University of Nebraska Lincoln

INSTITUTE OF AGRICULTURE AND NATURAL RESOURCES
DEPARMENT OF BIOLOGICAL SYSTEMS ENGINEERING
Nebraska Tractor Test Laboratory

May 21, 2018
Stephen Heckeroth
Founder & CEO
Solectrac LLC
Albion, CA

Re: NSF SBIR Phase 1 proposal "All-Electric Tractors for Agriculture and Utility"

I am most happy to support your National Science Foundation SBIR Phase 1 application entitled "All-Electric Tractors for Agriculture and Utility". The National Tractor Test Laboratory has validated emerging agricultural tractor technologies on numerous occasions for nearly a century. Since 1920, we've validated over 2100 tractors. Our museum contains examples of several firsts, perhaps a Solectrac unit will join them. Our laboratory has a permanent staff of agricultural engineers overseeing a student workforce of 30 undergraduate and graduate students. As Director, my work is dedicated to establishing world standards for tractor testing, working with international agricultural manufacturers and farmers, as well as teaching the same to our dedicated student body. We test several dozen tractors per year. In my many years here and abroad, Solectrac is the first electric tractor we've tested in March 2017.

As Director of the NTTL for over 11 years, I have overseen the development of tractor testing as vehicles become more complex to meet more stringent emission requirements. The Solectrac tractors are zero Emission and therefore are the harbingers of a potentially revolutionary change in agricultural tractor power. Testing revealed that electric motor power could be successfully delivered through the Power Take off (PTO) with adequate power for the intended use. A PTO is one common method by which tractors deliver power to implements. Overall, the battery power was very impressive; however, for commercial viability sufficient power to allow 8 to 12 hours of continuous operation is a need that can be met as battery technology continues to improve.

It was a good first visit. Solectrac's electric tractors showed a lot of potential for future farming applications. Solectrac is definitely on to something and is on the track to develop a viable prototype for successful commercialization. NTTL validated claims of both the eFarmer and eUtility tractors, using a PTO dynamometer on the eUtility model, strain gauges linked to actuators on the eFarmer model, and bucket loading tests which exceeded expectations. In addition, we did a sound study using the eFarmer, which was so quiet we had trouble measuring output above background when the test vehicle was over 50ft away. These tests are a portion of the battery of tests performed on production tractors for manufacturers seeking sales permits in Nebraska.

At the conclusion of the demonstration and testing, our students gathered for a Question and Answer session where topology of the battery management and charging was discussed, as well as your return to a center 3-point hitch for ergonomic implement control. Your technicians provided thorough explanations
with insightful answers. It is my opinion, which I shared with both our students and lab faculty, that

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Solectrac represents the very future of agriculture, the start of an electric tractor revolution. You have my full support.

Good luck with your application.

Sincerely,

Roger M. Hoy
Professor and Director – Nebraska Tractor Test Laboratory

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