Abstract

Engineers are excellent sources of high-growth potential entrepreneurial ventures with their creative product and technology ideas, in various disciplines. However, academia in general has not effectively developed this resource.

This paper reviews contemporary literature on teaching of entrepreneurship and describes an innovative, holistic Engineering Entrepreneurship program backed by the resources and activities of a technology incubator. This program is designed to provide engineering students and researchers with tools and opportunities for entrepreneurial success, establish deeper and more meaningful community ties, and facilitate the incubation of technology-based start-ups.

Packaging the “incubator concept” into a series of graduate, undergraduate and continuing education short courses is a unique aspect of UCF’s entrepreneurship program. This program has received very favorable reviews from local, state and national organizations. The entrepreneurship initiatives at UCF have had a positive impact on other universities and in making the Central Florida area a hub of high tech entrepreneurial activity.

Introduction

Engineers are excellent sources of high growth potential entrepreneurial ventures with their creative product and technology ideas, in multiple disciplines. However, academia in general has not effectively developed this resource. This paper reviews the contemporary literature on the teaching of entrepreneurship and describes an innovative holistic Engineering Entrepreneurship program backed by the resources and activities of a technology incubator. The impact of university entrepreneurship initiatives on other local universities and in making the Central Florida area a hub of high tech entrepreneurial activity is also discussed.

Contemporary Models of Entrepreneurship

There have been a number of contemporary models of entrepreneurship. In one of the first efforts to explain what makes up an entrepreneur, Blake and Saleh\(^1\) combine personality factors,
knowledge, managerial mechanisms and environmental forces in a schematic that traces out the entrepreneurial process. In this model, the entrepreneur begins a venture by coping with environmental change through three critical responses: 1) uncertainty management 2) knowledge filtering and 3) the exploitation of environmental change. What the individual does in this process is helped or hindered by personality characteristics that play a role in guiding the use of mechanisms to perform successfully. The idea is that a person’s characteristics will encourage risk-taking or networking and co-ordination to bring about a successful launch. This process is initiated by certain occurrences or issues that exist in the environment. An opportunity is seen by the entrepreneur, perhaps as a result of environmental change, who then, through efforts of personality, uses a number of mechanisms such as innovations, or market attraction, to make things happen. In the Entrepreneurial Model propounded by Ford, Churchill and Walker, there are three classifications that reveal the entrepreneur: These include the historical roots of an individual which are said to be important in bringing him or her to the point of creating the new venture - this Historical Background which includes family, culture physiology, demographics, etc. establishes the values that guide individuals in life and make an important contribution to the entrepreneur. The Personal Elements of the individual (Motivation, Personality, Abilities, Skills) are critical in setting out to understand the entrepreneur and the effect organizational abilities might have on the process. Finally, there is the Outcome, which in fact becomes the process itself: entrepreneurship. In this model, Motivation is the operant condition that initiates the entrepreneurial process. It is the individual desire to build something, to gain recognition or to reach a particular end-state that kick-starts the push to a self-determined future. The new venture creator with a need for recognition and who is confident of his ability to perform will be very motivated. Fred Fry has suggested that these variables do come together in an equation:

\[ M = Ai \times Ti \]

Where \( M \) = Motivation

\( Ai \) = Antecedent variables (e.g. background, creativity, personality, experience, and education)

\( Ti \) = Triggering factors such as job loss, opportunity, idea, environmental change, etc.)

Fry incorporates a “Triggering event” as a component of motivation. The Antecedent Variables emphasize the roles that historical and personal variables play in defining the entrepreneur.

In examining technically-oriented entrepreneurs, Robert Edwards lists three primary causes (a) independence, (b) challenge and (c) monetary reasons. Monetary causes tend to be low on the list as being critical to the high tech entrepreneur. Freeser and Dugan have determined that four factors, distilled from eleven motivational elements, are able to set out the parameters that make up the motivation to become entrepreneurial: (a) feeling of frustration with the employer (b) desire to avoid working for others and be properly rewarded for one’s own efforts (c) drive for challenge and advancement (d) intense drive to do one’s own thing, to develop one’s own ideas.

**Teaching of Entrepreneurship**

The field of “Teaching of Entrepreneurship” has been divided as to whether entrepreneurship can be taught or not. Those who favor it as an independent academic discipline see it as a distinctive, if not unique component of the free enterprise system. In this respect, it creates wealth, improves the productivity of a region, adds to employment, and offers a more exciting dimension to society. A second consideration is that entrepreneurship contains specific knowledge, concepts and theories that apply in a reasonable and consistent manner across the discipline. The search for an opportunity, the verification or viability of the opportunity and the
language of financing are distinct and particular to entrepreneurship in its own right. Those who do not favor an entrepreneurship discipline are becoming less vocal in their opposition than in the past. Entrepreneurship courses and programs are sprouting up in business and engineering colleges of esteemed universities. What does remain is the lingering argument that much of what is applied in the process of entrepreneurship includes material that overlaps in other courses. In the early days, a number of large universities claimed that the functions of management—planning, organizing, controlling—are very much evident in entrepreneurship and need not be treated as a uniquely different discipline. The debate did not recognize two critically important features of an entrepreneur: The role of creativity in entrepreneurship, whereby the new concept, invention and innovation that literally takes charge of the entrepreneur. Second, there is the vision that goes along with the new concept. A final argument that the more conservative academics pursued was that, since a new venture cannot really be created in the classroom, the concept of entrepreneurship cannot be taught and that the “concept of starting one's own business” does not require academic treatment. However, teaching entrepreneurship offers the advantage of avoiding those errors and misjudgments made by individuals who ventured before. The academic propositions in teaching business to young people also apply in the teaching of entrepreneurship. The number of businesses created and the economic impact of entrepreneurship courses and programs at Stanford, MIT, University of Texas-Austin and other leading universities is testimony to the fact that entrepreneurship skills and know-how can be taught and entrepreneurs can be nurtured through supporting programs in university-based incubators, entrepreneur associations and local business networks.

Environmental Factors Impacting New Venture Creation
Given a satisfactory market opportunity, there are a number of environmental elements that must be in place to support a successful start-up. William B. Gartner lists ten ingredients that are most important to successful venture creation

1) Suitable financing
2) Availability of a competent workforce
3) Accessibility to helpful suppliers
4) Government support, or at least the absence of obstacles
5) Proximity of Universities to assist in research
6) Availability of land or facilities
7) Access to transportation
8) Support of local population
9) Available support services- secretarial, telecommunications, etc.
10) Low entry barriers

Each of the above factors is important, some of them may be more critical to one venture and not another, but all of them have a considerable role in ensuring new venture success. Proximity to universities is noteworthy in two respects: In high tech start-ups where new inventions or technologies play a dominant role, these institutions can make significant contribution to successful start-ups through research, problem solutions and engineering support. Another benefit of the university is its business school and the availability of consulting services in terms of marketing, production systems, MIS, accounting and finance advice, etc.
Benjamin Mokry\textsuperscript{12} suggests that in order to create a more receptive environment for entrepreneurship, a number of fundamental societal changes must occur. He supports the major truism that “local communities are the breeding ground of entrepreneurship” and are capable of creating an environment favorable to it. Mokry has added two factors to Gartner’s 10 factors that affect entrepreneurial success:

1) Existence of an entrepreneurial sub-culture. The tremendous success of Silicon Valley, Boston, Austin and San Diego very much support the notion that entrepreneurs feed off each other in a synergistic fashion and create their own dynamic environment.

2) Incubator organizations, many of which are initiated by local universities and governments as enterprise centers

Recent studies\textsuperscript{13} have developed a more positive awareness of educating people in entrepreneurship and eventually how to become entrepreneurial. It has been determined that 1) potential entrepreneurs can be encouraged through university-based entrepreneurship programs 2) entrepreneurship within an established definition can be taught and 3) entrepreneurial alumni do succeed and they themselves provide further insights and educational materials for dissemination in the classroom.\textsuperscript{14, 15}

Studies by Wolfe, Adkins and Sherman\textsuperscript{16} have shown that universities serve as sources of new technologies that might be commercialized by incubator client firms and other regional start-ups. Universities can also provide other valuable services and unique resources to both the incubator, its clients and other regional start-ups such as (1) Faculty / technologist managerial or technical consulting on a pro bono or fee basis (2) Student interns and employees (3) Access to technical labs, facilities and equipment (4) Access to databases and researchers (5) Access to research and development financing through programs such as SBIR – federal grant funding is greatly enhanced when incubator clients submit a joint proposal with a university or federal laboratory (6) Additional services and resources including patent knowledge, alumni who may act as advisors, business contacts and strategic alliance facilitators or investors, access to a far-flung network of laboratories and technical expertise, and access to investment by university foundations.

All the above mentioned research findings and other issues and environmental factors were considered when designing the entrepreneurship programs at the University of Central Florida. Additionally, leading entrepreneurship programs in the country were benchmarked and the best practices were adopted.\textsuperscript{17, 18, 19, 20, 21}

The Central Florida region has had most of the ingredients for transforming the area into a hub of high tech entrepreneurial activity – these include a central location, availability of land, communications infrastructure, transportation resources (which even include a spaceport), trained workforce, high tech companies, state incentives, strong research universities providing the intellectual capital, research parks and incubators. There was not a very strong entrepreneurial sub-culture as in Silicon Valley or Boston and this had to be created through university entrepreneurship programs.
Entrepreneurship at University of Central Florida

The University of Central Florida has been developing a unique interdisciplinary program to promote technical entrepreneurship, facilitate technology transfer and make the Central Florida area a hub of high tech entrepreneurial activity. This program is strongly oriented into steering undergraduate and graduate engineering students towards careers in entrepreneurship.

The University of Central Florida (UCF) is a growing metropolitan research university that delivers comprehensive programs of teaching, research and service to more than 42,000 students. UCF offers high-tech research in Optics, Lasers, Communications, Simulation, Alternative energy, Materials, and other branches of engineering. UCF has developed, in partnership with industry, world-class centers and institutes that focus on these strengths and other core competencies. UCF’s location in the heart of the state’s most rapidly growing technology cluster has led to an unique affinity with the businesses that comprise the growth and continued quality of students poised to run these businesses. The university is a proven leader in promoting and developing high-tech growth in central Florida, having established a very successful technology incubator and strategic alliances with local and state agencies such as the Florida High Tech Corridor Council, Enterprise Florida, etc. UCF is delivering on its promise of becoming America’s leading partnership university through relationships on local, national and international levels. Partnership through the UCF Technology Incubator and UCF’s Small Business Development Center solidifies the university’s local connections; promotes technical entrepreneurship and assists UCF researchers in transferring technology to the marketplace.

The UCF Technology Incubator is a university-driven community partnership with the mission of building high-tech opportunities into successful business ventures in Central Florida. Its primary goals are to graduate financially stable companies poised for significant revenue growth and to create an effective means for University faculty to commercialize technology through licensing and strategic partnerships. Located adjacent to the UCF campus in East Orlando, the Incubator consists of over 70,000 square feet space with the addition of its new Center for Entrepreneurship located in Downtown Orlando.

The local economic downturn in the tourism industry following the 9/11 terrorist attacks has highlighted a strong need to diversify, build a strong technology base and make this region a hub of high tech entrepreneurial activity. The Central Florida region has many of the key components necessary for technology innovation, commercialization and entrepreneurship. These elements include research university systems with steeples of excellence in technology sectors of significant commercial potential such as Photonics, Simulation, Software and Space Sciences. There is also a strong commitment from regional policy makers to transform the region’s economy heavily dependent on tourism to a diverse, “High Tech, High Fun”, community. The need to develop an entrepreneurial culture, facilitate technology transfer and improve upon the current infrastructure for enabling entrepreneurship in the area is imperative. The local universities have excellent programs in entrepreneurship, business and high tech engineering disciplines. The Engineering Entrepreneurship program at UCF aims to produce tech-savvy entrepreneurs who have a comprehensive understanding of the processes of technology development, transfer and commercialization through the establishment of start-up entrepreneurial ventures.
3-Course Engineering Entrepreneurship Program
The goal of the 3-Course Engineering Entrepreneurship Program is to produce business-savvy engineering entrepreneurs who can leverage their innovative, proprietary university-developed technology and products into creating investable start-ups in the Central Florida area.

This one-year program comprised three courses:
1. Engineering Entrepreneurship
2. High Tech Product Strategy
3. Technology Commercialization Strategies

Completion of a Business Plan is a requirement of the program. This program is oriented towards hands-on entrepreneurial training and focused on business plan development and execution. Students gain valuable insights through the case method and from the networking opportunities and guest lectures by successful and struggling entrepreneurs, business service providers, VCs, Angel investors, attorneys, financial advisors, accountants, and marketers. Engineering Entrepreneurship is an introductory course that outlines the entrepreneurial process and highlights the critical success factors. High Tech Product Strategy focuses on the marketing aspects of entrepreneurship and presents product strategy from a unique, holistic perspective to greatly increase the probability of success. The final course emphasizes project management, other operations strategies necessary to grow the start-up venture and systematically covers the Technical, Marketing and Business aspects of the Technology Commercialization process through the 3 phases (Concept, Development and Commercialization) and six stages (Assessment, Feasibility, Development, Launch, Growth and Maturity).

It has been observed that when engineers are exposed to High Tech Marketing and Product Strategy, their entrepreneurial enthusiasm and instincts take a quantum leap and they develop new paradigms for commercializing their ideas. This zeal, combined with their technical creativity and innovative product ideas creates an “Entrepreneurial Fire in the Belly”.

This three-course series is designed to develop a collegial, co-operative learning environment that mimics the activities of a technology incubator. The students pursue their own entrepreneurial ideas and work in teams. These teams are not restricted to the students in the class. They can be virtual teams including external experts as members of the start-up management team or the board of advisors. The enthusiasm in these Engineering Entrepreneurship classes has been observed to be very high - students sometimes arrive an hour before the start of class and often stay over late, huddling and hustling, working in small groups on projects, networking with guest speakers, making deals and helping each other out and working on their business plans.

Packaging the “incubator concept” into a series of graduate, undergraduate and continuing education short courses is a unique feature of UCF’s overall Entrepreneurship program, which offers practical insights, tools, objectives, case studies, strategies, mock negotiations and actions that one can apply to any stage of an entrepreneurial or intrapreneurial venture from initial idea to growth and profitability. There are some stereo-typical differences between Engineers and Marketers that this holistic Entrepreneurship program attempts to alleviate: Engineers are typically facts oriented, tend to think serially and sequentially with strong paradigms. Marketers on the other hand are typically perceptive and tend to think holistically with flexible paradigms. A successful entrepreneur needs to balance the roles of a engineer, marketer and administrator...
through different stages of the entrepreneurial venture. The ever-pressing issue of funding is presented as a manageable hurdle and options to structure and develop the business to attract potential investors are presented. The critical roles of engineering, marketing, finance and management are clearly explained as the entrepreneur learns practical and leading-edge approaches to bring products to market and grow the organization. Attempts are also made to resolve/avoid IP issues that commonly impact university-industry partnerships, with guest lectures by the university-affiliated attorneys and technology transfer director.

The academic requirements for these courses are fulfilled through a series of case study assignments in which student teams analyze, write up and lead class discussions on Entrepreneurship and Technology Commercialization-related cases. Additionally, the mid-term assignment involves the development of a comprehensive proposal to raise funds from public and private organizations. In these highly structured and regimented courses, students are also graded on their performance in periodic project reviews, class participation and the comprehensive end-of-term team project and business plan presentations.

This formal training program is supported and supplemented by other activities and programs of the University of Central Florida Technology Incubator (UCFTI), The College of Business Administration (CBA) and the College of Engineering and Computer Science (CECS) such as:

**Excellence in Entrepreneurship Workshop:** which is an intense seven-week program that provides entrepreneurs with the business strategies needed to start-up, enhance, grow and strengthen their businesses – culminating in the development of business plans.

**Industry Executive for the Day Program:** which places highly successful industry leaders in the UCFTI for a day for mutually beneficial experiences and interaction between the incubator clients and industry leaders. Under this program, the industry leaders get a closer look at entrepreneurial commercialization efforts of nascent technologies and the incubator clients gain insights from industry veterans.

**Entrepreneurship Speaker Series:** These seminars by business services professionals, VCs, Business Angels, attorneys, struggling/successful entrepreneurs, etc. are held periodically on topics such as patent protection, legal issues related to high-tech startups, marketing and branding, and raising capital (banks, venture, SBIR, STTR, ATP), etc.

**The UCF Engineering Entrepreneurship Colloquiums:** are held at the end of the semester with keynote addresses from successful local entrepreneurs, presentation of student business plans and panel discussions with industry experts and is a popular networking event.

**Bootcamps for Potential Entrepreneurs:** These are one-day camps initially developed by the UCF College of Business with customized programs intended to meet the needs of underrepresented groups. These programs include intensive panel discussions focused on answering the questions that challenge most entrepreneurs, incisive insights from successful /struggling entrepreneurs, tips and feedback on business plan preparations, etc. Follow-up Bootcamps for attendees are 2-day or 8-week courses.

**UCF Student Entrepreneur Society (UCF SES)** is a grassroots students body that promotes entrepreneurship in Central Florida by providing UCF students with a forum to associate with like-minded entrepreneurial students from various disciplines. Through its bi-weekly meetings which feature guest speakers and other activities, UCF SES creates a network of support for UCF entrepreneurs, and provides guidance, resources and hands-on experience in the entrepreneurial process. Throughout the year, the UCF SES offers seminars given by
entrepreneurs who have started businesses from scratch, as well as business service providers and representatives from organizations which provide advice on how to ensure a start-up business to be successful.

**Internship Program for Entrepreneurial Students:** The program places students in paid or unpaid internships, working with start up companies in the university-based incubation programs. Networking opportunities facilitated by the UCF Technology Incubator and the UCF Student Entrepreneur Society also help students to identify local companies that match well with their particular business interest or expertise. It is the goal of this program to enrich the academic experience of the student while providing much needed help to the local and incubator client companies.

**Competitive Business Idea Pitching Competitions:** These competitions held at the end of the semester in conjunction with the UCF Entrepreneurship Colloquiums, have the following objectives: 1) to establish a culture of entrepreneurship 2) create a very visible, well publicized program (in the media, educational system and business community) highlighting the importance of preparing a well thought out, cogent business plan for commercializing innovative ideas, and 3) offer participants the opportunity to bring their ideas to the market place by being mentored and critiqued by active venture capitalists, entrepreneurs, lawyers and others involved in high tech commercialization. The winners were awarded virtual client status in the incubator for six months.

**Activities of the Emerging Business Network (EBN):** This network links together disparate academic, government and industry leaders to improve communications, pool resources, reduce redundancy, and in general foster tech transfer and innovation. It enables exchange of information concerning technology development and provides a clear path to relevant resources of the regional universities and industries. The network also assists in the development of unique collaborations to promote innovation. The monthly “Technology After Dark” forums of EBN are widely attended.

**Impact of Engineering Entrepreneurship Initiatives at UCF**

Some of the nascent engineering entrepreneurship activities initiated by the UCF Technology Incubator, UCF Office of Research, The College of Engineering and the College of Business Administration have yielded impressive results. The Incubator currently serves more than 50 companies and has created over 400 jobs in Central Florida since opening its doors in 1999. These affiliate companies have raised over $60 million in venture capital and have an average annual salary of $68,000. One of these companies, Optium Corp. was among the highest privately VC-funded start-up company in the country in 2001. Rini Technologies, Inc. is a successful high tech start-up solely focused on developing innovative thermal management solutions for high power solid state lasers. This technology which was developed as part of a doctoral dissertation has been successfully commercialized by Rini Technologies, Inc. for Defense, Space and Consumer applications. 2000-X Technologies, Inc. – a current incubator client which is a business performance management, research and information technology firm, epitomizes a successful model of UCF’s cross-disciplinary entrepreneurship program. It was started by a Engineering Entrepreneurship student in the college of engineering and a student in the Executive MBA program and included two students who met the founder in the undergraduate Entrepreneurship class. Other companies that have graduated from the UCF Technology Incubator include Alinean (developing ROI financial analysis tools); Craneware Ltd (specializing in software development for healthcare billing and auditing; ibackoffice (offering
comprehensive CRM support and service solutions); Netlander (IT management and software development) and psiloQuest (an Orlando based manufacturer of CMP polishing pads for semiconductor manufacturing).

The high-efficiency Gossamer Wind ceiling fan technology developed by UCF’s Florida Solar Energy Center was successfully licensed by the Office of Research into a resounding market winner. This family of energy-efficient fans has achieved a high level of market acceptance and is one of the best selling products in Home Depot since its market introduction.

The annual Central Florida Technology Conference co-sponsored by the University of Central Florida has become a popular networking event for entrepreneurs, VCs, and local business service providers, attracting over 300 attendees.

The UCF Engineering Entrepreneurship Colloquiums, which have been held at the end of the semesters, have been well publicized in the media, have been attracting increasingly larger audiences and have become popular networking events for aspiring engineer-turned entrepreneurs, investors and business service providers. The last two colloquiums attracted over 100 attendees each and have featured Business Idea Pitching Competitions, high profile panel discussions (on promoting entrepreneurship and technology commercialization in Central Florida and on raising capital for start-up ventures in tough times, respectively) and experiential key note addresses from successful local technical entrepreneurs.

The “Bootcamps for Entrepreneurs” an educational outreach program initiated by UCF’s College of Business Administration have already graduated over 150 potential entrepreneurs. The “Excellence in Entrepreneurship” program has been held twice a semester and has seen increasing enrollments since its inception.

The three course program in Engineering Entrepreneurship, which takes engineers and trains them to be entrepreneurs, has been adjudged by the National Collegiate Inventors and Innovators Alliance (NCIIA) as “well-planned entrepreneurship course with solid projects and a good sequence,” and has been awarded the NCIIA Entrepreneurship Course and Program Development grant of $15,500. Entrepreneurial Teams (E-Teams) from this course were awarded E-Team grants totaling $32,500 by the NCIIA to commercialize the highly innovative and the patented “Zip Vac Bag” and “Floatation Flood Wall” technologies during the first two terms of the course. The Zip Vac Bag E-Team won major Business Plan Competitions in the nation including invitation to present at the NCIIA National Conference, Runner-Up in The C-E-O (Collegiate Entrepreneur Organization) competition and Winner of the Howard J. Leonhardt International Business Challenge in Miami.

Additionally, there have been a number of other technology commercialization initiatives that have emanated from the three-course program such as: Plasmonia (proliferation of space technology to produce ultra-pure H2), Zone Hitter Adjustable Batting Tee, Air-Foil Curved Efficient Fan Blades for AC units, Travel Air Filter, Parking Slot Locator, etc. The three-course Engineering Entrepreneurship program received very favorable evaluations from the students that completed the course. The need for more coverage of Entrepreneurial Finance topics was cited as a major area of improvement for the program.
In 2002, UCF was awarded the $600K NSF Partnership for Innovation Grant for establishing CENTECOM (CENter for ENTrepreneurship and TEchnology COMmercialization) a regional partnership with the University of South Florida, Florida Tech and Florida A&M University. This $600K grant was matched by $200K from the Florida High Tech Corridor. CENTECOM activities have helped UCF proliferate its Entrepreneurship program beyond Orlando, along the I-4 corridor from Tampa to the Space Coast.

In 2002, UCF was awarded a $50K Kauffman grant for increasing Entrepreneurship awareness, organizing Business Plan Competitions and for activities of the Student Entrepreneur Society. In 2003, UCF was awarded another NCIIA grant for a program to support cross-functional E-teams, and interns working with the UCF Technology Incubator companies.

**Impact of UCF’s Entrepreneurship Initiatives on Central Florida**

In its Technology Administration Report released April 2003, the US Department of Commerce ranked the UCF Technology Incubator among the Top Ten Best-In-Class Incubator Programs in the country for employment growth and sales revenue growth.

UCF’s initiatives in teaching Entrepreneurship and the activities of the UCF Technology Incubator have had a contagious impact on other universities in Central Florida, some of which have had their own Entrepreneurship programs. There is a lot of synergy and co-operative collaboration between these universities through the activities of the NSF-funded CENTECOM Center for Entrepreneurship and Technology Commercialization) at UCF. The UCF Engineering Entrepreneurship Colloquiums have been attended by representatives of other schools such as the Rollins College in Winter Park, University of South Florida in Tampa and Florida Institute of Technology (Florida Tech) in Melbourne. Florida Tech students have participated in the UCF Business Plan pitching competitions. The UCF Technology Incubator has played an advisory role in the setting up of the Florida TechStart Business Accelerator in Melbourne. The success and the enthusiasm generated by the Entrepreneurship Programs at the local universities, has even inspired the local community colleges such as Brevard Community College to initiate Entrepreneurial Internship programs.

The Central Florida Technology Partnership which was established in 1999 as a collaborative public/private sector effort to build and enhance the Central Florida Technology community has identified Entrepreneurship as one of its eight focus areas. Its goal is to encourage the creation and growth of new technology companies through synergistic activities of the UCF technology Incubator, the National Entrepreneur Center, Rollins College Entrepreneurial Initiative, and Network of Business Assistance Providers.

The Florida High Tech Corridor Council which is co-chaired by the Presidents of the University of Central Florida and University of South Florida has the mission to attract, sponsored a variety of projects geared at accomplishing its mission including providing matching funds for university and business research & development projects. A number of local high tech entrepreneurs have availed of this funding opportunity through matching Small Business Innovation Research (SBIR) grants. The UCF Technology Incubator conducts seminars on SBIR grants and other grant funding opportunities.
Over the past few years since its inception, the Council has provided $30 million to more than 345 projects with more than 175 corporate and institutional partners. This investment has resulted in the attraction of more than $60 million in matching funds for a total of more than $90 million invested in Corridor research projects. This has also led to a variety of patent applications and royalty agreements between the two universities and their partners. A study by TaxWatch, a state watchdog group, retain and grow high tech industry to Florida’s High Tech Corridor in six target sectors: Aviation & Aerospace, Information Technology, Medical Technologies, Microelectronics, Modeling, Simulation and Training and Optics & Photonics. The Council has revealed that for every tax dollar invested in this initiative, approximately three dollars have been generated in Florida’s economy.

The tremendous impact of UCF’s Entrepreneurship initiatives were very much evident by the large attendance at the NCIIA/Kauffman - sponsored “Invention to Venture Workshop”, which was hosted by UCF in November 2003. The attendees included students and high tech entrepreneurs from all over Central Florida, including Tampa Bay and the Space Coast area. The EBN (Emerging Business Network) meetings organized by the UCF Technology Incubator and its affiliate organizations such as TOPIE (Team of Professional Innovators and Entrepreneurs) are drawing attendees from all over Central Florida, thus making Orlando a hub of high tech entrepreneurial networking activity.

Conclusions
The three-course program in Engineering Entrepreneurship and the activities of the UCF Technology Incubator have yielded impressive results thus far. There is a culture of entrepreneurship that has been created on campus and in the Central Florida area, and this has resulted in the successful launch of a few high tech start-ups. There is increased awareness of the potential benefits and opportunities from Technology Commercialization. All these successes point to the fact that Entrepreneurship skills can be learned and acquired through a multifaceted Entrepreneurship program. Entrepreneurship programs not only result in start-up companies, they also promote intrapreneual culture and attitudes in established organizations. With their creative product and technology ideas, engineers are excellent sources of high growth-potential entrepreneurial ventures. By creating an environment that fosters entrepreneurship, this resource of engineering entrepreneurial creativity can be tapped to create investable start-ups and have a positive impact on the local economy. The tremendous impact of UCF’s entrepreneurship initiatives on entrepreneurship programs at other local universities and in transforming the Central Florida area into a hub of high tech entrepreneurial activity is a testament to the potential of such programs.

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TOM O’NEAL is Associate Vice President for Research at the University of Central Florida (UCF) and CEO and Director of the UCF Technology Incubator, which he founded in 1999 in the Central Florida Research Park. Tom has also assisted in the formation of several spin-off companies for technologies developed at UCF and has been influential in establishing partnerships for the Incubator both with the University and with the community. Tom received his BSEE from the University of South Florida, and MS in Engineering Management and MBA from the University of Central Florida. He is currently finishing up his Ph.D in Industrial Engineering.
I recently read that a disproportionate number of entrepreneurs went to school for engineering. I am considering starting a company when I get out of school. I'm wondering how common this is in the field in general, who's considering (or already is) doing this themselves, and what are some bits of advice you can think of that someone considering this path should know? Without standard measures of entrepreneurship, private and public decision makers cannot properly evaluate a region’s entrepreneurial activity or assess ways to spur faster economic activity. Ideally, two distinct measures of entrepreneurial activity would set critical benchmarks. The first would assess the quantity, or breadth, of entrepreneurial activity across a region. Depth reveals the value these foundations add to the local economy and offers insight into whether a region’s entrepreneurs are reaching the frontiers of the marketplace. This section first describes entrepreneurs and then discusses why they are important to regional economies. Next, it introduces two new measures of entrepreneurial breadth and depth. Meanwhile, investors, entrepreneurs, and I talked to them about things like finding sustainable business models and offered encouragement—and skepticism—when it was needed. One team from Yale, called Red Ox, was working on electrochemical technology to desalinate brine, the salty wastewater that results from a number of industrial processes. The researchers came into the program thinking that desalination plants would jump at the chance to update their technology. After talking to dozens of potential customers, however, they learned that it would take years—even decades—for those water plants to be able to upgrade their facilities. So the team started contacting people in other sectors. It identifies managers’ attitudes towards the engineer and reveals the real factors that can explain the policy of hiring senior technicians in the Tunisian Cap-Bon industry. The sociological analysis of the representation of the industrial company leader on the issue of executive recruitment engineers had helped to highlight the risks of driving performed changes, the discrepancy between managerial objectives and how implement decisions. This paper aims to investigate a new perspective that can incrementally analyze framework of entrepreneurs’ representations with regards to engineer image. It identifies managers’ attitudes towards the engineer and reveals the real factors that can explain the policy of hiring senior technicians in the Tunisian Cap-Bon industry.