Impacts of Florida Modeling, Simulation and Training

A Research Report Sponsored by the Florida High Tech Corridor Council
for the National Center for Simulation | September 2012

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1.0 | Executive Overview

This report provides a summary of the impacts of Florida's modeling, simulation, and training (MS&T) sector. While the primary focus of the report was upon the sector's economic impacts to the State of Florida, it also covers qualitative and some quantitatively reported impacts to the United States military capability, to our nation's health and medicine, and to society and education. This report was commissioned by the National Center for Simulation under support by the Florida High Tech Corridor Council, Inc.

MS&T has a tremendous economic impact on Florida.

The sector directly employs more than 27,000 jobs with an average approximate annual salary of $69,797. In 2011 the MS&T sector contributed more than 60,700 jobs (direct, induced and indirect) to Florida's economy, more than $4.8 billion to Florida's Gross State Product, and nearly $8 billion in state sales (economic output) activity.

Nationwide, the US Military relies upon Florida MS&T.

Florida MS&T is a unique, critical national knowledge and innovation resource that is the result of almost seventy years of growth and evolution. Almost every soldier recently deployed overseas has been trained on systems developed in Florida. These systems have helped US soldiers to be better prepared than ever before, resulting in the lowest levels of reported injuries and casualties than in any prior engagement. Companies from across the US invest in Florida MS&T research, attend Florida MS&T activities, and leverage central Florida as a "hub" for developing business networks and developing critical technology partnerships.

Florida has been at the forefront of national medical simulation innovation.

Florida hosts the leading national conference on medical simulation, and has been at the forefront of medical innovation for remote surgery, doctor education, trauma response and training, and medical research. Florida technologies have developed some of the first patient and trauma simulators, and Florida researchers are continuing to be at the forefront of medical science that will have global future impact such as Telesurgery and Automatic Surgery.

Lessons from Florida military MS&T are benefitting the education of our children and the safety of our society.

Florida's simulation innovations are being leveraged across the US for improving public-sector emergency response, transportation, and safety. Florida MS&T technologies are also being leveraged to support national science and math education programs.

2.0 | Overview of the Cluster

Modeling, Simulation, and Training - A Definition

Simulation and modeling has applications across almost every academic discipline and industrial sector. Simulation is used for semiconductors and manufacturing, for medicine and economics, for geology and hydrology, for networks and software, and for many types of design and entertainment applications. However, Florida holds a particular niche that focuses on experiential modeling and simulation for the purposes of training and education. Florida's modeling, simulation and training (MS&T) cluster also has a particular strength in aviation, aerospace, military and emergency simulation and modeling technologies.

A Brief History of Florida's MS&T Cluster

Industry experts believe that the global simulation and training industry had its start in 1929 with the development of the "Link Trainer." Although it increased in complexity, this simple mechanical device largely remained one of the few flight simulators for training pilots until the 1960s. An early successor to the Link Trainer – the Navy PBM trainer – was built at Banana River, Florida in 1943 by Bell Laboratories.

Like many of Florida's other technology industries, the MS&T cluster owes much of its development to the state's defense and aerospace industry and the long-standing presence of key military installations. By the late 1940s, a few key US military bases were established in Florida to support the growing national need for aerospace control, guidance and tracking systems, particularly in the development of weapons systems. This included the McCoy Air Force Base, which was a training base located near Orlando that had significant responsibilities during the Vietnam War and the Cold War period (1940-1947, 1951-1975).

In 1949, an interagency agreement was signed between the US Army and Navy to establish the Naval Training Device Center (NTDC) and the Army's PMTRED operations. The Air Force and the Marines joined the NTDC in the late 1960s, and in 1968 the Naval Training Center Orlando was also established (1968-1993). According to Wikipedia,

> *...The newest of three Naval Training Centers in the United States providing training to recruits, as well as being a base for selected post basic training programs for enlisted personnel, NTC Orlando also conducted nuclear power training for commissioned officers and the base had a prominent presence in the area.*

By 1975, the Naval Training Systems Center (NTSC, now the Naval Air Warfare Center Training Systems Division-NAWCTSD) was established, which attracted companies such as General Electric (at Daytona Beach), Scientific Applications International Corporation (SAIC), and Link (which later became Raytheon/E-Systems). GE originally developed visual systems to support the Apollo Lunar programs at Cape Kennedy; later, GE focused on visual systems and consolidated operations in Orlando. Their business units were eventually acquired by Rodan and Martin Marietta (now Lockheed Martin).

By the 1960s the US military's training needs became much more complex with

Major Historical Florida MS&T Milestones

1929	First Link Trainer Flight Simulator
1943	Navy PBM Trainer Manufactured in Banana River, Florida
1940	McCoy Air Force Base established near Orlando
1943	Naval Training Device Center Orlando established
1949	Interagency agreement to establish the NTDC and the Army PMTRED
1960s	Naval Training Device Center moves from Long Island to Orlando
1968	Naval Training Center Orlando established
1982	UCF Institute of Simulation and Training established
1985	Florida's National Center of Excellence in Simulation and Training established
1988	Naval Training Systems Center moves to Orlando, Florida
1988	UCF Institute for Simulation and Training (IST) established
1993	NTSC becomes the Naval Air Warfare Center - Training Systems Division (NAWCTSD) National Center for Simulation established
1996	Air Force Agency for Modeling and Simulation (AFAMS) established
1997	US Coast Guard Liaison established
1999	Joint Advanced Distributed Learning Co-Lab established
2000	Florida Simulation Center established
2001	Marine Corps Systems Command PM Training Systems established and moved from Quantico; UCF Partnership I building completed
2002	ARMY STRICOM reorganized as PEO-STRI
2003	Navy support activity established; Human Performance Center established
2004	FLETC Department of Homeland Security Liaison established; UCF Partnership II building completed
2006	Air Force TSPG joins Team Orlando; Joint Training Integration and Evaluation Center (JTIEC) established
2007	Joint Training Experiment Network Node established
2009	Team Orlando Virtual Presence deployed

Sources: National Center for Simulation, Team Orlando

Florida MS&T

27,000 Jobs

1,000+ organizations

$4.2 billion+ annual Federal budget

the addition of air defense systems, helicopters and the integration of computer electronics into almost every type of military equipment. With these developments, simulation and training solutions became increasingly necessary and cost-effective, and the simulation and training industry became firmly established.

In 1988, the University of Central Florida helped establish the NTSC outside of the naval base through the formation of its Institute for Simulation and Training (IST).

The interagency presence in Orlando, in conjunction with the fact that the NTSC was well funded but understaffed, allowed many small companies to establish and build up quickly to fill the military's need. The majority of these companies were created by retired military personnel and previous employees of such companies as Raytheon, Lockheed Martin Information Services, and SAIC.

> *The Orlando area's remaining military presence is the Naval Air Warfare Center Training Systems Division/Naval Support Activity Orlando, located just East of the city limits in the Central Florida Research Park. The U.S. Army's Program Executive Office for Simulation, Training and Instrumentation (PEO-STRI), the U.S. Marine Corps' Program Manager for Training Systems (PMTRASYS) and the U.S. Air Force's Agency for Modeling and Simulation are also collocated at that location.*

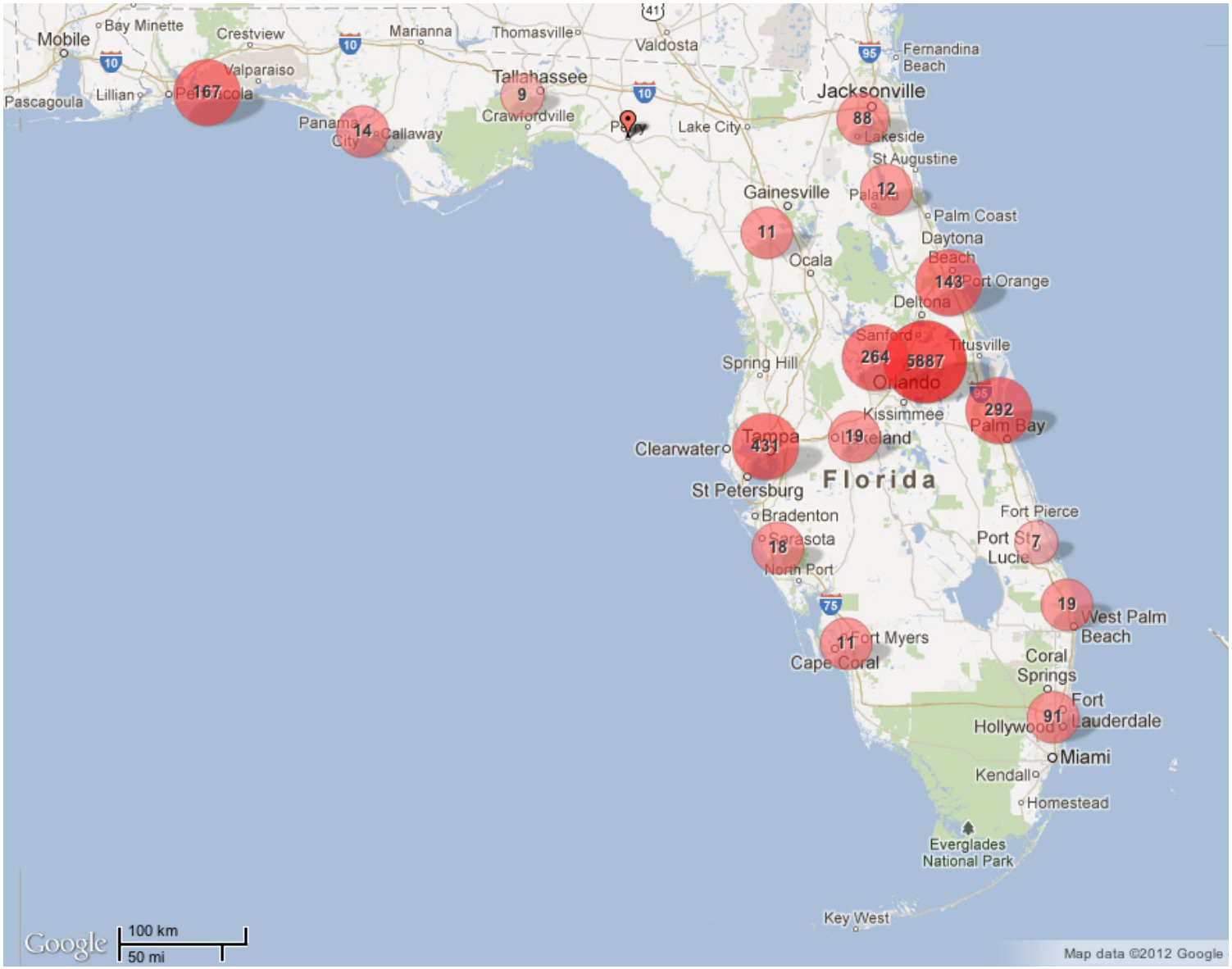
The presence of these bases contributed to the formation of leading international aerospace installations such as the NASA Cape Kennedy Space Center. These installations have also been pivotal in attracting and supporting a core group of specialized high-tech military manufacturers, including Reflectone / BAE Systems, Martin Marietta, and Rockwell Collins.

Florida MS&T Today

Today, companies active in MS&T are present across all major Florida metro areas and nearly every legislative district. The National Center for Simulation currently lists 130 Florida member organizations, and reports that more than 100 have locations in the University of Central Florida Research Park. However, this is just a subset of the many companies across the state that are active in MS&T markets; the National Defense Industry Association (NDIA) lists more than 7,400 individuals at more than 1,000 Florida organizations that participate in the Interservice/Industry Training, Simulation and Education Conference (I/ITSEC) held annually in Orlando (demonstrated by the Florida map on the following page).

Currently, Team Orlando Command organizations employ nearly 2,800 military & civilian personnel in the UCF Research Park, collectively providing budget procurement for more than $4.2 billion in annual US MS&T expenditures. No other Florida industry focuses such a large market opportunity into such a concentrated location and small group of customers, and this it is precisely this economic resource which drives Florida's MS&T sector growth and attracts competition and interest from across the US.

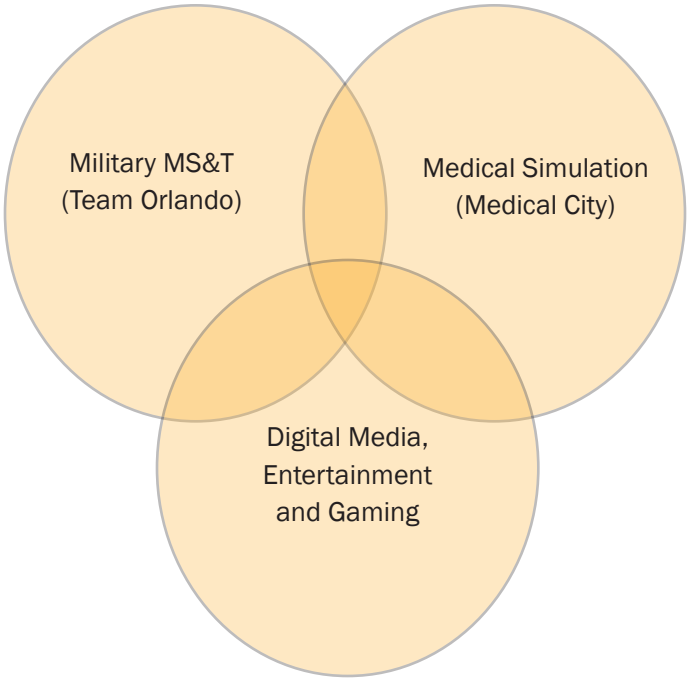
MS&T Companies in Florida



Source: 2011 I/ITSEC attendees and exhibitors, National Training and Simulation Association (NTSA)

Modeling and Simulation Markets

Central Florida supports not just the military MS&T cluster, but at least two other growing industry clusters that are built on complementary technologies and specialized workforces. The overlap among these clusters drives innovation and growth to the benefit of each.



In addition to these clusters, most Florida MS&T companies report being focused on one or more of the following markets.

- Medical, telemedicine, health
- Aerospace, aviation
- Defense, military
- Homeland security, police, fire, emergency
- Entertainment
- Media - television, film, radio, audio, visual
- Transportation
- Education, training

The Future of Military MS&T

As our presence in the Middle East and the Federal defense budget both continue to shrink, the MS&T opportunity actually is growing. MS&T technologies are lower-cost solutions to expensive legacy, hardware-intensive platforms, and are increasingly driven by private-sector innovation and competition versus proprietary military technologies. New soldiers expect to be trained in MS&T environments, and to have access to ubiquitous, on-demand information and training. Private sector medical simulation technology is just beginning to gain momentum, and has potential to eclipse military MS&T in demand and growth. As other US regions suffer from BRAC closures and non-MS&T procurement budgets decline, Florida MS&T will face increasing pressure from competitors to evolve and not lose its key resources.

3.0 | Impacts on Florida's Economy

This study includes a formal estimate of the annual economic contribution of the presence of the MS&T sector to Florida's economy. This was performed using the Minnesota IMPLAN Group (MIG) IMPLAN software (version 3, social accounts model) using a 2010 Florida statewide data model. Primary input data were collected from Team Orlando agencies, educational and research partners such as the University of Central Florida Institute for Simulation and Training (IST).

Economic analysis can be confusing. However, the way our economic software models economic impacts can be very intuitive if we use the metaphor of a tree. There's a lot more to a tree than you can see above the surface; in much the same way, industry activities touch the local economy on different levels. There are three types of impacts we consider – direct, indirect, and induced – and we will relate each of these to how a tree connects to the earth and surrounding landscape.

First, direct impacts represent the actual jobs and business expenditures that take place in the industry sector. Just as it's easy to see a tree's trunk, branches, and leaves, it's relatively easy for most people to see and understand how these direct economic activities are a source of economic activity.

Indirect activities are like the roots of a tree, which reach unseen into the ground. Indirect impacts constitute the local demand for products and services from other companies and service providers (goods, materials, supplies). They are the local vendors and suppliers that receive money from the company for goods and services provided; like roots, they are the feeder system in which local goods and services support the industry, company or project.

Trees have leaves, branches, trunks and roots; but if you have ever pulled a tree or shrub from the ground, you pull up a lot more than clean roots – you also get earth, weeds, grass, bugs and worms and everything else that makes up healthy soil. All of this additional earth and life that depends on the tree is similar to what we call induced economic impacts of a company or project. Induced impacts reflect every person, company, or organization which relies on spending generated by direct and indirect activity. This includes restaurants, retail stores, service providers, schools, real estate, etc. They are job losses and gains by people who have no direct connection to an specific industry, but benefit from the money that industry introduces into the local economy.

Thus, when we speak of economic impact, we speak about the combined contributions of all three types: direct, indirect, and induced together. Thus, our metaphor of economic impact includes not just the tree, but everything that is connected to and dependent upon it.

Direct + Indirect + Induced = Total Impact

We use the Minnesota IMPLAN Group (MIG) IMPLAN software to calculate our impacts; it is one of the most widely used and validated tools available for this type of research. This software works by using documented direct impacts as inputs

to calculate indirect and induced impacts over time. It is based upon federally published industry-by-industry buy-sell (input- output) relationships; how much each industry sells to each other industry to create the total national product. Using this national data, IMPLAN is able to create a national average profile of how much a typical company in each industry must buy, sell, and hire to do its business. It then calibrates its profile with state and local economic, business, tax, labor, and demographic information to generate local models of typical companies in each industry, and how much they must buy, sell, import, export, and hire locally or externally to do their business. As a result, IMPLAN can estimate how direct changes in a local industry trickle through the web of local buy, sell, and hire relationships. The result is a widely accepted and well published model of the spending, employment, exporting, sales and production activities of typical companies in every industry sector, such as medical device manufacturing. This model is calibrated even further by information we can collect on a given company, project, or program's activities, expenditures, and operations.

Definitions for economic terms used in this section are included as an appendix to this report.

3.02 | Economic Impacts

Based on the estimates from the IMPLAN software, each year Team Orlando and Florida MS&T activity contribute more than 60,000 jobs to Florida's statewide economy, and also contributes almost $4.8 billion to Florida's state's Gross State Product. The sector generates more than $3.3 billion in Florida wages, and nearly $8 billion in Florida sales activity. Clearly, MS&T is a significant driver in Florida's economy, especially in technology, manufacturing and technical services

Impact Type	Employment	Labor Income	Gross State Product	Output / Sales
Direct Effect	27,060.8	1,888,772,017.1	2,266,525,721.2	3,906,545,126.1
Indirect Effect	11,682.1	541,461,932.9	877,163,023.9	1,431,585,612.4
Induced Effect	22,010.8	902,776,174.8	1,653,173,252.7	2,645,837,295.1
Total Effect	60,753.7	3,333,010,124.7	4,796,861,997.8	7,983,968,033.5

sectors.

Further, our model estimates that the average MS&T sector wage (direct impacts) is approximately $69,797 (note, this wage level is estimated by our economic software; anecdotally, Research Park tenants report higher average wages). Each year, this combined economic activity generates more than $220 million in collected state and local tax revenue, primarily from indirect business property taxes and sales tax activities.

Description	Employee Compensation	Indirect Business Tax	Households	Corporations	Combined
Dividends	$887,166			$333,045	$333,045
Social Ins Tax- Employee Contribution	$2,055,481				$887,166
Social Ins Tax- Employer Contribution					$2,055,481
Indirect Bus Tax: Sales Tax		$47,920,928			$47,920,928
Indirect Bus Tax: Property Tax		$129,087,040			$129,087,040
Indirect Bus Tax: Motor Vehicle Lic		$585,840			$585,840
Indirect Bus Tax: Severance Tax					$0
Indirect Bus Tax: Other Taxes		$7,856,487			$7,856,487
Indirect Bus Tax: S/L NonTaxes		$13,012,150			$13,012,150
Corporate Profits Tax				$4,950,756	$4,950,756
Personal Tax: Income Tax					$0
Personal Tax: NonTaxes (Fines-Fees			$10,234,830		$10,234,830
Personal Tax: Motor Vehicle License			$1,041,305		$1,041,305
Personal Tax: Property Taxes			$2,376,737		$2,376,737
Personal Tax: Other Tax (Fish/Hunt)	$2,942,647		$427,722		$427,722
Total State and Local Tax	$2,942,647	$198,462,444	$14,080,593	$5,283,801	$220,769,485

As shown on the next page, the industry sectors and occupations most impacted by Florida's MS&T activity include technical and engineering sectors, and commercial and service industrial machinery manufacturing.

Description	Total Employment	Total Labor Income	Total Value Added	Total Output
Architectural, engineering, and related services	20,799.7	1,290,046,820.5	1,311,025,429.5	2,278,232,869.3
Other commercial and service industry machinery manufacturing	3,271.7	316,487,873.3	476,817,426.7	1,103,975,734.1
Food services and drinking places	3,133.4	69,617,046.4	106,342,971.0	191,324,331.8
* Employment and payroll only (federal govt, military)	2,750.0	261,340,516.0	420,465,474.1	446,928,125.9
Employment services	1,968.6	53,095,074.1	57,228,021.7	70,545,521.1
Real estate establishments	1,815.8	32,272,929.5	236,679,339.5	272,786,189.3
Offices of physicians, dentists, and other health practitioners	1,176.7	87,005,282.9	89,848,903.7	143,508,287.9
Wholesale trade businesses	1,059.5	76,923,819.3	137,394,845.4	164,163,705.0
Private hospitals	976.1	60,496,984.0	66,059,248.9	125,441,981.4
Nondepository credit intermediation and related activities	867.1	50,370,403.7	57,012,261.5	108,187,835.8

3.03 How Did We Reach These Figures?

The leading researcher for this report, Guy Hagen, has authored dozens of economic impact assessments and has over 15 years of experience leading high-profile economic, market, and technology research projects. His work has been published in peer-reviewed academic journals, and his leadership in economic research has been leveraged by major corporations and state and local governments. He has been a leader in promoting objective and transparent economic analysis, including co-chairing a state task force to provide guidelines for consistent and transparent economic measurement for public policy (the Florida Governor's Office Cluster Metrics Task Force).

A review of potential economic substitution and duplication (double-counting) effects was undertaken during the research for this project. Substitution effects often are relevant in economic impact studies when the impact of a project is considered without also considering the impact of returning the funds that supported the development, and their potential impact if those funds had been spent elsewhere. For example, the construction of a hypothetical new government building can be shown to have a strong economic impact, but government funds that paid for that building could have potentially had a greater or lesser impact if invested in educational programs, loans, or even returned as a tax rebate to taxpayers. In this case, part of the inputs for this report included the public (State of Florida) cost of university staff, faculty, and capital investments in the UCF Research Park. Substitution effects were not calculated on Federal spending.

The impact estimates described in this section are adjusted for inflation and presented in 2012 US dollars. This analysis was structured as an "Industry Change" study. The primary inputs included the following:

- FY 2011 Team Orlando Commands' collective contract awards, and percentage awarded to Florida recipients (local purchase coefficient) based upon analysis of Federal procurement data (see following for details).
- FY 2011 Team Orlando employment figures (employment budget is not included in Team Orlando contract awards).
- FY 2011 University of Central Florida Institute for Simulation and Training (IST) sponsored research funding (approximately $17M), which are research funds attracted from external (non-university) sources. IST staff and faculty payroll was not included due to possible duplication effects (IST payroll is sourced from both state and sponsored research sources).
- $9.1 million in anti-terrorism investments to provide electronic security and vehicle barrier systems and perimeter controls in the UCF Research Park (this is included as a public sector cost or negative input, reducing the overall estimated impact).
- $333.8 million in 2011 Federal, non-PEOSTRI contracts awarded to Florida companies who have reported (by survey) that 100% of their activities are tied to MS&T.

This study does not include as inputs the economic activity of Florida private sector medical simulation centers or other private sector activity, as those data were not available at time of analysis. We also did not include Florida corporation revenue figures from foreign sales. Although these may also contribute significantly to the Florida economy, they were deemed beyond the scope of this study to collect and filter for duplication effects.

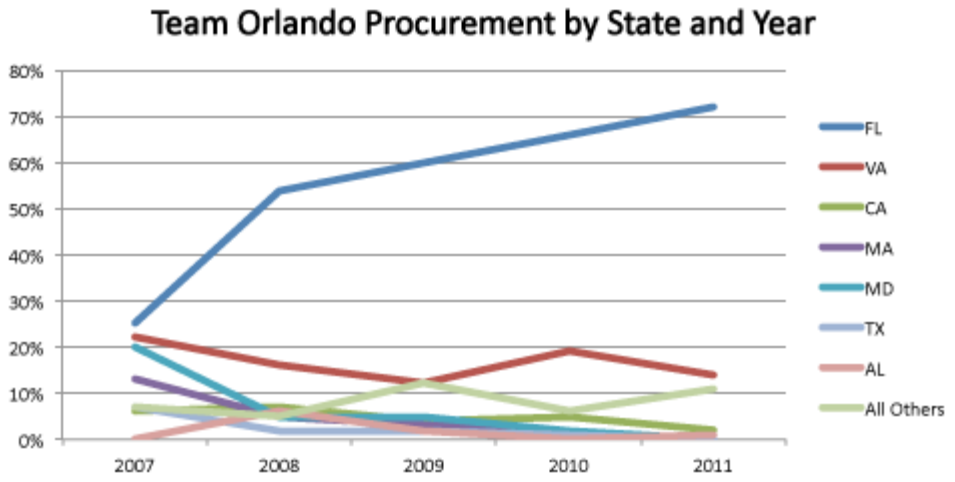
In 2011, members of Team Orlando commands reported that they collectively awarded $4.215 billion in procurement contracts. In order to calibrate what percentage of these awards were received and performed by Florida companies (and thus the percentage of economic value captured within the state), we analyzed data from the Federal Data Procurement System (https://www.fpds.gov) for PEOSTRI (the Team Orlando command with the largest annual expenditures) between 2007 and 2011. Covering that period, we identified 2,174 contracts and 13,603 contract transactions (including contract modifications) totalling more than $10.4 billion in obligations. For 2011 (the year we calibrated our impact analysis against), this constituted approximately 61% of the combined, reported contract amount issued by Team Orlando officials. While this does not appear to include contracts classified from the public record and is only a subset of the total MS&T awards from Team Orlando agencies during this period, our findings should provide a more than adequate sample of procurement award activity to benchmark which percentage was awarded to Florida vendors.

Period	Transactions	Contracts	Net Obligations
2007-2011	13,603	2,174	$10,488,647,093
2011	3,649	1,067	$2,552,875,509

The FPDS data included delivery orders, definitive contracts, IDCs (Indefinite Delivery Contracts), Purchases, and BPAs (Broad Purchase Agreements).

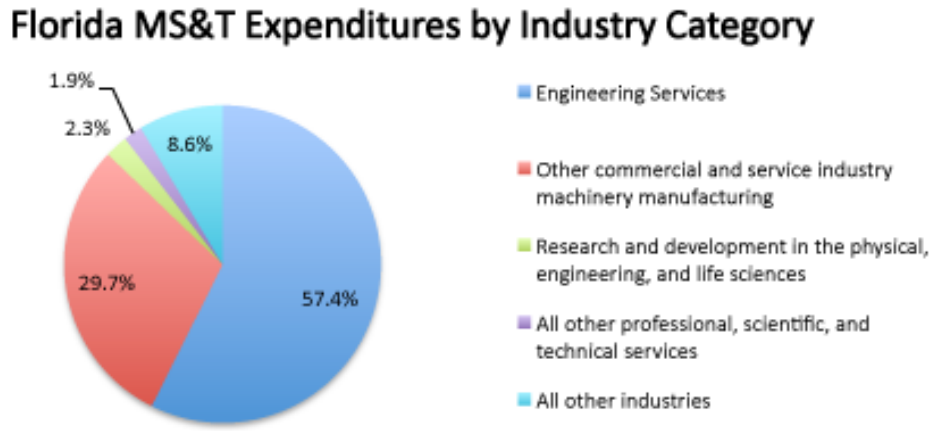
As shown on the following table, in 2011 Florida vendors received 72% of these Team Orlando contracts. Every year since 2007, Florida has increased its share of awards relative to other states, as companies (local, non-Florida and even foreign-owned) built Florida offices and capabilities to better support the needs of Team Orlando commands.

	2007	2008	2009	2010	2011
FL	25%	54%	60%	66%	72%
VA	22%	16%	12%	19%	14%
CA	6%	7%	4%	5%	2%
MA	13%	5%	3%	1%	0%
MD	20%	5%	5%	2%	0%
TX	7%	2%	2%	1%	0%
AL	0%	6%	2%	0%	1%
All Others	7%	5%	12%	6%	11%



It is observed that Alabama has a smaller reported share than expected in the FPDS data; this may be an artifact of how classified contracts are reported in the FPDS system, or how the FPDS system reports transactions by Contracting Office and Agency. Only contracts reported under the Contracting Office of PEOSTRI were analyzed for this report.

We further used FPDS data for FY2011 Florida awards to calibrate which industry sectors should be used as input categories. As shown in the following chart, the majority of awards were performed by companies in Engineering Services and specialized industrial machinery.



3.04 How Do These Findings Compare to Prior Studies?

In Fall 2008, a similar analysis of the economic impacts of Florida's MS&T cluster was performed by the same researchers, and released under the report "Florida's Modeling, Simulation and Training Cluster". The 2012 findings are consistent, reporting between 2% (GSP) to 15% (employment) impact growth since 2008.

Year	Employment	Labor Income	Gross State Product	Output / Sales
2008	53,060	$3.2 Bn	$4.5 Bn	$7.82 Bn
2012	60,754	$3.3 Bn	$4.8 Bn	$7.99 Bn

The 2012 figures are lower than forecasted from the 2008 report, but this can be explained by the intervening economic downturn, to which the MS&T sector was not immune. The downturn was characterized by reported employment reductions across Florida MS&T companies of all sizes, except companies with between 1-10 employees in 2012 which reported an 86% growth since 2008. This, too, can be understood as the result of a typical pattern when larger companies downsize, a certain percentage of industry professionals join smaller, more nimble and lean companies or start new companies.

In terms of combined economic impact, the economic downturn was balanced by the fact that a greater percentage of Team Orlando contract expenditures was shown to have been captured by Florida companies, resulting in a small net four-year growth (not including inflation).

3.05 Spin-Off Companies

In addition to the formal economic impact estimate, the presence of the UCF Institute for Simulation and Training, Team Orlando and the many MS&T companies in the UCF Research Park have helped to create several new modeling and simulation businesses. These companies are all clients or graduates of the UCF Business Incubator, and have focused on modeling and simulation.

- 360 Software
- Abamis IT Solutions
- Advanced Simulation Research (ASRI)
- AgileSrc
- H2 IT Solutions
- Productivity Apex
- Sabalcore
- SimStaff
- Strongpoint Research
- Tech Solutions Inc (became Bush Enterprises)

4.0 | Impacts on National Defense

Florida MS&T makes a critical contribution to military readiness and effectiveness across the United States. Companies, Federal agencies, educational and research institutions nationwide rely upon the resources of the University of Central Florida's Institute for Simulation and Training (IST), Team Orlando, and the companies in UCF's Research Park. The combination of these resources represent a critical and unique national asset and capability that developed over the course of seventy years, and cannot be easily replaced or relocated.

The following quotes and anecdotes were collected through more than 100 surveys and interviews of Florida MS&T companies and organizations. They describe specific examples of Florida's importance to the overall US military and its supporting network of defense companies. These are just a sampling of the contributions the Florida MS&T cluster has made to national defense capability, and additional investigation can produce supporting facts, statistics, and case studies.

Cost Efficiency and Expenditure Reduction

- The omnibus contracts let by the Team Orlando military services, and the streamlining of the acquisition process, enable the quick response of the simulation industry to military requirements. Team Orlando is the acquisition center for military simulators. Team Orlando is the only node outside of the Pentagon where the services come together for joint procurements. Taxpayers realize cost savings through this synergistic relationship. Team Orlando provides "one-stop-shopping" for the defense industry with the I/ITSEC and other galvanizing conferences involving government, academia and industry.

- The third largest non-equipment cost in the DoD is fuel; additional costs can be documented in wear and tear on equipment in all areas of the service, land sea and air. It should be possible to move 30% of training off platforms and onto sims [simulation systems], reducing an immense cost of fuel, maintenance and replacement of equipment, hardware and platforms.

- "Simulators operate at 10% of the cost of the parent weapons system."

Investment in Critical National Capability

- As described in the "A Brief History of Florida's MS&T Cluster" section, the current partnership of federal agencies, research institutions, and companies evolved over a period of nearly 70 years. The cluster of activity and capability surrounding Team Orlando represents a unique and critical national investment that would take decades to recreate. The value of this investment in terms of a critical national military knowledge and expertise resource is difficult to quantify, but may be best expressed not in terms of economic impact or annual leasing costs but in terms of what it would cost the US Federal government in time and money to build again "from scratch".

Effectiveness

- "We fought two wars simultaneously with the lowest rate of casualties in

the history of mankind, largely due to outstanding training of our warfighters. Central Florida was the major contributor to the advancements made in training over the last twenty years."

- Training warfighters on humvee rollovers has made a [measurable] impact on the lives of our soldiers. Examples include the Common Driver Trainer (USA), the Deployable Virtual training Environment (DVTE) (USMC), the new Littoral Combat Ship (LCS) (USN), the large number of new medical training devices, and the MOUT training facilities for urban combat (USA and USMC)."
- "We have received feedback from the soldiers returning who trained on these systems as to how important they were to them since it provided them the training they needed to understand the environment and survive. The technologies we develop to represent the synthetic natural environment of the geo-specific locations they will be deployed to has greatly contributed to the lower fatality rates over the past 10 years at war."
- Companies cite that Florida simulation and training systems have proven not only critical in improving the safety and effectiveness of US soldiers, but in supporting and improving joint operations with our allied countries.
- Florida simulation technologies such as the MET Rollover Trainer have been cited as being critical in saving the lives of our soldiers.

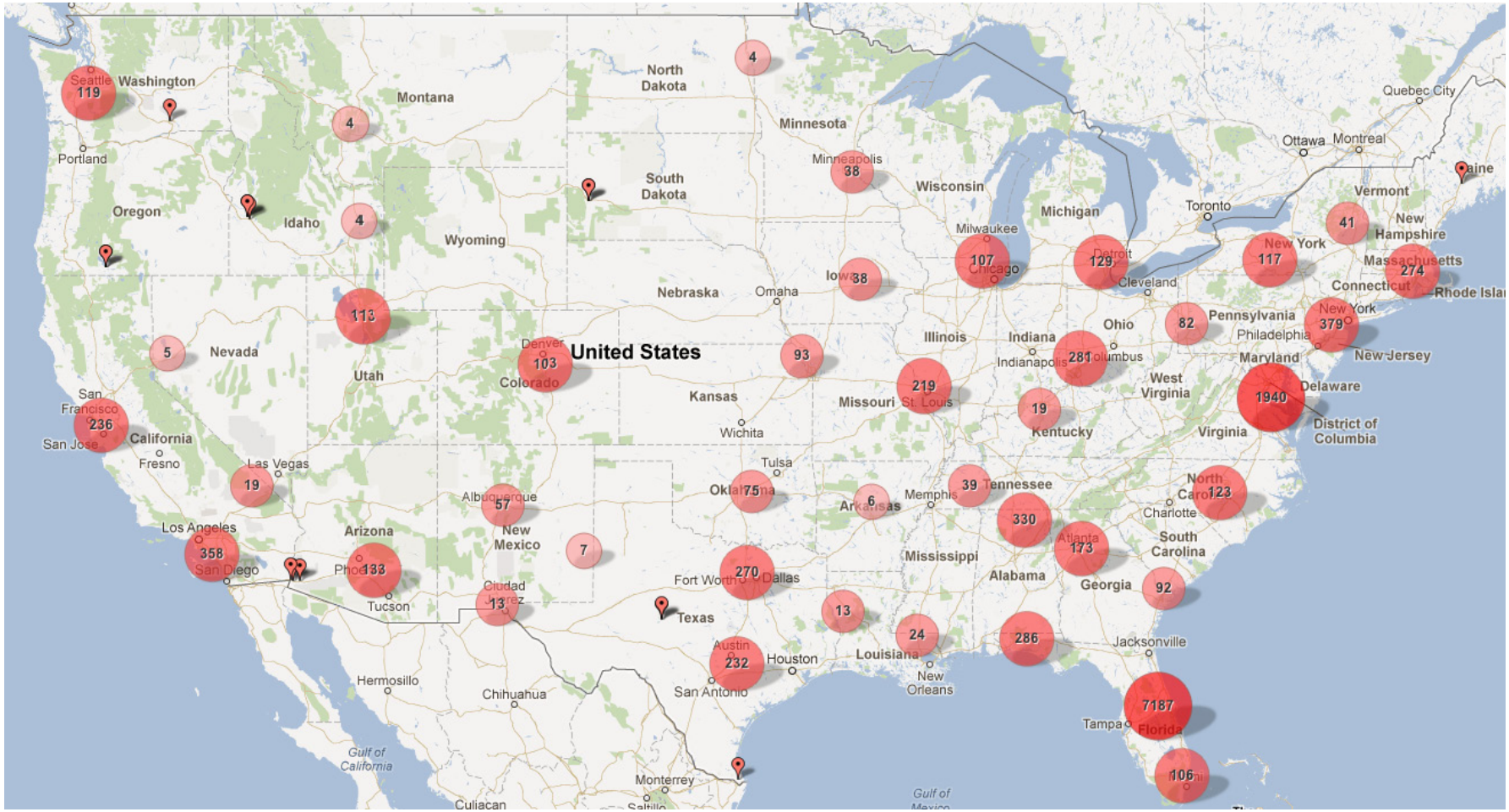
Operations Importance

- Northrop Grumman owns and operates the Distributed Mission Operations Network (DMON) from the Central Florida Research Park in Orlando, Florida for the USAF Air Combat Command. The DMON is used by geographically separate Combat Air Forces for realistic training to sustain a high level of combat readiness. The use of this network to connect aircraft training simulators has proven to be a cost effective substitute for air crew "live fly" training in an environment of declining defense budgets. Air Force units stationed in the continental US, Europe, Hawaii, Alaska, Korea and Japan rely on engineering and services provided with the DMON to connect them with their counterparts across the world to maintain their combat readiness.
- Every major MS&T company and training facility in the US (and abroad) participates annually in the annual Interservice/Industry Training, Simulation and Education Conference in Orlando (refer to map on the following page).
- "Military training establishments at Ft. Eustis, Ft. Rucker, and Norfolk NAS have maintained a reliance on training products produced here in Orlando."

Responsiveness and Readiness

- Simulation technologies can be quickly reconfigured, scenarios quickly designed, and potentially be delivered on-demand and in a distributed fashion. A number of Florida companies have speculated that probably 99% of deploying soldiers have trained on systems developed by Team Orlando

Exhibitors and Participants in the 2011 Interservice/Industry Training, Simulation and Education Conference



Source: 2011 I/ITSEC attendees and exhibitors, National Training and Simulation Association (NTSA)

contractors. Ubiquitous, on-demand education features are predicted to become a growing and increasingly important component of future military training.

- "At Lockheed Martin, we developed the Multi-Function Training Aid to provide a low-cost, medium fidelity two-seat trainer. Within minutes a software change will transition the platform between different aircraft, ground vehicles or ships. Now used in C-130 training and with Army programs … delivered at a time when aircraft operations severely limited the availability of aircraft to support training."

- "[An important example includes our] quick turn-to-develop convoy training simulator for troops deploying to Iraq and Afghanistan. At the start of the wars, ground convoys suffered significant casualties from insurgent raids and IEDs. In weeks, Lockheed Martin developed a prototype simulator that has now evolved several generations and is part of routine training."

- "Kratos' virtual and hands-on maintenance trainers have greatly improved the speed and turn-around of repair of military assets, to rapidly return them to the battlefield and [more quickly return to their mission of] saving lives."

Serious Games and Gaming Innovation

Florida is a leader in the development and innovation in the field of serious gaming, one of the most exciting areas of growth and collaboration between the military and the private sector.

- UCF's Florida Interactive Entertainment Academy (FIEA) provides a master's level degree for students going into the interactive entertainment / gaming industries. Full Sail University and the Digital Animation and Visual Effects (DAVE) School also are based in the Orlando region and offer degrees in animation and aspects of game design.

- Orlando is home to the annual Defense Gametech User's Conference (http://www.gametechconference.com).

- Competing against large international corporate software developers at the Serious Play Conference 2011, UCF/IST RETRO Lab landed a Bronze Medal for its Devil's Advocate game submission in the Government/Military category. Devil's Advocate is a lightweight, Flash-based mini-game embedded within an interactive learning simulation designed for teaching psychological health skills to military service members at various stages of their deployment. Devil's Advocate deals with anxiety and depression and provides players with an opportunity to practice cognitive restructuring of negative thoughts as a stress management technique. The project is sponsored by the Defense Centers of Excellence for Psychological Health.

- UCF is home to a multimillion dollar Advanced Research Computing Center that supports serious games for training.

- "Los Angeles-based motion capture studio Vicon/House of Moves (HOM)

Locations of US Sponsors of Research at the University of Central Florida Institute of Simulation and Technology

Legend: Size of bubble represents number of individual sponsoring organizations and companies. Source: UCF IST (2012)

expanded into Orlando in 2007. The nationally recognized company equips the only professional motion capture studio on the East Coast with fully integrated film, video and audio facilities. Co-located with FIEA, HOM serves as the cornerstone for Orlando Mayor Buddy Dyer's Creative Village in downtown Orlando."

Technology, Innovation and Industry

- To date, University of Central Florida MS&T research through the Institute of Simulation and Training (IST) has been sponsored by at least 140 companies and organizations across the US. The following map (next page) is a partial demonstration of how Florida MS&T research has contributed to the development of MS&T solutions across the the nation. This map represents research totalling more than $136 million to date.

- Companies have reported that they have established or moved their operations in Florida not only to interact with Team Orlando, but to better build prime/sub relationships with companies across the US. Central Florida is becoming a "networking and partnership hub" for military technology companies that extend beyond MS&T.

Military Talent and Workforce

The DoD is facing a significant talent crunch as a large percentage of career soldiers retire over the next decade. In order to meet its human capital needs, the military will be forced to innovate and create new tools for providing rapid, quality technical education for high school and university graduates in formats that are more suitable to younger generations - digital, interactive, distributed, and on-demand. MS&T will be critical to addressing this issue, and Florida's MS&T organizations are already laying the foundation in developing these new training environments and systems.

Foreign Relations

Florida training systems include culture, language, and human terrain skills, and are provided before, during, and after engagements and both in the US and on engagements in foreign countries. The socioeconomic aspects of warfare are increasing in importance, and our soldiers are having an increasingly important impact on relations with foreign nations. Our training policies and tools influence our allies as well. Consequently, Florida MS&T tools have been cited as having a subtle but important impact on international relations.

Future Areas of Interest

Florida MS&T companies and specialists have pointed to medical simulation, Battle Stations 21 and Dismounted Soldier simulators as key future growth areas in which Florida has already made significant contributions, but which will be particularly important over the next decade.

5.0 | Impacts on Society

Florida's military MS&T has had impacts on public education, public safety and society in general. These are just a current sampling, but do indicate that changes to Team Orlando will have far-reach impacts in both the local and national community.

- UCF IST's participation in a Federal Department of Transportation-sponsored study of cell phones and driver distraction caught the attention of local law enforcement, UCF student government and even the Discovery Channel on cable TV, giving national exposure to the institute's RAPTER group. RAPTER (Research in Advanced Performance Technology and Educational Readiness), led by Dr. Ronald Tarr, studies ways to use simulation-related technology to get maximum training value using equipment and methods efficiently.
- Lockheed Martin launched an academic version of Microsoft's ESP technology, which is designed to support science, technology, engineering and math curriculum in the K-12 arena. It is the core software for a growing education offering called ACES (Aviation Classroom Experience), and runs the simulators at the National Flight Academy in Pensacola.
- Student interns from UCF IST's E2i Creative Studio built a virtual model of the Lake Eola Park area in downtown Orlando as part of a study how environment can be used to improve socialization skills needed for success in STEM vocations. The study, which has gained the interest and support of the National Science Foundation, focuses on the overcoming challenges high-functioning autistic young adults face as they enter science-related disciplines.
- After four years of study, planning, invention and construction, IST's E2i Creative Studio is installing its interactive addition to the Ft. Lauderdale Museum of Discovery and Science's new EcoDiscovery Center. The exhibit focuses on human impact on Everglades ecology with interactive elements.
- Florida MS&T research is leading innovation in the treatment of PTSD, wounded soldier, and returning soldier therapy as well as job reskilling and readiness. While these may be considered military or medical issues, the reintegration of returning soldiers is a high-profile and sensitive social issue that spans the US.

6.0 | Impacts on National Health and Medicine

Florida MS&T has been at the forefront of innovation in medical simulation and public health simulation technologies. Many of these technologies were developed foremost for military applications, but the medical market is rapidly maturing and demand is increasing in order to support the aging demographics of the US.

- Orlando hosts an annual world-class medical simulation conference; the first Medical Training, Technology and Treatment (MT3) conference was held on May 9-12, 2012.
- "For the military, the CAESAR Project provides effective training in field medicine including trauma. This same technology has civilian applications including PTSD treatment."
- Florida has contributed successfully to telesurgery technologies - already in deployment - and is now leading development in the field of Automatic Surgery for environments where telesurgery is infeasible. "Automatic Surgery is a marriage of surgical simulators and surgical robots. It allows a surgery to be performed in a simulator on a CT scan of a human, and then transmitted any distance over any comms lines to a surgical robot where it can be performed on the human patient."
- Florida has helped pioneer military use of surgical simulators.
- It has been described by our survey respondents that almost every deploying solider has been trained on systems developed in Florida, and it would be easy to collect moving anecdotes and case studies describing how skills learned from the Engagement Skills Trainer and the Medical Simulation Training Centers have helped us bring back soldiers alive.
- "Through the AUSA chapter of central Florida, L-3 has been part of the team Orlando effort to support wounded warriors and soldiers returning from combat deployments."
- After more than a decade of experience with medical simulation research, the University of Central Florida IST has amassed a considerable number – and variety – of medical-related projects including the following:
    - Combat Trauma Patient Simulation (US Army/METI) program in the 1990s. Some "firsts" include: human patient simulation mannequin put in military context; to train emergency medics, prototyped software that allowed a human patient simulator to sustain, one after another, numerous battlefield injuries; demonstrated the first High Level Architecture medical simulation federation; demonstrated an ability to link live, constructive and virtual medical simulations.
    - Team STEPPS on a mobile platform
    - Combat Medic teaching cards
    - Medical error prevention with automated pharmaceutical dispensing

- Evaluating training strategies used by Army teams prior to deployment to treat trauma patients
- Virtual patients for medical college training simulations
- Use of mixed reality therapy for traumatic brain injury patients
- Simulations to address female health care issues with Hispanic youth (a collaboration with UCF's College of Nursing)
- Mixed reality simulation for physical therapy and stuttering
- Creation and commercialization of a mobile tourniquet application trainer
- Data accumulation and approaches for purchasing and developing medical simulation devices
- Data standards supporting interchange of information between simulations (for hand-off between simulators and remote control)
- Work toward extending interoperability between simulators by including treatment codes, diagnostics codes, images, etc.
- Technological assessments for various US Federal Healthcare and Simulation groups.
- Physiological measurement studies
- Physical rehabilitation games (Smash Me) MR Paint

7.0 | Acknowledgements

This report, and the research behind it, was undertaken under generous sponsorship from the Florida High Tech Corridor Council, Inc. Important contributors included, but were not limited to the following:

- Thomas Baptiste, National Center for Simulation
- Carol Dykes, UCF Business Incubator
- Kent Gritton, Joint Training Integration and Evaluation Center
- Guy Hagen, Tucker/Hall
- Nicole Hawker, Tucker/Hall
- Carla Hoskins, National Center for Simulation
- Danielle Lavey, Tucker/Hall
- Bill Owen, W.H. Owen Consulting
- Roger Pynn, Curley and Pynn
- Stephen Seay, Seay Business Solutions
- Dr. Randall Shumaker, UCF Institute for Simulation and Training
- Joe Wallace, Central Florida Research Park

In addition to the listed individuals, more than 100 MS&T industry experts from across Florida provided information, feedback, anecdotes, and guidance to our research. Their collective contribution was critical to our ability to understand the many important ways that Florida's modeling, simulation and training sector contributes to all of our lives and welfare. We thank each of them for their time and contributions.

8.0 | Appendices

8.01 | Appendix: Acronyms

AFAMS: Air Force Agency for Modeling and Simulation

BPA: Broad Purchase Agreement

FPDS: US Federal Procurement Data System

IDC: Indefinite Delivery Contract

IST: University of Central Florida Institute for Simulation and Training

JTIEC: Joint Training Integration and Evaluation Center

MS&T: Military modeling, simulation and training

NAWCTSD: Naval Air Warfare Center Training Systems Division

PEOSTRI: Program Executive Office for Simulation, Training and Instrumentation

PMTRASYS: Marine Corps Systems Command, Program Manager Training Systems

PTSD: Post-traumatic stress disorder

RDECOM: Research Development and Engineering Command

UCF: University of Central Florida

8.02 | Appendix: General Economic Impact Definitions

Output: Output represents the value of industry production. In IMPLAN these are annual production estimates for the year of the data set and are in producer prices. For manufacturers this would be sales plus/minus change in inventory. For service sectors production = sales. For Retail and wholesale trade, output = gross margin and not gross sales.

Labor Income: All forms of employment income, including Employee Compensation (wages and benefits) and Proprietor Income.

Direct Impacts: take place only in the industry sector immediately affected, such as direct jobs and investments.

Indirect Impacts: concern inter-industry transactions: if an analyzed sector is removed from the economy, sector companies will no longer have a demand for locally produced materials needed to produce their product. This will affect all of their suppliers.

Induced Effects: measure the effects of the changes in household income: employees laid-off by removing the analyzed sector from the economy may reduce their expenditures in restaurants and shops since they are no longer employed. These changes effect the related industries.

GDP: Industry Gross Domestic Product is the contribution of each private industry and of government to the nation's output, or GDP. An industry's GDP, or its "value added," is equal to its gross output (which consists of sales or receipts and other operating income, commodity taxes, and inventory change) minus its intermediate inputs (which consist of energy, raw materials, semi-finished goods, and services that are purchased from domestic industries or from foreign sources). It can also be measured as the sum of incomes related to production, such as wages and salary accruals and gross operating surplus. (BEA)

Sources: Implan.com; Wikipedia.com

8.03: Tax Impact Definitions

Dividends: Any payment to administrative government is considered a tax. It represents a source of revenue to state and local government.

Social Insurance Tax- Employee Contribution: Employees' social contributions are the amounts payable by employees to social security funds and private funded social insurance schemes.

Social Insurance Tax- Employer Contribution: Employers' social contributions are payments by employers which are intended to secure for their employees the entitlement to social benefits should certain events occur, or certain circumstances exist, that may adversely affect their employees' income or welfare - sickness, accidents, redundancy, retirement, etc.

Indirect Business Tax: Prior to the 2003 comprehensive NIPA revision, IBT was the name of one of the three components of value added. It consists of tax and nontax liabilities that are chargeable to business expenses when calculating profit-type incomes and of certain other business liabilities to government agencies that are treated like taxes. Thus, IBT includes taxes on sales, property, and production, but it excludes employer contributions for social insurance and taxes on income. As part of the NIPA revision, this component was modified and termed "taxes on production and imports less subsidies." The major differences between the two are attributable to the treatments of subsidies and non-taxes. (BEA)

Indirect Business Tax: Sales Tax: Includes sales tax charged to both businesses and individuals.

Sources: Implan.com; Wikipedia.com