

Titan Medical Inc. (TMD-V) Rise of the Machines

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We are initiating coverage of Titan Medical with a Buy rating and a 12-month target price of C\$3.50. In summary, our recommendation is based on the following:

- With 360,000 procedures in 2011 (+30%), robotic surgery has moved beyond the niche and into the mainstream. It is now widely perceived to offer significant advantages for all of the major stakeholders including patients, surgeons and hospitals.
- Urology and gynecology have been early adopters of the technology. With 80% of prostatectomies and 30%+ of hysterectomies now performed robotically, greater penetration of the technology will have to come from other indications such as General Surgery.
- While Intuitive Surgical (ISRG – Q, Not Rated) is the clear market leader, it may find penetration of the General Surgery market more challenging. As such, we believe the large cholecystectomy market is open to another participant who has a better solution.
- Titan Medical, with its recently licensed IREP robotic technology, integrated with its existing surgical console and video tower, has the ability to materially extend robotic procedures to General Surgery.
- We expect Titan to meet or exceed its stated clinical milestones over the next 24 months and launch its Amadeus Surgical System™ in Europe in late 2014 and in the US in 2015.

With a current market capitalization of ~C\$80 million, we do not believe the shares are accurately reflecting either the growth of the robotic industry or Titan's ability to gain significant share within General Surgery. As such, we believe its shares represent an excellent risk-return proposition.

Initiating Coverage

BUY C\$3.50

Previous Close	C\$1.32
12-month Target Price	C\$3.50
Potential Return	165%
52 Week Price Range	C\$1.20-\$1.99

Estimates

YE: Dec 31	FY15E	FY16E	FY17E
Revenue (\$000s)	\$11,883	\$29,826	\$50,752
EBITDA (\$000s)	(\$7,847)	(\$2,390)	\$5,224
FD EPS	(\$0.10)	(\$0.03)	\$0.05

Valuation

	FY15E	FY16E	FY17E
EV/Sales	6.3x	2.5x	1.5x
EV/EBITDA	N.A	N.A	14.3x
P/E	N.A	N.A	26.4x

Stock Data ('000s)

Shares Outstanding	
Basic	62,700
FD	83,100
Market Cap (C\$)	
Basic	82,764
FD	109,692
Cash (C\$)*	8,000

• As of March 31, 2012

About the Company

Titan Medical Inc. is a Canadian public company (TSX VENTURE:TMD) (OTCQX:TITXF) focused on the design, development and commercialization of new robotic surgical technologies. The Company is advancing the development of a robust product portfolio with the objective to meet current needs in surgical procedures which would benefit all stakeholders, including patients, surgeons, and hospitals. Robotic surgery has developed over the past 10 years into a proven and growing method of treatment. With a CAGR of 45% over the last 5 years, the robotic procedures sector has the fastest growing adoption rate in the history of surgery.

All prices in US\$ unless otherwise indicated

Stock Performance

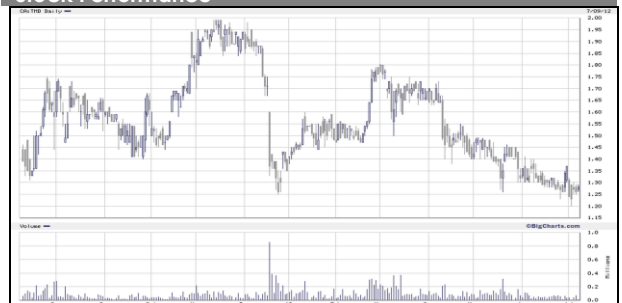


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Investment Thesis

The term “surgery” is derived from the Greek/Latin word meaning “hand work”; interesting, since surgery had seen few advances from the ancient Greek period to just 150 years ago. Those who were good with their hands often doubled as surgeons. In fact, in 1540 England, the Fellowship of Surgeons merged with the Company of Barbers to form the Company of Barber-Surgeons. However, as scientific evidence began to mount about how the body worked, surgical techniques advanced. Those techniques and advancements have all revolved around mitigating three main issues: bleeding, pain and infection.

While the modern age of surgery can be seen to have started circa 1850 with the advent of anesthesia, patients still underwent significant trauma due to the large incisions necessary for the surgeon to see and insert their hands inside the body. It is logical that smaller incisions would result in less loss of blood, less pain and less chance of infection but the technology was not available until the mid-1980s. At the start of the commercialization of the computer age, smaller was now possible, specifically the creation of the endoscope, which enabled Minimally Invasive Surgery (MIS). While this represented a giant leap forward from Open Surgery, it still had its drawbacks in terms of dexterity, range of motion, and visualization. Consequently, Open Surgery was still the dominant form. Nevertheless, patients now understood that they did not have to endure the pain associated with Open Surgery, especially during “routine” procedures.

The major step forward was the development of Robotic Surgery, which was designed to overcome the limitations of MIS by restoring the surgeon's range of motion while simultaneously allowing the surgeon to work through the ports used in MIS. Intuitive Surgical Inc. broke this technology into the main stream such that the majority of prostatectomies and a large percentage of hysterectomies are now done robotically. Following on the heels of that success, MAKO Surgical Corp. (MAKO – Q, Not Rated) is making great inroads into robotic procedures for knees and hips. Nevertheless, these procedures represent less than 20% of the market. We believe that because the benefits of robotic surgery are now well documented to all stakeholders (patients, surgeons, hospitals), other surgical indications are open to this technology. The issue to date has been that the existing robotic platform is not well suited for general procedures such as cholecystectomies (gall bladder removal), for reasons including footprint and cost. Nevertheless, when this market is finally penetrated through a robotic platform, it will represent a significant market opportunity as there are ~700,000 cholecystectomies performed per year in the United States; a market that is larger than the entire urology and gynecology opportunity.

Titan Medical's (TMD or the Company) Amadeus Surgical System™ has the potential to bring robotic technology to General Surgery and in particular to the cholecystectomy market as it fulfills the requirements needed to be successful, namely small footprint, high degree of freedom (DOF) in the robotic instrument movement and affordability. History has shown that as development companies reach the inflection point whereby revenue visibility is imminent, they experience a significant revaluation. We believe Titan will reach that inflection point within the next 12 months, resulting in a significantly higher stock price. With a management team and medical board consisting of industry leading robotic surgeons, a significant opportunity with a differentiated and patent pending product, an attractive recurring revenue model, yet a market capitalization of only ~C\$80 million, we believe Titan offers investors a very good risk-return proposition.

Industry Overview

Surgery (Finally) Enters the Digital Age

Forty-three years after man first walked on the moon, technology advances have played a major part in the everyday lives of people. The first mobile phone was invented in 1973; today over 5 billion people use one. Likewise, the Internet was invented in 1992 and over 2 billion people currently are connected. It is hard to believe how much of our daily lives have been affected by the technological changes of the past 50 years.

However, when we think of surgery, the average person still conjures up an image of a masked man standing over a prone patient with sharp instruments in his hand. This stereotype may be rooted in nighttime television dramas such as ER that racked up huge viewer numbers. That image of the surgeons, however, was not materially different than M*A*S*H* that showcased Korean War surgeons in the 1950s. There was typically lots of blood, long recovery periods and high risk of infection...I guess that makes good TV! Nevertheless, it is not far from the truth, at least up to the last five years.

The evolution of surgical techniques had been a slow one as the medical community was cautious when adopting new methods. Up until the mid-19th century, surgery had changed little since the time when Hippocrates walked the Earth. The advent of anesthesia in circa 1850 certainly helped to reduce the pain associated with surgical procedures, but did little to mitigate the bleeding that comes with the large incisions of Open Surgery. That technique of anesthesia and Open Surgery (recall the masked man with sharp tools) has remained the norm for many procedures even to this day.

There have been, however, some advances. The development of the endoscope in the 1980s finally enabled surgeons to be able to see inside the patient without the large incisions necessary to do so. This ushered in the era of Minimally Invasive Surgery (MIS, also called laparoscopic surgery) whereby surgeons would make three or more small incisions and insert long instruments and an endoscope into the body through those key holes in order to execute a surgical procedure. Instead of looking inside the body, the surgeon could see what was happening through the "eyes" of the endoscope, which was displayed on a TV monitor. The result was lower blood loss, faster recovery time and more aesthetically pleasing results (i.e. less scaring).

However, execution of the procedure was difficult, specifically the range of motion of the instruments and instability associated with holding a long instrument at one end (i.e. think of the quality of writing if you hold the pen at the very top). As such, only specifically trained surgeons could perform MIS procedures. Nevertheless, MIS procedures now represent a significant percentage of surgical procedures as the number of trained surgeons has mushroomed over the past 30 years. Looking back, the development of MIS certainly appears to be the moment akin to the invention of the cell phone in 1973. While the first mobile phones were large, heavy and had

little capability, today's versions are very small, "smart" and have computing capacity much greater than the PCs of 25 years ago. Nevertheless, without the initial technological advancement, today's smart phones would not exist. Likewise, without the initial breakthrough that enabled MIS, the next evolution of the technology would not have been possible. While the "son of MIS", or robotic surgery, is still in its infancy in terms of the number of procedures and indications on which it is performed, we believe there is little doubt that as the technology advances, its efficacy and ease of use will increase while its cost structure will decline, which will expand the market enormously. *In fact, procedures performed robotically have seen a CAGR of 45% since 2007, making it the fastest growing adoption rate in the history of surgery.*

Technology has always been a catalyst for efficiency. It is also dynamic and always moving forward. Much as surgeries without anesthesia could not continue once that genie was out of the bottle, Open Surgery will continue to decline in significance as other methods are deemed to be more efficient, both from the patient care and cost perspective. It is when these two factors align that the market explodes. We believe we are just on the cusp of that transition with robotic surgical systems gearing up to take significant market share, not only from Open Surgery, but from MIS as well.

Rise of the Machines

Terminator 3 – Rise of the Machines was released in 2003. While it was the third film in the Terminator trilogy starring Arnold Schwarzenegger, it could have easily referred to the revolution that was taking place within the medical device market. Intuitive Surgical was founded in 1995 on a concept of furthering the advancements made in MIS and addressing its shortcomings, all the while improving patient care.

Exhibit 1. Minimally Invasive Surgery



Source: University of Texas MD Anderson Cancer Center

By the time the film was released in 2003, ISRG had just shipped its 100th unit and revenue was approaching the significant milestone of \$100 million. The Rise of the Machines had started.

Exhibit 2. Intuitive Surgical's da Vinci Robotic Platform



Source: Intuitive Surgical Inc.

Over the next 8 years to 2011, ISRG grew its sales 19-fold to \$1.75 billion, a remarkable 45% internal CAGR as it grew its installed base to ~1,600 units in the United States and 2,226 units worldwide. The stock price over this period speaks to the impressive financial performance of the Company.

Exhibit 3. ISRG 10-Year Stock Chart



Source: Bigcharts

With a market capitalization that recently peaked at \$24 billion, or 14x TTM revenue, it is clear that investors are betting that “The Machines” will continue to change the nature of the operating theatre. As a point of reference, Covidien Plc. (COV – N, Not Rated) is a leading supplier of MIS instrumentation. While the company is diversified in terms of its product mix, “medical devices” comprise 67% of the \$11.6 billion in 2011 revenues. The growth rate in that division over the last two years has been 13%; certainly quite strong and speaks to the growth of MIS as it captures share versus Open Surgery, but a growth rate less than half that of ISRG. Furthermore, the stock trades at ~2x TTM sales. In our opinion, the market is accurately forecasting that growth in robotic systems and its instruments will greatly outstrip the growth of MIS instruments.

Urology and Gynecology Were Early Adopters

We refer to it as “Rise of the Machines” since even though ISRG has undergone remarkable growth over the past decade, its market share of the entire surgical procedure market is only ~10%. Like any new technology, initial growth is driven by early adopters. While we do not believe that ISRG's da Vinci was ever “bleeding edge” due to its strong profitability profile (note the company turned profitable early in 2004 and now boasts a 40% pre-tax margin), it is certainly cutting edge. The high price point at ~\$2 million per system (plus service fees + recurring instrument sales) has made ownership of the system a little bit of an exclusive club in terms of hospital purchasers. The initial indications or procedures, therefore, had to fulfill three primary requirements:

- a) The system as it was configured had to be able to perform the procedures effectively;
- b) The potential procedure volume had to be large enough to sustain a high utilization rate;
- c) The procedures had to have a high revenue rate to offset the high upfront and recurring costs.

The early adopter procedures that fulfilled these requirements have been urology (prostatectomy) and gynecology (hysterectomy). With procedure levels now sufficiently large, we can conduct a “back of the envelope” ROI analysis to ascertain the overall cost/benefit to the hospital. The following table outlines some basic assumptions as to the break-even point (excluding the amortization of the upfront cost) as well as the volumes necessary to achieve an acceptable ROI (deemed to be 15%) and therefore justify the purchase from a pure “financial” perspective. Note that our assumptions are a system sale of \$2 million, annual maintenance of \$150,000 per system and \$1900 of instrument revenue per procedure. These assumptions are consistent with ISRG's latest quarterly results.

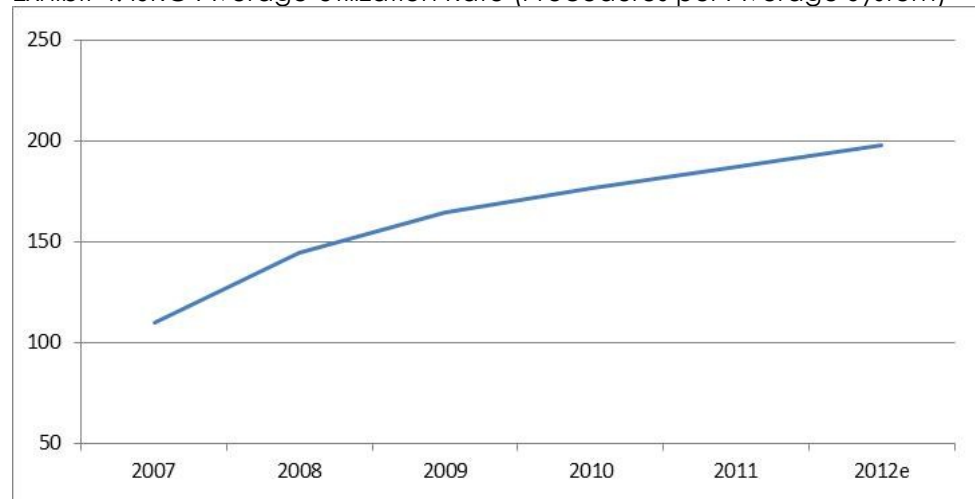
Table 1. Da Vinci Procedure Volume for Operating Break-Even and 15% ROI

	Operating B/E	15% ROI
Robotic cases per year	95	280
Hospital days saved with robotic procedures	1	1
Hospital days saved	95	280
Number of procedures made possible by freed up beds	95	280
Average contribution per procedure	\$3,500	\$3,500
Annual contribution from increased bed capacity	\$332,500	\$980,000
Robotic annual maintenance	\$150,000	\$150,000
Disposable robotic instruments	\$180,500	\$532,000
Net annual benefit	\$2,000	\$298,000
Upfront robotic investment	\$2,000,000	\$2,000,000
Years to pay off acquisition	1,000.0	6.7
ROI	0.1%	14.9%

Source: Beacon Securities Ltd. and Open Access Surgery, "Robotic surgery: applications and cost effectiveness"; 2010: 3 99-107

Volume is clearly a critical success factor when determining the ROI of the system. Therefore, those early hospital adopters focused on marketing themselves as Centers of Excellence for those indications. Having the best equipment attracts the best surgeons who in turn attract a greater number of patients. One can see it in the numbers. While ISRG has sold systems to only 30% of US hospitals, its da Vinci Surgical System is utilized on 80% of prostatectomies (~120,000 procedures in 2011) and 30% of hysterectomies (~150,000 procedures in 2011 and growing significantly). The da Vinci was used in a total of 360,000 procedures in 2011 on an average installed base of 1,900 units versus 85,000 procedures on an average installed base of 943 units in 2007. The average procedure growth of 45% versus the average system growth of 28% has translated into higher average use per system (utilization rate) from ~110 in 2007 to 187 in 2011. As such, we believe those hospitals that are achieving this average utilization rate are now generating a positive ROI on their investment (~9%) but in the aggregate are still not generating a 15% return. That ROI should increase as the utilization rate continues to grow.

Exhibit 4. ISRG Average Utilization Rate (Procedures per Average System)



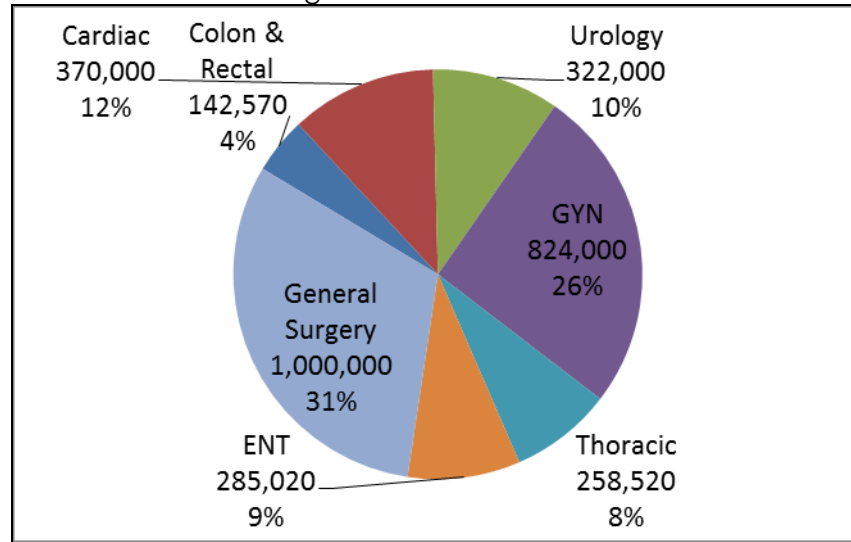
Source: Intuitive Surgical Inc. Reports and Beacon Securities Ltd

To recap our investment thesis thus far, we believe that technology advances have enabled, and will continue to enable, market share gains by robotic surgical platforms at the expense of both Open and MIS (laparoscopic) procedures because it results in:

- a) *Better Patient Care*: Decreased blood loss, post-operative pain, narcotic use and length of hospital stay.
- b) *Better Outcome for Surgeon*: Better visualization (3D), mitigation of surgeon tremor, ergonomic and intuitive hand movements, greater range of motion approximating the human wrist, shorter learning curve (versus MIS), and a reduction in the surgeon's physical stress as a result of the surgeon being able to sit at a console versus standing up.
- c) *Better Outcome for Hospital*: Enhanced hospital reputation and ability to attract better surgeons and more patients. With high volumes, hospitals have the ability to generate high ROI as shown above.

The question becomes how many more procedures can these "early adopters" perform to drive further system sales and procedure growth? With a market share of only 30% in hysterectomies and a growth rate that is exceeding that experienced in prostatectomies, we believe ISRG can continue strong procedure growth in gynecology over the next several years. While this certainly represents a significant growth opportunity, the question is whether ISRG's current system, as presently configured and at its current selling price, can penetrate *other* surgical indications, and expand the market beyond those "early adopters". As one can see from the chart below, there remains a large opportunity outside of urology and gynecology which has yet to benefit from robotic surgery. From a sheer numbers perspective, "General Surgery" is the obvious candidate with 1 million procedures annually, a market opportunity that is equal to urology and gynecology combined.

Exhibit 5. Annual US Surgical Procedures



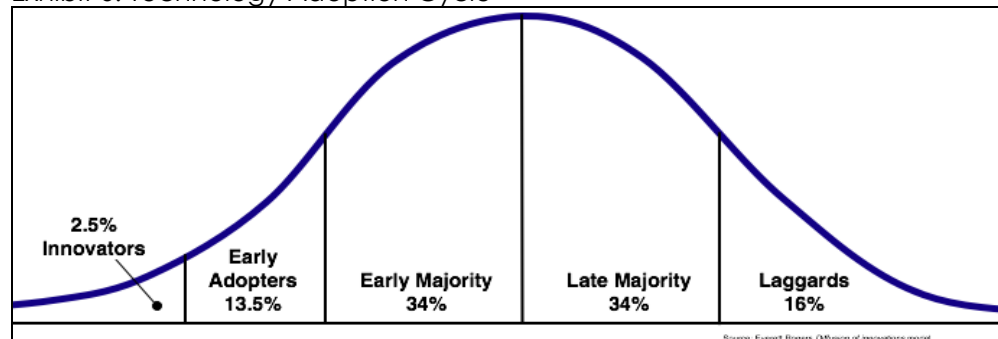
Source: Titan Medical Inc.

The largest procedure within General Surgery is cholecystectomies with ~700,000 annual procedures in the United States and 1.5 million worldwide. Other significant procedures within General Surgery include gastric bypass and appendectomies. This certainly appears to represent a large market opportunity, but can the da Vinci replicate its previous success in it?

General Surgery and Cholecystectomies

As with any technology advancement, the early adoption group naturally expands to include a much larger participation. Typically, this is driven by a wider perception of the value proposition as well as a reduction in price as those later adopters place more emphasis on price.

Exhibit 6. Technology Adoption Cycle



Source: Everett Rogers

We believe it is inevitable that robotic surgery's penetration will follow this well-trodden path. Interestingly, of the total surgical market, robotic surgery has an approximate 10% penetration rate, or right in-line with the adoption curve noted above. Even full share of the gynecology market would still not represent the majority of the market. To reach that maximum penetration, robotics has to penetrate General Surgery and cholecystectomies in particular. However, that procedure has distinctly different characteristics than urology and gynecology. In particular, it has:

- a) Different surgeons, i.e. general surgeons are not necessarily familiar with the da Vinci system;
- b) Shorter procedure times;
- c) Lower revenues per procedure.

Our conversations with current da Vinci users indicate that, as a result of these issues and as it is currently configured and priced, the da Vinci cannot successfully penetrate the General Surgery market as the value proposition and ROI does not meet the threshold level; even for those hospitals that consider themselves the "Thought Leaders". The result has been twofold:

- a) MIS techniques have gained a significant share of this market from Open Surgery (recall Covidien's growth rate);
- b) ISRG has recently developed and received FDA approval (January 2012) for a component that hospitals can attach to their current generation da Vinci, the da Vinci Si, that enables them to perform general surgeries such as cholecystectomies (Single-Site).

The first point we have already addressed. We believe that technology change is inevitable and robotics has proven to have better patient care over Open Surgery and even MIS in terms of blood loss, recovery time and scarring. The second point needs more analysis.

Da Vinci Single-Site Instrumentation – Not the Killer App

As mentioned, the recent FDA approval of ISRG's Single-Site instruments opens up the General Surgery market in theory. But does it in reality? While it is too early to ascertain whether or not ISRG will be successful within the General Surgery market, there are some assumptions we can make that will help us with our analysis:

- a) The current installed base of da Vinci systems comprises ~30% of US hospitals;
- b) Those 30% of US hospitals represent a much greater percentage of prostatectomies (80%) and hysterectomies (30%+), especially as they continue to "win business" in these two indications;
- c) The remaining 70% of US hospitals, having lost a significant amount of urology and gynecology procedures, have focused on General Surgery and cholecystectomies in particular. As such, the

remaining 70% of US hospitals that do not have a da Vinci Si system perform more than 70% of the US cholecystectomies;

- d) ISRG is not attempting to penetrate the General Surgery market through a new stand-alone system, but rather through the sale of an instrument that enables the current da Vinci system to perform single site surgery;
- e) General surgeons, even those operating at hospitals that currently have a da Vinci, do not have any "time" on the system and therefore need training time;
- f) That Si instrument costs \$100,000.

It follows from these assumptions and our knowledge that ISRG is seeing significant procedure growth within gynecology that its existing installed base has seen, and should continue to see good utilization growth as we have shown in Exhibit 4. Given that increasing utilization time with urology and gynecology surgeons and the inherent complexities of Operating Room schedules and sharing the system, the potential to grow material utilization within General Surgery may be limited. In essence, the payback to the hospital is enhanced through greater utilization for urology and gynecology procedures (as we have seen above in Table 1) versus "lending" it out to general surgeons that, as we will show later, would have a lower ROI.

The conclusion we reach, therefore, is that while ISRG is making some initial inroads into the large cholecystectomy market with hospitals who already own a da Vinci Si, we believe that to gain significant market share, it will have to sell the entire system, including the da Vinci system and the Single-Site instrumentation based on its own merits within the General Surgery market to those hospitals that do not currently own a da Vinci. As we have shown, we believe that represents ~70% of US hospitals, who perform ~80% of cholecystectomy procedures. At ~\$2.1 million (i.e. \$2 million for the da Vinci Si + \$0.1 million for the Single Site component), we do not believe this price point represents a significant enough value proposition to drive adoption by the "Early Majority" as indicated in Exhibit 6.

As such, while we believe General Surgery and cholecystectomy in particular, is open to robotic solutions versus the current MIS solution, the winning system will have to be better configured to the specific requirements of those procedures. It will also have a materially lower price point to drive a satisfactory ROI and therefore drive greater penetration as per the Technology Adoption Cycle. We believe Titan Medical's Amadeus Surgical System™ has the ability to be such a system.

Company Overview

Wrath of the Titans

Titan Medical Inc. was formed in 2002 by Dr. Reiza Rayman (President) but did not really start to make significant strides until mid-2008 when the company went public on the TSX Venture exchange and could access capital. Since then, Titan has raised a total of \$36 million to fund its development. As of March 31, 2012, it had \$8 million in cash and zero debt.

Dr. Rayman has been an early adopter of robotic surgical techniques. In fact, he performed the first robotic beating heart cardiac bypass surgery in September 1999 with Dr. Douglas Boyd using the ZEUS Robotic Surgical System (Computer Motion, which was subsequently bought by ISRG in 2003 for \$148 million). Subsequently, Dr. Rayman received C\$30 million in government grant money to continue his research on robotic platforms. He has performed over 400 robotic surgeries. Dr. Rayman received his MD from The University of Toronto and a Ph.D. in Telesurgery from The University of Western Ontario.

Since its beginnings, Titan has realized the importance of two issues:

- a) Involve robotic specialists who can advise and guide the company such that it can position itself for success;
- b) Involve a knowledgeable capital markets executive given the necessity of securing development funds.

To this end, the company has put together a very impressive group including:

Craig Leon (CEO): Mr. Leon has extensive experience in the capital markets as well as the biotechnology industry. From 2000-2003, Mr. Leon was a consultant to Genex Biotechnology Corp. During his time with the company, he helped raise ~\$40 million. From 2003-2009, Mr. Leon was Chief Financial Officer and Chief Operating Officer of Redwood Asset Management, a fund who grew its assets from a start-up to C\$120 million during his time there. Mr. Leon received his MBA from York University.

Dr. John Valvo (VP, Medical Affairs): Dr. Valvo is currently the Chief of Urology and Executive Director of Robotic and Minimally Invasive Surgery at Rochester General Hospital in Rochester, New York. Dr. Valvo founded the robotic program at the hospital in early 2004, which currently ranks in the top 4% of robotic surgeries in the US with over 30 robotic surgeons and over 5,000 robotic procedures to date.

Dr. Dennis Fowler (Consultant): Dr. Fowler is Medical Director of the New York Presbyterian Hospital/Columbia Simulation Center (NYPH) and Director of the Reemtsma Center for Innovation and Outcomes Research in the Department of Surgery at Columbia University. He has been involved in minimal access surgery since 1990 when laparoscopic techniques became available and developed new techniques for laparoscopic surgery, including colon surgery. From 2000-2008, Dr. Fowler

led the Minimal Access Surgery Center (MASC) at both the Columbia and Cornell campuses of NYPH where he co-invented the Insertable Robotic Effector Platform (IREP), a product that Titan believes can revolutionize robotic procedures for General Surgery given its technical performance and small footprint. Titan licensed the IREP in February 2012 and is focused on integrating it with its surgical console and video tower.

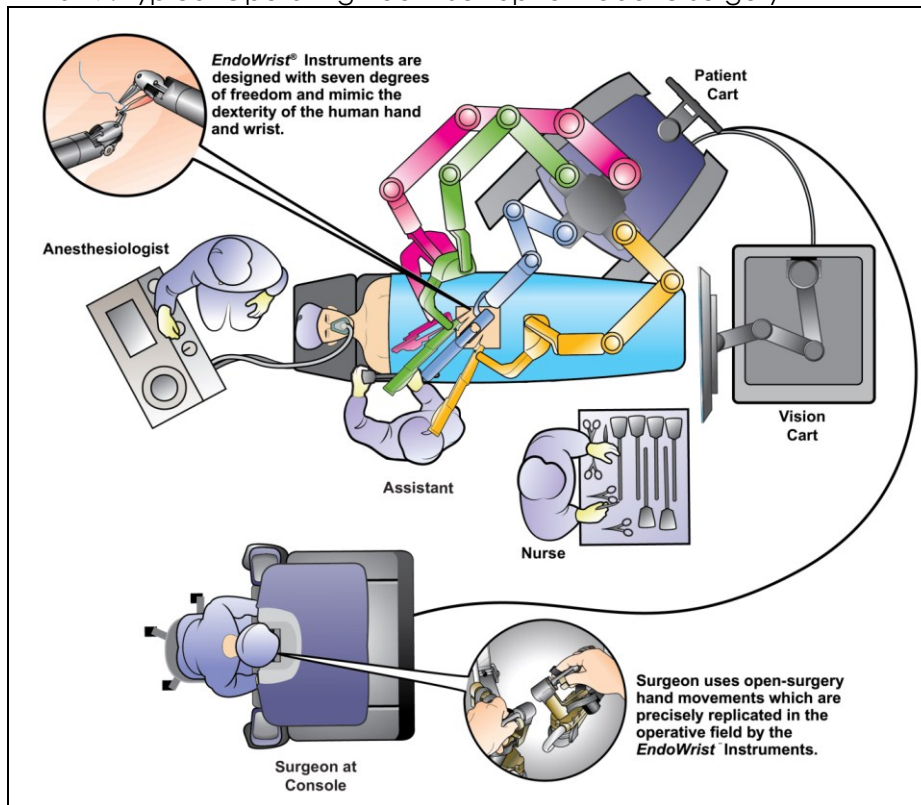
Dr. Balasubramanian Sivakumar (Advisory Board): Dr. Sivakumar is currently Vice President of St. Joseph's Hospital Health Center in Syracuse, NY and President elect of the medical staff for 2012. He is a robotic surgeon proctor/mentor and has trained numerous surgeons practicing robotic surgery in specialties including General, Urologic, Thoracic and Gynecological.

Joe Talarico (SVP, Business Development): Mr. Talarico has been active in the surgical medical device industry for 9 years. From 2004-2009, Mr. Talarico held various positions with Intuitive Surgical including Area Training Director, Clinical Sales Manager, Area Sales Manager and Clinical Sales Representative.

Building Blocks of a Robotic Platform

Below is an illustration of a standard set-up for a robotic surgical procedure. Within the system, there are three major components including a surgeon controlled console, a patient cart and a video cart.

Exhibit 7. Typical Operating Room Set-Up for Robotic Surgery



Source: Intuitive Surgical Inc.

From 2008 to 2011, Titan focused on the development of its surgeon console and video tower. In particular, the combination of its console and video tower offers some unique capabilities.

- a) *Immersive High-Definition 3D:* Vision is an incredibly important aspect of any robotic platform because if the surgeon cannot see properly, the surgery will not be successful. In addition to 3DHD, the surgical view also includes an intraocular overlay display to present supplementary information such as the patient information and currently selected instrumentation.
- b) *Haptic System:* Haptic refers to the sense of touch and has been historically one of the drawbacks of Robotic Surgery versus Open Surgery. Titan has developed a haptic system which is connected to two symmetrical and independent hand controllers that together are used to simultaneously control the position, orientation and pinch of the patient cart instruments in real time. The haptic system also provides force feedback to the hand controllers to provide valuable tactile information from the surgical field back to the surgeon.
- c) *Simulation:* The surgeon console contains surgical skill and procedural simulations affording greater training options. The surgeon can train on the console without being connected to the patient cart and perform surgeries in a realistic simulated environment that includes feedback. Each simulation outputs evaluation metrics to assess the surgeon's proficiency in a task or procedure.

With its console and video tower in gamma stage development, the company began to consider the ideal solution for its patient cart. Knowing that ISRG had the urology and gynecology markets "sewn up", it believed that there was an opportunity to expand the use of a robotic platform and extend its use to other indications such as General Surgery. However, as we have seen, procedures are shorter (i.e. ~35-45 minutes versus ~2 hours in urology) and are typically less complicated. As such, the company believed that specific configurations of the patient cart would be necessary, especially in terms of footprint and cost. At the same time, it also believed that dexterity of the robotic instruments was a very important attribute to incorporate into its patient cart. The ability for movement inside the body as opposed to outside the body was critical to reducing the overall system footprint.

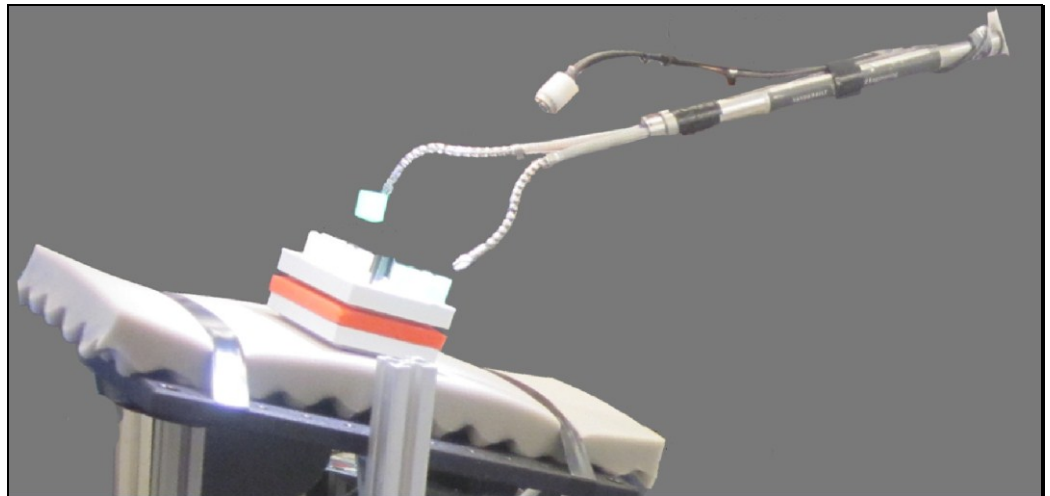
Enter the IREP

Through its deep relationships within the robotic intellectual community, Titan was able to secure the global rights to develop the technology involving a single port access robotic surgical system called the Insertable Robotic Effector Platform ("IREP"). These rights were acquired in February

2012, pursuant to an exclusive patent license agreement with Columbia University (see biography of Dr. Fowler above).

The IREP is a single-site platform that consists of a collapsible configuration that contains a sensory array for insertion, a dual instrument configuration with 9 degrees of freedom (DOF), a binocular camera for 3D visualization and an automated instrument tracking system. The IREP contains unique technology in the way it deploys the dual snake-like arms and vision system such that the necessary triangulation of the instruments is created while also positioning the instrument tips in the middle of the surgical field. In addition, the IREP is capable of delivering the necessary energy sources in order to achieve the necessary hemostasis.

Exhibit 8. IREP



Source: Titan Medical Inc.

We believe the IREP is significantly differentiated from the da Vinci robotic system both technically/mechanically and from a cost perspective. Therefore, it will meet the requirements for small to medium space surgeries, such as General Surgery and cholecystectomies. In particular:

- a) **Small Footprint:** The IREP can be bed mounted or on one external arm. This significantly reduces the size of the footprint versus the da Vinci Single-Site solution, which has a large patient cart with 3 external arms;
- b) **Greater Dexterity and Visualization:** The IREP unit consists of two-snake like instruments having 9 DOF that open up once inside the body. The unique 3D vision system, which includes a stereoscopic 3D camera inside the body, can be used to automatically track anatomical structures and surgical tools during a procedure, providing real-time in-vivo viewing for the surgeon.
- c) **Ease of Use:** The IREP unit fits through a 15mm trocar and the instruments are controlled in an easy to use manner, especially

versus MIS instruments. Furthermore, given its smaller footprint, set-up for the IREP is significantly easier and quicker.

- d) Lower Capital Cost: Given the IREP has one external arm instead of three, it will have a smaller patient cart. In addition, the surgeon console is also smaller and less complicated than the da Vinci. The more spartan design means that it will have fewer components and thus a lower capital cost as well as lower ongoing service cost than the da Vinci.

Intellectual Property (IP)

IP is an integral part of Titan's strategy. The company currently holds 3 US patents that pertain to ancillary robotic technology. It also owns 12 patent applications filed in the US or under the Patent Cooperation Treaty. The company holds exclusive rights to four patent applications presently pending before patent offices in the US, Canada and Europe. Titan continues to expand its patent portfolio by filing patent applications with various patent offices as new technologies pertaining to surgical systems are refined or newly developed. Finally, Titan also continues to seek in-licensing opportunities to expand its IP as deemed prudent, such as the recently consummated transaction whereby Titan secured an exclusive license agreement with Columbia University for the IP of the IREP.

Putting it All Together

With the console and video tower in pre-production, the focus of the company in the immediate term will be on final development of the IREP. Once that is completed, the entire Amadeus Surgical System™ will start the process towards eventual commercialization. The key milestones over the next 24-30 months are highlighted below:

- | | |
|--|---------|
| a) Cadaver and Animal Studies: | Q1 2013 |
| b) Human Clinical Trials Outside the USA | 2H 2013 |
| c) Human Clinical Trials in the USA | Q1 2014 |
| d) FDA 510(K) Submission | 2H 2014 |
| e) Global Market Launch | Q3 2014 |
| f) US Market Launch | 2015 |

Revenue Model

ISRG has established a revenue model that has been accepted within the hospital community, namely one whereby there is an upfront system sale, followed by an annual service commitment as well as recurring instrument sales. Each instrument lasts for 15-20 procedures, but multiple instruments are needed per procedure. On average, ISRG generates \$1900 in

instrument sales per procedure. Once Titan starts to commercialize its product late 2014/early 2015, we expect its business model to follow this successful format.

Sweet Spot for General Surgery Probably \$500,000-\$700,000 Range

To review our investment thesis, we believe that:

- a) Robotic surgery will win market share from Open and MIS procedures;
- b) General Surgery and cholecystectomies represent the next major growth opportunity for robotic procedures;
- c) ISRG's Single-Site instrument solution is likely too expensive to gain significant traction outside of those hospitals that already own a da Vinci system;
- d) Titan's Amadeus Surgical System™ inclusive of the IREP will gain market share within General Surgery because of its small footprint and affordable cost.

The question that immediately comes to mind, therefore, is what is that price "sweet" spot?

To attempt to ascertain the answer, we revisit the analysis we did in Table 1. In this analysis, we have made the following assumptions:

- a) ISRG's complete Single Site platform costs \$2.1 million;
- b) Titan's Amadeus Surgical System™ costs \$600,000;
- c) Annual maintenance costs are \$150,000 and \$50,000 respectively (~8% of initial cost);
- d) Instruments per procedure cost \$1200 and \$1000 respectively.

Table 2. Procedures Needed to Drive Operating Break-Even

	da Vinci	Amadeus
Robotic cases per year	188	51
Hospital days saved with robotic procedures	1	1
Hospital days saved	188	51
Number of procedures made possible by freed up k	188	51
Average contribution per procedure	\$2,000	\$2,000
Annual contribution from increased bed capacity	\$376,000	\$102,000
Robotic annual maintenance	\$150,000	\$50,000
Disposable robotic instruments	\$225,600	\$51,000
Net annual benefit	\$400	\$1,000
Upfront robotic investment	\$2,100,000	\$600,000
Years to pay off acquisition	5,250	600
ROI	0.0%	0.2%

Source: Beacon Securities Ltd

This table compares the operating break-even of the two systems for General Surgery. As one can see, under our assumptions, hospitals would need to perform almost 4 times the number of procedures using the da Vinci to achieve operating break-even. Similarly, as one can see in the following table, in order to generate that 15% ROI threshold, Titan's Amadeus™ system would need to be used on only 175 annual procedures; a level we believe hospitals would find easily achievable within General Surgery.

Table 3. Procedures Needed to Drive 15% ROI

Procedures Needed to Drive 15% ROI	da Vinci	Amadeus
Robotic cases per year	580	175
Hospital days saved with robotic procedures	1	1
Hospital days saved	580	175
Number of procedures made possible by freed up beds	580	175
Average contribution per procedure	\$2,000	\$2,000
Annual contribution from increased bed capacity	\$1,160,000	\$350,000
Robotic annual maintenance	\$150,000	\$50,000
Disposable robotic instruments	\$696,000	\$210,000
Net annual benefit	\$314,000	\$90,000
Upfront robotic investment	\$2,100,000	\$600,000
Years to pay off acquisition	6.7	6.7
ROI	15.0%	15.0%

Source: Beacon Securities Ltd

The sheer number of procedures necessary to drive an acceptable ROI on the da Vinci solidifies our view that it may be difficult for ISRG to sell this as a stand-alone system for General Surgery. However, for those hospitals just looking to add greater utilization to their existing da Vinci Si system, we believe it would make a positive financial contribution as the incremental payback for just the \$100,000 Single-Site instrumentation is ~125 procedures.

As for Titan, with a \$600,000 system cost and \$1000 in instrument costs per procedure, one can see that the operating break-even is only 50 procedures with a 15% ROI based on 175 annual procedures. We believe this represents a compelling value proposition to hospitals, even in this era of funding constraints.

Forecast

Revenue Ramp to Start in 2015

As we have indicated, we believe Titan will follow the same revenue model as ISRG, namely upfront system sales, coupled with recurring annual maintenance revenue as well as recurring instrument sales, driven by procedures. We have assumed system revenue of \$600,000, annual maintenance of \$50,000 (8%) and instrument revenue per procedure of \$1000.

We have assumed the Company will receive its approvals in late 2014/early 2015 and will start selling in 2015. In the first year, we have assumed Titan will sell 18 systems, growing to 40 in 2016 and 60 in 2017. Note in the early years of its revenue ramp, the bulk of revenue is derived from system sales that will drive the higher margin recurring revenues in later years.

Table 4. Income Statement Forecast Summary

Year-End: Dec 31	FY11	FY12e	FY13e	FY14e	FY15e	FY16e	FY17e
(\$000's)							
Sales:							
Products	-	-	-	-	11,283	27,592	45,851
Services	-	-	-	-	600	2,234	4,901
Total Sales	-	-	-	-	11,883	29,826	50,752
EBITDA	(15,612)	(8,500)	(12,000)	(17,000)	(7,847)	(2,390)	5,224
Net Income	(16,128)	(8,628)	(12,265)	(17,306)	(8,181)	(2,744)	4,857
EPS	(0.30)	(0.13)	(0.16)	(0.22)	(0.10)	(0.03)	0.05

Source: Beacons Securities Ltd

Balance Sheet

Titan ended Q1/FY12 with C\$8 million in cash and C\$32 million (17.4 million) worth of unexercised warrants, albeit they are slightly out-of-money based on today's stock price. We believe the Company's development schedule, including clinical trials, will cost ~\$50 million between 2012-2015. We have modeled in our forecast that the Company raises an additional C\$45 million over the next 3 years. Given the remaining life on the warrants, we have not assumed that Titan will receive the cash from them during its development schedule, albeit the cash will flow to it in the years during which they expire (December 2015 – December 2017). We have assumed that the Company will have 100 million shares outstanding on a fully diluted basis (versus 80 million today) once it completes its funding cycle.

Recommendation and Valuation

Valuation, especially on a pre-revenue company is as much of an art as it is a science. We can look to its aforementioned peer group of ISRG for guidance and analyze both their current and past valuation.

Over the last decade, ISRG has traded in an average EV/Sales range of 4-12x (currently 9.6x FY12 forecast). These kind of trading multiples are clear indications that the market is making a bet on robotic platforms being the future for operating procedures.

Table 5. Comparable Companies Multiples

(\$000s, except EPS)	Symbol	Shares O/S	Current Price	Mkt Cap	Cash	TTM			FY12e		FY13	
						Sales	EBIT	EPS	Sales	EPS	Sales	EPS
Intuitive Surgical	ISRG	40,200	\$536.52	\$21,568,104	\$2,371,000	1,864,400	740,000	13.22	2,140,000	14.73	2,500,000	17.36

	TTM			FY12e		FY13e	
	EV/Sales	EV/EBIT	P/E	EV/Sales	P/E	EV/Sales	P/E
Intuitive Surgical	10.3	25.9	40.6	9.0	36.4	7.7	30.9

Source: Beacon Securities Ltd, First Call Estimates

Another way to look at valuation, in our opinion, is to look at the market capitalization per installed system. On this basis, ISRG has traded in a range of US\$6-US\$11 million and is currently at US\$10.3 million.

Table 6. Industry Specific Multiple

(\$000s, except install base)	52 Week		52 Week EV		Installed Base	EV/Install
	High	Low	High	Low	Q1/FY12	High Low
Intuitive Surgical	\$594.89	\$320.00	\$23,914,578	\$12,864,000	2,226	\$10,743 \$5,779

Source: Beacon Securities Ltd

So what does this imply for Titan Medical? We believe the lessons are twofold:

- a) The market is currently affording growth multiples to those companies it believes will have an impact on the future of operating procedures;
- b) Once the market begins to get visibility that Titan will be one of those companies, it will start to re-value its shares.

Returning to our financial forecast, by the end of 2016 we have forecast that Titan will have an installed base of 60 systems with revenue that year of \$30 million. Based on the above metrics of 11x revenue and \$10 million per installation would imply a value of \$300-\$600 million. Using a 25% discount rate to reflect both time and execution risk, we arrive at valuation range of \$250 - \$450 million. As we have indicated, we have assumed the company issues equity to be able to execute its plan and will have 100 million shares outstanding once it starts to commercialize its Amadeus Surgical System™. That would imply a target share price range of \$2.50-\$4.50. Once the company starts to meet its milestones and visibility improves, we believe the stock will trade at a lower discount rate, which would drive the stock above that target price range.

Key Risks

Financing Risk: In order to commercialize its Amadeus Surgical System, Titan needs to raise ~\$45 million. If it is unable to adequately finance the development of its platform, it will be unable to achieve our financial forecast.

Regulatory: Titan needs to achieve both CE Mark and FDA approval for its product prior to commercialization. If its Amadeus Surgical System does not receive these approvals, it will be unable to achieve our financial forecast.

Competition: MIS has been widely adopted in General Surgery. In addition, ISRG has recently launched an FDA approved product for this market. If either ISRG gains widespread acceptance of its new Single Site component and/or MIS techniques maintains its market share, Titan's platform may not be accepted by hospitals.

Initiating Coverage with Buy Rating and C\$3.50 Target Price

We are initiating coverage of Titan Medical with a Buy rating and a target price of C\$3.50. In summary, our recommendation is based on the following:

- a) With 360,000 procedures in 2011 (+30%), robotic surgery has moved beyond the niche and into the mainstream. It is now widely perceived to offer significant advantages for all the major stakeholders including patients, surgeons and hospitals. As such, we believe that robotic procedures will continue to take market share from both open surgery as well as MIS procedures.
- b) Urology and gynecology have been early adopters of the technology. With 80% of prostatectomies and 30%+ of hysterectomies now performed robotically, greater penetration of the technology will have to come from other indications such as General Surgery and cholecystectomies in particular; a market opportunity that in and of itself is larger than urology and gynecology combined.
- c) ISRG is the clear market leader within urology and gynecology. Just recently, it has received FDA approval for a Single Site component with which to attack the General Surgery market. While we believe it will have success with the hospitals that already own a da Vinci system, as a stand-alone product for General Surgery, we believe its price point will prove prohibitive. As such, we believe the large cholecystectomy market is open to another participant who has a better solution.
- d) Titan Medical, with its recently licensed IREP technology and integrated with its existing surgical console and video tower, has the ability to materially extend robotic procedures to General Surgery. The combination of small space precision (9 DOF) and a significantly lower price point than the da Vinci make Titan's Amadeus Surgical System™ an excellent value proposition for General Surgery.
- e) We expect Titan to meet or exceed its stated clinical milestones over the next 24 months and launch its Amadeus system in Europe in late 2014 and in the US in 2015.
- f) Current industry participant ISRG trades at ~10x forecast EV/Sales and \$10 million per installed system. As visibility of that launch date becomes clearer, we believe Titan will receive similar growth multiples.

With a current market capitalization of C\$80 million, we do not believe the shares are accurately reflecting either the growth of the robotic industry or Titan's ability to gain significant share within General Surgery. As such, we believe its shares represent an excellent risk-return proposition.

Appendix: Financial Statements

Income Statement

Year-End: Dec 31	FY09	FY10	FY11	FY12e	FY13e	FY14e	FY15e	FY16e	FY17e
(\$000's)									
Sales:									
Products	-	-	-	-	-	-	11,283	27,592	45,851
Services	-	-	-	-	-	-	600	2,234	4,901
Total Sales	-	-	-	-	-	-	11,883	29,826	50,752
COGS:									
Products	-	-	-	-	-	-	6,610	15,365	24,247
Services	-	-	-	-	-	-	120	447	980
Total COGS	-	-	-	-	-	-	6,730	15,812	25,227
Gross Profit	-	-	-	-	-	-	5,153	14,014	25,525
SG&A	483	1,902	2,867	4,000	4,000	6,000	9,000	11,931	15,226
R&D	166	1,574	12,744	4,500	8,000	11,000	4,000	4,474	5,075
EBITDA	(649)	(3,476)	(15,612)	(8,500)	(12,000)	(17,000)	(7,847)	(2,390)	5,224
Amortization	24	41	98	128	265	306	334	354	368
EBIT	(674)	(3,517)	(15,709)	(8,628)	(12,265)	(17,306)	(8,181)	(2,744)	4,857
Interest Expense	(29)	(34)	(95)	-	-	-	-	-	-
EBT	(644)	(3,484)	(15,614)	(8,628)	(12,265)	(17,306)	(8,181)	(2,744)	4,857
Other (incl stock based com	103	205	513	-	-	-	-	-	-
EBT	(747)	(3,689)	(16,128)	(8,628)	(12,265)	(17,306)	(8,181)	(2,744)	4,857
Tax Expense	-	-	-	-	-	-	-	(823)	1,457
Tax Loss Carry Forward	-	-	-	-	-	-	-	(823)	1,457
Net Income	(747)	(3,689)	(16,128)	(8,628)	(12,265)	(17,306)	(8,181)	(2,744)	4,857
Shares Outstanding	33,437	42,898	54,286	67,315	75,315	80,315	80,315	85,315	95,773
EPS	(0.02)	(0.09)	(0.30)	(0.13)	(0.16)	(0.22)	(0.10)	(0.03)	0.05
Shares Outstanding	33,437	42,898	54,286	87,760	95,760	100,760	100,760	100,760	100,760
Fully Diluted EPS	(0.02)	(0.09)	(0.30)	(0.13)	(0.16)	(0.22)	(0.10)	(0.03)	0.05

Source: Company Reports and Beacons Securities Ltd.

Balance Sheet

Year End: Dec 31 (000's)	FY09	FY10	FY11	FY12e	FY13e	FY14e	FY15e	FY16e	FY17e
ASSETS									
Current Assets:									
Cash	3,213	9,615	9,739	8,489	16,089	16,189	13,581	26,435	30,003
Account receivables and prepaids	70	137	275	275	275	275	2,930	7,354	12,514
Inventory	-	-	-	-	-	-	1,383	3,249	5,184
Other	-	-	774	774	774	774	-	-	-
Total Current Assets	3,283	9,752	10,789	9,538	17,138	17,238	17,894	37,038	47,701
Fixed assets									
Fixed assets	-	87	367	461	535	587	623	649	667
Patents	144	120	195	223	284	326	356	376	391
Total Assets	3,427	9,958	11,350	10,222	17,957	18,151	18,873	38,064	48,759
Liabilities and Shareholders' Equity									
Current Liabilities:									
Bank debt	0	-	-	-	-	-	-	-	-
Accounts payable	310	728	2,007	2,007	2,007	2,007	1,659	3,899	6,220
Dividends payable	-	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-
Total Current Liabilities	310	728	2,007	2,007	2,007	2,007	1,659	3,899	6,220
Long term debt									
Long term debt	-	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-
Total Liabilities	310	728	2,007	2,007	2,007	2,007	1,659	3,899	6,220
Common Equity:									
Share Capital	7,068	16,871	33,217	40,717	60,717	78,217	87,467	107,162	110,678
Retained Earnings	(3,951)	(7,640)	(23,874)	(32,502)	(44,767)	(62,072)	(70,253)	(72,997)	(68,140)
Total Shareholders' Equity	3,117	9,231	9,343	8,215	15,950	16,144	17,214	34,165	42,538
Total Liabilities and S.E.	3,427	9,958	11,350	10,222	17,957	18,151	18,873	38,064	48,759

Source: Company Reports and Beacon Securities Ltd.

Statement of Cash Flows

(\$000's)	FY09	FY10	FY11	FY12e	FY13e	FY14e	FY15e	FY16e	FY17e
Net Income	(747)	(3,689)	(16,128)	(8,628)	(12,265)	(17,306)	(8,181)	(2,744)	4,857
Amortization	24	41	98	128	265	306	334	354	368
Other	103	205	513	-	-	-	-	-	-
Cash Flow Operations	(620)	(3,442)	(15,517)	(8,500)	(12,000)	(17,000)	(7,847)	(2,390)	5,224
Changes in non-cash WC	185	351	367	1	-	-	(3,611)	(4,051)	(4,773)
Cash Flow Operations (+ WC)	(435)	(3,091)	(15,150)	(8,499)	(12,000)	(17,000)	(11,458)	(6,441)	452
Capital Expenditures	-	(104)	(353)	(200)	(250)	(250)	(250)	(250)	(250)
Patents	-	-	(100)	(50)	(150)	(150)	(150)	(150)	(150)
Other	(3)	-	-	-	-	-	-	-	-
Cash Flow Investing	(3)	(104)	(453)	(250)	(400)	(400)	(400)	(400)	(400)
Principal Repayments	-	-	-	-	-	-	-	-	-
New Equity	2,043	9,598	15,727	7,500	20,000	17,500	9,250	19,695	3,517
New Debt	-	-	-	-	-	-	-	-	-
Other (Net)	-	-	-	-	-	-	-	-	-
Dividends	-	-	-	-	-	-	-	-	-
Cash in Discont. Ops	-	-	-	-	-	-	-	-	-
Cash Flow Financing	2,043	9,598	15,727	7,500	20,000	17,500	9,250	19,695	3,517
Other (Net)	-	-	-	-	-	-	-	-	-
Cash Flow	1,606	6,403	124	(1,249)	7,600	100	(2,608)	12,854	3,568
Cash, begin period	1,607	3,213	9,615	9,739	8,489	16,089	16,189	13,581	26,435
Cash, end period	3,213	9,616	9,739	8,489	16,089	16,189	13,581	26,435	30,003

Source: Company Reports and Beacon Securities Ltd.

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Ending		
Q2 2012	# Stocks	Distribution
BUY	9	81.8%
Spec. Buy	1	9.1%
HOLD	1	9.1%
SELL	0	0.0%
Restricted	0	0.0%
Total	11	100.0%

*as of quarter end

BUY

Total 12-month return expected to be >15%

SPECULATIVE BUY

Potential total 12-month return is high (>15%), but given elevated risk, investment could result in a material loss

HOLD

Total 12-month return expected to be between 0% and 15%

SELL

Total 12-month return expected to be negative

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