross-talk and light paths need to be evaluated.* This is waiting on the two new optics channels as noted above.
- *Other performance measurements needed.* Most of these are minor, but internal temperature stability in different ambient temperatures is high on the list.
- *Interface/Requirements changes.* We have changereq20070518.doc from MBARI that we need to review. MBARI has changereq20070521.doc from us that they need to review.

There main project-level action item remaining from the CDR is to set the extra module and spare parts amounts for the production run. The SOW specified that 4 production modules would be delivered and we do not have excess money in the accounts to make extra modules. However, if MBARI can supply additional funds for parts or whole modules, this is a good time to order extra hardware. We also need to work out the intellectual property plans for the hardware and software, and what form of production documentation will be available.

Schedule and budget

We are about two months behind the original schedule, but it was agreed in the CDR that the timing is fine. As of 6/2/2007, the total spent was 462 k\$ (60 k\$ in May) and 87 k\$ remained in the account. The remaining budget is 66 k\$, so we have to be very careful about any expenditures.