Florida Digital Media Education Coordinating Group
Graduate Curriculum and Research Committee
Report, November 27, 2000
Gerhard X. Ritter, Chair

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This committee was tasked to pursue six objectives:

1. Identify existing *graduate* programs or tracks related to digital media within the SUS and independent sector.
2. Identify *major* research being conducted which relates to digital media.
3. Identify common core course requirements (if any) which need to be included within various graduate programs.
4. Propose mechanisms for transfer of technology from academic research into the business sector.
5. Propose mechanism for the creation of internship opportunities with Florida based corporations.
6. Identify business sector users and creators of digital media technology outside the entertainment industry.

The outcome of these tasks are summarized below. The outcome is intended as the contribution of this committee to the overall draft plan of the Digital Media Education Coordinating Group.

Task I: Identify Existing Graduate Programs or Tracks

Digital media technology represents a significant growing sector of the U.S. economy and comprises many facets of current manufacturing, medical, military, and entertainment technology. Generally speaking, digital media technologies are associated with computer-based systems capable of representing various aspects of real world objects and environments through the effective application of multi-modal information. The current explosion of these multi-media digital technologies into virtually every aspect of human activity associated with entertainment, education, commerce, communication, science, and engineering attests to the importance of these technologies. The very nature of these technologies requires that future development of these technologies involve researchers whose educational backgrounds span more than one discipline and have a substantial computer science/engineering background.

Based on this brief background analysis of digital multi-media technology, a list of graduate programs in the SUS is being established that currently trains the next generation of a highly skilled digital workforce. This list is divided into two components. The first component lists those programs that are truly interdisciplinary, while the second component lists those programs or tracks that are related to digital media.

1.1: SUS Interdisciplinary Digital Media Graduate Programs

Interdisciplinary programs are those that require interaction between faculty and students from two or more distinct departments and colleges such as engineering and arts or computer science and broadcasting. Courses in such programs are typically housed in several departments and colleges.

University of Florida

1. Master of Science in Computer Engineering with a concentration in Digital Arts and Science
   With BOR approval, this will become UF's MS in Digital Arts and Science

2. Master of Arts in Art with a concentration in Digital Arts and Sciences (offered in Fall 2001)

With BOR approval, this will become UF's MA in Digital Arts and Science

1.2: SUS Digital Media Related Graduate Programs

These are programs that are closely related to digital media training, but are not interdisciplinary. They are solely housed in a single department and college.

University of Florida

1. MFA with concentration in Graphic Design, Creative (Digital) Photography, or Electronic Intermedia
2. MA in Mass Communications with specialization in Advertising, Communications Research and Telecommunication
3. Ph.D. in Mass Communications with specialization in Advertising, Communications Research and Telecommunication
4. MA and Ph.D. in English with specialization in Film and Media Studies

Florida State University

1. MS in The Interactive and New Communication Technologies
2. MFA in Digital Arts
3. MS in Information Studies

University of South Florida

1. MFA with concentration in electronic media
2. MA in Mass Communication
3. MEd and Ph. D. in Instructional Technology
4. MA with components in web design and web management

Florida Atlantic University

1. MFA in Graphic Design
2. MFA in Computer Arts
3. MS in Electrical Engineering with concentration in Digital Transmission Techniques

Florida International University

1. MS in Broadcast Journalism
2. MS in Television Production/Directing
3. MS in Television Management

Florida A&M

1. MS in Broadcast Journalism

1.3: Digital Media Related Graduate Programs Currently Under Development

University of Central Florida

1. Ph.D. in Text and Technology
2. MS and Ph.D. in Simulation

Florida A&M

1. MS in Graphics Communication

University of North Florida

1. MS in Graphic Design

In addition to these programs focusing on digital media. There are obvious graduate degree programs that play a vital support role in digital media technology development. These are the MS and Ph.D. degrees in computer and information science, computer engineering, electrical engineering, and management and decision information science. As these programs exist (at least at the master's level) at basically all SUS institutions, they are not listed in this report.

Task 2: Identify Major Digital Media Research

The research considered here is focused on defining, creating and advancing digital media technology for applications in the entertainment industry, science and medicine, manufacturing, and education. By its very nature, such research exhibits synergy between such diverse fields as the arts, sciences, and engineering.

University of Florida

1. Interaction between UF's Digital World Institute (UFDWI) and UF's Brain Institute in the area of anatomical shape modeling, visual reconstruction, shape matching, and shape recovery from 2D and 3D digital data. This includes multi-modal data obtained from MRI, CT, FMRI, and PET. This research is supported by NSF, NIH and DoD, and exceeds $4 million.

2. The Interactive Media laboratory at UF's College of Journalism is engaged in the design and production of web-based content, and the local PBS television affiliate (WUFT-TV) which serves as a laboratory for student instruction as well as a professional station and, thus, provides a "real-world" arena in which to implement experimental digital formats. The college also is engaged in conducting research in digital technologies, especially the development of management and programming approaches related to the implementation of digital television as mandated by the Telecommunication Act of 1996.

3. UFDWI researchers are supporting UF's Engineering Research Center for Particle Science and Technology (ERC) efforts in terms of simulation, modeling and visualization. The ERC is funded by the National Science Foundation (NSF) with a grant that will eventually provide more than $60 million over 11 years. The UF ERC is one of 25 NSF engineering research centers, and is the only one dedicated to particle science and technology. Particle technology deals with the production, handling, and use of a variety of wet and dry particles. Particle science has a $1 trillion impact on the advanced materials, environment, chemical, mineral, energy, agriculture, pharmaceutical and food processing industries each year. The center's purpose is to advance fundamental knowledge about particles and develop innovative technologies for products and devices that will enhance the competitiveness of U.S. industry, benefit the economy, and contribute to the environment and public health. The center will accomplish this through interdisciplinary research, technology transfer, and education.

4. UF's College of Fine Arts Electronic Intermedia Program: Electronic Intermedia investigates time-based technologically-related media as a fine art form. This is a broad-ranging field, involving many approaches and combinations of approaches, including video, sound works, kinetic sculpture, installation, computer, and performance art. The program benefits from and facilitates connections to other disciplines within a diverse state university such as the University of Florida. Video is also treated as the precursor of the present and future digital realms of multimedia, digital video and interactivity. In this sense the area is seen as a matrix of art and technology that includes computer horizons as well as the employment of other electronic or mechanical devices. Artworks may range from the material, such as in sculptural installation, to the ephemeral as in computer-based projects.

5. The Center for Data Intensive Science (CDIS) engaged in discovery, development, dissemination, and education regarding the methodologies, algorithms, software, tools, and technology critical to qualitatively new modes of discovering and extracting scientific knowledge from massive, internally complicated data collections. Data intensive specialties are growing rapidly in number and variety. CDIS participants represent a major sub-

set: high energy physics, nuclear physics, whole-sky astronomical digital surveys, gravitational wave searches, synchrotron radiation studies, climate modeling, systematic satellite earth observations, molecular genomics, 3D whole organism scans, proteomics virtual reality simulations, digital archiving, and molecular and materials modeling. Participants come from Computer Science, Computational Science, Engineering, Physics, Astronomy, Chemistry and Biology. This month UF was awarded $11.8 million from NSF for providing the network infrastructure for CDIS.

University of South Florida

1. USF's Center for Digital and Computational Video facilitates research on various aspects of digital video and digital television. Reflecting the interdisciplinary nature of the center, much of this research is collaborative across departments and units. As shown below, a bold and broad-swath of DTV topics are encompassed by more than 20 faculty and staff members affiliated with it, and the research students.

Applications	Technologies	Mathematics
Telemedicine	Microelectronics	3D object models
3D medical imaging	Digital TV Technology	Video motion models
Digital TV	Networking (Internet2)	Transformations
Distance learning	Telecommunications	Lattices
Virtual art & design	Signal processing	Morphology
Remote collaboration	Software	Algorithms

2. DCV Conference: The first in the State of Florida, the annual international workshop was sponsored by USF's CDCV, which addressed digital television and other aspects of digital video. The first International Workshop on Digital and Computational Video in 1999 was attended by more than 50 participants from six countries. The presented papers addressed theories, implementations, and applications of digital video and digital television. Two keynote speeches highlighted the workshop: "Entering the visualization age", and "Digital video opportunities for the next 10 years". The workshop advisory committee spans 10 important leaders in the field, from industry and government, hailing from U.S., Japan and Germany. The sequel, to be held in February 2001, is expected to bring twice as many participants from across the globe, to further add to the prestige of the State of Florida and USF in the twenty-first century digital television technology and its diverse applications.

   Specific DCV Conference research on digital television includes:
   (a) Video compression and coding
   (b) Standards conversion, for example from HDTV to/from SDTV
   (c) Picture error amelioration/concealment
   (d) Transmission technologies for DTV, including the latest COFDM
   (e) VLSI architectures for video and DTV
   (f) Fast color conversion from RGB to HSI
   (g) The futuristic stereo vision and 3D reconstruction
   (h) Microchip 'parallel architectures' for medical imaging and video
   (i) Video signal processing

3. USF's Center for Communications and Signal Processing addresses Communications, Signal Processing, Imaging and Video, Networking, and Microchip Design.

4. Researchers in USF's Center for Microelectronics Research are actively investigating interconnect technology and systems, i.e. the design, integration, and test technologies for the high-performance circuits and systems. Specific design efforts have been focused on the development and rapid prototyping of large-scale integrated, systems, low-power circuit optimization, and techniques for defect and fault tolerance. Companions to these efforts have been CMR's research test technologies for high performance systems, including major contributions in the area of high-speed digital test. Digital circuit testing at high speeds in excess of 1.6GHz has been recently demonstrated at CMR through the combination of custom test hardware and a commercial VLSI test system.

5. USF's microwave and wireless research group, Department of Electrical Engineering, has interests and expertise that ranges from systems to component level design and device modeling.

6. USF's high-speed communication networks research group, under the guidance of Professor Ravi Sankar, Department of Electrical Engineering, has been conducting research in the general area of high-speed network design and analysis. At present, several graduate students pursuing projects ranging from high performance and fault tolerant network (LAN/MAN/WAN) analysis, architectures and protocols for broadband networks (ATM) supporting multimedia traffic, to the study of wireless personal communication services (PCS) systems.

7. USF's College of Engineering offers graduate courses on "Digital Video and Multimedia", "Digital CMOS/VLSI Design (i.e., microchip design –which includes on an optional basis instruction and/or projects on digital TV and other signal processing architectures)", "Broadband Communication Networks (which stresses networked video), and "Digital Signal Processing". The students taking these courses typically follow the Communications and Signal Processing track, or the VLSI Design track. Term-papers/projects in these courses often include 'HDTV', 'Standards Conversion', 'Rate Control for Networked Video', 'Video Compression', '2D and 3D filtering', 'Stereo Vision', 'Parallel VLSI Architectures for Video Motion Estimation', etc.

8. WUSF-TV is building a new facility, which is expected to be operational by the middle of 2001, and is planned to be fully digital. This facility is designed to support USF production needs as well as to provide full digital services to its community of license. In particular, a pioneering experiment is under way in partnership with Washington State University toward transmission and distribution of programming over Internet2. The facility will also be available to the research students across the university, in particular to the students involved in DTV work in the College of Engineering, and the media students in the School of Mass Communications. WUSF-TV commands the third largest viewer constituency in the State of Florida among all of the public television stations.

Florida Atlantic University

1. A high definition camera has been developed that produces color images with 1920 x 1080 pixels progressively scanned at 60 frames per second (FPS). The camera uses two recently developed CCD sensors made by Eastman Kodak. One sensor detects luminance detail and is progressively scanned at 30 FPS. The other has color stripe filters and is progressively scanned at 60 FPS. The second sensor is used to derive color and low resolution luminance. Because of the progressive scan, the vertical and horizontal resolution is 1000 TV lines per picture height. Motion rendition is excellent. The sensor and processor are programmable so that all of the scan formats that are likely to be used in the near future can be produced by the camera.

2. Subband Coding Compression System for Program Production
   As program production moves to higher definition and digital recording it would be desirable for cameras to use enough digital compression to allow 525-line digital recorders to be used for high definition recording. Compression
   using 2-D subband coding has many advantages for this application. An experimental, programmable real-time system that can perform both 2-D and 3-D subband coding has been constructed that can evaluate this technique.

3. Simple Scalable Video Compression Using 3-D Subband Coding
   3-D subband coding as a video compression system is particularly well suited for use where inexpensive, simple encoders are needed. Program production or teleconferencing are good examples. Since the system uses octave width bands it is inherently scalable. Real-time programmable hardware has been built to process video at various bit rates using this technique. The results of these tests will be demonstrated.

Florida International University

1. FIU DIGITAL LIBRARY Program
   A University-wide digital library initiative Project began in 1997 as a cooperative project between Administrative Systems, Instructional Media Services, and the Libraries includes collections of images, sound, video, and

text.
http://www.fiu.edu/~library/staff/catalog/poster/tsld002.htm

2. CREATING MULTIMEDIA FOR WEBCT PROGRAM
   Creating Images for WebCT Workshop Description: This workshop is designed to introduce WebCT course designers to several types of multimedia that can be used in WebCT courses.
   http://www.fiu.edu/idc/workshops/creating_multimedia.htm

3. CENTER FOR ADVANCED TECHNOLOGY AND EDUCATION
   Research in the CATE center related to the area of digital media include:

   - Human-Computer Interface Research for universal Access
   - Spatial Imaging for 3-D Media and 3-D Modeling

4. HIGH-PERFORMANCE DATABASE RESEARCH CENTER
   Spatial Image Databases
   Medical Resource Reviews
   Arial Photography

   Among the many objectives of the HPDRC, some that are related to the digital media area include:
   - Using NASA Regional Applications Center (RAC) -created, *in situ* and ancillary databases to support the calibration and validation of NASA satellite data.
   - Incorporating RAC applied research results into shareable global environment knowledge bases.

   The NASA Regional Applications Center is a reseller for SpaceImaging, SPOT Image, and Orbimage data products. Any satellite imagery available from any one of these data providers can be packaged in TerraFly through the NASA RAC. Currently, you may use the online TerraFly web tool to fly over USGS Aerial Photography of South Florida and Landsat satellite Imagery of the entire state of Florida

   TerraFly: is an interactive vehicle for flying over remotely sensed data (e.g., TerraFly runs on any standard browser such as Internet Explorer (version 4.0 or newer) and Netscape (version 4.06 and newer).

   TerraFly is designed as a tool for navigating and manipulating virtually any type of remotely sensed data, making this data available to the average user over the internet. The data that is currently available on-line is: USGS Aerial Photography for Dade County, FL, Expedia Maps for Central and South Florida, LandsatNV (natural view) for the state of Florida and multi-spectral Landsat for the State of Florida. Other data will soon be made available.

Florida State University

1. The Film School operates its main studios in Tallahassee and its music recording stage and back lot property in Quincy, Florida. Taken together, these facilities are among the largest and best equipped in the world devoted wholly to film education. It is the only school in America that pays for all of its students' production expenses, including their thesis film. Altogether, over 150 complete sound films are made by students each year, of which 10-12 are thesis films. In the MFA program, 24 students are admitted to begin a six consecutive semester intensive filmmaking program.

2. The Center for Music Research was founded in 1980 to bring together the already strong research component of the School of Music with its newly-created computer facilities. The purposes of this union are to create effective computer music environments for students and faculty and to form a research system that blends the best human characteristics of the researcher and teacher with the technological advantages of computers. The missions of the CMR are related to the central goal of bringing the best
   available technology and research to music as an art form, as an educational discipline, and as a revealer of the workings of the human mind. Its staff is dedicated to the premise that music deserves the finest scientific inquiry that modern technology is able to support**.**

University of Central Florida

High-Definition Displays. Various faculty in the School of Optics/CREOL and the College of Engineering are working on topics related to high definition displays, including: mechanical and optical methods for the manufacturing of flat panel displays, and laser sources for digital projection displays. For instance, Michael Bass (School of Optics/CREOL, Physics and EECS) is developing a direct write, 3-D, 3-color display technology using frequency upconversion from two separate IR laser sources. This will constitute the next generation Digital TV requiring even higher data rates than today's HDTV standards.

High Density Information Storage. Leon Glebov (School of Optics/CREOL) has developed glass technology allowing multiple, high density, permanent holograms to be stored. This has allowed him to make a variety of optical elements from lenses and mirrors, to narrow band frequency filters and components of importance for optical scanners (angle multipliers). In addition, holographic storage has the potential to store multiple digital TV movies on a single cubic centimeter of glass. Many of these devices can have significant impact on the development of digital TV systems.

High Speed Transmission Systems. Ron Phillips (Florida Space Institute) leads the Photon Satellite Laser communications satellite experiments, which investigate the use of lasers for very high speed ground-to-satellite communication. Such optical channels could transmit many times the number of digital TV channels as can be transmitted by traditional microwave means.

TeraNex, is using highly parallel computing systems derived from Lockheed-Martin's military imaging technology for motion compensated de-interlacing converters (and other converters) for various digital video formats including HDTV. He is also developing an image quality metric for in-service quality assessment.

Video Image Compression Systems. Erol Gelenbe (EECS) studies image compression via adaptive frame subsampling and image segmentation; MPEG-4 related systems; and is also developing quality of service evaluations for video transmission over heterogenous networks. Takis Kasparis (EECS) has conducted research concerning image encoding using approximate trigonometric expansions, and has a variety of interests concerning realtime signal processing. Amar Mukherjee (EECS) conducts research on algorithms for image and text compression.

Virtual Imagery. The Institute for Simulation and Training (IST) is a world leader Peter Delfyett (School of Optics/CREOL) has developed an optical link based on a modelocked semiconductor which generates multiple wavelengths simultaneously, with demonstrated bandwidth of 165 Gb/s and potential bandwidth of 800 Gb/s. These links can handle over 30,000 compressed digital video channels.

Patrick LiKamWa (School of Optics/CREOL and EECS) is developing all-optically controlled data switches and routers allowing for ultrahigh speed fiber optic routing without the need to convert to electronic signals.

Guifang Li (School of Optics/CREOL and Physics) is sending microwave on optical links by high frequency modulation of diode laser outputs. This technology is of use, for example, for local area networks requiring high datarate information capacity as would be needed in digital TV signals.

Simulation, Graphics and Machine Vision. Niels Lobo and Mubarak Shah (EECS) conduct research on machine vision, which includes many algorithms that are directly relevant to MPEG-4 with its requirement for image segmentation. Ratan Guha, Mustafa Bassiouni, Charles Hughes and Michael Moshell (EECS) conduct research concerning computer graphics, virtual environments and networked simulation – all of which are expected to play roles in the interactive digital televisions systems of the future.

Video Conversion Systems. Harley Myler (EECS), working with Orlando firm in the development of technology for networked simulation and applications of virtual reality. Digital television will involve an increasingly rich mix of totally synthetic imagery (e. g. *Toy Story*), real-world video images and hybrid mixtures of the two. IST is developing extensions to the universal OpenGL software environment for modeling and simulation which will support mixed video and graphics. A project sponsored by Evans and Sutherland will involve quantitative measures of image correctness.

Jannick Rolland (School of Optics/CREOL and EECS) is developing innovative systems for sharing real and synthetic medical images and live video via Internet-II. Her NIH-sponsored project involves collaboration between physicians in teaching and research hospitals across the country who use a combination of realtime graphical simulation and radiographic imagery to teach principles of orthopedics.

J. Michael Moshell, Charles Hughes and Guy Schiavone (IST, EECS, Digital Media) and Valerie Sims (Psychology) are conducting a project sponsored by U. S. Army STRICOM to develop novel techniques for managing Level of Detail in trees and plants in complex virtual forest scenes. John Weishampel (Biology) won a National Science Foundation Career Enhancement Award to extend this work to the modeling of rain forests and the development of a virtual rain forest display for science centers.

Public Simulation Network. Chris Stapleton of IST, Film and Digital Media has organized the Public Simulation Network project which develops reusable simulations for science centers. The first funded project (joint with Orlando Science Center, J. Michael Moshell and Charles Hughes) is MeasureMe, which involves measuring human parameters as input for a lesson in statistics. The Virtual Rain Forest (above) is the second PSN project; others are under development. PSN is co-sponsored by the Amusement and Music Operators of America (AMOA), the nation's largest association of coin-op entertainment operators.

Video Servers. Min-You Wu (EECS) has developed a clustered video server which can deliver up to 228 on-demand MPEG-1 video streams. Kien Hua (EECS) has developed three new multicast techniques to support Video on Demand (VoD), exploiting "last-mile" technologies such as xDSL and cable modem.

Novel Media. Charles Hughes and Michael Moshell (EECS, Digital Media), Barry Mauer and David Gillette (English) and Chris Stapleton (IST, Film, Digital Media) are conducting the *Earth Echoes* Project, which uses portable electronic devices to capture oral history in Central Florida communities and make it available to future visitors to those sites via wireless technology.

Florida A&M

NSF has funded Florida A&M $3.5 million to develop web courses/programs for the Sciences, Technology, Engineering and Mathematics (STEM).

University of North Florida

The Applied Global Systems Laboratory at UNF's College of Computing Sciences and Engineering is engaged in the research and development of Real Time Internet Geographic Information Systems (GIS). Areas of focus include "smart" field instrumentation, embedded systems, Personal Digital Assistants, Global Positioning System, wireless communications, digital imaging and Internet GIS Servers. Information gathered in the field including multimedia data types is made available in real time via the Internet

Task 3: Identify Common Core Course Requirements

The State of Florida does not require common core courses for a particular graduate degree program. As digital media spans a wide range of disciplines and generally consists of different tracks— e.g., digital arts and science, digital film and media studies, etc. — we recommend avoidance of standardization of courses or program core requirements. Refraining from standardization aids in program flexibility in response to the rapid changes encountered in this discipline. However, because of the nature of this discipline we recommend that digital media graduates have a solid foundation in computer science. This does not mean a degree in computer science, but only a solid background in computer programming.

We also recommend the establishment of a digital media education board consisting of representatives from the SUS and private Florida universities. The board would meet periodically in order to discuss and coordinate issues concerning digital media graduate education and curriculum.

Task 4: Proposed Mechanisms for Transfer of Technology

In general, most universities have technology transfer offices in existence and these have proven very successfully in the transfer of technology from academia to the private sector. Additionally, there are the transfer facilities of STAC and GCATT that can be used for this endeavor. However, the traditional university-industry transfer model consisting of joint research and development projects sponsored by industry is the model of choice for university research faculty. It has proven extremely beneficial in fostering relationships between departments, students, and industry. Universities and small businesses often leverage federal funds for these joint efforts. The State needs to follow this example by providing incentives and funds for such collaborative efforts. Such incentives have proven successful in previous endeavors such as the I-4 Corridor Initiative and the Florida High Tech and Industry Council grants. The availability of statewide resources of the above examples, but focused on digital media technology is highly recommended.

In addition to these mechanisms, a yearly showcase conference where faculty and students can exhibit and present their latest breakthroughs and innovations in digital media technology is another excellent way of alerting industry to available technology in the SUS system.

4.1: Recommendation for a Florida Center for Digital Media Research

One way technology transfer occurs is through forums and workshops. To facilitate this type of technology transfer and to bring rapid global visibility to Florida's digital media research efforts and technology development, we recommend the creation of a Florida Center for Digital Media Research.

The Center's role is to provide an international forum for top researchers and executives from academia, industry and federal agencies involved in digital media research and technology applications. One function of the Center is to bring together distinguished digital media researchers for three to four day seminars and workshops. Ideally, there should be at least one such seminar or workshop per month, each focusing on a distinct area of digital media research and technology. The outcomes of these workshops will be used to promote and enhance digital media research across SUS campuses and to make Florida a world leader in digital media research.

In addition to hosting seminars and workshops there will be a community education and outreach effort. Interactive programs for public schools and the general public designed to educate and inform and to provide a forum for feedback should become an integral part of the Center.

In order to facilitate digital media technology to industry the Center will also be tasked to:

- Support the expansion of the digital media industry in Florida
- Strengthening SUS ties with industries and agencies such as Disney MDM, Universal Studios, the Harris Corporation, Lockheed Martin, Motorola, the various DoD branches, etc.
- Channeling graduating students to these Florida industries

The Center should be governed by a board consisting of representatives from each of the SUS institutions. This board elects a director from its membership who will be in charge of administering the daily affairs of the Center. The director will serve a two-year term and can be re-elected for at most one more two-year term. This type of administration is necessary in order to avoid turf battles between the SUS campuses. For the same reason, it is necessary that the Center is not associated with any particular campus but that each campus has fair representation in determining the direction of the Center. Most SUS schools have strengths in some areas of digital media research. Joining these strengths will accelerate the global visibility of the Center while associating the Center with a single SUS campus will result in just another low visibility university center.

Task 5: Proposed Mechanism for the Creation of Internship Opportunities

The general feeling among committee members was that there is no lack of demand for interns form the business community. Although industry most often look for undergraduates, they could be induced to provide internships for graduate students as well.

Two problems with internships have been identified. The job market for undergraduates majoring in IT related fields is extremely good. Thus, many undergraduate students skip internship opportunities in order to concentrate on graduating faster and enter the job market. This actually leaves internships unfilled or filled by less qualified students. Graduate students concentrate more heavily on their research during the summer and are, therefore, less willing to take time out for internships. In addition, top graduate students are usually supported by their faculty mentor's research funds or fellowships. This creates another barrier for getting involved in summer internship programs.

One way around the barriers discussed above is to require some sort of internship for graduation in digital media technology. However, such requirement can be counter productive in various instances. We recommend that industry make internships more attractive to undergraduates. This can be accomplished by representatives visiting campuses and explaining the pros of their programs as well as providing special incentives and free summer housing. For graduate students, a proven method is to provide small grants to faculty for supporting research of common interest. These grants include internships for the faculty's graduate students.

Task 6: Identify Business Sector Users and Creators of Digital Media Technology

There exists an extremely large business sector for digital media outside the entertainment industry. In Orlando, the simulation industry is the largest such market. The following is but a partial list of the business sector:

SGI (Silicon Graphics) (Orlando)
3dfx Interactive, Inc.(Orlando)
Harris Corporation (Melbourne)
Harbor Branch Oceanographics Institute (Ft. Pierce)
Vcom3D (Orlando)
Hypercube, Inc. (Gainesville)
Adjoined (Miami)
Nichols Research– Eglin Branch
Nielson Media (Dunedin)
Sun Microsystems (Orlando)
Advertising
Health Fields/Hospitals
Financial Institutions
Motorola
ECI
Lockheed-Martin

We recommend including the study being undertaken by Jud French for the Central Florida Economic Development Commission. This study will be more complete than what the committee can provide within its limited time frame.