

Diasonics was founded in November 1977 by Al Waxman, Arthur Rock, and Bob Noyce. The company is engaged in the diagnostic medical imaging business. It is located in Milpitas, California, and presently employs in excess of 1,300 people.

The objective of the company is to obtain a leadership position in the high technology, high growth, computer-based diagnostic imaging business. We define that business as ultrasound, digital x-ray, and nuclear magnetic resonance, or NMR. Diasonics views itself as a computer company in the very advanced, sophisticated area of diagnostic medical imaging. Let's take a look at Diasonics, the ingredients that made the company a success, and what the key factors are in that success.

The first of these key factors is technical and clinical innovation. Not only is Diasonics a high technology company, it is a company that uses its technology to solve significant clinical problems. Secondly, we are very responsive to market opportunities, and that is a key part of our strategic business operation. We use our responsiveness against our larger and slower-moving competitors. Diasonics is also an aggressive sales and marketing company. Those of you who are familiar with the medical electronics field know the importance of this approach. Not only is it important for a company to develop a high performance product, it is equally important to get out there and sell it to the customer. Diasonics is also a rapid growth company and, within the framework of that rapid growth, has been able to obtain the standards it has set for itself of high profitability and financial performance. Finally, Diasonics is an entrepreneurial company in both spirit and management technique, yet has filled its ranks with the professionals necessary to manage a 140 million dollar company.

Let's now take a look at the market in which Dasonics competes. As mentioned before, it's the worldwide diagnostic imaging market, a market that was 2.3 billion dollars in 1979 and 3.6 billion dollars in 1982. It is estimated to grow to 5.5 billion dollars in 1985 and 7 billion dollars by 1987. The three businesses in this market in which Dasonics competes--ultrasound, digital radiography, and NMR--represented 900 million dollars in sales in 1982, or 25 percent of the world diagnostic imaging market. By 1987, these same three businesses are projected to represent 70 percent of the total market, or approximately 5 billion dollars.

In order to understand the reasons for this shift from the older imaging modalities to the newer ones, we need to examine the factors driving the market. First, there are the health care factors. These include better patient outcome and reduced cost--both of which come through the increased diagnostic capability of the new modalities--less exploratory surgery, safer and easier procedures, and reduced hospitalization. One of the most significant items in the cost of medical care today in the United States and throughout the rest of the world, is "hotel" cost--the time the patient stays in the hospital.

The other factor driving this business is the technological one. If we look at the diagnostic imaging market today and compare it to the market five years ago, it's obvious that many of the things we are able to do today would either not have been possible or would not have been cost-effective. The tremendous micro-electronic revolution changed all that with the advent of low cost memory systems, sophisticated microprocessors, and high speed A to D conversion and image processing.

Employing this new technology, Dasonics entered its first business, ultrasound, in November 1978. Ultrasound is the use of high frequency sound waves to image the body. It measures tissue density and tissue elasticity and has a number of advantages. It is non-

ionizing and demonstrates motion readily, so one can see moving organs. It has the kind of high resolution that is required to see small anatomical structures and, as opposed to x-ray, provides excellent soft tissue contrast. Ultrasound is also the lowest cost imaging modality. Coupled with its non-ionizing characteristics, it's ideally suited as a screening modality.

The applications of ultrasound are many. There are the classic applications--abdominal, cardiac, obstetrics and gynecology--and, in the last two years, some newer ones. These include scanning of superficial organs, peripheral vascular examinations for stroke screening, neonatal imaging of the newborn child, pediatric ultrasound, and a new and very exciting area, intraoperative ultrasound, where ultrasound is used in the operating theatre to reduce the amount of surgery and the trauma to the patient, hence, reducing the patient's stay in the hospital.

With the increased number of ultrasound applications has come an increase in the number of ultrasound purchasers. Past and present customers have been hospital radiologists and cardiologists; but, as we look at what has occurred in the last 18 months--and what we are projecting to occur--we see ultrasound being used in private practice radiology, internal medicine, neurology, peripheral vascular ultrasound and general surgery. To sum it up, ultrasound can really be viewed as the high tech stethoscope of the 1990s, analagous to a search light in the hands of a physician.

All of this activity in ultrasound has clearly lead to substantial competition. The leading ultrasound companies are Dasonics and ATL, followed by Philips, Toshiba and Technicare. Dasonics and ATL really dominate this market, with almost identical market shares. Dasonics has approximately 35 percent of the U.S. market and 16 percent of the world market.

What product features have we offered that have resulted in Dasonics growing from a start-up company in 1979 to the world leader in diagnostic ultrasound today? First, ultrasound is an imaging technique. This means that the company providing the best picture becomes the market leader. We pioneered high resolution real-time ultrasound through our unique probe technology and the design of a sophisticated, computer-based system that allows us to perform advanced image processing to obtain the maximum image quality in ultrasound.

Another very important part of the Dasonics product philosophy in ultrasound is the modular system concept. When the company was started five years ago, we made a commitment that we would not obsolete our customers' equipment through the introduction of new products. The growth of Dasonics' ultrasound sales would come through the selling of enhanced capabilities, allowing our customers to continually upgrade and improve their systems as new applications occurred. This is a very important, because the ultrasound market and, in fact, the imaging market in general, is a referral base market. The quality of your customers, and their willingness to give you positive referrals, ties very strongly to your ability to increase your market share. Dasonics has a very strong referral base because we do not obsolete our customers. Additionally, our ability to sell modules and upgrades to our customers has become a substantial part of our business.

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What has all of this meant to Dasonics in terms of financial performance? Dasonics had ultrasound sales of 4.9 million dollars in 1979, our year of entry into the market, and by 1982, the sales had grown to 102.5 million dollars and a world leadership position.



In the future, we see ultrasound as a very viable and growing business, in fact, remaining the core business of Dasonics in the 1983 to 1985 time frame. We expect to maintain our technological and clinical superiority through continuing our R&D investments. We are expanding into new markets clinically, as I indicated before, and also geographically. Our recent acquisition of Sonotron substantially increased our market share in Western Europe. We also expect to maintain the marketing and sales aggressiveness that has moved us into a leadership position.

We see substantial new opportunities for ultrasound in the private practice market, including the family practice and internal medicine markets. We also see the potential for tissue characterization and external biopsy techniques through the use of ultrasound.

Dasonics second business is the new business of digital radiography, a technique for imaging the vascular or arterial systems of the body to diagnose disease using conventional x-ray systems and digital image processing. Digital radiography is a new market which began in 1981, and it has shown dramatic growth. From its inception, with the introduction of the first digital image processing computer in 1981, until the end of 1982, the world market has grown to be 270 million dollars. Dasonics began its internal product development in digital radiography in April 1981 and demonstrated its product at the RSNA in November 1981. Our goal was to develop a product that offered substantial technological and clinical benefits when compared to competing products, and we met that goal. The Dasonics system was recognized as a dramatic advance in the area of digital radiography. We began shipment of this product in April 1982 and, by year-end, had converted our technological and clinical leadership position into a market leadership position. We shipped 166 systems and generated more than 36 million dollars of business in 1982.

What has caused all the excitement about digital radiography? Certainly there are the advantages it provides to both the physician and the patient, which include lower x-ray dose and the use of less contrast media. It is the media injected into the vascular system that causes negative reaction on the part of the patient. Therefore, because digital radiography uses lower x-ray dose and lower contrast media, it is less invasive. The results are shorter procedures using equipment that has substantially increased throughput and patient safety. The applications of digital radiography are interesting and expanding substantially. In its early days in 1981, digital radiography was seen strictly as a screening technique for peripheral vascular disease. Now its uses are expanding into the lung, abdomen, dynamic studies of the heart, and into high resolution intracranial studies.

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With these increasing applications, we've seen an increase in the numbers and types of digital radiography customers. In 1982, the primary customers were hospital-based radiologists. In 1983 and beyond, we see continued expansion in hospital radiology, as well as newer expansion into private radiology and hospital cardiology--the cardiac cath lab, the ICU, and the CCU.

The digital radiography market is divided into two sectors. One is the add-on market, the a digital image processing computer purchased as an add-on to already existing x-ray equipment. The size of this market has been scaled at about 18,000 systems in North America and an unknown number of systems in Western Europe, so it is quite large. The leading companies in the add-on market are Dasonics, ADAC, Technicare, Philips and GE, with Dasonics and ADAC having by far the predominant market share.

The second sector of the digital radiography market is integrated systems; that is, an x-ray system already integrated with a digital image processing computer. Disonics decided to enter this market in 1982 through a technological and marketing partnership agreement with Fischer Imaging Corporation of Chicago, Illinois. At the RSNA meeting in 1982, we introduced and showed several new integrated system products. They were met with very good acceptance at the meeting, and sales have been brisk since that time.

Let's now look at how Disonics was able to advance so rapidly in the digital radiography market--from introducing a product in late 1981 to becoming a marketplace leader in less than one year. Again, it is based on technological innovation. The add-on systems that we manufacture offer unique benefits. There's our high speed PIPELINE image processor, which provides performance that cannot be obtained with other systems. Additionally, we are still the only company shipping systems with high speed digital image storage. We have a proprietary television camera technology and, again, have applied the modular system concept which allows physicians to make investments in new technology without the fear of obsolescence.

Our integrated x-ray systems offer other benefits as well. Of course, each is incorporated with our PIPELINE processor and with state-of-the-art microprocessor-based x-ray generators. This makes us unique and, as a result, we have price/performance leadership in this market.

What does this mean in terms of financial performance? Let's take a look at the financial results for first quarter 1982, the quarter in which we introduced the product, where we had sales of 1.6 million dollars. By the fourth quarter, this had grown to 21.7 million dollars, for total sales in 1982 of 35.9 million dollars and a market leadership position by year-end.

The digital x-ray market is a new, expanding and very exciting market, so let's discuss our strategy as we face the future. We will grow in this market through the expansion of our computer image processing technology to continue to move forward. We will continue to pursue the integrated systems market. We're expanding into other world markets and, again, the acquisition of Sonotron plays an important role. We are investing in advanced digital radiography technology in the area of camera systems and image intensifiers, and we expect the investments we make in 1983 to further improve digital radiography in 1984 and 1985.

The opportunities for digital radiography are many. They include the continuation and expansion of outpatient, intravenous imaging and, recently, intra-arterial imaging--the complete replacement of conventional angiography with digital procedures and all their intended benefits. Included also is expansion into other x-ray procedures, such as GI series and chest studies. And, finally, when all x-ray procedures really become digital procedures, we see the advent of the "less film" radiology department, where images are processed by and stored in the computer and films are taken only occasionally. For all this to become a reality, substantial advancements in technology must occur. We feel it will happen by the late 1980s.

The third business of Dasonics is not only a new business, but a technology that's really in its infancy--nuclear magnetic resonance. First, what is it? Nuclear magnetic resonance utilizes magnetic fields and radiowaves to obtain cross-sectional images of the body. I'm sure many of you have read about NMR lately in the press, and it has caused much excitement. Leading radiologists and cardiologists believe that NMR will be the most important imaging modality of the late 1980s and the 1990s.



When we think about NMR systems, we think about expensive systems. High performance NMR systems will cost anywhere from one to two million dollars; so, in order for them to be a significant factor in the health care environment, they must offer clinical benefits that are not offered by other imaging modalities. When we think of other expensive systems, we think of CAT scanning, so NMR must offer clinical benefits not presently provided by CT. It's believed that NMR will provide diagnosis of disease at an earlier stage. In all other imaging modalities, including CT, disease is diagnosed by seeing geometric distortion of organs. This is very late in the disease process. Hopefully, with NMR, one will be able to see disease at the point the tissue is changing, long before geometric distortion occurs. And, of course, diagnosing disease at an early stage is what the business of diagnostic medicine is all about.

Other clinical benefits of NMR include the elimination of the invasive use of catheters and contrast injections in vascular studies, neurological imaging, and cardiac imaging. We believe the cardiac applications of NMR will be extremely important. Additionally, it is believed that NMR will image pathological conditions not easily seen by other techniques; the most spectacular to date is its ability to diagnose multiple sclerosis and dislexia.

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There are many companies in the NMR market. We see them broken into two groups. There are the companies that already have working clinical systems, such as Dasonics, Picker and Technicare. There are also the companies that have R&D efforts ongoing to enter the NMR market; they include GE, Siemens, Philips, Toshiba and Elscint.

Why do we believe Diasonics will be a success in NMR? Our partnership with the University of California, San Francisco, is one reason. The UCSF people have been developing NMR since 1975 and have made major advances. Additionally, we believe that we have pioneered superconducting magnet technology. We were the first to use superconducting magnets and high magnetic fields to do NMR imaging. The early experience UCSF obtained, coupled with the experience that we have obtained with them since August of 1981, has lead us to develop a number of unique, proprietary approaches that give us a substantial technological lead in making NMR a significant clinical system. One of these is our pulsed gradient power supply. It's responsible for the high resolution images we've obtained and for the excellent soft tissue contrast and the high throughput rate that we have achieved. We have also developed other proprietary imaging techniques to allow us to image the heart without any blurring due to motion and to image other parts of the body. Our dual computer system is devoted to the concept that high throughput will be very important in NMR imaging in order to make it an economic reality. Finally, we designed our system to be installed within the hospital environment.

The Diasonics NMR program includes thirteen successful clinical installations in 1983: eleven in North America and two in Western Europe. We are making major R&D investments to expand our existing technological lead and, when NMR really becomes a product for manufacturing in 1984, to manufacture with the kinds of margins that we are accustomed to in the high profit business that we run. We are looking forward to mid-1983 FDA approval, a key part of NMR. NMR was developed after the Medical Device Act of 1976 and, since it was not grandfathered under that act, requires FDA approval. We applied for this approval in November of 1982, and it is a 6-9 month process. Finally, we are making plans to begin our manufacturing and service scale-up of the NMR business in late 1983 and throughout 1984, when it becomes a business of substantial size.

The marketing projections for NMR are exciting. In 1982, of course, there was no NMR market. In 1983, the projection is 60 units on a worldwide basis, or approximately 75 million dollars in sales. Projections are that this market will grow to 800 instruments worldwide by 1984, or a 1.3 billion dollar market.

Having talked about the technology and the clinical aspects of Dasonics' products, let's now look at the key links in the chain of the Dasonics success formula. In order for a high growth company to obtain the profits we have and be responsive to the marketplace, Dasonics has developed a manufacturing organization that is capable of responding to the requirements of rapid new product introduction, while building in the kinds of efficiencies that are required for high growth margin products.

Our marketing/sales strategy is simply the identification of technological and clinical opportunities, and the quick response to those opportunities. We have direct sales and service in all major geographical markets. We also use dedicated sales forces for each imaging modality, because we feel that each modality is sophisticated, both technologically and clinically, and requires its own sales force.

User education is another area in which Dasonics has invested substantially. Not a week goes by without some type of Dasonics education meeting, seminar, or other type of support.

Another key factor in our marketing and sales strategy is identification with leading medical institutions. The fact that Dasonics has been successful is largely attributed to its close working relationships with many leading institutions throughout the world.

Our marketing and sales organization has grown today to a significant size and is one of the largest in the industry. At the end of 1982, we had 156 direct sales people through the world and 278 service people.

Let's now take a look at Disonics' financial performance, beginning with revenues. In 1972, our first operational year, we had revenues of 4.9 million dollars. This number grew to 138.4 million dollars in 1982, a growth rate of 255 percent over that four-year period of time. But perhaps more significantly, over the last two years, this represents a growth rate of 110 percent.

In 1979, our start up year, our income showed a loss of a half million dollars. But income grew to 12.2 million dollars in 1982, a growth rate in the last two years of 132 percent. Income is now growing faster than revenue.

In 1979, we had a loss of 3 cents in earnings per share. Our earnings per share then grew to 30 cents in 1982. Our initial investments in research of 600,000 dollars in 1979 grew to 10.0 million dollars in 1982. In addition to this is another 8 million dollars in NMR investment that was spent through our R&D partnership.

The balance sheet, which is obviously another important financial parameter, shows our working capital and stockholders' equity. Our working capital of 44 million dollars in 1982 grew by 27 million dollars over 1981. Stockholders' equity of 61 million dollars in 1982 was up by 31 million dollars from 1981.

We've looked at the past. Now, let's look at the future and see why we feel optimistic about our opportunities in the 80s. As I've mentioned, Disonics is in three medical imaging

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markets--ultrasound, digital radiography and NMR. The ultrasound market is, today, a world market of 625 million dollars, and Dasonics has 16 percent of that share. That market, by 1987, is projected to grow to 1.9 billion dollars. Today's digital radiography market is 175 million dollars. Dasonics has a 20 percent share. That market is projected to grow to 2.1 billion dollars by 1987. There was no market for NMR in 1982 and no sales. However, the NMR market is projected to grow to 1.3 billion dollars by 1987, and Dasonics is today positioned as the technological and clinical leader in that market.

In conclusion, as we look at the future, we see that Dasonics is well positioned to become a major leader in the medical imaging market.