



DESTINATION STARTUP

LumenAstra

One-Sentence Summary of What You Do: LumenAstra is commercializing a wearable, non-invasive core body temperature sensor with impactful applications in tumor hyperthermia therapy and monitoring brain temperature for neonates and stroke/brain injury patients to prevent additional brain damage during the critical hours post-injury.

Affiliated Institution: University of Colorado Boulder

Have you formed a company yet? Yes

Funding/Financing: Grant Funding, Angel Funding (including Self or Friends/Family)

Please describe your company and the problem you are trying to solve: LumenAstra is commercializing a University of Colorado patent for a wearable, non-invasive core body temperature sensor. Think of a small patch that can be placed on any part of the body or head and directly measure tissue temperature several cm below the skin. Applications: Through more than 80 customer discovery interviews, we have uncovered many applications with high societal impact including: • Monitoring and managing tumor temperature during hyperthermia therapy increasing overall cancer recovery rates by 20-40% while reducing the dosage of radiation and chemotherapy and their debilitating side effects. • Monitoring for elevated brain temperature for stroke and brain injury patients to prevent additional brain damage during the critical hours post-injury. • More consistent representation of internal body temperature for early warning of infection or immune system response (e.g. Covid screening) Competition: Our non-invasive solution will replace highly invasive devices such as nasal, esophageal, rectal or urethral catheters placed “close” to a desired internal location. Existing technologies include sensor-tipped needles inserted through the skin into tumors or organs which tend to under-sample and misrepresent desired tissue volumetric temperatures. Status/Intellectual Property: Dr Zoya Popovic, Distinguished Professor in the CU-Boulder EE Dept, demonstrated the science with a grant from DARPA and NSF. The positive results were published in multiple papers and IEEE proceedings. A patent with 20 detailed technical claims was issued in November 2019. In addition to blocking patent protection, several technologists and companies made failed attempts at implementing this technology due to difficulties that Dr Popovic innovated through.

What is/was your go-to-market strategy? Our extensive customer interviews have uncovered a large pent up demand for a non-invasive method of directly measuring localized deep tissue temperature. Brain temperature monitoring in the hours after brain injury is important for reducing additional damage and disability post-injury. Accurate determination of tumor temperature during hyperthermia co-therapy can increase overall cancer recovery rates 20-40% versus stand alone



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chemo/radiation therapy. Total available markets for these applications alone include:

- CDC estimates 2.87 Million Americans per year experiencing Traumatic Brain Injuries (TBI) with emergency clinic visits and 56,000 deaths. TBI is a major cause of death and disability in the US and THE major cause of child death.
- CDC estimates 875,000 Americans experience a stroke/annum resulting in 175,000 deaths. Stroke is the leading cause of long term disability.
- The Dept of Veteran Affairs reports 414,00 US military personnel (17.3%) experienced TBI's between 2000 to 2019.
- The National Cancer Institute estimates 1.8 Million new cancer cases diagnosed in US for 2020 with 600,000 deaths with chronic disease cost of \$30-45K/per person per year.

The existing technology for these measurements are highly invasive temperature catheters and sensor tipped needles inserted thru the skin. There is NO direct way to measure brain temperature. We will be offering core temperature sensor components through OEM arrangements with existing patient monitoring solution providers such as Medtronic, Philips, BioIntellisense, Stryker, BD Medical and Masimo. Integration with our sensor technology will improve their patient outcomes and offer a competitive advantage over their competitors using traditional invasive techniques.

How will/do you generate revenue? LumenAstra will primarily be a hardware company and generate revenue through OEM sensor hardware sales through existing patient monitoring and hypo- and hyperthermia device manufacturers. Our non-invasive sensor will replace highly invasive sensors while offering increased temperature accuracy and target temperature resolution. Our interviews are showing that the benefits and superiority of our sensor create an upside “price to value” opportunity over lower cost invasive sensors. In the brain temperature market (brain injury, stroke, shock and hypoxic neonates) there may be an opportunity for stand-alone device(s) with increased margins that can still be sold through patient monitoring system providers (e.g. Medtronic, Stryker, Masimo) or through other medical supply companies. Interviews have shown that if we keep our per sensor customer price under (roughly) \$500, many hospitals will treat our devices as single use “throw aways” rather than attempting to sterilize, repackage and reuse. This increases the consumption rate of our sensors and generates an opportunity for continuous recurring hardware sales. Interestingly, this potentially also allows us to tap a developing country reuse market to recycle single use sensors. Recurring original sensor sales followed by a second sales to a secondary market!

How will this showcase benefit your company or technology? The technology we are commercializing from the CU EE Department is very early stage. While the basic science has been proven with prior DARPA and NSF grants, we still have some basic capabilities to develop and prove prior to miniaturization and productizing. The timing of this showcase in Feb 2021 will be excellent as a preview to potential partners, investors and for recruiting engineering talent. We will be looking for angel investment with an eye out for early discussions with future VC. We will also have bench prototypes to demonstrate the technology as we look at more in depth discussions with possible partners. Our technology will be attractive to larger medical device companies such as Medtronic, Masimo, Philips, and BD Medical. Any of these larger companies could not only be a valuable



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distribution partner, but also as a strategic investment partner. As of this writing, we are still fleshing out possible vertical applications and prioritizing them for our first beachhead and following landing sites. We still have some basic research at CU to perform from now through summer 2021 to better understand our development commercialization costs, device form factor(s) and cost structures. We will soon have a better estimate of our investment strategy and timeline. A reasonable guesstimate at this point would be for us to be looking for a \$1.0 to 1.5M angel round summer 2021 and a \$5-10M VC round in spring/summer 2022.

Who are the members of your team and why is this the right team to get the job done?

- LumenAstra and the CU Popovic RF Lab have assembled an excellent team that is tuned for our current stage.
- CU Radio Frequency Lab: Dr Zoya Popovic is a Caltech PhD, CU Distinguished Professor, IEEE Fellow and principle investigator of the patent LumenAstra is commercializing. Dr Popovic holds the Lockheed-Martin Endowed Chair for the RF Lab. She has graduated 62 PhD students in her 30 years at CU. Her lab's important work has generated over \$1M of funding per year for the last 20 years.
- Robert Streeter is an analog EE PhD researcher in the RF Lab and exclusively working on this project. Dr Popovic recently secured an NSF \$400K research grant fully funding Robert's activities. LumenAstra - a Colorado Corporation founded to commercialize this technology.
- Jim Pollock/CEO is an MIT alum starting his career at Hewlett-Packard before involvement in 8 early stage and startup technology companies. Several of his companies have exited thru a merger/IPO and acquisitions.
- Michael Hurowitz/acting CTO is a serial entrepreneur and has extensive design experience in spaceborn radiometers, similar in design to the near-field radiometer at the heart of our sensor.
- Walter Wong/VP Product Development spent 20 years as Engineering Director for Seagate with extensive consumer electronics manufacturing experience and 10 years consulting with Medtronic and major medical device companies.
- Nicole Forsberg/VP BizDev is currently heading partner relationships with CU Venture Partners with extensive Bizdev experience with university tech transfer into industry. As noted previously, we have identified candidate medical device company manufacturing and distribution partners.