



Industries

Interventional Medical Devices
Controls/Sensors

Officers/Directors

Chris Hymel (Pres/Treas/Dir)
Ron Stubbers (VP/Dir)
Malcolm Skolnick (Sec/Dir)
Richard Seltzer (Dir)

Investment to Date

\$823,600 (cash)
\$4,557,500 (assets/services)

Capital Required

\$2.5M over 12-18 months
\$20M over 4 years

Use of Funds

Technology Refinement
Specific Application R&D
Sales/Marketing/Licensing
Intellectual Property Prot.

Overview: Signal Advance, Inc. has been developing and is now commercializing its proprietary Signal Advance (SA) Technology which has been shown to reduce signal detection delays associated with a variety of physical sensors and thereby improve performance in control, intervention, and/or signal transmission systems.

Challenge: In interventional medical devices or non-medical control systems, delays in detection, processing and response to various signals negatively affects overall performance. For example, with certain types of biomedical signals, the greater the detection/response delay, the more difficult it is to successfully intervene in order to contain or limit a pathological process such as cardiac fibrillation or an epileptic seizure. The earlier the intervention is initiated, the greater the probability of success.

In non-medical applications (military, industry, transportation, etc.), earlier signal detection means faster control system response to improve efficiency, accuracy, safety, product yield, fuel efficiency and emissions.

Solution: SA Technology can offset these signal detection and processing delays and thereby improve performance. The technology is based on "negative group delay" a well documented phenomenon in wave propagation physics. SA Technology can be applied in conjunction with other approaches such as faster electronics to reduce these delays to maximally enhance system performance and may enable the development of novel control/interventional approaches.

Market: SA has identified whole classes of sensors with signal characteristics suitable for the use of SA Technology, and thus, a broad range of licensing targets. The addressable markets include medical (e.g. cardiac rhythm management, neurostimulation) and commercial, industrial, transportation and military applications (e.g. process control, vehicle/engine/flight control, weaponry, etc). With any new or disruptive technology, recognition and acceptance will gain momentum over time, thus SA Technology will likely have slow initial impact.

In medicine, the application of SA Technology to temporally advance bioelectric and other signals can potentially improve performance in interventional medical devices. Projections in major medical markets include: Cardiac Rhythm Management (CRM): \$28B by 2017 (CAGR: 9.8%); Neurostimulation: \$8.8B by 2020 (CAGR: 4.3%); Magnetic Resonance Imaging (MRI): \$6.9B by 2018 (CAGR: 5%); Radiation Therapy: \$6.8B by 2016 (CAGR: 6%). Digital Brain Health: \$2.0B in 2012, \$6.0B by 2020 (CAGR: 25.1%) For these and other medical devices, improved performance translates directly to increased value - providing significant revenue opportunity.

There are also a wide range of non-medical global markets for SA Technology including the Sensor Market: \$69B in 2012, \$116B by 2019 (CAGR: 7.9%) and Industrial Control/Factory Automation Markets: \$171B in 2015, \$302B by 2020 (CAGR: 8.5%). The automotive sensors market alone is expected to reach \$22B by 2015 and \$35B by 2020 (CAGR: 9.7%).

SA Technology could potentially improve accident avoidance, safety/security, engine performance and vehicular control/safety, and thus improve fuel economy and save lives. In high performance aircraft engines, SA Technology could increase stability, reduce stall margins improve performance and fuel efficiency. Industrial examples include improved compressor performance and increased petrochemical yields. The projected market contribution is 1-3%.

Intellectual Property: Steven Weeks, Ph.D. (solid-state physics), First Principals, Inc. performed an independent intellectual property (IP) valuation based solely on the "cardiac" and "neuro" device market segments and drew the following conclusions:

VALUE: Including the projected, risk-adjusted licensing royalties, we project A NET PRESENT VALUE OF UP TO ~\$10.4 MILLION. This valuation will increase rapidly as the technology is proven and then successfully applied to products in this very large market. ... IT IS, HOWEVER, DELIBERATELY CONSERVATIVE.

Patent applications were filed in the U.S. Patent Office (USPTO) and foreign counterparts. Patents have issued in the US, China and Mexico. European is under examination and the Company addressed office actions. Additional patent applications are in preparation for specific application, circuits and signal processing to improve signal fidelity. "Signal Advance" trademarked for Class 10 devices.

IP defense strategy is based on the fact that SA Technology designs are application-specific, enabling novelty and non-obviousness in patent claims with the associated analytical methods remaining trade secrets. Potential infringers would have to expend undue time and money to develop such methods to pursue individual applications. This application-specific approach gives SA a significant competitive advantage. Each application will have its own patent filing and stand independently. An attack on any one will not affect others. SA will work with licensees to determine which international patent applications to pursue. Licensees will assume patent costs and be required to participate in the defense of licensed IP.

Competition: Quotes from 3rd party experts regarding SA Technology: "...seminal in concept"; "...SA has no current competition"; "...truly 'pioneering' or 'landmark'..."; "I expect to see Mr. Hymel's methods and related systems come to underlie groundbreaking advances"; "... revolutionize the non-pharmacological treatment of arrhythmias and epilepsy"; "...seen as a disruptive technology that forces rapid change...early adopters...gaining a significant commercial advantage..."; "...key to effective seizure suppression".

Indirect competition exists as in the form of ever faster electronics used to improve signal detection and processing performance. In addition, alternate control strategies, (e.g. predictive feedback and feed-forward) are often used to improve performance but also have significant drawbacks. Faster electronics alone will reduce, but never eliminate, circuit delays. For a number of applications, some of these techniques may be adequate. SA Technology can be used in conjunction with these methods to further improve performance.

While SA is not aware of any direct competition, its own success will likely precipitate competition as SA Technology gains recognition and acceptance. This will include potential infringement and legal machinations based on a larger, financially successful firms' capability to engage in lengthy and expensive litigation. Searches and analyses of the patent and scientific literature have not revealed any prior art that would negate the utility and novelty of SA Technology and no combination of the references sees to render the technology obvious to a person skilled in this area. However, the defensive strategies, outlined above, and constant vigilance are required.

Revenue Generation: While the addressable market is in the billions, it is expected that many licensees will require exclusivity which would limit SA to a single license in a given application area. Therefore, SA will target multiple application areas to generate licensing revenue. To generate revenue SA will: 1) license intellectual property to product manufacturers, 2) consult with licensees on implementation of the technology in target applications, 3) commercialize SA enhanced products & 4) participate in joint ventures.

Marketing strategy: 1) identify application targets and develop application-specific SA circuitry, 2) protect the intellectual property, 3) demonstrate performance improvement to target licensee, and 4) secure licensing/consulting agreements. Target applications are based on: 1) intervention/control impact, 2) signal parameters, 3) market size, 4) supplier market share, 5) competition, and 6) regulations. The approach is to identify applications and protect IP; consult with application-specific experts, develop SA Technology for their specific application and demonstrate improved product performance. Later strategy will shift development costs to the client.

Recent Progress: The Company developed and continues to refine its proprietary Signal Advance technology operating on broad-band analog signals (over a specified frequency range) with minimal signal distortion. SA has established collaborations with research institutions and private companies to develop SA Technology in specific application areas.

The Company is evaluating options for microelectronic implementation of SA circuitry to facilitate evaluation by potential licensees in target markets segments. The Company is currently pursuing the development of application-specific SA circuitry for neural bioelectric signals in the brain health market in the detection of neural bioelectric signals and for remote power management applications.

Independent validations of Signal Advance technology have been established in the following areas:

Scientific: Prototype Signal Advance circuitry, developed for bioelectric signals (cardiac) was rigorously tested using a range of simulated signals and actual ECG signals from cardiac patients. This development activity and experimentation resulted in completion of a successful doctoral dissertation study at the University of Texas Health Science Center at Houston;

Technical: A peer-reviewed feature article summarizing the technology, study results, and broad range of potential SA Technology applications was published in the IEEE Circuits and Systems Magazine in the third quarter of 2011;

Commercial: SA was awarded first place in the 2011 Goradia Innovation Prize competition. The selection was based on: 1) the commercial potential of the technology, 2) the soundness of the business plan, 2) the potential for job growth within the region, and 4) the likelihood of significant long-term success.

Innovation: The State Bar of Texas Intellectual Property Section recognized Dr. Hymel as the 2015 Inventor of the Year. The Oklahoma Bar Association Intellectual Property Section named Dr. Chris Hymel, the company's president, the 2012 Innovator of the Year.

The awards were based on Dr. Hymel's development work and patents related to Signal Advance technology.

Directors/Officers

Chris M. Hymel, Ph.D. (President/Treasurer, Director), B.S. & M.E. in electrical engineering; Experienced entrepreneur; Engineering/ scientific consultant; Technical manager; Author/co-author of scientific and technical publication; Multiple patent holders, including company's intellectual property. Dr. Hymel is experienced in startup & early stage companies as well as taking a company public.

Ron Stubbers, B.S., M.B.A. (Vice President, Director) held engineering and production management positions in start-ups and early-stage companies; Experienced in product development, production, world-wide client fulfillment, quality control and regulatory requirements. Mr. Stubbers holds multiple patents. Mr. Stubbers holds an MBA and bachelors degree in electrical engineering.

Malcolm Skolnick, Ph.D., J.D. (Secretary, Director), Theoretical physicist, former tenured professor and director of technology transfer at the University of Texas Health Science Center - Houston, former president and CEO of a publicly traded biotech firm (10 yrs). Dr Skolnick is a registered patent attorney, licensed to practice in Texas, and experienced biomedical researcher with related publications and patents.

Richard Seltzer, J.D., LL.M. (Director), Licensed to practice and is an approved mediator in the State of Texas, LL.M. in Taxation; Experienced in corporate and tax law, mergers and acquisitions and contract/license negotiations, business litigation, shareholder disputes. Mr. Seltzer lectures on general business law matters as an invited speaker.