

“Resolution Optics Inc. Business Plan Submission  
as part of the InnovaCorp I-3 Competition: A Living Case.”

by

Stephen Edward Jones

A thesis Submitted to  
Saint Mary's University, Halifax, Nova Scotia  
In Partial Fulfillment of the Requirement for  
the Degree of Executive Masters of Business Administration

December 10, 2013, Halifax, Nova Scotia

Copyright Stephen Edward Jones

Approved: Dr. Ellen Farrell  
Supervisor

Approved: Dr. Patricia Bradshaw  
EMBA Program Coordinator

Date: December 10, 2013

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## **Abstract**

“Resolution Optics Inc. Business Plan Submission  
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By Stephen Edward Jones

Abstract: InnovaCorp recently held an I-3 Technology Start-Up competition to find and support high potential early-stage Nova Scotia companies and encourage entrepreneurial activity. Submissions are evaluated based on: business plan credibility, management experience, a high barrier to competitive entry, a large addressable market, and the probability of obtaining a fully-funded business plan. This thesis is the submission from Resolution Optics Inc. with accompanying background information about the company’s go-to-market strategy. This MRP neither promotes good nor poor management practices. It is useful as an example of the kinds of proposals that are submitted to the Province of Nova Scotia’s most prestigious innovation competition. It is a living case of a current high tech company.

December 10, 2013

# I-3 Technology Start-Up Competition

## 2013-2014



### Round One Submission Form

Current / Proposed Business Name	<b>RESOLUTION OPTICS INC.</b>
I am applying for Zone # <i>(indicate the zone where your head office is located):</i>	<input type="checkbox"/> Zone 1: Cumberland, Colchester, Pictou, Antigonish, Guysborough <input type="checkbox"/> Zone 2: Lunenburg, Queens, Shelburne, Yarmouth <input type="checkbox"/> Zone 3: Digby, Annapolis, Kings, Hants <input checked="" type="checkbox"/> Zone 4: Halifax Regional Municipality <input type="checkbox"/> Zone 5: Victoria, Cape Breton, Inverness, Richmond
Business Overview (a 50-word or less non-confidential summary)	Resolution Optics Inc. (ROI) uses patented holographic technology to create a simple yet powerful 3D submersible microscope used for real-time, <i>in-situ</i> monitoring of water. The award winning microscope is likely the world's smallest and fastest and is being exported globally to revolutionize the way research is conducted and supporting breakthroughs in science and industry.
My submission can be categorized in the following sector <i>(you may choose more than one sector based on the type of your business):</i>	<input type="checkbox"/> Information and Communications Technology <input type="checkbox"/> Life Sciences <input checked="" type="checkbox"/> Clean Technology <input checked="" type="checkbox"/> Oceans Technology <input type="checkbox"/> Other (please specify) _____
Mailing Address	6589 Chebucto Road, Halifax, Nova Scotia B3L 1L9
Contact Name	Stephen Jones, Ph.D.
E-mail	<a href="mailto:stephen@resolutionoptics.com">stephen@resolutionoptics.com</a>
Telephone	902-444-4449
How did you hear about the I-3 competition?	Through Innovacorp

Your submission must be made online at [www.innovacorp.ca](http://www.innovacorp.ca) by 5:00 pm AST on Friday, October 18, 2013.

Please answer the following questions as briefly as possible. If you have any questions or require more information about the competition, contact Shelley Hessian, Manager of Incubation & Entrepreneur Programs, Innovacorp, at [I-3@innovacorp.ca](mailto:I-3@innovacorp.ca) or 902.424.8670 ext 1123.

## Project Team

Please list the name or names of the majority owner (51 per cent or more). Briefly describe his/her background and experience as well as the other entrepreneur(s) involved, including their roles and responsibilities.

**Dr. Juergen Kreuzer: Co-Founder-** Dr. Kreuzer developed the algorithm that allows the fast and accurate reconstruction of holographic images captured by digital inline holographic microscopy platform instruments. Dr. Kreuzer holds a Doctorate in Science from the University of Bonn, and is the A.C. Fales Professor of Theoretical Physics, Department of Physics at Dalhousie University. He is a Fellow of the Royal Society of Canada, and has held 35 visiting appointments at universities in the United States, Britain, Germany, Israel and Australia. He is widely published in academic journals and continues to earn significant research funding from respected sources in Canada and the United States.

**Dr. Manfred Jericho: Co-Founder-** Dr. Jericho co-owns the patent for the holographic reconstruction algorithm that makes the digital inline holographic microscopy technology possible. Dr. Jericho holds a PhD in Physics from Cambridge University, and was the George Munro Professor of Physics at Dalhousie University for 32 years, until his retirement in 2006. He is a Fellow of the Royal Society of Canada, and has been a visiting scholar at universities in Britain, France, Switzerland and Germany. He is widely published in the areas of holographic microscopy, instrument development, atomic force microscopy and scanning tunneling microscopy.

**Dr. Stephen Jones: CEO-** Appointed CEO in January 2013 after originally joining in April 2012 as VP of Business Development and Marketing. Dr. Jones has an EMBA and a Ph.D. in Physiology & Biophysics. He has eight years of past business development experience with HEKA Electronics Inc. where he established a global sales and distribution network with particular focus in Chinese markets, generating \$3-5 million in annual sales.

**Dr. Sergey Missan: CTO-** Dr. Missan has served previously as a team lead at the medical device development start-up, Enable Imaging Technologies Inc., and led teams of contract software engineers on customer projects at numerous Fortune 500 companies. His professional interests include embedded and mobile software development, scientific data visualization and data processing algorithms and effective software team management using agile development processes. He is a primary author on 22 peer reviewed publications.

### Product and/or Service Offering

1. What is the problem your potential customers are experiencing?

With a growing world population that consumes and produces more per person, we are increasing our effect and dependence on a water source that is constant in size. Clean water is no longer abundant everywhere; instead the quality of water, drinking water, wastewater and surface water is a growing concern and requires continuous monitoring. Traditional water monitoring requires sampling that is time consuming, tedious, expensive, subject to user error, not possible in all environments and depths and does not provide real-time, *in-situ* results. Regardless of the individual market segments, customers are increasingly requiring early monitoring technologies to allow time to adapt current practices and take preventative measures. This is felt particularly harshly in some environments (i.e. markets) such as monitoring of harmful algae bloom species, and ensuring safe drinking water sources.

Currently there is no commercially available device/instrument that will constantly provide water results with no time-lag while concurrently being able to identify harmful microorganisms automatically and have results displayed in an easily understood manner with notifications sent wirelessly to either local or remote locations.

2. How does your product/service solve the problem you just outlined?

The ROI submersible system is capable of not only imaging in real time what is in the water column but sizing, counting, providing concentration results and velocity flows. The ability to image at high resolution with the speed of a particle counter without sacrificing performance is an unparalleled achievement in the water analysis and monitoring sector. The submersible is deployed by hand, boat, attached to a buoy or incorporated into robotic underwater vehicles. The current version of the microscope is tethered to a cable for power and data transmission. The next version of the product scheduled for launch in Q2 of 2014 is completely autonomous with wireless data transmission. This brings innovation, real-time, *in-situ* monitoring to even more diverse and extreme environments and to areas that have cable-free requirements such as oil rigs. Automatic morphology analysis, so specific species of interest can be targeted and analyzed satisfying the most common requests of harmful algae monitoring groups and oceanographers, is now being introduced.

3. In one sentence, what is the end result of your service/product? Does it save money, make customers' lives easier or give them new opportunities?

ROI technology enhances the depth and breadth of clients' observations, reduces costs and the time it takes to complete research, and improves our understanding and protection of the Earth's water supply.

### **Uniqueness of the Offering/Barriers to Entry from Competitors**

1. Who are the major competitors?

There are two principle direct competitors: (i) Fluid Imaging Technologies and (ii) Sequoia Scientific. Fluid Imaging has produced a "FLOWCAM" device. It is an image-based, bench-top unit that will characterize a water sample and automatically separate microorganisms based on morphology and other user-selected parameters. It is not, however, an instrument that can be placed in water directly. Sequoia's LISST-100X is a very fast particle counter that is an industry go-to device for characterizing oil droplets and sediment

particles. It is not however, image based and as a result provides non-discriminate results. The Sequoia LISST-HOLO is most like Resolution Optics submersible microscope but in comparison is much slower in data acquisition and analysis and does not match the resolution. Both of these competitors are well established globally with customers in over 25 countries and combined annual sales in excess of 20 million USD.

2. Why is your product/service unique or different from the competition?

- **Speed:** Real-time image collection and analysis (15-50 images per second); 1000 times faster than both competitors.
- **Simplicity:** Sturdy, small, simple maintenance, little training, large application range (>5000 m in water).
- **Versatility:** Imaging, counting, sizing, identification. Microscopy based monitoring, which is not offered by the LISST-100X.
- **Value:** 20-40 % lower priced than competing products, lower costs of maintenance and deployment.

ROI's submersible is more than a microscope; it is the combination of a microscope that captures and analyzes images in real time and it is a particle counter that is able to differentiate shape size of different particles and perform specific counts. It essentially offers the combined feature-set of both the LISST-100X and the LISST-HOLO devices in one product. In comparison to the LISST-HOLO, Resolution Optics submersible can acquire images 100 times faster, reconstruct images 1000 times faster with 50 times the resolution and can be deployed at substantially greater depths. The marketing approach being used to counter the product offerings of Sequoia is that the submersible microscope can match the speed of the LISST-100X along with improved accuracy of the LISST-HOLO in a fraction of the time.

Although the FLOWCAM device is widely used worldwide in a variety of applications, it is basically an extension and automation of traditional water sampling. It is not submersible whereas Resolution Optics product offering is based on *in-situ* sampling with a small footprint with rapid streaming images and results updated every second.

On a cost basis, the Resolution Optics system is slightly less expensive to purchase upfront with no consumables and little to no maintenance.

3. Is this uniqueness sustainable (e.g., patents, intellectual property, first to market, subject matter expertise, barriers to entry, etc.)?

The true value of Resolution Optics Inc. lies in the speed of the mathematical algorithms used to reconstruct the holographic images obtained by the microscope. These algorithms took over a decade to perfect and optimize and are patent protected in the United States and Canada through to 2020. The hardware design for the digital in-line holographic microscope is also patent protected through the same time-frame and geographical area. Additional patent applications will be submitted on existing hardware and software for Europe and Asia. In addition, ongoing and future R&D prototypes will be patent protected.

ROI benefits from the more established competitors mentioned above that were first to market because there is similar market segments to target and a direct technical comparison is possible. ROI has an added advantage of having world renowned holographic microscopy pioneers as founders and an extensive publication and validation portfolio.

## Market Opportunity

1. Who are your target customers?

As a start-up company with a technology that can cater to a wide range of potential applications, the

challenge is to focus on a select few markets to establish a loyal customer base. ROI is actively pursuing three market segments: (i) oil research, (ii) oceanographic institutes and (iii) harmful algae bloom (HAB) detection. In all three segments, customers are a combination of government, industry, private and academic institutes. These segments were selected based on revenue potential, the state of the company's current technology to satisfy industry pain, existing customer relations, and future validation and feedback.

The oil research market is characterized by regulatory bodies such as Environment Canada and the Environmental Protection Agency, oil spill research groups and oil companies themselves. Some examples of current customers within the oceanographic and marine research institutes include Bedford Institute of Oceanography, Woods Hole Oceanographic Institute, Monteray Bay Aquarium Research Institute and Centre for Water Research in Australia. These represent a sampling of similar target customers. Harmful algae monitoring customers will be represented by university clusters, governmental regulatory bodies, and aquaculture associations as an example.

## 2. How big is the market?

The water sector has emerged from its historical "low-tech" image to become a key component of the "clean-tech" or "blue" global economy. This demand for technology innovation can be attributed to the insistence on high quality drinking water and efficient use of water and energy demands. According to a study released in September 2013 by Global Industry Analysts, Inc. (GIA), the global market for **Water Analysis Instrumentation** is expected to reach US\$3 billion by 2018, driven by population growth, rising need for safe and clean water, tightening water standards and stricter regulations for protection of water resources. Currently Europe and North America represent the largest markets, however, increasing awareness over water quality issues have and will continue to create significant interest in monitoring and analysis technologies in countries such as China, Japan, India and Brazil. ROI's patented-technology is primarily

focused on key segments of the water analysis instrumentation market where we have a sustainable competitive advantage including in-situ, particle and water attribute analysis, as well as turbidity and microbial characteristics.

Taking algae monitoring as a specific example; this is a global market and all indication is that China represents the largest segment with approximately 6,700 water monitoring stations. A recent trip to Hong Kong confirmed that there are 40 red-tide algae stations in that harbor alone. Water samples are obtained by hand weekly and algae counts performed manually through microscopy in a lab and results are posted online weekly. The need for a device that can obtain red-tide causing algae counts in real-time is immediate. Research partnerships that ROI has established with marine pollution groups in China may provide a direct sales and marketing channel. China's commitment to improving its environmental management is significant: the central government has pledged over \$US 850 billion to water projects over the next decade and is beginning to outline stringent industry regulations and water quality standards. The infusion of funding and growing political support for a "clean tech" economy is providing opportunities for innovation, business development and long-term industry growth in the water treatment and monitoring sector. ROI will leverage existing relationships in China and focus on becoming listed on the Chinese government procurement list within the water monitoring segment.

### 3. Is there evidence customers will buy the product?

Customers have already purchased ROI's submersible microscope in all three of these identified market segments. ROI has the advantage of being located in Halifax and adjacent to first class, world-renowned researchers that were early adopters of the technology and provided valuable feedback. Through a CIF grant in 2012, the Dept. of Fisheries and Oceans operating out of Bedford Institute of Oceanography purchased a system to monitor and profile the water column in the Bedford Basin. The Center for Offshore Gas and Energy Research (COOGER) also used the submersible to characterize oil droplets and the

effectiveness of chemical dispersants at their wave tank facility in Dartmouth and have since requisitioned the purchase of a system.

In 2013 alone, systems have been purchased and deployed in the United States, Canada, China and Europe. There is growing interest and there is a waiting list from customers requesting a demonstration of the technology before making a purchasing decision. Revenue through the first 9 months of 2013 has doubled that of 2012 and reached \$185,000 with a projected target of \$250,000 and \$750,000 in 2014.

### **Current Stage of Development**

#### **1. What is the current status of the technology/venture?**

The technology is commercially sold and sought after. The market segment where the technology can be sold "as is", without customization and tweaking, is the quantification and characterization of oil droplets in water. Head-to-head comparisons with the leading competitor have validated surpassed technical specifications and there are clear targeted customers, some of which including Environment Canada and the US Environmental Protection Agency (EPA) have tremendous potential.

ROI has been and will continue to actively conduct R&D. Imminent is an autonomous submersible microscope with an on-board computer and rechargeable batteries. On the software side is the equivalent of facial recognition software for marine microorganisms. In addition, there is a vision of creating a global user base where people can download and access a marine specimen library and request customized software for identification.

There currently is a concentrated marketing effort directed on the target market segments being pursued. Activities include creation of product brochures with applications of interest, promotional product videos, and photography. The company is also in the process of rebranding (name, logo, tagline etc.) to more accurately

reflect what the company stands for, its culture and future directions; that is not captured currently by the name “Resolution Optics”.

Up to this point, ROI has survived and made the transition out of the University based on limited founder investment, a business development loan from ACOA, R&D funding through IRAP and very prudent and cost effective management. The company is currently seeking a more substantial first round of equity investment.

## 2. What are the key next steps?

- By Q4 2013: secure \$250k of equity investment and matching ACOA funds.
- 2014: Attend five key targeted conferences and trade shows: (i) International Society for Applied Phycology, (ii) International Conference on Harmful Algae (ICHA), (iii) Oceanology International 2014, (iv) Marine Oil Spill Conference and (v) American Water Works Association.
- By Q1 2014: launch of beta version of automatic morphology recognition software. Essential for HAB monitoring and other microorganism identification.
- By Q2 2014: commercial availability of autonomous module of submersible microscope with satellite transmission of data.
- By Q2 2014: prototype of low-cost, high-quantity bench-top microscope with built-in fluorescence capabilities.
- By Q1 2014: complete rebranding of Resolution Optics Inc. to more accurately describe the company, its values and culture and future directions. This will include name, logo, tag-line, strategy, web design, implementation, professional photography and product videos.

## **Business Model**

### 1. How will the company generate sustainable revenue?

Based on the current level of expenses and list price, the breakeven point would be achieved by selling ten submersible microscopes in 2013 (half direct and half through distributors). This objective, will in all likelihood, fall slightly short and the company will have a Net loss for the fiscal year. This is projected to be \$50k, in comparison to a Net loss of \$175k in 2012. Revenue to date in 2013 is \$185k. Sustainable revenue will be generated by the end of 2014 through the hard work achieved in 2013. This includes signing key distribution agreements with very well established and connected companies in high market growth areas of the world such as China and Japan. Training their sales staff, providing demonstrations and marketing material and offering excellent pre and post-sales support.

Internally, ROI is streamlining production, lowering the cost of goods sold, shortening delivery times and increasing production lots to five units at a time instead of one unit upon receipt of order.

Revenue will also be dependent on promotion and advertising, which is largely through the company website, distributor promotion, company LinkedIn and other social media sites, blogs, conferences and demonstrations.

## 2. How will you get your product/services to market?

Products are currently sold either direct or through distributors. Non-exclusive distribution agreements have been signed for mainland China and Hong Kong, India, Singapore, Malaysia, Korea, Spain, Portugal and the United States. An exclusive agreement has recently been signed with TOYO Corp. for Japan. In all other geographical areas, ROI sells direct.

## 3. Describe your revenue streams and cost structure.

Revenue is currently generated on a one-time purchase and sale agreement. The current list price for a complete submersible system, including hardware and software, is \$50,000 CDN. The cost of goods sold is

\$17,500 CDN excluding labor and overhead expenses, which would bring it close to \$20,000 CDN.

Distributors receive a 25% discount off the list price and the majorities have payment terms of Net 30 days from invoice. To improve cash flow, some more established distributors have agreed to pay 30% at time of order and the remaining 70% on delivery.

ROI currently produced units one at a time when an order is received. This has a negative effect on preferred pricing of components and delivery time. The COGS sold would decrease by 15% and delivery time shortened from 7 to 3 weeks if production lots were done 5 units at a time.

At some point in 2014 a revenue stream based on a subscription to an image library database and customized identification software will be implemented. In addition, revenue from custom integration, consultancy services and water analysis services are possibilities.

### Milestones and Success Metrics

#### 1. What are the success metrics and timelines?

- 2013 revenue of \$250k CDN (on target).
- October 2013: hire a production manager (done)
- Dec 2013: secure first round of equity investment and matching ACOA funding (on target)
- By end of 2013: increase financial resources and infrastructure to carry out production lots of 5 units at a time.
- By end of Q1/2014, acquire 3 to 5 customers in the Oil Research market segments
- By end of Q2/2014, acquire 3 to 5 customers in the Oceanographic Institute market segments
- By end of Q2/2014, acquire 3 to 5 customers in the Harmful Algae Bloom Detection market segments

- By end of Q1/2014, advance discussion with key regulatory partners, such as EPA, EC and Asia regulators
- By end of Q2/2014, advance discussion with key industry partners around potential synergies, including with Water Analysis Instrumentation manufacturers and Monitoring Equipment Companies.

2. What is the time required to go to market?

ROI product line is currently commercially available and is largely being exported outside of Nova Scotia and outside of Canada and North America.

The time required to go to market with the next generation of autonomous submersible microscope is scheduled for Q2 of 2014. Approval was just awarded for a NRC-IRAP grant for development starting in November 2013 lasting for 6 months.

The time required for releasing a software version with automatic morphology recognition capabilities is scheduled for Q1 of 2014. Work is currently underway since July 2013 and being financially supported by a NRC-IRAP grant.

### **Capital Requirements**

1. How much funding is needed to move forward? How will the money be used?

ROI, like many start-up companies, is actively searching for investment. The question become how much money is required, at what valuation and the effect this will have on current majority shareholders. ROI is currently seeking \$280k of equity investment based on a valuation of \$1.75 million. There is already a guarantee in place from ACOA to receive a matching interest free business development loan up to a

maximum of \$280k. This would result in total funding, excluding R&D grants and fees, of \$550k.

This money covers some of the following key activities: (i) production of five demonstration units that will also be part of inventory for eventual sale, (ii) inventory of some key individual components with long lead-times such as the digital camera, (iii) purchasing of some essential production equipment to increase efficiency, accuracy and quality control, (iv) hiring a sales and marketing assistant / administrative support, (v) company rebranding including brand identity, website design, photography and product videos and (vi) increased presence at key conferences, trade shows, doing customer site visits and demonstrations and training and supporting distributors.

## 2. Why do you think your business would be attractive to investors?

Attractiveness with investors lies in the potential return on initial investment. Very realistic sale targets are the sale of 30 systems in 2014 and 60 for 2015. Meeting the sales targets for 2015 will give the company the position to expand and become a substantial player in the growing market of water monitoring equipment and sell hundreds of systems annually realizing \$20m+ in revenue. The company will become an attractive acquisition target for major players like Hach or GE or system manufacturers.

Currently the company can offer a NS equity tax credit and there are only a few shareholders with a small number of issued shares. The end goal of management and the founders is to have a profitable exit and there is a clear vision of how to achieve this goal while maximizing returns on investment.

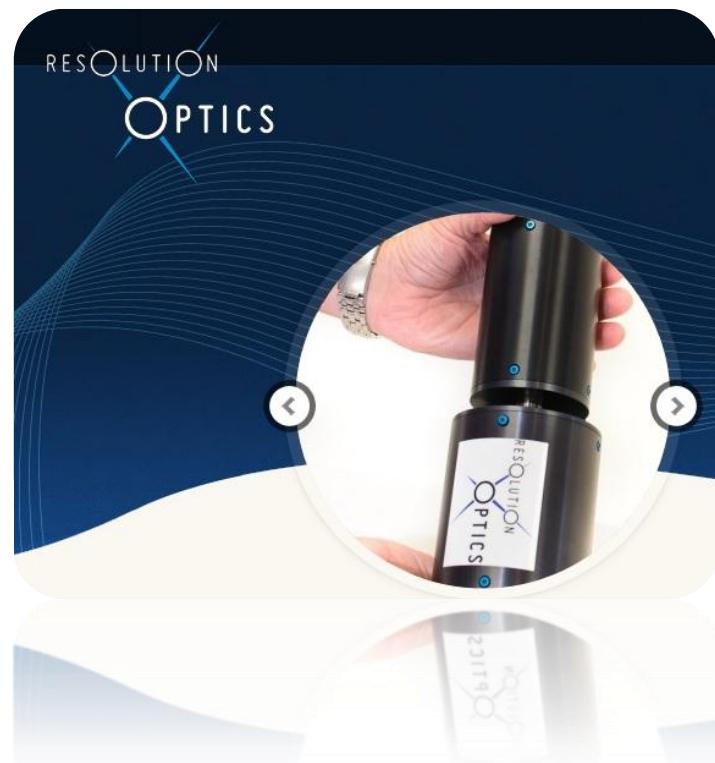
## Other/Appendices

Please provide any other information that could be used to determine your venture's viability and growth potential.

Attached is a supplemental document outlining Resolution Optics Inc. go-to-market strategy.

**Confidentiality:** All submissions will be treated confidentially and will not be made available to the public. Only those directly involved in managing or judging the competition will view submitted documents. While submission details will not be disclosed, the competition organizers reserve the right to publicly announce those who advance to subsequent competition rounds.

Supplemental Go-To-Market Strategy Report for Resolution Optics Inc.



## RESOLUTION OPTICS INC.

### GO-TO-MARKET STRATEGY REPORT

Resolution Optics sustainable go-to-market strategy and business model is essential in order to ensure that limited financial and personnel resources are utilized to their full potential. This market strategy was initiated with the aim at better understanding the market pain points and current applications of the technology. Market segments were identified and refined on the basis of a series of face-to-face meetings, emails and conference calls with key stakeholders, including the company's distributors, partners, existing customers and competitors.

Resolutions Optics' go-to-market strategy has been transformed from a wide market approach to one that is focused on the highest-value niche markets where the company can leverage its competitive advantages and dominate these select niche markets. As a result, the company will be better positioned to execute on its path to successful growth. This report outlines this evolution and provides specific recommendations for the implementation of Resolution Optics' go-to-market strategy.

## (1.0) Introduction

Resolution Optics Inc. is a Halifax, Nova Scotia-based company, incorporated in 2008. The company uses patented holographic technology to create a simple, yet powerful microscope to help enhance research and discovery quickly and easily, with minimal cost and intervention. The company's award-winning line of

microscopes can be used for desktop or submersible research in the lab or in the field. Driven by the Swordfish and Octopus software packages, this technology has the potential to revolutionize the way research is conducted and supporting breakthroughs in science and industry.

"Our current technology not only enhances the depth and breadth of your observations, it also reduces costs and the time it takes to complete research. The microscopes and software consistently receive excellent feedback whether they're being used for academic or commercial applications, in domestic or international markets."

*Adapted from Resolution Optics website*

Resolution Optics' proprietary technology is applicable in various sectors such as oil and gas, municipal water treatment, industrial and academic research. However, the existence of well-established competitors in the market place, combined with limited resources, require the company to identify niche segments where it can add the most value. The company's product portfolio needs to be aligned with key needs (or pain points) in the market, in order to achieve a sustainable competitive advantage. This report is designed to help Resolution Optics assess its product and service offering, its market positioning relative to its key competitors, and define its evolved go-to-market strategy using effective and proven business strategies and tools.

## (2.0) Research Methodology

Eight key steps were followed to arrive at recommendations:

1. **Capabilities and market offering** – To develop a deeper understanding of the company's capabilities and full product and service portfolio; the

main components of this phase of the research included reviewing hardware and software specifications, ensuring these are communicated effectively on the website and in promotional brochures.

2. **Market research** - Market research was undertaken to better understand the various potential client groups the company's solutions were generally aimed at helping and a high-level look at the range of their needs and challenges.
3. **Competitor analysis** - The Company's main competitors were analyzed with a focus on understanding their company history and growth trajectory, product offering, competitive advantages, segment focus areas, market traction and acceptance, as well as corporate strategic direction.
4. **High-level market identification** - The Company's core challenges and opportunities were identified by undergoing a general market segmentation process, identifying five high-level potential markets: (i) Oil Spill Research (ii) Oceanography, (iii) Algae Research, (iv) Aquaculture, and (v) Water treatment.
5. **Refining into niche market segments** - Each of the above five high-level markets was further broken down into up to five granular niche segments each. Twenty segments in total, referred to as niche segments, are identified in Appendix A. Further analysis and research into each of these 20 niche segments was conducted to identify the most significant corresponding pain points (Appendix B). These pain points are based on

the efficacy of the company's solutions in relation to an identified market need.

6. **Selected niche markets and business model canvas** - *Alexander Osterwalder and Yves Pigneur's Business Model Canvas framework (see Appendix C)* was used to determine the five highest-value potential niche markets. These were directly associated with the most significant pain points that the Company's capabilities and solutions could solve for these potential clients. A business model canvass was then developed for each of the five identified, potential highest-value niches. The business model is a strategic tool with nine elements, which describe how the company is going to validate and implement its go-to-market strategy.
7. **Consolidated business model matrix** - The five business model canvasses for highest-value niche sub-segments were consolidated to the ROI Business Model Canvas Matrix (see Appendix D), the template which is going to be used in guiding execution of the overall strategy.
8. **Implementation** - The process of beginning the implementation of the go-to-market strategy in two of the five highest-value niche markets we jointly identified, namely Oil spill dispersant and absorbent research and Algae-to-biofuel. Nearly 1,200 potential leads in the Oil spill research niche were identified, of which 237 were qualified and 64 were contacted via email or phone. For the Algae-to-biofuel niche, 37 qualified leads were identified, of which nearly half have been contacted to date.

### **(3.0) Findings**

Based on collaborative in-depth analysis and industry research, Resolution Optics will be able to deliver the most value in the following five targeted niche segments (see Appendix D);

- 1. DRINKING WATER QUALITY & COMPLIANCE**
- 2. OIL DISPERSANTS & ABSORBENTS: CHARACTERIZATION & COMPLIANCE**
- 3. OCEANOGRAPHIC RESEARCH & WATER PROFILING**
- 4. ALGAE TO BIOFUEL**
- 5. HARMFUL ALGAE BLOOM (HAB) Detection**

#### **(3.1) Market profile & size in targeted niche segments**

##### **3.1.1 Drinking Water Quality and Compliance**

The global water treatment chemicals and technology market was worth USD



Figure 1: Water Treatment Plant<sup>1</sup>

115,809.7 million in 2011 and is expected to reach USD149,895.6 million in 2018, growing at a CAGY of 3.8% from 2013 to

2018.<sup>1</sup> In the overall global market, North America is the largest market; however, Asia Pacific is expected to be the most promising market in the near future. The global water treatment chemicals and technology market is driven by various factors such as increasing population, stringent government policies, demand for clean or freshwater for various purposes and increasing industrialization.<sup>1</sup> The North American market for produced water treatment equipment was valued at \$760 million in 2011 and should reach \$825 million in 2012. Total market value is expected to reach nearly \$1.2 billion in 2017 after increasing at a five-year compound annual growth rate (CAGR) of 7.7%.<sup>1</sup>

Responsibility for water quality and compliance to existing environmental legislation falls under local municipalities or private companies in most countries. In this niche sub-segment, focus is on water purification (for drinking, specific industrial use). Players in this sector need the capability to detect and quantify organic (e.g. algae) and micro particles in the water in order to comply with existing legislation.

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<sup>1</sup><http://www.prnewswire.com/news-releases/global-water-treatment-chemicals-and-technology-market-is-expected-to-reach-usd-1498956-million-in-2018-transparency-market-research-171313161.html>

Instruments used for this purpose need to be cost effective, reliable and easy to maintain. As illustrated in Figure 2, drinking water purification is a multifaceted processes and it is important we are clear on which stage of the process our technology adds value. In the market study, it was discovered that the filtration and backwash processes can be enhanced by using Resolution Optics technology.

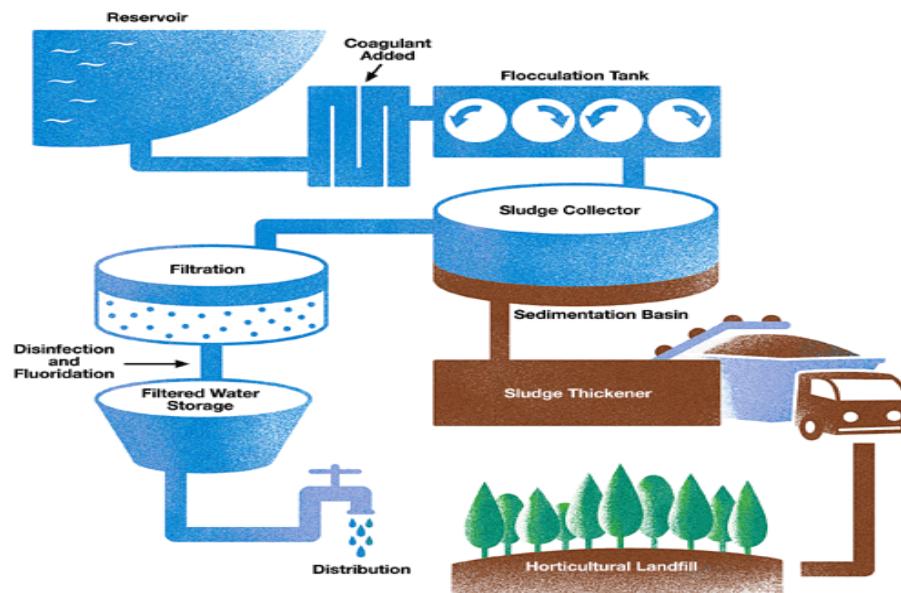
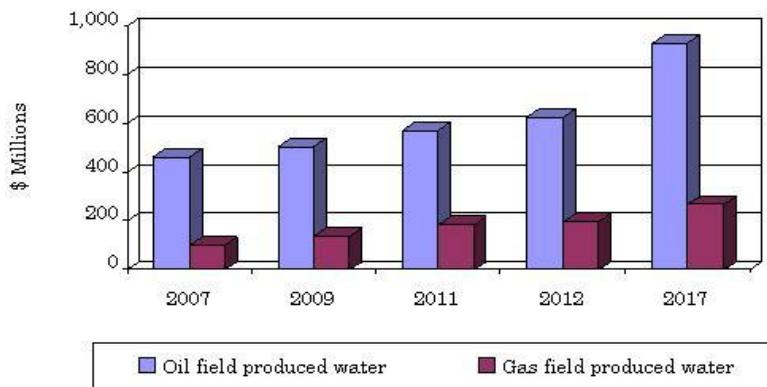


Figure 2: Water Filtration Process

### 3.1.2 Oil Dispersants & Absorbents Characterization & Compliance

The market for oil dispersants and absorbents is scattered globally and fragmented. Chemical composition may vary as a result of different legislation and targeted use e.g. inland waters vs. ocean use. The report "Dispersant /

Dispersing Agent Market, by End-User Industries (Construction, Paint & Coating, Pulp & Paper, Detergent, Oil & Gas, Agriculture, Pharmaceutical) & Geography - Trends & Forecast to 2018", states that the dispersing agents market is going to be worth \$6.3 billion by 2018<sup>2</sup>. The graph below<sup>3</sup> highlights expected market growth rates for treatment of water from oil facilities in North America.



**Fig 3: North American market size and growth for produced water treatment equipment, by application, 2007-2017 (\$ MILLIONS)<sup>3</sup>**

Besides being used for mitigating against the effects of an oil spill on the natural environment, they have other uses in construction, paints and solvents etc.

Measuring the effectiveness of these chemicals remains a challenge.

Environmental agencies have become stricter on the effects of dispersants on the natural ecosystem and manufacturers need to not only produce evidence on the efficacy of the oil dispersants but also their lifespan once in the environment.

Some of the inherent problems discovered in this study include:

<sup>2</sup> <http://www.marketwatch.com/story/dispersing-agents-market-worth-63-billion-by-2018-2013-09-24>

<sup>3</sup> <http://www.bccresearch.com/market-research/environment/produced-water-treatment-north-america-env014a.html>

- Lack of techniques available to measure efficacy of the oil dispersants and absorbents
- Not possible to accurately quantify the amount of oil particles in water
- Lack of imaging technology to monitor pollutants by visual observation
- There is a need for software and device solution to monitor in real time the effects of oil spills on the ecosystem. This can prove to be a much more cost effective method as opposed to deploying teams to do this manually.

### **3.1.3 Oceanographic Research and Water Profiling**

Requirements in this niche segment include:

- **Water profiling-** Equipment needs to be able to take high resolution images at deep depths and sometimes under extreme weather conditions such as turbulence, storms or shear. Equipment manufacturers need to communicate these specs in their market offerings.
- **Plankton & Phytoplankton Research –** These are two important indicators of the health of an underwater ecosystem. Researchers and environmental agencies monitor concentration and spread of Plankton & Phytoplankton to detect the existence of pollutants and invasive species. Of value is specie identification and quantification.

➤ **Micro-particle detection –**

**Figure 4:** Oceanographers deploying a CTD; a device that's used to measure the Conductivity (salinity), Temperature and Depth of seawater.<sup>4</sup>



The types of micro particles present in water may vary. Measuring trace contaminants in water is a challenge as they normally appear in very low concentrations. Accurate measurements require collection and filtration of large volumes of water with suspended particles (sediment) in order to collect enough material for analysis.<sup>5</sup> Monitoring of micro-particles in-situ and in real time will be of great convenience and value to researchers.

In approaching this niche market segment, there are three main customer groups; government environmental regulators/agencies, private environmental agencies e.g. Green Peace and research institutions. Key to success in this market segment is developing long-term relationships with these customers and matching products according to the needs of ongoing funded research projects.

### **3.1.4 Algae to Biofuel**

Algae-derived biofuel can reduce life cycle CO<sub>2</sub> emissions by 50 to 70 percent compared to petroleum fuels, and is approaching a similar Energy Return on Investment (EROI) as conventional petroleum according to a new peer-reviewed

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<sup>4</sup> [greatbeltresearchcruise.com/gbr11/oceanographic-instruments/](http://greatbeltresearchcruise.com/gbr11/oceanographic-instruments/)

<sup>5</sup> <http://www.sequoiasci.com/about/news/sequoias-lisst-100x-improves-trace-metal-sampling-saves-time/>

paper<sup>6</sup>. Although producing biofuel from algae on a commercial scale still seems to be years away, technological improvements are making this dream seem more feasible. In 2012 the U.S. Department of Energy pledged to invest up to \$24 million in three research groups looking at ways to commercialize algae-based biofuels. Resolution Optics products can aid Algae to Biofuel research through monitoring of algae growth in real-time and providing an automated solution of when to harvest algae for maximum yield.

It is possible to cut costs and eliminate the manual processes involved in the research through real-time high resolution monitoring. Researchers are also interested in comparing different species of algae's biofuel conversion efficiency. Customer groups in this segment consist of research institutions funded by the government or private funds. There seems to be growing apathy on the long-term viability of such projects. ExxonMobil which ran one the largest projects, announced in May 2013 that it was scaling down its algae-based biofuels research citing a number of challenges still needing to be overcome.<sup>7</sup> Having invested more than \$100 million into the project, this was quite a setback for the industry.

### **3.1.5 Harmful Algae Bloom Detection**

Toxin releasing species of algae pose a potential threat to drinking water and marine life. These forms of algae naturally exist in the environment at low

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<sup>6</sup> <http://phys.org/news/2013-09-algae-biofuel-co2-emissions-percent.html>

<sup>7</sup> <http://www.bloomberg.com/news/2013-05-21/exxon-refocusing-algae-biofuels-program-after-100-million-spend.html>

concentration, but release of nutrient rich water from sewage plants, farms and existence of light and warm weather is thought to lead to rapid growth of these plants, forming algae blooms (HAB's as they are known) Harmful algae blooms HABs include different types of algal taxa such as dinoflagellates, diatoms, and cyanobacteria. The Harmful Algal Bloom and Hypoxia Amendments Act of 2004 mandates that the National Oceanic and Atmospheric Administration (NOAA) advance the scientific understanding and ability to detect, monitor, assess, and predict HABs and hypoxia events in coastal waters and the Great Lakes.<sup>8</sup>

Key customer groups include, privately funded research organizations / institutions, government funded research groups and environmental agencies. The classical approach for detecting and enumerating phytoplankton species, including those referred to as harmful and/or toxic, is direct observation by light microscopy of live or preserved material. Although this technique provides important visual confirmation of the presence of a species in a water sample and generates reasonably accurate estimates of cell abundance, it is generally considered to be tedious and time-consuming while requiring an appropriate level of experience/expertise in phytoplankton identification. Light microscopy is therefore of limited use when real-time or near-real-time detection is the objective. An alternative approach to detecting phytoplankton cells also based on their morphological/optical properties and relying largely on the principles of flow cytometry was developed recently. The instrument, referred to as the flow

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<sup>8</sup> <http://www2.epa.gov/nutrient-policy-data/cyanobacterial-harmful-algal-blooms-cyanohabs>

cytometer and microscope (FLOWCAM, see: fig.5) The most rapidly growing area of HAB species detection involves the targeting of specific molecules, such as chemical moieties located on the cell surface and various components of an organism's genome. These classes of molecules lend themselves well to detection by antibody or oligonucleotide probes, respectively, using methods derived from previously developed biomedical applications.<sup>9</sup>



Figure 5: Docktop flow cytometer and microscope (FLOWCAM) system developed, Fluid Imaging Technologies<sup>9</sup>

Generally there is a need for rapid HAB detection and monitoring solutions which can distinguish between the different species of algae and also detect toxic particles in-situ.

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<sup>9</sup> <http://aquaticpath.umd.edu/mybay/sellnerhabcauses.pdf>

### (3.2) Competitor Profile in targeted niche segments

Two main competitors were identified in the research;

1. Sequoia Scientific, Inc.
2. Fluid Imaging Technologies

**Table 1: Outline of key competitor products in the five key targeted niche segments.**

	Drinking Water Quality and Compliance	Oil Dispersants & Absorbents Characterization & Compliance	Oceanographic Research and Water Profiling	Algae to Biofuel	Harmful Algae Bloom Detection
Fluid Imaging Technologies	<p>Fluid Imaging Technologies proprietary FlowCAM® technology is able to:</p> <ul style="list-style-type: none"> <li>✓ Detect &amp; Monitor Nuisance Algae</li> <li>-Taste &amp; Odor Producing Algae</li> <li>-Cyanobacteria</li> <li>-Invasive Zebra and Quagga Mussels (in veliger stage)</li> <li>✓ Identify, Count and Classify Algae</li> <li>✓ Particle Removal Evaluation</li> <li>✓ Monitor and Measure Filamentous Bacteria</li> <li>✓ Research</li> <li>✓ Operator Training</li> </ul>	<p>The PetroCAM® is a version of the FlowCAM® technology used within the petrochemical sector. Its strength lies in the ability to automatically differentiate oil droplets from other particulates in the produced water based upon particle shape which enables high speed calculations of oil concentration in real-time.</p>	<p>The company's FlowCAM® detects and measures marine plankton and particles in a continuous fluid flow. It produces high resolution images that allow for easy identification and differentiation of particles present.</p>	<p>In this segment, Fluid Imaging Technologies offers the FlowCAM® product for rapid, automated identification and characterization of algal species. A library of different species is created which allows for identification on future sample runs.</p>	<p>Invasive mussels can be detected using the FlowCAM® XPL. It is possible to detect larval-stage invasive mussel species such as Zebra and Quagga mussels. Early stage identification allows for immediate interventions to be taken.</p>

	Drinking Water Quality and Compliance	Oil Dispersants & Absorbents Characterization & Compliance	Oceanographic Research and Water Profiling	Algae to Biofuel	Harmful Algae Bloom Detection
<b>Sequoia Scientific, Inc.</b>	No specific product is recommended for drinking water quality and compliance purposes.	The LISST-100X® monitors oil droplets and concentration and is being used by the oil spill research community. In the Gulf of Mexico, the EPA requires the use of LISSTs when oil dispersants are applied in order to monitor the amount of oil droplets in-situ.	LISST-100X from Sequoia Scientific, Inc. is to improve trace metal sampling. The LISST-100X is also able to provide a continuous concentration profile or time history of the sediment being sampled on the HVS filters. Also logged are particle size distributions, which is critical to contaminant fate and transport modeling.  Other products that can be used in Oceanographic studies include: <ul style="list-style-type: none"><li>✓ EcoLight-S</li><li>✓ FlowControl-Sub</li><li>✓ HydroLight</li></ul>	No specific product is recommended for this purpose although for overlapping research fields a product may exist.	The LISST-100X instrument can be deployed for this purpose.

#### (4.0) Recommendations

Resolutions Optics' capabilities and innovative solutions are world-class and have the potential to add significant value to its clients. The current focus of the company is to implement a disciplined and targeted approach in capturing market share in the specific niche markets profiled in this report.

As initial indications of market acceptance and traction emerge in some of these granular niche markets, Resolution Optics is focusing on the niche markets receiving the most significant external customer validation. A further refined focus of up to three top niche markets the company believes it could potentially dominate. As Resolution Optics' efforts evolve in this regard, critical decisions must be taken to achieve the right balance between a niche small enough to dominate and large enough to support a substantially profitable business.

Resolution Optics' efforts of communicating its value-proposition to these targeted niche markets must initially be aimed at educating and generating market awareness of its unique capabilities and focused solutions. These could be through a combination of direct and indirect conversations, presentations and product demonstrations to the key decision makers in these niche segments, whether one-on-one, via select tradeshows or association events.

Geographic focus is also critical. As Resolution Optics aims to maximize the reach of its limited resources, the Company's primary focus will be in the US, Canada and Japan. Based on the success of these three markets, the Company will expand its geographic coverage to Western Europe and select Asian and emerging markets in the future, specifically to those which are capable of meeting specific scale and milestone metrics.

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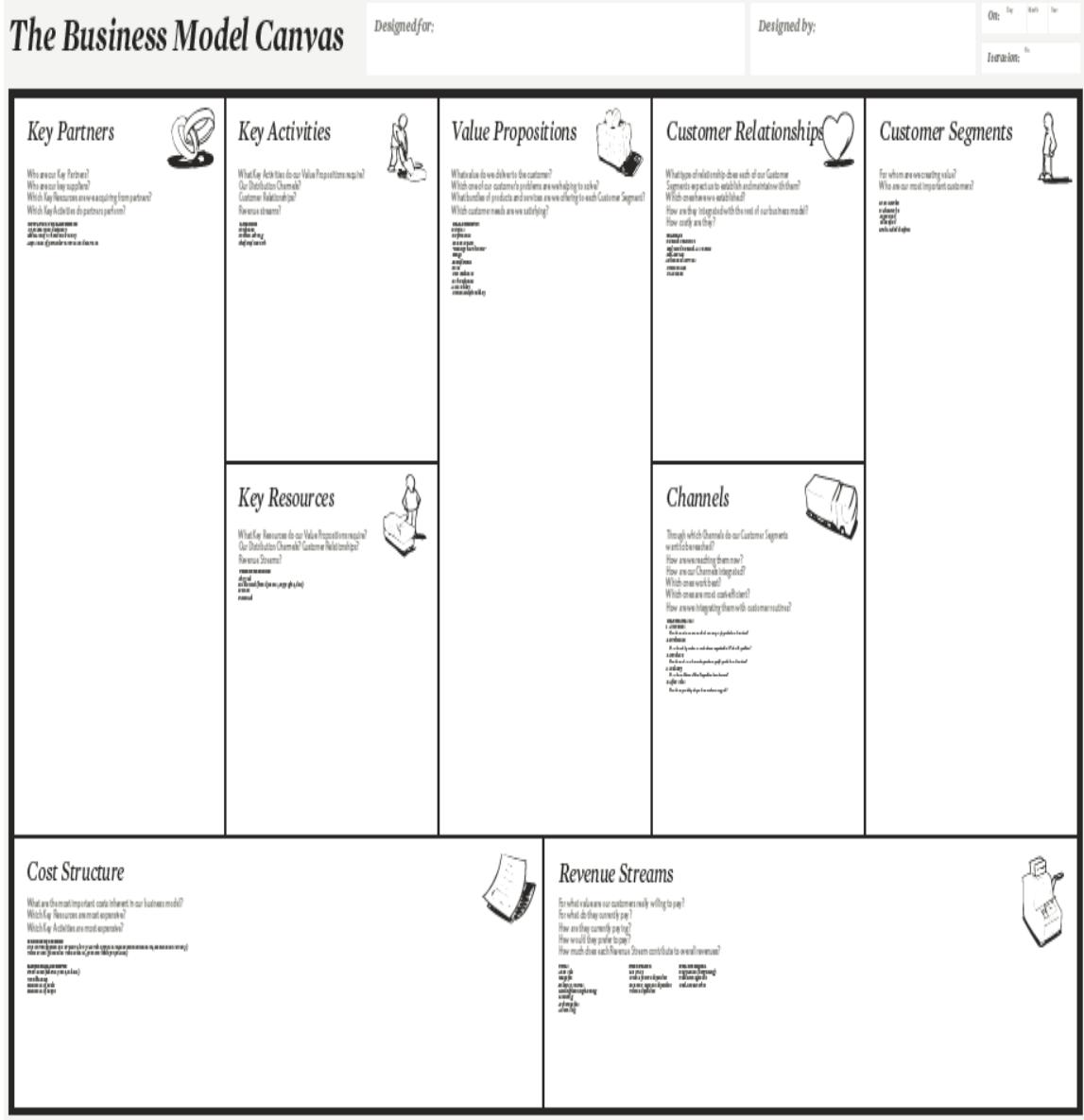
## Appendix A

RESOLUTION OPTICS INC. GRANULAR MARKET SEGMENTATION					
	OIL SPILL RESEARCH	OCEANOGRAPHY	ALGAE RESEARCH	AQUACULTURE (LAND & SEA)	WATER TREATMENT
1	<b>Dispersent Efficacy</b> Chemical Dispersants <ul style="list-style-type: none"> <li>* Effectiveness</li> <li>* Ecological impact</li> <li>* Degradation Rates</li> </ul>	<b>Plankton Characterization</b> Plankton & Phytoplankton Research <ul style="list-style-type: none"> <li>* Quantification &amp; Identification</li> </ul>	<b>HAB Detection</b> * Harmful Algae Bloom Monitoring in all water bodies	<b>Fish Feed Quantification</b> * Unconsumed feed <ul style="list-style-type: none"> <li>* Depth Profile</li> </ul>	<b>Filtration Efficiency (Chemical Use)</b> <ul style="list-style-type: none"> <li>* Floc Characterization (chemical usage and backwash rates)</li> </ul>
2	<b>Absorbents &amp; Compounds</b> <ul style="list-style-type: none"> <li>* Effectiveness</li> </ul>	<b>Water Profiling / Depth Analysis</b> <ul style="list-style-type: none"> <li>* Composition at different depths</li> </ul>	<b>Algae-Biofuels</b> <ul style="list-style-type: none"> <li>* Yield Maximization</li> </ul>	<b>Water Quality &amp; Monitoring</b> Ecological Component <ul style="list-style-type: none"> <li>* Water Quality &amp; Monitoring</li> <li>* Effect on ecosystem (ex lobster larvae)</li> </ul>	<b>Bio-reactor / Membrane</b> Microparticle Detection <ul style="list-style-type: none"> <li>* Drinking and Wastewater</li> </ul>
3	<b>Oil Particle Interaction</b> Oil-Particulate Mixtures <ul style="list-style-type: none"> <li>* Migration, formulation &amp; shearing</li> </ul>	<b>Microparticle Detection</b> <ul style="list-style-type: none"> <li>* Quantification</li> </ul>	<b>Algae Culture Characterization (Lab)</b> Algae in Culture <ul style="list-style-type: none"> <li>* Counting, sizing, characterization</li> </ul>	<b>Parasite Detection &amp; Characterization</b> Parasite & Bacteria Detection <ul style="list-style-type: none"> <li>* Sea Lice, Copepods</li> </ul>	<b>Source Water Monitoring</b> (Lakes, Rivers & Reservoirs) <ul style="list-style-type: none"> <li>* Water Quality &amp; Monitoring for Algae</li> </ul>
4	<b>Oil Detection &amp; Quantification</b> <ul style="list-style-type: none"> <li>* Size, shape, velocity, track</li> <li>* Emulsification rates</li> <li>* Mobility &amp; persistence</li> </ul>			<b>Adverse (non-Conventional Conditions)</b> <ul style="list-style-type: none"> <li>* Under Ice</li> <li>* Offshore</li> <li>* Submersible Cages</li> </ul>	Waste Water Monitoring
5	<b>Oil Impacts on Ecosystem</b> <ul style="list-style-type: none"> <li>* Water quality &amp; monitoring</li> <li>* Microalgae, microorganisms</li> </ul>				<b>Ballast Water Compliance</b> <ul style="list-style-type: none"> <li>* Living vs Nonliving</li> <li>* Detection &amp; quantification</li> <li>* Regulatory Compliance</li> </ul>

## Appendix B

RESOLUTION OPTICS INC. MARKET SEGMENTS & KEY PAIN POINTS					
	OIL SPILL RESEARCH	OCEANOGRAPHY	ALGAE RESEARCH	AQUACULTURE	WATER TREATMENT
1	Product Quality / Validation - Chemical Dispersants * Effectiveness * Ecological impact * Degradation Rates	Water Profiling * Composition at different depths	Time Delay of Traditional sampling HAB Detection * Harmful Algae Bloom Monitoring in all water bodies	Ecological Component * Water Quality & Monitoring * Effect on ecosystem (ex lobster larvae)	Reduce Cost of Chemical for Filtration Drinking Source Water Monitoring (Lakes, Rivers & Reservoirs) * Water Quality & Monitoring for Algae
2	Compliance / Regulatory Requirement Absorbents & Compounds * Effectiveness Clean up Efficacy	Plankton & Phytoplankton Research * Quantification & Identification	Yield Maximization Algae-Biofuels * Yield Maximization	Parasite & Bacteria Detection * Sea Lice, C	Water Odour and Discolouring Filtration Efficiency * Floc Characterization (chemical usage and backwash rates)
3	Oil Detection & Quantification * Size, shape, velocity, track * Emulsification rates * Mobility & persistence	Microparticle Detection * Quantification	Algae in Culture * Counting, sizing, characterization	Fish Feed Quantification * Unconsumed feed * Depth Profile	Microparticle Detection * Drinking and Wastewater
4	Lack of Monitoring Equipment Oil-Particulate Mixtures * Migration, formulation & shearing	-	-	Adverse (non-Conventional Conditions) * Under Ice * Offshore * Submersible Cages	Wastewater
5	Oil Impacts on Ecosystem * Water quality & monitoring * Microalgae, microorganisms	-	-	-	Compliance / Regulatory Requirement Ballast Water * Living vs Nonliving * Detection & quantification * Regulatory Compliance

## Appendix C



## Appendix D

### Resolution Optics Inc. Business Model Canvas Matrix

		A	B	C	D	E
	MARKET SEGMENT	DRINKING WATER QUALITY & COMPLIANCE	OIL DISPERSANTS & ABSORBENTS CHARACTERIZATION & COMPLIANCE	OCEANOGRAPHIC RESEARCH / WATER PROFILING	ALGAE TO BIOFUEL	HARMFUL ALGAE BLOOM (HAB) Detection
1	VALUE PROPOSITION	- Help to ensure drinking water compliance and regulation - Reduce chemical costs &	- Meet oil dispersants (D) and absorbent (A) compliance - Validate efficacy	- Quantify and identify various plankton, phytoplankton and other species	- Increase returns by maximizing biofuel yield - Increase biofuel production efficiency	- Save money and time by detecting Harmful Algae Bloom early - Reduce cost of HAB clean
2	KEY PARTNERS * See Separate List	- Regulatory bodies - Water treatment plants/utilities - Water treatment associations - Water quality monitoring/treatment equip. Mfc. (Hach, GE, ) - Water filter/membrane Mfc.	- Regulatory bodies - Oil spill associations, environmental consultatnts & other stakeholders - COOGER, EPA, Ohmsett, Eniv. Canada	- Oceanographic researchers - Ocean & Marine Sciences institutes and special interest groups	- Biofuel producers - Biofuel researchers - Biofuels associations and special interest groups - Biofuel consumers	- Acquaculture associations - Governments - Regulatory bodies - Key research initiatives (ex China and Canada cooperation)
3	KEY ACTIVITIES	- Morphology recognition software development - Image database - Hardware manufacturing	(Ready to go for applications less than 200m) -Hardware manufacturing for deeper water	- Morphology recognition software development - Image database (Jan 2014) - Hardware manufacturing (Autonomous w/ wireless transmission - Q1/2014)	- Customize phase-intensity reconstruction software - Matching existing biochemical data	- Morphology recognition software development - Image database (Jan 2014) - Hardware manufacturing (Autonomous w/ wireless transmission - Q1/2014)
4	KEY RESOURCES	- Personnel - IP - Capital	- Personnel - IP - Capital	- Personnel - IP - Capital	- Personnel - IP - Capital	- Personnel - IP - Capital
5	CUSTOMER RELATIONSHIPS	- Direct	- Direct	- Direct	- Direct	- Direct
6	CUSTOMER SEGMENTS * See Separate List	- Regulatory bodies - Water treatment plants/utilities	- Researchers - Regulatory bodies (EPA, EC) - Commercial labs - D&A manufacturers	- Researchers	- Biofuel producers (Sapphire Energy) - Biofuel researchers	- Governments - Acquaculture farms
7	CHANNELS	- Direct & Targeted distribution in the future	- Direct & targeted distribution in the future - Hydrowise (China) - TOYO (Japan)	- Direct & targeted distribution in the future	- Direct & targeted distribution in the future	- Direct & targeted distribution in the future - Zealquest (China)
8	COST STRUCTURE	- BOM - Cost of software - Cost of marketing	- BOM - Cost of software - Cost of marketing	- BOM - Cost of software - Cost of marketing	- BOM - Cost of software - Cost of marketing	- BOM - Cost of software - Cost of marketing
9	REVENUE STREAMS	- Hardware & software sales - Annual maintenance - Other licensing	- Hardware & software sales - Annual maintenance - Other licensing	- Hardware & software sales - Annual maintenance - Other licensing	- Hardware & software sales - Annual maintenance - Other licensing	- Hardware & software sales - Annual maintenance - Other licensing