SIAM / Instrument Puck Design Review Comments and Notes November 25, 2003

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Thank your for inviting Sea-Bird to the design review. I felt that the presenters were well informed and presented the information clearly. The documentation was helpful. There was so much information to disseminate regarding the overall software design that it was difficult to get a good understanding of the details, especially in areas that are outside my main expertise.

**Instrument puck Concept:**

Having general purpose data storage in a puck that is closely associated with a sensor or built into the sensor is a powerful enabler.

At the lowest level do not attempt to define what is stored in the puck in any way. What is stored in the puck should be an operational decision; it should not affect the basic puck design.

**Puck Commands:**

Puck commands should have a unique identifier so that they do not conflict with existing commands eg. PUCK_VR, PUCK_FL.

Existing instruments or instruments with limited RAM may have limited receive buffers; this is a good reason to keep the WM command limited to a maximum of 32 bytes.

Existing instruments may implement the puck storage in NAND FLASH. In this case the FLASH memory is written one page at a time where a page is typically 256 or 512 bytes. Defining the WM command to be used only after an ER command makes it possible to implement puck storage with existing FLASH designs.

Since the puck command set may change over time and the controller will need to automatically discover the puck it may be useful to consider that only one puck command is permanent: PUCK_VR. The reply from PUCK_VR indicates the firmware version. This version defines the command set programmed into the puck firmware. The PUCK_VR reply format needs to be tightly controlled in order for this to work.

The puck needs to time out after a period of not receiving command and go into sensor mode.

One area of concern is how to establish and maintain a unique ID for the puck. With the existing proposal when one wanted to update any information in the puck the puck memory would have to be read (capturing the ID and other permanent header information), changes would be made (with some sort of user interface?) and the entire memory dumped back into the puck. This process would make it easy to inadvertently change the ID since it has to be copied into the puck each time anything in the puck memory is changed.

**External Puck Hardware:**

In order to support incorporation into existing instruments it may be beneficial to reduce the minimum amount of required memory since the puck memory will be taken from data storage memory.

One could argue for the 'executive' puck that was isolated (supporting instruments with 4 or 5 wire interfaces) and had both RS-232 and RS-485 interfaces but this device would be significantly more complicated than a puck tailored to the specific application.

It looks like there could be a need for 3 versions (6 if separate RS-232 and RS-485 versions are developed):

Non-isolated RS-232 (very small form factor).

5 wire isolated RS-232 (where the external instrument has separate power and communication grounds)

4 wire isolated RS-232 (where the external instrument has one ground connection and the instrument is a high current device or there is significant impedance in the cables connecting the instrument to the controller)

In all cases I do not see why the puck quiescent current should be greater than approximately 30 microamps.

Is the relay in the current design specified to work over the 8 – 16 VDC range? The current isolated design has the coil of the relay is powered from the non-isolated controller power. This may be a problem if the voltage at the instrument end of the cable is too low.

**Puck Development support:**

During the meeting support for a puck development kit was raised. I see this as happening on two levels. The first is a simple puck hardware verification application program. This program would simply exercise all the puck commands and report to the developer whether the puck passed or failed (giving the reason for failure). This way the puck functionality can be independently verified by the designer.

The second level is supplying tools to create the instrument metadata and instrument driver software. If MBARI wants the end users to supply the drivers then there must be a relatively easy way to create them. This could be a combination of good reference designs (working examples), a complete description of the controller interfaces, API's and services provided by the controller and software that emulates the controller. The tools supplied to the user/developer would:

Generate the header
Generate the metadata
Generate the instrument driver
Package the data
Download the data into the puck
Simulate the controller taking a sample to verify the instrument driver (while plugged into the instrument via the puck)
The software could run on a PC communicating with the puck via the PC's serial port

Even with these tools it may be unrealistic to have the users develop the services (but they would be useful for internal development).

**Metadata:**

I agree that the choice of using XML for system metadata is a good one.

**Power Management:**

It is unclear that technical issues related to cycling between running, idle, and sleep states and the detailed behavior of the LINUX operating system have been thoroughly thought through. This may require people with end-to-end knowledge of the system. The parking lot setup with regular testing will help identify problems early in the design cycle.

It seems that RMI should be used only for testing and debugging the system before it goes operational. Once the system is operational I would see the end users obtaining all science data from the shore side data repository, not directly from the controller using RMI.

**Finally:**

An impressive amount of work has gone into the planning and design of MOOS in particular and Ocean Observatories in general, however it is clear that much remains to be done in order to meet the upcoming schedules for the upcoming test moorings and science mooring.