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INTRODUCTION

New Hampshire's economy is built on a long history of innovation and independent thinking. Settled in the early 1600's, New Hampshire was the first state to declare its independence from England and the first state to elect a woman to public office. The "Live Free or Die" state is known for its spirit of self-reliance, "Yankee ingenuity" and superior quality of life.

Strategically located near major urban centers, New Hampshire faces the challenge of retaining its rural charm while diversifying its economy to meet the needs of the 21st century. With sponsorship from the State of New Hampshire's Department of Resources and Economic Development, this feasibility study charts a path for New Hampshire's commercialization of science and technology based innovations in biotech, biomedical, environmental and life sciences through business incubation. The study proposes a development strategy based on leveraging the significant intellectual capital available in the state, with a goal of creating clean industries and livable wage jobs.

The following strategies and recommendations build on the region's assets, or comparative advantages, by suggesting innovative ways to turn science and engineering "know how" into products and services, as well as commercializing technology in both existing and new start up companies.

The vision is to build on the state's existing base as a center for medical research, environmental technologies, and telecommunications. This initiative is designed to serve as a blue print for improved infrastructure in biomedical and environmental entrepreneurship and the creation of new research based innovations that will also improve the health and well being of the citizens of New Hampshire.

OBJECTIVE

The objective of this feasibility study is to determine if New Hampshire can support the development of self-sustaining technology business incubator facilities focused on biotechnology and biomedical entrepreneurship[1]. The goal of such programs would be to develop and commercialize new products and services for improved healthcare, bring greater relevance to the state's academic institutions, better leverage the State's significant R&D resources and existing infrastructure, generate wealth, and ultimately create a higher tax base throughout the region. These programs would enhance New Hampshire's competitive edge and further diversify its industrial base in an increasingly competitive global economy.

Business incubation programs catalyze the process of starting and growing companies by providing entrepreneurs with management expertise, networks and access to seed capital. Technology incubators provide the physical infrastructure necessary to launch new businesses, offering furnished offices and lab space, and shared resources such as specialized equipment and support services.

[1] Definition: The term "biomedical" includes the broad areas of health and medical care, and a diverse range of biotechnology and medical technology. While based primarily on the life sciences, important interdependencies exist in the broad biomedical arena with the physical sciences and related technologies. Biotechnology, a component of the broader concept of "biomedical," has been defined by the Federal Office of Technology Assessment as "those techniques that use live organisms (or parts of organisms) to modify products, to improve plants or animals, or develop micro organisms for specific uses." The term "Medical Technology" encompasses many other diverse areas of science and technology, including computer science Informatics, software, fiber optics, materials science, specialized electronics related to health care. The goal of biotechnology and medical technology is to produce new or improved medical devices and processes, human therapeutics and diagnostics, innovative health care, improved crops and livestock, and advanced drugs and food processing techniques.

CONCLUSIONS

This study found clear and compelling evidence of demand and community support for high-technology incubator programs in New Hampshire. Based on National Business Incubator Association best practices criteria for technology incubator development, the study found that the Upper Valley, and the Seacoast Region are the two most promising locations for biomedical/life science focused technology incubators. The Upper Valley, with Dartmouth College as a sponsor, is well positioned to begin immediately on the development of a business incubator facility. The Seacoast region, with two strong sponsors – The University of New Hampshire (UNH) and the New Hampshire Community Technical College (NHCTC), requires further planning. The study found that both locations would benefit greatly by coordinating closely with the NHCTC as a partner in workforce development and business incubation.

In assessing the opportunities and risks associated with the development of a biotechnology or more broadly focused biomedical business incubator program, this study assessed the demand for, and viability of biotechnology focused incubator vs. mixed use technology incubators. Both Dartmouth College and UNH have a proven track record for innovation and the requisite knowledge base, and community support necessary to successfully implement high-technology business incubation programs.

It was determined that technology Incubator programs would be compatible with Dartmouth College, UNH, NHCTC, and the surrounding community's overall culture and vision. We found many examples of academic entrepreneurship, identified prospective clients, and documented companies that would have benefited had technology incubators been in place.

The study found that most of the necessary components for successful technology commercialization already exist within these institutions, but are not directly focused on the economic development/ entrepreneurial mission of a technology incubator. The majority of those surveyed believed that it was premature to limit the scope of the proposed technology incubation facilities to only biotechnology and biomedical technologies.

The study found that this initiative would require a further coalescing of Federal, state and community resources and the further development of a shared vision by community leaders in both communities and around the state. This study provides an assessment of the presence and relative strengths of the required resources, as well as recommendations for action and strategies for implementation. This includes a concrete action plan for the real estate component with recommendations for developing the proposed incubator facilities and partnerships.

FEASIBILITY STUDY METHODOLOGY

Rainey & Associates was retained by the Grafton County Economic Development Council to assess the potential for high technology business incubator development and to develop a concrete set of recommendations. A multi-task study was undertaken that included testing community reaction, identifying New Hampshire's core competencies, and studying the state's economy. The study benchmarked best practices in biomedical technology incubation in comparable regions, developed real estate recommendations and provided a funding strategy.

This effort sought the active participation of key economic and technology development officials, higher education partners, non-profit organizations, private sector innovators and business people. A Feasibility Advisory Committee provided critical input throughout the assessment process.

Feasibility Study Advisory Committee

Roy Duddy,NH Department of Resources and Economic Development

Steve Epstein, Grafton County Economic Development Council

Gregg Fairbrothers, Dartmouth Entrepreneurial Network

Warren Lackstrom, The Hamel Center for the Management of Technology & Innovation, UNH

This study attempted to make all aspects of the decision making process as explicit as possible, and was systematic in its approach. A feasibility study asks many fundamental questions such as: who supports the initiative, what is the motivation – is there a demonstrated need, and can a compelling argument be made for funding the real estate costs? One of the fundamental questions is whether the proposed centers can sustain themselves after becoming operational.

It is imperative to understand the organizational culture of the institutions being studied and to test the overall climate for technology commercialization. Would a program to foster entrepreneurship and greater "relevance" from a commercial standpoint be consistent with the values and culture at Dartmouth College, UNH and NHCTC? What unique problems would technology business incubators solve? Who will serve as the "champion"? Do these individuals have the credibility and influence to insure success? Does the champion have the necessary background? To what degree are these institutions and communities willing to invest resources into this initiative?

The study began by defining the community assets required for successful technology business incubation. Once it was established that a region met the basic criteria for successful technology incubator development, the study examined the extent and degree of that community's support for the proposed initiative and overall business environment. Examples of successful Biotechnology/Biomedical incubators were provided to serve as possible prototypes for a New Hampshire program.

Statistics show that incubator developments are growing at the rate of two per week worldwide and one per week in North America. Funding constraints and limited state resources make it essential that a business and technology incubation strategy be formulated to provide the business principles and criteria to guide the direction and establishment of technology incubators in New Hampshire.

SELECTION CRITERIA

In recent years there have been numerous initiatives to stimulate community economic development by establishing infrastructure such as industrial parks and mixed-use business incubators across New Hampshire. Technology incubators require a strong support network to be successful.

In 1997 the Southern Technology Application Center (STAC) published a report called A Study of Business Incubators: Models, Best Practices, and Recommendations for NASA and Florida. The study involved assembling information that could explain why technology incubators succeed, fail, how they are organized and what services they provide. Recommendations reflect the essential characteristics of successful incubators.The New Hampshire Biotechnnology Incubator Feasibility Study followed these same criteria, but with a specific focus on biotechnology/biomedical. Because bioscience business development is capital intensive, an additional requirement of demonstrated access to seed and venture capital was also added. The search for an ideal location for lauching biosciences oriented facilities evaluated communities based on eight main categories:

1. Access to business support services
2. High tech R&D base
3. High tech business base
4. High tech manufacturing base
5. Access to University and/or Federal laboratory technology
6. Community College/workforce development programs
7. Demonstrated access to seed/venture capital
8. Community “champions” with a strong mandate to carry out development

Using the established criteria, both the communities of the Upper Valley and Seacost region rated high as potential locations for high technology business incubation programs in New Hampshire.

It is the recommendation of this study that the State of New Hampshire adopt the above guidelines for assessing communities seeking future funding for high technology incubator development. High technology-themed business incubators developed in regions with insufficent existing infrastructure are likely to fail.

It is also recommended that the proposed incubators be linked with regions of the state that are more manufacturing orriented, so that workforce development initiatives can be established that anticipate the needs of graduating Upper Valley and Seacoast companies looking for manufacturing infrastructure. In this way, this initiative will benefit other regions of the state.

NEW HAMPSHIRE TECHNOLOGY INCUBATORS

BUSINESS INCUBATOR CONCEPT

In the late seventies and through the nineties corporate restructuring, layoffs, mergers and stock devaluation created conditions conducive to small business entrepreneurship. The eighties and nineties saw an explosion of small business in America. Small companies have been the primary source of the net new jobs in the United States over the past decade, and the "drivers" of the new economy. According to the North Carolina Small Business and Technology Development Center, in an era of corporate down-sizing, small business has grown in importance as an engine for economic growth. America's small businesses employ about 54% of the private workforce, contribute 47% of all sales in the United States, create two out of every three new jobs, and produce two-and-one-half times as many innovations per employee as large firms.

The development of a business incubator involves numerous stakeholders that have an interest in the success of the initiative. Stakeholders are client companies, incubator staff and board of directors, government sponsors and private investors, and the service providers in the community. In addition, incubators create new business opportunities for real estate developers and land owners as "graduating" companies move into their own facilities. Local suppliers and service providers benefit from incubator successes, as does the community at large. Business incubators are a self-sustaining source of jobs and economic activity as companies emerge as stand-alone, self sustaining corporate entities.

New high-technology firms are unstable and traditionally have a high failure rate. The challenge is to identify the ventures with the greatest potential and provide the assistance required for them to achieve their full potential. [2]

Perhaps the most crucial element in the development of business incubators is the identification and commitment of sponsors such as universities, economic development agencies, community organizations, utilities, governmental units and established companies. These sponsors do not necessarily have to make a financial contribution, but may act as advocates for the incubator to help persuade or lobby other organizations to contribute.

ROLE AND IMPORTANCE OF THE INCUBATOR

Business incubators are defined as facilities whose purpose is to promote the growth and development of new companies by providing flexible space at affordable rates, a variety of support services, access to management, technical and financial assistance and opportunities to interact with other entrepreneurs and business experts. The main goal of an incubation program is to produce successful graduates—financially viable client businesses that graduate and become independent.

New Hampshire is a state rich in intellectual capital due to the diversity of programs at UNH, Dartmouth College, and the extensive state community college system. Research at UNH and Dartmouth College has resulted in an abundance of technology that can be licensed by private entrepreneurs. In addition, new business startups unrelated to the university are drawn to New Hampshire due to the superior quality of life and relative low cost of doing business. Until recently, much of New Hampshire's available "intellectual capital" or either remained un-commercialized or left the state to be developed elsewhere.

[2] Source: Mark Rice and Dana Matthews, "Growing New Ventures, Creating New Jobs."

The work being carried out by the Dartmouth Entrepreneurial Network, a technology oriented business assistance organization which functions as an "incubator without walls", and the state's Small Business Development Center network, and NHCTC has proven the need for technology-related business support. New Hampshire needs to create the infrastructure necessary to nurture the kinds of technology business startups that fuel high quality job creation and high value-added product development.

Business incubators have become crucial to the success of fledgling companies. Many science and technology based entrepreneurs have little experience in managing and growing small enterprises. Engineers and scientists may have an idea or technology that can be potentially marketed as a product or service. However, in most cases, they lack the captial, business skills, and experience needed to commercialize their products. The critical success factors involve:

- Management and human resource issues
- Access to capital
- Product development and marketing

In effect, the business risk for any start-up is compounded by the risk inherent in new technology. Significant expertise and experience is needed to surmount these obstacles.[3] This is where the crucial role of the technology-focused incubator becomes apparent.

Findings from the study *Business Incubation Work*[4], document the following:

- 87% of firms studied that graduated from an incubator remain in business.
- 84% of firms studied that graduated from an incubator remain in their community.
- On average, firms that graduated from an incubator returned $4.96 for each $1.00 of public subsidy.
- In 1996, incubator firms on average created 468 direct jobs and 702 total jobs.

[3] Louis Tomatzky, Yolanda Bates, Nancy McCrea, Marsh Lewis and Louisa Quittman: "The Art and Craft of Technology Business Incubation: Best Practices, Strategies and Tools from 50 Programs".

[4] The study, published in August 1997, was conducted in partnership with the University of Michigan, Ohio University, National Business Incubation Association, and the Southern Technology Council to research the impact of incubators.

BIOTECHNOLOGY / BIOMEDICAL INCUBATORS: EXAMPLES OF SUCCESS

In July of 1995, Alachua County launched the Sid Martin Biotechnology Development Institute (BDI) with the goal of commercializing University of Florida biotechnology research into healthy, viable businesses that could grown and create local jobs. Despite its position as one of the top ten research funded public universities in the country, the intellectual capital generated at the University of Florida (UF) was historically an underutilized asset. Prior to the development of the BDI, few resources existed to help local entrepreneurs turn UF technology into real-world products.

Funds were raised through the university and U.S. Department of Agriculture to build and equip a 40,000 square foot facility. Project planners expected to rent half the leasable space within two years. The lease up exceeded their expectations. This business incubation program has created over 400 high-income jobs, and has attracted approximately $40,000,000 in private investment and grant funding. Now at full capacity, BDI is developing a second building with additional laboratory and office space to meet demands. Consequently, the BDI has led to the development of a high-paying biotechnology industry in Alachua County where over 70 percent of the county's private employment is in retail and services, two of the lowest paying employment sectors. The success of the Sid Martin Biotechnology Development Institute (BDI) is an example of success that points to what could be accomplished in New Hampshire.

In 1998 the University of Missouri, St. Louis University and Washington University developed the St. Louis Center for Emerging Technologies. This initial 42,000 square foot biomedical oriented incubator program has operated at full capacity since its inception, and underwent a 50,000 square foot addition last year after opening its doors less than five years ago. Of the 12 client companies, there are over 40 contacts or relationships with faculty at Washington University. Student interns are also used on an extensively to support incubator staff and client companies. The average wage of client companies is $60,000 for each new job, and they have created over 120 to date.

While 80% of the Center for Emerging Technologies clients are biotech/biomedical, the center opted not to limit its selection of clients to biotechnology. They provide wet lab space and specialized equipment, but also provide office space to promising technology focused businesses in software develop, for example.

CONCEPT HISTORY

Plans for a technology business incubator were first presented in a study done for UNH by Hammer, Siler, George Associates in September 1995. The study found that a technology incubator at the UNH Durham campus was feasible. However, this project was never carried out. A brief concept assessment commissioned by the New Hampshire Biotechnology Council in 2001 recommended that a full incubator feasibility study be conducted. The findings from the initial study suggested that the seacoast region and the Upper Valley, New Hampshire had many of the necessary "ingredients" for successful technology incubation development. The New Hampshire Department of Resources and Economic Development funded the current statewide feasibility study in January 2002.

TESTING COMMUNITY REACTION

SEEKING COMMUNITY CONSENSUS

This study began by interviewing the individuals serving on the Feasibility Study Task Force. This task force is comprised of four representatives: Roy Duddy, representing state government, Steve Epstein representing a regional economic development organization, Gregg Fairbrothers from Dartmouth College and Warren Lackstrom from UNH. Task Force members were asked to prepare a list of leaders in the community to interview (either directly or through a survey instrument) who have the potential to become stakeholders in the proposed incubator initiatives.

In developing a business incubation program, it is critical to assess community reaction, both positive and negative, and to form a consensus for the project at the outset. Throughout this process we identify the constraints and opportunities that surround the proposed initiative.

Because many prospective stakeholders have no prior knowledge of business incubation, this stage of the study includes a substantial community education component. This feasibility process is designed to forge consensus among key civic/academic leaders and organizations regarding the definition of the type of incubator that could best serve New Hampshire's needs and to identify the appropriate stakeholders for the program. The process itself was used as catalyst to motivate participation and mobilize resources related to facilities, equipment, human resources, and potential future funding.

Rainey & Associates tested community reaction for the proposed business incubation program through interviews, surveys and meetings with key business, academic and civic leaders around the state. Due to the short timeline for completion, telephone interviews were used in addition to face-to-face meetings with potential stakeholders. A focus group meeting was held on January 30, 2002 at the University of New Hampshire at the College of Physical Sciences. Dean Arthur Greenberg chaired the meeting. Gregg Fairbrothers chaired a meeting of Dartmouth College stakeholders held on February 1, 2002. On February 14, 2002 a meeting was held with officials from state and federal agencies to discuss funding strategies for incubator facilities. On February 28, 2002 a meeting was held with John O'Donnell, Commissioner, NHCTC System, and key members of his staff to discuss coordination and cooperation with their biotechnology workforce training initiatives.

Developing a shared vision is of utmost importance. In 1992 the City of St. Louis commissioned a feasibility study for a proposed St. Louis Biomedical Technopolis. This initiative was intended to lead to the development of a urban science park in partnership with Washington University's School of Medicine.

The St. Louis Post Dispatch later called this "a first-rate plan with second-rate implementation." Why did initial plans fail? The feasibility study demonstrated a strong need, however there was no consensus, no shared vision, and no one "champion." There were misunderstandings about the overall goals, direction to be taken, and location. There were many opinions on how a program would operate, but no single strong leader or champion emerged to build a consensus. Despite many good intentions, worthy goals and a comprehensive study, meetings of the group resulted in paralysis and frustration because no one viewpoint could command majority support. The potential stakeholders had no sense of direction and gradually lost interest. An incubator development must have a strong, committed champion to succeed. This should be a highly credible, influential person in the community who accepts responsibility, forms a consensus, develops a vision, and who is willing to work hard to do the detail work. The program must also have sponsors; a group with credibility that can drive the project and who have the authority to move the project forward.

Contact List

In keeping with the state's long valued approach to collective decision-making, Rainey & Associates solicited input from 126 individuals in order to assess community reaction to this initiative.

Bethlehem
Mike King, *North Country Council, Inc*.
Jeffery Hayes, *North Country Council, Inc.*

Hanover
Clint Bean, *Chamber of Commerce*
Julia Griffin, *Town Manager*

Lebanon
James McSweeney, *Town Manager*
Ken Niemczyk, *City Planner*
Caleb Wolfe, *State Office of Employment Security*

Berlin
Dennis Cote, *BEDCO*

Littleton
Don Jutton, *Town Manager*

N. Conway
Jac Cutty, *Mt. Washington Economic Development*

Dover
Beth Thompson, *Economic Development Office*
Richard Jones, *Community Development Coordinator*

Durham
Todd, Selig, *Town Manager*

Rochester
Kenneth Ortman, *Economic Development*
Bill Andreas, *Economic Development*

Manchester
Jay Taylor, *Economic Development*
Julie Gufstavson, *Amoskeag Small Business Incubator*
George Kurzon, *New Hampshire Biotechnology Council*

Claremont
Robert Weaver, *Economic Development*
Jill Michaels, *Claremont Industrial Park*

Portsmouth
Ron Fitz, *Portsmouth Chamber of Commerce*
Past Chairman, ecoast Technology Roundtable

Regional/Statewide Resources
Steve Epstein,
Grafton County Economic Development Council
Gene Talsky,
Grafton County Economic Development Council
Richard Green,
Grafton County Economic Development Council
Pamela Woodman,
Strafford Economic Development Corporation
Dennis McCann,
Strafford Economic Development Corporation
Jessica Hejtmanek,
S*trafford Regional Planning Commission*
David Mullen, *Pease Development Authority*
Karen Wyman, *Office of International Commerce*
Lulu Pickering, *New Hampshire Biotechnology Council*
Mary Collins, NH *Small Business Development Centers*
Marie Cappello, *Rockingham Economic Development*
Paula Newton, *Dept of Resources and Econ Development*
Bob Ebberson, *Manchester Office, SBDC*
Paul Boucher, *Greater Lebanon Chamber of Commerce*
James Saudade, *Green Mountain Econ. Development*
Patricia Powden, *Springfield Economic Development*
Janice St. Onge, *State of Vermont*

State Government Resources
Stuart Arnett, D*epartment of Resources and Economic Development*
Roy Duddy, *Dept of Resources and Economic Development*
Jeffrey Sohl, *Governor's Advisory Committee on Capital*
Jeffrey Taylor, *Office of State Planning*
Jack Donovan, *NH Business Finance Authority*
Michael Donahue, *New Hampshire Business Finance Authority*
John Duclos, *Office of Business and Industrial Development, Division of Economic Development*
Philip Waterman, *Community Development Finance Authority*
Patricia Garvin, *Office of State Planning*
Robert Nichols, C*ommunity Development Finance Authority*

Dartmouth College
John Baldwin, MD, *Dartmouth Medical School*
John Kavanagh, *Grants & Contracts*
Adam Keller, *Dartmouth Medical School*
Mary Lou Guerinot, *Associate Provost*
Paul Danos, *Tuck School of Business Administration*
James Danko, *Tuck School of Business Administration*
Gregg Fairbrothers, *Dartmouth Entrepreneurial Network*
Robert Haynes, *Dartmouth Alumni Association*
Paul Olsen, *Dartmouth Real Estate*
William Cote, *Corporate Relations*
David Nicol, *Depart of Computer Science*
Dr. Bruce Donald, *Department of Computer Science*
Peter Glenshaw, *Office of Development, Ventures*
Dr. Bruce Donald, *Computer Science Department*

University of New Hampshire, Durham
Joan Leitzel, *President*
Warren Lackstrom, *Hamel Center for the Management of Technology& Innovation*
Jeffrey Sohl, *Center for Venture Studies*
Steven Bolander,
Whittemore School of Business and Economics
William Gilbert, *Hubbard Center for Genome Studies*
Donald Sundberg, *Research and Public Service*
Henry Mullaney, *NH Industrial Research Center*
Arthur Greenberg,
College of Engineering and Physical Science (CEPS)
Robert Dalton,
Office of Intellectual Property Management
William Gilbert, *Hubbard Center for Genome Studies*
Ihab Farag, *Chemical Engineering*
Vernon Reinhart, *NIS Sponsored Research*
William Trumble, *Associate Dean, Research (COLSA)*
Ross Gittell, *Associate Professor, Management*
Andrew Rosenberg, *College of Life Sciences and Agriculture*
Candace Corvey, *VP Finance and Administration*

New Hampshire Community Technical College
John O'Donnell, *Commissioner*
Catherine Smith, *President, Manchester Campus*
George Futch, *Training and Business Development*
Sonia Wallman, *Center for Biotechnology Education*
Valerie Mahar, *Government and Public Relations*

Seed/Venture Capital Resources
Phil Ferneau, *Borealis Ventures*
Brian Clevinger, *Prolog Ventures, St. Louis, Missouri*
Gordon Baty, *Zero Stage Capital Capital, Boston*

Federal Resources
Senator Judd Gregg
Richard Lougee, *Senator Gregg, Manchester Office*
John Cavanaugh, *Senator Gregg, Portsmouth Office*
Rita Potter, *US Department of Commerce, EDA*
Robert McCarthy, *US Department of Agriculture*
Bob Dalton, Ian Rutherford
Center for Technology Commercialization
James P. Dunn, *Center for Technology Commercialization*
Tom Kennedy, *Public Safety Technology Center*

New Hampshire Incubators
Julie Gustafson, *Amoskeag Small Business Incubator*
Jac Cutty, *Mt. Washington Economic Development*

Industry Peers –
National Business Incubation Resources
Dianh Atkins, *National Business Incubation Association*
Patty Breedlove, *Sid Martin Biotechnology Incubator*
Dr. John Evans, *University of Vermont*
Bill Simon, C*enter for Emerging Technologies*
Tom O'Neal, *University of Central Florida, Orlando*
Kevin O'Sullivan, *Massachusetts Biomedical Initiative*

Real Estate Professionals/ Architect/Construction
Paul Olsen, *Dartmouth Real Estate*
Allan Braun, *Jr. Assistant VP, Facilities, UNH*
Laurence Ufford, *Trumbull-Nelson Construction*
Steve Usle, *Trumbull-Nelson Construction*
Dan Bauer, VP, *Trumbull- Nelson Construction*
Robert Haynes, Jr., *RE Haynes Co.*
Frank J. Barrett, Jr. *Architect*
Wayne Bonhag, *Mechanical, Engineering*

Private High Technology Firms
Stephen Norton, *Owl Separation Systems*
Dr. Robert Kline, *Creare, Inc.*
Peter Gariepy, *Stryker Biotech*
Francis X. Smith, *Bio-Concepts Labs*
Lulu Pickering, *Informagen, Inc*
Dr. William Gilbert, *Informagen, Inc.*
Ron Midgett, *Lonza Biologics, Inc.*
Dr. Subbiah, *Fluent Inc.*
Dr. Ty Lanahan, *Lanahan Labs*
Robert Dean, *Synergy Innovations*
Skip Irving, *Healthadvances.com*
Daniel Kerrigan, *Fisher Scientific Company*
Melissa Doerr, *Apogent Technology Inc.*
Javier Valenzuela, *Micros Manufacturing*
Klaus Lubbe, *BioExpress, Inc.*

Survey Responses

Community interviews/surveys regarding technology business incubator were very positive. Input from the attached contact list confirmed that the program receives broad community support. The following is a summary of the responses obtained from the interviews, meetings, and surveys with community organizations and a select group of community leaders, including members of the Feasibility Task Force.

The questions did not lend themselves to a strict tabulation of results since most responses were narrative in form. Rainey & Associates has summarized the answers and highlighted the most common suggestions/patterns. For ease of reference, survey questions are shown in bold type followed by a summary of the responses.

1. **How would you measure the success of a technology-oriented small business incubator if one were to be established?**

All respondents mentioned the number of sustainable companies that eventually graduate, and the number of high wage/livable wage jobs created as appropriate measures of success. While no one proposed specific numbers, there are well-documented measures from other successful technology incubator programs, which could be benchmarked.

Suggested Success Metrics

Creation of successful new businesses with $ 10+ million in revenue
Create serious, rapid growth companies rather than "lifestyle" businesses
Develop new products and services that enhance public health
Create new high wage/livable wage jobs
Operate a self sustaining program
Dartmouth and University of New Hampshire cooperation: shared goals/ common vision
Use the incubator as a tool for building, attracting and retaining a quality work force (halt "brain drain" of skilled labor to neighboring states)
Diversify local economy away from reliance on tourism, agriculture, telecom, forestry, etc.
Increase linkages between innovators (for example: information tech/biomedical)
Cross-fertilize ideas/break down institutional barriers
Further promote cluster-based technology development
Foster a more entrepreneurial culture that supports and nurtures new firms
Enhance the image of New Hampshire, and the prestige of Dartmouth College, UNH, and NHCTC
Use program to establish an internal and external focused "branding" campaign to raise awareness and understanding of New Hampshire's assets
Creating "deal flow" for venture capital investment
Capitalize on the significant R&D infrastructure in place in New Hampshire
Improve and expand statewide cooperation and coordination
Improve tax base of Durham and Hanover/Lebanon and surrounding communities
Serve as a feeder to outlying, under-served areas for new industrial growth (Littleton, Berlin, Claremont, N. Conway, etc.)

2. What type of businesses should the incubator target? Do you know of any specific new technology based businesses that would benefit from such a facility?

While there is a consensus that the proposed incubator programs should support the development of biotech/biomedical firms, the large majority of respondents felt that the focus should be broader to include environmental technology, information technology, instrumentation, engineering spin-offs, etc. Only two respondents felt that the program should be exclusively focused on Biotech/Biomedical technologies. There is a history of successful technology spin offs in the Upper Valley from Creare, Inc. and subsequently Synergy Innovations (itself founded by the former President of Creare). Companies such as Fluent Inc. now have revenues in excess of $50 million. There is a strong culture of entrepreneurship in the area. Since the majority of these spin-off companies are in engineering services and the manufacturing sector – the consensus was that an Upper Valley incubator should be a mixed-use technology incubator facility enabling it to take advantage of the inevitable start-ups from these high growth firms.

Many respondents pointed out that a UNH Incubator has the potential to draw biotech/biomedical start-ups from the concentration of biotech firms in Massachusetts that could supplement UNH spinouts and local start-ups. Proximity to Massachusetts and cost advantages at the UNH location would be the big attraction for Massachusetts's entrepreneurs.

3. Do you believe that there are a sufficient number of new biotech firms or biomedical firms to justify limiting the proposed centers to biotech or biomedical technologies?

With two exceptions, the faculty and staff interviewed at both Dartmouth College and UNH felt that an incubator facility should not be exclusively focused on biotechnology/biomedical at this time.
However, it was pointed out that Dartmouth is reaching a "critical mass" with $90 million of its $130 million in research focused on biomedical research (NIS Funding). Faculty and staff at the medical school are very enthusiastic about the technology incubator concept. There is also strong support from Dartmouth and UNH leadership. Both Dartmouth College and UNH are rapidly expanding their infrastructure to support the life sciences. Both have seen a dramatic increase in sponsored research funding over the past five years. UNH has no medical school and its core competency continues to be more focused on environmental sciences/ technologies. With one exception, all of the New Hampshire biotechnology companies interviewed believed that the proposed incubators could be sustainable even if focused strictly on biotech or biomedical technologies.

4. Do you know of a specific new start up company that might be interested in space at the incubator?

A dozen or more prospective tenants were identified at each campus. The majority have promising technologies but no formal business plan.

5. Do you know of an organization that would be interested in contributing as a founding sponsor?

A few of the larger companies indicated that financial support might be considered – subject to the availability of a firm plan for the project. No one offered direct financial support although several respondents implied the potential for some monetary support at a later date. Several offered assistance in obtaining grants and in-kind services.

6. What role, if any, could your organization play in the incubator <u>after</u> is it established?

The most common response was training and mentoring for the companies and their employees. One respondent offered assistance in securing financing for start-up businesses.

7. Which entity should own, operate and manage the incubator?

Upper Valley

The most common response was that a separate, non-for-profit 501 C (3) organization with a manager experienced in entrepreneurship/economic development should be established to take ownership. In the Upper Valley area, most respondents felt that strong coordination should be developed between the Dartmouth Entrepreneurial Network, Dartmouth Medical School, Tuck School of Business, the Computer Science Dept., Thayer School of Engineering, as well as the Foster Center for Equity Studies and the newly formed Borealis Ventures. It was recommended that this initiative be tied to Dartmouth College's technology licensing office.

A Board of Directors with broad community representation and strong private sector involvement was suggested. Many respondents emphasized that incubator management experience and reputation in the community was of high importance. Most responded that Dartmouth's Entrepreneurial Network should be involved in the management of the program.

Seacoast Region

There are two schools of thought on the incubator development in the Seacoast area. The majority of those interviewed believe that the incubator would have a better chance of success if it were located on the UNH campus. A smaller group believes that the incubator must be developed at the Pease International Tradeport. Reasons given for the Pease location included superior access to the Portsmouth business community, Massachusetts, and other business amenities. Many mentioned the acute shortage of parking at UNH and that it represented a major barrier to faculty, students and staff at UNH leaving the campus to conduct business off campus. After 9:00AM there simply are no parking spaces to return to on campus. Industry representatives and the Boston based VC's were wary of too much university influence in the project.

As in the Dartmouth community, most felt that a new not-for-profit organization should be formed and that the new Hamel Center for the Management of Technology and Innovation should be involved in managing a center. The companies interviewed stressed that the board of directors should include representatives from industry with a successful track record in building companies.

8. What type of corporate structure would be appropriate for the incubator?

The most common response was a not-for-profit 501 C (3) organization.

9. Will a member of your organization be available to serve on the incubator planning team?

A few were willing to participate in the planning – all were prepared to serve on the board or technology advisory board of the incubator – or the individual companies. The successful entrepreneurs interviewed were willing to mentor new businesses.

10. Do you know of an organization that would be interested in serving as an anchor tenant for the incubator, paying market rate for the space? If so, how many square feet would they need?

Two prospects were identified at UNH. Also, a Cambridge, MA start up was identified that will be in the market for space in New Hampshire.

One company in the Lebanon area expressed possible interest. By and large the academic leaders interviewed supported the idea of housing a larger strategic corporate partner at the incubator to help cover expenses during the ramp up period (2-5 years). However, some private sector representatives cautioned against this – unless it was the only way to operate at break even. Several Deans at both institutions suggested that a large corporate sponsor/ anchor tenant would enhance the prestige and credibility of the program, and ultimately influence its success.

11. Is there sufficient access to seed and venture capital in the region to support the development of start-up new high technology businesses?

All of the respondents stated that there was sufficient access to capital, stating the proximity of Boston capital sources and new, local seed fund developments. Most of the companies interviewed had not made use of venture capital and do not believe there is much VC activity in the Upper Valley area. They suggested that there was better access in Durham (nearer to Boston). A new, local seed fund, Borealis Ventures (The Borealis Fund) in Hanover has just closed and is seeking investment opportunities. The Boston VC's interviewed believe they can service the needs of this market – however they are driven by the individual deals presented to them by emerging companies which they look at on a case by case basis.

12. Are there other individuals/organizations in the area that should be contacted regarding reaction to the Business Incubator Feasibility Study? Please provide names, addresses and phone numbers.

Many suggestions were provided.

CONCLUSIONS

Some specific conclusions that were drawn from this effort are as follows:

- State and local government, academic institutions, and the business community are firmly behind the concept of technology business incubators and many individuals and organizations are prepared to assist. There is very little political fragmentation and a strong spirit of cooperation and collaboration was found in both target communities.

- The Dartmouth Entrepreneurial Network is viewed as the leading candidate for operating a center in the Upper Valley area and Dartmouth College has broad support. Dartmouth College, through the Dartmouth Entrepreneurial Network, should continue to play a leadership role in moving the business incubator concept forward. A "window of opportunity" has opened to pursue this initiative regarding a real estate donation from Dartmouth College

- The most common response on management for a Seacoast Region initiative was the Hamel Center for the Management of Technology and Innovation. However, the Hamel Center is still a relatively new program and the director has many other high priority tasks to complete to get the center started. There are four new Deans at UNH, and the University is also engaged in a recruitment effort to locate its next President. This period of transition at the University represents both risk and opportunity. There is a risk that critical decisions may not be made in this environment. However, new faculty and staff are generally more accepting of change and less resistant to new initiatives, especially if efforts are made to enhance their "buy in" at the early stage. The three deans interviewed were very supportive of this initiative.

- NHCTC must be a strong partner in the development of the overall statewide incubator initiative. NHCTC operates a biotechnology workforce-training program designed to prepare the state's biotechnology workforce at the technical level. This highly successful program has proposed the development of a business incubator component at its Pease International Tradeport location. A working group must be formed to coordinate the proposed initiatives and create a master plan.

- While there is a consensus that both the Upper Valley and Seacoast incubator programs should support the development of biotech/biomedical firms, the large majority of respondents felt that the focus should be broader and not restrictive to biotechnology/biomedical.

- Most felt that a technology incubator in the Seacoast region should focus on life sciences, environmental technology rather than strictly on biotechnology. Other areas mentioned were space technology, ocean mapping and other ocean related science (aquaculture), and software development. Most felt that a technology incubator in the Upper Valley has the critical mass to support biotechnology but should be designed to support broader technology development as well. While a focus should be on biomedical, including medical devices, a portion of the facility should be open to non-medical such as information technology, software development, etc.

- The proposed incubators must be linked to industrial/manufacturing development initiatives in other parts of the state, and be developed as a component of a broader science and technology strategy for the State of New Hampshire.

- An effort should be made to link the proposed incubator initiatives with other operating and proposed incubators in Vermont, Maine, Massachusetts, and Quebec.

NEW HAMPSHIRE ECONOMIC TRENDS

New Hampshire is well positioned for high-technology growth. The state offers a rich and diverse quality of life. It is no coincidence that New Hampshire has ranked first in the North East in the number of new residents since 1980. Three of New Hampshire's cities dubbed the "golden triangle,"– Nashua, Manchester, and Portsmouth have made Money Magazine's top places to live since 1995. New Hampshire has experienced explosive growth in the high tech industries of information technology, biotechnology, computer hardware and software, and telecommunications. There are over 1,000 software companies in state, which is significant given New Hampshire's population density.

New Hampshire is a small business state – of the 36,000 businesses in New Hampshire, only 100 are considered large businesses, employing more that 500 people. In contrast, there are 18,000 firms in the state employing fewer than five people.[5] New Hampshire is business friendly as reflected in its relatively low business costs, in contrast to neighboring Massachusetts which is ranked 5th in terms of highest per capita tax burden in the nation. New Hampshire is geographically well situated near major East Coast and Canadian cities. Proximity to Massachusetts's human, education, seed and venture capital, technology is of great strategic value.

New Hampshire is the fastest growing state in New England. According to the Report *New Hampshire in the New Economy*, the state is projected to grow from 1.2 million today to 1.5 million in 2020, an increase of 25%. For the past 30 years, New Hampshire has been one of the ten fastest growing states, and at one point in the 1980's, the state ranked third fastest in the nation.

New Hampshire is building its economy on knowledge-intensive industries. The state ranks number two out of all 50 states in the percentage of the workforce employed in high technology industries. Further, New Hampshire has an unusually high concentration of employment in skilled professions. For example, New Hampshire's concentration in line and middle management positions is 44% higher than the average of other states in the nation. The state ranks 45% higher in first line supervisors; 31% higher in other managerial and administrative occupations; 26% higher in engineers; 12% higher in supervisors in service occupations and 10% higher in health practitioners.

The University of New Hampshire Survey Center for the Manufacturing Management Center (MMC) conducted a study of 674 manufacturing firms in 2000. This survey found that "investments in technology and strong customer relationships were associated with high growth overall, with a strong focus on such industries as chemicals, paper and miscellaneous manufacturing.

New Hampshire leads the New England region in manufacturing growth and the percentage of workers employed in that sector. Some of this can be seen as the "silver lining" to the recession of the early 1990s. After a painful transition period, New Hampshire companies successfully shift from producing non-durable goods to value-added, high technology products.

[5] US Small Business Administration 1995-1997 *Small Business Profile by State*

Recession and the Post-September 11th Economy

Prior to September 11th, New Hampshire was already experiencing the affects of global recession. Over-saturation in the world telecom and manufacturing sectors combined with a stock exchange adjustment of the overvaluation of information technology (IT) businesses resulted in lay offs and slow downs. As the second largest High-Technology employer in the nation, on a per capita basis, New Hampshire's business and industrial community was bound to feel the effects of a slowing economy. In the first three quarters of 2001, 60 of New Hampshire's high tech companies – roughly two thirds of them – have laid off a total of 7,000 workers. These in-state employee layoffs contributed to additional pressure on the workforce retraining infrastructure. At the same time, manufacturing layoffs in the Northeast and Midwest contributed to a reduction in tourism activity.

In the area of finance, venture capitalists retreated from the IT and high technology. There has been a subsequent reduction in the $2.2 billion dollars in high technology investment monies that had been invested in 2000. Venture capital investing in New Hampshire is down from $232 million in the fourth quarter of 2000 to $11 million in the first quarter of 2001 and $38 million in the second quarter according to University of New Hampshire's Dr. Ross Gittell.

Over the past two decades, New Hampshire has found strength in diversity. As the pace of shipbuilding, agriculture, and military spending declined in the late 80's, telecom and tourism served to infuse another sector of the economy with fresh capital, and as the state's telecommunications industry experienced difficulties, an influx of biotechnology/biomedical companies began to emerge in the Southern half of the state.

During this period of reduced economic expansion, it is important to critically survey New Hampshire's industrial and high technology "engines" and develop strategies to make them more resilient to future interruptions. It is clear that, like portfolio investing, the key to long-term prosperity and success is to constantly drive for diversification. After the examination of future and current studies that assess the strength of the various national high technology sectors, it is also clear that an investment in biotechnology/biomedical technologies and small incubators at the two primary sources of technology in the state is one key to building that diversity.

ECONOMIC DEVELOPMENT CHALLENGES

Workforce

Focus on developing a world-class high technology workforce is a key factor. According to the State of New Hampshire's Department of Resources and Economic Development, the state has been a magnet for new economy industries due to its entrepreneurial spirit and highly trained work force. However, a survey of available workforce found that the level and types of skills potentially required by incubator clients is in high demand and in tight supply. Biotechnology industry analysts are finding that there is one trained person for every five new jobs being created in the field. As the need for biotech workers grows, community colleges and universities nationwide are taking the lead in developing training programs through federal grants and partnerships forged with private companies.

Education/Life Long Learning

According to the Mellon Foundation study *Competing in the Age of Talent: Quality of Place and the New Economy*, in order to be competitive in the new economy, regions must be able to quickly mobilize skilled workers and needed resources. In an increasingly competitive environment, it is essential to "generate, retain, and attract the best talent."

Building an economy based on technology industries requires an acknowledgement that a 12th grade education is no longer sufficient. Fewer than 20% of native New Hampshire residents now in the State's work force have baccalaureate degrees or higher. As a consequence, New Hampshire businesses and industries import the educated work force that is required, which is very costly and a practice that is not sustainable.

Addressing Economic Disparity

The U.S. Department of Commerce, EDA has designated the North Country in New Hampshire as a distressed area. Recent new mill closings in Berlin and Gorham in 2001 raised Berlin's unemployment rate to from 3.5% to 17.1%. Efforts to ameliorate the effects of the paper mill's closing in the North Country are underway, but difficult. The structural crisis affecting the North Country has been brought about by the dominance and the region's dependence on traditional industries.

Along with industrial decline comes high unemployment, flight of skilled labor and companies and an overall weakening of the region's economic infrastructure. A 'vicious circle' develops in which lack of economic activity leads to a lack of business investment, and a lack of business confidence. The lingering crisis in the North Country[6] is a matter of great concern for New Hampshire policy makers. Increased frustration and public awareness of the North County's eroding economic position vis-à-vis the rest of the state is a strong incentive for policymakers to take measures to reverse the recent decline in the vitality of the region.

[6] The North Country includes Coos County and the top half of Carroll and Grafton Counties

Livable Wage Jobs

New Hampshire needs high quality jobs that pay a "liveable" wage. In the words of Caleb Wolfe, State Office of Employment Security in Lebanon, "We don't need more box stores and fast food restaurants – what we need are quality jobs in this region. As you develop you plans, please don't forget about the bottom tier. It is heart breaking to send a single mother off to interview for $7.50 an hour job."

Housing

The booming economy over the past eight years has contributed to a widening gap between housing costs and the ability for many in the state to afford home ownership. Real estate prices have increased dramatically (20% a year in some areas), and there are housing shortages, particularly in affordable housing in several parts of the state. Outside of California, the Portsmouth area is now one of the most expensive areas in the country for housing. The need to build more housing has, in turn, prompted concerns about growth issues.

Regional Competition

Technology incubators in Massachusetts, Portland, Maine and Burlington, Vermont (planned) are seen as a potential competition. Proximity to Boston, and its lure of higher salaries, intensive high tech environment, with more opportunities regarding vendors, venture capital contacts and management talent is also a concern.

State Leadership and Coordination of Resources

Over the past decade it has become increasingly obvious that the innovation process is a collection task, which involves numerous economic factors. The number of parameters involved is so great that technological innovation can no longer be guaranteed by the functioning of economic mechanisms of the free market alone. Technological progress is influenced by many factors. Maximizing the chances the "the right" combination will arise is the objective of proactive science and technology strategies.

Thus, in recent years many states have seen government investment as increasingly necessary to provide leadership and to implement finer, more complimentary measures to address the specific problems within their local economies. In innovative places such as North Carolina, state government has come to be seen as an indispensable component in the orchestration of resources.

For these states, the role of the government in implementing innovation policies extends beyond sponsoring its traditional role, and covers a whole spectrum of activities involved in the innovation process: education and retraining, identification of industrial priority areas, government procurement, technology assessment, reassessment of tax and labor policies, investments in telecommunications infrastructure, stimulating access to capital, and direct marketing assistance for small companies.

At the same time, the government's role in stimulating and nurturing the innovation process is a controversial one. While some states adopt activist science and technology policies with strong federal government support to influence the factors that contribute to a more innovative economy; other states feel that government involvement should be kept to a minimum. In recent years, however, even more conservative states have encouraged government involvement in programs to encourage technological development.

Coordination: A Strategy for Technological Innovation in New Hampshire

State science and technology strategies seek to coordinate government activities more efficiently and fully utilize all of the assets the state has at its disposal.

An important strategy used to enhance research effectiveness is the breaking down of institutional barriers to improve communication and collaboration between various disciplines, departments, and state institutions. By removing institutional obstacles and improving cooperation between various actors, state governments can coordinate intellectual resources and in doing so, forge new linkages, which facilitate the flow of people and research, and overcome bottlenecks in the innovation process.

This strategy encourages new "cross-over" disciplines from several fields (particularly in biochemistry), and encourage less compartmentalization, less duplication of efforts, greater mobility, formal and informal communication, and efficiency of resources. The proposed high technology business incubators at Dartmouth College and UNH offer an excellent opportunity for the State of New Hampshire to better coordinate and leverage existing "intellectual capital."

Diversifying the High Tech Sector: The Advantages of Biotechnology

In the last decade, there has been a fundamental shift in the manufacturing industry in New Hampshire away from machinery-based manufacturing and towards value-added high technology manufacturing. The impetus for this shift came in large part from the decline of the defense industry during the 1980's, which spurred the creation of small, new innovative business by displaced, yet highly trained defense workers.

New Hampshire's strong agriculture and elder communities, and the university and health care infrastructure lend themselves to the development of the biomedical sector. The development of this sector lends itself easily to the continued diversification of New Hampshire's economy and adds additional fringe benefits. Biotechnology/biomedical provides the following advantages as a strong economic engine:

- It pays a higher than average annual salary. Current estimates are that the average biotech salary in Florida, for example is $50,000 dollars per year.

- It is of great interest to venture capital resources. As the dot.com "bubble" comes to a close, more venture capitalists are placing their bets on companies with tangible products.

- It is currently a stable sector. According to a recent report by Ernst and Young, the national biotech sector collectively raised $33 billion dollars in 2000 and most companies are in a better position than their IT and dot.com counterparts to ride out the current economic downturn.

- As the U.S. population continues to age, it will look to increasingly tap the biomedical community for health solutions. Also, New Hampshire is an agricultural state. Biotechnology is an invaluable partner with agriculture in the improving of crops and livestock and the production of fertilizers and pesticides.

- It is clean. Because the number one reason people come to New Hampshire is the quality of life, it is vital to protect the state's image as a clean state, with open spaces and low industrial density. Biotechnology is a clean industry that produces little or no effect on the natural environment.

Assessing the National Biotechnology Market:

Within the national market, it is clear that the top tier states in technology innovation and manufacturing are Massachusetts, California, Texas, and North Carolina. Top tier states in biotechnology, a subset of the technology industry as a whole, are Massachusetts and California. Maryland is often included as a top tier state, but that ranking relates directly to its playing host to the National Institutes of Health. More specifically, Boston, San Diego, and San Francisco account for the primary biotechnology clusters of international significance. In recent years, St. Louis has made dramatic strides in becoming a life sciences center and has invested heavily in research and incubator facilities.

In comparing New Hampshire to other states, most of the New Hampshire-based experts agree that any strategy developed to place New Hampshire on par with Boston, or California is bound to be disappointing. Well over twenty years of work and investment have been poured into the clustering effect that has centralized the great majority of capital, workforce resources, and intellectual and physical infrastructure within those two states.

However, there are a few very strong second-tier states in the field of biotechnology such as New Jersey, Michigan, North Carolina, Texas, Wisconsin, Georgia, Alabama, and Pennsylvania that have instituted policies and programs with which New Hampshire could be competitive. Those second tier states have developed the critical ingredients necessary to build a world-class biotechnology industry and have taken concrete steps to reach that goal. While New Hampshire has been behind the curve, the diversity of the economy, the breadth of the university system, and the State's proximity to major urban centers provides a solid base for future development.

Assessing New Hampshire' Biomedical Potential

Intellectual Infrastructure

In assessing the intellectual and physical infrastructure for biotechnology in the state, it is important to examine the position of Dartmouth College and the UNH and NHCTC to determine capacity for development.

Three Keys to a Healthy Biotechnology Sector:

The strength of Massachusetts and California as it relates to the biotechnology sector rests on what should be termed the pillars upon which all state economies build a successful biomedical programs.

Those pillars are:

- Strong intellectual and physical infrastructure
- Access to capital
- A skilled and available workforce

Dartmouth College ranks as a significant research institution and has already fostered the start-up of over 18 high technology companies, many of which are highly successful. The University of New Hampshire has spun off only one company to date, but has recently invested in the expertise necessary, and has set in place the policies and procedures to foster technology transfer and commercialization.

New Hampshire's population ranks as one of the most highly educated in the U.S. It is a state with a high level of business acumen and a large pool of highly educated people. New Hampshire, for example, ranks eighth in the number of patents issued per 1000 workers, and sixteenth in R&D per capita.

The skill sets of people moving to New Hampshire also bodes well for the state's future economic development, as non native adults are two and a half times more likely to have an undergraduate degree than those born in the state (Dr. Ross Gittell).

A technology business incubator requires the "right" culture. They are most successful in environments were the population is well educated and open to new ideas and change. Both the Upper Valley and Seacoast Region have such necessary "ingredients" in terms of high levels of education, a strong research tradition, and a congenial atmosphere for new ideas. They also share a strong research-oriented business culture. A strong symbiotic relationship already exists between Dartmouth College, UNH, NHCTC and local industry. The academic traditions, large student populations and special way of life inherent to small college and university towns are assets in high technology incubator developments.

Access to Capital

Businesses need access to capital to be successful. Business incubation programs, universities, local government, and entrepreneurs have served as catalysts to develop capital formation programs for local emerging growth companies. In order to be successful, an incubator program must develop a comprehensive strategy for providing access to early-stage seed capital to client companies. New Hampshire ranks fourth in venture capital invested in companies as a percentage of high technology jobs. To date, initiatives that have been launched in or near the target communities include:

- Borealis Ventures – A $20 million technology fund based in New Hampshire
- TechVenture's - A Portland, Maine group that frequently invests in New Hampshire companies.
- Acorn Investors Alliance – Grafton County Angel investors network
- Green Angels Network – Dartmouth College alumni - informal Angel investor network
- eCoast Angels – Angel Investor Network serving the Seacoast area
- Green Mountain Capital – Vermont Angel investors group
- AIG – Vermont Angel investor group

Five angel investor networks and one early stage seed fund are now operating in or near New Hampshire, a state where risk capital was once a rarity. Angel investors will be the most likely partners of new start up incubator companies. As part of this study, Mr. Gordon Baty, Principal, Zero Stage Capital, a long established VC firm in the Boston area with a predominance of technology-based investments, was interviewed. Zero Stage Capital is offered over 4,000 investment propositions a year so increasing their deal flow is not a high priority. However, Mr. Baty stated that if a compelling investment opportunity presented itself they would be interested. Zero Stage Capital has a strong track record of investments in New Hampshire.

Mr. Rana Gupta**,** Navigator Technology Ventures, was also interviewed. This firm is the venture capital arm of Draper Laboratories. They look beyond Draper technology for their investments and within the scope of their investment mandate will consider investments in technology from other sources. Biomedical and particularly medical devices fall within their mandate. Again, if the incubators can show investor's viable investment opportunities they will come. According to Mr. Gupta, the proposed incubators should establish a simple outreach program to let investors know what is available on a regular basis.

Most incubators have had a poor record in terms of working with venture capital resources. VC firms are looking for the creation of high growth companies – those with sales over $10 million in 3-5 years from start and a $100 million potential. Incubator companies are often too small and too early stage to interest venture capital firms. As evidence of the accessibility of capital for good investment opportunities, Dr. Jeffrey Sohl, Director of the Center for Venture Studies at UNH, provided a list of recent investments in New Hampshire companies. The Foster Center for Private Equity Studies in Hanover has also identified 250 Dartmouth graduates who are either working for, or are associated with recognized venture capital groups. These individuals, with some outreach, could also be a powerful resource to business incubator clients in New Hampshire.

Skilled and Available Workforce: The Role of New Hampshire's Community Technical College

Dr. Sonia Sparks Wallman, Director, New Hampshire Biotechnology Center, member of the Council of Biotechnology Centers (CBC) and board member of the Biotechnology Industry Organization (BIO) shared the history of her program an as an example of state responsiveness in working with high tech employers. In 1991 the state provided Lonza Biologics a low-interest $30 million loan to build a manufacturing facility at Pease International Tradeport in Portsmouth. At the same time, a committee of industry and education officials identified a need for a companion biotechnology center to train and prepare a qualified work force to meet the growing needs for the state's fledgling biotechnology industry.

NHCTC responded by launching a unique biotechnology-training program to support New Hampshire's existing biomedical sector and promote further growth through workforce development. By tapping an $80,000 Advanced Technology Education Federal grant in 1993 and securing matching funds from the state, NHCTC launched its first biotechnology-training center. The program yielded results from its inception as graduating students secured jobs with biotech firms in Massachusetts and New Hampshire paying an average starting salary of $38,000, plus benefits that often include 100 percent education reimbursement.

A Bio-Link grant enabled this program to expand its influence on both a regional and national level. The number of graduates has increased to around 30 a year. Programs at the center provide the growing biotech industry with trained workers at the technician level. Today, the New Hampshire Biotechnology Center is a state and regional center for Biotechnology Education and Training. The Center produces workers with biotechnology skills, knowledge and attributes for the biotechnology industry and mentors these workers into good jobs. The Center models the biotechnology industry by using its tools, processes, and regulatory structure to teach what is called Virtual Workplace.

The New Hampshire Biotechnology Center supports the Northeast Region of Bio-Link, a National Science Foundation (NSF) Advanced Technological Education (ATE) Center for Biotechnology. Bio-Link's goals are to provide support for biotechnology students and technicians, improve biotechnology instruction and learning, share biotechnology information and resources, and foster biotechnology collaboration and partnerships. In the spring, summer and fall of 1999, Dr. Wallman hosted meetings with local industry to set-up a statewide biotechnology organization called the New Hampshire Biotechnology Council (NHBC).

The New Hampshire Biotechnology Center has become a training lab for Lonza Biologics. Lonza is taking small groups of new hires and putting them through a basic, four week, bio-manufacturing course that utilizes our equipment and adds large-scale bio-manufacturing equipment and skills.

The New Hampshire Biotechnology Center works closely with the Eastern Region (School-to-Work) Partnership (ERP) and with the New Hampshire Science Instrumentation Project (NHSIP) to help educate and train teachers in the use of biotechnology's tools and processes and to help provide these teachers with supplies, equipment, and instructional materials. Many high school students have taken Biotechnology Explorations, which is a one-credit overview of the biotechnology industry. The Biotechnology Center has also worked with three high schools to develop a biotechnology curriculum.

NHCTC's workforce development component is a perfect compliment to the proposed technology incubators, and promises to play an important role in preparing surrounding communities for the growth of new high technology manufacturers.

Strengths, Weaknesses, Opportunities, Threats

Dr. Lulu Pickering, Vice President, New Hampshire Biotechnology Council, and Paula Newton, Biotechnology Industry Representative with the New Hampshire Department of Resources and Economic Development prepared a comprehensive SWOT analysis of regarding the state's biotechnology industry. Summaries of their findings are as follows:

Strengths

- The biotech industry in New Hampshire is old and well established, going back at least 15 years. The industry itself is only 30 years old from its start in the late 1970's.There is a significant depth, breath and diversity to the biosciences industry in New Hampshire. However, New Hampshire biotechnology is best categorized as high tech manufacturing. Lonza is one of the world's premier contract manufacturers of recombinant proteins and antibodies for the pharmaceutical industry and had been located in Portsmouth, New Hampshire for over 10 years.

- A large segment of the bioscience industry in New Hampshire is the OEM (original manufacture) segment that includes companies manufacturing and marketing laboratory products and equipment for cell culture, molecular biology, clinical testing, drug screening, prenatal screening, liquid handling, diagnostic, image analysis, and pharmaceutical markets. Bioinformatics and medical informatics is a rapidly expanding biotechnology segment in New Hampshire. Companies are involved in geomatics, proteomics, spectroscopy, and regulatory data analyses and management. Several companies provide formulation and contract R&D services for the pharmaceutical industry, and other companies manufacture blood substitute materials, cell culture additives, radio-pharmaceuticals, immunoassay reagents, kits and antibodies. Several testing labs in New Hampshire supply analytical, chemistry, clinical and biotechnology testing services and products to the industry. Corporate headquarters of several very large global companies are located in New Hampshire including Fisher Scientific, GenTek and Tyco International.

- Multiple companies are developing biomedical devices in New Hampshire for uses such as balloon angioplasty, surgery, laser micro machining, electrotherapy, sapphire products, and their components. This medical device segment overlaps in part with the healthcare industry and includes almost 200 medical device companies.

Weaknesses

- New Hampshire is a state sometimes referred to as "Cow Hampshire", where the perception is of flannel shirts, and beautiful natural recreational areas. It is not generally known as a high tech state, yet New Hampshire's scores on high technology indicators are very high.

- One of the greatest weaknesses of biotechnology in this state is its "perception problem". It is widely assumed by many, inside and outside of the industry, that very little biotechnology occurs here. This problem is exacerbated by the lack of a "biotech industry identify" in the state. Each company feels it is trying to make it on its own. A lot of good work is ongoing with several excellent universities and many companies, but the industry has not yet formed a cohesive identity or network.

- Until recently, very little promotion in the biotech industry occurred in New Hampshire, which has allowed the poor perception problem continues. In fact, the whole Northeast corridor from New England to Canada has a perception problem that can make getting financing – private placements or venture capital – difficult for startup biotech companies.

- University, business and government interactions have not been well established. All of the pieces seem to exist, but they have not been integrated. Most companies, universities, state offices and schools have little communications, yet education, job training & retention all require a strong communication environment by these major players to be successful.

- New Hampshire's lean budgets and lack of broad – based taxes have lead to chronic problems of insufficient funds to sponsor new programs or even to fully fund existing ones. Finding adequate funding at the State level may overwhelm other issues.

- Economic development in New Hampshire can be difficult, since there are few state – backed incentives, such as bonds, low interest loans or tax credits to entice businesses to relocate here. More people must realize that to succeed in the future, more need to be done in our state to promote and develop the biotechnology industry. To date, there had been very little legislative activity in developing or promoting biotechnology in our state. Thus, New Hampshire may not be competitive with other states (region or countries) that have taken the potential of biotechnology seriously and have launched extensive biotechnology development initiatives.

- A State Science and Technology Committee does exist in the New Hampshire legislature, yet there has been few state bioscience or biotechnology initiatives to date. Biotechnology or related sciences of the Human Genome Project, and bioinformatics have been largely overlooked.

- New Hampshire has several large, global, multi-billion dollar companies active in life science markets that have their corporate headquarters in New Hampshire. To date, these companies have not taken an active or a leadership role in advancing biosciences in the state.

- Many biotech and biosciences companies in the state are small. For example, there are few publicly traded biotech companies in the state. Many research and analysis firms do not address the non-publicly traded market, which results in the bio-industry in New Hampshire being "pigeon-holed" into a category that is not addressed.

- Many smaller biotech companies are "running-in-place" maintaining their business as is and have little time or incentive to address the larger picture. For example, they are often too preoccupied to investigate other opportunities, such as those offered by DRED and the International Trade Resource Center on international trade missions and business development opportunities.

- The public-at-large in New Hampshire has little understanding of biotechnology and needs education on issues.

- New Hampshire state universities lag behind other states in teaching the applied technologies of biotechnology and bioinformatics. There are ongoing liberal arts biology classes and genetics classes, but very little emphasis on the applied genomics and biotechnologies used in the workplace.

- Given the extensive land, farm and barn infrastructure present at our universities, it is surprising that animal, marine and crop biotechnology programs are not being pursued more aggressively. These programs could include transgenic animals, animal cloning, genetically modified foods, aquaculture, and biotech derived pesticides or herbicides, among others.

- Biotechnology and genetic modification will play an important role in agriculture, food, and veterinary sciences into the foreseeable future.

Opportunities

- High technologies such as biotechnology and bioinformatics, no longer require physical locations in larger metropolitan areas. High speed internet access, secure networks, fax machines, teleconferencing and express delivery, remove barriers to technology businesses locating in areas where employees can enjoy a greater quality of life with minimal commuting requirements.

- Biotechnology has matured to the point where the next "revolution" after the sequencing of the human genome (and other genomes) is going to be the analysis of data. Small states like New Hampshire can enter this area at relatively low costs and resources since bioinformatics using computers and networks is much cheaper than the wet labs required for sequencing and basic genomics research.

- Information technology in biotech / genomics area (e.g. bioinformatics) is an excellent means to "fast forward" New Hampshire into the new economy at a relatively low cost. Gene and medical data is the key and data analysis is much cheaper than data generation.

- The establishment and growth of the New Hampshire Biotechnology Council has brought the industry together to form a cohesive identify and to educate various groups on the success and future potential of Biotechnology in New Hampshire.

- An immediate goal is the generation of a science and technology strategic plan to outline the current status of the biotechnology industry in New Hampshire and to put forth an economic development plan on where it should be over the next ten years.

- A regional cluster approach to biotechnology should be created as part of Northeast Biotechnology Corridor, including New England states, Quebec, Maritime provinces of Canada. Massachusetts, of course, is a force into itself. A regional cluster will establish a much larger market and power base for all the participating states and provinces.

- A Regional Biotechnology Network should be established. New Hampshire and the Northeast region of the US and Canada could become a global economic marketing cluster for biotechnology and genomics.

- There are several groups and organization that are working on various aspects of biotechnology. Many components are in place but need to be integrated to work towards common strategic development goals.

Threats

- New Hampshire is in close proximity to one of the most outstanding and oldest biotechnology centers in the world – located around Boston and Cambridge, Massachusetts. The extraordinary success of Massachusetts' biotechnology industry provides very high expectations and unsatisfactory comparisons for New Hampshire. It is more appropriate to define New Hampshire's goals and successes by comparison with the other New England state and Canadian Maritime provinces.

- New Hampshire's highly educated and trained workforce can easily find jobs in the Boston area or elsewhere and relocate for often higher-paying positions.

- Highly successful companies (Diatide, Medarex, Perspective Biosystems) grow to a certain point in New Hampshire and then are sold, acquired or move elsewhere. New Hampshire has incubated some top-notch biotech companies, but few of the successful ones go public in New Hampshire. Many seem to leave once they have attained a certain size / success. Reversing this trend alone would be a great benefit.

- Small biotech companies need to grow larger and go public in New Hampshire to get their much-needed operating funds. The long-term answer is not just venture capital, but public equity, strategic alliances and private placements both domestically and internationally.

- The New Hampshire bio-industry has the grassroots support of such national organizations as PhRMA (Pharmaceutical Research and Manufacturers America) and BIO (Biotechnology Industry Organization), but the industry is less mature here than in other states. Thus, the agendas and lobbying priorities of these national organizations may be in conflict with activities ongoing in the state legislature.

Summary

There is little doubt that New Hampshire must play a role in the genomics revolution in order to stay abreast of the science, medicine and diagnostic breakthroughs created through biotechnology. Biotechnology is a viable economic development vehicle that affects all levels of education, job formation & retention, sales and global trade. To reach its full potential in New Hampshire, much more must be done to develop and promote the biotechnology industry.

TARGET COMMUNITY PROFILES

UPPER VALLEY

Located along the Connecticut River, halfway between Massachusetts and Canada, the towns of Lebanon and Hanover offer excellent quality of life and easy access to New York and Boston, respectively 250 and 135 miles south, and Montreal 190 miles to the North. The geographical region, know as the "Upper Valley," (Upper Connecticut River Valley) is a rural area with Hanover and neighboring Lebanon serving as the cultural center, due to the presence of Dartmouth College, the ninth oldest college in the country.

The Town Of Hanover, Population 10,800, has all the charm of an archetypical New England college town. The Town Of Norwich, one mile over the river to the West in Vermont, serves as a bedroom community to Hanover. Norwich is home to many students, faculty and staff from the college. Lebanon, population 12,000, to the immediate south is larger and more developed, but also offers a high quality of life based on the many recreational and educational opportunities, cultural events, low crime, and slower paced life that small towns offer. The area's largest employers are: Dartmouth College and the Dartmouth – Hitchcock Medical Center (DHMC), Hypertherm, and the tourism industry.

According to the U.S. Census Bureau and a local Venture Fund Manager (Borealis Ventures), this area possesses a number of key demographics and economic characteristics that make it attractive for high technology based entrepreneurship and venture investing. The Upper Valley has the education demographics comparable to those found in the top ten venture capital markets in the nation, where typically 27% of the population possesses bachelor's degrees and 10% possess advanced degrees. A total of 42% of Hanover's residents possess a bachelor's degree, and 20% possess advanced degrees.

DARTMOUTH COLLEGE

Founded in 1769, Dartmouth College is one of the oldest and most prestigious Liberal Arts Colleges in the U.S. Dartmouth College offers 16 graduate programs and is home to 5,600 students and 1,200 institutional faculty from around the world. A total of 98% of the faculty possess a doctorate or equivalent degrees.

Research, Technology Licensing and Commercialization

Dartmouth's share of sponsored research has increased dramatically over the past five years, and it now enjoys the largest research budget of all Northern New England universities. This year the college will bring in $130 million in sponsored research. Of that, a total of $90 million will be biomedical related. The largest single source of funding is the National Institute of Health (NIH), which has doubled the amount of awards to medical schools since 1991 – from $3.9 billion in fiscal year 1991 to $7.5 billion in Fiscal year 2000.

Dartmouth Medical School's overall research funding – 65% of which comes from NIH, was $80.7 million in Fiscal year 2001, up 14% from $70.8 million received in 1999. This upward trend is expected to continue as the nations commitment to biomedical research grows with an aging population. As an example, the NIH announced recently that they would be awarding a Dartmouth professor of microbiology and immunology $11.6 million for a Center of Biomedical Research Excellence. This center will partner with several investigators from the University of New Hampshire.

Dartmouth ranks 58th among the nation's 125 medical schools in terms of funding from NIH and is in the 82nd percentile for funding per basic science faculty member.[7] In Fiscal year 2000 the college had 42 technology disclosures and received approximately $1.13 million in revenue from technology license agreements. Dartmouth also received in fiscal 2000 a "windfall" of $67 million form the sale of stock from an earlier technology license. These numbers underscore the success of the college's research efforts. This development has occurred without a strong focus on technology licensing and commercialization. Dartmouth College generated $924,963 in licensing agreements in FY01 and applied for 27 U.S. patents. Washington University in St. Louis, by comparison, filed 70 patents and collected $9 million from 300 licensing agreements. This is an area for improvement that is being given a higher priority at the Dartmouth College.

Dartmouth College has a strong history of entrepreneurship and innovation. Dartmouth faculty, for example, were pioneers in launching the modern petroleum and computer industries.

The Dartmouth Entrepreneurial Network was initially designed as a "virtual incubator" to coach and train new high-technology businesses and assist with strategic planning and capital formation. Since January 2001, the DEN has been involved with over 50 startup teams or individuals, helping crystallize concepts, assemble teams, connect team members, resources and customers, and secure funding. The rate of new contacts has accelerated in the past few months and they are currently running at a rate of 3 per week.

Business teams are active in a diverse range of industries including:

- Biotechnology
- Software
- Medical devices
- E-commerce and e-commerce technologies
- Consumer entertainment and media devices
- Healthcare service technology
- Education content providers
- Environmental, recycling and reconditioning technologies
- Management and metric systems

The DEN has recruited an extensive network of active alumni and business service providers. DEN has also started internship placements for Dartmouth students in venture capital and entrepreneurial organizations. DEN is leasing office space and infrastructure on-campus to start-up student teams as a pilot program for a future incubator facility. The DEN relies heavily on Dartmouth's extensive and very accomplished alumni - "a network of 50,000" for support. This loyal alumni network is an important resource for future technology business incubation.

Dartmouth-Hitchcock Medical Center (DHMC), located three miles from the main campus, is a top ranked tertiary care teaching hospital (2,000 full time and adjunct Dartmouth faculty) is another important component to the business incubator plan. The medical center's mission rests on the "three legged stool" of clinical excellence, teaching, and research. DHMC`s Board of Trustees have encouraged community service and outreach. DHMC and the College have considerable research strength in microbiology, immunology, the neuroscience, and genetics and they are actively expanding their focus. As an example, DHMC recently recruited Dr. Mark Israel to head up its new Cotton Cancer Center. Dr. Israel has a strong reputation nationwide as a medical innovator.

[7] Research is Still Strong for DMS Faculty, Dartmouth Medical Magazine, Winter 2001

Amos Tuck School of Business - Ranked among the top ten business schools in the country, Tuck's alumni network and top graduates are well positioned to assist Upper Valley entrepreneurs as mentors and managers. Tuck Student Consulting Services (TSCS) is a free student consulting service for local businesses focused on business plan development, marketing, technology, valuation and investment.

Foster Center for Private Equity Studies - The Foster Center is a Tuck School initiative designed to provide research in equity studies and serve as a clearinghouse for information and a forum for networking and exchange.

Thayer School of Engineering - The Thayer School has nurtured high tech entrepreneurs in the Upper Valley producing over a dozen companies and over a thousand high wage jobs since the 1950's. These developments are a direct result of Dartmouth's recruitment of world-class faculty in the fields of material engineering, fluid mechanics, mechanical and chemical and communications engineering. Thermal Dynamics was founded in 1958 in Lebanon, NH and led to the creation of Creare, which spun off Mikros, ERC, Hypertherm Inc, Fluent Inc., Concepts ETI, Irad Gage, and Creative Innovations. From these companies other spin-offs have occurred.

Department of Computer Science – Past innovations include time-sharing, BASIC, and new advances in security and mobile computing. Dr. Bruce Donald of the Dept of Computer Science was interviewed for this study and discussed several opportunities for commercializing technologies currently available in the department's labs. The Image Science Group is focusing on image processing, computer vision, and computational and human aspects of perception. Other projects include research in computational biology and chemistry, micro-electromechanical systems and micro-robotics.

Institute for Security Technology Studies – This new Department of Justice/Department of Commerce funded center for the study of cyber security has excellent potential for spinning off commercial products and services.

Borealis Ventures – Hanover and Concord, New Hampshire based $20 million Early Stage Venture Capital Fund focusing on Northern New England start-up companies engaged in life sciences, communications, information technologies, and the physical sciences.

Evidence of Entrepreneurial Activity at Dartmouth

Dartmouth's graduate programs in business, computer science, engineering, and medicine have produced a number of successful ventures and commercially valuable technologies in the past. Other Dartmouth research initiatives that may yield technology commercialization potential include and the Public Key Infrastructure Lab; fiber optics from Thayer`s Fiber Optics Lab; genetics from the Medical School's new Department of Genetics; brain imaging from the Center for Cognitive Neuroscience; molecular materials; and wireless networking.

The following is a current list of Dartmouth College associated start-up companies in the early stages of development in the Upper Valley area:

ABC Care is a new firm associates with the Thayer School of Engineering involved in developing remote medial monitoring software.

AudioWorld is developing a business plan based on customized radio content and voice recognition software.

Mobius Audio has recently received seed funding from an angel investors group formed by the Board of Overseers of the Thayer School of Engineering to allow the company to complete core software, build a functional prototype, and begin an industrial design study.

Aurora Optics is involved in the design and fabrication of medical and industrial optical diagnostic and optical fiber based spectrophotometric analysis systems. They are also involved in fabrication of optical and optical fiber-based hardware including pressure and vacuum feed through.

EarData is developing auditory display systems to present complex and real-time data using software generated digital sound and music. EarData will provide organizations and users in today's data rich world powerful new ways to interact with critical information by listening to it. EarData will leverage the unique advantages of auditory cognition.

EnerNOC LLC is emerging as the leading provider of energy-technology software products and managed services that address the unique needs of enterprises with distributed power systems. The company has developed a suite of software products.

Grammaton LLC is involved in foreign language translation of financial, legal, and medical device documents and text for websites. Core products include translation of financial statements, shareholder reports, marketing brochures, proposals, company prospectuses, affidavits, warranties, intellectual property material, litigation documents, depositions, and court proceedings. Grammaton also delivers desktop publishing and graphics formatting solutions using all software platforms.

Lorien Logic Systems provides electronics systems design consulting services, specializing in the area of large CMOS logic devices (ASIC, FPGA) and high-speed circuit packs. The company's expertise is applicable to any market segment or customer problem requiring custom design, though most of our experience is in the telecommunications and computing sectors.

QuantiSense, Inc. focuses on providing tools and expertise to maximize customer profitability. The company is building a software application focused on small to medium sized banks. Their software enables managers to digest transactional information to make strategic decisions

StratBridge, Inc. focuses on designing and developing sophisticated software for strategic analysis. The company provides specialized counseling services around strategic analysis.

Windirector, Inc. focuses on designing and developing technologically advanced vertical axis wind turbines for low wattage power generation requirements. The company has a set of initial products that drastically reduce the ownership costs of independent power generation.

Other

Thayer School of Engineering's Professor Gemgross, specializing in high yield fermentation process has expressed interest in incubator space. Ambrose Chung, Dartmouth Medical School Faculty, has three patents licensed and is developing antibiotics for Staph and A&E based on gene identification.

SEACOAST REGION

Situated at the center of the Seacoast Region, Durham is a typical rural university town located 10 miles from Portsmouth and the coast. The University serves an undergraduate student population of 10,500 students. Durham's 12,664 inhabitants include many full time students. Most of the 5,620 resident labor force is tied to the UNH or retail. Durham is surrounded by five small towns. Dover, population 27,000 is to the immediate North. Dover's resident workforce is made up of 15,280 and is one of the fastest growing towns in New Hampshire. There are approximately 100,000 living in the immediate vicinity of the proposed incubator.

The Seacoast region enjoys an excellent quality of life and has a strong reputation for fostering business innovation and entrepreneurship. The region as a whole is very pro-growth and aggressively supports small businesses. Dover's downtown and waterfront has undergone an intensive beautification and revitalization effort. Massive mill buildings, such as the Cocheco and One Washington Center, were completely renovated and currently house dozens of small businesses, including high tech, manufacturing, retail and services. Over 500 small business people are employed and operate out of the mill buildings in Dover alone.

Portsmouth, the region's major business center, is often referred to as the "epicenter" of the "e-coast." The e-coast is an area running from Cape Ann in Massachusetts to Casco Bay in Maine, and home to 400 technology mostly internet/telecommunications and software companies. The region has proven to be resilient in weathering severe defense and shipyard down-sizing, and the recent recession. Much of the Seacoast's success is due to the redevelopment of the Pease Air force into the Pease International Tradeport

UNIVERSITY OF NEW HAMPSHIRE (UNH)

Founded in 1866 and relocated from Hanover to Durham in 1890, UNH is home to 10,500 undergraduate students and 2,100 graduates at the main campus and offers a wide variety of graduate programs. UNH has 94,000 graduates from all over the world and offers 2,000 classes in over 100 majors.

Research, Technology Licensing and Commercialization

Established as an agricultural college, UNH is now a comprehensive land, sea, and space grant university and has the third largest annual research expenditure of all the Northern New England universities ($81.9 million in the year for the fiscal year that ended June 30, 2001). A dramatic increase in sponsored research coincides with a wealth of new resources for New Hampshire businesses in the seacoast area. While the majority of Dartmouth College's sponsored research funding comes from NIH for medical research, the majority of UNH's funding comes from the U.S. Department of Commerce, National Oceanic and Atmospheric Administration (NOAA) which increased by 40% to $23.8 million last year. UNH's second largest sponsor is the National Aeronautics and Space Administration (NASA), which also increased by 9% last year to total $9 million.

UNH successfully raised $100 million in capital investments to improve science and engineering buildings at a time as the state was reducing funding to the university. UNH currently receives only 15% of its overall budget from the state of New Hampshire. Out of necessity, UNH has had to be entrepreneurial in how it funds its core mission, and new initiatives. In 1998 UNH completed the

renovation of it's 207,000 square foot library, built a journalism laboratory, two theatres and a 6,000-seat sports complex.

The Hubbard Center for Genome Studies - launched in September 2001, The Hubbard Center is devoted to understanding the structure and function of genomes across the spectrum of life. Genomics is a new area of biology made possible by large-scale DNA sequencing efforts that study the complete genome and its protein expression patterns. This center occupies 7,500 square feet of space in the new Environmental Technology Building on campus. The center will focus on aquatic and marine organisms and environmental genomics. The center will also develop a focus on in the multi-disciplinary field of bioinformatics.

The Institute for the Study of Earth, Oceans and Space (EOS) conducts research projects that are nationally recognized, particularly in the areas of climate change, and life sciences. The NASA certified machine shop at the Institute has designed and fabricated advanced instruments for 14 NASA missions. EOS is well known for innovations in ocean mapping, and modeling.

The Environmental Research Group (ERG) was founded in 1987; this program's fundamental mission is applied and fundamental environmental engineering and science research. In 2001 ERG moved into a new state-of-the-art Environmental building on campus. This interdisciplinary program ties three departments (microbiology, civil and chemical engineering) together to solve real world problems in areas such as water treatment technologies, bio-remediation, and electro-technologies research.

The Center to Advance Molecular Science Interaction (CAMI) is engaged in developing new analytical instrumentation that is used primarily by biopharmaceutical researchers to characterize molecules. UNH holds a number of patents on these instruments. The accurate description of molecular interactions is a central element in understanding disease mechanisms and is essential for devising safe and effective drugs. CAMIS is a world leader in the development of data acquisition systems for the analytical ultracentrifuge. Its research is on the cutting edge of biomedical and biomaterials industries.

Biomolecular Interaction Technology Center was designed to serve as a university-industry Research Center and was created in 2002 with a grant by NSF. BITS is a new consortium of biopharmaceutical companies that will allow them to access the instrumentation developed at CAMIS for testing purposes.

The Research Computing Center's Interoperability Lab provides performance testing services for over 100 vendors of computer communication devices. The Laboratory is also developing a new generation of police cars. These cars are voice operated and test new developments in design, function, and service.

The Center for Venture Studies is a multidisciplinary research unit of the Whittemore School of Business and Economics that is specialized in the area of early stage equity financing and high growth ventures. Since its inception in 1984, the center has become nationally recognized for its expertise in venture management, and would serve as an invaluable resource to new UNH start up companies seeking mentoring and contacts in the investment community.

The Hamel Center for the Management of Technology and Innovation was established by the University of New Hampshire in 2001 with a $7 million endowment. Its mission is to establish UNH as a leader in providing integrated interdisciplinary management and technology programs for students and professionals. Center Director Warren Lackstrom has a strong background in both

business and technology. This experience embodies the Hamel Center's mission of bridging the gap between business and science and engineering.
One of the goals of the center is to bring solid experience in real-world situations to the campus. Three UNH faculty named to Hamel professorships make up a multi-disciplinary team including a Professor of information systems, a professor of chemical engineering, and associate professor of biochemistry and molecular biology. Besides offering a new Master of Science degree, the Hamel Center will partner with New Hampshire businesses to provide educational and technical assistance for managing technological change and commercializing emerging technologies. The new center focuses on commercializing three main technology areas -- biotechnology, information technology and nanotechnology.

UNH Office of Intellectual Property Management (OIPM) was launched in November 2000. This office reports to the Vice President of Research and Public Service. While the University of New Hampshire has long been considered a serious research intuition, the active pursuit of technology licensing, technology transfer and commercialization is a relatively recent activity.

The establishment of the OIPM provided the organizational structure and resources necessary to support the growth of UNH's research programs and put in place the mechanisms necessary to protect proprietary research though patents, copyrights, and trademarks. This initiative also provides a strong mandate to transfer intellectual properties from UNH to industry for commercial products, economic development, and public benefit.

In fiscal year 2001, four licensing agreements were executed, bringing the total to 18 active license agreements that represent technology innovation from a wide cross section for the research at UNH. UNH has also launched an intellectual property protection project, undertaken in cooperation with **Franklin Pierce Law School** and funded by the U.S. Patent and Trademark Office.

The New Hampshire Industrial Research Center is located on the UNH campus, with a satellite office at Dartmouth College, is designed to assist New Hampshire Industry by improving its competitive position. The center provides matching grants for R&D; technology transfer, fostering public private partnerships, and serves as a clearinghouse for information.

New Hampshire Small Business Development Centers (SBDC) is headquartered on the UNH campus. The SBDC provides a wealth of support services to the small businesses of New Hampshire. In 2001 the SBDC`s provided counseling services to 1,800 companies around the state in 183 cities and towns. Last Fall the New Hampshire SBDC program was one of the 30 programs nationwide to be awarded a FAST (Federal and State Technology Partnership Program) grant to support high technology and manufacturing companies in pursuing Small Business Innovation Research Grants (SBIR) and Small Business Technology Transfer Grants. In 2000, 52 SBIR awards were made to New Hampshire businesses, totaling $13.5 million. The state hopes to use these funds to jump start high tech companies and facilitate the commercialization of technology. This is another very important resource for the proposed technology incubation program.

Evidence of Entrepreneurship at UNH

In assessing technology commercialization potential at the UNH this study relied on interviews and surveys to identify prospective tenants, and document the need for a high technology business incubator program in the Seacoast area. In addition to the wealth of services available, the study found compelling evidence of demand for a business incubator program. Academic Entrepreneurs who could potentially lease incubator space include:

Dr. Vern Reinhold – Dr. Reinhold has developed an Ion-trap for use with Mass Spectroscopy to aid in the identification of proteins.

Dr. Thomas Lauer - Professor Biochemistry, Director, Center to Advance Molecular Interaction Science (CAMIS) /Director, Biomolecular Interaction Technologies Center (BITC). Professor Laue has a number of products he would like to spin out as the basis for a start-up company. A technology incubator would be an ideal location for his business. This company would require space within 12 –14 months. Dr. Thomas Laue develops instrumentation for physical biochemistry measurements. These instruments are unique prototypes, capable of being patented, and have a specialty market potential in both research and production laboratories. Dr. Laue has built and sold several units and is interested in commercializing an instrument production company.

Dr. Stacia Sower – Dr. Sower works on endocrine disruptors and the potential for using the gene product (proteins) expressed in response to these agents as inhibitors of reproduction. Patents are in place (and in progress) and preliminary trials have provided successful proof of principle.

Dr. Chuck Walker – Dr. Walker has two areas ready for commercialization. The first is the synchronized development of sea urchin roe for the Asian market. The gonads may be induced to develop large amounts of high quality roe. Second, Dr. Walker has developed the clam as a model for human leukemia studies. He has demonstrated that this system can be used to test the effectiveness of anti-cancer agents.

Dr. Tom Kocher – Dr. Kocker is a fish genetic/genomic scientist. He currently works with an existing company on telapia development and growth conditions for aquaculture.

Dr. Paul Fisher – Dr. Fisher does horticulture work with ornamental flowers. He has developed and patented several software programs to help growers determine when the flowers will bloom and how to schedule blooming at the desired intervals.

Dr. Subhash Minocha – Dr. Minocha specializes in genetic modification of plants. He has collaborations with several companies and expertise in expressing desirable (valuable) proteins from plants.

Dr. Hunt Howell – Dr. Howell directs the Open Ocean Aquaculture project. This new system allows fish farming in deep ocean waters. The design and system are a UNH innovation.

Dr. Tony Taglioferra – Dr. Taglioferra is a nutritionist with a program to test aspects of health. He uses an innovative "Bod-Pod" to determine body fat and health perimeters. He has an interest in developing a health related consulting company to service sports programs, health clubs and hospitals.

Dr. Glenn Shwarey - Dr. Shwarey works with DOD in the development of non-lethal weapons. These futuristic weapons are in the development and testing phase.

Dr. Dennis Bobilya – Dr. Bobilya has developed a cell culture model of the blood-brain barrier. This allows testing of drug delivery and dose effects. This system also allows testing of multiple anti-cancer agents.

Dr. John Halstead – Dr. Halstead has developed software programs to predict the impact of multiple factors on the economic health of rural communities. This program can be used to predict the economic impact of a new department store, or a local retailer closing its doors in the community.

Dr. Kelley Thomas – Dr. Thomas is Co-Director of the Genomics Center. He is an expert in micro-array technology that could be used to produce "microarray chips" for DNA analysis from any organism.

Dr. Rosanna Freyre – Dr. Freyre has executed trial agreements with New Hampshire farmers and is in a position to commercialize breakthroughs in flora culture research.

In November 2000 UNH spun out its first company, Chaoticom, Inc. If a business incubator had been in place in 1999, Chaoticom would have been an ideal client company. The company now employs six and was launched by Associate Professor Kevin Short. Professor Short developed an algorithm that allows sound and video images to be compressed more efficiently. This business was developed out of research sponsored by the National Security Agency. Chaoticom, Inc. received its first round of funding from Kodiak Venture Partners and eCoast Partners. Dr. William Gilbert, also interviewed for this study, is a partner with a local consulting practice, Informagen, Inc. that specializes in the area of bioinformatics. Informagen Inc. is not directly linked to UNH, however, it is a good example of the types of public private partnerships that can develop, and how UNH informally transfers knowledge and technology into the community.

FUNDING NEW HAMPSHIRE'S TECHNOLOGY INCUBATORS

U.S. incubators are funded by wide variety of sponsors. According to the National Business Incubation Association the breakdown is as follows:

Non-Profit, Public or Private – 51% of all U.S facilities are sponsored by government and non-profit organizations, and are primarily for economic development. This mission includes job creation, economic diversification and/or expansion of the tax base.

Academic-Related – 27% of all U.S. facilities are affiliated with universities and colleges and share some of the same objectives of public and private incubators. In addition, they provide faculty with research opportunities, and alumni, faculty and associated groups with start-up business opportunities.

Hybrid – 16% of all U.S. facilities are joint efforts among government, non-profit agencies and/or private developers. These partnerships may offer the incubator access to government funding and resources, and private sector expertise and financing.

Private, For Profit – 8% of all U.S. incubators are run by investment groups or by real estate development partnerships. Their primary interests are economic reward for investment in tenant firms, new technology applications and other technological transfers, and added value through development of commercial and industrial real estate.

Other – 5% of all U.S. are sponsored by a variety of non-conventional sources such as art organizations, American Indian tribal governments, church groups, chambers of commerce, port districts, etc.
Incubators are typically funded by a combination of the sources listed below:

- US Dept of Commerce, Economic Development Administration
- US Department of Agriculture
- Community Development Finance Authority
- HUD/Community Block Grant Funds
- State Tobacco Settlement Funds
- State Tax Credits
- Private Contributions
- University/College

FUNDING STRATEGY - CONSTRUCTION

US Department of Commerce, Economic Development Administration (EDA)
EDA has requested $349.9 million for FY 2003, which is a $15.7 million decrease from FY 2002. EDA has provided support to communities across the country for the construction or renovation of facilities for use as a business incubators. EDA is the leading source of funding for incubators nationwide. The consulting team discussed the proposed New Hampshire projects with EDA officials and received positive feedback regarding funding support, provided that the regions still qualify under the census track 2000 figures for per capita income/ or unemployment. In order to qualify, the target community are must have an unemployment rate of at least 8.5 percent, a labor force of at least 1,500 people, and the building contractor must commit to hiring 40 percent of the construction labor force from the target area.

As an alternative to high unemployment, a community may qualify if the per capita income is determined to be 80% or less than the national average. Both Durham and Lebanon qualify under per capita income statistics from 1996. Neither area qualifed based on unemployment.

It is recommended that Darmouth College and UNH seek grants from EDA for 60 percent of the funds needed for construction. The 40 percent local match could be made up by the donation of land from the partnering academic institutions and state economic development funding (CDBG). Both institutions have expressed an interest in donating land to leverage federal grant dollars.

U.S. Department of Agriculture (USDA)

USDA has requested $74.4 billion for FY 2003, $2.2 billion less than FY 2002. The Sid Martin Biotechnology Incubator located in Alachua, Florida was funded by U.S. Department of Agriculture. USDA is a strong supporter of business incubation as a vehicle for diversifying the economic base of traditionally agricultural communities. UNH, with its heavy emphasis on environmental, earth sciences and particularly marine and aquaculture technologies would be a strong candidate for USDA funding.

We have discussed the incubator projects with NH Rural Development and they are supportive of this initiative and have offered to research funding possibilities. USDA invested $2.693 million in the Sid Martin Biotechnology Incubator in Florida. These funds came through the Cooperative State Research, Education and Extension Program. New Hampshire is not a big farm state, but rather has strength in forestry. It could be argued that the proposed technology incubators are designed to offset jobs being lost in traditional industries around the state.

State of New Hampshire Tobacco Settlement Funds

In 1999 the five largest tobacco manufacturers in the U.S. settled a historic $246 Billion lawsuit with all 50 states in the U.S. The settlement agreement specifically gives state legislatures full authority to spend these funds any way they see fit- as long as it meets their citizens' most pressing needs. To date, health care services have received the bulk of the settlement funds (51%). Another 14% goes to K-12 education and scholarship funds, 11% to children's services, 7% to tobacco control and smoking cessation programs, and 7% to long-term care and pharmaceutical assistance for the elderly. New Hampshire received $42.7 million in 2000 and will collect $1.3 billion by 2025.

Many states have used these funds to build infrastructure such as highways, veterans' homes, and museums, rescinding turnpike tolls, fire departments and highway construction.

New Hampshire, facing court-ordered improvements, created an education trust fund that will provide grants to local school districts. $40 million dollars of its initial payment went into the fund the first year. Given the state legislature's propensity towards using the tobacco settlement money for educational funding, few are optimistic that these funds could be used for the development of biomedical business incubator infrastructure in the state.

However, there is a presence for spending tobacco settlement dollars on research and biomedical infrastructure development. Almost every state among those that have initiatives focused on biotechnology have either begun construction or are planning business incubators and centers of excellence attached to universities. One notable example is Michigan where the governor and legislature have launched a "Life Sciences Corridor." This is a billion dollar initiative that is being funded in twenty $50 million annual installments using the state's tobacco settlement funds. Part of these funds will be used to build 5 laboratories or "Centers of Excellence" at key universities around the state. A total of 17 states are using tobacco settlement funds for high technology business incubation.

Community Block Grant Funds

Many communities around the country have used community block grant funds as part of their local matching requirement for federal grants. These funds require that a significant low/moderate job creation plan be in place to justify the funding. While the goal of the proposed technology incubators is the creation of high wage jobs, many other low/moderate wage jobs will be created, and retained as a result of the development and graduation of new high growth companies in each community. Each of the proposed incubators should seek up to $1 million in CBDG funding to serve as the local matching funds needed to leverage Federal funding.

State of New Hampshire Support

As a low tax state, there are limited funds available at the state level to support the construction of high technology incubator facilities. However, there are some innovative strategies that could be pursued in terms of tax credits to private corporations who ultimately have an interest in seeing a cluster of new high technology companies develop in the state. Banks, utilities, construction companies, and existing corporations are all potential candidates for this type of public-private partnership. Other creative strategies have been suggested. The Pease International Tradeport, for example, has recently begun repaying $650,000 per year back to the state. These funds could be allocated for a technology incubator initiative that would serve to grow new clients for the Pease International Tradeport at nearby UNH, or could be used to further diversify the state's economy by being invested in Grafton County at a Lebanon based incubator facility. The state can replicate the success of the Pease Tradeport on a smaller, more appropriate scale in other parts of the state.

FUNDING STRATEGY - OPERATIONS

Anchor Tenants : To offset initial start up costs, one or more anchor tenants paying full market rates will be recruited. The anchor tenants are an important part of the success of the incubator. These anchor tenants will be allowed to lease up to 20% of the faculity to assist in covering expenses during the ramp up period and allow the incubator manager to be more selective about prospective clients accepted into the incubator program. The corporate sponsor is often seen as also adding credibility and a professional feel to the new facility.

Client Rents/ Center services : The attached budgets provide estimates of the income that will be generated from rents and services over the first three years of the program.

REAL ESTATE REPORT

UPPER VALLEY SITE SELECTION

Basic Assumptions:

Only sites that were properly zoned and accessible via municipal highways with municipal water and sewers in place or readily available were assessed. Access to high-speed data and telephone lines were also a primary requirement for any location. All recommended sites had to be convenient to Dartmouth College and the Dartmouth-Hitchcock Medical Center (DHMC). These factors eliminated a number of physically available but deficient options that will not be covered in this report.

This list includes land and buildings that are presently for sale and those that could be purchased. Land that "might be available" but probably wouldn't work with respect to access, timing, seller's expectations have been excluded. The following is a description of the best available options. This overview includes a physical description, list of attributes and liabilities, and suggests likely purchase prices. The Upper valley market for commercial real estate is very tight at this moment. There are only three potential alternatives available in terms of existing facilities at this time.

Existing Buildings:

1. **New Hampshire Industries, Etna Road, Lebanon**: Robert Haynes, Project consultant, knows this property well and represents its owners who have listed it for sale. The sale price is $2,250,000. It is a 45,220 square foot light manufacturing building sited on 5.19 acres near the intersection of Etna Road and Route 120. The original building has been expanded in three phases over the years. It is presently used by a busy manufacturer (100 employees), is fully air-conditioned, served by loading docks and 62 on-site parking spaces. Some expansion of the building could be undertaken by adding 10-12,000 square feet of office space to the front (Western) elevation. The owners have put the building on the market because it is no longer large enough to meet their needs (75-100,000 square feet.) They have leased overflow space in adjacent buildings and will continue to occupy it until a replacement property can be obtained (search is underway) and an acceptable purchaser found. The location of the building is excellent in terms of its proximity to DHMC, Centerra Park and Interstate 89. The owners are motivated to find a replacement facility that can satisfy their future needs.

2. **20 Airpark Drive, West Lebanon**. This is a 24,000 square foot Butler building which is located opposite the Lebanon Airport terminal. It consists of 6,000 square feet of office space and 18,000 feet of warehouse with loading docks. Technica originally constructed this building for warehouse distribution of ski boots. The Company relocated to a larger facility nearby and the building has been used by a number of warehouse/distribution tenants. Its present owners are actively seeking a buyer for the property that is listed for sale for $950,000 ($39.58 per square foot). The listing broker suggests that some possibility exists for slight expansion of the building. The building occupies a 2.0-acre parcel with 24 parking spaces in front, and room in the rear for deliveries and some storage. This site does not offer as close proximity to the hospital and to the Dartmouth campus due to the well-known traffic issues presented by Route 12-A. However, most employees who work in buildings on Airport Road and in the Airpark feel that this is a very pleasant work environment.

   17 Technology Drive, **West Lebanon**: Potential exists for the purchase of this 28,000 square foot Butler building which is located near the top of the Lebanon Airpark. While the building is not formally for sale, its owners have suggested that they would consider a sale for $2,500,000. It is presently leased to a company that designs and manufactures processing equipment. They could be relocated. While the building would represent an excellent option from a physical perspective, its price ($88.49 per square foot) is a significant disincentive. It is physically available however and would work well for the intended purpose.

Raw Land Options:

1. **Lots 36 and 37 Centerra Technology Park, Lebanon**: These are the last two undeveloped lots in the Research / Industrial zone of Centerra Technology Park and have been formally off the market for approximately 18 months. Combined they total 5.65 acres and were seriously considered by a high-tech company which sought a location for a 30,000 square foot precision manufacturing facility. Business constraints prevented the execution of a purchase agreement in May of 2000. This land belongs to Dartmouth College and it retained these lots for its own uses.

   While some potential exists to develop a larger building, a 30,000-40,000 square foot building is a more realistic possibility. There is potential for further expansion of the Centerra Technology Park on land adjacent to these lots that would provide physical access to it. There is no guarantee that this will take place, but the College has pursued this plan for several years and still hopes to purchase this Dartmouth property. This land is known as the Lahaye land and is essentially landlocked.

   Paul Olsen, the Director of Real Estate for Dartmouth advised that although these lots are not formally on the market, the College views them as having a value of $700,000 ($124,000 per acre). An inspection of the neighboring uses would indicate the obvious strengths that this option would provide in terms of access and site development costs. The project real estate consultant, based on his knowledge of construction costs of nearby buildings, feels that there would be significant advantages to building on this site. On a 1-10 scale (10 being the highest) he described this site as a 9.9 for our intended use, reserving a 10 for guarantees of a larger building(s). The only negative is the potential cost and delay of wetlands determination due to the existence of a small wetland identified on the site.

2. **Busky Land, Heater Road, Lebanon**: Two parcels that total 4.91 acres lay between Heater Road and Interstate 89 East of the truck stop and West of the overpass. They have been for sale for a number of years with a current asking price of $525,000 ($27,000 per acre). Previous approvals were obtained for two 15,000 square foot buildings. The land is presently served by municipal water and jacking underneath the interstate must provide sewage. The owner feels that City of Lebanon would be very receptive to using the property for the development of a technology incubator facility. The site is highly visible to the public, and is well located with respect to the DHMC and Centerra Technology Park, the interstate, in downtown Lebanon. The site is relatively flat and the only unusual cost would be for sewer expansion.

3. **Campion Land, Labombard Road, Lebanon:** This is a late entry to the inventory list. Jay Campion, a Hanover based developer, has assembled several properties behind Miller Auto's Chevrolet dealership on Heater Road. Although his property has frontage along Route 120, access is provided via Labombard Road from Heater Road. Mr. Campion's plans include construction of a sports facility, if he is successful in obtaining the necessary permits and approvals. This is considered unlikely based on experience with Lebanon's Planning and Zoning boards. An alternate plan for the site is to develop industrial buildings. There are approximately 13 acres of land to work with which could accommodate a 150,000-200,000 square foot building. The site development costs would be very low due to favorable topography.

4. **Penfield land, Great Hollow Road, Hanover:** Etna Road becomes Great Hollow Road in Hanover and ends where it merges with Greensboro Road. At that intersection, a recent PUD was approved on the former Creare land. The owner is presently constructing warehouse / distribution buildings for relocation of his existing tenants who occupy building the hospital is purchasing. His approvals include a 12,000-foot building and a 20,000-foot building that are not spoken for yet. The owner is interested in including his property as an option. Centerra would be a good indicator of value (closed sales of $100,000 per acre). The necessity to purchase this land would require conversion of his PUD to a subdivision. From a physical and location standpoint, this property works well. It is opposite the Creare facility, the source of many high tech companies in our region. If the ownership of the underlying land is a necessary element, this may put it out of contention. However, if a land lease were possible or if the owner would re-subdivide it, this opportunity should warrant further investigation.

5. **Haverford Property, Airport Road, West Lebanon**: This is the undeveloped corner property at the intersection of Airport and Terminal roads in West Lebanon. It consists of several parcels that total 10.6 acres. Although the property is presently zoned General Commercial (GC) the City Council was petitioned about its willingness to reclassify it as Light Industrial (IND-L) which is necessary. The owners purchased it in order to relocate and expand their business, Centricut. They have since tabled their request to change the zoning following the sale of the business (to Hypertherm) and have listed the property for sale for $1,200,000 ($113,000). Its high price reflects its value for retail use, but the owners have encouraged me to solicit offers.

   Site schematics that were developed for Centricut which depict tremendous flexibility and real potential for use as a small research park in a PUD configuration. It could also be sub-divided. This property presents the very best available in this region for the evolution of an incubator into an actual production, office, or distribution facility(s). The site development costs would be very reasonable. Water and sewer are in place.

6. **K&J Property, Lebanon Airpark:** Located at the top of the Airpark adjacent to Technica's complex, this 42 acres of Light Industrial land and would also be perfect for use as an incubator site or a campus of several large buildings. The owners have declined offers to purchase it but would ground lease it and are eager to develop the site to suit a large tenant's needs. They have also expressed a willingness to participate in an equity partnership with the State or who ever ultimately owns the facility to be built. This option would be worth pursuing due to its expandability if its location is acceptable.[8]

Upper Valley Summary

Based on all available options, the best site for the designated purpose is the Centerra Technology Park, lots 36 and 36 to be used for the construction of a new facility. The viable options near the campus are limited. The Centerra Technology Park in Lebanon has infrastructure fully in place. The Centerra Technology Park presently houses approximately 24 tenants on a 120-acre park. An incubator should be centrally located and within easy reach for Dartmouth College faculty and students and offer access to business services including restaurants, banks, professional firms, etc. Given its proximity, this study found that the incubator should be sited within the Lebanon area. Lebanon is also more favorable in terms of Federal grant eligibility due to its demographics.

This location has a decided advantage in that Dartmouth College owns the property and has made a commitment to donating the property. The College has already investigated code issues and other property/construction considerations and does not anticipate any impediments to locating the business incubator on the site. A further incentive to locating the incubator at this site is that the property lies within the Centerra Technology Park which already houses new, high technology based businesses– this will also have a positive impact on funding opportunities for the incubator program. Finally, there are preliminary plans being discussed for a larger research park, which would "dovetail" perfectly with the proposed high technology incubator concept. A combination of research park, Centerra Technology Park and high technology business incubator would provide a highly centralized and visible complex of community and business activities and services. The Centerra Technology Park is an ideal environment for a technology business incubator.

[8] Robert E. Haynes Jr., President, RE Haynes Co prepared this report.

SEACOAST REGION SITE SELECTION

Basic Assumptions:

Using the same selection criteria as the Upper Valley, all potential sites had to be properly zoned and accessible via municipal highways with municipal water and sewers in place or readily available. Potential access to high-speed data and telephone lines were also a requirement.

All recommended sites had to be convenient to the University of New Hampshire, Durham and its various research institutions. These factors eliminated a number of physically available but deficient options that will not be covered in this report.

The following are description of the best available options identified to date:

1. University of New Hampshire Campus – raw land located at Leeward's Orchard located off of Mast Road North and Old Route 4. This land belongs to UNH.

2. Pease International Tradeport – 320 Corporate Drive, Existing 42,220 s.f. Former Air Force hospital building. Top three floors are vacant and available for renovation.

The New Hampshire Community Technical College's (NHCTC) Center for Emerging Technology provides biotechnology and information technology training on the first floor of the 320 Corporate Drive facility. The top three floors, if converted to a high technology incubator, would require extensive renovations, in excess of $2,500,000. The building is attractive in that it has an existing biotechnology-training program, and it is near several larger biotech/medical related companies and has extensive plumbing/electric, etc. The site also offers a high profile address and access to business amenities such as copy shops, restaurants, etc.

The following are existing properties that were also considered and that are available though Pease Development Authority:

7 Manchester Square	27,415s.f.	Business/Commercial	Available
358 Corporate Drive	10,898s.f.	Business/Commercial	Available
65 Aviation Avenue	24,446s.f.	Industrial	Available
75 Rochester Avenue	15,720s.f.	Industrial	Available
22 Hampton Avenue	13,433s.f.	Industrial	Available

Real Estate options available for the construction of a new facility where more limited than in the Upper Valley. The study found that in order for a university technology incubator to succeed at UNH, it was necessary to locate it on or very near the campus. We discovered a number of logistical issues regarding access to off campus locations and a strong preference by most staff and faculty to have a center located in close proximity to where their research is occuring. Based on these considerations, and because UNH may make land available for the construction of a new facilty, it is recommended that a working group consider locations on the campus in Durham and consider ways to tie in the Pease International Tradeport component. This is the same conclusion reached by Hammer, Siler, George Associates, Inc. in a study conducted in 1995.

The Entrepreneurial Campus - UNH

The team first evaluated the possibility of locating a newly constructed facility on the West Campus in an area referred to at UNH as the "Entrepreneurial Campus." UNH has constructed a number of very well appointed laboratory buildings on that part of the campus and it was felt that this would be an ideal location for a technology incubator. However, after discussions with the Director of Real Estate at UNH, we determined that it would be far too costly to build a stand-alone incubator facility in that space. The recently constructed 42,000 s.f. Enviornmental Building in that area cost in excess of $14 million to build due to the institutional quality materials and finishes that went into the building. The pre-engineered, Butler style building envisioned for an incubator development simply would not fit into that overall mix of buildings. There is an opportunity, however, to partner with a proposed Telecomunications building scheduled for development on the Entreprenurial Campus in two to three years.

Seacoast Summary

This study concludes that a 25,000 – 30,000 square-foot new construction building located off of Mast road North and Old Route 4 on the University of New Hampshire's campus would be the best possible location for a business incubator given timing, access to the research facilities, the possibility for land donation, and various other support services from UNH. If this option was pursued, the building should be designed with 80% leaseable space. The mix of office to lab space should be 70% office, dry lab, and 30% wet lab space. This location is central to other research facilities and would offer ample parking.

An alternative, longer-term strategy would be to support the renovation of one floor at the Pease International Tradeport location in a partnership with NHCTC, and to incorporate a technology incubator into the planned telecommunications building scheduled for development at the Entrepreneurial Campus in two to three years. A partnership arrangement between UNH and NHCTC could provide for two locations to be developed. The first incubator site would be at the Pease International Tradeport in cooperation with the existing Biotechnology Center and the second could be developed on UNH's Entrepreneurial Campus as a modual of a newly constructed building. It is recommended that the Working Group further evaluate the advantages and disadvantages associated with this alternative proposal.

RENOVATION VS. NEW CONSTRUCTION

Based on a study of existing buildings and land available for new construction, and considering inputs from the community regarding interest and support for a business incubator, the following preliminary conclusions can be drawn:

- Several existing buildings were identified as potential sites for high technology business incubators. These facilities would require extensive renovation – so much so that the cost for acquisition/renovation could approach the cost of new construction. The locations are adequate but not ideal considering access to UNH and Dartmouth College
- The sites identified should be considered "Plan B" and only selected for implementation if the primary recommendation cannot be pursued;
- The primary recommendation is to build two new facilities in the 25,000-35,000 square foot range

This study addressed the following issues:

- What is the optimal size for a facility - what is the need in the community in terms of the number of companies likely to be housed in the incubator;
- Where should a facility be located to be easily accessible and/or to qualify for funding support;
- How should the building be configured (what kind of space is needed – office, laboratory, manufacturing, lab, etc.)?

The optimal size - Determining the size of an incubator requires two related considerations – the need in the community and the desire for a financially self-sufficient program. The National Business Incubation Association (NBIA) model for self-sufficiency suggests a facility with a minimum of 25,000 - 30,000 square feet.

Because the cost of operating a technology oriented facility is higher than a mixed-use office building, a 25,000 square feet or larger building would be recommended. Several other factors affect self-sufficiency – occupancy levels and rental rates; staff size and salaries; revenue from program service fees; etc. It is assumed that Dartmouth/UNH/NHCTC will provide some services at our below cost to the technology incubator facility thereby lowering its operating expenses. It is also assumed that the host institution, at least through out the initial lease ramp up period, will cover the salary costs for Center directors.

Need in the community –Assessing the number of companies likely to be housed in the incubator is critical. An incubator program can never be self-sufficient if the facility cannot reach full occupancy. Based on discussions with real estate specialists, community and business leaders, and considering several initiatives in the planning stages as previously described, it is reasonable to expect that a business incubator of at least 30,000 – 35,000 square feet will draw considerable interest.

Building configuration has been determined primarily from the results of the need analysis that has been completed. Based on the previously described economic development initiatives that are underway and discussions with existing small businesses in the area, several observations can be made to arrive at a preliminary estimate of the kind of space that is likely to be required:

- The incubators should be classified as a mixed use technology incubators but with considerable focus on the needs of biotechnology and biomedical-based businesses;
- There will be an emphasis on office- space but 30 –40% of the leaseable space will be devoted to both wet and dry. Laboratory space:
- Software development is expected to be a key component of many tenant companies, especially with the interest in internet-based applications
- Potential for biotech, biomedicine and life sciences businesses is significant and will necessitate some special fixtures and shared equipment.

The focus of the incubator will be on “clean” businesses that will create well-paying jobs, interface productively with UNH, NHCTC and Dartmouth College students, faculty and staff and utilized other resources to increase their chances for success.

EXISTING FACILITIES OPTIONS

Seacoast Region

There are no existing buildings currently available for sale on the UNH campus, according to the UNH Director of Real Estate.

Upper Valley

There are no buildings currently available for sale on the Dartmouth campus. Based on the minimum size envisioned for a Dartmouth College business incubator of 30,000 – 40,000 square feet, only three buildings have been identified within the 15-mile radius from Dartmouth College that are available and might be adequate. Because of the dearth of existing buildings, new construction offers more options and is recommended. A newly constructed incubator is preferable because it can be configured to meet the exact local needs including the latest technology infrastructure. Moreover, new construction techniques and materials can be applied that will likely reduce the operating costs for the facility compared to a renovated, existing building.

CONSTRUCTION COSTS

Based on experience with several incubator construction projects, the cost of a 25-30,000 square foot, mixed-use facility will be in the $70-90 per square foot range. From discussions with local builders and developers, the cost of technology-focused incubator buildings in Lebanon and Durham could be at the higher end of this range depending on the level of finish. Square foot costs decrease with a larger facility due to inherent economies of scale.

PROPOSED DEVELOPMENT BUDGETS

DARTMOUTH COLLEGE TECHNOLOGY INCUBATOR

Upper Valley Region

A 39,900 square-foot pre-engineered building at Centerra Technology Park in Lebanon, with 80% leaseable space, constructed on lots 36 and 37 would be the best possible location. The recommended mix of office to laboratory space is 60% office, dry laboratory and 40% wet laboratory space.

DETAILED BUDGET – CONSTRUCTION

LINE ITEMS	PROPOSED BUDGET
Land	Donated as local match
Site Development costs	$200,000
Project Inspection fees (wetlands determination)	$30,000
Architectural/Engineering fees	$150,000
Other Architectural & Engr. fees	$15,000
Construction management	$35,000
Construction of 39,900 square foot at $76 s/f	$3,032,000
Equipment Budget	$175,000
Signage	$5,000
Contingencies	$60,000
TOTAL PROJECT COSTS	**$3,702,400**

UNIVERSITY OF NEW HAMPSHIRE - TECHNOLOGY INCUBATOR

Seacoast Region

A 25,000 – 30,000 square-foot new construction building located at Mast Road and Old Route 4 on the UNH's campus of would be s possible location given access to the research facilities, land availability, and other support services from UNH. The building should be designed with 80% leaseable space. The mix of office to laboratory space should be 70% office and dry laboratory, and 30% wet laboratory space.

DETAILED BUDGET – CONSTRUCTION

LINE ITEMS	PROPOSED BUDGET
Land	Donated as local match
Site Development costs	$200,000
Project Inspection fees	$15,000
Architectural/Engineering fees	$150,000
Other Architectural & Engr. fees	$15,000
Construction management	$35,000
Construction of 25,000 square foot at $100 s/f	2,500,000
Equipment Budget	$175,000
Signage	$15,000
Contingencies	$60,000
TOTAL ESTIMATED PROJECT COSTS	**$3,165,000**

Four to five acres of land are required for each construction project. Dartmouth College has made a commitment to donate the required land, and the UNH has discussed the possiblity of making land available on or near the campus for the project. Each institution has stipulated that a land donation is contingent upon the project receiving sufficent outside funds for construction. The land proposed by Dartmouth College is located at the Centerra Technology Park and is valued at $700,000.

FINANCIAL PROJECTIONS

Upper Valley - Budget Narrative

A projected proforma budget was prepared for a 39,900 square foot building at Dartmouth College's Centerra Technology Park. This building would offer 32,000 square feet of net leasable space, with a mix of 60% office and 40% lab space. It is estimated that during the first year of operation, the incubator will need local subsidies of $49,120, plus whatever percentage fee is negotiated with the Grafton County Economic Development Council for their participation in the program. Based on the information gathered in the study, it is anticipated that the incubator will reach break even its second year in operation with occupany rates at 70% for office space and 65% for wet lab. This assumes an anchor tenant leasing 5,000 s.f. of space in the office area. This plan assumes very efficent layout and use of space and a very aggressive lease up period. Please see the detailed operating budget overview provided (Attachment E).

Seacoast Region – Budget Narrative

The proforma budget for the proposed incubator on the Univeristy of New Hampshire campus assumes a slower space absorption rate, especially with non-university tenants. The Proposed incubator will be 25,000 square feet, with 18,700 net leaseable offering 70% office and 30% lab. The team assumes that the incubator program will require an operating subsidy of $161,005, and $39,606 respectively in the first two years of operations. In the third year of operation, at 70 –75% percent occupancy, the incubator is expected to generate a profit of $12,743. Incubator revenues are projected to increase each subsequent year as rents increase and royalty streams begin to flow to the facility. The first two years will require a total estimated operating subsidy of $200,611.

The building layout allocation for square footages and the projected occupancy rates were determined from data obtained from the National Business Incubation Association (NBIA) nad reflect experience of incubator programs across the country; the rental rates were provided by using their experience in the Grafton County/Stafford County markets; and the incubator operating expenses and tenant income figures were derived primarily from the St. Louis Center for Emerging Technology – a business incubator program that has similar characteristics to the proposed project.

A verbal (informal) survey of local realtors was carried out in each community to determine the average rental costs in the area. The realtors had no exact comparable figures for the incubator space as there is no similar facilities in the state to use as a model. However, the realtors stated that typical retal rates for office space are as follows:

New Hampshire Commercial Real Estate Market

According to the Real Estate and Lending Commercial Directory, the market for office space in the state is tight. The two markets commanding the highest lease rates for prime office space are Portsmouth and South Nashua. Portsmouth remains a hot market, especially with high technology companies, despite the economic downturn in the state. South Nashua continues to be tight due to its proximity to Massachusetts.

Upper Valley Area Rents

Discussions with local landlords and tenants reveal that the typical rental rate in Hanover/Lebanon for high quality office space is generally between $18.00 - $24.00 per square foot including janitorial and utilities. For example, at the Centerra Technology Park, a new facility located in the Lebanon, charges approximately $22.00 per square foot with utilities and maintenance.

Seacoast Area Rents

The breakdown in the Seacoast are is $10 –12 per square foot, on average in the Durham area, $20 in Portsmouth, and $17 – 21 at the Pease International Tradeport.

Rental of incubator space in the first year is often offered at slightly below the local market rate. Rent can then be increased in the following years on an escalating scale. By the third year a tenant generally can obtain a more favorable lease outside of the incubator. This is a method used to encourage graduation and discourage long-term stays.

Detailed assumptions are as follows:

- Common area includes circulation (halls), break room, toilet rooms, conference rooms, reception area and office space for the incubator management staff.
- Areas have been designated for anchor tenants (well established companies or service organizations that are willing to pay market rate for the space and also bring some added value to the project – for example, a business assistance organization, a law firm or an existing biotech firm). Space for anchor tenants could be increased or decreased depending on project need. Typically, no more that 20% of the available floor space is set aside in an incubator for anchor tenants. The need for positive cash flow may dictate a larger percentage.
- As noted above, rental rates are based on current market conditions in the area. Generally, anchor tenants can be identified and commitments for space obtained prior to the incubator opening its' doors. With regard to incubator companies, some commitments can be predetermined but start-up companies need space at the point in time when they are formed, and they may not be able to wait until the incubator is ready to receive tenants.As a result, NBIA surveys show that a modest occupancy rate for incubator companies at the outset is more realistic and, from a financial perspective, more conservative in estimating the need for early subsidies. This project is expected to achieve full occupancy (of 90% since some space if always in transition as companies "graduate" and new tenants are identified) by the end of the fourth year of operation.
- All rental rates are "full service" which includes utilities, taxes, insurance, and common area charges, all prorated based on square footage, plus the basic charge for the floor space.

Should a tenant require an inordinate level of power or other service, an addiiton charge would be levied.

- Certain tenant programs such as the copies and telephones will be reimbursed by the tenants on a cost plus basis. The amount of the markup is shown in the projections.
- "Tenant ROI" provides for compensation to the incubator to account for tenant companies being charged less than market rate, initially, for their space and in exchange for the business assistance services provided by the incubator management. This compensation can be in the form of royalties on future sales and/or equity (stock). This "return on investment" (ROI) will be critically important to the incubator in achieving financial self-sufficiency in later years (including salary of Director). The first five year projects assume no payments from these sources. The amount of the subsidy shown in the spreadsheets is simply that amount required in addition to the rental, other income, in order to cover expenses.

Expenses

- Incubator staff is composed of Director, whose intial salary will be covered by the host insititution (this could be DEN/ Hamel Center Directors),a program manager who has responsibility for the facility including leasing, and a site administrator who handles all of the tenant shared services, and serves as receptionist/secretary. For the purposes of this exercise, it is assumed that the incubator support staff will spend 30% of their time on incubator facility issues and 70% of theit time assisting tenant companies. Incubator staff benefits are included at 20% of direct labor costs.
- Facility expenses includes all costs for operating the building. The figures used are derived from the experience of the St. Louis Center for Emerging Technologies, a possible prototype for the New Hampshire Centers.
- Program expenses include all other expenses required to support the incubator staff and to provide a variety of shared services for the incubator tenant companies. These figures are also derived from the Expenses in many program categories increase over time as occupany increases – postage, telephone and copies costs are examples. Tenant events, publications, and dues/subscriptions generally provide resources for both staff and tenants. Other program expenses support the incubator staff.

PROJECT TIMELINE
SHORT TERM GOALS

February 20 – June 20, 2002

1. Conduct Fund Raising Campaign - Grant writing, EDA Pre-Application
2. Provide Further Information to College/ University Faculty Staff, Administration (Approvals)
3. Secure Land Donation as Local Matching Requirement for Federal Grants
4. Seek Further "Community Buy In." Brief Legislators, Government Officials
5. Confirm EDA Funding Support for the Project/ Seek Other Sources of Funding
6. Write Incubator Business Plan / Policies and Procedures/ Job Descriptions
7. Recruit Board of Directors
8. Form Real Estate Committee
9. Refine Incubator Floor Plans /Site Plans
10. Develop Prospective Client List – Document Space Needs
11. Coordinate Initiative with Internal Partners (Technology Commercialization Office, Etc.)
12. Further Integrate Other External Service Providers/Strategic Partners (Investors, Etc.)
13. Consider Public Relations/ Marketing Plan

The timeline is dependent on the ability to secure all necessary approvals, donations, and funding for the project. EDA`s fiscal year ends in October 2002. Local EDA representatives are waiting for U.S. Census 2000 results to determine if the target communities are eligible.

INTERMEDIATE GOALS

Assuming that no other more immediate sources of construction funding are identified, and asssuming that an application to EDA can be prepared, presented and approved for funding to commence November 2002, the project timeline for this project is estimated as follows:

Real Estate Development Timeline

Activity	**Timeline**
➢ Acquire land for the project	June 2002
➢ Begin wetlands determination	November 2002 – February 2003
➢ Prepare a Request For Qualifications and obtain bids from architects	November 2002
➢ Hire A/E and prepare bid documents	Devember 2002 – February 2003
➢ Develop RFP for Construction	January 2003
➢ Submit site plan for town approval	January 2003
➢ Advertise/Solicit Bids in CompetitiveProcess	Feburary 2003
➢ Obtain site plan approval for the project	March 2003
➢ Bid Opening/ Execute Contract with Builder	March 2003
➢ Obtain building permits for the project	April 2003
➢ Hire Construction Manager	April 2003
➢ Break Ground/Begin construction	April 2003
➢ Procure necessary equipment	May 2003
➢ Begin Marketing space/ pre-leasing	September 2003
➢ Complete construction	December 2003
➢ Obtain certificate of occupancy	January 2004
➢ Grand opening/ move in	January 2004

PROTOTYPES - TAPPING SUCCESSFUL EXPERIENCES

After more than 20 years of growth in the incubation industry, there are many examples of programs that have made critical errors in such areas as facility selection, governance structure, and the formation of valued-added management assistance programs. These errors are numerous enough to identify patterns - the best practices for success and patterns of error that are to be avoided.

The 42 life science-related business incubation programs around the US have valuable experiences – good and bad – from development to operations. It is important to make contact with successful incubator programs in communities that are similar or that have like goals. When combined with the wealth of information that NBIA has accumulated on contacts, research, and recommended best practices, the margin for error is significantly reduced and chances of success are improved.

A 2001 study conducted for the University of Florida, Sid Martin Biotechnology Incubator near Gainesville provided a competitive analysis of several biotechnology incubators around the U.S. The study examined the following centers[9]:

- **SOUTHEAST**:
    - Arkansas BioVentures, University of Arkansas for Medical Science
- **NORTHEAST**:
    - Alpha Center, John Hopkins University/Heath System, Baltimore, Md.
    - Technology Advancement Program (TAP), University of Maryland, College Park
    - Technology Enterprise Center, University of Maryland, Baltimore County
    - Association for Entrepreneurial Science (AES), Rockville, Md.
    - Science Park, Yale University, New Haven, Conn.
    - Virginia Biotechnology Research Park/Virginia Biotechnology Center, Richmond
    - Massachusetts Biotechnology Research Institute, University of Massachusetts Medical School, Worcester
- **MIDWEST**:
    - Chicago Technology Park, University of Illinois at Chicago/Rush-Presbyterian-St. Luke's Medical Center
- **WEST**:
    - California was not included, as the state does not have any biotechnology incubators. According to the California Health Care Institute, the state houses nearly one third of all of the biotechnology firms in the United States. These findings were confirmed through interviews with BIOCOM San Diego, Bay Area Bioscience Center and San Diego State University. All of these sources confirmed that in California, natural incubators form within parent companies, so formal ones are not needed. However, many of these organizations have recommended the formation of incubators. Two very small, private incubators may open in California this year.

[9] Source: Mason Strategic Communications study

Alpha Center
Baltimore, MD
Johns Hopkins University and John Hopkins University Health System

Major research institution: Associated with Johns Hopkins University.
25,000 sq. ft. incubator managed by the Dome Corp.
Current capacity: 100% filled with eight companies
Success rate: 15 graduates, two of which are on the NYSE
Organization/services: This incubator charges higher rent to tenants, but doesn't take part of the profits when companies graduate.
Funding Sources: Facilitate access to funding. State funding. Private donations.
Strengths: Access to National Institute of Health, shared research with Johns Hopkins School of Medicine, access to funding.

Technology Advancement Program (TAP)
University of Maryland, College Park

Major research institution: University of Maryland
Founded in 1985, Areas of concentration: bioengineering and bio-space
Organization of and arrangements with incubating companies:
- Three year cap
- Incubator takes one percent of equity for each year in the program.

Services provided:

- Fume hoods
- Bio safety cabinets
- Furnished
- Internet connections
- Purified water
- Centrifuges
- Microscopes
- Autoclaves
- Walk-in freezer

Current capacity: 100% full, 12 companies of which six are biotechnology
Success rate: Have graduated 56 total companies, of which 17 were biotechnology based.
Challenges/threats: With the emergence of more for-profit incubators, participating companies need to be more cautious about their financial arrangements e.g., how much they give up.
Funding Sources: Venture capital and State of Maryland funding.
Strengths: University resources and expertise. Proximity to NIH, Army, Navy, Humane Genome Project, 270 Biotech Corridor, shared services and facilities. Guides to venture capital.
Competitive Point of Difference: New facility that is well appointed.
Reputation/Image: Excellent.

Technology Enterprise Center
University Of Maryland Baltimore County

General description: 160,000 sq. ft. facility on 30 acres
Areas of concentration: Biotech/Biomedicine
Organization of and arrangements with incubating companies:
Timeline: Average lease is three years.

Equipment and service provided:

- 40+ wet labs
- Deep freezer
- Autoclaves
- Glassware washing machine

Incubator takes one percent of the equity and/or royalties to UMBC
Current capacity: 100% full with a waiting list. 12 companies in the incubator
Success rate: Eight biotechnology graduates, of which three are very successful
Reasons companies' fail: Don't track companies after they leave the incubator.
Challenges/threats: "None"
Funding Sources: Provide access to venture capital outlets, coaching to get funding.
Strengths: "State of Maryland established technology resource organizations, more credibility which is critical to success, wisely done state investments." Provides excellent management and coaching.

Association for Entrepreneurial Science (AES)
Rockville, MD

This is a 48,000 sq. ft. facility that has been open for the past 15 years. Managed by a private corporation set up to invest in start-up companies, with 75 percent lab space and 25 percent office. No university affiliation. Started by a landlord with spare lab facilities and no use for it, decided to "fill the space instead of tearing out the equipment and leasing it to an insurance agency."
Internal organizational structure: Variable, no full-time employees, and eight to 10 part-time administrative personnel.

Timeline: Ranges from six months to 12 years.
Equipment and service provided: Full-service, including wet labs, lab benches, air, gas, vacuum, deionized water, office equipment, autoclave, biohazard hoods centrifuges, clean rooms, animal facilities (don't supply specific equipment), business development, provide sample grant proposals.
Current capacity: 100% with 100 current employees, has been as high as 250. Four out of the current eight are biotechnology companies.
Success rate: Eight graduates. No failures to date that they know of, but don't track graduates.
Challenges/threats: None. Don't see current competition with the few existing competition.
Funding Sources: Venture capital, "boot strap" operation, equity positions, graduates or private donations
Mission Statement: Advancement of entrepreneurial ship in science.

Science Park
Yale University

New Haven, CT

Major research institution: Yale University
A cluster of rehabilitated buildings that house medical laboratories.
The Park has been open since 1982.
Areas of concentration: 50% of the companies are biotechnology
Timeline: As long as a company can pay rent, they can stay. Lease rates are market-driven.
Equipment and service provided: Share equipment and wet lab space at Yale University.
Success rate: Currently don't track.
Challenges/threats: Limited lab space; ability to provide quickly
Funding Sources: State, city, university
Mission: To provide jobs in the area; become an asset for New Haven.
Image/reputation: In the community, they are experiencing backlash, as the project was positioned as a job-generator for an area not populated by people with the advanced degrees needed for the industry. Within the scientific community, however, the reputation is very good, primarily due to the affiliation with Yale.
Strengths: State funding; expertise in running businesses
Weaknesses: Quality of some of the available office/lab

Chicago Technology Park
University of Illinois at Chicago, and Rush-Presbyterian-St. Luke's Medical Center

Major research institution: University of Illinois
Quasi-state supported non-profit.
Designed to attract and support advanced medical, biological, chemical, engineering, computer and other technological research and product development. It is located five minutes west of Chicago's Loop in the Illinois Medical District. The 57,000-square-foot facility includes 39 wet labs/ offices.
No equity is taken in companies.
Timeline: Companies can stay for up to six years. This timeline is currently under evaluation. The typical company stays for 4 to 5 years.

Equipment and service provided:

- Independent exhaust system with fume hoods
- Laboratory laminated benches with gas, air and vacuum lines
- High-purity RO deionized water
- Individually metered electric service and heating
- 120/208 volt, 100 amp electric service
- Sprinklers and fire alarms
- Nine-foot ceilings150 lbs. Per sq. ft floor loads
- Specially keyed security locks
- Fluorescent lighting
- Horizontal aluminum blinds
- University-standard steel furniture
- Darkroom facilities
- Cold rooms
- Autoclaves
- Dishwashers connected to high-purity RO deionized water
- Passenger and freight elevators
- Shipping and receiving dock

Current capacity: 100 percent full with 26 companies and a waiting list of four companies
Success rate: 24 graduates, of which 12 are still in business, three are very successful
Reasons clients fail: Competition or funding issues
Challenges/threats: They don't have the infrastructure for mid-stage growth space. The Midwest has lagged behind in venture capital funding.
Chicago Technology Park (continued)

Only five of 25 venture capital firms in Chicago recognize biotechnology as a good investment. Many times the companies receive funding from different areas of the country.
Funding Sources: Incubator creates liaisons for companies. Illinois Coalition. State matching funds. Received $8 million in start-up funds.
The Chicago Technology Park provides an affordable, resource-rich environment where entrepreneurial ventures can take root, where young companies can develop their potential, and where firms can expand their opportunities.
Image/reputation: Great reputation. Claim to be the country's first biotechnology incubator (1986). They are associated with University of Illinois, a phase-one research institution.
Point of differentiation: State of the art equipment with the right setting for growth.
Strengths: Networking opportunities they can provide, outside services that change with the changing needs of the companies, very strong grant writing (22 SBIR awards – 6 phase 2 that average $1 million a piece), joint purchasing. Located in the world's largest medical district.
Weaknesses: Limited venture capital dollars in the local area.

Iowa State Innovation System
Iowa State University, Ames

Major research institution: Iowa State University
The Iowa State Innovation System reflects Iowa State's commitment to leadership in economic development and technology transfer and is an integral part of the university's sophisticated research network. The facility is 8,000 square feet.
Areas of concentration: all technology-based concepts

Equipment and service provided:

- Wet lab space from 300 sq. ft. up to 2,000 sq. ft.
- Fume hoods
- Casework
- Sinks
- Eyewashes
- Purified water
- Gas
- Vacuum
- Air
- Custom-designed labs are also available
- Shared autoclave
- Centrifuge
- Freezer
- Tissue culture hoods
- Conferencing
- Break room

Current capacity: Has 38 tenant companies and has supported more than 71 start-up companies. Currently 1,100 employees work in the park.
To support the growth and successful introduction of technology related start-up businesses into the Iowa business community.
Image/reputation: Very good reputation because of significant partnerships with business development centers.
Point of differentiation: Comprehensive innovation network.
Strengths: Access to university lab equipment for supplemental research, relationships with scientific and entrepreneurial association, university expertise and collaborations, state of the art telecommunications, technology-based business assistance, technology-based seed capital.

"VIRTUAL" INCUBATOR

Arkansas BioVentures
Little Rock, Arkansas
University of Arkansas for Medical Sciences

Major research institution: University of Arkansas for Medical Sciences
The incubator program was created to facilitate the start-up of biotechnology-based business enterprises and to enhance the growth of job opportunities in Arkansas. Arkansas BioVentures supports the development of novel biotechnology commercialization through start-up companies and provides a university hosted business incubator program to benefit the state's economy.
Equipment provided varies because the companies in the incubator are placed into laboratories in the university and around the area where there is space. Services provided are access to venture capital and help with business plan development and scientific planning.
They have a "virtual incubator" so they always try to find space. Currently they are incubating nine companies and are interviewing two candidates.
Two companies have graduated from the incubator. Another is getting ready to graduate in the next few weeks.
Reasons companies fail: Never had a failure.
Challenges/threats: "There are no challenge or threats because we have great support from the Department of Commerce. The only challenge we face is that our growth is slowed because we don't have a facility."
Funding: Two private venture capital groups, private partnerships, SBIR funding.
Image/reputation: Great recognition locally and regionally. Little recognition on a national scale.
Strengths: Able to access the laboratories and resources at the University of Arkansas.
Weaknesses: No formal organizational structure due to lack of a facility.

BIOTECHNOLOGY AND ECONOMIC DEVELOPMENT
NATIONAL TRENDS IN BIOTECH/BIOMEDICAL BUSINESS INCUBATION

New Hampshire's leadership must pursue proactive strategies to strengthen the economic and industrial framework of the state. The key to building the biotechnology/biomedical business base in any state is to recognize the critical role that the university system plays in the development of products that may be commercialized. In this study, there will be a description of the attributes of the biotechnology industry that make it an important target for the state's continued drive for economic diversification. Much of this information has been shared from states that have been successful in developing their biotechnology/biomedical infrastructure.

A 2001 Survey commissioned by the Biotechnology industry Organization (BIO) and conducted by Battelle Memorial Institute[10] with assistance of the State Science and Technology Institute and PMP Public Affairs Consulting, Inc. identified biotechnology activities in 41 States. The study found that states are more active and involved in biosciences than at any time in the past decade.

Factors contributing to this rising interest include:

- Public attention to human genomics.
- States' agreement with tobacco industry and settlement.
- Demise of the dot.com phenomenon.
- Citizen interest in human health and disease prevention.

State Government Biotechnology Strategies

Ten states report having developed a biotech or life sciences strategic plan with nine done in past several years. The most recent state developments include the Arkansas Biotechnology Strategy, Biotechnology in Hawaii, and the Michigan Life Sciences Strategy. Broader regional strategies have been carried out in both St. Louis and Kansas City with a major push in the development of life sciences. Other cities focusing on life sciences include Indianapolis, Peoria, Central Ohio, Pittsburgh, and Philadelphia.

State Government Focus on Biotech

- States hiring specialists with in-depth knowledge and understanding of the industry.
- States organizing to link their financial, regulatory, and tax policies together to better meet biotech firm needs.
- States reporting they have dedicated professional biosciences staff include Georgia, Louisiana, Maryland, Michigan, Minnesota, Missouri, New Mexico, Ohio, Utah, and Virginia.

Recent State Trends in Biotechnology

- Use of tobacco settlement funds for biosciences.
- Increased state government funding of academic bioscience research centers.
- Increased focus on financing needs of biotechnology firms.
- Ongoing issue of financing biotech firm space needs.
- Growth of State biotech trade associations and networks.
- Regulatory and tax issues and policies continue to receive high priority.
- Interest increasing in biotech-related research parks and incubators.
- Emergence of bioscience commercialization and business development initiatives
- Workforce development programs are receiving increased focus

[10] Walter H. Plosila, Ph.D., Battelle Memorial Institute

Trend One: Use of Tobacco Settlement Funds

- At least 17 states are dedicating some portion of their tobacco settlement funds to biotech research (many focus on tobacco-related diseases; only a few emphasize commercialization).
- Michigan Life Sciences Corridor ($50 million/year for twenty years – recently cut for this year to $40 million).
- Ohio Biomedical Research and Technology Transfer Fund ($20 to 25 million/year initially).
- Pennsylvania providing $60 million annually for basic research and over $160 million. In one time funds for bioscience-related venture funds and establishing three Life Sciences Greenhouses.

Trend Two: Increase State Government Spending for Biosciences Infrastructure

- Recognition that strong research universities are prerequisites for biotech-based development
- Facilities, talent recruitment, and equipping labs with state of the art instrumentation underway throughout the U.S.
- Examples of centers and projects include:
- One of California's three new $100 million institutes is in bioengineering and biotechnology
- Four of New York's STAR centers focus on biosciences.
- Texas Legislature appropriated $800 million including funds for seven new or expanded health science research centers.
- Wisconsin launched BioStar, a $317 million, 10 year initiative at university of Wisconsin-Madison.

Trend Three: Increase Focus on Funding Needs of Biotechnology Ventures

27 states indicate they are trying to address financial needs of firms through various venture mechanisms and 5 states have exclusive funds for life sciences. Examples:

- North Carolina Bioscience Investment Fund ($10 million state appropriation).
- CALPERS's California Biotechnology Program ($500 million in pension funds).
- Wisconsin Investment Board ($50 million in pension funds).
- Pre-seed/seed equity funding gap national phenomena for this industry.

Trend Four: Ongoing issue of financing biotech firm space needs

- Financing facilities and wet labs (leaseholder improvements) not as problematic in cluster regions as in developing regions.
- Nine states use traditional economic development programs (loans, loan guarantees) to fund bioscience facilities.
- Two states have specialized programs for bioscience facilities: Connecticut Biotechnology Facilities Fund has financed more than 225,000 sq. ft. since 1998, and Arkansas provides a tax credit for the cost of constructing biotech facilities.

Trend Five: Growth of State Biotech Trade Industry Groups

- Serve as educators, advocates, and clearinghouses for information on the industry
- Vary in membership, dues, sources of funding, staff support and agenda
- 34 states have a statewide or regional group or organization focused on biosciences
- 15 states report more than one organization, usually a metro or regional council as well as a statewide entity

Trend Six: Regulatory and Tax Issues Continue to be a Priority

Three primary areas of regulatory focus have been:

- Genetic privacy (24 states)
- Right to know (8)
- Drug discount or price controls (5, with 9 considering)
- State tax policies and structure
- Sales and use tax exemptions or deferrals
- Investment and research and development tax credits
- Capital gains tax cuts
- Net Operating Loss provisions
- Tax credit transferability
- Other incentives (job creation, cooperative research, worker training, R&D expenditures)

Trend Seven: Increased Interest in Biotechnology Incubators and Technology Parks

- Research parks are the 21st Century equivalent of business parks of the 1950s.
- 25 states report research parks than can or do house bioscience firms but only 8 states report exclusive parks.
- 33 states report having biosciences incubator space with 15 states having dedicated bioscience incubators and 18 states having tech incubators that include we lab space. Examples:
  - OADI incubator and research park, Birmingham, Alabama.
  - Colorado Bioscience Park Aurora incubator and Research Park.
  - Shady Grove Life Sciences Park and incubator, Rockville, Maryland.
  - Massachusetts Biotechnology Research Park and innovation center, Worchester.

Trend Eight: Emergence of Biotech Commercialization Efforts

States and regions experimenting with approaches to facilitate commercialization of research
The majority of states have some type of commercialization and business support mechanism to help entrepreneurs and startups. Newer models include: Oklahoma Technology Commercialization Center And the Carilion Biomedical Institute

Trend Nine: Workforce Development Initiatives Receiving Support and Focus

Workforce has not been the problem in biosciences as it has been in IT industry.
Increased attention is being given to workforce:

- Technician programs (12 states)
- Curricula changes in higher education
- Outreach to bioscience firms to determine skills and training needs
- New delivery approaches to reach students and future workers

THE BIOTECHNOLOGY INNOVATIVE PROCESS

Ms. Patti Breedlove, Manager of the Sid Martin Biotechnology Incubator in Alachua, Florida shared an understanding of how biotechnology companies are formed so that their basic needs may be analyzed. A biotechnology firm is generally formed in a four-step process. While there are some variations in each unique business model, this process usually includes the following elements:

- **University level research:** When an inventor or a scientist first conceptualizes an idea that may lead to a product, he usually applies through a university for Federal research funds to research the "pure science" of an idea. This essentially provides the inventor or scientist the opportunity to explore for the benefit of society whether a concept may be developed or proven in a laboratory situation.

- **Proof of principle:** After successful laboratory results, which may take five years, the next step for commercialization is to take the product outside of the university for a "proof of principle trial." This is an endeavor that usually requires some sort of private funding to show that the product may indeed do commercially what it was conceived of in the laboratory.

- **Corporate formation and venture capital infusion:** After a product has achieved proof-of principle stage, the intensive need for cash arises. Development of the product through human clinical trials initially requires tens of millions of dollars to develop it to the point of attracting a large pharmaceutical partner. Venture capital usually supplies this cash and recruits a management team. Many rounds of venture capital may be sought and expended before entering the final stage of commercialization.

- **Collaboration and/or sellout:** After sustained economic development and proven product marketability, the next stage is for the company to either collaborate or sell out to a larger pharmaceutical entity that has the horsepower capable of mass marketing the product and creating a profit. This entire process can be lengthy especially for biomedical products. For instance, some technology transfer experts estimate that it may take as long as 15 years and hundreds of millions of dollars of expended capital to bring a drug or medical device to market.

This basic business plan represents what almost every scientist or inventor must endure on the road to profitability. However, for those that make it through the gauntlet, the reward can be great for the inventor or scientist, the research institution involved at the outset, the state and local economies in which the product was developed, and society as a whole for the health benefits of the product. The inventor receives a share of the royalties and perhaps the stock created in the formation of a company. The university receives royalties on the commercialized product that may be used to fund additional research leading to further product development that adds more royalties that contribute to the self-perpetuation of such research activities, and more importantly, to the retention and recruitment of talented faculty. The state and local economies enjoy the fiscal impact of the job creation, increased commercial property valuation, and additional sales tax revenues.

One example of such a success story is the drug Taxol produced at Florida State University. With funding from the National Institute of Health, Professor Robert Holton, a chemist at FSU, found a way to synthesize a product called paclitaxel, found only in the bark of Yew trees. Florida State licensed the product to Bristol-Myers Squibb in 1992. The National Cancer Institute has called paclitaxel the most important cancer drug to be approved in 15 years. FSU is still receiving royalties to fund personnel and expenditures for research on other projects.

At their best, biotechnology incubation programs produce thriving, commercially successful businesses like Therics, Inc., a Princeton-based biotechnology firm that started out with five employees in the Trenton Business and Technology Center. Therics sold to publicly traded Tredegar Corp. in 1999 for $13.9 million. In October 2000 Tredegar Corp. invested $60 million into expanding Therics tissue engineering technology business.

New Hampshire must aggressively plan to place more economic tools in the hands of the business community so that the benefits of commercialization may be realized. High technology incubators provide the necessary resources for building an environment conducive to the creation of local firms and the relocation of firms from other states. High-Tech enterprises rely heavily on cluster based economic development. New Hampshire needs to attract more medium to large companies to act as anchors and partners with the fledgling startups and small companies that need to collaborate with a stronger organization.

In its written assessment of the Australian level of competitiveness in the biotech sector, one of the points raised by the Western Australian Technology and Industry Advisory Council was that many biotechnology regions are clustered around key research institutions, primarily because the majority of firms have formed as spin-offs from these institutions. This core of firms then attracts other firms that may be suppliers or those that would like to create strategic alliances.

SUCCESSFULLY BUILDING NEW HAMPSHIRE'S BIOTECH SECTOR

Building the infrastructure for commercialization is the key to building New Hampshire’s biotechnology industry. In other words, it is the task of building the research base, identifying research capable of being commercialized, ensuring its rapid transfer to the private sector for product development, and then providing incentives and resources that will ensure that companies and jobs are created through the process and that as many companies and jobs as possible will remain in the state of New Hampshire. This effort should be undertaken while keeping in mind the importance of also strengthening the three key pillars of accessible capital, ready infrastructure, and a skilled workforce.

Following the example of other states, one of the essential actions that New Hampshire could implement to aid faster and more efficient commercialization in keeping with the strategic plan laid out by the Governors taskforce is the development of High Technology Business Incubators.

BIOTECHNOLOGY IN NEW HAMPSHIRE: REACHING CRITICAL MASS?

The biomedical industry is research and capital intensive. New Hampshire has an extensive research and development infrastructure for a state its size. There are already over 50 biotechnology-related companies in New Hampshire. The majority of these businesses are involved in bio manufacturing, biomedical product development and manufacture of products and equipment to support neighboring Massachusetts' extensive biomedical research community. Membership in the NH Biotechnology Council is approaching 100 members. New Hampshire's health care services industry, which includes all jobs provided by hospitals, clinics, home care, etc. employs 50,600 people and is growing.

Massachusetts has a significant concentration of early-stage biotechnology companies and the region is a major source of research activity (MIT, Harvard University, Tufts University, and Massachusetts General Hospital. However, the cost of doing business in Massachusetts is substantially higher than in New Hampshire. Interest in Massachusetts biotechnology companies relocating to New Hampshire is growing, according to an earlier study conducted for the NH Biotechnology Council.

New Hampshire's First Economic Development Plan

In accordance with the Governor Jeanne Shaheen's comprehensive strategic plan for the state, the proposed high technology incubators would provide the infrastructure necessary to support technology commercialization. *New Hampshire in the New Economy: A Vision for Expanded Prosperity,* the first-ever comprehensive economic development plan calls for state government to focus its activities toward encouraging innovation, strengthening education and workforce development, retaining and protecting the quality of life, and extending economic opportunity in every part of the state. The plan calls a holistic approach to planning. Many of the activities recommended focused on creating and growing potentially high-growth technology oriented companies, enhancing the region's existing companies, and capitalizing on the regions strategic/competitive advantages. Specific recommendations relating to tech-based economic development are highlighted below:

1. Maintaining A Strong Economy

Develop a long-term integrated approach to supporting new economic activity, while maintaining support for firms in traditional industries. Develop a long-term strategy to encourage more investment in Research and Development, technology transfer, and support for other initiatives. Work specifically with small businesses to help them expand their market opportunities, obtain venture capital and benefit from technology transfer. Encourage venture capital investment in a range of business sectors, and more in-state venture investment.

2. Developing a Globally Competitive Workforce

Identify ways to increase support for the University and Community Technical College Systems to make higher education more affordable and accessible to New Hampshire residents and increase the likelihood that New Hampshire will retain talent that may otherwise be persuaded to leave the state. Provide opportunities for lifelong learning through continuing education and training programs. Improve K-12 math, science and technology education so that more students will have the option of pursuing technology careers.

3. Address Economic Disparities

Encourage development programs with financial incentives such as the community development finance authority, community development block grant program and the business finance authority to give priority to projects aimed at economically disadvantaged regions and populations. Increase access to education and job training programs to increase the overall educational attainment and skill level of underemployed and lower income residents. Support efforts that encourage women to own businesses, receive fair pay and become economically self-sufficient.

4. Integrate Telecommunications

Encourage public/private consumer aggregation partnerships to attract advanced telecommunication infrastructure investment and reasonably priced access in the northern, western and other rural parts of the state. Continue to use economic development funding to stimulate private investment in broadband infrastructure in rural areas.

Governor Jeanne Shaheen created New Hampshire Economic Advisory Council to advise the on continuing implementation of the plan's recommendations. The development of a technology business incubation program for the state would address each of these target areas.

The State's Technology Track Record

The State has been supportive in developing a wide array of services for small businesses. The state has also worked diligently on the development of large infrastructure development projects such as the Pease International Tradeport.

One June 1, 2000 the **Pease Development Authority (PDA)** celebrated its' 10 year anniversary. Many landmark changes have occurred at the Tradeport since New Hampshire's State Legislature empowered the PDA to develop the former air force base. The United States Department of Defense continually cites Pease as the "model" for successful base closure and reuse. Envisioned to be the economic engine of the Greater Seacoast area, the Pease International Tradeport & Pease International Airport continues to evolve into a world- class office, research and development industrial/aviation park. Pease is strategically on I-95 and markets itself as being 50 minutes to Harvard, Tufts universities, and MIT in Boston, and minutes from the University of New Hampshire.

Accomplishments to date include:

- More than 155 operating businesses/tenants
- In excess of 3,600,000 square feet of new, or newly renovated space
- Creation of 6,000 jobs, with additional commitments to bring total to 10,000+ jobs
- 1,250,000 square feet of new construction approved since January 2000.

Fostering a Business Friendly Image

The State of New Hampshire has aggressively marketed itself as a superior business environment, focusing on its unequaled tax structure for businesses and citizens alike. New Hampshire is a state that heralds no income tax, no capital gains tax, no inventory tax, and no machinery or equipment tax. Articles in major publications such as Fortune magazine have rated New Hampshire one of the best places to live. As a result, the state has ranked number one in the Northeast in terms of numbers of people moving into the state since 1980.

The New Hampshire Biotechnology Council

The mission of the New Hampshire Biotechnology Council is to:

- Promote and grow the biotechnology (including life sciences, biosciences and medical sciences) industry in New Hampshire.
- Provide information and/or assistance to biotechnology startup companies and biotechnology companies interested in relocating their operations to New Hampshire.
- Foster the growth of educational infrastructure and programs to support the biotechnology industry.
- Promote job-training activities for the biotechnology industry in New Hampshire.
- Promote public awareness of the biotechnology industry in New Hampshire.
- Implement education seminars for Association Members.

The New Hampshire Biotechnology Council is a natural partner to the proposed incubators and it should be involved in the planning, develop, marketing and support of the proposed incubators.

Existing /Proposed Incubators in New Hampshire

There are currently three non-profit business incubators in New Hampshire, and several other for-profit former mills that provide only the real estate component of a business incubator program.

Established in May 1997, the Amoskeag Small Business Incubator is a joint venture between NH College and the City of Manchester. The 24,000 square foot, historic former Jefferson mill yard has been converted into a mixed-use incubator and currently houses 18 businesses and is strategically located in an “enterprise zone.” Center Director Julie Gustafson stated that graduate companies stay in the area. The center has had five graduates. This incubator is currently renting space and is seeking funding for the construction of its own facility.

According to Jay Taylor, Director, Economic Development for the City of Manchester, the City is actively marketing the French Hall Buildings at Hacket Hill as a potential location for business incubation or research park development.

The Mount Washington Valley Economic Council has developed a business incubator in North Conway in an effort to diversify an economy traditionally focused on tourism. The town hopes to capitalize on its superior quality of life and access to high speed data transmission to draw would be entrepreneurs. This incubator is currently renting space and is seeking funding for the construction of its own facility.

In Peterbourgh, the Monadnock Business Ventures building was acquired through the Investment Tax Credit Program of 1994 and serves as a small business incubator program. The mixed-use incubator offers 5,000 square feet of space and houses 2 client companies.

Plans are also underway in Claremont for the development of a 2,000 square foot business incubator in a renovated building, and the Business Enterprise Development Council (BEDCO) located in Berlin, NH and the Town of Littleton are both interested in the development of business incubator initiatives that could also allow North Country residents to telecommute and serve as a skilled workforce to other technology centers in the state. The proposed technology incubators must explore ways to integrate and leverage the activities occurring in these communities.

The New Hampshire Community Technical College (NHCTC) System is considering the feasibility of renovating the Littleton Hospital and the Littleton Learning Center to include 6,000 s/f of small business incubator space. The Town of Littleton and NHCTC are evaluating the possibility of linking this initiative with the proposed biotechnology incubation program.

Several meetings have occurred between the Technology Incubator Feasibility Managers and the North Country Council to discuss ways in which the proposed incubators can be linked to initiatives in the Northern half of the state. It is recommended that a working group be formed to further explore this important component and the development of an overall statewide incubator development strategy.

Identify Businesses/Industries with Potential for Spin-Offs

For many reasons, medium and large companies often choose not to pursue ideas, which their research staffs have developed. This has led to employees leaving to start up their own "spin off" companies based on their discoveries, or a recognized gap in the market. This "spin off phenomenon" has been the subject of much attention over the past few years as it has been recognized to be another important mechanism for promoting technological innovation and economic development.

New technology-based firms contribute to the variety of consumer choice. They often flourish in a limited or specialized market that is profitable for the small firm, but would not be worthwhile for a large firm to enter. Many large companies are highly dependent on such small suppliers for essential components and specialized products. Over the past two decades, large firms have begun to encourage and sponsor such spin off activity from their R&D departments into areas which are commercially viable, but not suitable or relevant to the companies overall business plan. In these cases, the "parent" company invests significant amounts into the new company and in many cases becomes an early market for the spin off firm.

This study examined the potential of working with existing New Hampshire high tech companies to foster spin off activity at the proposed business incubators**.** Twelve firms representative of the high tech business community in New Hampshire were interviewed in the course of this study. The New Hampshire Biotechnology Council provided us with a list of nine of their members to interview, of which we were able to contact eight. In addition we identified five spin out companies from Creare, Inc. for interviews and reached four of them. There was universal support for the concept of a technology incubator at both Dartmouth College and UNH. The Creare spin off companies typify the entrepreneurial culture that appears to thrive in the Hanover/Lebanon area. These businesses were created from innovative technology developed at Creare, Inc, which was then spun out as separate companies. Selected detailed interview summaries are provided in this report (see Attachment C).

Other State Resources

Center for Technology Commercialization is the NASA Regional Technology Transfer Center serving the New England States and New Jersey & Connecticut. In addition they are involved in technology transfer with industry and other government laboratories. CTC has a history of working with technology incubators including MBRI in Worchester, MA, and MRI in Boston.

Franklin Pierce Law School - Germeshausen Center for the Law of Innovation and Entrepreneurship created in 1985 is the umbrella organization for the Law Center's intellectual property specializations. The Germeshausen Center is a driving force in the study of international and national intellectual property law and transfer of technology. It acts as a resource to business as well as scientific, legal and governmental interests in patent, trademark, trade secret, licensing, copyright, computer law, and related fields. In 1999, the Law Center established the Center for Law, Technology and Management to be the focus for research projects and programs at the intersection of the technological, legal and managerial worlds.

CONCLUSIONS AND RECOMMENDED ACTIONS

Incubator Concept Supported at all Political Levels

This study found a strong consensus in the state for investment in biotech and biomedical infrastructure and the development of high technology business incubators.

- **Federal Level Support**

Senator Gregg has been a strong supporter of UNH, NHCTC and Dartmouth College's efforts to expand infrastructure and fund important projects in the state. Senator Gregg and senior staff members at both the Portsmouth and Manchester Office have expressed support for this initiative. Senator Gregg has personally been involved in two briefings on the incubator initiative.

- **State Level Support**

Governor Jeanne Shanheen is widely regarded to be a strong supporter of entrepreneurship and the high technology industries in the state, and has focused on enhancing New Hampshire's global image. In her inaugural speech in 1997, the Governor vowed that she would build a high technology and international economy, and her administration has led New Hampshire into the new economy with several initiatives to move the state forward. During the Governor's two first terms in office, New Hampshire experienced an influx of high tech workers, boosting the state to the second highest in terms of high technology workers in the country. In her state of the state address on January 17, 2002, the Governor expressed her support of entrepreneurship and supporting new biotechnology start up companies. The Governor provided a letter of support on the business incubator initiative to the New Hampshire Biotechnology Council.

The State of New Hampshire Department of Resources and Economic Development has expressed enthusiasm for the high technology incubator concept and recognizes the value of leveraging the state's extensive intellectual capital.

- **Local Government Support**

The managers of Durham, Hanover and Lebanon have responded with enthusiasm and support for the business incubator concept. Both recognize the economic development benefits that the proposed program would bring to the community.

The Feasibility of High Technology Business Incubation - Conclusions

Upper Valley

This study found that the Upper Valley Incubator Initative – a partnerhsip between Grafton County Economic Development Council, Dartmouth College and the business community is well positioned, in the short term, to implement a incubator development plan. The Upper Valley has:

- An existing and well established "ìncubator without walls" program
- A demonstrated need, access to technology, capital, and skilled workforce
- A firm offer of a land donation valued at $700,000 to serve as a local match
- A cohesive vision and strong support for immediate action
- A local "champion" who is well established and well positioned regarding time priorities
- A strong constituency of local "stakeholders"
- Strong support from the Grafton County Economic Development Council
- Community Block Grant funding from the State Office of Planning (tentative)

It is therefore recommended that Upper Valley development team move forward with its plans to develop a high technology business inucbation program at Centerra Technology Park immediately. It is also recommended that Dartmouth College develop a strong link between its Technology Transfer Office and the proposed technology incubator initiative, and other strategic partners in the Upper Valley and North Country.

Seacoast Region

While all the necessary "ingredients" exist at UNH and in the Seacost region, including a demonstrated need, this study found that the Seacoast region requires more planning to implement a successful technology business incubation program.

It is recommended that a Working Group, chaired by a senior administrator at UNH, be formed to focus on several key issues regarding the Seacoast incubator program. This Working Group, which should include several non-UNH stakeholders, should focus its attention on quickly identifying the appropriate "champion" for this project. This study found that the Hamel Center, the potential management entity most often named, is in the start up phase. However, the Center director has expressed a strong interest in serving in this role.

Another issue to be addressed is that while the overall community consensus is that a high technology incubator is needed, there are logistical and political issues regarding where a facility could be located in the Seacoast area. This study recommends that further discussions take place between the various stakeholders, and that a initiative be designed that will serve as a regional resource. The Seacoast area should design a program that serves as a bridge, and fosters a mutually beneficial relationship, between the exciting developments at the Pease International Tradeport, the New Hampshire Community Technical College and the University of New Hampshire.

The New Hampshire Community Technical College has played a leadership role in the development of the biotechnology industry in the state. NHCTC's New Hampshire Biotechnology Center has established a wide network of contacts in New England and Canada, and has been engaged in developing important regional high technology development initiatives that match the proposed business incubator's mission.

The proposed incubator also has an excellent opportunity to partner with the Portsmouth Chamber of

Commerce's Technology Roundtable group. The mission of this group is to foster high technology economic development. The business leaders that serve on this committee are well positioned to support the technology incubator initiative, and would be a very positive factor in the technology incubator's success in building an advisory network, and broader community support.

Organization And Structure - Recommendations

It is critical that there be a strong, industry-driven and college/university supported managing organization responsible for ensuring that these strategies are implemented. The best organizations to launch these strategies are the Dartmouth Entrepreneurial Network in the Upper Valley, and a partnership between UNH and NHCTC in the Seacoast Region.

It is also recommended that the State of New Hampshire develop an overarching program that informs and connects these and other incubators, incubator managers, and tenants across the state. This would include an overall systemic approach. Coordination is essential for increasing the quality and quantity of services, scalability of the programs and resource and knowledge sharing across a network of autonomous incubators. This program would establish standardized measures and metrics for success and serve as a benchmarking tool for policy makers.

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ATTACHMENT A – THE BUSINESS INCUBATOR INDUSTRY

States that cultivate a niche of technology companies expand their tax bases and create high-paying, knowledge-based jobs. This has been demonstrated repeatedly in cities and towns across the U.S. Studies conducted by the National Business Incubation Association found that there are more than 900 business incubation programs in the United States, compared with only 12 in 1980.

The study found that business incubators are a proven tool for creating jobs, encouraging technology transfer and starting new businesses, and they do it at a low cost per job created and with a good return on investment. A very high percentage of incubated companies remain in their communities, confirming the goal of business incubators to build the business base for job creation and tax revenue in their regions.

According to a 1997 comprehensive study on the Business Incubation Industry by the Economic Development Administration (EDA), University of Michigan, the National Business Incubation Association (NBIA), Ohio University, and the Southern Technology Council:

- Business incubation programs produce graduate firms with high survival rates – a reported 87 percent of all graduates are still in business.
- Most firms that graduate from business incubators remain in their local communities – an average of 84 percent.
- Business incubation programs create new jobs for a low subsidy cost and a substantial return on investment. The estimated public subsidy cost per job created was $1,109.

On average, in the U.S. new incubator facilities are coming on line at the rate of one each week. More than 10,000 small firms currently reside in incubators, and thousands more are "graduates," having moved on to occupy commercial space in their communities. NBIA's 1998 State of the Business Incubation Industry survey discovered the following:

North American incubators have created nearly 19,000 companies still in business, and more than 245,000 jobs. Incubators were classified as 45% urban, 36% rural and 19% suburban. Most incubator facilities (75%) are less than 40,000 s.f. – average is 36,657 s.f.; median is 16,000 s.f.

Like venture capitalists, incubators impose selection criteria upon prospective clients. Some accept a mix of companies, but others focus on serving companies of a particular type. According to NBIA research, business incubator focuses may be classified as follows:

- 43% Mixed Use
- 25% Technology
- 10% Manufacturing
- 9% Targeted[11]
- 6% Service
- 5% Empowerment
- 2% Other

Business incubators accelerate the development of successful entrepreneurial companies by

[11] Targeted incubators focus on assisting start-up companies from a specific industry, such as biomedical, manufacturing, arts, food production, retail, etc.

providing hands-on assistance and a variety of business and technical support services during the vulnerable early years. Typically, incubators provide offices and manufacturing facilities for a number of businesses under one roof with such amenities as flexible space and leases; office services and equipment on a pay-as-you-go basis; an on-site incubator manager and staff as a resource for business advice; orchestrated exposure to a network of outside business technical consultants, often providing legal, accounting, marketing, engineering and design expertise; assistance with financing; and opportunities to network and transact business with other firms in the same facility.

Incubators reduce the risks involved in business start-ups, as their young tenant companies gain access to facilities, equipment and resources that might otherwise be unavailable or unaffordable.

An incubation program's main goal is to produce successful graduates – businesses that are financially viable when they "graduate" from the incubator, usually within two or three years from entering the program. Highly adaptable, incubators have differing goals: to expand the business base for well-paying jobs, to diversify local economies, to provide employment for and increase the wealth of depressed communities, and/or transfer technology from universities and major corporations. Similar to venture capitalists, incubators impose strict selection criteria upon prospective tenants; some accept a mix of companies, but others concentrate on industry niches, such as specific technologies.

HISTORIAL PERSPECTIVE

Science Parks, Silicon Valley, And the Birth of Academic Entrepreneurship

Prior to business incubators, the notion of the university science park was developed in California where the first and most famous one was founded at Stanford University in 1951. Today, the Stanford Industrial Park at Palo Alto, south of San Francisco in Santa Clara County is known around the world as "Silicon Valley."

The Stanford Industrial Park was established by Frederik Terman, Professor of Engineering at Stanford University. Professor Terman felt that the encouragement of knowledge-based industries was one of the most valuable activities the university could engage in to promote the development of the regional economy. Professor Terman also saw the great potential of the university-industry relationship and encouraged a high degree of interaction between the university and the local environment.

Professor Terman actively encouraged individual members of the academic staff to make available their services and resources to local industry on both an informal and professional basis. He felt that local business leaders should play a greater role in university activities by giving lectures on current technological developments, serving on university committees, giving advice to researchers and students, and making available the use of industrial facilities for students doing higher degree work, etc.

Professor Terman believed that having business people on campus widened and enriched the interests of the academic staff and the students. Through closer contact with industry, students could gain a better understanding of the needs and current areas of interest outside of "the ivory towers of academia" and thus, a more relevant education.

Prof. Terman was also concerned about the "brain drain" away from California. Until the 1950's Stanford saw its top students graduate and move to the east coast where the best job opportunities and most interesting research projects were to be found. Prof. Terman believed that by encouraging bright students to open their own businesses and capitalize on their research findings he could help California keep its newly graduated engineers, and improve the local economic base.

Stanford University's positive attitude towards industry enabled it to create an environment where the diffusion of an "entrepreneurial spirit" or "spirit of free enterprise" could flourish. As a result, a culture based on economic initiative developed around the university that led to spin-offs of new businesses and a great diversity of services. The Stanford Industrial Park was founded on university owned land. The first big names to join the project were Lockheed aircraft manufacturers, and Hewlett and Packard, two of Terman's students.

There are many factors that contributed to the success of the Stanford Industrial Park. One of the most important factors was the invention of integrated circuits and the large amounts of federal money that was being spent by the U.S. military complex to develop electronics and computers for military application. The Korean War, space program and aerospace industry kept up strong demand for the sophisticated microelectronics that were being developed around the Stanford Industrial Park in its formative years.

The Silicon Valley success story has been attributed to a combination of complementary factors, such as a major breakthrough in a viable new technology, a strong entrepreneurial business culture, economic policies which promote a competitive, free market, availability of highly skilled scientists and engineers, good business managers, high ratio of research and development to sales, venture capital and the overall willingness of American entrepreneurs to take risks. Another important factor in the "Silicon Valley Phenomenon" was luck. The timing was right, and all of the critical ingredients were available.

The development of a culture based on high technology and entrepreneurship brought about a burst of growth and creativity in the Santa Clara County. Through spin-offs and the process of technology transfer, a multiplier effect took place creating many new jobs in the wider economy for every one job in the knowledge-based companies around the industrial park. Thus the diffusion of technology, creation of firms, creation of wealth and creation of jobs became aspects of the same phenomenon.

In 2000, venture capitalists in the Valley invested $17 billion in new companies.[12] The region is now home to a who's who of technology and is the source of much of what we take for granted in the information age. Now boasts of some high technology based firms in such fast paced industries as microelectronics, computers, pharmaceuticals, genetic engineering, aerospace, new materials, instrumentation etc. It is an environment that is continually growing, changing and evolving along with every new technological advance. The Valley's per capita income increased 36% in the 1990s (the national increase was 17%) One of the unique features of the "Silicon Valley phenomenon" is that it developed not in a major city, nor raw material center, but rather at a university

[12] Inside the Dream Incubator – Silicon Valley, National Geographic, December 2001

Route 128 – Massachusetts Institute of Technology

Another classic example of the commercialization of university- based research during the 1960's was off of Route 128 in Boston. "Route 128" as it is popularly known, grew as several hundred new, high technology based firms established themselves as spin-offs from the Massachusetts Institute of Technology, MIT.

As in Silicon Valley, Route 128's proliferation of Spin-offs has been attributed to the presence of a strong science and technology based research institution (MIT), and its positive policy towards cooperation with industry.

Factors that can be attributed to Route 128's success are: 1) the encouragement of academic staff (at M.I.T.) to involve themselves in industry as consultants on a part-time basis, 2) the presence of research laboratories that make discoveries which could be commercially exploited; 3) the availability of industrial park space near MIT, 4) government policy which placed contracts with technical entrepreneurs; 5) local venture capital availability from Boston Capital Corporation, which could only invest in small businesses, and finally, 6) the quality of life and rich cultural heritage of Boston and the surrounding area, and the availability of a wide range of ancillary services and industries in the region.

While the Stanford industrial park and MIT's Route 128 developed and became successful more or less spontaneously, economic development professionals and university administrators from around the world have been eager to follow the model. The creation of science parks and later business incubators in the United States grew rapidly as the potential of university technology transfer became more apparent.

Biotechnology is a research and capital -intensive industry. Of the 900 business incubators around the country, 42 are specialized in biotech and life sciences. The majority of these specialized business incubation centers are associated with research universities.

Incubating at Colleges and Universities: Bridging the Culture Gap

Critics of university-based incubators feel that the presence of for profit, private enterprise on campus can negatively impact the universities integrity, autonomy and ability to carry out "free research." They fear that the university's growing obligation to the private sector could lead to the erosion of the university's intellectual freedom and free flow of information; shrouding university research in secrecy and choking the free low of academic cooperation and exchange. A common fear is that academic institutions, in playing an expanded role in the economy, could suffer from an overload of functions. There is a fear that new obligations could dilute the university's primary functions and weaken its overall ability to serve as a place of learning.

As evidenced by the boom in university based incubator developments over the past two decades, the public is increasingly coming to see universities as public resources. Industries become more knowledge-intensive, they seek closer relations to universities. Industry's interest in being located at university based incubators or science parks is based on the rationale that it is easier to withdraw valuable knowledge if you are located closer to the source.

Supporters of university based incubators, research and technology parks feel that these are ways of enhancing the relevance of university education and making the university more useful to society. Business incubators are proven vehicle's for improving and diversify local job opportunities for the

university's graduates, spouses, and are also an asset in attracting the best staff and faculty. In this way the business incubator is a direct asset to the college/university.

Supporters argue that academic institutions must constantly be used or entropy sets in. For a university to remain vital, it needs fresh air from the outside, and it needs to be needed. The business incubator is one of the many ways of achieving this goal. Entrepreneurs, Federal and state government, and the many other constituents of university based high technology incubators are also valuable allies when the government begins to discuss how much should be spent on education and research.

The Bayh-Dole Act of 1980 (Public Law 96-517) served as groundbreaking legislation allowing universities to lay claim to innovations developed within their environs. This legislation also required that inventions arising from Federal Government sponsorship and assigned to the university, must be actively transferred to the private sector for the benefit of the general public. This study found that, as elsewhere, there were concerns at both Dartmouth College and the University of New Hampshire, and suggestions that any incubator initiative include tangible benefits in terms of the overall educational mission. However these concerns were limited[13].

[13] Recommended Reading: Technology Commercialization Through New Company Formation: Why Universities are Incubating Companies, Nanette Kalis

Advantages for Dartmouth College/UNH/ NHCTC in Technology Business Incubation

- Incubators support the central, educational focus of the institution. Entrepreneurial aptitude is a "life" skill, not just an avocation; the entrepreneurial mindset is increasingly sought and increasingly valued in the workplace today. Incubators are, by nature, a link between education, implementation and involvement. Incubators provide a range of opportunities for education in entrepreneurship characteristics, behaviors, and strategies.

- Business incubators provide a vehicle for enhancing research support and outcomes, and broaden the social benefits of research by supporting speedy commercialization of useful research discoveries.

- University-related incubators are an important resource in bridging the culture gap between the academic and private sectors.

- Incubators promote a more entrepreneurial culture within the institution. They are a demonstrated vehicle for promoting cross-disciplinary endeavors and other forms of cooperation among various schools and centers of the institution.

- Incubators are a demonstrated recruiting and retention tool for faculty, researchers and students. They are a vehicle for constructive engagement of alumni and other leaders in the financial and business communities.

- Well-conceived programs provide clearly articulated policies, which reduces ad hoc venture activity on campus and establishes an innovator-friendly regulatory context.

- Incubator activity improves the community's economic base. Business incubators are proven vehicles for improving and diversifying local job opportunities for spouses and graduates.

- In addition to licensing, university-related incubation provides another vehicle for supporting technology transfer. The Bayh-Dole Act of 1980 (Public Law 96-517) requires that inventions arising from Federal Government sponsorship and assigned to the college, be actively transferred to the private sector for the benefit of the general public.

- Commercialization provides potential for long-term financial rewards for the institution: proactive technology transfer pays off. Colombia University, for example, has granted roughly 1,000 technology licenses over the past several years, which generate about $95 million a year. Dartmouth College currently earns approximately $1.13 million per year.

ATTACHMENT B - THE BIOTECHNOLOGY INDUSTRY

Biotechnology[14] defined for our purpose:

"bio" — the use of biological processes and **"technology"** — to solve problems or make useful products.

Man has used the biological processes of microorganisms for 6,000 years to make useful food products, such as bread and cheese, and to preserve dairy products and crops. During the 1960s our understanding of biology reached a point where we could begin to use the smallest parts of organisms, their cells and molecules, in addition to using whole organisms. The biological molecules we most often use are nucleic acids, such as DNA, and proteins. A more appropriate definition of biotechnology today is: the use of the cellular and molecular processes to solve problems or make products.

Biotechnology is a collection of technologies. What they have in common is the use of cells and biological molecules. Cells and molecules are extraordinarily specific in their interactions. Because of this specificity, the tools and techniques of biotechnology are quite precise and are tailored to operate in known, predictable ways. As a result, the products of biotechnology will be better targeted to solving specific problems, generating lesser side effects and having fewer unintended consequences. Specific, precise, predictable. Those are the words that best describe today's biotechnology.

The Technologies and Their Applications

The new biotechnologies that use cells and biological molecules and examples of their applications in medicine, agriculture and environmental management are as follows:

Monoclonal Antibody Technology uses a type of immune system cell that makes proteins called antibodies. The antibodies we make to fight off a flu virus one winter do nothing to protect us from a slightly different flu virus the next year. The specificity of antibodies makes them powerful tools for locating substances that occur in minuscule amounts and measuring them with great accuracy. For example, we use monoclonal antibodies to distinguish cancer cells from normal cells.

- Locate environmental pollutants.
- Detect harmful microorganisms in food.
- Diagnose infectious diseases in humans, animals and plants quicker and more accurately than ever before.

Cell Culture Technology is the growing of cells outside of living organisms. By using insect cell culture to grow microorganisms that infect insects, we will be able to use bio-control more often to kill insect pests, such as mosquitoes and corn earworms. Because of their specificity bio-control agents will infect problem insects without harming beneficial insects, such as honeybees and ladybird beetles. Mammalian cell culture often allows us to replace animal testing with cell testing when evaluating the safety and efficacy of medicines. In the future, we may be able to treat certain diseases, like diabetes and muscular dystrophy, by replacing malfunctioning cells with normal cells grown in culture. We are using plant cell culture to produce naturally occurring compounds that have therapeutic value, such as the chemotherapeutic agent taxol, a compound found in yew trees.

[14] Written by Adrianne Massey, Ph.D.

Biosensor Technology combines our knowledge of biology with advances in microelectronics; a biosensor is composed of a biological component, such as a cell or antibody, linked to a tiny transducer. Biosensors are detecting devices that rely on the specificity of cells and molecules to identify and measure substances at extremely low concentrations. When the substance of interest collides with the biological component, the transducer produces a digital electronic signal proportional to the concentration of the substance.

Biosensors can:

- Measure the nutritional value, freshness and safety of food.
- Provide emergency room physicians with bedside measures of vital blood components.
- Locate and measure environmental pollutants.
- Measure blood glucose levels more rapidly and precisely than existing methods.

Genetic Modification Technology is often referred to as recombinant DNA technology. Recombinant DNA is made, both in nature and by humans, by combining genetic material from two different sources. Humans began to preferentially combine the genetic material of domesticated plants and animals thousands of years ago by selecting which individuals would reproduce. Certain organisms had traits we valued, so we chose them as parents for the next generation. By selectively breeding individuals with valuable genetic traits while excluding others from reproduction, we intentionally changed the genetic makeup of the plants and animals we domesticated. Techniques for making selective breeding more predictable and precise have been continually evolving, especially since the genetic basis of heredity was discovered in the early 1900's.

In addition to using selective breeding to combine valuable genetic material from different organisms, genes are combined at the molecular level using the more precise techniques of genetic modification. Selective breeding and genetic modification fundamentally resemble each other, but there are important differences. In genetic modification, single genes whose functions we know are moved from one organism to another; in selective breeding, large sets of genes of unknown function are transferred. By making our manipulations more precise and our outcomes more certain, we decrease the risk of producing organisms with unexpected traits and avoid the time-consuming trial-and-error approach of selective breeding. Currently, genetic modification is being used to:

- Produce new and safer vaccines.
- Treat some genetic diseases.
- Provide new and better medicines.
- Enhance biocontrol agents in agriculture.
- Increase crop yields and decrease production costs.
- Decrease allergy-producing characteristics of some foods.
- Improve food nutritional value.
- Increase livestock productivity.
- Develop biodegradable plastics.
- Decrease water and air pollution.

Antisense Technology decreases the production of specific proteins by using small nucleic acids to block the genes responsible for making these proteins. Currently, researchers are investigating how to use this technology to do the following:

- Slow food spoilage.
- Control viral diseases.
- Inhibit inflammation.
- Treat diseases such as asthma, cancers and a kind of anemia called thalassemia.

Protein Engineering Technology will often be used in conjunction with genetic modification to improve existing proteins, usually enzymes, and to create proteins not found in nature. These new and improved proteins will encourage the development of ecologically sustainable industrial processes. Enzymes trigger the biochemical reactions on which all living organisms depend. Unlike most chemical catalysts used in industrial manufacturing processes, these biocatalysts dissolve in water and work best at neutral pH and comparatively low temperatures. Because biocatalysts are more specific than chemical catalysts, they produce fewer unwanted by-products.

The chemical, textiles, pharmaceutical, pulp and paper, food and feed, metal and minerals and energy industries have all benefited from cleaner, more energy-efficient production made possible by incorporating biocatalysts into their production processes.

ATTACHMENT C –

Companies Interviewed/ Summaries of Meetings

Stryker Biotech
Peter Gariepy – Director of Manufacturing
9 Technology Drive
Lebanon, NH, 03784

The Biotech Division of Stryker serves as the manufacturing facilities for osteogenic protein-1 (OP-1), a member of the family of bone morphogenic proteins (BMPs), which is involved in skeletal tissue repair and regeneration.

Interview Notes

Stryker's success is an example of what the incubator should attempt to achieve. The measure of success should be the substantial businesses that emerge from the incubator. Stryker acquired Verax, which was one of the many start up companies started by Dr. Robert Dean, the original founder of Creare, Inc. There is a strong culture of incubating and spinning out companies in the Upper Valley – driven by the Creare model.

The Upper Valley Technology incubator should have a broader base than biotech/biomedical technologies. He points out that this sector experiences fast-paced changes that can kill start-ups before they mature – and for those that do survive revenues and profits may be along way off. A more balanced portfolio would be prudent with biotech/biomedical capped at 50% - to allow for a critical mass in other technology areas to evolve. Most of the Creare spinouts are manufacturing and engineering related and this is the other axis of technology creation in the area.

Dartmouth is a huge draw as a source of technology in both medical and other sectors. Stryker would support the concept of the incubator and would be prepared to support in the planning of the project, board membership as mentoring of client companies. Financial participation would have to be considered separately. The challenge for the management of the incubator will be how to make the facility sustainable financially. The Centerra location is a good one – particularly since it is off campus.

Lonza Biologics Inc.
Mr. Ron Midgett
Manager Technical Operations Training
101 International Drive
Portsmouth, NH. 03801

Lonza is a contract manufacture of biopharmaceutical products, large scale manufacture & purification of therapeutic proteins, cGMP multi-product manufacturing facilities, mammalian cell culture, deep tank fermentation systems, stirred tank reactors; GS mammalian gene statement system. They currently employ approximately 500.

Mr. Midgett feels that there is sufficent critical mass of biotech/biomedical companies in southern New Hampshire to a technology incubator facility near Durham. The facility should focus on the biomedical/biotech sector. Also, the location is close enough to the greater Boston area, where the majority of the 400-biotech companies in the Northeast are located, to attract start up companies looking for a lower cost alternative.

80% of the biotech companies in the Northeast focus on biopharmaceuticals so the incubator should provide high cost facilities relating to the needs of the sector on a shared basis, such as aseptic processing facilities, bioreactors, and controlled atmosphere laboratories. Also there is an increasing interest in the genomics area and consideration should also be given to the particular needs of this sector.

Should there only be funding for a single incubator in NH it should be located near UNH at Durham. If both go forward, each should have a different mission and focus – they can't compete and must be complimentary and encouraged to work together. Again, he prefers the model that the Dartmouth facility focuses on early stage research and the UNH facility on product development.

Lonza would want to contribute to the planning process and possibly to the cost of the incubator (cost participation is outside of his areas of responsibility). It is very much in their best interest since Lonza Biologics is a contract manufacturer with the capability to bring new drug products to the market for the smaller companies which have developed them and who own the Intellectual Property.

He also sees the incubator as a source of highly trained people – some of who might eventually join Lonza (who are looking to increase their staff levels by 300 - up from the current 500 – over the next year or so). He had little input as to the ownership and management of the facility – it should be a for profit business which would earn the operating group an equity position in the companies sponsored in the incubator. He thought the Incubator should be off campus otherwise it runs the risk of being an extension of university research and not a business focused enterprise - the former Pease AFB would be an ideal location.

One or more anchor tenants might attract others to the incubator. Mr. Midgett suggested we look to the Boston area to attract growing companies seeking additional space at a lower cost.

Fluent Inc.
Dr. Subbiah
VP Products/Strategy & US Business Operations
10 Cavendish Court,
Lebanon, New Hampshire 03766

In the early 1980's, when computational fluid dynamics was mainly of academic interest, a modest project funded by a New Hampshire company called Creare Inc. led to the development of an interactive CFD software code for engineers. The first version of the FLUENT code was launched in October 1983. It was so successful and the CFD software business grew so rapidly that the Fluent group at Creare became a separate company, headquartered nearby in Lebanon, New Hampshire. In May 1996, Fluent acquired Fluid Dynamics International, the developer of the FIDAP software code and its nearest competitor in the CFD business. Today, Fluent is the worlds' largest provider of commercial CFD software and services. Its staff exceeds 350 people, most with highly technical backgrounds as applied CFD engineers, plus experts in computational methods, mesh generation, and software development.

Interview Notes
Success of the proposed technology incubator should be measured on the success of the companies spawned within its environment. At least one company should be capable of generating revenues in the $ 50 million + range within five years. If all it does is spin out a number of small local companies with revenues in the $ 2-5 million range it should not be considered a success. The advisors to the incubator must have the technology and business savvy to recognize potential winners and drop potential losers.

Whatever the focus of the incubator it must have a critical mass of innovators, local technology links and networks so that the new businesses can feed on each other to leverage their growth. If the biomedical sector can offer this critical mass he would have no trouble with supporting this decision. A group of dissimilar entities without any common ground would not work. Dr. Subbiah does not have enough background to determine if the biomedical sector would be the best platform on which to found the incubator. He has no trouble with service providers or local technology based businesses as financial sponsors of the project. They should not have equity stakes in the individual companies in the incubator.

Fluent would be interested in supporting the creation of the program and its on-going operations – any discussion of possible financial commitments would not be appropriate at this early stage. Even if the focus is on technologies outside of Fluent's sector, the availability of technology jobs in other areas is important to them. Increasingly they have to be able to help place the spouse in a double professional family in order to attract top talent. The lack of a diverse industry pool is a drawback of the Upper Valley.

He had no input as to the entity that should own the building or manage the incubator other than the fact that the advisory board and/or board of trustees should be dominated by experienced business people with a background of building new enterprises. This must be a facility which demands performance from its tenants – university spin offs who are merely extending academic curiosity through SBIR funding and other research grants – without a clear business goal should have no place in this environment – they should remain in the university.

Does not like the concept of an anchor tenant – it would take board's eye off its primary objective which is to create new companies and run the incubator more as a landlord for established businesses. Venture Capital is not important in the planning stages. If the incubator is successful they will come once they sense that profitable opportunities are available for investment. A simple outreach activity to the VC community in the Northeast should be sufficient.

The government and the university should seed the concept – and then get out of the way. He supports the concept – but only if the governance of the facility has a clear business focus. The creation of $ 10-50 million dollar companies must be the goal here.

Bio Express Inc.
Klaus Lubbe
10 Technology Drive #2B
Lebanon, NH, 03784

Bio Express is a cell culture service company located in West Lebanon, NH. The company has more than 10 years of experience in custom manufacturing monoclonal antibodies and recombinant proteins in cell culture employing state of the art bioreactor technology. It supplies researchers in academia, pharmaceutical and diagnostic industry with pre-clinical grade monoclonal antibodies and with recombinant proteins expressed with the Baculovirus system.

Interview Notes
Dr. Lubbe is a strong backer of a Technology Incubator focusing on the biotech/biomedical sector in the Dartmouth – Hanover area. A core group of biotech companies already operate in the Upper Valley and with a potential home for spin outs from the university he is convinced the critical mass is present to support the endeavor. He also points to history for the justification of the concept.

He would have started his business at the incubator were it available at the time. He also mentioned that Prof. Gerngross at the Thayer School of Engineering has developed a high-yield fermentation process, which has received some venture investment and is on its way to become a start up business. Availability of both business advice and technology services is important. He used the local SCORE office to help him set up his business and presumably similar skill sets would be available at the incubator. His firm offers outsourcing services for types of cell development and the manufacturing of proteins – services that could be utilized by early stage companies in the incubator.

He would like the opportunity to mentor new companies in the incubator. He believes his start up experience would be valuable to others. Was not sure about the type of ownership - thought the Centerra location would work – but it would be expensive for a start up compared to locations like his in the Airport Business Park. Bio Express has no experience with VC or angel investors – they bootstrapped the business with a SBA loan and operating profits have provided sufficient capital for growth.

Mikros Manufacturing Inc.
Javier Valenzuela, CEO
88 Etna Road
Lebanon, NH, 03766

Mikros is a Creare spin off. The company is a highly specialized manufacturer of micro-machined parts based on technology originally developed at Creare for a NASA program. Their customers are OEM's and suppliers of components requiring tiny micro-machined parts and accurately drilled orifices in the 5-10 micron range with smooth bores. The company employs 17 and sales are in the $ 2 million range.

Interview Notes

While the company was spun out of Creare in 1991 it did not move into its own facility until a few years later. If a technology-based incubator offering equipment and services had been available, they would have used it. Mr. Valenzula likes the concept of a technology incubator.

He suggested that it be designed to serve other technology sectors, beyond biomedical. He points out that all the spin offs from Creare are manufacturing or engineering software related and that they are now big contributors to economy of the Upper Valley. Next to Dartmouth the combination of these companies are the largest technology developers in the area. For example, the availability of shared facilities such as machine shop and photo fabrication would be of interest to early stage companies in the manufacturing sector.

He agrees that the incubator should have ties with the University – but he does not believe the University on its own can generate enough new technology to make the Incubator viable. He believes that manufacturing and software development should be part of the mix.

Having taken a business venture out of Creare and survived the hard knock experiences of its early years he would be interested in transferring some of this knowledge to start up companies in the incubator. Also, if the scope is expanded, Mikros has several pieces of very expensive equipment, such as an electron scanning microscope, which they absolutely require for their operations – but are not fully utilized – a resource available to be shared with others.

The idea of locating the incubator in Centerra Park sounds good – he had little input as to the structure of the operation other than it would have to offer flexibility, security and independence to

the start ups. He did not believe the incubator should take equity in their corporate tenants in exchange for rent subsidies or services. Mikros is in the final stages of planning a move into a new 15,000 s.f. Plant to be built for them in Claremont, NH. He is not aware of any VC's active in the area – Mikros bootstrapped its own growth without third party financing.

Creare, Inc.
Dr. Robert J. Kline-Schoder
Principal Engineer
PO Box 71
Etna Rd
Hanover, NH 03755

Creare provides engineering services to a diverse international customer base. Their services span applied research, engineering design, new product and process development, numerical simulation, mechanistic analysis, large-scale testing, model studies, computer software development, problem-solving consulting, legal services, and data acquisition systems and software. Creare Inc. is also the forefather of a family of high-technology product companies including Hypertherm, Creonics (now a part of Allen-Bradley, Spectra, Fluent and Mikros. All located in the Hanover area.

Since 1961, Creare has served industry and government on the frontiers of product and process technology. Combining judgment and sophisticated scientific, mathematical, computational, and experimental methods with an appreciation of the art where science is lacking, the company has a reputation for skill and creativity in the solution of difficult problems. Creare serves diverse industries ranging from aerospace to biomedical to semiconductors. Senior staff members are leaders in their fields. A group of Creare associates from universities and industry provides technical augmentation and support.

Dr. Kline-Schoder's responsibilities include licensing and other ways to commercialize technology developed at Creare. He believes the concept of a technology incubator in the area is sound, if properly set up and managed. Possibly reflecting the fact that Creare's own business is only 20% in the biomedical sector, he would prefer the incubator to have a broader mandate. As probably the leading corporate generator of new technology in the area, he could see potential spin off business from Creare being attracted to the incubator as a start up location. That said, in point of fact, their last spin off was Mikros in 1991 – and they might have gone to the incubator were it available at the time.

Interview Notes

It his understanding that the local biomedical companies, are not developing technology to the point of conducting human studies where the FDA approved facilities at Dartmouth Medical College become important. Those that are working towards this goal are looking to partner (or sell) to one of the major players in the industry before they reach this point. This is a reason to give the incubator a broader mandate. At one time Creare had some dealings with a biomedical incubator, Seedling Enterprises, in Boston. A local alternative would have been more attractive.

Creare would not likely be sponsor as such but might support the advisory board for the Incubator, or for specific start up companies in areas where they might have knowledge. The incubator should be a non-profit corporation and the business model should be sustainable. The majority of its trustee/advisors should come from the private sector. Locating it in the Centerra Technology Park would make sense – if the economics work out –however, he sees this as a high cost location.

Creare is a fee for service contract research business. If they have skills important to the detailed planning process, which would involve substantial time commitments they would expect to charge for their time. He is not aware of any VC's active in the area – would have to be attracted from Boston. If the feasibility study supports the incubator concept Creare would likely support the project.

Bio-Concept Laboratories, Inc.
Dr. Francis (Frank) Smith - President
4 Tinkham Avenue, Suite 104
Derry, NH 03038

Contract research & development company with expertise in formulations, process research, analytical chemistry, biochemistry, microbiology, and manufacturing processes for development of medical devices, pharmaceuticals, diagnostics and personal care products; applied new product research; testing services; manufacturer of sterile cGMP clinical products.

Interview Notes

Incubator facilities should not be in a University facility. They must be separate but nearby. They should seek to attract an entrepreneurial/business partner for a university spin off. Academics can seldom accomplish the transition from research to business without business support. University access is still important and a source of cost effective support providing access to professors who can act as technology advisors.

Incubator should target scientists/engineers currently working in industry with good ideas to advance an existing technology or start a new business. Academic based companies lack the right business experience. Not sure that there would be enough potential entrepreneurs in the Hanover/Lebanon area to make it work. Durham would be a better location – and near Nashua would be even better – would attract people in the industry who live in NH but commute to the Boston/Cambridge biotech firms to start their own business near where they live.

Believes the Incubator(s) should be themed – Biotech/medical would be his preference – he is not sure there would be a critical mass at either proposed location. Service providers are not critical partners – the needs of start up businesses are minimal – low-level accounting/financial planning needs. The companies in the incubator should be encouraged to outsource sophisticated processing to the University labs in the early stages and to local for profit suppliers of services – like Bio Concept when they grow bigger – but not large enough to leave the incubator facility.

He employs 10 people and cannot afford to become actively involved, but might give limited support to specific companies. The Incubator should be a non-profit corporation with a strong board of trustees with a mix of backgrounds. The majority should come from the business sector and be people capable of evaluating the potential business prospects and business plans of the companies applying for space and support. University and Government appointees should not be in control. He does not have the time to participate in the planning team.

If it were to focus on the Bio Medical sector the individual lab space should have minimal equipment. High cost reactors, clean rooms etc. should be provided in a common service area. Each company should have its own offices and basic laboratory space where confidentiality and security can be controlled – but a common reception area would be acceptable. The Incubator should provide facilities for the control and disposal of hazardous/contaminated wastes – this is very important. Also a materials receiving area with controls in place to track, segregate and securely store critical materials.

ATTACHMENT D - REALATIVE STRENGTHS – UPPER VALLEY/SEACOAST

ATTACHMENT E – PROJECTED OPERATING BUDGETS