Final Report – Wireline Modem Development for Real Time Borehole Monitoring

ICEFIELD TOOLS

PRECISION BOREHOLE SURVEY TECHNOLOGY AND TOOLS

Original Project Scope and Current Evaluation

The original goal of the project was to create a functional surface communication system including both a downhole and surface modem prior to April 1st, 2014 that:

- communicates with all of the Corporations' existing products
- transmits and receives data
- works with common wireline cables, trucks and monitoring devices that are standard

The project was not 100% complete as of the original end date, March 31st. Since that time, the project has continued, the prototype has been both built and tested. The completion of the project within the original timeline was not directly limited by financial resources, but rather by the volume of assigned labour. While on target up until late January, progress towards a finished product was slowed after the initial plan did not perform up to our requirements. The program was revised and personnel continued with the new design plan.

Below is a breakdown of the individual tasks and activities that were defined as individual components of the project:

- Design and definition of the modem system's features – Complete
- Implementation of wire-line mode on the tool side, including electronics, communication hardware and software and mechanical interfaces – Complete *Note, as a component of this research, we have identified an improved 'wireline mode' that will be implemented in a future version of our primary instrument.
- Testing of prototype and collecting feedback about further necessary improvements – Complete

Challenges Encountered

There were a number of difficulties encountered, some anticipated and some unanticipated, but generally related to the required robustness of the modem system in most environments. Specifically, this included:

- rate of data transfer in real world settings
- moderation of error conditions
- unexpected behaviour from a batch of hardware components that were incorrectly documented by the original manufacturer
- Exaggerated specification claims by manufacturers that were not reflected in actual performance.
- In order to overcome these hardware challenges, this impacted the related software development of a robust modulation and demodulation algorithm based on digital signal processing

I note that most of the components were built first using computer simulations, then implemented based upon the results of those simulations. This reduced the potential impact on progress to the current prototype

Testing of Prototype

Testing of the resulting package has exceeded our expectations

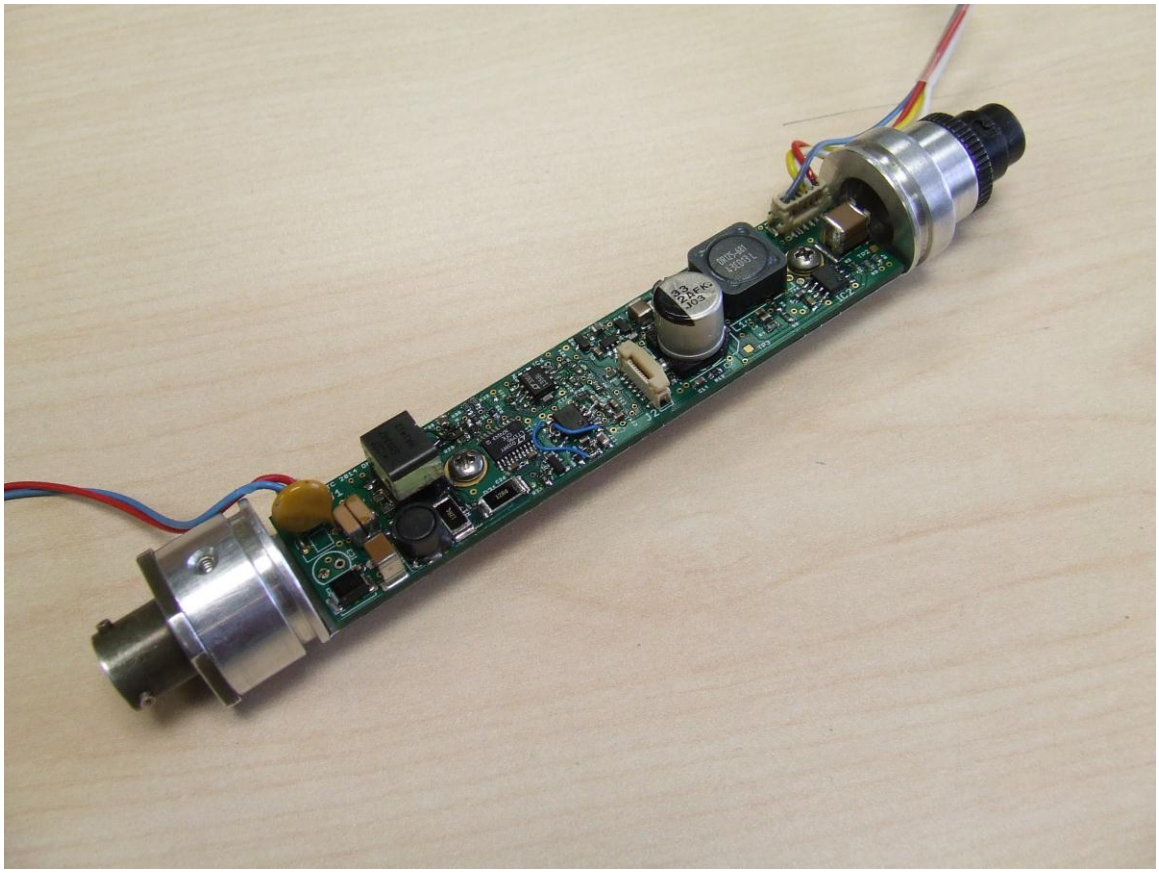
- The system is able to communicate over a longer range than required (8km required, but signal is sufficient at more than twice that distance, and signal to noise ratio is improved, resulting in greater data accuracy)
- Power efficiency of the converters and components is approaching theoretical limits
- The chosen communication frequency provides maximum range with minimum power consumption
- The robustness of the design allows for greater flexibility for use with a range of client cables, both in length and type
- The unit works with AC, American or European Standard, and DC 12v to 50v
- It is protected against short circuits resulting from cable break or mishandling of the system
- It includes a warning signal to the operator when there is potential danger, as well as safety protections to limit electrocution.
- It handles both USB and Serial communication
- The systems LED notifications work as required, demonstrating conditions of operation and performance

Impact on Operations

Although this project was not finalized within the timeline of the original proposal, the project was a success and has resulted in a valuable product. The group feels confident with the design and implementation of this device, and will begin marketing the completed product late in the 3rd quarter this year. This will include trade events for both mining and oil & gas, demonstrations with existing clients, as well as follow up with our list of interested parties who have made previous enquiries.

We anticipate a significant boost to top line revenue, and similarly to our budget for current and future R&D efforts, in house personnel and finally, profitability. The capability that this system provides is not a standalone product, but rather increased applications for all of the corporation's primary products, providing additional benefits beyond just the sale of a new product. While specific numbers are not yet known, it is not unreasonable to expect an increase

in top line revenue of 50% in the first year following the date of completion; the increased revenue will likely result in 2 additional full time positions over the same period.

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