ENTERPRISE FLORIDA

Growing
The
Future

Florida Chamber of Commerce

FOUNDATION

MISSION STATEMENT

To provide statewide leadership in formulating public policy alternatives which will best assure a high quality of life for Floridians in the twenty-first century, and to use wisely the contributions given to sustain this mission.

FLORIDA CHAMBER OF COMMERCE FOUNDATION, INC.
BOARD OF TRUSTEES
1988-1989

CHAIRMAN:
Robert W. McKnight
Planned Development Company
Vero Beach

VICE-CHAIRMAN:
Chesterfield Smith
Holland and Knight
Miami

TREASURER:
Jerry D. Dingle
Price Waterhouse
Tampa

MEMBERS:

Irving H. Bowen
Fort Lauderdale

John A. Brabson, Jr.
Peoples Gas System
Tampa

Richard Capen
Knight-Ridder
Miami

Talbot "Sandy" D'Alemberte
Steel Hector & Davis
Miami

Fred C. Donovan
Baskerville-Donovan Engineers
Pensacola

Kenneth M. Good
Gulfstream
Tampa

R. Ray Goode
Babcock & Company
Coral Gables

Glenda E. Hood
Hood & Morgan
Orlando

Allen L. Lastinger, Jr.
Barnett Banks, Inc.
Jacksonville

Dr. Charles B. Reed
State University System of Florida
Tallahassee

Lee H. Scott
Florida Progress Corporation
St. Petersburg

W. H. Bill Stuart, Jr.
Edward C. Stuart Foundation
Bartow

Robert E. Tallon
Florida Power & Light Company
Miami

A. Bronson Thayer
First Florida Banks, Inc.
Tampa

Troy W. Todd
United Telephone Company of Florida
Altamonte Springs

J. Joseph Tuohy
Citizens & Southern Florida Corporation
Fort Lauderdale

ENTERPRISE FLORIDA

Growing the Future

September 1989

Prepared by:

Eric R. Hansen
Douglas C. Henton
John G. Melville
Steven A. Waldhorn, Director
Center for Economic Competitiveness

SRI International
Menlo Park, California

Sponsored by:

Florida Chamber of Commerce Foundation, Inc.

ABOUT THIS REPORT

Enterprise Florida identifies strategic directions for how Florida can build a leadership economy by promoting the growth of new enterprise. It was commissioned by the Florida Chamber of Commerce Foundation as an outgrowth of Project Cornerstone to focus specifically on new enterprises that can bring in or capture new income for the Florida economy.

Cornerstone found that new firms in high-quality, high-value-added industries are especially important to Florida's future because they create high-paying jobs, generate wealth for the residents of the state, and add to the state's fiscal base. The creation of new high-value-added firms has significant spinoff effects on the rest of the economy, stimulating new jobs and income in other sectors and regions.

The Research Committee of the Florida Chamber Foundation selected three emerging industrial clusters important to Florida's future to include in this analysis of new enterprise development: the information, biomedical, and space industries. While the report focuses on these three industries and the regions of the state in which most activity is concentrated, the overall concern of the report is with the process of enterprise development. Clearly, new enterprise development is taking place through the state. Thus, the principles about new business formation and the strategies for promoting the growth of new firms that are described here can be applied to other business sectors of the economy than the three industries discussed in this report.

The report is the product of more than 150 interviews with entrepreneurs, business and government leaders, and entrepreneurial support "network"people. Much appreciation is due to those individuals for their time, especially to those entrepreneurs for whom every minute counts, and for their insights into new enterprise development in the state.

Overall, Enterprise Florida argues that new enterprise development holds a key to Florida's economic future. The report outlines a strategy and action plan for supporting enterprise; what is required now is a bold vision and the will to implement a strategy for achieving that vision.

FLORIDA CHAMBER OF COMMERCE FOUNDATION, INC.
RESEARCH COMMITTEE
1988-1989

CHAIRMAN:
Cass D. Vickers
Messer, Vickers, Caparello, French & Madsen
Tallahassee

COMMITTEE MEMBERS:

Benjamin Lester Abberger III
Florida Hospital Association
Tallahassee

Elizabeth C. Bowman
Hopping Boyd Green & Sams
Tallahassee

Dr. Kenneth W. Clarkson
University of Miami
Miami

Robert E. Coker
United States Sugar Corporation
Clewiston

John C. Evelyn
Florida Power & Light Company
Miami

Courtney L. George
CSX Corporation
Jacksonville

John M. Godfrey
Barnett Bank
Jacksonville

Elliott L. Grosh
Post, Buckley, Schuh & Jernigan
Sarasota

Glenda E. Hood
Hood & Morgan
Orlando

Dr. Robert F. Lanzillotti
University of Florida
Gainesville

William J. Meurer
Arthur Andersen & Company
Tampa

Loyd S. Pettegrew
University of South Florida
Tampa

Maurice H. Phillips
Florida Power Company
St. Petersburg

Malcolm S. Scott
American Resources, Inc.
Bartow

George A. Weeks
ITT Community Development Corporation
Tallahassee

TABLE OF CONTENTS

EXECUTIVE SUMMARY

New enterprise development is critical to Florida's economic future. Florida's shift to a high-value-added economy in the 1990s depends on the growth of industrial clusters composed of tightly linked large and small firms that together create comparative advantage in an increasingly competitive marketplace. In the past, Florida has been successful in attracting large firms within emerging clusters such as information, biomedical, and space industries. Florida must now focus on promoting the growth of new firms within these clusters to achieve its full economic development potential in the next decade.

Florida is already a leader in new enterprise development. It can do more, however, to achieve high-value-added enterprise growth. For example, although Florida led the nation in the growth of new firms between 1983 and 1988, it ranked 16th in the creation of "high-growth" new enterprise. Only a small portion of these high-growth firms, however, are within Florida's emerging high-value-added clusters.

New enterprise development within these clusters is important to Florida's future because it will be a major source of both job creation and wealth generation in the 1990s. These new firms are important to increase Florida's exports and to expand the revenue base that will be required to pay for the economic infrastructure that is critical to Florida's future. The importance of new enterprise development in today's economy is underscored by a growing body of research which indicates that the formation of new enterprise and the expansion of existing firms account for the majority of job growth.

This report examines the growth of new enterprise within value-added clusters in four regions: Computer Coast (Palm Beach and northern Broward County), Health Technology Coast (Dade County and southern Broward County), Space Coast (Orange, Brevard, Seminole, and Volusia counties), and Technology Bay (Hillsborough and Pinellas counties). Within these regions, several industry clusters are examined: laser/electro-optics, health technologies, information industries, space, and emerging clusters in Technology Bay. The report also identifies the steps that can be taken by both the private and public sectors to accelerate the development of high-growth enterprises within value-added clusters in Florida.

The analysis has found that the development of the laser, health technology, and information industries clusters has occurred mainly through spinoffs from major corporations. Very few new companies in these clusters were spun off from universities or created by inventor/entrepreneurs not connected to existing companies in the cluster.

On the basis of this analysis, a new framework is identified for understanding and promoting value-added enterprise development within industry clusters. This framework identifies the needs of new enterprises at different stages of the life cycle of emerging industry clusters: Stage 1, early formation; Stage 2, expanding linkages; and Stage 3, "lift-off."

In this report, strategies are identified for promoting new enterprise development within clusters at different life cycle stages. Strategies for meeting the different technology, human resource, and capital needs of enterprises by stage of cluster development are also suggested.

Action should be taken at both the regional level and the state level to provide support to new enterprise development initiatives in Florida. The report identifies several regional clusters where public-private consortia should be developed to promote more concerted action, including health technologies in Southeast Florida, laser/advanced technologies, and commercial space in the Space Coast, information technologies in the Computer Coast, and advanced technologies in Technology Bay.

The report recommends that local Chambers, universities, industry leaders, regional and local government leaders, and other relevant participants establish regional cluster consortia that provide a focus to promote new enterprise development within value-added clusters.

There is also a need to increase support for enterprise development at the state level. The report recommends that the Florida Chamber play a catalytic role in support of new enterprise development through a series of statewide and regional forums on the importance of new enterprise and strategies for promoting value-added clusters, a statewide television series on Florida enterprise, and the development of a new enterprise development monitoring system.

The report also recommends that the Florida Department of Commerce expand its current efforts in business assistance by establishing a new enterprise development program that strengthens support networks at the regional level, works with financial institutions to increase the availability of capital, and cooperates with the Florida Chamber in the development of statewide awareness-raising programs and a monitoring system.

Finally, the report recommends that state- and regional-level organizations interested in new enterprise development consider developing a statewide initiative called *Enterprise Florida* that would provide overall leadership to efforts to support new enterprise development in the state. Other states have taken this step.

The 1990s present great opportunities for new enterprise development within emerging clusters, but Florida's clusters will not achieve critical mass without strategic intervention by both the private and public sectors. Bold action must be taken now to create an environment for new enterprise development and to build the critical economic infrastructure required for growing the value-added clusters that are critical to Florida's economic future.

I THE ROLE OF NEW ENTERPRISE DEVELOPMENT IN FLORIDA'S SHIFT TO A VALUE-ADDED ECONOMY

Purpose of the Report

The purpose of this report is to identify strategies that both the private and public sectors can pursue to promote high-value-added new enterprise development in Florida. It focuses on the state's best opportunities for growing industrial clusters that will generate jobs and incomes for Florida's residents while creating profits for business and wealth for the state. Based on extensive fieldwork that documents the current state of high-value-added enterprise development in Florida, this report recommends a comprehensive set of practical actions that can capitalize on the state's unique opportunities.

This report builds on the results of *Cornerstone*, a comprehensive examination of the Florida economy prepared by SRI International for the Florida Chamber in April 1989. *Cornerstone* found that a key to high-quality economic growth that will bring rising real incomes for Florida's residents in the 1990s is the development of value-added industrial clusters through the support of new economic foundations. Emerging clusters important to Florida's economic future include the information, biomedical, and space industries. A high-quality workforce, accessible technology, availability of risk capital, forward-looking physical infrastructure, and a high quality of life are the critical foundations required for growing these value-added industrial clusters.

A central element of implementing the vision of Florida's economic future described in *Cornerstone* involves promoting new enterprise development within high-value-added clusters. Traditionally, economic development in Florida has focused on attraction of industries and people to the state through low-cost advantages and quality-of-life considerations. Although effective in an earlier era, this approach is no longer enough for the competitive global economy of the 1990s.

As the Florida economy has grown, creating a large internal market, the opportunities for growing new firms within the state to serve both producer and consumer markets have greatly increased. Furthermore, comparative advantage in today's economy increasingly comes through the added value gained from close linkages among large exporting firms and smaller supplier firms within industrial clusters. Hence, the time has come for Florida to pursue a new economic development strategy that seeks to attract, retain, and grow value-added industrial clusters. Within this new strategy, new enterprise development plays a critical role.

The Importance of New Enterprise Development

An extensive body of national research and experience, supported by evidence in Florida, suggests that new enterprise development has become a central element of state and regional economic growth.

New Enterprise Development Drives Economic Development

Numerous researchers have shown that new enterprise development accounts for most of the business and job growth in state economies. Although observers disagree on the dimension of this contribution, they agree that growth due to new and small business is greater than that from industrial attraction or the expansion of larger firms. A review of the research on this subject completed by the Florida Department of Commerce in 1987 found that "the majority of jobs are generated evenly between young small businesses and expanding firms, while in-moving firms account for few new jobs: generally believed to be 10 percent or less."

New enterprise development plays several roles in state economic development. In addition to providing a major source of new employment opportunities, it is a primary vehicle for the business innovation that creates new dynamism in state economies. It also is a primary vehicle for economic diversification, helping state economies transform from dependence on traditional industries to broader reliance on more promising emerging sectors.

High-Value-Added Enterprise Development Is Most Important

New enterprise development can have several meanings. It can mean retail development, beginning with the traditional notion of the small "mom and pop" establishment. At the other end of the spectrum, it can mean the creation of new high-value-added, often advanced-technology-based enterprises that transform the very fabric of an economy. There is general agreement that this latter kind of new enterprise development is most important because its impact ripples through the economy. It creates jobs both directly and indirectly in support and other service (e.g., retail) sectors. Because it is export oriented rather than simply local serving, it acts as a magnet for new sources of wealth. It is high-value-added, so it tends to produce higher incomes for workers.

In short, higher-value-added enterprise is particularly important in enabling new enterprise development to play a major role in state economic development. Because of this special role that

HIGH-VALUE-ADDED ENTERPRISE

Value added is the difference between value of output and the cost of production. Value can be added to products or services by either increasing the value of output or reducing input costs.

High-value-added industries have a high ratio of output price to input costs. Examples range from computers and communications equipment and information and business services to specialty agricultural products and processed food products. High-value-added industries compete on the basis of quality and productivity (high output per unit of input), rather than simply cost.

high-value-added enterprise development plays in Florida and elsewhere, this report focuses on the specific opportunities to promote new enterprise development at the top strata of the economy.

There is evidence that Florida is currently a national leader in new business formation. Although accurate data on new business formation is difficult to obtain because of a variety of measurement problems, a number of national studies have suggested measures for comparing state performance. For example, in 1988, *Inc.* Magazine reported that Florida ranked first in the nation in new companies per 10,000 founded since 1983. When measuring percentage of companies founded after 1978 with a growth index of 20 or more between 1978 and 1983, Florida ranked 16th in the nation. (The growth index is the percentage of job growth multiplied by the actual increase in the number of jobs.) However, only a small portion of the high-growth firms are within Florida's emerging high-value-added clusters.

The focus of this report is the fast-growing, higher-value-added new enterprises that make an important contribution to both job growth and wealth creation in Florida. Although there is evidence that these high-growth companies are already making an important contribution, given Florida's top ranking in overall new company formation, that contribution could be even higher.

Encouraging Enterprise Clusters Has Become a Key to Success

Promoting high-value-added enterprise development requires a new understanding of the dynamics of the economy. Whereas much of traditional small-business development strategy has focused on the specific management, technology, and human resource needs of individual firms, high-value-added enterprise development requires an appreciation for not only the needs of specific firms but the dynamics of university commercialization, business interrelationships, and specialized labor and capital markets, among other factors.

In short, encouraging high-value-added enterprise development requires an understanding of the role of economic clusters. Clusters are critical because they are concentrations of business activity that act as cornerstones of an economy. Clusters are the context in which business similarities, interrelationships, and specialized needs develop. Clusters are important to understand because their success depends not only on the individual performance of the firms that comprise them but also on the development of strong interfirm connections and a "critical mass" that provides sustained momentum for ongoing economic spinoffs, vertical integration, and product diversification.

ECONOMIC CLUSTERS

Clusters occur through a complex process of both industrial attraction and new enterprise development. The stronger the linkages, the more dynamic the clusters become, eventually reaching a point where "regional agglomerations" are created that develop strong comparative advantages through the higher value added. Such agglomerations tend to grow in regions with key elements of economic infrastructure: a skilled and adaptable workforce, accessible technology, available risk capital, and a climate for entrepreneurship. Classic examples include Southern California's aerospace complex, Boston's Route 128, and Silicon Valley. Agglomerations can occur outside of high technology, such as New York's financial services, robotics firms around Detroit, and textile industries in Hong Kong.

New high-value-added enterprise clusters present a unique challenge to state and regional economies because they are evolving entities that often do not yet have a support infrastructure in place. This is in contrast to more mature clusters, such as tourism or citrus in Florida, that have more established channels for meeting their technology, human resource, and capital financing needs.

New clusters cannot command major new investments or redirection of existing institutional policies since they have yet to prove their viability over time. However, they need more than what can be provided through traditional small-business development services. The strategy that is required is one that meets the development needs of both the individual firm and the collective cluster. It is one that encourages rapid yet focused and incremental changes in the technology, human resource, and capital infrastructure of the state, beginning the process of building the specialized capacities needed to sustain new clusters and create new cornerstones of the state economy.

Florida's Value-Added Industrial Clusters

Cornerstone identified a number of important industrial clusters that contribute a significant portion of Florida's value added and exports. Through an analytical process of grouping industries into clusters and examining output and productivity growth between 1979 and 1989 and then projecting growth to 1997 using the DRI economic model, *Cornerstone* identified nine clusters for detailed examination: three emerging clusters, three expanding clusters, and three transforming clusters. The three emerging clusters represent the fastest-growing industries with the highest value added per employee. They represent some of the best opportunities for high-value-added enterprise development over the next decade.

Emerging Clusters

Information Industries (17.6% average annual growth 1979-1988)

- Office and computing equipment (SIC 357)
- Communication equipment (366)
- Electronic components (367)
- Information services (737)

Biomedical Industries (6.4%)

- Drugs and pharmaceuticals (283)
- X-ray and electro-medical apparatus (3693)
- Surgical and medical instruments (3841)
- Surgical appliances and supplies (3842)
- Optical instruments (3832)

Space Industries (7.8%)

- Missiles and space vehicles (376)
- Aircraft and parts (372)
- Ordnances and accessories (348)
- Engineering/scientific instruments (381)

The unique dynamics of growth within each of these clusters is driven by a different set of external competitive market forces and internal intercluster linkages. Whereas *Cornerstone* described these dynamics at a macro level and identified opportunities for future growth of the clusters in Florida, this report examines the growth of these clusters from a micro level, focused on the development of new enterprise within the clusters and the economic infrastructure that is required by specific firms.

Accelerating the Growth of Value-Added Clusters

Although the development of these three emerging clusters in Florida has been rapid, outpacing overall economic growth in the state, they have not yet reached a "critical mass" in which internal growth complements the attraction of industry in such a way that these high-value-added clusters represent a truly significant portion of the state's total output and employment, such as can be found in advanced regional economies like Silicon Valley, Route 128 in Massachusetts, or Southern California. For each cluster, although the potential is great, it can be said that Florida has not yet reached "lift-off."

Most troubling from the standpoint of cluster development through new enterprise development is the current high concentration of employment within the information and space industries in a few large firms. *Cornerstone* found that, to date, Florida has prospered primarily as essentially a "branch plant" location for large national firms involved in the development of computers, communications, electronics, and aerospace. The lack of homegrown firms that are suppliers to major producers reduces the "multiplier" effect in both jobs and wealth creation that can derive from concentrations of both large and small firms. Unlike California, for example, where the multiplier effect for information and space industries is estimated to be 3, a recent report by Goodkin Research Corporation estimated the multiplier for Florida to be slightly more than 1. This means that Florida is not getting the full economic benefits from these emerging clusters.

It may well be asked whether Florida can simply reach critical mass in the concentration of its clusters and hence achieve lift-off and a full multiplier effect naturally, without any strategic intervention to either promote new enterprise development or build supporting economic infrastructure. Two factors make this prospect unlikely. Today, competition for the industries represented in these clusters is intense, both domestically and internationally. Without strong private and public efforts to create a supportive environment for new enterprise development and build the critical elements of economic infrastructure, Florida risks falling behind its competitors who are taking these steps now. Furthermore, a piecemeal, programmatic approach that proceeds without strategic direction for concerted public-private efforts simply will fail to achieve the scale or intensity required to make a real difference in terms of either cluster development or infrastructure support.

There is clear evidence that concerted effort by business, education, and government can make a difference in supporting new enterprise development within high-value-added clusters. Regions as diverse as Austin, the Research Triangle in North Carolina, Salt Lake City, Wichita, and

Minneapolis have developed effective strategies for new enterprise development that involve a blend of private-sector and public-sector actions. What is required is a vision and the will to proceed according to a new strategic direction.

Methodology of the Study

This study focuses on understanding new enterprise development in three high-value-added industry clusters in the state: information, biomedical, and space. The basic approach of the study has been to gather information about the extent and nature of new business formation through direct interviews with entrepreneurs of start-up companies, with key informants or "network" people, and with representatives from larger existing companies that may have spun off small companies or have supplier-buyer relationships with start-up companies. Five basic tasks were carried out in completing this study.

First, sectors and regions in the state that have already experienced growth in the three industry clusters were identified. County business pattern data for 1986 were analyzed to determine the geographical concentrations of clusters and new enterprise development. This analysis, coupled with our reviews of other reports and literature on new enterprise development in Florida, helped to focus our efforts in each cluster on those areas that have already experienced a level of growth in the clusters. Although it is recognized that all parts of the state have new enterprise development, this analysis concentrates on four major regions of the state. The results of this analysis are presented in Chapter II and Appendix A.

Second, initial interview lists were developed drawing on information gathered in the course of studying the clusters for *Cornerstone*, and from recommendations from key informants. Interviewees were drawn from the three clusters in different regions of the state and included:

- Representatives of organizations working with new enterprises—such as inventor's groups and service providers (e.g., incubator or venture center managers, SBDC, Department of Commerce staff, etc.).
- Entrepreneurs in each of the three clusters.
- Representatives of existing cluster firms, especially those who have had contact with entrepreneurial firms (e.g., technology managers, finance directors, and other executives).

Third, interview protocols were developed to guide the individual interviews with the entrepreneurs, network people, and representatives from larger firms. Issues covered in the protocols include:

- Why entrepreneurs are choosing to start new firms.
- Their knowledge of other new firms in their industrial cluster.
- The types of market opportunities that start-ups are seeking to meet.
- Critical problems encountered as a new enterprise.
- The strength of the local support infrastructure—the key needs of new firms in the cluster, and how well they are being met.

Fourth, over 100 interviews were conducted beyond interviews that were conducted for *Cornerstone*. In-person interviews were conducted primarily in the Southeast, the East Central, and the West Central regions of the state, with interviews elsewhere conducted over the phone.

Fifth, the information derived from the interviews, as well as from other sources, was analyzed to develop an understanding of how value-added enterprise development is or is not occurring within the state. A new framework has been identified for promoting value-added enterprise development within industry clusters. The experience of new enterprise development programs in other states has been reviewed to identify and develop strategies appropriate for promoting enterprise development in Florida. Finally, on the basis of the analysis, action initiatives are recommended at both the regional and state level to provide support to new enterprise development initiatives in Florida.

Although the study focuses on only a few regions of the state and only a few selected industry clusters, it does not suggest that these are the only regions and industries that should be promoted. Other regions such as the Pensacola, Gainesville, and Jacksonville areas, for instance, have been successful in developing new high-value-added enterprise through spin-off from defense spending, and emerging opportunities in biotechnology and data processing. Other regions and sectors can also be expected to benefit by the growth of the state's value-added clusters, and other efforts can be directed more broadly at enterprise development throughout the state.

II VALUE-ADDED NEW ENTERPRISE DEVELOPMENT IN FLORIDA

Overview

Florida has emerged over the past 10 years as a major state to be reckoned with in the generation of new enterprise. Indeed, according to *Inc.* Magazine's indices of economic growth based on level of job creation, significant new business start-ups, and the percent of young companies enjoying high growth rates, Florida is doing well. According to these indices:

- Between 1984 and 1988, Florida experienced a birthrate of 2.9% in new firms employing 10 or more people. This rate of growth was first among all U.S. states.
- 3.1% of all the companies founded in Florida between 1980 and 1988 were classified as "high-growth" firms. According to *Inc.*'s index, Florida ranked 16th nationally in terms of the number of start-ups that were high growth firms. This suggests that although Florida has a good number of start-ups, many of them may be slower-growing, less innovative firms.
- Five Florida cities—Orlando, Tampa-St. Petersburg, Pensacola, Fort Myers, and Jacksonville—ranked in *Inc.*'s top 25 "Metro Hot Spots." This index is based on a weighted average of jobs generated, the rate of significance new business start-ups, and the percent of young companies enjoying high growth rates.
- Three Florida cities—Miami, Tampa-St. Petersburg, and Fort Lauderdale—ranked in the top 25 nationally in terms of the absolute number of both young, high-growth firms and significant start-ups.

Two studies published by the University of Miami's Innovation and Entrepreneurship Institute have documented the growth of Florida's high-technology industries. The standard U.S. Department of Commerce definition of high tech was adopted, which includes the following industries with their corresponding Standard Industrial Classification (SIC) numbers:

SIC #	Industry
283	Drugs and pharmaceuticals
3573	Electronic computing equipment
3622	Electrical industrial equipment
366	Communication equipment
367	Electronic components and accessories
3693	Electrical machinery
372	Aircraft and parts
367	Guided missiles, space vehicles
381-385	Scientific instruments, medical and optical equipment
7372	Software
7391	Research and development

High-technology industries grew rapidly in Florida during the 1970s and early 1980s. High-tech employment in the state more than tripled from nearly 45,000 in 1972 to 151,262 in 1986. Florida ranked 6th nationally in high-technology employment in 1986, with 4.3% of the national total. Between 1972 and 1984, the number of high-technology companies quadrupled from 429 to 1,694, an average annual growth of 11.9% per year, outpacing that of the leading high tech states of California (9.9%) and Massachusetts (7.7%). After 1984, the number of high-tech firms dropped to 1,531 in 1986, a net loss of 163 high-tech companies. However, because of declines elsewhere, Florida's national rank in number of advanced technology companies actually rose from 7th to 5th.

Whereas it is possible to identify the number of high-technology companies in Florida and changes in the number over time, reliable data on new business formation (births of new companies) in Florida's advanced technology clusters are not available. Changes over time in the number of companies in Florida indicate the absolute gains or losses in companies operating in the state, but these changes do not reveal whether these companies are new start-ups, branch plants, or companies transferring operations to the state. Without a database that distinguishes between births, branches, and transfers, we must rely on secondary sources and qualitative information. Although *Inc.* Magazine (from Cognetics, Inc.) provides rates of overall new business formation in the state, it does not detail this information to show new business start-up rates for high-technology industries.

Thus, although the number of Florida's high-tech companies declined by 163 between 1984 and 1986, it is not readily discernable whether the business start-up rate has declined or the business failure rate has increased or whether mergers and acquisitions have resulted in fewer high-tech companies. Obviously a central source of information on new business formation is needed to gather important growth data for high-technology industries in Florida.

Regional Concentration of Advanced Technology Industries

The growth of Florida's advanced technology industries has concentrated primarily in three regions of the state: the Southeast, the East Central, and the West Central regions. As shown in Figure II-1, in 1986 these regions combined accounted for 90% and 71% of the state's advanced technology employment and number of firms, respectively. New names for these regions have been popularized in recent studies and articles, generally reflecting the industrial specialization of the region.

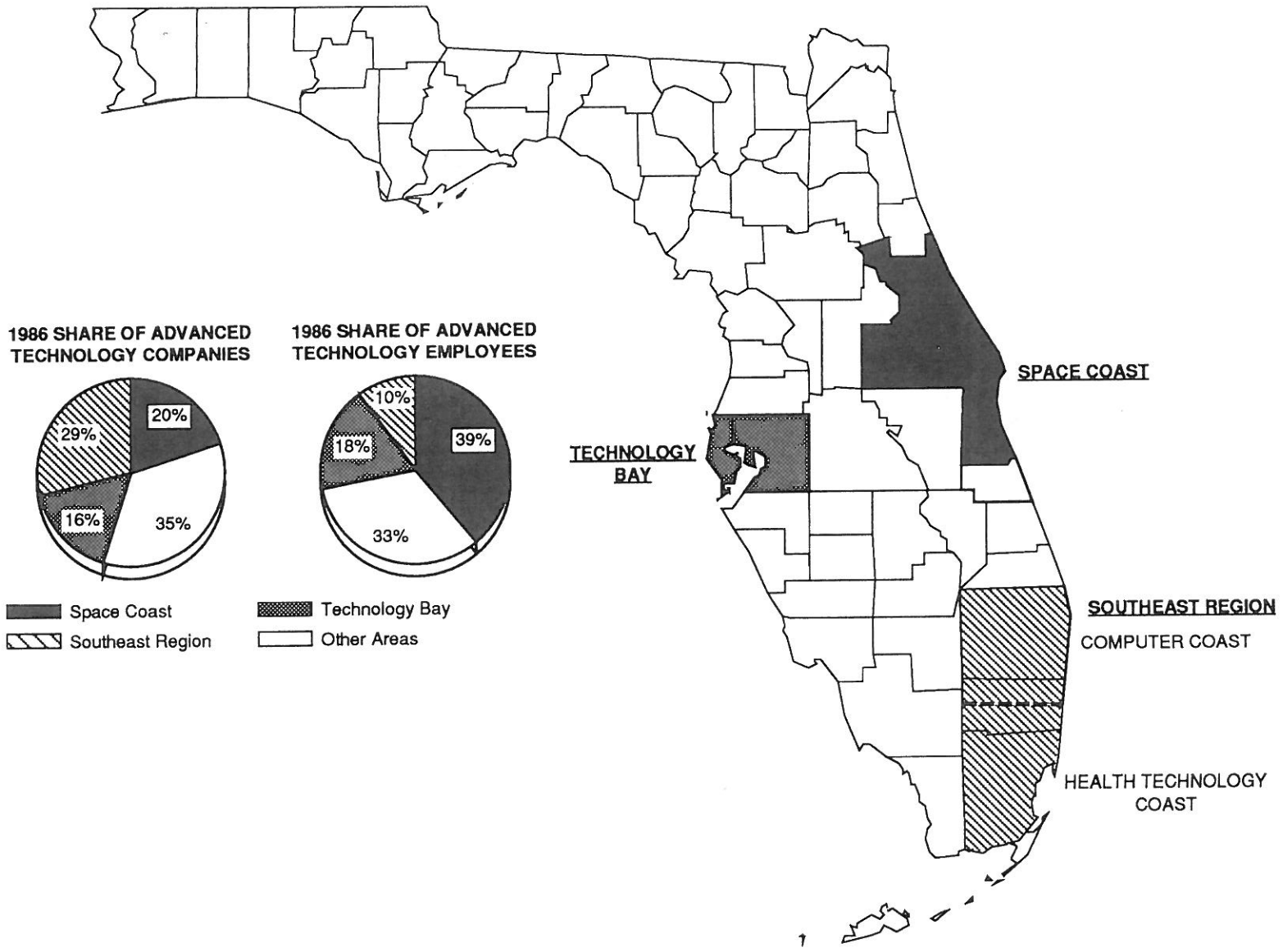


FIGURE II-1 REGIONAL CONCENTRATION OF ADVANCED TECHNOLOGY INDUSTRIES

The Southeast region is split into two areas, the Computer Coast and the Health Technology Coast, reflecting the industrial clustering occurring in each area. The Computer Coast (Palm Beach County and northern Broward County) accounts for more than half of the state's computer and communication industry employment, and the Health Technology Coast (Dade County and southern Broward County) has more than half of the state's pharmaceutical and scientific, medical, and optical instruments industries.

The Space Coast region (Orange, Brevard, Seminole, and Volusia counties) accounts for virtually all of the state's guided missiles and space vehicle industry (99% of state employment in this industry), and thus is appropriately named. However, the Space Coast is also host to over half of the electronic components industry and one-fourth of the communications equipment industry. The most distinguishable industry clusters in the Space Coast are the laser/electro-optics cluster and the space cluster.

Technology Bay, a region consisting of Hillsborough and Pinellas counties, accounted for 18% of the state's high-tech employment in 1986. It has a diverse assortment of advanced technology industries, including communications equipment, electronic components, and scientific and medical equipment and instruments. Although Technology Bay is host to a significant high-tech activity, there are no easily definable industry clusters that have taken shape in the region to date.

The changes in employment and number of companies in high-tech industries from 1984 to 1986 vary by region. Technology Bay shows the strongest growth during this period. Its high-tech employment base rose by 10%, and the number of high-tech companies increased by 1.9%. The Space Coast showed the second-strongest growth with high-tech employment increasing by 5%. However, the number of high-technology firms declined slightly (-1.4%). Of the major high-tech regions of the state, the Southeast region had the weakest showing during this period. Its high-tech employment base declined by 6.9% while the number of high-tech firms remained stable, increasing by only 0.1%.

Within the four advanced technology regions, distinct industry clusters are in the process of forming. The key industry clusters include the:

- Health technologies cluster in Southeast Florida
- Laser/electro-optic cluster in the Orlando area
- Information industries cluster along the Computer Coast
- Space cluster in the Space Coast
- Emerging clusters in Technology Bay.

Each of these clusters is briefly characterized below, highlighting patterns of new enterprise development.

Health Technologies Cluster

The Health Technologies cluster in Southeast Florida is a good example of a small but rapidly growing cluster characterized by considerable new enterprise development. The cluster consists of an evolving nucleus of companies primarily producing medical devices and pharmaceutical products. The Southeast region is today developing critical mass in the biomedical industry and has the potential to become a national leader in the industry if it can successfully capture much of the rapid growth expected by the industry. In many respects, this cluster is on the threshold of achieving lift-off. The evolution of this developing cluster provides insight into how new enterprises are formed.

The biomedical industry in Southeastern Florida has evolved incrementally over the past 40 years, largely, through the growth of several major firms and their spinoffs. Early entrepreneurship in Florida's biomedical industry can be traced back to John Elliot, who founded the Miami Blood Bank in 1946 and developed several blood typing innovations. Since the time of the Blood Bank, a number of companies have grown up in the region. In particular, four firms constitute the pillars of the biomedical community in Southeast Florida: Baxter Dade Reagents, Cordis Corporation, Coulter Electronics, and Key Pharmaceuticals. As these companies have grown, top people in medical devices and pharmaceuticals have been attracted to the region. Many of the biomedical firms in the region are spinoffs, spinouts, the result of a breakup, or in some way are related to one of these major companies. Figure II-2, a genealogy of the health technology industry in Southeastern Florida, traces the origins of the 40 or so biomedical firms in the region.

One of the first major firms to spring up in Southeastern Florida after the Miami Blood Bank was established was Dade Reagents. Dade Reagents added to Elliot's original work and developed diagnostic and clinical chemistry products. Dade Reagents was later acquired by American Hospital Supply Corporation and ultimately became Baxter Dade Reagents, a division of Baxter Health Systems. Baxter Dade Reagents develops and manufactures reagents for diagnostic use and automated laboratory instruments, and employs 1,100 in its Dade County facilities.

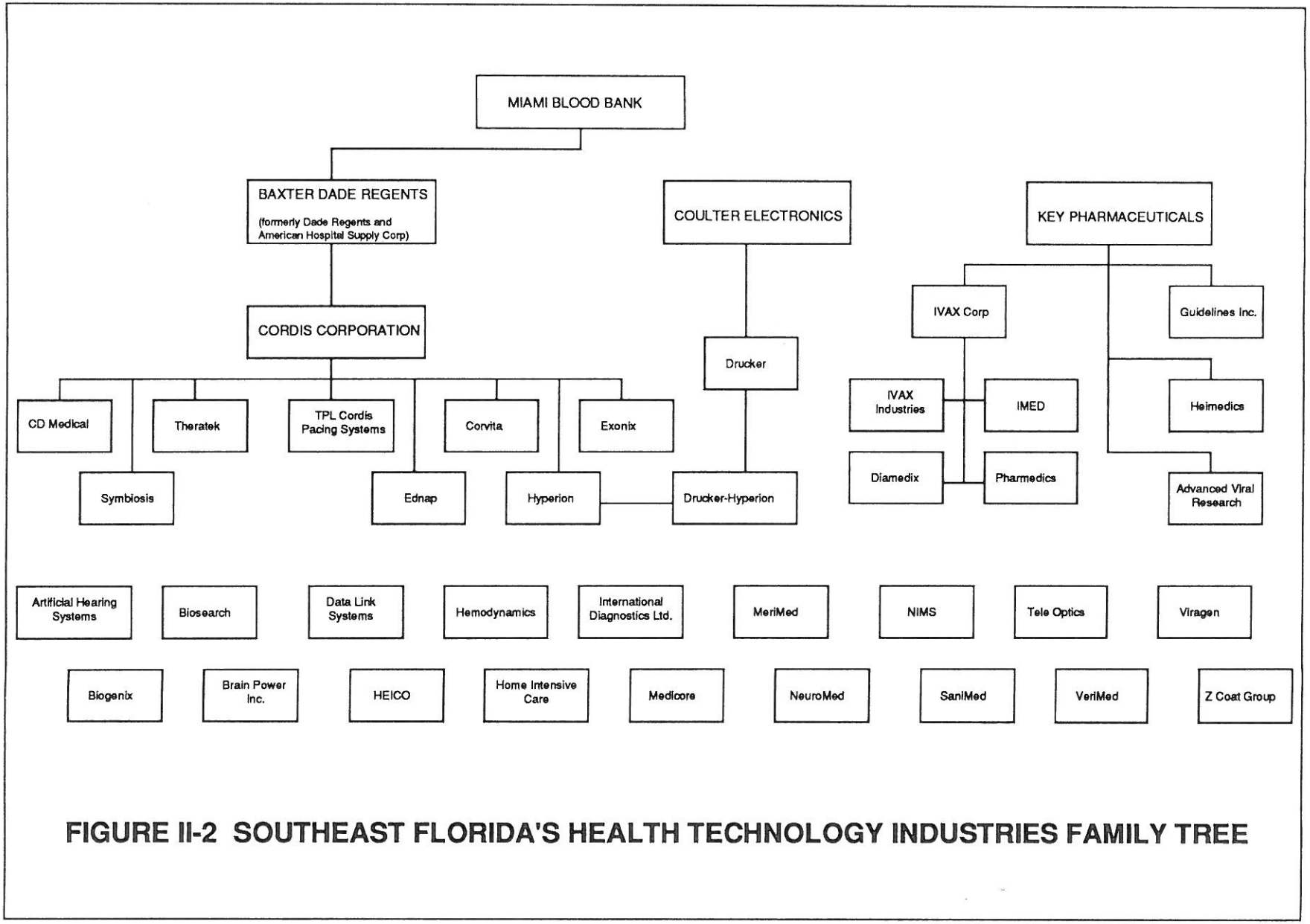


FIGURE II-2 SOUTHEAST FLORIDA'S HEALTH TECHNOLOGY INDUSTRIES FAMILY TREE

The second major development in the evolution of the industry was the establishment of Cordis Corporation. In 1957, Dr. William P. Murphy, Jr., a medical doctor and biomedical engineer, left his position as Director of Research at Dade Reagents to start the Medical Development Corporation, which was subsequently renamed Cordis Corporation in 1959. At the onset, Cordis developed and produced several innovative instruments and devices, including the first disposable procedure kits and trays. Later the company entered the field of implantable pacemakers and soon became the second-largest supplier of those in the world. In the mid-1960s, Cordis continued to expand its scope, developing two major product lines—angiographic catheters and implantable valves for hydrocephalus—and becoming the largest supplier worldwide in these products.

Since the 1970s, a handful of biomedical start-up companies can be traced back to Cordis. Several joint venture companies have been established between Cordis and other companies to develop and commercialize new medical devices (e.g., CD Medical, a joint venture between Cordis and Dow; Theratek, a joint venture between Cordis and an out-of-state firm). A number of other Cordis spinoffs have been started by former employees of Cordis (e.g., Exonix, Ednap, Symbiosis). Another firm, Corvita, was founded in 1987 by the former president of Cordis, who acquired rights from Cordis to develop a line of unique arterial grafts and got several Cordis employees to join him in developing Corvita. Another company, Novoste, was recently formed to manufacture radiological catheters and market them through Cordis. In many respects, Novoste represents the archetypical "natural partnership" between a new technology company and a major company. The new technology company is the ideal setting for innovating new products and brings new technology products to the partnership, while the larger, established company contributes marketing capacity and possibly equity capital to the partnership.

A third pillar to the health technology cluster is Coulter Electronics. Wallace Coulter invented the Coulter Counter for cell counting, an invention that became the key component for a series of highly successful laboratory instruments developed by Coulter. The company has since diversified from the instrument field and now produces diagnostic and therapeutic biological products as well.

The fourth pillar of the industrial base of the health technologies cluster is, or was, Key Pharmaceuticals. Founded in Miami Beach in 1947, Key was originally founded as a distributor of pharmaceutical products, but later became well known for its controlled-release patches for therapeutic agents, particularly for hypertension. In 1986, Key Pharmaceuticals was acquired by Schering Plough, who moved major portions of the company to New Jersey. Many of Key

Pharmaceuticals' key people chose to remain in South Florida, and a handful started companies of their own, such as Heimedics; Guidelines, Inc.; IVAX; Advanced Viral Research; and others. IVAX Corporation, founded by a former Key Pharmaceuticals executive, manufactures specialty chemicals, diagnostic test kits, reagents, and medical instruments, and serves as a holding company for four other health technology companies: IVAX Industries, IMED, DIAMEDIX, and Pharmedics.

Overall, the health technology cluster has evolved because over the past 40 years the base of medical device companies and pharmaceutical companies has gradually attracted a specialized pool of talented people to the region. The visionary leadership of people like Dr. William P. Murphy, Jr., at Cordis, who created an exciting environment for "gold-collar" workers and motivated them to be creative and produce new innovations, is what made the difference. Cordis Corporation was an exciting place to be and could attract the best and brightest from around the country. Similarly, 15 years ago, Dr. Phillip Frost and Michael Jaharis took over Key Pharmaceuticals and over time turned it into a dynamic company that was able to attract top research talent to the area. With a critical mass of bright, energetic people, and a fair amount of job mobility and interaction among people and among companies, it was inevitable that spinoff activities would occur.

Spinoffs are of several types. Cordis had spinoffs where good researchers simply needed the opportunity to take a concept, build their own company, and try to succeed as entrepreneurs. Exonix is a good example of this type where researchers started a company to sell pacemaker kits that could be assembled offshore and marketed to lower-income countries. Other spinoffs resulted when Cordis sold proprietary technologies to former employees. In one case, two long-time engineers at Cordis who wanted to develop a specialized syringe for angiographic procedures were not given the go-ahead. They ultimately convinced Cordis to let them purchase the idea and develop the product and formed Symbiosis. In another case, Corvita was founded by Norman Weldon, who served as president of Cordis for 7 years before acquiring the rights from Cordis to develop a line of unique arterial grafts. Corvita and Cordis started out as a "natural partnership" in which Corvita was the ideal small company setting for very high-productivity product innovation activity and Cordis was the large company to market the new product.

The other major vehicle for new business formation in the health technology cluster was the breakup of Key Pharmaceuticals in 1986. Many company executives and other personnel elected to stay in Florida, and many started companies of their own. A dozen or so start-ups in Southeast Florida are linked to the breakup of Key, as shown in Figure II-2. People from Key were

reluctant to give up the mild winters and their Florida life styles, and many believed that South Florida has the opportunity to become one of the major states in biomedical development. So a number of former executives and employers used profits from exercising Key Pharmaceuticals stock options to start up their own firms. The acquisition of Key Pharmaceuticals was a classic case of Schumpeter's "creative destruction" in which talent and resources were released from a large company to form new enterprises—offspring companies that may be able to adapt better to the changing economic environment than the parent company.

Whereas start-ups have been spawned by the industry base of the health technology cluster, few, if any, spinouts have been generated from the university. Similarly, few new start-up companies have been grown from the inventor/entrepreneur. For one thing, the starting costs are very high. It is very difficult for university personnel to make a living and start a company. Moreover, the University of Miami, FIU, and other universities lack an explicit policy about faculty engaging in entrepreneurial businesses.

The Laser/Electro-Optics Industry Cluster

The laser/electro-optics (LEO) cluster in the Space Coast is one of the more developed value added clusters in the state and has generated many homegrown Florida companies. It is a cluster that began in Central Florida in 1957 when Martin Marietta Corporation (MMC) initiated the field of electro-optics. Today more than 30 LEO companies form the cluster, many of which have branched out from MMC. The cluster is an example of an intermediate-stage cluster (Stage 2 from the cluster life cycle typology developed in Chapter III) that is developing a substantial base of related companies, a specialized labor force, and a network of support services and institutions specific to the LEO field.

The evolution of the LEO cluster provides a good example of how new enterprises develop in a value-added cluster. Shortly after Martin Marietta's Tactical Missiles Division invented the laser in 1960, the company recognized the potential application of lasers to missile guidance and started an R&D effort to develop laser rangefinders, target designators, and seekers. Over the past two decades, MMC's laser and electro-optics activity continued to expand in response to major military programs that use laser guidance technology.

As MMC's laser operations expanded, top researchers and technology managers were brought to Orlando. Three waves of development resulted in the expansion of the LEO cluster in the Orlando area from 1 company in the early 1960s to 30 LEO companies today. The first wave

occurred during the late 1960s, when three laser/electro-optical companies spun off from MMC. These new companies were Orlando Research (now Control Laser), International Laser Systems (now Litton Laser Systems), and Wood Ivey Systems. All three companies have prospered and are in operation today, although two were acquired and are not operating under their original management. Then, during the 1970s, another 10 LEO companies were formed or moved into the area. During the 1980s, 16 more companies emerged, bringing the total to 30 companies in the Orlando area. The genealogy of LEO company spinoffs is illustrated in Figure II-3. Although not every company is shown in Figure II-3, there have been 7 LEO spinoffs from Martin Marietta over the years. International Laser Systems and Control Laser had 5 spinoffs each, accounting for 10 of the 30 companies in existence. Altogether, two-thirds of the 30 Orlando-based LEO companies are spinoffs from other LEO companies. It is interesting that only two LEO companies founded in Orlando have moved out of the area, KEI to Dallas and American Laser to Salt Lake City.

Many of the start-up companies are small companies innovating new lasers, laser equipment, and other applications for industrial, military, and medical uses. Many are developing the products under contracts to original equipment manufacturers (OEMs), who will then market the equipment. The small companies are better able to serve as the source of new technology, and many have the production capability. Many of the larger OEMs are not well organized to do the technology development in-house and some do not want the technology developed in-house. Increasingly, OEMs are finding their niche as systems integrators, using small technology companies to develop the components of the system. The small-company, large-OEM company partnerships characterize the basis for many of the LEO start-ups. Lee Lasers and Advanced Laser Systems Technology are examples of recent start-ups that have established relationships with OEMs, which have, in effect, guaranteed markets for the products of the new companies. In addition to securing a market, the relationship with an OEM can also be a source of seed or start-up capital. Lee Lasers, for instance, obtained R&D seed capital from an OEM to develop its product.

Looking beyond the Orlando area, the laser/electro-optics cluster extends to include more of the Space Coast, especially over to Melbourne and Palm Bay. There are an additional 10 LEO companies in this area, the largest of which is Harris Corp. Seven of these 10 companies are homegrown spinoffs from other companies in the Space Coast. Several of these companies have grown very rapidly (e.g., DBA Systems and Opto Mechanik). Opto Mechanik is today the largest optical instrument manufacturer in the Southeastern United States.

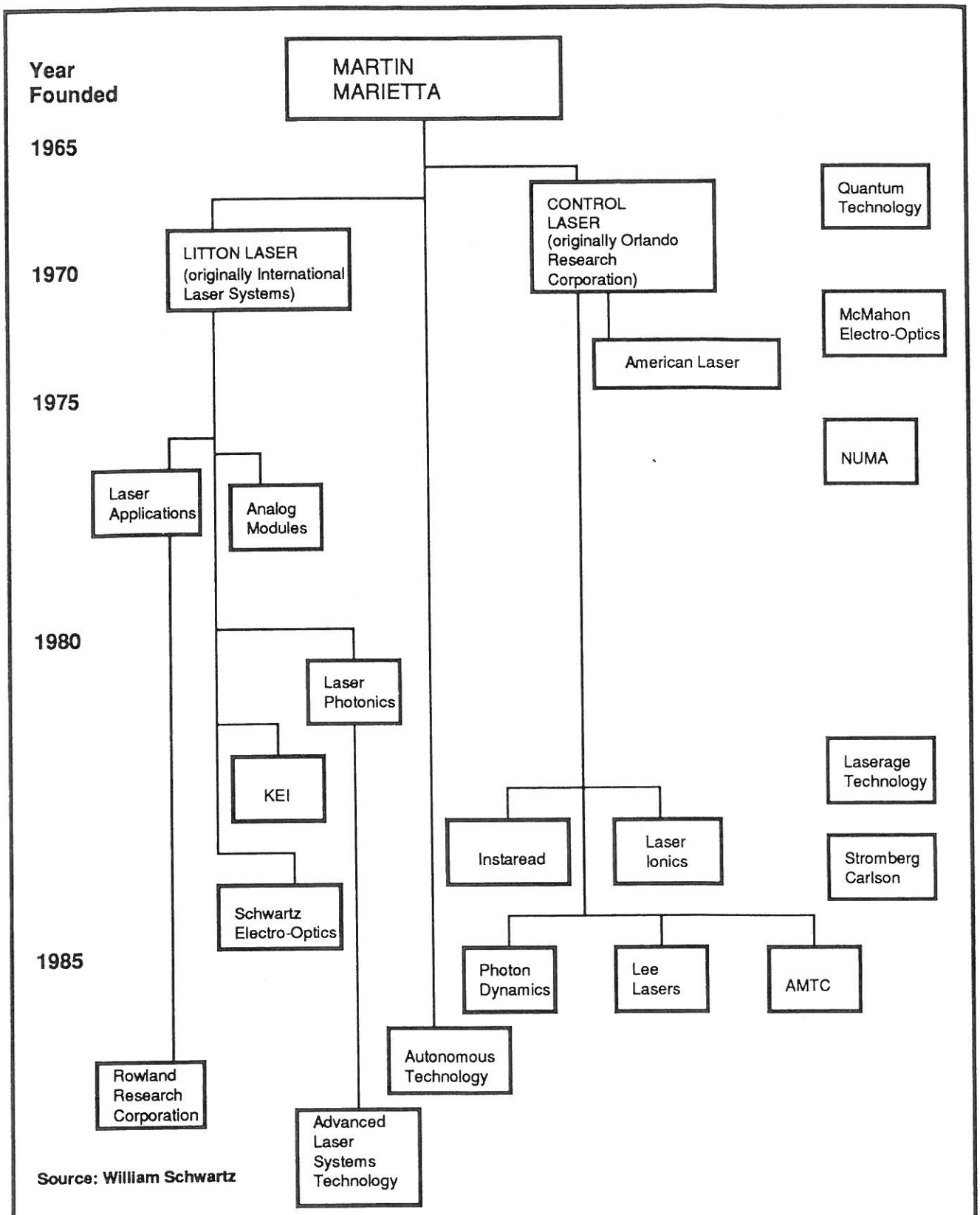


FIGURE II-3 ORLANDO LASER INDUSTRY FAMILY TREE

Thus, the 40 LEO companies in the Space Coast represent a sizable industry cluster. A 1987 study prepared for the Florida High Technology and Industry Council indicated that LEO industrial activity in the Space Coast employed 10,400 workers, including 2,700 scientists and engineers, and generated a total sales base of $1.2 billion. This is the profile of a value-added industry cluster in the making. The growth of the sector to date has created a base of high-quality, high-paid jobs.

The main force leading the evolution of the LEO cluster has been the development of the industrial base. Firms have formed and grown, and top people have been attracted to the cluster because of the increasing activity and opportunity occurring in the industry. Only recently have universities become an important contributory factor in the growth of the cluster. University spinoff companies have not played a role in the development of the cluster to date, and few of the entrepreneurs and leading technical people and engineers are graduates from local universities. It was not until 1987 that the University of Central Florida established a center of excellence, the Center for Research in Electro-Optics and Lasers (CREOL).

Despite the late start, it is clear that for the LEO cluster to approach the "lift-off" stage of development, the universities must play a key role in providing a critical role as a source of scientific and technical research, a source of highly trained engineers and managers, and ultimately a source of new technologies, product innovations, and new companies. CREOL has experienced substantial growth since its inception and now has 13 faculty and 10 senior research staff members performing research in a wide range of LEO activity. CREOL operates with $2.4 million of support from the Florida University system and about $5 million of private contracts and grants annually and is continuing to grow rapidly. Similarly, in the eastern part of the Space Coast in Melbourne, the Florida Institute of Technology (FIT) is growing a strong electro-optics program. Photonic research facilities at FIT encompass seven laboratories covering laser meteorology, solid state devices, optical pattern recognition, optical research, fiber optic sensors, optical computing, and signal processing.

Although the laser/electro-optics cluster in the Space Coast is considered to be the third-largest LEO cluster nationally, only smaller than the Silicon Valley area and Route 128 around Boston, it has not achieved the critical mass necessary for "lift-off." However, if the university component of the cluster is sufficiently built up and other aspects of the supporting economic infrastructure for enterprise development are improved, the LEO cluster may achieve the critical mass needed for lift-off.

Information Industries Cluster

The largest concentration of information industries is along the Computer Coast. Over 50% of Florida's total employment in computers and communications is in this region. The information industries cluster is characterized by several major computer and communications equipment companies and a growing number of smaller technology, supplier, and support services companies. The computer equipment industry is dominated by IBM and Harris, which together account for more than 40% of all employees. Similarly, the communications equipment industry is dominated by a few large companies: Harris, Motorola, and Racal-Milgo dominate the industry with more than one-third of all employees.

The early development of the information cluster occurred in the 1960s with the evolution of the real-time computing industry (superminicomputers). In the early 1960s, several engineers spun out from Radiation Inc., a Melbourne-based engineering company contracting with NASA and other government agencies and now part of Harris. They formed Systems Engineering Laboratories, which specialized in simulation software and was later bought by Gould. Subsequently, two other companies spun out of Systems Engineering Laboratories: Modular Computer Systems, which today employs more than 1,200, and Computer Data, which became Harris's computer division. Other companies that can be traced back to Radiation Inc. include Computer Products and Telematics International.

The most successful entrepreneurial companies in the Computer Coast have spun off from the major computer companies. Telematics and Equinox Systems are key success stories that follow this pattern. Telematics is a spinoff of people from Gould and Modular Computer Systems that started in 1982 and is today a $60 million company.

Another source of spinoff activity in the information industry cluster has been IBM. After IBM consolidated operations in Florida with the winding down of the personal computer project, many managers and engineers elected to leave the company (many with "golden parachutes" and early retirement packages) and stay in Florida. Many people found jobs with other companies while others actually retired. However, a number of former employees started off on their own and developed new start-up companies. In software, IBM has had several spinoff, including Gulf Stream Microsystems and Core International.

New enterprise development in the communications equipment industry has been constrained in part because many of Florida's major manufacturers of communication equipment are currently

producing for defense. Over 50% of shipments in the communications industry are purchased by the U.S. government as military equipment. This has also constrained the fusion of the computer and telecommunications industries. To achieve the real potential for synergy between the computer and communications industries in Florida, manufacturers will need to move into commercial markets as defense spending slows down over the next decade.

Overall, the high concentration of employment in a few large firms creates barriers to further development of the information industries cluster in the form of strong linkages between local buyers and suppliers. To date, the cluster has prospered primarily as a "branch plant" location for large national firms involved in the development or production of computers, electronics, and communications. The lack of homegrown firms that are suppliers to major producers causes problems for creating a truly strong industrial cluster. The information industries cluster has not yet reached true "critical mass" to achieve the full benefits of a cluster. What is required is to broaden the cluster by stimulating stronger linkages with local suppliers, more spinoff firms, and more homegrown industries. This involves promoting new enterprise development, import substitution that encourages major producers to purchase supplies and components from local firms, and expansion of the cluster to encompass more research on one end of the product cycle and more service on the other end.

Within the past decade, increasing competitive pressures worldwide have forced major companies to become leaner and more reliant on outside suppliers. For example, IBM has changed its approach in dealing with outside companies. The firm used to be very inward looking and refused to work with third parties. In 1979, IBM began to offer its first discounts to companies that were developing products and equipment that was compatible with IBM equipment. By the early 1980s, IBM launched a value added remarketer (VAR) program that would enter into arms-length agreements with smaller companies who develop peripheral equipment and products and software that complement IBM equipment. Now, IBM is doing joint marketing with VAR partners. Computer Applications Systems (CAS) is a company that started as a group that spun out of IBM to make security access control systems for IBM computers and developed a partnership with IBM. CAS has grown very rapidly and was the 50th-fastest growth company in *Inc.*'s 500 in 1988.

Perhaps the most important impediment to the development of the information industries cluster is the lack of a strong university in the Computer Coast. Today most major firms rely primarily on out-of-state sources for research and technology development. Linkages between information companies and Florida's universities in applied research have only recently been developed in the

fields of computer software and computer science (at the University of Florida in software, Florida State University in supercomputer computation, University of Central Florida in computer science) and microelectronics (at the University of Florida's integrated electronics center and University of South Florida's Center for Microelectronics Research). Florida Atlantic University (FAU) is a small, young, growing university that is viewed by industry as not having met the needs of the regional market. The university has been building and expanding its programs with good faculty, branch campus courses, and remote teaching. However, despite an active effort to respond to industry's desire for more prestigious engineering training, FAU is not able to meet the demand of neighboring companies for world-class education and research. Still, FAU is trying to respond as effectively as it can. It is completing construction of a new engineering building. It is trying to establish an R&D park on university land and is expanding the urban teaching and corporate training programs to meet industry and community needs. However, there is a fundamental mismatch between the needs of local industry for research excellence and high-quality graduates and FAU's capacity. The university should be expanded to meet the requirements of the region and bring the geographic concentration of higher education resources in line with the geographic demand that exists.

To date, no new enterprises have spun off from Florida Atlantic University. FAU is trying to develop a research park on 60 acres of university land. FAU had established an innovation center, housed in a trailer at the research park, but that has since been closed down for lack of ongoing funding. Despite the loss of the innovation center, the development of the research park is moving ahead.

Although farther to the south of the main concentration of the information industries cluster, Florida International University (FIU) is aggressively moving to become a university hub for the information industries cluster. FIU has been expanding its work in information sciences through the construction of a new $10 million Engineering Sciences facility that will be the location for its computer laboratories, which will be used by students and faculty in the School of Computer Sciences, the second of its type in Florida.

The information industries cluster can only be considered an intermediate cluster because of the high concentration of the cluster in a handful of large firms primarily based outside Florida, the lack of buyer-supplier linkages among firms, and the weakness of the regional universities and university-industry relationships.

The Space Industries Cluster

Florida's space industries cluster has experienced great volatility over the past 25 years. In the 1960s, billions of federal dollars were spent in Florida to develop programs to place a man on the moon. Besides developing a space launch infrastructure at Cape Canaveral, the Florida space cluster expanded with the development of related aerospace, communications, and space-support service activities. Following the successful Apollo program, the 1970s were years of spending cuts and indecision in the nation's space program. In the 1980s, the space program was revived with the launch of the space shuttle. During 5 years of operation, space shuttles delivered at least 24 satellites into orbit. During this decade, Florida's missiles, communications equipment, and space vehicles industries experienced rapid growth. However, following the 1986 Challenger tragedy, a period of reexamination of the U.S. space program ensued during which industry-wide layoffs resulted. In 1988, this period of reexamination ended, resulting in a major shift in U.S. policy toward space that has major implications for Florida by creating opportunities for rapid growth of the space industry. The Presidential Directive on National Space Policy reaffirmed the nation's commitment to NASA's civil space activities and established policies designed to encourage the growth of commercial space activities. In particular, the new policy directed government agencies to encourage the development and use of U.S. private-sector access to federally owned facilities, hardware, and services. It is estimated that the commercial space industry will become one of the nation's fastest-growing industries over the next decade. The issue for Florida is how to get its share of this growing space industry.

Florida's space industry cluster should be well positioned to take advantage of the opportunities in space commercialization. Substantial federal funds have provided support to a large number of firms in the state. This funding has helped develop a pool of scientific, technical, and managerial talent that can provide the foundation for an expanded space industry in Florida. In addition, growth of the space industries creates strong demands for a variety of linkage industries, including electronics and communications, and advanced materials. Along with a broad range of additional component suppliers and service support industries, Florida has the potential to develop a strong regional agglomeration around the growth of the space industry.

Currently, the space industries cluster in the Space Coast region contains over 99% of the state's employment in space industries. The cluster consists mainly of a few very large firms that specialize in missiles and space vehicles, communications, and space-support services and a set of medium and small companies that subcontract to the larger firms. These large firms tend to be the prime contractors for space and defense programs, with other firms providing support

services and products. Employment in commercial space in the Space Coast has risen significantly in the past few years from virtually zero in 1987 to about 1,000 today in the four major companies: Martin Marietta, McDonnell Douglas, General Dynamics, and AstroTech.

New enterprise development in the space industries is dominated by start-ups that are subcontractors to the larger companies who are the prime contractors with the military, NASA, and other federal agencies. Many of the new smaller companies provide software, communications, and other specific high-technology inputs to the the prime contractors.

One group of new enterprises emerging along the Space Coast is in the realm of command, communication, control, and intelligence (C^3I), developing products and services related to satellite surveillance, data transmission, and other support for intelligence-gathering ("spook") activities for the Department of Defense, CIA, and related agencies. The prevalent start-up pattern is the story of an individual or group of individuals, usually bright engineers with security clearances, who spun out of Harris Corporation with a new technology application concept and now sell back the product or service to the prime contractors. A number of the more successful, high-growth start-ups in the Melbourne area, such as Software Technology, CSI, and Software Productivity Specialists, follow this pattern. They got started by winning Small Business Innovation Research (SBIR) grants, then raised additional capital through local private placements and self-debt financing by the entrepreneurs themselves, and finally obtained venture capital financing, virtually all from outside Florida.

Although a number of entrepreneurs with good technical grounding and innovative technologies in the space field have tried to get companies off the ground, many have failed because they could not put together a solid management team. The space cluster clearly lacks a deep pool of people with management experience, especially in finance and marketing. Therefore, the success stories tend to emerge from start-ups that are run by experienced managers of the major companies. Many of the successful start-ups in the space cluster, such as CSI, Software Tech, SPS, and Skydata, were started by former managers or employees from Harris Corp., Martin Marietta, and so on. Skydata, an uplink-downlink satellite communication start-up, was formed by experienced managers from Harris, who have succeeded in attracting French and Japanese companies to invest in the company.

There are other space-related companies emerging in the Space Coast that are winning contracts for space and commercial space R&D that is captured locally. With the commercialization of space, it is likely that the number of start-ups related to commercial space development will

expand significantly along the Space Coast. Although firms in this area are limited today, the groundwork is being laid to establish the right kind of environment for the commercial space industry.

The feasibility study for the Florida spaceport identifies growth opportunities for a range of supplier industries as well as complementary facilities, including a commercial experiment-preparation laboratory, a small space business incubator, and a space museum and space theme park including an "analog moon base."

Other elements are being put into place that will contribute to Florida's readiness to take advantage of the opportunities in commercial space. The new Space Research Foundation is engaged in developing space R&D in the state by increasing space agency R&D (e.g., NASA, DoD) and industry R&D at Florida universities. Space curricula are being advanced in Florida universities (e.g., UCF's Center for Space Policy Space Studies Program, Stetson University's Space Law Program). The simulated moon base program will clearly contribute to the base of activity.

Overall, the space industries cluster at present remains a cluster in a formative stage. The cluster is highly concentrated in a few large firms, and the linkages among large producers and small suppliers are still weak. In part, this is the result of the predominance of federal agency contracts in the overall business of the space cluster. Typically, the scale of operations required for participation tends to be large, so that there are barriers to entry for smaller and start-up companies. The complexities of interfacing with the government are costly. For example, a small company that wants to enter the launch vehicle market must be willing to meet the extensive federal documentation requirements in complying with public safety standards, engineering reviews, and other requirements. The high costs of developing the bureaucratic infrastructure and paying for studies is a serious deterrent for would-be entrants to the industry.

In the future, to the extent that commercial space activities become viable, the pattern of business formation will lend itself more to corporate and university spinoffs and new start-ups by entrepreneurs in general. However, this will require a fundamental shift in the thinking of entrepreneurs from "NASA think" to a more commercial orientation. For this reason, it is not likely that the "old timers" from major space companies, who are used to dealing with government operations and not used to the commercial side, will be a source of entrepreneurs in space commercialization. Thus, the first infusion of entrepreneurship in space commercialization may come from other parts of the country. A number of new space ventures have been formed in the United States in recent years that hope to engage in commercial launch services. Florida needs to

target and attract these companies. It also needs to create the supportive environment that encourages the formation of new ventures locally and helps entrepreneurs to pursue new opportunities (e.g., lower-cost launch vehicles, microgravity products, light satellites, etc.) in a multitude of ways, including helping them identify current supplier opportunities and gain access to financing and management expertise.

Emerging Cluster Formation in Technology Bay

Technology Bay is a region with a sizable assortment of advanced technology firms and industries. The region has exhibited tremendous growth in recent years. In 1986, Hillsborough and Pinellas counties were host to 16% of the state's high-tech firms (236) and 18% of the state's total high-tech employment base, with employment growing by 10% between 1984 and 1986. However, despite the growth of high-tech employment, the region's industry base remains highly diverse. While this diversity helps the region to withstand downturns affecting any one industry, the industry base is somewhat amorphous and, so far, lacks the critical mass required to comprise one or more strong industrial clusters.

Technology Bay high-tech employment is spread chiefly among the communications equipment industry, which accounts for 47% of high-tech employment in the region, electronic components (21%), and instruments, medical, and optical equipment (13%). However, in looking at the range of large high-technology companies in the region, the spread of companies appears highly diverse. Major communications equipment companies include GTE, Honeywell, and E-Systems. Computer and information systems companies include Paradyne, Unisys, IBM, Philips Circuit Assemblies, and GTE in data processing. Major medical equipment producers in the region are Concept Inc. and Critikon. The region is also host to a handful of large space/defense contractors such as General Electric (nuclear devices), Honeywell (guidance/navigation equipment), Hercules (defense electronics), and several simulation and training equipment producers, including Reflectone and SSI.

Although these firms, plus other smaller firms, represent a significant agglomeration of advanced technology firms in the region, the region lacks any significant, distinct industry clusters. Within any industry in the region, most firms are loosely related and, overall, the industry lacks critical mass.

However, Technology Bay does have several "pre-clusters" or clusters in the incipient stage of formation. Perhaps most prominent among these is the communications equipment industry. As

mentioned above, the industry accounts for nearly half of the high-tech employment in the region, with 12,500 workers, and has close to 30 companies. The communications equipment industry is closely allied with the electronic components industry in that semiconductors, circuit boards, and other electronic components are critical inputs to the communications equipment producers. There are about 45 electronic component companies in the region. In many respects, the distinction between these two industries is becoming increasingly blurred. However, despite the overall size of these two industries, a size that might be considered a cluster, these two industries are not what might be considered a cluster yet. The wide diversity of products, markets, and other attributes among communications and electronic components companies and the limited relatedness between companies has slowed the process of cluster formation. Recall that within these industries there are telecommunications companies, nuclear detonation device manufacturers, navigation equipment makers, circuit board designers and producers, defense communication systems designers, and so on. Therefore, it is an amorphous cluster. What might be expected over time is for certain elements of this cluster to emerge as the dominant identity.

Another set of activities that might also be called a "pre-cluster" is the biomedical industry in the Technology Bay area. In the biomedical devices area, there are over 30 firms in the medical instruments and supplies industry. Another handful of firms are in the pharmaceutical and biologicals sectors. Technology Bay represents perhaps the second-largest concentration of biomedical firms, after the Miami area.

Interviews with start-up companies in the Technology Bay region reveal that most new enterprises have been of two basic types: spinoff employees or inventor/entrepreneurs. Most new companies have been started by managers and engineers who have left their original employers to start up their own company. This has been the case of a number of electronic component companies, such as a power supply company that was started by an engineer who had worked with General Electric before venturing his own company. In addition, several start-ups in the area have resulted when existing companies scaled back operations in the region--either closing Florida operations or consolidating divisions--and former employees stayed in the region and started up their own companies. This has been the case for several companies in the military communications industry. For instance, when General Datacom consolidated operations back to Connecticut last year, none of the 60 people in the military group went north with the company. A number of the higher-level technical people formed their own company in Pinellas.

Other companies have been started by inventor/entrepreneurs who either are from the Tampa/St. Petersburg area or have migrated to the area. This has been especially prominent in the

biomedical area as doctors and other medical people have developed their own products or devices and started companies. SRI interviews with entrepreneurs indicated that much of the new entrepreneurial activity in Technology Bay is the result of talented individuals with entrepreneurial experience elsewhere coming to start a company in the region. Some of these people are retirees, but most are young people who have start-up experience elsewhere and have come to Technology Bay to get a new start. Some of these people have been recruited to the area by entrepreneurs to help in launching a new company; others have simply decided to come to the region.

SRI interviews suggest that the Tampa/St. Petersburg area is perhaps the most attractive destination within Florida among migrant entrepreneurs. A number of migrant entrepreneurs/managers have been drawn to the area from Silicon Valley and Boston's Route 128. They remark on the nice weather and so on, but, more importantly, they consider the region to offer a relatively fresh, emerging business environment to get a new business started, unlike the congested, highly competitive environments in Silicon Valley or Boston. Entrepreneurs see the area as a positive one in which to start a new business because of low housing costs and the availability of workers, including engineers, at considerably lower labor costs than, say, the Silicon Valley, and because it is a rapidly growing economy in which it would be desirable to emerge as an early pioneer.

SRI interviews with new companies and with "network" people--people involved with providing technical, management, or financial services to new business--in the Technology Bay area indicated that many entrepreneurs tend to be technology driven as opposed to market driven. Many entrepreneurs are inventors or engineers who are knowledgeable about the product or technology they are innovating, but are weak in the actual marketing of that product or in developing a business. Moreover, many inventor/entrepreneurs are so preoccupied with developing their product/technology, they are unaware of potential resources, networks, and other information that can help them to develop their business. A number of entrepreneurs cited story after story of how they wished they had known, for instance, about the Tampa Bay Inventors Club, the Small Business Development Corporation, NASA/STAC, the American Society of Inventors, and other network organizations. Many related stories about how they were swindled by charlatans who said they would help raise capital, and so on.

Although Technology Bay has a variety of networking activities, more is needed. There need to be more venture forum activities, more conferences about how to secure a Small Business Innovation Research (SBIR) grant, more ways to get entrepreneurs, private investors, and network people together and talking and learning. Other areas in the state are farther along than

Technology Bay in this regard. Networking is especially critical for start-up companies and has been instrumental in helping businesses obtain SBIR grants, get products patented, write up business plans, and find resources.

Many of the more seasoned entrepreneurs in Technology Bay are generally aware of the existing networks and services for entrepreneurs. These entrepreneurs are typically former managers or engineers from area businesses who are already acquainted with business resources in the area, or they have experience in new enterprise development elsewhere. These entrepreneurs generally know how to get assistance for writing the business plan, going after grants, including SBIRs, approaching private investors, approaching venture capital companies, and so on.

Several start-up firms in the communication/electronics industries indicated that it was not difficult to recruit workers. Many people are disillusioned with working for larger companies and are eager to work with smaller technology companies, both because they are more exciting places to work and because they offer the chance to gain equity, especially with involvement at the early stages. But management with start-up experience is more difficult to recruit. In this respect, Technology Bay, like other regions in the state with emerging technology clusters, must attempt to recruit experienced management talent from elsewhere. Many companies, especially those in early stages, faced financial difficulties in bringing on a senior management staff person (e.g., chief executive officer or chief financial officer) unless they were able to remunerate them on the basis of future stock options. Typically, firms found people who were currently employed and got their assistance in a part-time basis. Other firms use outside consulting help from accounting firms specializing in assisting entrepreneurial start-ups. Many start-ups are simply operating at a very low level of capitalization and rely on "sweat equity" by the founder and early employees during the start-up phase.

Although seed and venture capital were invariably raised as major problems faced by start-up companies, another financing problem emerged that appeared to surface more in the Technology Bay region. Banks in the region tend not to lend to start-up companies. Generally, banks have not been responsive to entrepreneurs, even ones with contracts, because they are considered too risky. Banks also have not been using the Small Business Administration's loan guarantee program, which would provide the banks with an 80% loan guarantee for up to $500,000 exposure. This is a valuable resource that could be tapped much more effectively.

Access to capital from private investors remains difficult for most new enterprise in Technology Bay. However, a number of biomedical firms have been able to raise capital from the medical

community. Doctors and other medical people have an understanding of the market for biomedical products and medical devices and are thus in a position to be able to personally evaluate the market prospects of new products and overall business plans. Several new enterprises in the area are relying on the medical community as a source of seed and start-up capital. A specialized venture forum focusing on new enterprises in biomedically related fields was mentioned by several firms as a useful way to increase the supply of capital.

A number of start-up companies in Technology Bay mentioned that it has been difficult for them to develop supplier relationships with large businesses. One electronic component firm, for instance, has tried unsuccessfully to develop business with large government contractors who are under obligation to use small business as subcontractors. Overall, examples of buyer-supplier relationships between large companies and start-up companies appear to be less prevalent in Technology Bay than in other technology regions in the state.

Most of the entrepreneurs interviewed expressed concern about the general level of educational institutions, including both K-12 and higher education, in Technology Bay. The common concern was that K-12 education needs to be stronger to maintain the quality of life in the region as well as to provide a strong labor pool. A number of people said that one of the greatest difficulties encountered in attracting top people to the area related to quality of schools, including higher education. Although some entrepreneurs had complaints about the current status of the University of South Florida, most people acknowledged that USF has improved in quality over the past several years. USF is perceived to have built up its faculty and to be able to generate good research and produce good students.

Very few firms interviewed were contracting research from USF or using faculty as consultants. Some firms expressed interest in working with the university on proposals and product development, for example, by linking up with the USF Center for Microelectronics Research. Many firms had heard of NASA/STAC and were using its databases and assistance in patent search, SBIR grant writing, and so on.

In sum, although the overall value-added industry base of Technology Bay has grown rapidly, the region has yet to form any distinct industry clusters and has yet to develop critical mass in specialized labor markets, buyer-supplier relationships, university-industry linkages, and other synergies that are important ingredients to value-added new enterprise development. It is clear that Technology Bay is on the verge of developing its potential. Many of the needed elements

are already in place, and with effective public and private leadership, the region should be successful in nurturing the development of its value-added industry clusters.

Conclusion

In sum, the development of the laser, health technologies, and information industries clusters in the state has occurred mainly through the spinoffs from major corporations. The growth of each of these clusters has been characterized by spontaneous private-sector growth. Each is dominated by a handful of large companies, such as IBM, Martin Marietta, Harris, and Baxter, most of which are divisions of a major corporation. The employees of these large companies constituted a pool of talented scientists, innovators, managers, and other talented people in each region such that some degree of entrepreneurship was inevitable. Obviously, as the above cluster profiles describe, industry clusters have began to take shape in lasers, biomedical, and computers as new companies were spawned, mainly through corporate spinoff of one sort or another. Although the origins of some companies can be traced to inventor/entrepreneurs not connected to companies in the cluster, very few new companies in these clusters were spinoffs from universities, and most are traceable to existing companies in the cluster.

The space cluster and the emerging clusters in Technology Bay remain in an early formative stage. Some of the elements are in place for further growth of these clusters with the presence of major employers, the beginnings of a specialized labor force, and growing interindustry and industry-university linkages. However, these clusters have considerably farther to go to reach critical mass than the laser, biomedical, and information clusters.

III A NEW STRATEGIC FRAMEWORK FOR PROMOTING VALUE-ADDED NEW ENTERPRISE DEVELOPMENT

Overview

In the previous chapter the patterns of new enterprise formation in Florida's key value-added economic clusters were described. This chapter presents a strategic framework for understanding the stages of cluster development and ways to promote new enterprise development within Florida's value-added economic clusters. The framework developed here to understand economic clusters emerges in part from our analysis of new enterprise in Florida and in part from our growing knowledge of cluster development elsewhere in the country. While the patterns of new enterprise development discovered in Florida's clusters have distinct differences from those observed elsewhere in the country, the framework developed provides a common basis for identifying strategic approaches to promote enterprise development. These strategic approaches or options are presented in Chapter IV.

Why a New Framework Is Needed

Value-added new enterprise development is distinctly different from traditional notions of small-business development. This difference must be understood because it means that many of the established programs and practices promoting small-business development may not be appropriate for nurturing higher-value-added enterprises whose needs tend to be more advanced, specialized, and sometimes altogether new. Thus, a new strategic framework is required to understand the range of needs and responses that apply to this specific kind of new enterprise development.

The strategic framework for promoting cluster-based, value-added new enterprise development is driven by the following key principles:

- Cluster-based, value-added new enterprise development is a small but critical component of traditional new enterprise development, focusing on the evolution of cohesive clusters of high-return economic activity and the "care and feeding" of both individual firms and the synergies holding together individual clusters.

- Cluster-based, value-added new enterprise development accounts for the broader dynamics of new business creation, acknowledging the roles that industrial attraction and expansion can play in providing sources of new entrepreneurs, expertise, and industry linkages for new value-added firms.

- Cluster-based, value-added new enterprise development recognizes that clusters evolve along an industrial life cycle much like individual firms and that such life cycle

differences correspond to needs for different kinds of resources, talent, and industry linkages over time.

The Importance of Clusters in New Enterprise Development

Cluster-based, value-added new enterprise development is the most important dimension of new enterprise development in state economies. It focuses on the firms and industrial synergies that have the greatest potential for creating rapid, sustained, and high-quality economic growth. It focuses on high-end economic activity that has the greatest multiplier potential, as well as the ability to ripple through the economy and to create new business growth in related sectors, advanced service and component supplier industries, and ultimately retail and other consumer service sectors.

It is also a more complex phenomenon than most new enterprise development. Cluster-based, value-added enterprises are much more dependent on specific sources of expertise, capital, technology, and industrial synergy than many new business start-ups. They usually thrive in environments rich in these resources (e.g., Silicon Valley, Route 128, Minneapolis-St. Paul, Research Triangle). They have needs specific not only to the internal business plan and management of the firm, but also to the external environment in which the firm operates. The absence or presence of certain industrial synergies (buyers, suppliers, partners, even competitors) can mean the difference between the occasional free-standing start-up and a mutually reinforcing cluster of value-added enterprises.

Thus, the strategic framework for cluster-based, value-added new enterprise development accounts for the greater complexity of this phenomenon—the broader set of individual firm and collective cluster requirements—than that of more generic, generally lower-value-added new business development.

Roles for Industrial Attraction and Expansion

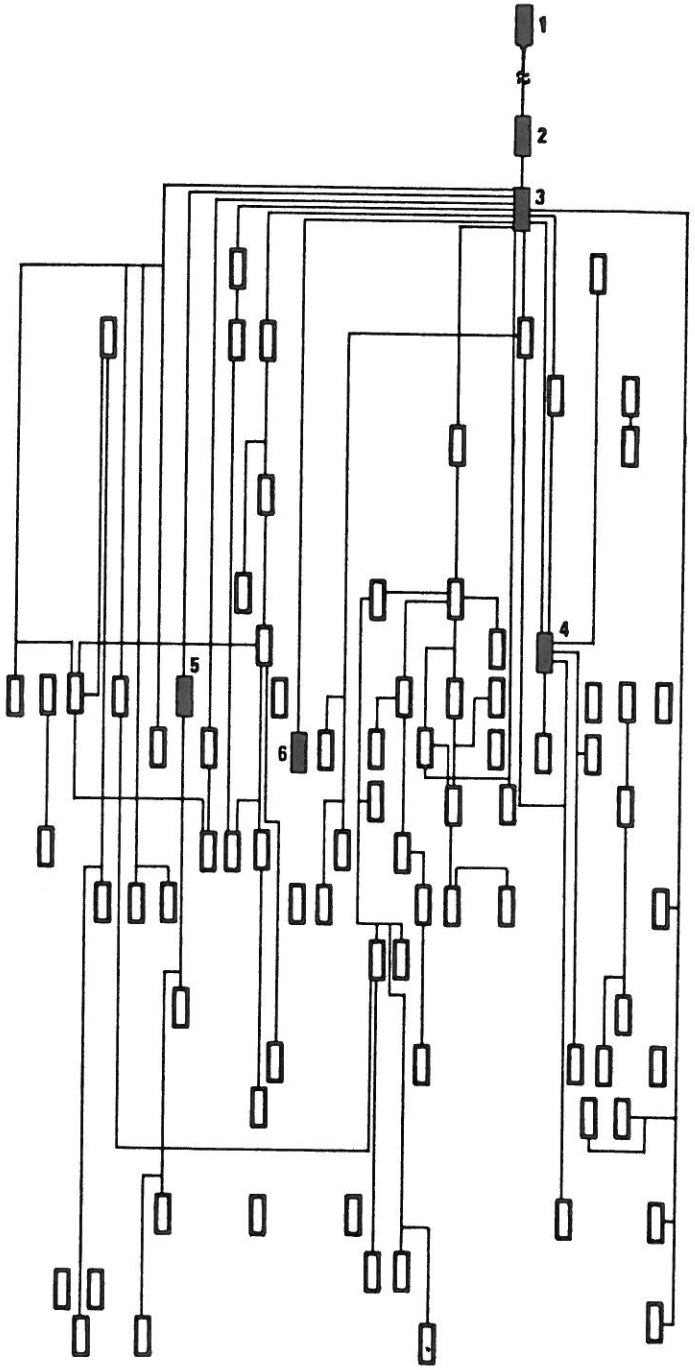
As states across the country have discovered and as the Florida Chamber's *Cornerstone* report has shown, the key to high-quality economic growth is the nurturing of value-added industrial clusters. Growing value-added clusters requires a range of strategies from industrial attraction to business expansion to new firm creation. Although this report focuses on the best opportunities for cluster-based new enterprise development in Florida, it also recognizes the important roles that targeted industrial attraction and expansion efforts can play in enhancing the climate for new enterprise development. It recognizes the broader dynamics of new enterprise development and

the roles that large branch plants and established Florida companies can play in serving as a wellspring of entrepreneurs, expertise, and other industrial synergies for fledgling value-added companies.

At a basic level, industrial attraction and expansion can enhance local sources of entrepreneurs. Often, large firms are the sources of spinoffs and start-ups. As indicated in Chapter II, Martin Marietta is a prime example of a large company that served as the wellspring for laser company spinoffs in Orlando that have spawned additional firms that now comprise an emerging cluster of economic activity. Elsewhere, Austin and Colorado Springs are seeing the beginnings of value-added spinoff activity from firms that have relocated existing operations or established new operations as a result of those areas' recent industrial attraction efforts.

Places like Route 128 and Silicon Valley show how the expansion of established firms can also serve as seedbeds for entrepreneurs that over time strike out on their own. Silicon Valley, for example, is the product of a 30-year process of spinoff activity, mostly the result of expanding firms that attracted top talent, venture capital, and support industries. Figure III-1 shows, like the previous examples of Martin Marietta and Cordis for Florida's biomedical industry, how one firm began a spawning process in semiconductors that continues today.

As shown in the previous chapter, a similar phenomenon is occurring on a smaller scale all across the country, including Florida. An analysis of the family trees of large companies in major metropolitan areas nationwide would generally show that some spinoff activity has occurred over time, although, of course, at very different rates and levels of success. The clustering of automobile industries around Detroit, pharmaceuticals industries in New Jersey, and chemical industries in Delaware, and the more recent development of biotechnology industries in Northern California and Massachusetts can all be traced to a few successful, expanding local companies whose employees spun off to start related, sometimes complementary, sometimes competitive new enterprises.



The genealogy of semiconductor firms in Silicon Valley. In this chart Firm 1 is Bell Labs; 2 is Shockley Semiconductor; 3 is Fairchild Semiconductor; 4 is National Semiconductor; 5 is Intel; and 6 is Advanced Micro Devices.

SOURCE: Semiconductor Equipment and Materials Institute, Mountain View, California.

FIGURE III-1 AN EXAMPLE OF CLUSTER-BASED, VALUE-ADDED SPINOFF ACTIVITY: THE SEMICONDUCTOR INDUSTRY IN SILICON VALLEY

Key Cluster Life Cycle Distinctions

The third important aspect of the strategic framework for promoting cluster-based, value-added new enterprise development is recognizing the importance of cluster life cycle differences in the focus and portfolio of strategies that need to be pursued. Two important distinctions need to be made.

Emerging Regional Agglomerations and State Industrial Clusters

First, as Figure III-2 shows, the Florida economy can be organized into a series of emerging, expanding, and transforming industrial clusters. As the figure also shows, the state's emerging industrial clusters are the focus for cluster-based, value-added new enterprise development. The reason is that these sectors offer the best potential sources of new high-value-added, large-multiplier business growth. Thus, Figure III-2 identifies five regionally based "agglomerations" that comprise various parts of Florida's emerging industry clusters. In fact, taken together, these regional agglomerations account for most of Florida's emerging industry cluster activity.

Henceforth, this report will call these regional agglomerations clusters. It is important to keep in mind that they are really distinct regional subclusters within Florida's statewide industrial clusters. For the sake of simplicity, the term cluster rather than subcluster will be used.

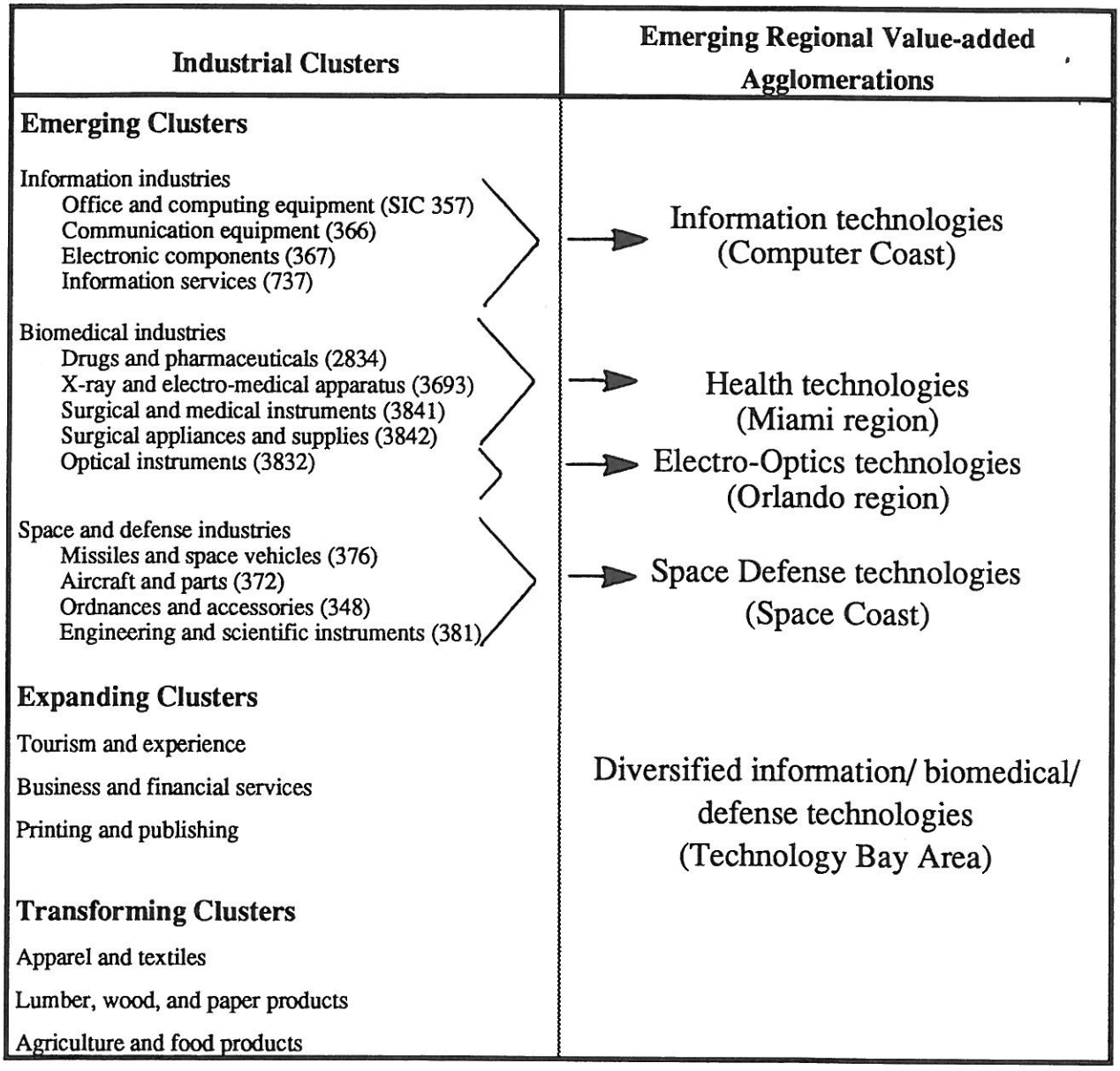
The Life Cycle Differences of Regional Value-Added Clusters

The second important distinction is that Florida's regional value-added clusters are at different stages of their life cycles. These differences must be taken into account in developing an appropriate strategy for promoting the evolution of each cluster. There are three distinct stages through which regional value-added clusters such as Florida's can evolve: Stage 1, early formation; Stage 2, expanding linkages; Stage 3, "lift-off" (Figure III-3).

Stage 1: Early Formation

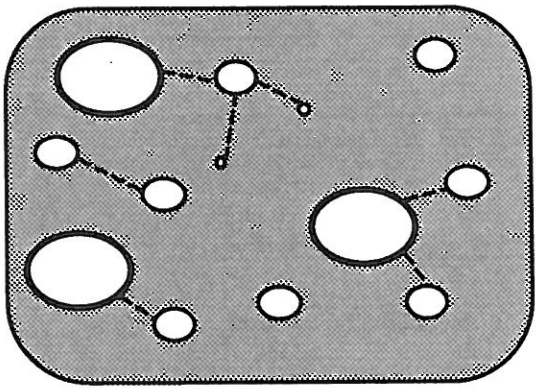
This initial stage is characterized by the presence of some minimum level of related business activity or investment that is distinct from traditional industry classifications. Evidence of early cluster formation is most often manifested in the appearance of a small number of similar firms. In such cases, the sources of entrepreneurs are limited, usually coming from an established large company or from the engineering or science departments of local universities or national installations.

FIGURE III-2 FLORIDA'S INDUSTRIAL CLUSTERS AND EMERGING REGIONAL VALUE-ADDED AGGLOMERATIONS

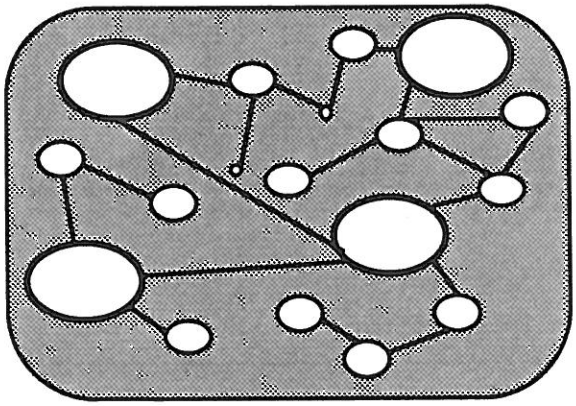


Source: *Cornerstone: Foundations for Economic Leadership*, SRI International

Stage 1 — Early Formation



Stage 2 — Expanding Linkages



Stage 3 — "Lift-Off"

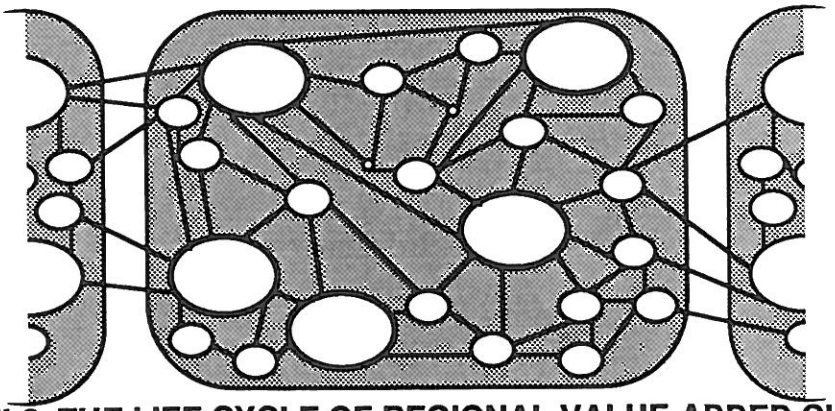


FIGURE III-3 THE LIFE CYCLE OF REGIONAL VALUE-ADDED CLUSTERS

Among the founders of enterprises at this stage are usually high-level technical people. Firms are usually still very small, have had little time or proclivity to develop linkages among themselves, and are often narrowly focused on limited product development, manufacturing, and sales.

As indicated in the previous chapter, Florida's space cluster and the emerging clusters in Technology Bay are representative of Stage 1 clusters. Both the space and Technology Bay clusters have a developing industrial base characterized by a handful of large, established firms and a few related smaller companies. Entrepreneurship remains somewhat limited, especially in the space cluster, and major spinoff activities have not yet taken place.

Clusters in this stage have a narrow set of needs. The firms in these clusters tend to have very specific, high-level R&D focuses; their founders are often leading innovators in these areas; and they often relate in some way to the organization (firm, university, national installation) that spawned them. The cluster's human resource needs also tend to be narrow and at a high technical level, as small start-up firms rely on a few key people to refine the value-added product and business management and marketing strategies. Capital tends to be a problem at this stage because there is still little evidence of the viability and sustainability of the cluster. In such cases, early seed capital must often come from the founders themselves. Sometimes, state or federal funds help underwrite R&D, but this assistance is usually limited if available at all.

Clusters in this stage also have limited impact on the regional economy. Their employment levels are small and their demand for components and services is limited because their products and markets are not yet well established. They have yet to generate much interest among similar firms, possible suppliers, or industrial customers outside the region. Thus, their ability to act as a magnet to attract complementary economic activity and thereby speed their evolution into a second stage of development is limited.

This stage also includes what might really be "pre-cluster" situations—those that seem ripe for a breakthrough if given a strategic push. Such a situation seems to exist especially in the Technology Bay region because of its relatively large number of mostly unrelated but high-value-added firms. The fact that the region has developed the capacity to sustain high-value-added growth creates the preconditions for cluster formation. In a sense, the region has already developed a kind of cluster (a diversified high-value-added cluster), but has yet to develop one or more specific agglomerations in that context.

A final situation that could also qualify as pre-cluster would be that in which a region has developed a concentration of certain kinds of resources (e.g., university, federal R&D) that could lead to new agglomerations of economic activity. There may be no new business spinoffs yet, but based on experience elsewhere and a unique concentration of R&D and specialized expertise, there is reason to believe cluster development is possible. Again, in a sense, such a region has already developed a kind of cluster (a focused collection of potentially commercializable activities), but has yet to develop one or more specific industry agglomerations in that context. In many respects, the space cluster exemplifies this kind of cluster because of the yet-to-be realized potential of commercial space developments.

Figure III-4 summarizes the distinguishing characteristics and critical needs of Stage 1 clusters.

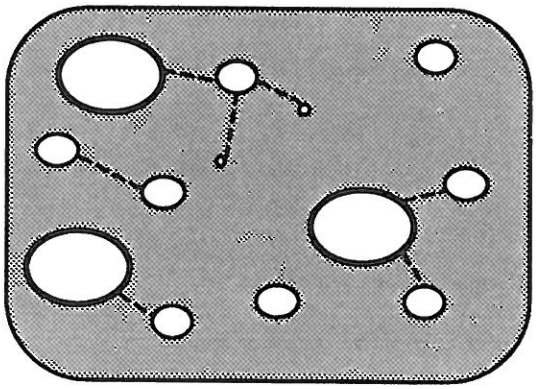
Stage 2: Expanding Linkages

This intermediate stage is characterized by the presence of growing interfirm synergies in the form of buyer-supplier relationships, joint venture partnerships, and/or shared labor, technology, and capital needs. Firms begin relating to each other in numerous ways—complementarily or competitively. They may complement each other in buyer-supplier relationships or through joint ventures and may compete with each other for limited local labor, R&D, or capital resources. In either case, they start to develop a collective synergy that begins to take on a life of its own.

As described in Chapter II, Florida's laser/electro-optics cluster, biomedical cluster, and information cluster represent Stage 2 clusters in which considerable new enterprise development is occurring and there are growing interlinkages among related companies and regional institutions. Within each of these clusters, a good deal of spinoff activity has occurred, and there are growing synergies between large, established firms and smaller start-ups.

Evidence of intermediate cluster development is most often manifested in the appearance of a growing number of related firms (e.g., Orlando's electro-optics cluster) or complementary firms (e.g., the biomedical cluster of the Miami region, the information technologies cluster on the Computer Coast). In such cases, firms are small but usually rapidly growing, are developing either complementary or competitive synergies (or both), and are increasingly moving their attention from initial product development, manufacturing, and sales to larger manufacturing scale-up, product diversification, market differentiation, and some business relationships outside the region.

STAGE 1 — EARLY FORMATION



Source of entrepreneurs	Large, established firms; universities; national laboratories
Nature of cluster linkages	Uneven, unpredictable
Nature of market/customer base	Underdeveloped, narrow, often serving limited local demand
Nature of technology R&D needs	Very specific and high-level; often still relate to spawning entity
Nature of human resource needs	Narrow but high-level; often reliant on a few key people
Nature of capital financing needs	Patient capital required; limited sources often lead to owner financing
Economic multiplier capacity	Small; employment and economic impacts limited
Ability to attract outside investment	Low; may attract some state or federal R&D or investment monies

FIGURE III-4: THE LIFE CYCLE OF REGIONAL VALUE-ADDED CLUSTERS

Both the sources of entrepreneurs and the complexity of the cluster's needs grow in Stage 2. Entrepreneurs still emerge from large, established firms, universities, and national installations, but they also increasingly spin off from younger growth companies that were part of the first-stage development of the cluster (e.g., the offsprings of Cordis in the biomedical cluster). New talent may also come from local branch plants and in the form of relatively new residents, both of which may have recently relocated to become part of the developing cluster and economic growth of the area. Such an influx of talent is characteristics of each of Florida's Stage 2 clusters.

The cluster's technology R&D needs get increasingly diverse, increasing the demand on local institutions for services. Although high-level R&D is still required, the efforts to develop diverse technology applications grow. Among some suppliers, the need to keep up with the latest in "off-the-shelf" technical equipment will be paramount. Overall, the demand for more interaction with other organizations increases. This may take the form of more reliance by suppliers on their buyers' technical expertise, more joint venturing to fill one another's technical gaps, or more consulting and joint projects between firms and universities. The growth of buyer-supplier relationships is particularly evident in both the information cluster along the Computer Coast and the biomedical cluster in the Miami area.

The human resource needs of the cluster get similarly more complex and diverse, expanding the demand on local education and training institutions. A number of occupations come into greater demand, beyond the few highly skilled technical and managerial personnel that were required in Stage 1. Mid-level manufacturing, design, marketing, and administrative staff become increasingly important in an expanding cluster. Some may require special or multiple competencies to succeed in an emerging industry. These competencies may not be present in the local workforce in sufficient amount; it may be somewhat difficult and expensive to recruit outside the region; and it may be the case that local education and training institutions are not equipped to deliver the needed skills upgrading. Special strategies may be needed to address these growing demands.

Capital actually tends to become less of a problem, although the complexity of capital needs increases. It tends to become less of a problem because the cluster is reaching some level of viability. Local institutions are becoming more acquainted with the financing needs and more comfortable with the success rate of cluster firms. Thus, expansion capital may become more readily accessible. Venture capital may also be attracted to the region, as high-value-added spinoffs continue to develop in a clustering environment that seems to enhance their likelihood of success. Overall, capital financing remains a challenge for new and expanding cluster firms, but

the track record of the developing cluster helps make it increasingly more accessible. Among Florida's Stage 2 clusters, although sources of venture capital in Florida itself have not expanded significantly in recent years, links to venture capital firms in New York, Boston, the Midwest, and California have become well established for entrepreneurs in lasers, computers, software, and biomedical devices.

Finally, the regional economic impact of the Stage 2 cluster tends to be significantly greater than that of its Stage 1 counterpart. Its multiplier effect on the economy is enhanced as spinoffs begin to emerge from Stage 1 start-ups, suppliers begin to expand nearby, and perhaps buyers locate a branch plant in the region. Secondary effects are then greater in the consumer service and retail sectors as well. In addition, outside firms and investors may begin to take notice of the special synergies and significant growth rate of the cluster. This may begin to raise the likelihood of relocations and expansions into the region. Austin, Texas, with its developing cluster of advanced technology firms and MCC, as well as new investments in the University of Texas, has benefited from this kind of changing image, which helps the region attract new relocations, technical talent, and investment.

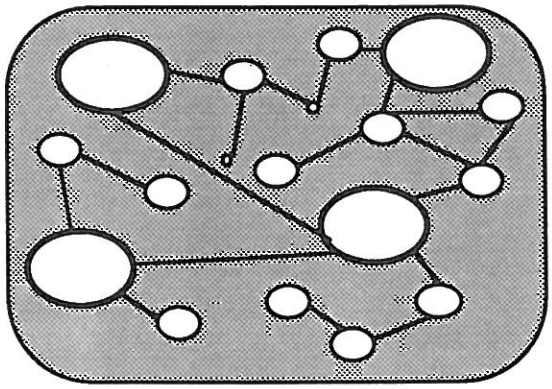
Figure III-5 summarizes the distinguishing characteristics and critical needs of Stage 2 clusters.

Stage 3: "Lift-Off"

This advanced stage is characterized by the proliferation of interfirm synergies in the form of buyer-supplier relationships; joint venture partnerships; shared labor, technology, and capital needs; linkages with other regional clusters; and connections to clusters and economies outside the region. Firms usually have competitive relationships with other local firms and most likely have regional synergies at levels above and below their own (i.e., with buyers and suppliers).

The collective synergy that was beginning to take on a life of its own in Stage 2 has now attained a virtually irreversible momentum. The cluster has in a sense "lifted off" with its own source of economic propulsion, producing ongoing spinoff effects in its wake and attracting attention from interested firms and investors outside its region. The cluster has attained the "critical mass" necessary to create enough demand for suppliers, human resources, capital, and other resources that so local and national institutions compete to serve the needs of the cluster.

STAGE 2 — EXPANDING LINKAGES



Source of entrepreneurs	Large, established firms, small branch plants, and young growth companies; relocating entrepreneurs; fewer from universities and national laboratories
Nature of cluster linkages	Increasingly diverse and sophisticated; multiple complementary and competitive relationships emerging
Nature of market/customer base	Expanding, diversifying within region, and developing links outside region
Nature of technology R&D needs	Some continuing high-level, but increasing technology applications activity and basic "off-the-shelf" equipment needs for suppliers
Nature of human resource needs	Some high-level professional, but increasingly mid-level technical and marketing needs as well; reliant on an increasingly diverse workforce
Nature of capital financing needs	More complex and diverse; venture capital and expansion capital are particularly important and may become more accessible as cluster increasingly proves its viability
Economic multiplier capacity	Growing; core firms now have impact on local suppliers and consumer services, etc.
Ability to attract outside investment	Emerging; cluster capabilities and synergies may begin to attract similar firms and suppliers and government/private investment

FIGURE III-5: THE LIFE CYCLE OF REGIONAL VALUE-ADDED CLUSTERS

Evidence of advanced cluster development is manifested in the appearance of a growing number of directly and indirectly related firms Florida has yet to develop a Stage 3 value-added regional cluster. Of course, Silicon Valley, Route 128, and the Research Triangle are classic examples of this advanced stage of regional cluster development. All are the product of many years of investment and experience. Another cluster that has attained an advanced stage is Minneapolis-St. Paul, with its computer hardware manufacturing agglomeration. Austin has also arguably attained or is close to attaining this advanced stage of regional cluster development.

At Stage 3, the cluster's firms come in all sizes, some large and diversified, some small and narrowly focused, and some with a unique relevance only to the cluster. Firms are usually maintaining an above-average growth rate, are developing increasingly sophisticated complementary or competitive synergies (or both), and are focused on diversified product development and manufacturing, far-reaching marketing and sales strategies, and strategic alliances with firms and universities within and outside the region.

Both the sources of entrepreneurs and the cluster's needs proliferate in Stage 3. Entrepreneurs come from every source imaginable, including large, established firms, universities, national installations, younger growth companies that were part of the first- and second-stage development of the cluster, and from areas outside the region. Because of the cluster, the region enjoys a substantial net inflow of talented technical and business people, which helps fuel the entrepreneurial momentum. While some parts of the country suffer a "brain drain," the region enjoys a "brain gain."

The cluster's technology R&D needs span the entire spectrum. Needs for directed basic research (technology discovery), applied R&D (technology applications), and "off-the-shelf" technical equipment (technology diffusion) are all present because of the wide array of firms in the advanced cluster. The demand for broad technology R&D capacity increases locally. However, so does the ability of the leading firms of the cluster to do their own R&D internally.

As they mature, these firms also have the ability and wherewithal for access to university and other technical resources nationwide, without necessarily having to rely on local capabilities. Smaller supplier firms can often tap into the expertise and guidance of their larger buyers. Other firms can buy the expertise away from larger firms to fill specific R&D needs. However, the effectiveness of the process of technology innovation and diffusion will still vary among clusters, depending on the technology needs, the level of industrial synergy, and other factors.

The human resource needs of the cluster also become very broad, fundamentally changing the environment in which local education and training institutions must plan and operate. The cluster demands a high-quality, diversified set of internal and external education and training capacities to maintain its competitiveness in national and international markets. Continuing education and training become particularly critical to enable firms to move into new product and service areas quickly and effectively.

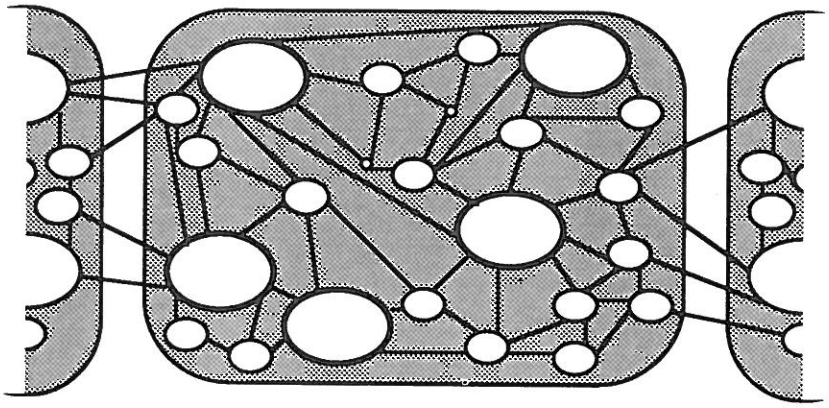
Highly skilled technical and managerial personnel are required, especially those with national and international qualifications. Mid-level manufacturing, design, marketing, and administrative staff needs grow dramatically as the cluster reaches Stage 3. The competencies required at all levels may not be present in the local workforce in sufficient amount, but recruitment becomes easier and the natural magnet of the region stronger as its economic performance attracts attention nationwide. However, major restructuring of local institutions may be required to enable them to meet the complex human resource needs of the cluster.

Although the cluster possesses the full range of capital financing needs, such resources can now be secured from many local and national sources. Capital financing tends to become less of a problem because the cluster has a track record that is enticing to venture capitalists and other financiers. Local institutions are joined by national firms and lenders in a competition to capitalize on the economic growth of the region. An entrepreneurial culture emerges that encompasses not only the cluster's firms but the financial service providers as well. Silicon Valley and Route 128 are classic examples of this phenomenon.

Finally, the regional economic impact of the Stage 3 cluster is far-reaching, much greater than that of earlier stages. Its multiplier effect on the economy grows enormously as spinoffs regularly emerge from Stage 1 and 2 start-ups, as suppliers are attracted in large numbers to vie for regional markets, as national firms seek to become a part of the action by locating a branch office or plant in the region, and as an explosion of high-value-added personal and business service establishments takes place.

Figure III-6 summarizes the distinguishing characteristics and critical needs of Stage 3 clusters.

STAGE 3 — "LIFT-OFF"



Source of entrepreneurs	Many sources; all across cluster firms; outside entrepreneurs drawn to region
Nature of cluster linkages	Extensive and multiple synergies within cluster; major linkages develop with other regional clusters and/or outside agglomerations
Nature of market/customer base	Both broad and niche markets; state, regional, national, even international customers; some mature markets
Nature of technology R&D needs	Needs at all levels, from technology discovery to commercialization and application to off-the-shelf equipment development, reflecting the spectrum of cluster firms
Nature of human resource needs	Very broad and high skill demands; occupations of many kinds required; institutions are responding
Nature of capital financing needs	Full range of financing needs represented in cluster; good access to regional and national sources because of cluster reputation
Economic multiplier capacity	Extensive; cluster becomes virtually self-reliant, attracting wealth and turning it over locally rather than exporting it
Ability to attract outside investment	Excellent; reputation spreads; major national players tend to feel they have a stake in the regional cluster, so relocations/expansions increase

FIGURE III-6: THE LIFE CYCLE OF REGIONAL VALUE-ADDED CLUSTERS

Conclusion

Cluster-based, value-added new enterprise development requires a strategic framework that accounts for the complex dynamics of business creation, industrial synergy, and life cycle evolution at this level. Success in promoting high-quality new enterprise development brings a high payoff for local and state economic development. However, traditional small-business development strategies are not enough to achieve this success. A new set of public and private actions is required, a comprehensive strategy that recognizes the complexities of regional clusters. The following chapters describe different options for promoting their development, and recommend regional and state-level actions to give cluster-based, value-added new enterprise development top priority.

IV STRATEGY OPTIONS

Overview

This chapter describes the strategy options that Florida could pursue to promote the development of its regional new enterprise clusters. The chapter makes two distinctions. The first is between strategies that are appropriate at the different life cycle stages of Florida's regional clusters. Stage 1 clusters such as the space industries and the Technology Bay clusters require a different set of strategies than Stage 2 clusters such as the health technologies, laser/electro-optics, and information industries clusters in the Orlando and Computer Coast regions.

The second distinction is between general and specific needs at each cluster stage. In general, Stage 1 clusters have certain kinds of R&D, human resource, financing, and other needs. The same thing is true of Stage 2 clusters. This chapter will describe generic strategy options for both Stage 1 and Stage 2 clusters. However, it will also suggest strategy options that might be appropriate for the specific needs of Florida's clusters, given their unique evolution and dynamics and the region's particular capacities and experience with promoting value-added new enterprise development.

Strategies are needed in several areas to foster the evolution of Florida's regional value-added clusters. These areas include the factors of production (i.e., technology, human resources, capital), but also the wellsprings of entrepreneurship (e.g., institutional spinoffs) and the environment for industrial synergy (e.g., buyer-supplier linkages). Action in all these areas (summarized in Exhibit IV-1) is required to move Florida's regional clusters to the next stage of their evolution.

Strategic Options for Stage 1 Clusters

Stage 1 clusters, like the emerging space industries cluster and the eclectic Technology Bay clusters, can be fostered by a series of strategies. The *overall* strategy for Stage 1 clusters includes efforts that will attract more related activities to the cluster and build up the industrial, intellectual (e.g., university), and support functions that will enable the cluster to establish an initial base for further growth. For instance, it is critical to attract top talent to the cluster. This can be accomplished in a number of ways, such as attracting top researchers to establish a new university program or department or by attracting a major company or R&D unit to establish operations in the region.

Exhibit IV-1

Fostering Florida's Regional Clusters: Key Areas for Action

- **Technology**—The technology needs of new cluster enterprises can range from early-stage R&D to production innovation. New firms may need access to high-level research from universities and elsewhere, or may require applied R&D capabilities to develop new product and process applications. New cluster enterprises may even need help adopting (or temporarily using) the latest "off-the-shelf" equipment available for designing, testing, and manufacturing their products.

- **Human Resources**—The human resource needs of new cluster enterprises can range from high-level technical and managerial talent to lower-level technician, marketing, sales, and administrative personnel. New firms may need access to special labor markets or specialized education and training resources. They may need to pursue continuing education and training for their employees to keep pace in a competitive value-added industry cluster.

- **Capital**—The capital financing needs of new cluster enterprises can range from start-up or seed capital to expansion financing. Especially in emerging clusters with short track records, new firms often have considerable difficulty securing financing. Special attention may be needed to provide better information on the prospects of cluster start-ups unfamiliar to the region, to offset the risks inherent in early-stage cluster development, or to gain access to capital sources outside the region.

- **Entrepreneurial Wellsprings**—The sources of entrepreneurs to guide the creation of new cluster enterprises can vary widely. In early-stage clusters, encouraging the commercialization and technology transfer of university and national laboratory work is often critical. So is the environment to support individuals who spin off from larger, established companies in the region. At later stages, cluster entrepreneurs emerge from earlier start-ups or suppliers or branch plants, and are increasingly attracted from outside the region. In each case, special strategies and support infrastructure may be needed to ensure that entrepreneurs are nurtured and brought into the cluster.

- **Industrial Synergies**—The promotion of industrial synergies may be one of the most overlooked and yet most important needs of developing regional clusters. It has been commonly assumed that industrial synergies would naturally develop as the critical mass of the cluster evolved. To some extent this is true. However, strategic actions can be taken to speed up the development of synergies—providing information and brokering assistance to link complementary firms and engaging in strategic recruitment to bring in firms relevant to the regional cluster.

Most of Florida's Stage 2 clusters got to where they are today via an incremental buildup of their industrial base and are now attempting to develop other capacities more fully in order to achieve critical mass and cluster lift-off. Considerable attention is being given to strengthening the universities and their ability to play a major role in the development of the clusters. This pattern of cluster evolution contrasts with that of Silicon Valley or Boston's Route 128, where the universities were an initial pillar of strength for cluster development. However, with Stage 1 clusters it will be possible to build up university capacity and enable the universities to play a more significant role in the advancement of the space industries and Technology Bay clusters than they did in the early stages of the health technology, laser, and information industries clusters.

This section systematically addresses strategic options that would foster the development of Stage 1 clusters. Below, options are presented by strategic area—technology, human resources, capital, entrepreneurial wellsprings, and industrial synergies. General strategies that could be used to promote Stage 1 cluster growth are presented first. These strategic options are then followed by specific initiatives that would be particularly appropriate for promoting the growth of Stage 1 clusters in the Space Coast and Technology Bay regions.

Technology Strategy Options

In the early stage of cluster development, the technology needs of new firms and prospective new enterprises tend to be high-level and quite specific. These enterprises are often based on the specific expertise and ideas of the individual founders, who often include top researchers and business managers. Many are still linked in some way to the organizations (universities, national installations, etc.) that spawned them. These firms may benefit from targeted investments in R&D capacity in the region as well as from ongoing technical interaction with local R&D institutions.

General Approaches

One key strategy option would be to build up the base of cluster-specific research excellence in local R&D institutions. Several states are pursuing some form strategic university investment. Below are some examples of different approaches.

Iowa Economic and Research and Development Grant Program—Concentrates on strengthening the state's basic research capabilities in targeted areas by endowing faculty chairs, underwriting new research centers, and financing research in specific areas such as genetics, molecular biology, and laser science. The program attempts to enhance the state's existing comparative research advantages, basing funding decisions on availability of facilities and support as well as scientific merit and job development, and requiring matching funds from applicants.

California Microelectronics Innovation and Computer Research Opportunities (MICRO) Program—This program provides both directed basic and applied research grants focusing on the microelectronics area. Projects are proposed by university researchers, must pass a peer review process for scientific merit, and must attract matching industry funds to demonstrate some commercial potential. Grant selection is then done by a public-private board consisting of state government, university, and industry leaders.

Michigan Research Excellence Fund (REF)—In addition to providing applied R&D funding, the program makes directed basic research grants to Michigan universities in three target areas: manufacturing automation, advanced materials, and biotechnology. The intent of the directed basic research grants has been to focus university researchers on topics with some possible long-term impact on the Michigan economy. The results of the program, however, have been mixed, with concerns about spreading research funds too thin and failing to create adequate "critical mass" for major breakthroughs.

Another strategy option would be to help new enterprises maintain ongoing technical interaction with local R&D institutions and, if possible, other expertise across the state. Below are some examples of this kind of approach.

The University of Utah's Innovation Center —Ideas for new businesses are submitted to the center from within and outside the university, and the most promising entrepreneurs are given assistance in performing feasibility studies and developing a business plan. If after this process the project is deemed exceptional, the center can take an equity position in the venture and arrange for ongoing consulting services and access to university equipment. The center in the past 2 years has helped more than 20 firms—now located in the university's research park—to start up successfully.

Ohio Technology Transfer Organization (OTTO), Illinois Resource Network, Michigan Technology Transfer Network, Texas Innovation Information Network System—All these programs make existing state technical assistance resources more accessible to firms, primarily by compiling databases of university and other consultants in various science and technology areas and providing technical assistance staff to help individual clients make connections.

The Alabama High Technology Assistance Center—Provides technical and managerial assistance to new and emerging technology-oriented small businesses. The Center utilizes technical experts from the university and other sources such as the Federal Laboratory Consortium, NASA Industrial Applications Center, and NASA Utilization Offices.

Specific Initiatives for Florida's Clusters

One of Florida's top priorities in advancing its Stage 1 clusters is to build up the base of research excellence as it relates to the space industry in the Space Coast and the emerging communications and biotech clusters in Technology Bay. A number of steps have already been taken by universities to establish new programs and upgrade university research excellence.

For the space industries cluster, the newly established Florida Space Research Foundation is coordinating space research activities among space-related programs throughout the state (i.e., UCF's Center for Space Policy and Space Studies Program, Stetson University's Space Law Program, and programs at FIT). The state was recently successful in getting David Webb, an internationally renowned space researcher, to come to the Space Coast to direct the Astronauts Memorial Foundation and head up the Space Studies Program at UCF. Florida needs to continue to attract world-class space researchers to the state. For the space cluster to develop rapidly, it is necessary to establish endowed chairs at UCF, FIT, and elsewhere. Florida could enhance universities' ability to develop the quality of research capabilities in targeted areas by developing an R&D grant program drawing, for instance, from the Iowa R&D grant program described above.

The Technology Bay clusters need programs to help provide greater focus to university research and technology commercialization concentrating on microelectronics and biotechnology. At present, many entrepreneurs in the region do not use the University of South Florida for access to technology or assistance. The NASA/Southern Technology Applications Center offers the only readily accessible technology-related services to entrepreneurs. In many respects, NASA/STAC performs services similar to those of the Alabama High Technology Assistance Center described above. However, with additional resources, the NASA/STAC program could be more effective in assisting new business development and technology commercialization with a broader mission to assist in university technology transfer. It would make sense for one or more technology transfer/innovation centers to be established (possibly connected with USF)—centers that focus on assistance to specific cluster industries, such as microelectronics or biotechnology, rather than general-purpose business assistance. To provide a high-quality technology assistance program, it is desirable to focus on fields of specialized knowledge and connections. Requests for general business assistance should be referred to Small Business Development Centers (SBDCs), and requests for assistance in other technology fields can be referred to other specialized centers.

Human Resource Strategy Options

In the early stage of cluster development, the human resource needs of new firms and prospective new enterprises tend to be narrow and at a high technical or managerial level. Start-ups tend to rely on just a few key people for their technical, business planning, and management direction. Because of the limited number of people involved, any one organization may not have the range of expertise necessary to take full advantage of its innovative ideas, explore emerging market opportunities, or analyze certain obstacles to growth. Upgrading the skills of key entrepreneurs and their small staffs particularly in business management skills, can leverage much faster and sustainable growth than might otherwise be the case.

At this early stage, work force training is less of an issue, principally because the staff of cluster firms is so limited. However, some targeted training of technicians and other specialized personnel may help a fledgling cluster firm make greater progress and build a comparative advantage in an important value-added field.

General Approaches

One key strategy option would be to round out the skills of entrepreneurs and their limited staffs so that they can overcome early barriers to growth and development. Several states are pursuing some form of strategic skills upgrading for entrepreneurs and new business owners. Below are some examples of different approaches.

Texas A&M's Institute for Ventures in New Technology (INVENT) is representative of the kind of university programs that have emerged to provide several basic services to assist entrepreneurs in developing new ventures, including evaluation of the technological feasibility, production costs, potential markets, and financial viability of their ideas.

North Dakota established a **Center for Innovation and Business Development at the University of North Dakota** to assist inventors and entrepreneurs in bringing a new product to market or starting a new firm. The Center's small staff coordinates university resources to provide patent counseling, engineering and product testing, and business plan development. The Center has developed a unique entrepreneurship package for manufacturing start-ups, including a step-by-step "how to" guide.

The Minnesota Inventors Congress assists inventors with intellectual property rights, holds expositions displaying Minnesota inventions, and seeks to foster a favorable environment for invention and entrepreneurship.

Specific Initiatives for Florida's Clusters

When a cluster is in its formative stages, successful role models are scarce, so that it is difficult to show local entrepreneurs alternative ways of getting a new business started and growing. The cluster lacks a foundation of companies, large or small, and the pool of experienced managers is thin. A number of entrepreneurs interviewed in Technology Bay said that they had limited opportunities to learn how to develop and run a new business. The classic example is the young entrepreneur who has a "novel technology product or concept" but lacks a concept of how to market the product or get a company off the ground. Typically, the most common resource new start-ups overlook is management experience. Many of these entrepreneurs have turned to professionals for help. Consulting groups such as Arthur Young & Co. are beginning to provide entrepreneurial support services (business planning, financial, accounting, tax, etc.) to would-be entrepreneurs and start-up companies. Other programs similar to Texas A&M's INVENT program offer a model organization to help entrepreneurs acquire the skills to develop new ventures.

One program that has served well to assist entrepreneurs is the mentor program established in the Twin Cities in the early 1980s to link small-company entrepreneurs with experienced people from large companies in the region. In this program, budding entrepreneurs are linked with senior management people who offer advice on how to manage and develop the company.

Capital Strategy Options

In the early stage of cluster development, the capital needs of new firms and prospective new enterprises tend to be difficult to meet because there is little evidence of the viability and sustainability of the cluster. Much of the early seed capital for new enterprise development comes from the founders themselves. Funds from other sources (e.g., private, state, federal) are at best unpredictable and usually unavailable.

The priority financing needs of Stage 1 cluster companies are usually twofold. Fledgling firms often need funds to conduct additional R&D to refine their core ideas and innovations and prepare them for full commercialization. Firms also need risk capital for the overall operation of the company, involving a wide range of costs depending on the specific focus of the firm.

General Approaches

One key strategy option would be to make funds available for new enterprise R&D activities and to enable firms themselves to leverage other outside funding (e.g., federal grants) to do additional research and development. Several states are pursuing some form of strategic R&D funding for new enterprises. Below are some examples of different approaches.

The North Carolina Innovation Research Fund (IRF) provides up to $50,000 in royalty financing to small businesses for research leading to the improvement or development of new products, processes, or services. Funds are to be used to conduct research and to obtain technical and managerial assistance that will result in the start-up or growth of new firms.

The (Michigan) State Research Fund, an extension of the Michigan Strategic Fund, provides grant assistance to organizations with commercially feasible R&D projects. Additional funding is available for projects with potential for prototype development. This program also offers interim grants for successful Phase I federal Small Business Innovation Research projects that are expecting Phase II funding.

The (Wisconsin) Small Business Innovation Research Support Program promotes the federal SBIR program through public information activities and provides technical assistance and bridge financing to small Wisconsin businesses participating in the SBIR program. Grants up to $30,000 will be awarded to businesses that have completed Phase I SBIR contracts and have applied for Phase II awards.

Another strategy option would be to help new enterprises gain access to seed financing to underwrite the overall development of their operation, beyond just focused R&D activities. Below are some examples of this kind of approach.

The (Pennsylvania) Seed Venture Capital Fund offers seed capital to small businesses for product conceptualization and development. The program draws from five separate funds established by Pennsylvania's Advanced Technology Centers. The funds provide equity financing to new businesses during their earliest stages of growth, including firms located in small business incubators. State appropriations of $4.5 million have been matched with $27 million in private funds for the program.

Connecticut and Iowa both have established **Product Development Corporations** to invest specifically in bringing new products or processes to market. Entrepreneurs are provided with risk capital and in return the Corporation receives royalties on sales. North Carolina operates a similar program through its Technological Development Authority, providing seed money to help new businesses (some of which are located in rural areas) research and develop new products and processes.

The Montana Seed, Start-up and Expansion Capital program provides risk capital to Montana's technology-based entrepreneurial sector. New businesses receive financial and management support needed during the early stages of development. The program makes direct investments in start-up projects and also provides indirect support by investing in Montana's private capital companies. The goal of the program is to facilitate the growth of young advanced technology companies, foster entrepreneurship, and leverage other sources of financial assistance.

Specific Initiatives for Florida's Clusters

Seed and start-up capital has been very limited in Florida in general and has been particularly difficult to secure by new enterprises in the emerging space industries and Technology Bay clusters. Florida has continually ranked very low in the percentage of venture capital invested in in-state firms. For example, a study by the Innovation and Entrepreneurship Institute of the University of Miami completed this year indicated that Florida received $339 million, or 1.4%, of the $24.1 billion in venture capital invested nationally in 1986 and 1987.

Florida has relatively low levels of early-stage financing partly because very few venture capital companies are located in the state. Although capital is liquid and venture capital can be invested in any state, venture capitalists like to provide management assistance to the companies they are investing in and hence often prefer to be located near their investments. There are only three venture capital companies in Florida at present, down from seven in 1985. Only two of the three are actively investing (one is fully subscribed). Although the number of venture capital firms has declined in recent years, the number of venture deals has increased. However, data collected by Venture Economics, Inc., suggest that many of the deals completed in Florida were financed by individuals making venture investments rather than by venture capital firms. The vast majority of venture capital investments made by Florida venture capital companies has been in later-stage deals (e.g., second- and third-stage mezzanine financing) rather than at the early stages of company formation. Consequently, venture capital from sources in Florida is generally not available to early-stage start-up companies. Most of the venture capital investments in Florida-based companies have been financed with out-of-state money, mostly from the Northeast and Midwest regions.

Seed capital is especially scarce in Florida. With suspension of the state seed capital program that was established to make $50,000 seed capital grants to new enterprises, there are now no organized sources of seed capital in the state. The Florida Department of Commerce and a number of local organizations have been active in sponsoring the formation of local investor networks, with the intention of facilitating interaction between individuals interested in seed capital deals. This interaction is important in bringing together individual investors—including business "angels"—with entrepreneurs. Although several investors' networks have formed across the state, the results have been mixed. Some continue to exist and have made placements; others have ceased operating for lack of interest or effectiveness.

Although there is a lot of money in Florida, it is not easy for entrepreneurs to tap because they lack the information to gain access to sources, but also for a host of other reasons, including:

- A relatively small pool of experienced venture investors
- Lack of a strong history of successful venture investments
- Weak networks of investors and entrepreneurs
- Risk aversion among the pool of potential entrepreneurs.

Florida has a strong "quick-return" mentality that derives from a tradition of real estate finance. The accumulated financial experience in the state has not yet made the transition from financing real estate and other commercial deals to financing high-technology projects. Florida's investors and financiers have very limited, if any, experience in dealing with biotechnology, information, or space technology projects.

Initiatives to address the shortage of seed capital for new enterprise in Stage 1 clusters in Technology Bay and in the space industries are sorely needed. There is no substitute for networking efforts and attempts to bring together potential investors with entrepreneurs, and these should be supported and encouraged at all levels, from the Department of Commerce to grass-roots community groups. However, it is important to form investor groups that are knowledgeable and experienced in relevant clusters. For example, entrepreneurial activities in biomedical fields in the Technology Bay area could be supported by forming investor groups of doctors and knowledgeable medical people. Similarly, investor groups of people with experience in space industries need to be mobilized.

Another important need is to help early-stage entrepreneurs gain access to funds to conduct additional R&D. The federal Small Business Innovation Research (SBIR) Program is a potentially important source of funding but is highly competitive. Support is needed at two stages. Many firms need assistance in preparing the initial proposal, and most firms need "bridge financing" to tide them through the period between completed Phase I SBIR contract and Phase II award. A state program to support businesses participating in the SBIR Program would be highly beneficial.

Finally, although the Florida Seed Capital Fund has been rendered inactive, efforts to revive the program should be made and could be based on successful programs in other states, such as Pennsylvania. The ability of the Pennsylvania fund to leverage public funds to raise private funds (by a factor of six) makes it an interesting model for Florida to consider, especially as a mechanism to regain public support.

Entrepreneurial Wellspring Strategy Options

In the early stage of cluster development, the sources of entrepreneurs are fairly limited. Potential entrepreneurs are usually locally based, are often employed by large science- and technology-based public or private institutions, and may need to join with other individuals to get a new enterprise off the ground. At this early stage, the most effective vehicle for promoting new wellsprings of entrepreneurial talent is to encourage local R&D institutions to identify individuals and provide the initial guidance to help them begin planning a spinoff activity.

General Approaches

A variety of strategy options have been used to turn local R&D institutions and large technology-based firms into wellsprings for value-added new enterprise development. Several states are providing some kind of catalyst to ignite entrepreneurial spinoffs from local institutions and firms. Below are some examples of different approaches.

The Washington Research Foundation identifies and assesses technology innovations generated by the state's university system. It helps arrange for patent licensing, provides marketing and financial advice to prospective entrepreneurs, and actively encourages the follow-through by entrepreneurs and venture capitalists to complete the commercialization process. Returns from royalties are redirected back into the universities to fund further research. Similar models have appeared across the country, including at the University of Wisconsin and University of Maryland.

The North Carolina Entrepreneurial Fellowships program awards two to four annual fellowships to university researchers to relieve them of their academic responsibilities and to allow them to pursue the commercialization of the products of their research.

Illinois has developed a **Technology Commercialization Grant-in-Aid Program** to foster research and development in the small business sector statewide. Technology Commercialization Centers have been established at selected Illinois universities, federal laboratories, and community colleges to explore the marketability of institutionally developed technologies or product ideas as well as the technologies or ideas of other local small business owners and entrepreneurs.

The Minnesota Cooperation Office is a nonprofit corporation with directors from business, labor, education, and government that instructs entrepreneurs on starting new companies. A small staff works with a volunteer advisory panel of engineers, scientists, and executives to help clients prepare and evaluate business plans and obtain financing. This program has served as a model for similar efforts in other states, including those of groups such as Competitive Wisconsin and Cleveland Tomorrow.

Specific Initiatives for Florida's Clusters

Efforts to promote enterprise development from large companies and universities in the Technology Bay clusters and in the space industries cluster could prove effective if established and nurtured over time. In particular, Florida could do well to establish a program to support university technology commercialization and entrepreneurship by establishing an enterprise development program targeted at USF, UCF, and other universities modeled on the North Carolina Entrepreneurial Fellowships program. Such a program would also serve as an effective mechanism for promoting greater university and industry interaction.

Efforts to establish university-based technology commercialization centers (and policy) are now beginning to gain momentum in Florida. For Florida's Stage 1 clusters, it is particularly opportune to establish these capacities because they will ultimately contribute to the development of the clusters and are likely to lead to university spinoff activity. NASA/STAC is a technology transfer institution with offices based at universities statewide that has been assisting entrepreneurs (mainly entrepreneurs from the public rather than the university, despite the location of their offices) to prepare SBIR and patent applications, and to research new technologies. Because of their track record, it would seem that with additional resources and a broader mandate, they could effectively broaden their scope of activities to assist university spinoffs and spinoffs from corporations and contribute to entrepreneurial wellspring strategies more generally.

Industrial Synergy Strategy Options

In the early stage of cluster development, industrial synergies within the cluster are few. Firms have little time or interest at this stage in developing linkages among themselves; they are often pressed just to maintain their own solvency. They also tend to be so narrowly focused (at least in their early development) that they find few common themes that might unite them with others in the cluster. Further, their supplier needs tend to be limited as their size and operations remain fairly small. Nevertheless, such firms can benefit from linking up with potential investors. They can also benefit from interacting with similarly situated entrepreneurs in the cluster, sharing their experience in overcoming obstacles, securing new funding sources, and a host of other issues.

General Approaches

A variety of strategy options have been used to encourage the interaction of entrepreneurs and potential investors. A number of initiatives have also been taken to link up similarly situated entrepreneurs to explore mutual problems, needs, and solutions. Several states are providing

some kind of strategic vehicle to promote these industrial synergies. Below are some examples of different approaches.

Missouri, New York, North Carolina, Oklahoma, and Texas provide **computerized investor-entrepreneur matching services**. The state screens proposed business plans of entrepreneurs, identifies a potential investor from its database, and informs the investor of the opportunity. Other states offer a similar clearinghouse function for inquiries from both groups.

Ohio and Indiana provide a **toll-free line to allow entrepreneurs access to financial information and appropriate referrals**. Florida, Pennsylvania, and others jointly sponsor seminars with professional associations such as those of bankers, lawyers, and accountants to acquaint entrepreneurs with their local support network. Georgia, Louisiana, and others organize local venture forums, bringing entrepreneurs, business professionals, and investors together to exchange ideas and discuss problems.

The Arkansas Business Incubator Program attempts to increase the survival rate of new, technology-based firms in Arkansas. The five business incubator projects funded by the Arkansas Science and Technology Authority (ASTA) provide office, lab, and manufacturing space, technical and managerial assistance, and other services to these young companies. The program's affiliation with publicly supported colleges and universities provide access to academic science and technology resources.

Ohio Thomas Edison Program's Business Incubators—The six Edison Incubators provide low-cost space and a wide variety of administrative, managerial, technical, and professional services that new businesses may otherwise be unable to obtain or afford. Business people, community groups, and local colleges and universities all actively participate in each of the incubators. Each incubator has management teams that have developed resource networks to assist incubator tenants in areas such as technology and market evaluation, strategic business and financial planning, and capital formation. Each incubator is guided by a Board of Trustees consisting of successful entrepreneurs, prominent community leaders, and representatives from the local academic community. In addition, specialized equipment and sophisticated laboratories are made available to tenants through arrangements with local universities.

Specific Initiatives for Florida's Clusters

Developing synergies between start-up companies and between existing companies and emerging enterprises is particularly important in the development of Florida's Stage 1 clusters. Many entrepreneurs and new start-ups in Technology Bay and elsewhere have expressed the need to develop forums and support groups, and others indicated their desire to participate in an incubator program. Some informal forum groups have formed and met in the Tampa area. The executive suites established by the Society of American Inventors in Tampa provide a setting for interaction between inventors, entrepreneurs, investors, and support services. Clearly, there is grass-roots interest in developing a business incubator in Technology Bay, but more coordinated

efforts are required to actually establish one. Steps have been taken to establish a technology-driven incubator linked to USF.

In the space industries cluster, a space business incubator was proposed in the feasibility study for the Florida spaceport. In addition to helping entrepreneurs hurdle the challenges of finding affordable facilities (perhaps with specialized labs and services) and get access to business services and advice, it would provide a useful mechanism for developing linkages and inter-dependencies among firms involved in space work.

Strategic Options for Stage 2 Clusters

Stage 2 clusters, like those in the Miami, Orlando, and Computer Coast regions of Florida, can also be fostered by a series of strategies. As before, options are presented below by strategic area—technology, human resources, capital, entrepreneurial wellsprings, and industrial synergies. General strategies that could be used to promote Stage 2 cluster growth are presented first. These strategic options are then followed by specific initiatives that would be particularly appropriate for promoting the growth of Stage 2 clusters in the Miami, Orlando, and Computer Coast regions.

Technology Strategy Options

In the intermediate stage of cluster development, the technology needs of new firms and prospective new enterprises become more diverse, especially for developing new technology applications. The demand for interaction at different technology development levels and with different institutions increases. Some firms seek out university assistance in the form of consulting and joint projects. Others rely on feedback from the buyers of their value-added products on ways to innovate. Still others are struggling to keep up with current "off-the-shelf" technology, requiring hands-on assistance at a basic level or better access to private vendors.

General Approaches

Across the developing Stage 2 cluster, the technology needs are becoming more varied and the demand for R&D partnerships is growing. Firms in clusters at this stage of development can benefit from efforts to promote better access to the state's R&D base and to direct R&D institutions into new joint project areas relevant to the cluster's needs. Several states are pursuing

some form of strategic partnership building between cluster firms and R&D sources. Below are some examples of different approaches.

The Ben Franklin Partnership has encouraged the involvement of all of Pennsylvania's major public and private universities and over 2,500 Pennsylvania businesses in joint R&D projects since 1983. Since its inception, the program has used just over $100 million in state funds to attract about $430 million in matching private investment. The Partnership is managed by a 15-member board which includes representatives from large companies, small business, higher education, labor, and the state legislature. Its grant-making activities are controlled by four advanced technology centers, representing different quadrants of the state, each with its own advisory board. Public matching funds are allocated for projects that promote the growth of small or emerging businesses, improve products, and evaluate and implement new or improved manufacturing processes for new and existing businesses of all sizes. With active outreach and an outstanding track record, the Ben Franklin Partnership has been particularly successful in linking smaller businesses with universities: more than half of all firms participating in its R&D projects have fewer than 50 employees.

The Microelectronics Center of North Carolina is a nonprofit corporation with a 1989 budget of more than $17 million. It is located in North Carolina's Research Triangle Institute, amid three major universities and several private firms. The Center provides a:

- Catalyst bringing together the diverse interests and capabilities of the University of North Carolina (Chapel Hill and Charlotte), North Carolina State, Duke, North Carolina Agriculture and Technical State, the independent Research Triangle Institute, and a number of affiliated private firms.
- Source of grant support for individual and joint efforts by local state universities as well as for funding its own research staff to conduct work in areas not pursued by the universities.
- Clearinghouse for nonproprietary research, including encouraging industry research scientists to spend time with faculty researchers and industry participation in technical seminars on recent developments in microelectronics research.
- Mechanism for making joint requests for federal and industry research funds, securing needed equipment, and underwriting graduate fellowships.

Specific Initiatives for Florida's Clusters

Florida's Stage 2 clusters in lasers, health technologies, and information technologies are sufficiently well defined to warrant the establishment of cluster-specific R&D partnership programs between public and private universities and private business. The recent effort to establish the Center for Health Technologies in the Miami area demonstrates the readiness of leaders in the cluster to put together a partnership or consortium to promote research and entrepreneurship in the region. Further attempts to establish such an entity may consider the organizational forms successful in Pennsylvania and North Carolina (see above).

Similar R&D partnerships programs should be developed in the laser and information industries clusters. R&D in the laser industry could be leveraged considerably by developing a partnership between laser firms and UCF. The Center for Research on Electro-Optics and Lasers (CREOL) has established a credible program of research, but it has not yet developed strong linkages with industry in the cluster. Although much of the effort at CREOL has rightly focused on obtaining research grants, particularly from federal sources, additional efforts need to concentrate on linking activities of the center to the needs of local firms. This will require increased outreach activities by CREOL. Ultimately, the establishment of a Laser Center or Consortium, similar to the Microelectronics Center of North Carolina, might be established that could serve to develop greater university-industry research activity and stimulate new business formation in the cluster.

Human Resource Strategy Options

In the intermediate stage of cluster development, the human resource needs of new firms and prospective new enterprises tend to get more complex, beyond just high-level technical and managerial people. Firms in the cluster include Stage 2 start-ups, expanding Stage 1 firms, new suppliers, perhaps new branch plants, and other variations. Mid-level occupations in design, manufacturing, marketing, sales, and the like have risen in importance. Although companies may be larger and more diverse, the labor force may or may not be sufficient to staff these fast-moving organizations effectively.

Even if firms are growing and becoming more financially capable, they still may not have the resources to recruit people in critical skill shortage areas. Although local education and training institutions are probably beginning to recognize the shape and magnitude of the developing cluster's specific human resource development needs, they may not be moving fast enough to produce a flow of adequately prepared workers sufficient to keep local cluster firms on the leading edge. All these potential obstacles to the cluster's continuing development can be addressed through a variety of innovative human resource development strategies.

General Approaches

A number of strategy options are available to help ensure that Florida's developing regional clusters have access to the human resource talent and education and training infrastructure necessary to keep them competitive and moving forward. Below are some examples of different approaches.

South Carolina's Technical Education System. This highly flexible program assists industry in three ways: Special Schools train workers for specific jobs in a particular company; Technical Education Center colleges offer a wide variety of technical degree programs; and Resource Centers within several of the colleges train technical education faculty and industry employees in the latest high-technology equipment and its applications.

The Special Schools are extremely flexible, meeting with company management to tailor training and providing short, intensive instruction either on or off site. Most courses are offered at night so that they can serve not only specific firms but other workers who want to upgrade their skills and become eligible for better jobs. Instructors can come from local school districts, colleges, company payrolls, or a pool of industry retirees. Those instructors without extensive teaching experience can themselves be upgraded with a short course on pedagogy.

The Technical Education Center colleges resemble community colleges in other states, except that they tend to be much more flexible. Programs can come and go much faster than in other college settings, especially if industry interest wanes. TEC colleges also remain flexible by operating special certificate programs developed for particular businesses.

Resource Centers are located throughout the state, each one focusing on a specific technology area, such as office automation, advanced machine tooling, microelectronics, computer applications, and robotics. The centers serve to continually upgrade faculty and industry employees in key technology areas, and as a focal point to attract local and national technology experts for seminars, workshops, and the like.

Southern California Aerospace Industry and Education Council brought together several aerospace companies and local community colleges to develop new curricula for seven occupations for which training was not being adequately provided in the region. The companies shared their 5-year labor and skill projections and worked with the community colleges to establish new offerings.

North Carolina's New and Expanding Industries Program, operated by the state Department of Community Colleges in cooperation with the local and state offices of the Industrial Developers Association, state Department of Commerce, local chambers of commerce, and other industrial groups provides a similar incentive. The program has been used to fund several supportive initiatives. Regional managers match individual firms and community colleges in customized training partnerships. The state also provides funds to local institutions to pay salaries of instructors for up to 60 days per year of educational or industrial leave for professional development and millions for the purchase of new equipment directly relevant to industry needs. And it provides targeted monies for cooperative Skills Training Centers to institutionalize close working relationships with industry.

Specific Initiatives for Florida's Clusters

Existing and emerging companies in Florida's Stage 2 clusters have experienced constraints in recruiting first-rate talent. In the health technologies cluster, negative perceptions about Miami's quality of life and the lack of advanced technical education offered at the University of Miami and Florida International University are factors cited by existing and emerging companies as the

reasons why they have problems in recruiting top researchers, engineers, and managers. The level of technical education in South Florida universities must be brought more in line with the demand by industries so that companies can recruit locally.

The need for enhancing advanced education is generally perceived across all of Florida's value-added clusters, but there is also great demand for improvement in technical education levels as the laser, information industries, and health technologies clusters continue to expand. Education resource centers, one for each of these clusters, may be appropriate for Florida at this time. The resource centers established as part of South Carolina's Technical Education System are a useful model for Florida to consider. Individually tailored resource centers, flexible to the changing needs of each cluster would assist the development of each respective cluster.

Capital Strategy Options

In the intermediate stage of cluster development, the capital needs of new firms and prospective new enterprises tend to become less of a problem as the cluster achieves some track record of sustained growth. Venture capital and expansion capital become more available generally, but for specific firms and start-ups problems with financing may persist. There is still value in priming the pump of risk capital in the region to promote easier access for all kinds of cluster-related businesses. There is also value in pursuing some of the same capital financing strategies that work in Stage 1 cluster development because in Stage 2 a number of firms will still have Stage 1 kinds of needs.

General Approaches

To promote broader capital availability, states have experimented with several approaches. In addition to the examples mentioned for Stage 1 cluster development, below are some different approaches that might also be appropriate for meeting capital financing needs in Stage 2 clusters.

Massachusetts has developed a **"capital resource company"** to encourage institutional lenders to increase their lending to new and small businesses. The capital resource company is privately managed and capitalized. The Massachusetts model was created by several state-headquartered insurance companies as a quid pro quo for an agreement by the state to reduce their tax burden.

Michigan uses a **loan-loss reserve program** to increase private-sector participation in riskier lending activity, such as small business loans. The state matches 3% to 7% of the value of the riskier loan with an equal amount from a participating bank. The bank can draw from this fund to offset losses up to a certain amount, encouraging more aggressive lending practices.

Several states have also created **business development corporations** or business and industry development corporations (BIDCOs). The former, adopted by Wyoming among others, is owned by state financial institutions and leverages its equity through lines of credit pledged by member institutions, thereby spreading the risks of lending to small business. The latter model, exemplified by California, allows for more varied ownership, including individuals and government bodies. In both cases, these institutions are not regulated as banks and thus have fewer constraints on their lending practices.

Specific Initiatives for Florida's Clusters

Most of the initiatives for greater access to capital outlined for Stage 1 clusters apply to Stage 2 clusters. With the Stage 2 clusters, access to finance is aided by the establishment of a track record of success for laser, biomedical, and information companies. There are true business "angels" like Dr. William Murphy, Jr., in the health technologies cluster and Ray Halpert and Jack Pruit in the information industries cluster. Although there is a shortage of in-state sources of venture capital for laser, biomedical, and information technology companies, there is a well-worn path from Florida to venture capitalists specializing in these industries in the Northeast, Midwest, and West. Still, the critical shortage of seed capital remains a prevalent problem for all entrepreneurs.

Although much of the financing of start-ups comes from personal resources, private placements, and venture capital, some financing comes from debt finance. A number of start-up companies complain that Florida banks are not very receptive to their needs. Consequently, many are developing banking relationships with out-of-state banks (including banks in the Southeast, and even Northeastern banks) that are responsive to the needs of start-up companies and recognize

the opportunity of financing a prospective high-growth company. Thus, to broaden financing options for new enterprise, Florida banks need to be encouraged to broaden their horizons. Programs such as Michigan's loan-loss reserve program and Massachusetts' capital resource company (described above) provide positive examples of actions Florida should take to increase local access to capital by new companies.

Entrepreneurial Wellspring Strategy Options

In the intermediate stage of cluster development, the sources of entrepreneurs are becoming more varied and numerous. Potential entrepreneurs are still often locally based, employed by large science– and technology–based public or private institutions, and may need to join with other individuals to get a new enterprise off the ground. However, at this intermediate stage, other sources also come into play, such as branch plants and new technical and business talent coming into the region looking for economic and career opportunities.

This means that many of the entrepreneurial wellsprings of Stage 1 are still producing and the strategies for keeping them producing are still effective in Stage 2. However, additional entrepreneurial encouragement can capture the attention of others who do not come from these original sources but might have something to contribute to the further development of the cluster.

General Approaches

A variety of strategy options have been used to encourage more entrepreneurial activity in local economies, including an array of entrepreneurship promotion and education programs that have appeared in the last several years. In 1970, only 10 universities offered courses on entrepreneurship; today that number has climbed to over 200. Below are some examples of different approaches to promoting entrepreneurship.

The University of West Virginia's Center for Entrepreneurial Studies and Development, for example, coordinates with small businesses to assign students as consultants, under faculty supervision. Students provide assistance and guidance on production, planning, and management techniques and in return gain insights into real-world business problems. Students prepare written reports about their experience, which are used later as case studies for courses at the university. In this way, the small business owners and students serve alternately as teacher and pupil, developing the entrepreneurial skills of both.

Minnesota's StarCo (Start-a-Company) Program, an example of private-sector initiative, is sponsored by a local business group, the Minnesota Business Partnership. In cooperation with the University of Minnesota and state and local governments, StarCo engages large established firms to assist small enterprises through technology spinoff, management counseling, and/or equity investments. More than 35 large firms have committed some of their employees to assist in the start-up of two new companies each. Similar programs in which company personnel are loaned by their firms to help fledgling entrepreneurs learn new skills have appeared in many communities across the country.

The Utah Pioneer Partnership is a voluntary association of organizations in the state dedicated to technological development. The goals of this partnership are to enhance communication and cooperation among participants, coordinate support for technological development, promote educational programs for technology development, increase awareness of goals and programs of various organizations, and recommend strategies to strengthen the state's technological environment.

Specific Initiatives for Florida's Clusters

As described in Section II, a large share of the entrepreneurship in the Stage 2 clusters has occurred through corporate spinoffs of one kind or another. Despite current efforts to bolster technology commercialization and spinoff from the universities, corporate spinoffs are likely to continue to be the wellspring for new enterprise in the laser, health technology, and information industry clusters. Although much of this spinoff activity will take place naturally, there have been successful attempts to foster the process systematically. Minnesota's StarCo (Start-a-Company) Program is an example of corporate citizenship at its finest in attempting to foster new enterprise growth (see above). Each cluster in Florida should establish similar programs to encourage large-company/small-company relationships.

As has been discussed in Section III, there are clear advantages for smaller and larger companies to develop relationships. Such relationships are becoming increasingly common in the world of new enterprise development. Start-ups that would once have been prime candidates for venture capital are instead looking for other sources of funding. Often their search leads them to established companies in related industries. In many cases, they wind up talking to potential

customers, and occasionally they go to potential suppliers or distributors. The goal is to find a larger company that can benefit from the start-up's success. If a deal is struck, usually the start-up is provided with capital and expertise, and the established company comes away with a promising relationship and equity in the new venture. This represents a win-win situation, a natural partnership. There is growing awareness among large companies in Florida of the advantages of partnerships with smaller start-up companies. The time is right for a set of Florida "Start-a-Company" programs in each of the major concentrations of added-value clusters.

Industrial Synergy Strategy Options

In the intermediate stage of cluster development, industrial synergies within the cluster are proliferating. Firms have begun to establish complementary synergies such as buyer-supplier linkages or joint ventures, or have begun to develop competitive relationships concerning common labor, R&D, and financing needs. They may also be looking beyond the region for business partners, new market connections, and the like. In each of these cases, the Stage 2 cluster can benefit from strategic assistance that helps provide information, forums, and incentives for developing industrial synergies.

General Approaches

A variety of strategy options have been used to encourage the interaction of firms within a Stage 2 cluster. The most common promote buyer-supplier linkages or help firms reach beyond the region for industrial synergies in terms of new markets. In some cases, local economic development leaders have also attempted to recruit firms that are deemed to be appropriate fits for the developing cluster. Austin, Texas, is notable in that in the wake of new value-added growth, the Chamber of Commerce is targeting the kinds of firms (R&D-based, information- and knowledge-driven firms) that would logically thrive in the developing cluster of the region. Below are some examples of different approaches.

In 1981, **Arizona** embarked on one of the pioneering efforts in this area: **The Arizona Supplier Initiative.** A survey of the state's high-growth high-technology manufacturing sector indicated that fewer than 10% of all purchases were made from Arizona suppliers. The survey also indicated that the level of purchases would increase about 65% over the next 4 years. Together, this information revealed a major opportunity for import substitution. Purchasing trends were matched with Standard Industrial Classification codes to identify 16 specific "Best Opportunity" supplier industries and other "feasible" supplier opportunities. A report was published documenting the range of opportunities. Local supplier opportunities ranged from high-tech to low-tech, from electronic components to corrugated cardboard boxes.

Taking the Arizona approach a step farther, the **Oregon Marketplace** program uses information about supplier opportunities with direct assistance to link suppliers with appropriate purchasers. Program staff contact local business to determine purchasing trends, then widely circulate a "search announcement" among potential suppliers using an extensive information network that includes public posting, business contacts, word of mouth, and other outlets. In this way, purchasers enter their requests in the Oregon Marketplace data-base; those requests are bid out locally, and matches are made. Product information is also retained from unsuccessful local supplier searches to provide direction to entrepreneurs wanting to start or expand a business.

New York offers a somewhat different kind of connection assistance: **matching foreign manufacturers with receptive New York firms in joint venture agreements, acquisitions, or licensing arrangements.** Foreign inquiries are directed to the Joint Venture Program in the International Division of the state Department of Commerce and then to a network of 10 regional offices and 120 local economic development groups.

Several states offer some form of export financing or assistance in the form of **loan guarantees** (California, Colorado, and others), **loans to lenders** (Illinois, Louisiana, and others), and **insurance and counseling** (California, Colorado, Washington, and others).

Specific Initiatives for Florida's Clusters

Florida's Stage 2 clusters can develop rapidly by growing local businesses that replace imported inputs (parts, components, services) coming from outside the state. Programs should be established in each cluster that examine local purchaser-supplier linkages for import substitution opportunities. Such an activity can indirectly support new enterprise development by disseminating market intelligence about business opportunities to the public. The Arizona Supplier Initiative and the Oregon Marketplace provide useful models for the development of programs appropriate to the information industries, laser, and health technologies clusters.

Strategic Directions for New Enterprise Development

Tables IV-1 through IV-5 present strategic directions for new enterprise development in Florida's value-added clusters. These tables *illustrate* the types of action steps that are required to enhance the climate for entrepreneurship and move Florida's regional clusters to the next stage of their evolution.

Table IV-1

STRATEGIC DIRECTIONS FOR NEW ENTERPRISE DEVELOPMENT
HEALTH TECHNOLOGIES CLUSTER

Sources of New Enterprise	Technology	Human Resources	Capital	Entrepreneurial Wellsprings	Industrial Synergy
Corporate spin-offs	• Develop Health Technologies Industry Council to foster technology exchange and entrepreneurship	• Establish resource center for coordinating education and training activities locally	• Establish SBIR "bridge financing" program	• Establish bio-medical "start-a-company" program	• Develop supplier-buyer information network
University spin-offs	• Support Technology Transfer Program development at local universities (e.g., UM, FIU)	• Expand university based entrepreneur business skills development programs	• Develop University Innovation Centers allowing equity participation in local ventures	• Reform patent policy at local universities and strengthen incentives for faculty entrepreneurship	• Host international conferences/events on health technologies—link industry and university
Inventors/ entrepreneurs at large	• Link entrepreneurs to industry and university technology clusters and support services (e.g., NASA/ STAC, UM Entrepreneurship Institute, Guidelines, Inc.)	• Link entrepreneurs to business and marketing skills development activities	• Develop and expand Miami Venture Forum and other activities linking investors to entrepreneurs	• Conduct seminars/ conferences promoting entrepreneurship in health technologies, establish entrepreneurship awards	• Support health technologies information networking • Attract potential new entrepreneurs from other states

Table IV-2

STRATEGIC DIRECTIONS FOR NEW ENTERPRISE DEVELOPMENT
LASER INDUSTRIES CLUSTER

Sources of New Enterprise	Technology	Human Resources	Capital	Entrepreneurial Wellsprings	Industrial Synergy
Corporate spin-offs	• Expand industry outreach effort by university centers of excellence (e.g., CREOL)	• Establish laser training center to promote industry responsive training for high growth companies	• Establish SBIR "bridge-financing" programs	• Establish corporate mentor program	• Develop laser industry council to promote technology development and entrepreneurship
University spin-offs	• Establish technology commercialization programs at local universities	• Expand business development and entrepreneurship programs and support services	• Establish SBIR preproposal grants program	• Establish "entrepreneurial fellows" program	• Promote industry-university links
Inventors/ entrepreneurs at large	• Strengthen technology outreach and business development programs	• Link entrepreneurs with experienced managers and managerial support	• Build up regional venture forum connecting investors and entrepreneurs	• Hold conferences on laser innovations, application and entrepreneurship	• Establish laser supplier-buyer information system

Table IV-3

STRATEGIC DIRECTIONS FOR NEW ENTERPRISE DEVELOPMENT
INFORMATION INDUSTRIES CLUSTER

Sources of New Enterprise	Technology	Human Resources	Capital	Entrepreneurial Wellsprings	Industrial Synergy
Corporate spin-offs	• Develop regional consortium to promote advanced information research and entrepreneurship in Computer Coast	• Form Computer Coast industry and education council to focus technical training	• Foster expansion of local venture forums	• Develop Computer Coast "start-a-company" program linking large companies to small start-ups	• Link potential suppliers with appropriate buyers (buyer-supplier initiative)
University spin-offs	• Reform university patent policy and develop progressive technology commercialization program (e.g., FAU, FIT)	• Establish business development center (e.g., FAU, FIT) to assist university faculty	• Link university faculty to local venture forums, investor groups	• Establish "entrepreneurial fellows" program at FAU, FIT)	• Increase outreach efforts of university centers of excellence to link university faculty and students with industry
Inventors/ entrepreneurs at large	• Increase outreach efforts to link inventors/entrepreneurs to technology centers at local universities	• Link inventors/ entrepreneurs to local business and marketing skills workshop and programs	• Link entrepreneurs to investors, develop computerized investor-entrepreneur matching services	• Support Southeastern Florida venture groups, develop inventors workshops, hold conferences with local and national entrepreneurial role models	• Develop supplier-buyer network and services to link entrepreneurs with local market opportunities • Develop campaign to attract new entrepreneurs to the region

Table IV-4

STRATEGIC DIRECTIONS FOR NEW ENTERPRISE DEVELOPMENT
SPACE INDUSTRIES CLUSTER

Sources of New Enterprise	Technology	Human Resources	Capital	Entrepreneurial Wellsprings	Industrial Synergy
Corporate spin-offs	• Improve access to research at UCF, FIT, Stetson—support efforts of Florida space Research Foundation	• Anticipate technical training needs of expanding space commercialization activities	• Create SBIR "bridge financing" program	• Develop mentor-mentee program with participation of major space firms	• Establish space business incubator • Attract new commercial space companies and entrepreneurs
University spin-offs	• Adopt reform university patent policy and develop technical transfer	• Link professors/ researchers to experienced managers and/or business development training	• Link university faculty to venture networks	• Establish "entrepreneurship fellows" program for university faculty	• Improve outreach of university centers of excellence to space industry
Inventors/ entrepreneurs at large	• Build on NASA/ STAC model to support entrepreneurs in research, grant writing, product development	• Promote space education and invention programs in K-12 and higher education	• Develop venture network for space entrepreneurs to link to potential investors	• Develop space industries' entrepreneur award program	• Develop Florida space supplier initiative to identify local business opportunities

Table IV-5

STRATEGIC DIRECTIONS FOR NEW ENTERPRISE DEVELOPMENT
EMERGING TECHNOLOGY BAY CLUSTERS

Sources of New Enterprise	Technology	Human Resources	Capital	Entrepreneurial Wellsprings	Industrial Synergy
Corporate spin-offs	• Strengthen center of excellence programs and industry outreach	• Establish Technology Bay education and training resource center	• Expand regional forums for matching investors to entrepreneurs	• Establish technology bay "start-a-company" program	• Establish technology bay industry council to support business development and entrepreneurship
University spin-offs	• Establish technology commercialization program at USF	• Link entrepreneurs to business skill development programs	• Establish Innovation and Technology Commercialization Center at USF with equity fund	• Establish entrepreneurial fellows program	• Form industry industrial council to support cluster-based entrepreneurship
Inventors/ entrepreneurs at large	• Link entrepreneurs to local technology commercialization support activities	• Expand business entrepreneurship business development	• Establish SBIR "bridge financing" and pre-proposal SBIR grant program	• Support inventor groups, networking, entrepreneurial forums, conferences	• Develop technology-based supplier-buyer initiative

For each of the five regional clusters highlighted in this report—the health technologies cluster, the laser cluster, the information industries cluster, the space cluster, and the emerging clusters in Technology Bay—key strategic directions and initiatives are presented to illustrate specific action steps aimed at promoting new enterprise development. Taken together, the tables, one for each cluster, present a strategic action framework for promoting entrepreneurship and building the critical economic infrastructure required for growing the value-added clusters so critical to Florida's economic future.

As used here, the tables identify the overall strategic directions or requirements that each cluster must strive for. For each cluster, strategic directions are identified by strategic area—technology, human resources, capital, entrepreneurial wellspring, and industrial synergies. Individual initiatives suggest new public or private investment, new public policies or adjustments to existing policies, or new or reorganized sources of community action and/or problem-solving capacity (e.g., industry groups, citizen task forces) needed in each strategic area to promote entrepreneurial activity.

These strategic directions are identified according to the sources of entrepreneurship within each cluster. The three main sources or potential sources of entrepreneurship are summarized as corporate spin-offs, university spin-offs, and inventor/entrepreneurs at large. As indicated in Chapter II, new business formation in Florida's regional clusters has stemmed primarily from former employees of existing companies spinning off to form their own companies. While corporate spin-offs are likely to remain as a major source of entrepreneurship, especially for high-growth, high-value-added new companies, university spin-offs and start-up companies emerging from entrepreneurs and inventors at large, including the growing number of entrepreneurs moving into Florida, have high potential within the state. These tables illustrate key actions steps that can be taken to lay the groundwork for tapping this potential.

Conclusion: Florida's Entrepreneurial Support Efforts

It is difficult to evaluate or predict the impact of establishing various entrepreneurial support programs on the rate of new value-added enterprise development in Florida. Available evidence suggests that Florida is currently a national leader in new business formation, ranking fourth in the nation in the number of new companies founded in 1984 or later that had at least 10 employees by 1988 and first in the birth rate of new businesses (total new companies founded divided by the total number of business establishments in the state (see Table IV-6). However, Florida ranks only 16th nationally in the percentage of fast-growth companies, suggesting that although Florida has a good number of start-ups, many of them may be slower-growing, less

innovative firms. Furthermore, only a small proportion of Florida's new companies are in high-value-added industries.

Table IV-6

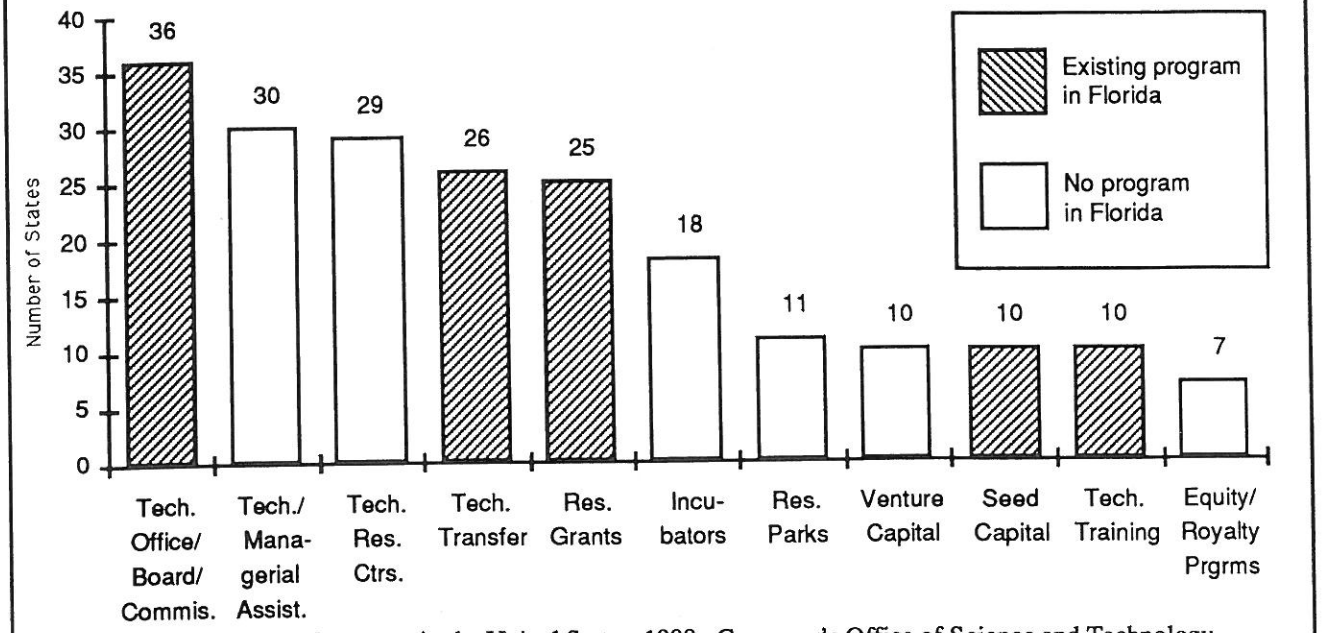
ENTREPRENEURIAL ENERGY—LEADING STATES

Rank	Number of New Companies 1984-1988 *	Business Birthrate 1984-1988†	Percentage of Fast Growing Companies‡
1	California (12,352)	**Florida** (2.88%)	New Hampshire (4.46)
2	Texas (8,289)	Arizona (2.87%)	Maryland (4.30)
3	New York (6,734)	Georgia (2.79%)	Arizona (4.0)
4	**Florida** (6,540)	Texas (2.58%)	Delaware (3.95)
5	Illinois (3,788)	Nevada ((2.57%)	Massachusetts (3.91)
6	Pennsylvania (3,469)	Maryland (2.55%)	Virginia (3.83)
7	Ohio (3,240)	Tennessee (2.41%)	California (3.59)
8	New Jersey (3,237)	California (2.38%)	Vermont (3.48)
9	Georgia (2,983)	New Hampshire (2.32%)	Georgia (3.43)
10	Michigan (2,752)	Colorado (2.26%)	Connecticut (3.40)
		16	**Florida** (3.06)

*Number of companies founded in 1984 or later that had at least 10 employees by January 1988.
†Birthrate is total number of new companies divided by the total number of business establishments in the state.
‡Number of fast-growth young companies divided by all state business establishments founded in 1980 or later.

Source: Cognetics, Inc.

In the past several years, Florida has joined other states in investing in a variety of entrepreneurial support programs. Figure IV-1 illustrates the number of states that have established various entrepreneurial support programs and identifies types of programs that have been put into place in Florida. Although this listing of programs does not reflect qualitative dimensions of the programs established, it does provide an indication of the kinds of programs existing in Florida.levels, the specific focus of programs, the number of years a program has been in effect, and so on. The areas with the strongest rates of high-value-added enterprise development have been those with existing positive environments for entrepreneurial activity, such as California, Massachusetts, and New York. Typically, these areas have had less reason to intervene with entrepreneurial support programs. Other states, like Pennsylvania and Virginia, have sought to boost their new enterprise development rates by investing in a variety of programs such as seed capital programs, incubators, and others designed to promote business formation in high-value-added clusters.



Source: State Technology Programs in the United States, 1988. Governor's Office of Science and Technology, Minnesota Department of Energy and Economic Development

FIGURE IV-1 NUMBER OF STATES INVESTING IN ENTREPRENEURIAL SUPPORT PROGRAMS

Many of the strategic options and initiatives suggested for Florida in this chapter provide an overall strategic framework for how the state can enhance the overall capacity for cluster development. The programs and initiatives cited in the chapter represent the kinds of actions that will best serve to promote new enterprise development and foster the evolution of Florida's regional value-added clusters.

V MOVING FORWARD: NEXT ACTION STEPS AND ROLES

New strategies and actions are required to promote new enterprise development in Florida's value-added clusters. This final chapter recommends key action steps and roles for Florida's public and private leaders and institutions in fostering the development of new enterprises. Although action is required on multiple fronts, it is important to be strategic. This chapter outlines a discrete set of actions at the regional and state levels for supporting enterprise development.

Regional-Level Support for Enterprise Development

Action to support new enterprise development is particularly appropriate at the regional level. This report has found that new enterprise development in value-added industries tends to take place in regional industrial clusters. Particular actions that are appropriate to promoting cluster and new enterprise development are described in this section.

Developing an environment that is conducive to cluster development and new business formation requires a set of converging factors: critical mass in the industry base, university excellence, strong linkages between large and small technology companies and between university and industry, support networks for entrepreneurs and investors, and coordinated state and local government assistance. Efforts to pull together these factors create a dynamic environment for cluster development.

New institutional alliances are required to coordinate cluster development. Already in Florida there are numerous state, regional, local, public, and private programs and initiatives to promote new enterprise development, ranging from local support and network groups to major state programs such as the Florida Seed Capital Board. The state has already come a long way in developing programs and institutional capacity to foster enterprise development. What is critically needed in Florida is a way to coordinate efforts at the regional level and provide focus to the strategic development requirements that are specific to regional clusters. Florida's challenge and opportunity is to identify a local or regional "focal point" for cluster and new enterprise development.

Create Public-Private Consortia for Regional Clusters

The region is a critical point of action because clusters occur in regions and because economic infrastructure can and must be addressed at the regional level. It is at this level that new steps are required to bring Florida's various regional value-added clusters to the critical mass needed for "lift-off." This can be achieved by coordinating strategies and actions of the various efforts and achieving a unity of thrust. It is recommended that coordinating bodies or consortia operating at the level of a regional cluster be established to coordinate and leverage development efforts in the region. Examples of such consortia could be envisioned, and for instance, as follows:

- "Laser/Advanced Technologies Corporation" in the Space Coast
- "Health Technologies Center" in the Health Technologies Coast
- "Information Technologies Council" in the Computer Coast
- "Space Industries Foundation" in the Space Coast
- "Advanced Technologies Consortium" in Technology Bay.

Such consortia would implement a strategy, coordinate programs and efforts, enhance "old" institutions, and invent new institutions. They would serve as a clearinghouse for linking together actors in the region, promoting university-industry ties, encouraging technology commercialization efforts, and unifying actions of disparate groups by getting them to work together toward common goals and themes.

There are models for public-private consortia from other states, such as the San Antonio Biotech Corporation and the Tennessee Technology Foundation. Consortia can be organized in various ways: public, quasi-public, private foundations, or nonprofit. Exhibit V-1 illustrates various forms that have been adopted in other states.

Closer to home, there has been a recent attempt to establish a public-private institution to promote the health technology cluster in Southeastern Florida, the Center for Health Technologies for Research, Development, Design, Management, and Training. Although the initiative was vetoed by the governor, the Center comes very close to the consortium concept in its proposed functions:

- Promote and assist technology transfer among local business and industrial firms, the universities, hospitals, and local governments.
- Provide a network of shared technical services.
- Coordinate an incubator for small cluster-related companies.
- Maintain a database of graduate students and other technically trained professionals in health technologies.
- Coordinate major R&D and other grant applications by linking local resources.

- Facilitate access to seed and venture capital.
- Promote and assist scientific and technical meetings held in South Florida.

EXHIBIT V-1
REGIONAL CLUSTER CONSORTIA CONCEPT

Tennessee Valley Aero Space Region (TVAR) —An Organizational Approach
A 10-county regional organization, the TVAR is devoted to the creation of high-quality jobs through new locations and entrepreneurial start-ups. The focus of the TVAR is the aerospace industry. Business climate improvements are an essential element of the program. The Center for Advanced Space Propulsion is a special project to promote commercialization in the region. The organization also has linkages with NASA.

Arizona—University Industrial Centers of Excellence Nonprofit Model
Located within Arizona State University are six Centers of Excellence. These are the Centers for: *Computer Integration and Manufacturing, Solid State Electrical Research, Telecommunication, Systems Science, Transportation, a*nd *Energy Resources*. Each program derives funding from the university, industry, and the state. Research and development projects are conducted jointly with private industry. The centers are currently planning to enhance their service bases by providing assistance for technology transfer, commercialization, and patent licensing.

Oregon—Aid for Regional Strategies
Oregon's approach to adaptation is helping regional rural groups to consider their economic adaptation needs carefully and choose priorities that state government can help them address. Oregon has developed a new Regional Strategies Fund that will distribute $25 million to communities across the state. Communities first hold public hearings to choose an appropriate regional group and set of possible strategies. The group decides on priority development needs in the region and what the region needs from the state to meet them. Regional strategy proposals are developed and sent to the state Economic Development Department, which reviews and approves them, and makes any appropriate links among proposals and with other state or private initiatives. The governor ultimately awards funds on a competitive basis.

Illinois—Promotion of Industrial Corridors
Illinois has initiated a targeted regional industry development program that designates specific areas of the state as "Corridors of Opportunity." The program provides grants to regional corridor councils to help them develop tailored industry recruitment and development strategies. Strategies may include new enterprise development, technology transfer, and continuing research programs. Different areas of the state have been designated high-technology "Corridors."

Colorado—Advanced Materials Institute
Colorado's Advanced Materials Institute (AMI) is a consortium of 10 private companies and 4 universities that operates as the Colorado Advanced Technology Institute (CATI) research arm. AMI encourages cooperation between university researchers and Colorado industries in utilizing research to serve the long-term needs of Colorado's advanced-materials industries. The Institute's long-term goal is to secure nonstate support for research in advanced materials. This would enable AMI to be regionally autonomous.

The proposed Center for Health Technologies is one form that a regional, cluster-focused consortium could take to effectively coordinate regional efforts that would move clusters to "lift-off" phase. Other forms are appropriate to other regional clusters and must be developed by leaders in the region.

Recommendations

Establish public-private consortia. Local Chambers, university leaders, industry leaders, regional and local government leaders, network groups, and other relevant participants should establish regional cluster consortia that provide focus to efforts to develop regional value-added industrial clusters and new enterprise development. Each cluster should develop its own approach and institutional form to address the critical needs of the regional cluster.

State-Level Support for Enterprise Development

Beyond regional-level public-private consortia and stronger support infrastructure in human resources, technology, and capital, there is a need to increase support for enterprise development at the state level. This is important for at least two reasons: regional efforts need the state-level support to achieve their full potential, and state-level infrastructure needs to be targeted more appropriately to the needs of new enterprise.

Action at the state level should occur through both private-sector initiatives and public policy. This can be done either through existing state-level organizations or through new organizations designed especially to support enterprise development. There are a number of successful examples of new state efforts that have helped to stimulate new enterprise development. These include Indiana's Corporation for Enterprise Development, the Greater Minnesota Corporation, Pennsylvania's Ben Franklin Partnership, Ohio's Thomas Edison Program, Illinois' regional Corridors of Opportunity program, and Arizona's entrepreneurship network. In each case, public-private partnerships at the state level were established to help provide financial and technical assistance to regional enterprise development efforts.

In Florida, state-level action in support of new enterprise development should be taken by the Florida Chamber and the Florida Department of Commerce. In addition, consideration should be given to creating an appropriate statewide enterprise initiative that would support regional efforts to promote industrial clusters and encourage statewide human resource, technology, and capital infrastructure to be more responsive to the needs of new enterprise.

The Florida Chamber

As a leading statewide business organization, the Florida Chamber should play a major role in supporting new enterprise development. The Florida Chamber is in a unique position to play this role, given its mix of both large and small firms. Although activity in this area would provide an important service to new small firms, it also can make a useful contribution to the needs of larger firms that depend increasingly on local suppliers. In many ways, the Florida Chamber can play an important brokering role between large and small firms in helping to promote an environment for new enterprise development in the state.

A critical role for the Chamber is providing the state with better information about the importance of new enterprise development through its ongoing communications activities and through a number of new specific initiatives. Today, the value of new enterprises within growing industrial clusters is not well understood by either business leaders or economic development professionals in Florida. A continuing focus on recruitment of industries to the state has tended to obscure the importance of new enterprise to the state's economic development. Furthermore, the role of entrepreneurship in job and wealth creation is not always appreciated when the focus is on large firms.

Gaining an accurate picture of the true dimensions of new enterprise development in Florida is difficult because of a number of technical problems in gathering and analyzing good information about company formation. The Florida Chamber could provide a useful service to the state and its business community by developing a more reliable new enterprise development monitoring system that tracked new business creation on an annual basis.

Recommendations

- *Hold statewide regional forums.* The Florida Chamber should sponsor a series of statewide and regional forums on the importance of new enterprise development and strategies for promoting industrial clusters within regions.
- *Sponsor a statewide television series.* The Florida Chamber should sponsor a statewide television series, possibly in cooperation with public television, that would identify Florida enterprise success stories and suggest steps that can be taken to create a supporting environment for new enterprise development.
- *Establish a new enterprise development monitoring system.* The Florida Chamber should sponsor a New Enterprise Development Monitoring System, possibly in cooperation with the Florida Department of Commerce, that would provide a reliable and accurate estimate of the rate of new enterprise development statewide, within industrial clusters, and within regions, on an annual basis.

The Florida Department of Commerce

The Florida Department of Commerce has become active in recent years in supporting small and new business development through the efforts of its Bureau of Business Assistance. In addition to providing assistance to over 14, 000 small businesses in 1987-88, the Bureau has provided deal packaging assistance that leveraged $5.1 million of public funds with over $9 million in private funds.

A major focus of attention by the Department has been on helping to address the capital needs of new and small business. Since a Seed Capital Task Force found that there were no organized sources of seed capital in Florida, the Department has been working with a number of local organizations to help encourage the formation of local investor networks, with the intention of facilitating interaction between individuals interested in seed capital deals. A Florida Seed Capital Board was created to make equity investments in new businesses in the state.

As this report has shown, more is involved in promoting new enterprise development within industrial clusters than simply the availability of risk capital. Other elements of economic infrastructure are required, including a high-quality work force, accessible technology, and an environment that supports entrepreneurship. Hence, it is appropriate for the Department of Commerce to expand its new enterprise development support efforts beyond capital.

A first step in this direction was the request by the Florida Legislature in 1989 that the Florida Seed Capital Board develop a framework for promoting technology transfer to new enterprise. The Department of Commerce has been developing strategies to support "technology-based" enterprises. This presumably would involve providing a range of economic infrastructure support activities at the regional level, including technology transfer, training, and management assistance in addition to assistance with capital financing.

Recommendations

- *Establish a new enterprise development program.* The Florida Department of Commerce should establish a new enterprise development program which strengthens support networks that provide management assistance and increased access to appropriate training and technology transfer programs at the regional level.

- *Increase availability of seed capital.* The Florida Department of Commerce should continue to work with financial institutions and venture capital firms to increase the availability of seed capital for new firms. Efforts should also be made to tap a small share of state pension funds (e.g. 1% to 2%) for seed and venture capital funding

- *Cooperate in new enterprise development monitoring*. The Florida Department of Commerce should cooperate with the Florida Chamber in supporting the Chamber's activities to promote greater awareness of the importance of new enterprise development and to create a statewide monitoring system.

A Vision of a Statewide Enterprise Initiative

Although state-level support activities should be pursued through existing state organizations, it is worth envisioning a bold statewide enterprise initiative that would accelerate Florida's movement toward a high-value-added economy. Recognizing the difficulties involved in creating new state-level institutions, it may be nonetheless necessary to contemplate such a bold step if Florida is to achieve its full potential in new enterprise development.

As mentioned earlier, some states have taken this step to establish a state-level public-private partnership for the support of new enterprise development, usually with a focus on high-value-added, technology-based enterprise. In Florida, a number of state-level organizations are now involved in these activities, including the Chamber, Department of Commerce, Florida High Technology and Industry Council, Florida Seed Capital Board, and STAC. Although each is involved in important activities, the total impact of these activities is less than it could be because there is no statewide strategy backed up by a set of state-level institutions to help implement the strategy. Every group has a piece of the puzzle, but the full solution has yet to come together.

What would an Enterprise Florida initiative look like, what would it do, and how would it operate? The following is an outline of a statewide effort that would need to be worked out in detail by all the parties that would have to be involved.

Structure: *Enterprise Florida* could be established as a nonprofit, public-private corporation with funding from the private and public sectors. It could have a board of directors and a small core staff.

Purpose: *Enterprise Florida* would provide financial and technical assistance to regional consortia; would direct statewide efforts in support of management assistance, technology transfer, and training for new enterprise development; and would work in cooperation with other state organizations to develop an overall strategy for new enterprise development.

Strategy: *Enterprise Florida* would be a "catalytic" organization serving as a broker in bringing together key groups at the regional level and helping firms find access to management, capital, training, and technology assistance. It would use its own resources to leverage additional private-sector resources in support of new enterprise development.

The time to be bold in Florida is now. The 1990s present great opportunities for new enterprise development in emerging clusters. Yet Florida's clusters will not achieve critical mass without strategic intervention. This can be done either through existing organizations or through a new set of institutions, or a combination of the two.

The challenge can be stated simply. Florida can be a leadership economy in the 1990s on the basis of the growth of its dynamic industrial clusters if two conditions are met: an environment for new enterprise development needs to be created, and key elements of economic infrastructure need to be in place. Bold action must be taken by the private and public sectors to create this enterprise environment and build this economic infrastructure.

If these steps are taken now, Florida will prosper in the 1990s and beyond. If these steps are not taken, Florida will not achieve greatness in the next decade and opportunities for both businesses and people will be lost.

New enterprise development holds a key to Florida's economic future. A strategy for supporting enterprise at both the regional level and the state level is required. Florida's business leaders, working with government and educational institutions, can make a difference. What is required is a bold vision and the will to implement a strategy for achieving that vision.

APPENDIX A

Appendix A

FLORIDA'S INFORMATION, BIOMEDICAL, AND SPACE/DEFENSE INDUSTRIES:

Where Are the New Enterprises?

An initial task in exploring new enterprise development among Florida's high value-added industries focused on determining areas of the state where new businesses where being formed within the three industry clusters that are the focus of this study. The locational analysis became an important way to narrow down areas in the state for more detailed analysis and for developing lists of new firms for interviews. This appendix reviews sources of data on new enterprise development in Florida and shows graphically the concentration of employment and firms in the information, biomedical, and space/defense industries.

Limited Databases on New Enterprise Development in Florida

Several sources have been involved in examining issues relating to new enterprise development in Florida. Although the picture is far from complete, they do reveal some interesting information about the climate for enterprise development in the state.

Perhaps the best-known source of information about new and small business development is David Birch and the firm Cognetics, Inc., with which he is affiliated. Birch's findings are based on a database that he has built using Dun and Bradstreet files on U.S. companies. Using this data, *Inc.* magazine creates indices of economic growth based on levels of job creation, significant new business start-ups, and the percent of young companies enjoying high growth rates. According to these indices:

- Between 1984 and 1988, Florida experienced a birthrate of 2.9% in new firms employing 10 or more people. This rate of growth was first among all U.S. states.
- 3.1% of all of the companies founded in Florida between 1980 and 1988 were classified as "high growth" firms by Cognetics. According to their index, Florida ranked 16th nationally in terms of the number of start-ups that were high-growth firms. This suggests that although Florida has a good number of start-ups, many of them may be slower-growing, less innovative firms.

- Five Florida cities—Orlando, Tampa-St. Petersburg, Pensacola, Fort Myers, and Fort Lauderdale—ranked in *Inc.'s* top 25 "Metro Hot Spots." This index is based on a weighted average of jobs generated, the rate of significant new business start-ups, and the percent of young companies enjoying high growth rates.

- Three Florida cities—Miami, Tampa-St. Petersburg, and Fort Lauderdale—ranked in the top 25 areas nationally in terms of the absolute number of both young, high-growth firms and significant start-ups.

Other research on new enterprise has been conducted through the Innovation and Entrepreneurship Institute at the University of Miami. The Institute has published several reports documenting the growth of high-technology industry in Florida and assessing the Florida venture capital industry. This research does not attempt to document the growth of new firms per se. However, it indicates where the major concentrations of high-technology industry employment are within the state. This research highlights the concentration of high-technology industry in three key regions of the state: the Computer Coast (Palm Beach, Broward, and Dade counties), the Space Coast (Orange, Brevard, Seminole, and Volusia counties), and Technology Bay (Hillsborough and Pinellas counties). The research on the Florida venture capital industry found that the low level of venture capital activity in the state is in part a function of the fact that the networks of entrepreneurs, investors, and other service providers that are so critical to a healthy climate for new enterprise development are very weak in most Florida cities.

Although some research has been done on new enterprise development in Florida, relatively little is known about the importance of new enterprises for Florida's economy. For example, although Florida seems to have strong rates of new business formation, we do not know which industries this growth is taking place in (although some crude indicators suggest that Florida is experiencing the formation of many new firms in the service and retail sectors). There is little information about the variation in both the nature and the needs of new enterprises across the various regions and cities in the state.

This lack of understanding of the scope of Florida's new business sector is in large part a function of the lack of high-quality data about new and small firms. Several sources of data on new firms do exist. The most widely used of these are the database used by Cognetics for its calculations of birth and growth rates and the U.S. Small Business Administration's two databases. These data sets were developed using the Dun and Bradstreet "Market Identifiers" (DMI) series, which have been edited and in some cases supplemented by estimates of missing information. More recently, several states have used the ES-202 data series, which is the data kept in each state for tracking unemployment insurance, to estimate the birth and death rates and employment impact of new firms.

The problem with these databases is that it is often several years before new firms are picked up. Thus, it may take some time to spot new trends. In addition, there is a high level of inaccuracy in the data, and many of the firms that appear to be new firms are often simply incorrectly classified. For example, one researcher working with the DMI files found that 50% of the firms classified as new businesses were listed incorrectly—some had closed, were duplicate listings, or were existing firms that had simply changed ownership.

In sum, there is very little information on business formation in Florida. No state agencies, universities, or other public institutions consistently track the formation of new enterprise in Florida. Only very basic information about the rate of new business formation statewide is available from secondary sources such as *Inc.* magazine, which gives the birthrate of new firms and the number of start-ups that were high-growth firms. Reliable information about new business formation by industry is not available. To assist new enterprise development in the state, the development of a statewide database system for tracking new business formation is critically needed.

Areas of Concentration in Three Industry Clusters

In the absence of data on new business formation in the three clusters, data on employment and number of firms were used to identify those areas that have already experienced growth. Data from County Business Patterns (CBP) were used to examine employment levels and the number of firms existing in Florida counties. Data were gathered for the most recent year available, 1986, and for 1984. Although the levels of employment and number of firms in 1984 and 1986 can be compared, it is not possible to derive new business start-ups from the total change. However, we used these differences as an indicator of likely new business development when they were large. Still, there are major limitations in using the CBP data because of the disclosure requirements that mask actual data from being used when the number of firms in any industry is small. Consequently, it is not possible to account precisely for industry changes between 1984 and 1986. The following section illustrate the geographic concentration of employment and firms by major industry cluster.

Information Industries

The information industry includes computer hardware and software, communication equipment, data processing, and related information services. Overall, the industry is highly concentrated in the three main high-tech regions of the state—the Computer Coast, the Space Coast, and Technology Bay. Figures have been prepared that display the counties with the highest levels of

employment in 1986 for each of the information industry sectors. Counties with relatively low employment and number of firms have been obscured from the figures in order to highlight the areas with the most significant employment concentrations.

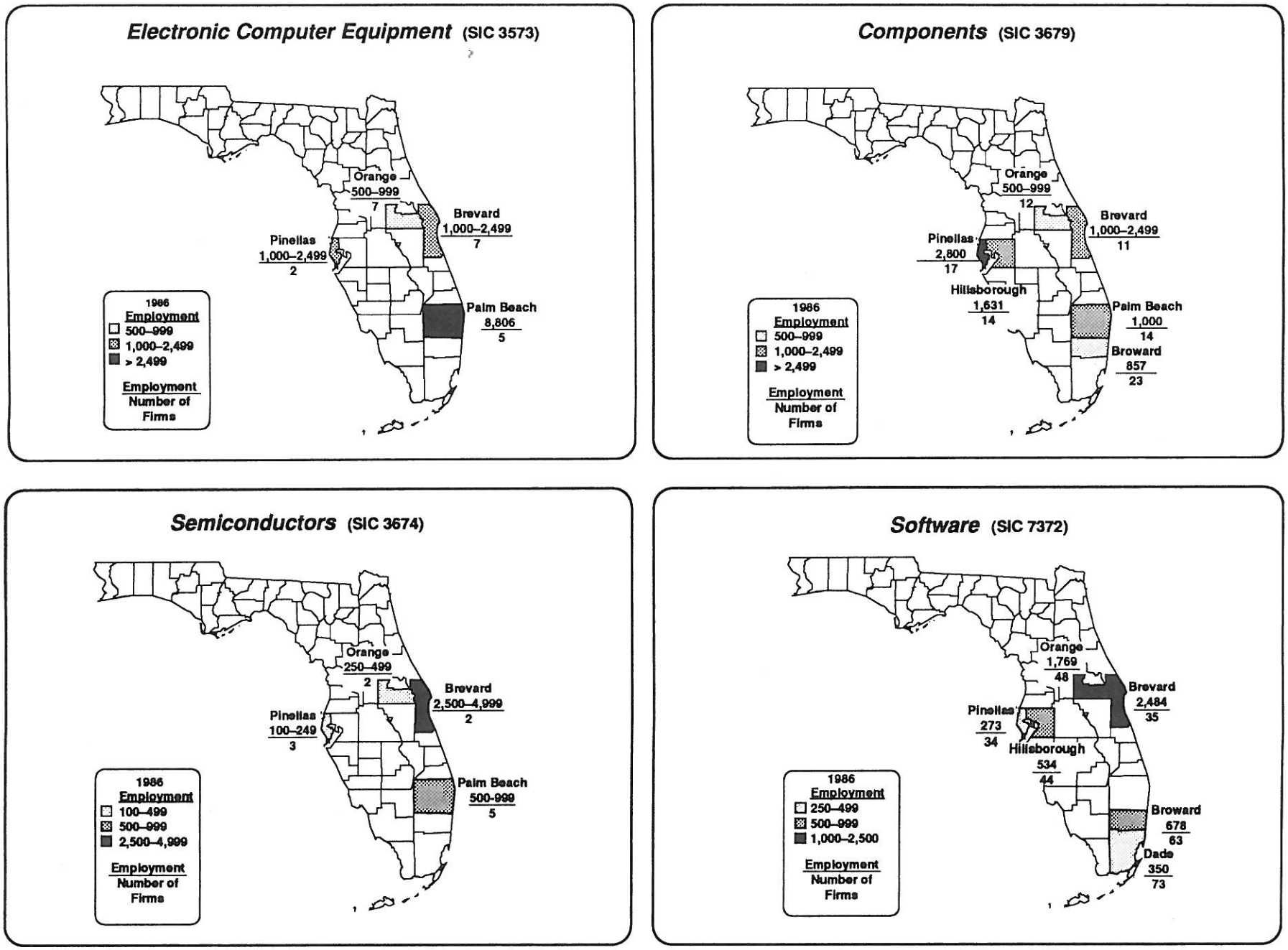
As shown in Figures A-1 and A-2, the computer industry is heavily concentrated in Palm Beach County, with smaller concentrations in the Space Coast and Technology Bay. Semiconductors is most heavily concentrated in Brevard County. Components are most concentrated in Technology Bay. Employment in the software industry is greatest in the Space Coast, but the greatest number of software firms is in Broward and Dade counties.

Communication equipment firms are also most prevalent in the three main high-tech regions of the state. Telephone equipment is most concentrated in Broward and Seminole counties, while radio and TV equipment is more evenly distributed in each of the three main regions. Okaloosa county is also host to a significant number of radio and TV producers.

Finally, areas with the most significant data processing activity levels include Technology Bay and the Computer Coast, as well as Orange and Duval counties. Related information services are most prevalent in the Space Coast, Technology Bay, the Computer Coast, and, once again, Duval County.

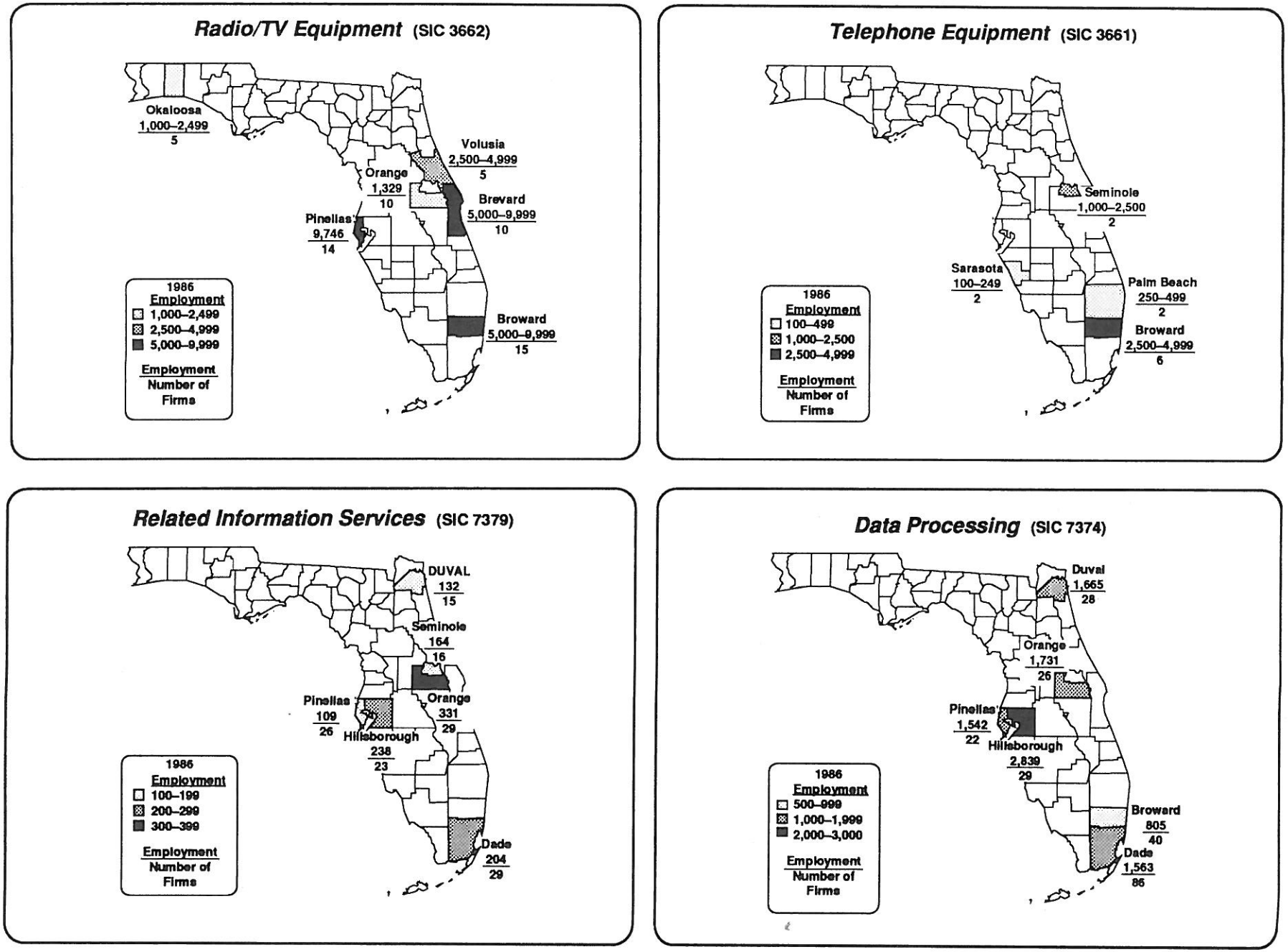
In general, the data show that employment and firms in 1986 in the information industries are relatively dispersed among the three main high-technology regions. The only two outliers in this pattern are Okaloosa County in the case of radio and TV equipment, and Duval County in data processing and related information services.

Table A-1 shows increases in employment and number of firms between 1984 and 1986 for sectors in the information industries that had increases. Overall, the increases were relatively minor on the hardware side of the information cluster but more pronounced on the software and services side of the cluster. Still, on the hardware side, increases in employment and number of firms mostly occurred in the Computer Coast and Technology Bay, and in terms of the software/services activities, most increases occurred in Technology Bay, the Space Coast, and the Computer Coast. The only outliers from this general pattern were Escambia County in terms of software and Duval County for related information services.



Source: County Business Patterns

FIGURE A-1 LOCATION OF INFORMATION INDUSTRIES



Source: County Business Patterns

FIGURE A-2 LOCATION OF INFORMATION INDUSTRIES

Table A-1

INCREASE IN EMPLOYMENT AND FIRMS IN INFORMATION INDUSTRIES, 1984 - 1986

	Increase in Employment	Increase in No. Firms
Computers (SIC 3573)		
Orange	0	2
Seminole	0	1
Electronic Components n.e.c. (SIC 3679)		
Broward	370	3
Palm Beach	35	3
Hillsborough	0	4
Sarasota	0	2
Lee	0	1
Software (SIC 7372)		
Hillsborough	150	10
Escambia	120	4
Broward	90	12
Dade	47	6
Brevard	0	4
Seminole	0	4
Palm Beach	0	3
Data Processing (SIC 7374)		
Pinellas	1140	2
Orange	300	2
Palm Beach	80	0
Brevard	0	8
Leon	0	3
Escambia	0	2
Related Information Services (SIC 7379)		
Broward	110	10
Pinellas	0	26
Seminole	0	9
Duval	0	4
Orange	0	4
Telephone Equipment (SIC 3661)		
Sarasota	0	1
Radio/TV Equipment (SIC 3662)		
Palm Beach	500	1
Dade	0	4
Alachua	0	1

Source: U.S. Dept. of Commerce, County Business Patterns.

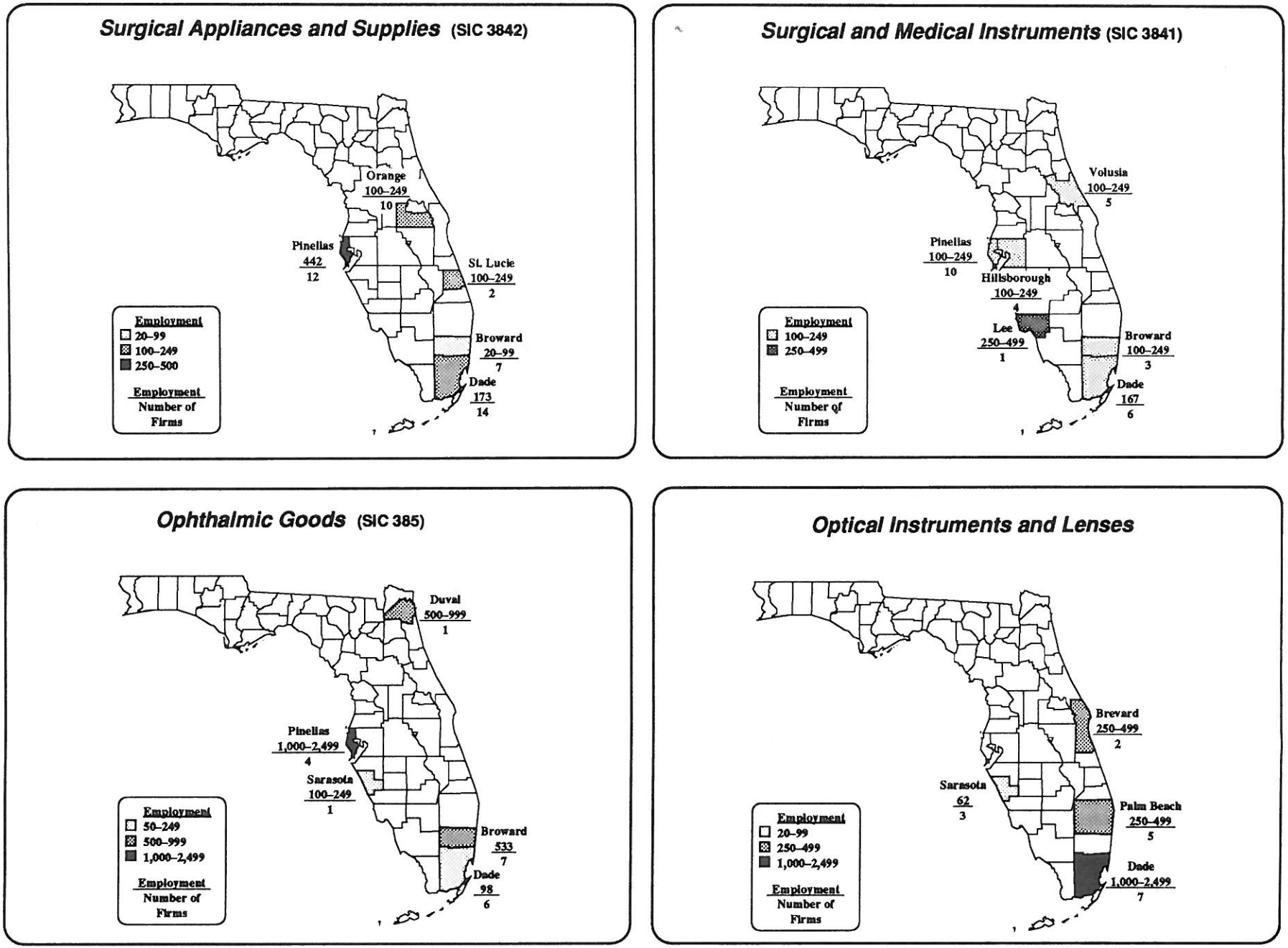
Biomedical Industries

The biomedical industry includes medical instruments and devices of all kinds (e.g., surgical, dental, X-ray, and electromedical), optical instruments and ophthalmic goods, and pharmaceutical and biological products. The industry is concentrated mainly in two regions of the state—the Southeast and West Central regions. Historically, biomedical activity has been highly concentrated in Dade County. In 1972, Dade County firms employed 48% of all biomedical workers in the state. As the industry has grown in recent years, it has begun to disperse to other parts of the state. Today Dade County firms account for 39% of Florida employment in the industry. Significant clusters of employment have formed in Pinellas and Brevard counties, which now employ more than 1,000 people in the medical manufacturing industry, and Jacksonville has experienced recent growth in biomedical employment. However, since much of this dispersion has also occurred in Broward and Palm Beach counties, the state's biomedical employment remains most concentrated in southeastern Florida. Figures A-3 and A-4 show the areas of employment concentration within various sectors of the biomedical industry.

Data from County Business Patterns show that both employment growth and increases in the number of firms in the biomedical industries between 1984 and 1986 have been minimal and confined to a few sectors (Table A-2). Pinellas County showed the most significant increase in new firms; and, overall, with the exception of new firm growth in surgical and medical instruments in Volusia County, the growth of the biomedical industry continued to be concentrated in the Southeast and West Central regions.

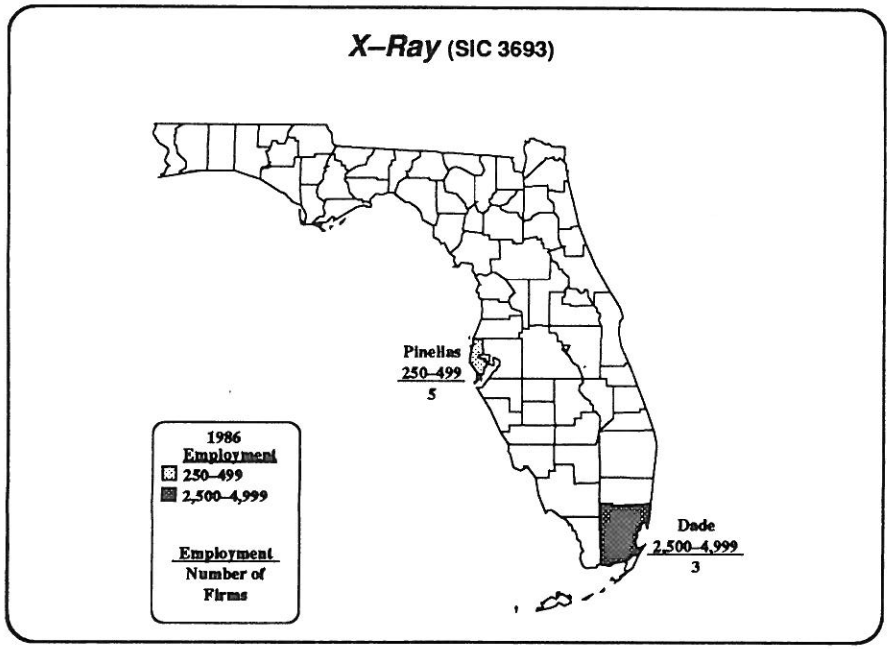
Space/Defense Industries

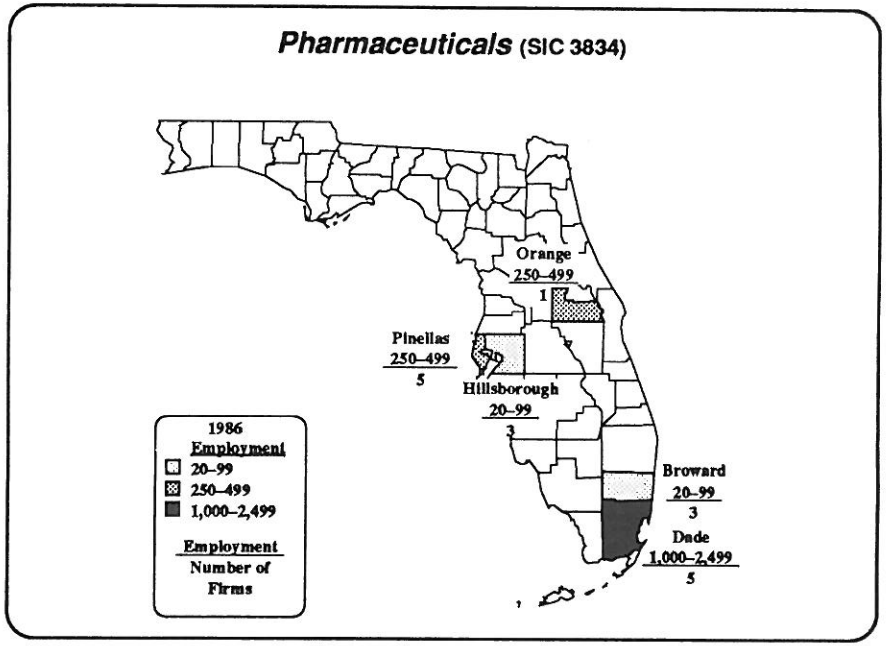
The space/defense industries—which includes missiles and space vehicles, aircrafts and parts, and instrument and related devices—is once again highly concentrated in the Space Coast, and in the Southeast and West Central regions. The Space Coast contains over 99% of the state's employment in the space industries. Four companies, two in Brevard County and two in Orange County, dominate the missiles and space vehicle industry. Employment in the aircraft and aircraft equipment industry is more dispersed with a major concentration in Martin and Indian River counties, in Southeast Florida, and in the West Central region. Employment in other sectors of the space/defense industries are sprinkled throughout the state, but there are no other major regional concentrations (see Figures A-5 and A-6).

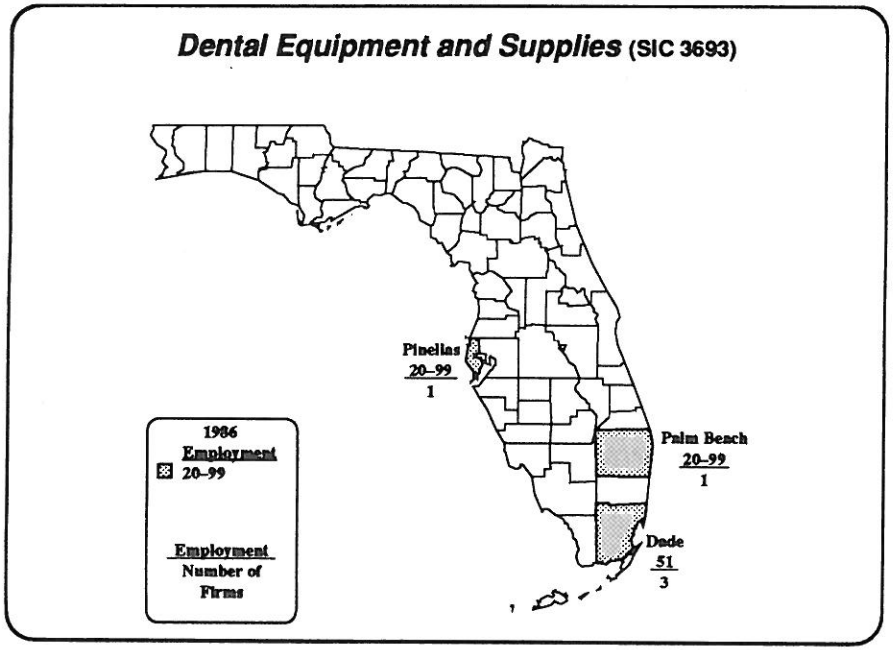


Source: County Business Patterns

FIGURE A-3 LOCATION OF BIOMEDICAL INDUSTRIES







Source: County Business Patterns

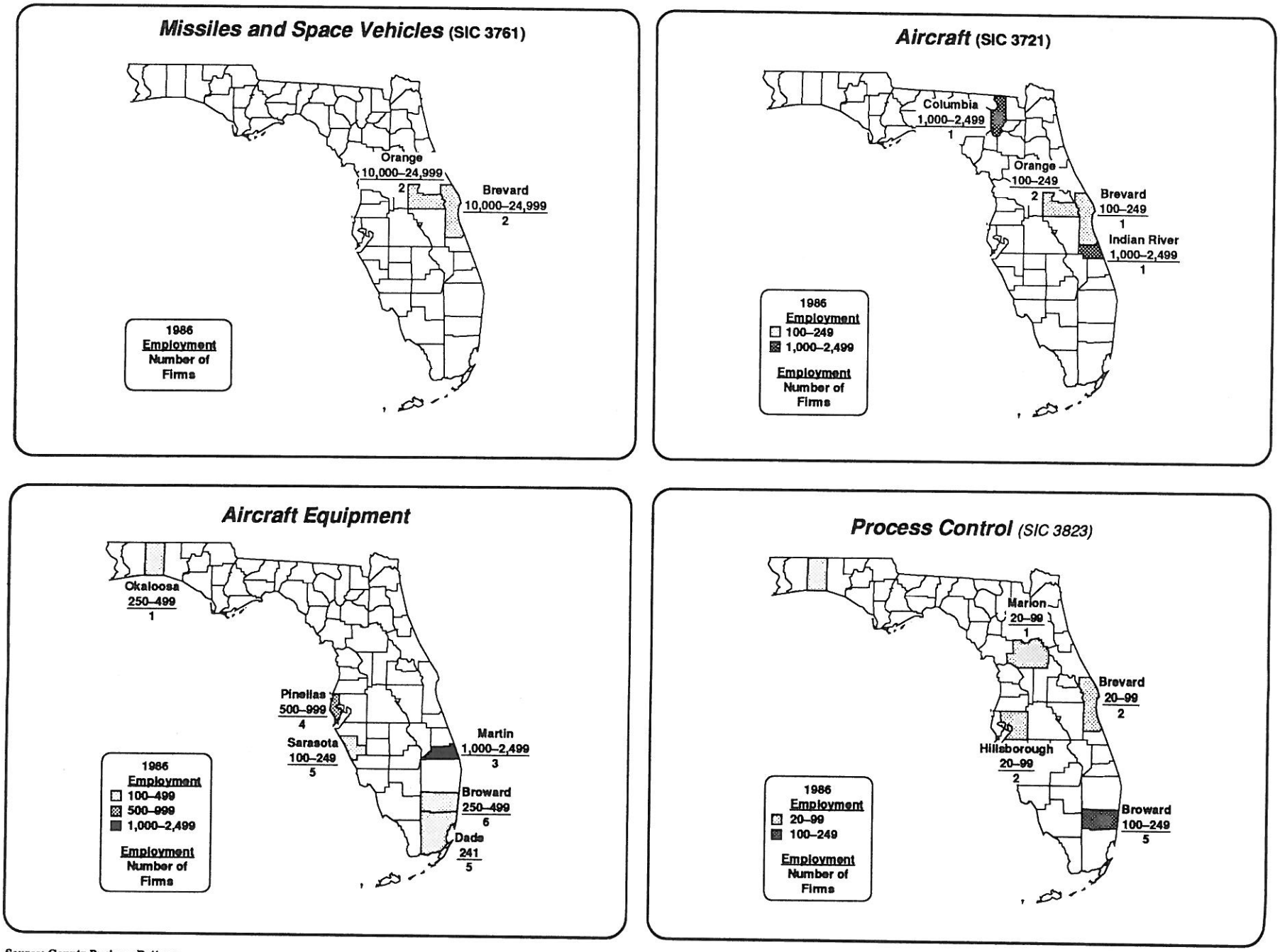
FIGURE A-4 LOCATION OF BIOMEDICAL INDUSTRIES

Table A-2

INCREASE IN EMPLOYMENT AND FIRMS IN BIOMEDICAL INDUSTRIES, 1984 - 1986

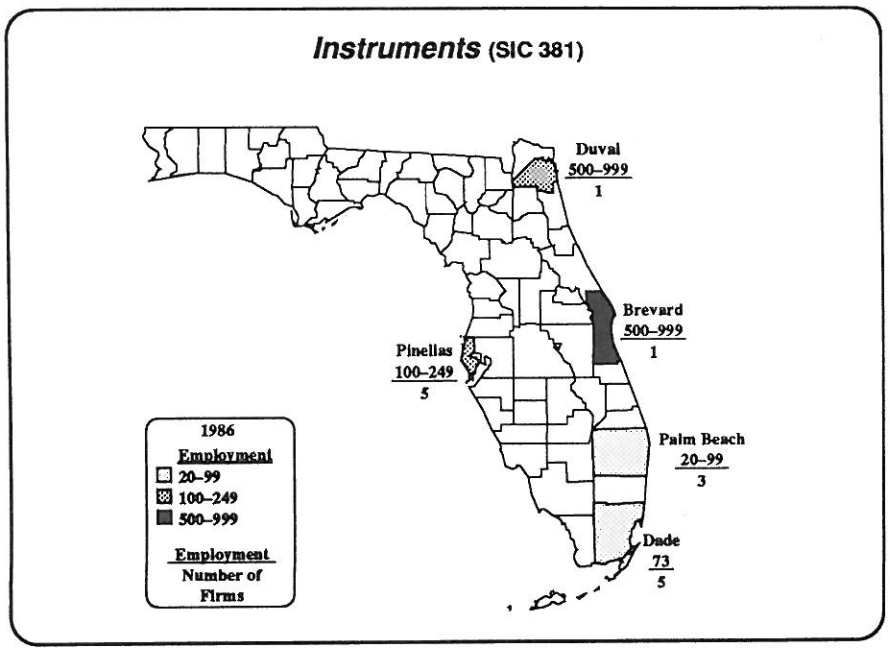
	Increase in Employment	Increase in No. Firms
Surgical and Medical Instruments (SIC 3573)		
Volusia	0	4
Pinellas	0	3
Broward	0	2
Optical Instruments and Lenses (SIC 383)		
Sarasota	0	3
Palm Beach	0	2
Ophthalmic Goods (SIC 385)		
Broward	240	1
Dade	230	1
Pinellas	0	2

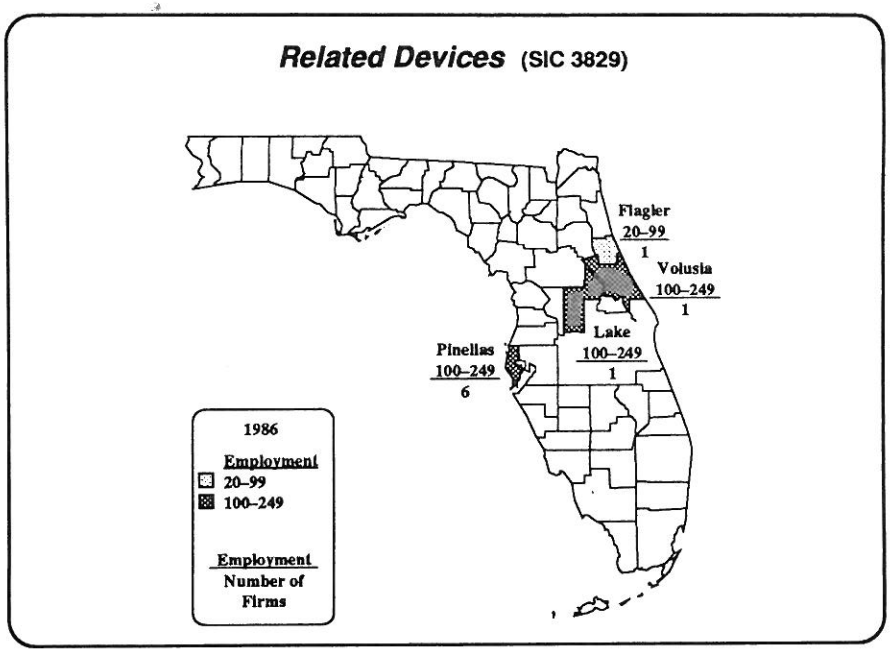
Source: U.S. Dept. of Commerce, County Business Patterns.



Source: County Business Patterns

FIGURE A-5 LOCATION OF SPACE/DEFENSE INDUSTRIES





Source: County Business Patterns

FIGURE A-6 LOCATION OF SPACE/DEFENSE INDUSTRIES

Table A-3

INCREASE IN EMPLOYMENT AND FIRMS IN SPACE/DEFENSE INDUSTRIES, 1984-1986

	Increase in Employment	Increase in No. Firms
Aircraft Engines (SIC 3724)		
Dade	0	2
Aircraft Equipment and Part (SIC 3728)		
Pinellas	200	1
Broward	0	2
Duval	0	1
Process Control Instruments (SIC 2823)		
Broward	0	2
Brevard	0	2

Source: U.S. Dept. of Commerce, County Business Patterns.

Employment growth in the space/defense industries was minimal between 1984 and 1986 (Table A-3). The only increase was in aircraft equipment and parts in Pinellas County. Increases in the number of firms were limited to aircraft, aircraft equipment and parts, and process control instruments. The majority of firm growth occurred in Southeast and East Central Florida.

For Additional Information Contact:
Tom Keating
The Florida Chamber of Commerce Foundation
P.O. Box 11309
Tallahassee, FL 32302
904/222-2831