

B I O M E D I C A L

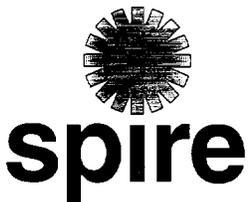
S O L A R E Q U I P M E N T

S O L A R - S Y S T E M S

O P T O E L E C T R O N I C S

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2004 ANNUAL REPORT

*Spire Corporation is a diversified technology company with product lines serving the solar energy, biomedical, telecommunications and defense industries worldwide with innovative products and services based upon a common technology platform.*

**Solar Equipment**  
for manufacturing photovoltaic modules

**Solar Systems**  
to provide point-of-use electricity

**Medical Products**  
principally for vascular access catheters

**Biomedical Services**  
improve orthopedic and other devices

**Contract Research and Development**  
to develop advanced technology for commercialization

**Compound Semiconductor Services**  
for optoelectronic devices

Roger G. Little, Chairman and CEO, during the "Escape from Alcatraz" triathlon in June 2004.



**DEAR STOCKHOLDERS, CUSTOMERS AND EMPLOYEES:**

Revenues for 2004 mark the fifth consecutive year of revenue growth for the Company. This growth is attributable to our continued innovation in the solar energy and medical product areas, and our return to compound semiconductor services.

Our revenues increased to \$17.3 million, a 9% increase from 2003 not including \$3 million and \$5 million of other income received in 2004 and 2003, respectively, for the sale of a license. Highlights for the year included gains in our solar systems, catheter products, biomedical processing services, government-funded research and development activities, and a full year of Bandwidth Semiconductor operations.

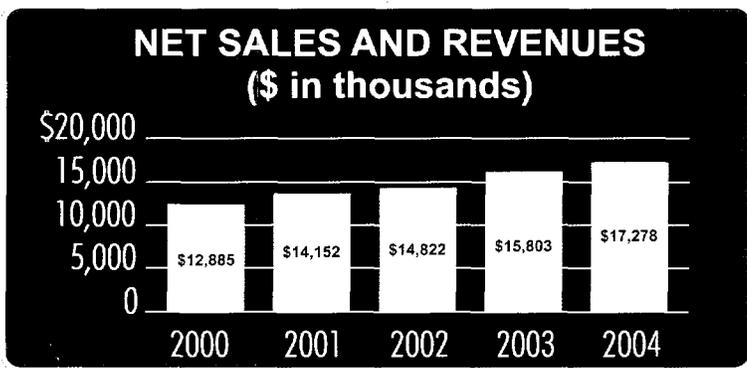
Although revenues were up, our operational costs were also higher in 2004 due to increased costs associated with sales and marketing efforts within our biomedical and solar business units, increased compliance costs and increased costs associated with our semiconductor foundry. Net loss for 2004, including the gain on the sale of a license in both 2004 and 2003, was \$4.1 million or \$0.60 per share, compared with net income of \$9,000 or \$0.00 per share for 2003. We begin 2005 with \$3.3 million in cash, total assets of \$20.1 million and no bank debt.

As oil prices remain over \$50 a barrel, there has been an increased interest in our solar equipment, especially for our turnkey photovoltaic module production lines. In biomedical, we continue to work on nano-coatings for orthopedic implants, expand our vascular product reach, and pursue surface treatments for enhanced performance in catheters. Our contract research and development (R&D) efforts are pursuing next-generation products and services within our focused markets as well as new opportunities. Bandwidth Semiconductor has continued to experience increased interest for its foundry services for defense and homeland security applications.

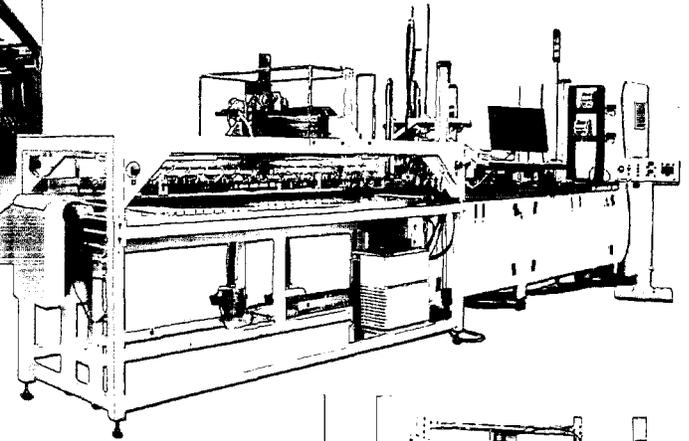
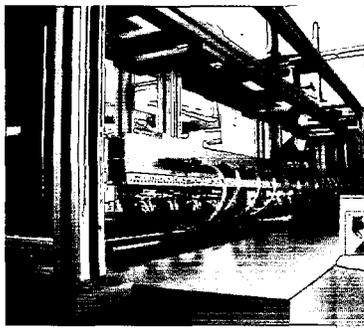
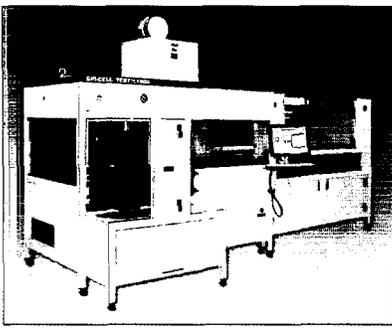
While we are encouraged with the increased interest in all of our product lines, we have not lost sight of the need to improve operations and convert our revenue gains into improved profitability.

We have many challenges ahead in 2005. However, we are encouraged by our prospects and are confident with our ability to shape our emerging technologies into commercial applications.

**SPIRE CORPORATION**



Roger G. Little  
Chairman of the Board, CEO and President

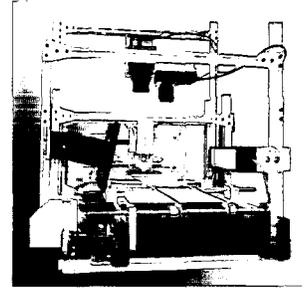


## SOLAR EQUIPMENT

Spire Solar continued advancing its module manufacturing equipment in 2004. The Company was successful in turning developments into sales to important customers, as evidenced by the delivery of a SPI-MODULE QA™ 460 fully automated module electrical test system to Evergreen Solar.

In addition, Spire Solar continued its strong commitment to our existing customers. In 2004 it delivered another SPI-ASSEMBLER™ 5000 to Shell Solar in the U.S. to support their widely publicized module production expansion efforts. It also executed a contract to provide Solaria Energia y Medio-Ambiente of Madrid, Spain, a customized SPI-LINE™ turnkey photovoltaic module production line to be delivered in early 2005, and in April 2005, announced another contract to provide Hyundai Heavy Industries Co., Ltd., of Ulsan, Korea, with a customized SPI-LINE turnkey photovoltaic module production line during the Spring of 2005.

Spire Solar is committed to its customer base, and continues to develop world class reliable equipment. Over 98% of all equipment that Spire has produced over the last 25 years is still in operation. This experience and commitment support the claim that over 80% of all modules produced in the world have been made by at least some part of Spire's equipment base. Spire continues to be the only manufacturer in the world that designs and builds all machine components of a module production line.



*Through our Department of Energy, PV Manufacturing Research and Development contract, Spire Solar successfully designed and fabricated equipment that performs sophisticated analysis on wafer and cell integrity, and a large area automated module string interconnect bussing station.*



## SPIRE SOLAR



## SOLAR SYSTEMS

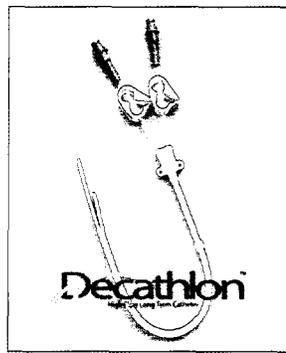
Spire Solar celebrated 2004 with the successful introduction of its own brand of BIPV (Building Integrated Photovoltaics) products. BIPV is driven by the growing demand for "green" buildings and has become one of the fastest growing and widely supported new areas of PV applications. Spire Solar's systems group provided some of the United States' most stunning BIPV systems in the City of Chicago's new Millennium Park. BIPV, designed for overhead skylighting at the Millennium Park Bike Shelter and integrated into curtain walls at the Exelon Pavilions,

has captured the attention of architects and designers worldwide.

With these systems, Spire crossed the one megawatt benchmark of installed systems. Spire Solar also expanded its activities outside of Chicago through the supply of custom BIPV modules that were installed in a new facility in Alaska, and the sale of a system in Rhode Island. Spire will continue to expand its systems business in markets like Florida and Connecticut.



Pourchez  
**retro™**  
High Flow Low Recirculation Catheter



### MEDICAL PRODUCTS

Spire medical products sales increased over 90% in 2004 as compared to 2003. Spire expanded its dialysis catheter product line with the introduction in late 2003 of its Decathlon™ catheter. It became Spire's number one selling catheter in 2004.

Spire Biomedical continued to strengthen its distribution in the U.S. The Company was also recently awarded a three-year contract with Premier Purchasing Partners, a group purchasing organization with over 1,500 affiliated hospital facilities. Spire continues to make gains in the European market through its distribution agreement with Gambro Renal Products, a leading worldwide supplier of dialysis products and services.

Spire Biomedical now offers a full range of chronic hemodialysis catheters in various configurations, materials, and methods of insertion.

### BIOMEDICAL SERVICES

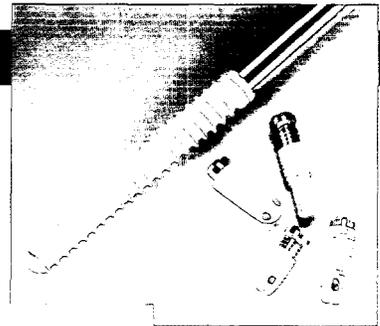
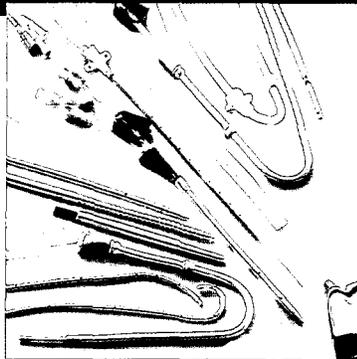
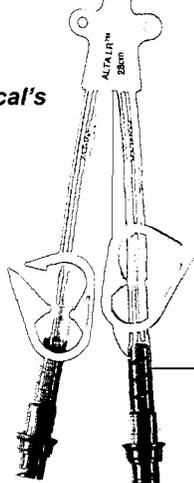
Spire's Biomedical services revenues increased in 2004 over 20% compared to 2003. This increase was driven primarily by continued strong demand for Spire's processes to improve performance of orthopedic, dental, and other medical products. The Company has been applying its IonGuard® process to orthopedic components for over 20 years. Approximately 700,000 joint replacement procedures are performed each year in the U.S., and this number is growing rapidly. Spire is continually developing new surface treatment processes to improve existing products and to address new market segments such as spinal products.

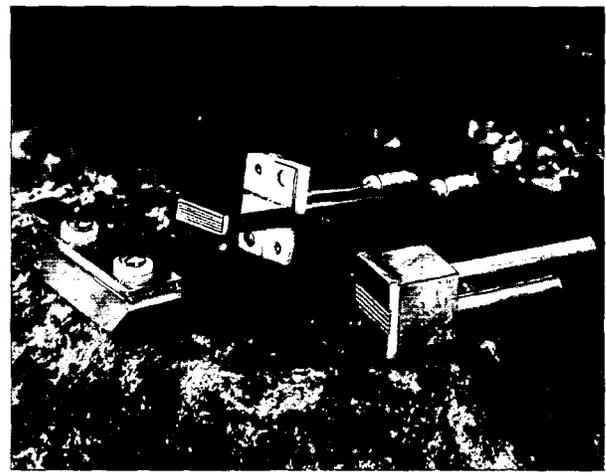
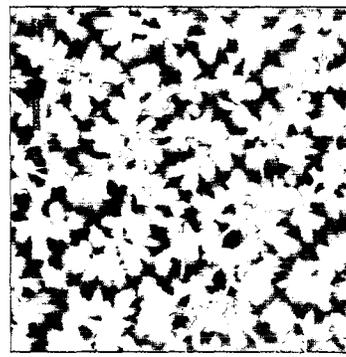
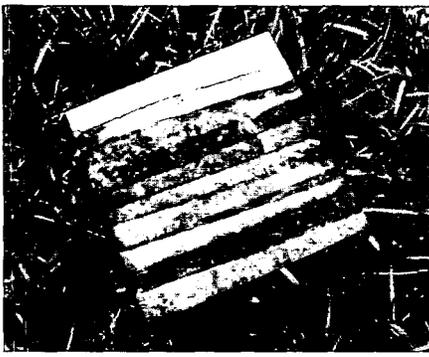
*Spire Biomedical offers premium vascular access catheters for dialysis treatment. The Company's products combine the highest level performance with increased catheter placement options.*



## SPIRE BIOMEDICAL

*The Alta LR™ fixed tip catheter is the newest addition to Spire Biomedical's line of hemodialysis catheters.*





## CONTRACT RESEARCH AND DEVELOPMENT

In 2004, Spire was awarded a number of new grants and contracts from various Federal agencies. The majority of Spire's programs are funded through the Federal Small Business Innovation Research (SBIR) initiative. For more than two decades, the SBIR programs have enabled Spire to conduct cutting-edge research to develop products and services in support of its semiconductor, biomedical, and photovoltaic business lines. Some of the potential products that are being investigated or developed under the 2004 government-funded R&D efforts are:

- Terahertz imaging systems for security screening and medical diagnostics applications
- Helmet-mounted non-invasive cerebral oxygen monitors for astronauts
- Hydroxyapatite coatings for improved fixation of dental implants
- Blood-compatible dialysis catheters
- Nano-structured scaffolds for neural electrodes
- Advanced photodiodes and solar cells

**Photos:**

*Top left - Camouflage solar cells*

*Top center - Porous silicon scaffold*

*Top right - Advanced diode lasers*

In 2004, we also successfully leveraged our expertise and assets to secure new R&D funds from commercial sources. These efforts included providing expertise in the areas of:

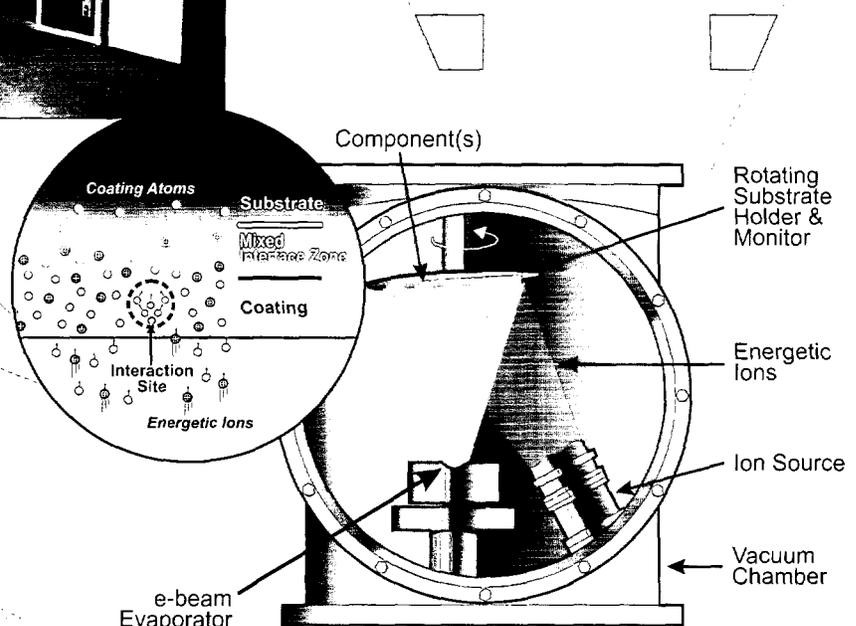
- Hard coatings for orthopedic implants
- Osseointegrative coatings for dental implants
- Dielectric coatings for surgical instruments
- Radiopaque coatings for medical devices
- Electrically-conductive coatings on advanced polymer-based medical devices
- Advanced catalytic coatings for fuel cells
- Anti-microbial coating development for vascular grafts

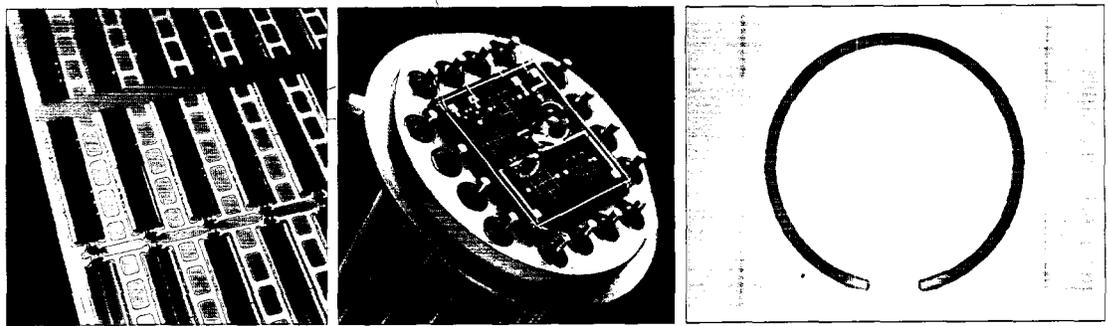


**SPIRE R&D**

Over the course of 35 years, Spire has created a valuable intellectual property portfolio with expertise in biomaterials surface engineering, optoelectronics and photovoltaics. These assets are represented by more than 40 patents, a skilled technical staff, and state-of-the-art R&D and manufacturing facilities. A broad range of thin film semiconductor fabrication and modification techniques, including ion implantation, ion beam assisted deposition, and metalorganic chemical vapor deposition (MOCVD), are the core of Spire's technology base.

**Advanced metal and ceramic coatings using ion-beam assisted deposition (IBAD)**





## COMPOUND SEMICONDUCTOR SERVICES

*Bandwidth maintains its leadership position through its advanced technology including three dedicated MOCVD reactors and ultra-clean laboratories, as well as fast turnaround service and strict quality controls. Bandwidth will continue to expand its core defense and telecommunications business while providing key building blocks for optoelectronic devices to support Spire's biomedical instruments activities.*

Bandwidth Semiconductor, LLC ("Bandwidth") develops and makes compound semiconductor wafers and components for the defense, consumer products, biomedical and telecommunications markets. These specialized wafers, which are at the heart of almost all optoelectronic systems are extremely efficient at generating light from electricity and converting light back into electricity. They are widely used for data transmission, satellite power, optical amplifiers, medical x-ray detection, and materials processing applications.

As the optoelectronics business unit of Spire Corporation, Bandwidth has a 20-year history of innovation in the development of metalorganic chemical vapor deposition reactor capabilities and deposition processes used for the epitaxial growth of thin films. In these processes, atomic layers are deposited on a variety of substrates with their thickness and chemical composition precisely controlled to create epitaxial wafers with desired electronic properties. The principal wafer growth substrates are III-V materials such as gallium arsenide and indium phosphide as well as silicon.

Bandwidth's activities focus on three primary areas: MOCVD wafers, device foundry services, and thin-film hybrid circuits. In its role as wafer foundry, Bandwidth purchases substrates, grows the epitaxial layers which define the basic device structure, and provides the wafers to device manufacturers for fabrication, test and marketing. Bandwidth engineers design the process steps and conditions to meet desired optoelectronic characteristics, saving customers development time and the expense of maintaining a dedicated internal fabrication line. Bandwidth's thin film area offers customers an extensive array of custom hybrid circuit and resistors.

Bandwidth operates out of a state-of-the-art semiconductor fabrication facility in Hudson, New Hampshire equipped with advanced MOCVD and fabrication equipment. The foundry is housed in a 90,000 sq. ft. building with Class 100/1000 cleanrooms. It can make large production volumes of wafers and devices on an original equipment manufacture basis, as well as support customer research and development programs including Spire's own contract R&D product line.

**BANDWIDTH**



# CORPORATE INFORMATION

## EXECUTIVE OFFICERS

**Stephen J. Hogan**  
Executive Vice President and General Manager,  
Spire Solar

**Rodger W. LaFavre**  
Chief Operating Officer

**Mark C. Little**  
Chief Executive Officer, Spire Biomedical

**Roger G. Little**  
Chairman of the Board, CEO and President

**James F. Parslow, CPA**  
Chief Financial Officer

**Gregory G. Towle**  
Financial Controller and Treasurer

## BOARD OF DIRECTORS

**Udo Henseler, Ph.D., CPA**  
CEO and Chairman  
eGene, Inc.  
(biotechnology company)

**David R. Lipinski, CFA**  
Assistant Vice President  
Business Development Group  
Fifth Third Bank  
(banking firm)

**Mark C. Little**  
Chief Executive Officer, Spire Biomedical  
Spire Corporation

**Roger G. Little**  
Chairman of the Board, CEO and President  
Spire Corporation

**Michael J. Magliochetti, Ph.D.**  
President, CEO and Director  
Rehab Medical Holdings, Inc.  
(company focused in orthopedics  
and related business)

**Guy L. Mayer**  
CEO and Director  
Tutogen Medical, Inc.  
(manufacturer of sterile biological  
implant products)

**Roger W. Redmond, CFA**  
Partner and Chief Investment Officer  
Stillwater Investment Management, LLC  
(independent, registered investment  
advisory company)

**INDEPENDENT REGISTERED  
PUBLIC ACCOUNTING FIRM**  
Vitale, Caturano & Company, Ltd.  
Boston, MA

**LEGAL COUNSEL**  
Greenberg Traurig, LLP  
Boston, MA

**TRANSFER AGENT  
AND REGISTRAR**  
American Stock Transfer & Trust Co.  
New York, NY

## STOCK EXCHANGE INFORMATION

The Company's Common Stock is traded on the Nasdaq National Market under the symbol "SPIR". On March 1, 2005, the Common Stock was held by approximately 211 persons or entities of record, including significant amounts of stock held in "street name". The Company did not pay any cash dividends during 2004 and currently does not intend to pay dividends in the foreseeable future so that it may reinvest its earnings in the development of its business.

## ANNUAL MEETING

The Annual Meeting of Stockholders is scheduled to be held at 10:00 a.m. on Tuesday, May 17, 2005 at Spire Corporation, One Patriots Park, Bedford, Massachusetts.

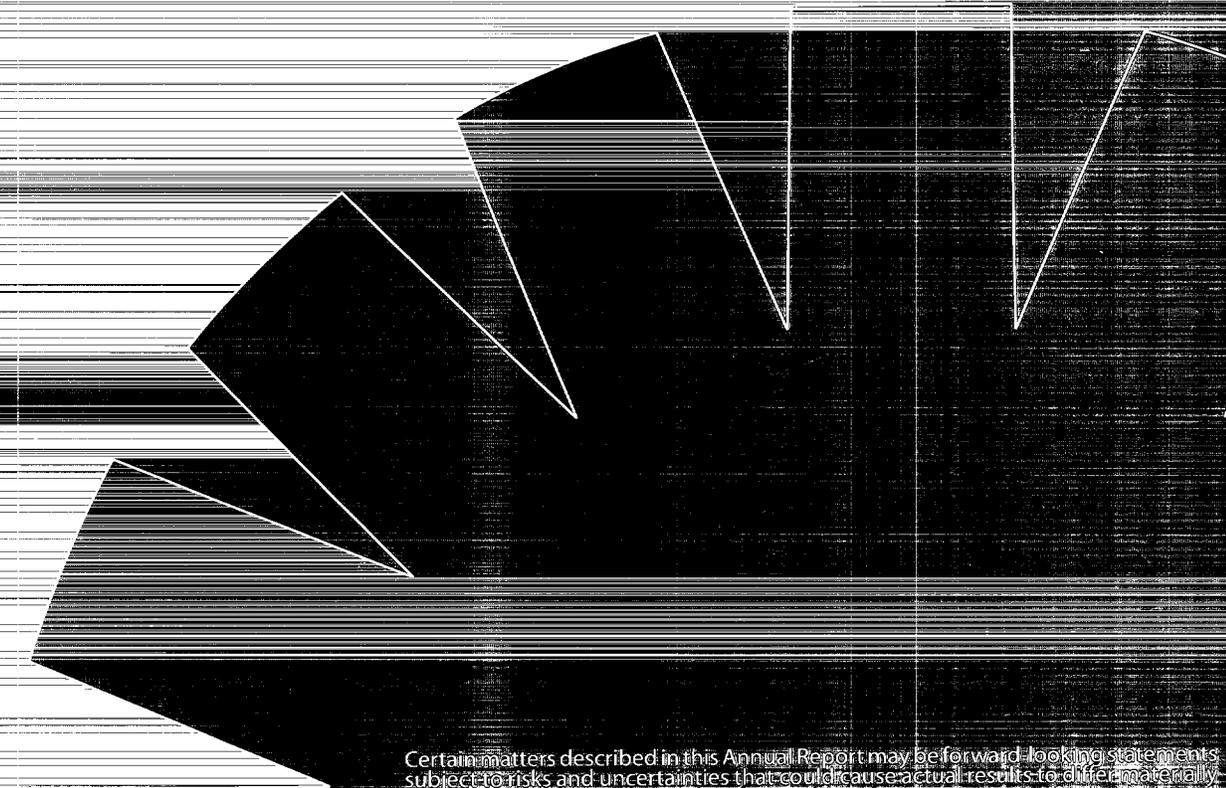
## INVESTOR RELATIONS

For further information about the Company or additional copies of this Annual Report, Form 10-KSB or other information, visit the Company's website at [www.spirecorp.com](http://www.spirecorp.com). The Company will provide to any person without charge, upon written request, a copy of the Form 10-KSB. Any person wishing a copy should write to Spire Corporation, Investor Relations, One Patriots Park, Bedford, Massachusetts 01730-2396.

## FINANCIAL HIGHLIGHTS

Years ended December 31	2004	2003	2002	2001	2000
	(in thousands, except per share amounts)				
<b>Consolidated Statements of Operations:</b>					
Net sales and revenues	\$ 17,278	\$ 15,803	\$ 14,822	\$ 14,152	\$ 12,885
Gain on sale of a license	3,000	4,989	4,465	—	—
Earnings (loss) before income taxes	(4,120)	42	2,569	(2,176)	(1,398)
Income tax expense (benefit)	—	33	332	(13)	(598)
Net income (loss)	(4,120)	9	2,237	(2,163)	(800)
Earnings (loss) per share of common stock - basic	\$ (0.60)	\$ 0.00	\$ 0.33	\$ (0.32)	\$ (0.12)
Earnings (loss) per share of common stock - diluted	(0.60)	0.00	0.33	(0.32)	(0.12)
Weighted average number of common and common equivalent shares outstanding - basic	6,809	6,764	6,750	6,695	6,629
Weighted average number of common and common equivalent shares outstanding - diluted	6,809	6,870	6,842	6,695	6,629
<b>Consolidated Balance Sheets:</b>					
Working capital	\$ 3,996	\$ 8,182	\$ 10,524	\$ 6,759	\$ 9,024
Cash and cash equivalents	3,337	5,999	7,799	5,583	7,463
Total assets	20,105	22,792	17,772	14,815	16,442
Stockholders' equity	7,892	11,796	11,775	9,268	11,331

The Company's Form 10-KSB for the year ended December 31, 2004, filed with the Securities and Exchange Commission, contains an audited consolidated balance sheet of Spire Corporation and subsidiaries as of December 31, 2004 and the related consolidated statements of operations, stockholders' equity and cash flows for each of the years in the two-year period ended December 31, 2004.



Certain matters described in this Annual Report may be forward-looking statements subject to risks and uncertainties that could cause actual results to differ materially from those indicated in the forward-looking statements. Such risks and uncertainties include, but are not limited to, the risk of dependence on market growth, competition and dependence on government agencies and other third parties for funding contract research and services, as well as other factors described in the Company's Form 10-KSB filed with the Securities and Exchange Commission.