Case Study: **NSF/SBIR IA2011-002**

Company: **0750512 Anasys Instruments Corp.**

Technology Segment: **Electronic Hardware**

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1. PREAMBLE:

1.1 TECHNOLOGY AND MARKET DESCRIPTION

This project seeks to develop the prototype of a characterization system which can perform infra-red (IR) spectroscopy and imaging at sub-100 nanometer (nm) spatial resolution and thus break the 5 micron resolution barrier that has limited IR spectroscopy for the last fifty years. This 50x breakthrough in spatial resolution is enabled by Anasys's proprietary technique of Photo-Thermal Induced Resonance (PTIR) whose feasibility has already been demonstrated in prior work funded by the National Science Foundation (NSF) Small Business Innovation Research (SBIR) program. The prototype will be based on a breakthrough broadly tuneable mid-IR laser invented by one of the company's scientific co-founders. Efforts will now focus on research to fully characterize and optimize the PTIR technique which in turn involves optimization of the nanoscale probe technology, IR illumination, detection algorithms and the minimization of non-IR absorption related contrast. This is a multi-disciplinary effort that will leverage the team's cutting edge competencies in IR physics, electro-mechanics, optics, and software. The outcome of this project will be a prototype platform capable of sub-100nm IR spectroscopy and imaging. The Anasys business model is based on continually investing in their current core competencies in new technique development for nanoscale property measurement, engineering product development and customer focused applications development. All aspects of manufacturing (including subassemblies) except the final assembly and quality control prior to shipment will be

outsourced. The company plans to use distributors to sell their products worldwide and will transition to a direct sales-force in the key markets of U.S., Japan and Western Europe. They already employ this model with their current product in the nanoscale thermal analysis arena. The initial customers for their nanoscale IR products will be the same customers of their current nanoscale thermal products which will make the adoption process easier. Their strategy is to launch their initial products (both thermal and infrared) to the Atomic Force Microscopy (AFM) industry to obtain customer validation and feedback needed to make the technique robust and easy to use. Based on this feedback, they will launch a next generation easy to use tool targeting the bulk analysis industry.

1.2 VALUE PROPOSITION

Ever since it led to the discovery of synthetic rubber during WWII, IR spectroscopy has remained a critical and ubiquitous analytical technique which is by itself a $1B/yr industry. However, its spatial resolution limitation has seriously hampered researchers in the strategic materials and pharmaceutical industries where multi-billion dollar nanotechnology investments have led to a massive need for information on nanoscale chemical composition. As reiterated by endorsements from Dr. Meyers (Dow Chemical), Dr. Chase (Dupont) and Dr. Germinario (Eastman Chemical), the enormous impact of nanoscale IR ranges from new materials discovery to interfacial property improvements in high value applications like automobiles. Prof. Bhargava (U. Illinois/Beckman) highlights the impact of this breakthrough to the life sciences in general and particularly in early prostate cancer screening. This will have a disruptive impact on the $200M/yr AFM industry. The AFM is a workhorse instrument for nanotechnology research and the information it provides drives a large part of the $1.2B National Nanotechnology Initiative. However, as reiterated by Dr. Thundat (Oakridge National Lab), the most serious bottleneck facing this user community is the AFM's inability to provide chemical analysis functionality. Anasys Instruments Corp. proposes to develop the world's first technology platform for sub-100nm IR spectroscopy and imaging, a 50x improvement in resolution over the state of the art. Their platform will be based on the proprietary and patent-pending PTIR technique that will shatter the optical diffraction limit that has plagued IR spectroscopy and imaging for the last 60 years. Satisfying these unmet needs in nanoscale thermal and chemical measurements will enhance the nation's nano-manufacturing infrastructure.

Their initial target market is the chemicals/materials industry. Four market segments have been identified:

AFM Users: The Atomic Force Microscope is the leading tool for nanotechnology research. It is a versatile platform that can be used for all types of nanoscale measurements. The current AFM market is $250 M/yr and growing at 15% (annual unit sales of 1000 and an installed base of 7000). However, the most important limitation of this tool is its inability to measure chemical properties of the sample. IR Microscopy Users: This user group consists of R&D scientists in the polymer and life sciences industry who are looking for localized chemical information (via an IR spectra) on their samples. The IR microscope market is currently $82 M/yr and growing at 7%. The most important limitation of this tool is its inability to resolve features of below 5 ìm in theory and 10 ìm in practice. IR Spectroscopy Users: IR spectroscopy is a

common technique for chemical identification used in applications ranging from quality control to R&D in most industries. The total size of the IR spectroscopy market is $1B/yr and growing at 4.5%. The most important limitation of this tool is its inability to work on samples smaller than a few mm across. This need for small samples is most felt by users from the organic materials, forensics and life sciences industries . Users tend generally to range from technicians to R&D scientists who use it to solve a specific problem and appreciate the fact that it is easy to use. The estimate of the total available market for a small sample IR platform is 20% of this market or $200 M/yr but with a higher growth rate of 10% a year. Advanced Optical Microscopy Users: This user group comprises R&D scientists in the polymer and life sciences industry whose microscopy applications require high resolution and who value more information on their samples. The total market size is $200M/yr and growing at 10%. An important limitation of this tool is its current inability to provide chemical information on samples. IR microscopes are not used since its resolution of 10 ìm is far worse than the optical imaging resolution of 1.5 ìm.

The competitive landscape includes large companies currently serving each of the four market segments: AFM: Veeco Instruments; Agilent; Seiko Instruments; IR Microscopy & IR Spectroscopy: Perkin Elmer; Thermo-Electron; Bruker Optics; and Advanced Optical Microscopy: Leica; Olympus; Zeiss. The intellectual property (IP) strategy consists of protection by a suite of twenty worldwide potential patents, five of which have been filed, in addition to which the company has exclusive licenses to fifteen others from TA Instruments Corp.

1.3 TEAM

Anasys Instruments Corp. was founded in 2005 by senior managers from the AFM industry together with key academic scientists to create patent-protected technology and products in the field of quantitative nanoscale property measurements based on scanning probe techniques. The company launched their first product (for nanoscale thermal analysis) in 2006. The co-founders are Kevin Kjoller and Roshan Shetty. Kevin Kjoller is generally considered one of the world's leading technology and applications experts in Atomic Force Microscopy and one of the key factors behind the emergence of DI/Veeco as the leader in the AFM industry. He spent 17 yrs in the industry and was most recently the Director of Engineering and Applications at Veeco Instruments. At Veeco, he led a team of over 40 engineers and scientists with an annual budget of over $10M and was responsible for the engineering of several Veeco products. Kevin is VP, Research, Engineering and Applications. Roshan Shetty was the Director of Strategic Investments at Veeco. He was a former investment banker with Alex Brown in San Francisco involved in technology Mergers & Acquisitions (M&A) and Initial Public Offerings (IPO). He was also an Operations Manager with KLA-Tencor in the field of semiconductor equipment. At Anasys, Roshan is the CEO and VP, Finance, Sales, Manufacturing & Administration.

Advisory Team:

1. Prof. Bill King, University of Illinois, is a scientific co-founder of Anasys and the world's leading authority on nanoscale thermal probes and property measurements.
2. Prof Alexandre Dazzi, University of Paris Sud, is the inventor of the PTIR technique which is the basic technology behind this R&D effort. PTIR is the only proven technique to obtain sub-100nm IR spectroscopy and imaging.

3. Dr. Ken Babcock, former General Manager of Veeco's $80M/yr Research AFM business and current CEO of Affinity Biosensors. Ken is also an investor in Anasys Instruments.

1.4 Innovation Accelerator (IA) Role

- Determined mutual interest; engaged with Anasys to identify issues, especially those that align with IA resources/attainable resources; prioritize key issues
- Key priority issue identified: term sheet from Veeco Instruments, the leader in the AFM space
- IA introduced Marco Rubin and Marcus Ruark, experienced term sheet negotiators, to Anasys
- IA conducted outreach/background diligence to provide potential IA Advisors to the Company
- IA monitored the engagement for compatibility and to identify emergent areas of potential assistance

1.5 Key Relations

- Potential (beta) customer
- Investor(s)
- NSF SBIR Program/PD/Innovation Accelerator (IA)
- Board of Directors
- Board of Advisors
- Domain experts/Mentors
- Strategic partners
- Founders/Key team members

1.6 Execution and Growth Strategy

- Rapid growth via infusion of venture capital/private equity funds
- Sales-driven steady and slow growth
- Merger; Acquisition; Spin-off
- IPO

1.7 Supplemental Reading Material:

a. IPVision intellectual property (IP) analysis
b. NSF SBIR documents

2. Workshop Block 1: Introduce the Case Study

Participants: Moderator + NSF Program Director (PD) + Founder/CEO

Discussion Items

1. Assess commercial opportunity/potential and value proposition
2. Technology strategy/roadmap – prototype/beta-version development
3. Business strategy/business model to adopt?
4. How best to fund this endeavor?

Course Content

1. Participants discuss items identified for Block 1
2. Founder/CEO explains Company approach/path; why NSF SBIR Program? SBIR route constraints; technical risk elements & mitigation; market factors – non-existent (create one); existing (carve out niche); NSF/SBIR panel reviews/summary implications; team building/dynamics
3. NSF PD viewpoint: Decision-making process/considerations; technology pull-push issues; rationale for funding

3. Workshop Block 2: Assess Where The Company is Now

Participants: Moderator + IA+ Founder/CEO + NSF PD

Discussion Items

1. Identify risk elements (technical, team, market, finance); how to manage/mitigate them?
2. Additional funding strategy
3. Barriers to entry
4. Right business model?
5. Identify areas where Company needs help

Course Content

1. Participants discuss items identified for Block 2
2. Company's efforts to obtain additional funding; developing business plan elements
3. NSF/SBIR PD: Next-round funding decision process/considerations; PD-Company relations; why introduce Company to IA
4. IA-Company relationship: building trust; identifying areas to provide assistance
5. How did IA help? Fill-out management team; mentoring; potential customer/partner/investor introductions; Board (Directors; Advisors) formation; business/IP/market strategy; valuation/negotiations

4. Workshop Block 3: Determine Where to Go Next

Participants: Moderator + IA+ Founder/CEO + "Partner" + NSF PD

Discussion Items for Block 3

1. IA approach right?
2. Timing market entry; go-to-market strategy
3. Growth strategy
4. Startup valuation exercise
5. Potential risk elements

Course Content

Note: "Partner", a potential customer/strategic partner (larger company)/investor

1. Participants discuss items identified for Block 3
2. Regulatory issues

3. Company valuation; partner negotiations
4. Partner relations – communications/clarity; expectations alignment
5. Additional resources/funding
6. Adversity: problem mitigation/resolution; mistakes/lessons learned
7. Growth; exit strategy

5. WRAP UP

Take away; final thoughts

6. COURSE EVALUATION QUESTIONNAIRE