THE "BIG BANG" OF MODELING AND SIMULATION AND THE INTERSERVICE/INDUSTRY TRAINING, SIMULATION AND EDUCATION CONFERENCE

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ABSTRACT

This paper describes the progress of the I/ITSEC conferences and the corresponding growth of Modeling & Simulation (M&S) over the fifty years from the initial convening to this year's conference. I/ITSEC began as a Navy/Industry conference and later it was combined with the other services to become a truly "interservice" event. The very first "industry" conference can be described as the "Big Bang" of simulation and training. It was held in 1966 at the Orlando Air Force Base, Florida and orchestrated by the Naval Training Device Center (NTDC). The conference was the beginning of an expanding universe of M&S and reflective growth of I/ITSEC. From its humble beginning with 49 industry attendees, the conference grew over the years to a projected 14,000 people this year, coming from all points of the globe. The venue for the original conference was an old World War II building, with a failing air conditioning system and an overhead projector-a sharp contrast to the spacious Orange County Convention Center, with the impressive simulation technology exhibited. The stage is set leading to the "Big Bang" by describing the simulation environment in the early 1960's with the Navy occupying the Gould (Guggenheim) Castle at Sands Point, N.Y. In 1965, NTDC moved its workforce of military and civilians to Orlando, Florida. Critical points in the growth of the simulation industry and I/ITSEC are addressed. Throughout its history, the simulation industry has been influenced by visionaries, innovators and managers making decisions and policies that have set and/or altered its course, growth and effectiveness. Management decisions were made outside of the military that caused major shifts in the organizations involved and other decisions were made within the system the events and decisions having the most impact will be identified as well as the author's observations and "lessons learned" are summarized.

ABOUT THE AUTHOR

Henry C. Okraski is currently a simulation consultant for the modeling and simulation industry, after serving 32 years as a government engineer/manager/executive. As a Senior Executive, he was the Director of Research and Engineering, Deputy Technical Director and Chief Scientist at the Naval Air Warfare Center Training Systems Division. He is a founding member of the National Center for Simulation (NCS), serves on the Board of Directors and is Chairman of the Education and Workforce Development Committee. He developed and implemented a high school curriculum and the nation's first certification in Modeling and Simulation (M&S) for high school and technical school students. He received awards including the Navy Meritorious Service and Navy Superior Service Awards. Mr. Okraski is a registered professional engineer and a certified M&S professional. He was selected Federal Engineer of the Year by the National Society of Professional Engineers. Mr. Okraski was inducted into the NCS M&S Hall of Fame in 2014.He has a bachelor's degree in electrical engineering from Clarkson University and a master's degree in systems engineering from the University of Florida. He received the *Golden Knight Award* from Clarkson, the highest alumni award given by the university. He is a reviewing authority for the Certified Modeling and Simulation Professional applicants. Formerly, he was an adjunct faculty member at Rollins College and the University of Central Florida and authored "The Wonderful World of Simulation".

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INTRODUCTION

This paper addresses the origin and expansion of the M&S (Modeling and Simulation) industry and the corresponding growth of the Interservice/Industry Training, Simulation and Education Conference (I/ITSEC), from the "Big Bang" (the first conference held in 1966) to the present, with projections for the future and lessons learned.

I/ITSEC has been a "barometer", measuring the health of the M&S industry, and served as a "compass", pointing to the research, innovation, new developments and accomplishments of the industry. Over its history, the simulation industry has been influenced by visionaries, innovators and managers making decisions and policies that have set and/or altered its course, growth and effectiveness. Management decisions were made that caused major shifts in the organizations involved (exogenous) and other decisions were made within the system (endogenous). The events and decisions having the most impact will be identified as well as "lessons learned" summarized later in this paper.

History is the accumulation of the biographies of great people. The M&S industry is no exception. Some "explorers" and "pioneers" in M&S will be highlighted. These are the people who dared to reach for the stars. The technology has expanded in several dimensions as one might expect- after a big bang. A montage of snapshots of the simulation world is presented in Figure 1.

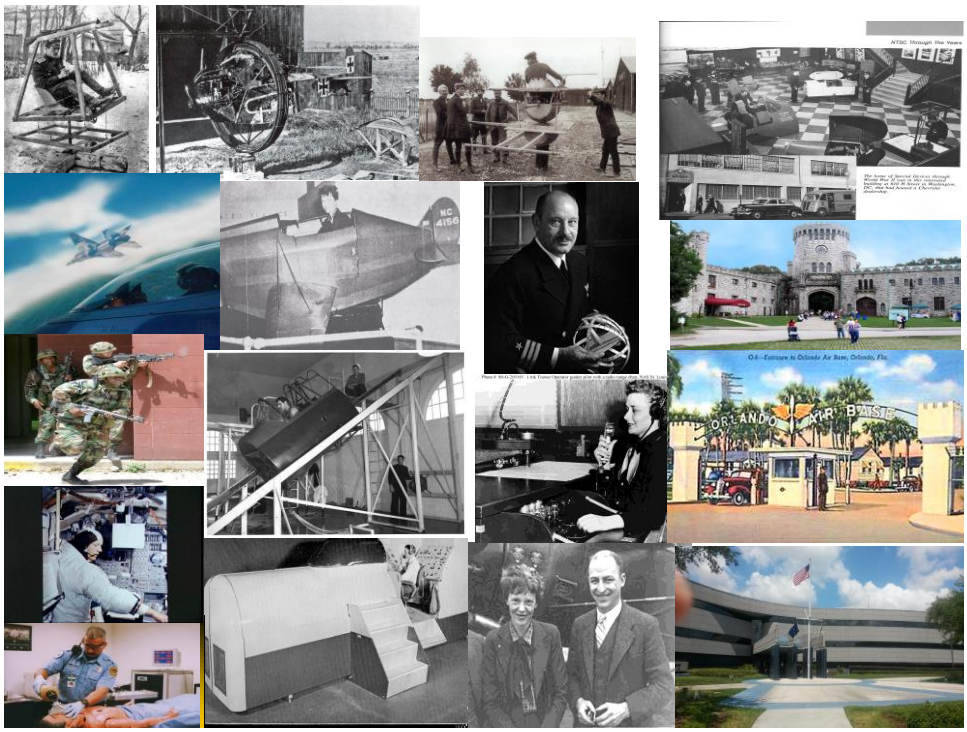

Figure 1. Snapshots of M&S History

Because I/ITSEC had its origin with the Navy, the focus of the paper will be on that service more so than the other military components. Also, since the author's career was primarily "naval", more attention is given to that service.

EARLY ATTEMPTS AT SYNTHETIC TRAINING

Various attempts were made as early as World War I to develop simulators to provide "ground" training for pilots and aircrews. (Okraski). Some examples: the Russian flying ace, Juri Vladimirovich Gilsher, designed and developed a Gunnery Trainer that taught new pilots how to aim their fixed gun mounted on top of the airplane wing, The French created the Antoinette Trainer which was simply a half barrel in which the pilot sat while others rocked the structure back and forth, giving the trainee the "feel of flight". One of the issues the German aircrew had to contend with was the problem involving the open cockpit aircraft. When the pilot made violent maneuvers, the crewman (observer) in the rear seat was often unexpectedly ejected. Carl Fink, a young German pilot, devised a trainer to prepare for these violent excursions. He removed the wings, horizontal and vertical stabilizers from a wrecked aircraft and inserted a large, pivot-mounted (3 meter) wheel, centered where the propeller would be located. With the pilot and observer in the cockpit, the ground crew rotated the structure in an attempt to eject the crewmen, giving them the "feel" of inverted and high "g" flight. Other trainers were developed such as the Sanders Teacher, Drexler's Training Swing, Ruggles Orientator and the British Silloth Trainer. All of these were rather primitive but represented the innovation of the times.

The recognized baseline of modern trainers is the "Link Trainer". It was the beginning of modern flight simulators. The "Blue Box" was designed by Edwin Link, using pneumatic components from his father's organ factory in Binghamton, N.Y. The importance of synthetic training was recognized in 1934 by the U.S. Army Air Corps, when they assumed the responsibility for air mail delivery. When visibility was poor, pilots would have to rely on instruments and the current cadres of about 100 pilots were ill-equipped to fly by instruments alone. Several of the military aircraft crashed in bad weather. An emergency appropriation of funds was approved by Congress and the President. The first 6 Link Trainers were delivered and a new industry was born. (Kelly). ***The Link Trainer was the only mature platform available to accomplish the urgent training mission. The requirements "pull" and technology "push" merged very effectively. This marriage gave Link Trainers an earned reputation with increasing sales and positioned the company for the future training of World War II pilots when 500,000 pilots were trained on the Link Trainer.***

The effectiveness of the Link Trainer and a family of gunnery trainers was demonstrated in combat during World War II where American combat airmen shot down more than 17 Japanese aircraft for each American aircraft lost. (Dawson).The Japanese had no solid training program to train pilots after the first wave of well-trained pilots were shot down at Midway, Solomon Islands and New Guinea. Training devices became force multipliers.

THE EARLY AVIATION ENVIRONMENT AND TRAINER"EXPLORERS"

The Environment

The 1920's through 1940's was an era of barnstorming pilots who performed at air shows, carnivals and other events with their "flying machines". They were the wing-walkers and daredevils of the time. Pilots formed a close-knit, rather small community before World War II. Their common interest was flying and, like Ed Link, they welcomed the opportunity to train new pilots, exposing them to the thrill of open-cockpit flight with oil spraying on their goggles, white scarf flowing in the airplane slipstream.

The locus of aviation activities on the east coast was the *Aviation Country Club of Long Island*. Membership included such notables as Walter Beech, L.R. Grumman, Robert L. Hall, Charles Lindbergh, and Rear Admiral John Towers. Other flying club members included Douglas Fairbanks, Chance Vaught, Amelia Earhart, William Boeing, Admiral William Moffett as well as Luis de Florez. (Dawson). All of these were involved with the Link Trainer and spin-offs in various ways***. Ed Link and Luis de Florez understood the value of networking and building an advocacy for their cause.***

Luis de Florez (1889-1962)

Admiral Luis de Florez was an MIT-educated, creative engineer and inventor. As a civilian, between the world wars, he was a very successful petroleum engineer, holding several patents. A patriot and reservist, he decided to volunteer for active duty and, at fifty years of age, he completed flight training at Pensacola, Florida. His first Navy assignment, made by Admiral John Towers, was to "examine and improve Navy training". In 1941, CDR Luis de Florez was assigned to the Special Devices Desk of the Bureau of Aeronautics Division to supervise experiments and the development of Special Training Devices. He visited England to study the training methods of the British Training Command. His report, "British Synthetic Training" became the key to a better understanding of the value of simulation. The concept of identifying military training requirements and developing training devices was born. (Dawson).

Edwin Albert Link (1904-1981)

Ed Link was a natural inventor with a great imagination and mechanical abilities. In the 1920's, he developed the Link Trainer, a fuselage-like device with a cockpit and controls that produced the motions and sensations of flying. Much of the pneumatic system was adapted directly from technology used in the organ factory. He formed the Link Aeronautical Corporation in 1929 to manufacture the trainers. His few early customers were amusement parks, not flight training schools; the early models served as carnival rides.

Richard Dehmel, PhD (1904-1992)

Dr.Richard Dehmel invented the first trainer to incorporate the equations of flight in a simulator having the exact controls and instruments found in the actual aircraft. Further, all systems functioned as they did in the aircraft through analog simulation. Prior to that, trainers used pneumatic and mechanical systems as the building blocks. This simulator was used in World War II, simulating primarily multi-engine transport and heavy load aircraft. Curtiss Wright Corporation developed and deployed the simulators, providing valuable training to the armed forces.

SETTING THE STAGE FOR THE "BIG BANG"

Finding a Home for M&S

Commander Luis deFlorez set up his newly-formed special devices organization initially at BuAIR headquarters and then in a Chevrolet garage in Washington, DC. As "seed money", he was given a budget of $50,000 to "improve naval training". His assistant, who later became the Commanding Officer of the Naval Training Device Center, Lt. Cdr D. L. Hibbard, helped establish the facility in the garage at 610 "H" Street. They had an area large enough to display some of the devices his team developed such as gunnery trainers (using film projectors), the celestial navigation trainer (incorporating the Norden Bombsight) and several small training aids (including ship and aircraft models, study card sets, raters and demonstrators). The location was ideal for bringing VIPs into the spaces to witness the emerging world of simulation. The concept of simulation was new to members of Congress and other dignitaries. The unit's budget skyrocketed once the effectiveness of the gunnery trainers was demonstrated in combat. (Dawson). The highly motivated and politically astute Commander needed more space for his organization. The demand for more trainers to help win the war increased dramatically.

Luis de Florez was on the hunt for a new location when he discovered that the old and palatial Guggenheim estate at Sands Point, Long Island, was vacant and available. Originally, the Gould estate, it had been donated by the Guggenheims to the Institute of Aeronautical Sciences. Guggenheim was very interested in aviation and was a close friend of Charles Lindbergh. Luis de Florez seized the opportunity and moved his unit to the north shore of Long Island in 1946 and remained there until the Naval Training Device Center (NTDC) moved to Orlando, Florida in the 1965-1967 time period.

Relocation of the Naval Training Device Center

In 1964, Captain Jack Sloatman, NTDC Commanding Officer, announced that the Center was to be relocated. "Your new home will be in Orlando, Florida", he proclaimed. Execution of the move was to be in three phases. The Army Participation Group was included in the order to relocate. The stated purpose of the relocation was to replace an Air Force activity that was being moved out of the Orlando Air Force Base. The base facilities were old, built in the 1940's for the Army Air Corps, and many buildings were without reliable air conditioning. Orlando was a small town in the orange groves at the time, before the Disney presence, with few technology firms in the area. The Martin Company was the only major contractor in Central Florida and was primarily in the missiles business. The company had a simple helicopter trainer, a testbed for research with a giant model board used for cockpit visual display experiments. ***The politics leading to the decision to move the approximately 1,100 Navy and Army personnel from Long Island to Orlando was intense and complex but that decision was the catalyst for the "Big Bang".***

The technology of that period was in transition from analog to digital computation. Analog devices included functional servo mechanisms with shaped or tapped potentiometers. (Figure 2)

Figure 2- Analog Computer (Aircraft Pitch Function Generator)

Digital computers were just beginning to be embedded in simulators. They were the large mainframes with limited capability compared to today's computing systems. ACF Industries, for example, was developing trailerized trainers for the S2F-3 Aircraft that employed Packard Bell computers with delay line memories. The A-7A Weapons System Trainer, manufactured by Melpar (flight) and Singer Link (tactics), also had mainframe computers of improved power. Visual systems were moving from model boards to Computer-Generated Imagery (CGI) via optical disks and other short-lived approaches. Head-mounted visual displays were still in the laboratory.

Complicating the relocation, new policy changes had to be implemented. The concept of Integrated Logistic Support (ILS) was required by Department of Defense Directive 4100.35 and demanded prompt attention by subordinate services. Bob Dreves, who worked with Adm. de Florez in the early years and accompanied him when he first flew over the Guggenheim Estate while searching for a new home for the Navy, directed the formulation of policy and procedures to treat and manage the elements of trainer logistics as a single entity, conducted in parallel with and integral to trainer engineering. The A-7A Aircraft Flight Simulator was the first application of ILS, the beginning of today's logistic support planning and execution and the institution of the Logistics Manager as a member of the acquisition team.

Up until the late 1960's, trainers were maintained and operated by active duty military technicians: TRADEVMAN was the Navy rating. During World War II, with the men serving as pilots and other aircrew, the Navy turned to recruiting women from the colleges and universities to be the instructors. These WAVE sailors provided the instruction to the amazing number of pilots trained on the Link Trainer. (Kelly). After the war, the WAVES were replaced with TRADEVMAN personnel. Ms Priscilla Getchell, in the NCS M&S Hall of Fame, was one of those women who proudly served their country. (NCS website)

THE FIRST NAVY/INDUSTRY CONFERENCE OF 1966 ("BIG BANG")

Government-Contractor relationship in that time period was one of "arm's length". Government employees were given training in procurement with repeated warnings about becoming too close to the contractor. President Eisenhower's concern and near-vilification of the "military-industrial complex" helped to establish that culture. Consequently, there was little dialogue between parties other than individual project discussions, and those were usually very structured and scripted. At that time, no attempt had been made for systemic improvement by involving stakeholders in that process. Team problem- solving and *continuous process improvement* had not been introduced into the Navy culture at that time.

The theme of the first conference, held in Orlando, Florida in November 1966, approximately one year after NTDC moved to Orlando from Sands Point, N.Y., was "On Time Delivery of Training Devices".(I/ITSC website). This theme was chosen because one of the primary concerns of the day was the late delivery of training devices to the Fleet user. Technology was changing which added to the delivery issue. Transistors were replacing vacuum tubes and the very first digital computers were being incorporated in trainers. NTDC was under pressure to improve delivery time and contain rising trainer acquisition and support costs**.** Aircraft data availability from the prime contractor was a serious issue and a major cause for late deliveries of the trainers.

The conference was held in the World War II Department of Defense Conference Facility at the Orlando Air Force Base. There were 49 companies represented, 193 attendees with 24 papers presented. At that time, exactly 50% of the contractors were located in New York and New Jersey. (NTDC). Papers were presented in series: there were no parallel sessions. In addition, there was no training device exhibits.[1]

Dr. Hanns Wolff, NTDC Technical Director, was the leader of the conference and Robert Beshore, Associate Technical Director, was the official Conference Chairman. Captain John Sloatman was the Commanding Officer. Vince Amico organized the conference and was a major participant at this and most of the conferences to follow. The author of this paper presented a paper at this first conference

Doctor Wolff, a former German Scientist who immigrated to the United States after World War II, was a learned and clever engineer. He was put into a concentration camp in Germany during the war. To keep alive and avoid punishment as a prisoner, he had to make himself indispensable. An electrical engineer, he quickly became familiar with the electrical wiring of the camp. Hanns would periodically put faults into the camp's electrical system and wait for the guard to pull him out of the barracks to fix the system. They needed his talents and he stayed alive that way. Several scientists came to America under the program dubbed "Operation Paperclip" and some of them passed through NTDC enroute to other duty stations. One notable example was Herbert Wagner, an Austrian scientist with expertise in glide bombs, who was sent from Germany to Long Island (Gould Castle) under the auspices of that program.

In his introductory remarks at this very first government/industry training conference, Dr. Wolff set the tone and objectives for this historic meeting with the simulator industry leaders (excerpts follow):
"Welcome to the Naval Training Device Center/Industry Conference. We at NTDC have been looking forward for quite some time to meet with you and discuss with you mutual problems that relate to the procurement of training device. I am sure that all of you will agree with me that a close cooperation between the vendor and customer, trainer

1 However, an enterprising Navy employee brought in some freshly-picked oranges from his grove that he offered for sale (Much to the dismay of his supervisor)

industry and NTDC, and a mutual understanding and appreciation of each other's problems is necessary if the trainer industry wants to stay in business, which is only possible if the Government is a completely satisfied customer…. If this conference shall fulfill its purpose, it is necessary that we exchange our ideas and present our problems with complete frankness, without hesitancy….Ladies and Gentlemen, we have made every attempt to satisfy your desires both by the papers that will be presented and by discussion periods that follow each part of the program" (NTSA website).

This was the first attempt on a larger scale to discuss and work systemic problems together as a team. Essentially, the conference was designed for "problem solving" and not so much to address or display technologies. It was the beginning of I/ITSEC-the Big Bang of the simulator industry. The relocation of NTDC and the conference touched off a chain reaction that resulted in the migration and start-up of simulator and support companies in Central Florida, the development of academic programs to support the simulation workforce, and the widespread application of simulation technology followed.

I/ITSEC BEYOND THE "BIG BANG"

Re-branding and Conference Evolution

Interest and attendance in the NTDC/Industry conference increased as the Navy continued down the same path until 1979 when it was decided to "re-brand" the conference to the Interservice/Industry Training Equipment Conference. (Amico). In 1980, with the Air Force as the lead service, the conference was held at the Salt Palace in Salt Lake City, UT. ADPA began its sponsorship in 1981. The two organizations National Security Industrial Association (NSIA) and the American Defense Preparedness Association (ADPA) continued their sponsorship roles until 1995 when the 17th conference became the first to be a jointly sponsored event of NSIA and ADPA. Sponsorship of the conference passed to National Training Systems Association (NTSA), an affiliate of ADPA. In 1997, NTSA became an affiliate of National Defense Industrial Association (NDIA). The conference and infrastructures have undergone changes over the years. From 1979 through 1985, it was known as the Interservice/Industry Training Equipment Conference; from 1986 through 1991, the Interservice/Industry Training Systems Conference; in 1992, renamed the Interservice/Industry Training Systems and Education Conference and in 1997, the title was changed to the Interservice/Industry Training, Simulation and Education Conference, recognizing the expanding utility and applications of Modeling and Simulation (M&S). The conference name changes reflected the change in emphasis due to a better understanding of the interests of the military services. In the beginning, there was a focus on equipment which was limiting; then the spotlight moved to total systems; the services wanted to include "education" beyond training and finally, it was recognized that simulation itself had taken on an expanding role in military and civilian arenas.

The breadth and depth of M&S began to balloon after the "Big Bang". The military simulator and training device procurement budgets increased to include various warfare areas (surface, subsurface, land and air), demanding trainers to support military requirements. Team training emerged as a necessary requirement to build upon individual training. The USS Vincennes (CG-49) and USS Stark incidents sparked the need for team training. Drs. Eduardo Salas and Jan Cannon-Bowers led Navy team training initiatives, building upon aircraft crew resource management methods already in place. To support team training, simulators networking (enabling) technologies were developed with the help of IEEE and the Simulation Interoperability Standards Office (SISO). The attendance at the conferences increased. The military services became equal "partners" in the conference. New features were added: tutorials, special sessions for school teachers, students touring the exhibits, serious games, medical training, paper awards and scholarships. Over the years, various locations were the venues for the conference, before settling at the Orange County Convention Center (OCCC) in Orlando.

Growth in I/ITSEC Attendance and Procurement Dollars

Figure 3 depicts the growth of I/ITSEC attendance from FY 1966 as well as NAWCTSD program funding.

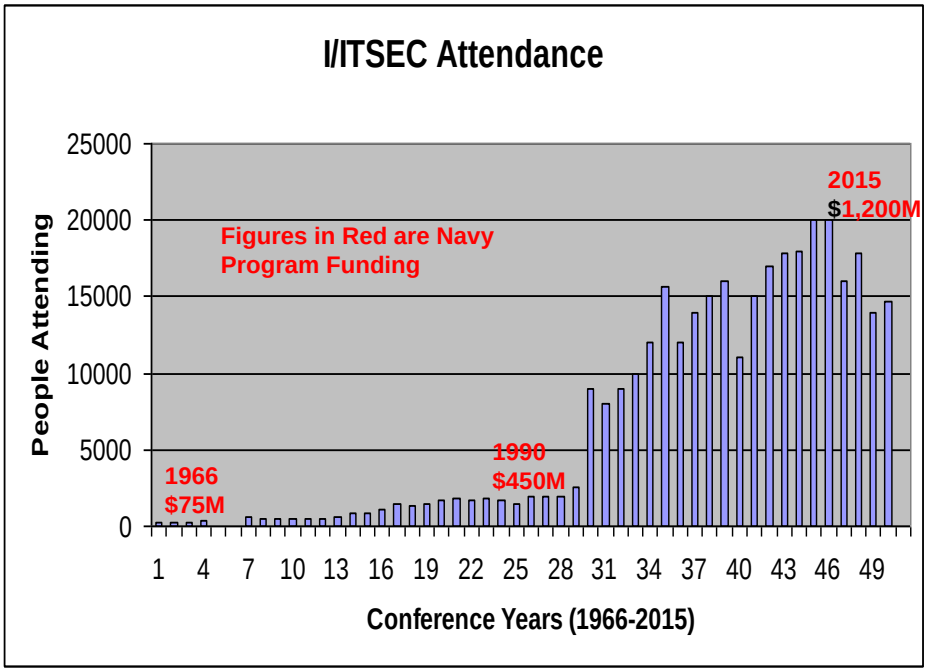

Figure 3- I/ITSEC Attendance and NAWCTSD Total Obligation Authority (TOA)

I/ITSEC recorded attendance over the time period 1990- 2015 rose dramatically from 1,415 to 14, 700. The figures have to be adjusted, however, because after 1994 the numbers of people attending the exhibits were counted in the attendance figures.

The Navy budget in 1956 was about $30M and it more than doubled to $75 million in 1966. In 1990, it went to $450M. In 2015, the Navy spent $1.2B. Combined with the Army and other Team Orlando members, the total for the year was $5.1B, a significant increase. (FHTCC).

Developing Post-Secondary Academic Programs to Support M&S

The Center of Excellence for Modeling & Simulation is a three-legged stool: government, industry and academia. Founded in 1963, UCF opened to provide personnel to support the U.S. space program at the Kennedy Space Center and Cape Canaveral Air Force Station on Florida's Space Coast. As its academic scope broadened, it was renamed from Florida Technological University to the University of Central Florida in 1978. While initial enrollment was only 1,948 students, enrollment today is in excess of 65,000 students from 140 countries and all 50 states and Washington, D.C. UCF was quick to develop graduate programs to serve the M&S industry. Further, the university created the Institute for Simulation and Training (IST), conducting research in support of the growing simulation and training industry.

Move of the Navy to the Central Florida Research Park

In 1988, The Naval Training Systems Center (NTSC) moved into the de Florez Complex at the Central Florida Research Park (CFRP). Forty acres of donated property adjacent to and south of the university were given to the Government for the purpose of establishing the Navy and Army at that location. The modern facility was designed by Nils Schweitzer, a student of Frank Lloyd Wright. It was a sharp contrast to the old World War II facilities that has since become Baldwin Park. Had the Center not moved to the CFRP, it would have been a likely candidate for

relocating from Central Florida. ***The vision of local leaders, including Congressman Lou Frey, set the foundation for the future of military simulation acquisition, research and logistic support.***

FACTORS INFLUENCING THE GROWTH OF M&S TECHNOLOGY AND I/ITSEC EXPANSION

Age of Enlightenment

Up until the 1970's, "simulator time" was considered an adjunct to flight training, Trainer utilization was not strictly enforced. The "age of enlightenment" came into being when the services institutionalized the Instructional Systems Design (ISD) process in the design of training systems. An important component of the ISD process is *media selection*. When training devices are incorporated into the media selection process, it was obvious that there are certain tasks that could be better taught in the simulator than in the expensive aircraft. Further, simulators are less expensive to operate with a 1/10 simulator to aircraft cost ratio. (NTSA website).

Admiral E. Zumwalt, Chief of Naval Operations, created the positions of Chief of Naval Education and Training in Pensacola and the Director of Naval Education and Training in Washington, DC, sending a strong message on the priority of education and training. Plans began to include requirements for simulators and other training devices. A strong advocate of ISD and a thinker "outside of the box" was Captain Frank Featherston, NTSC Commanding Officer, who created the Training Analysis and Evaluation Group (TAEG) that led the way for naval training in applying ISD and "ferreting-out" training requirements in all warfare areas at a time when the system became somewhat stagnant. He energized the system with fresh ideas and new approaches. ***This new paradigm was put into policy by the Chief of Naval Operations, requiring the use of simulators and training devices integral to the overall training program, substituting simulator training for aircraft time, where appropriate the behavioral sciences established a strong foothold in military training at that time.***

Congressional Support

Congress determined that M&S is a critical technology, necessary to ensure the defense of the nation. This decree came about largely through the efforts of Congressman Randy Forbes (R) of Virginia, who created the M&S Caucus. Florida state and national members of Congress have long supported the growth of M&S and secured funding for the Center of Excellence for M&S, enabling it to prosper. They also have opposed any BRAC activities that would threaten the integrity of the combined national asset. NTSA invites members of the M&S Caucus to meet at I/ITSEC and brief attendees on Congressional issues and open discussions with the attendees. Annually, NTSA hosts an "Industry Day" in Washington, DC to demonstrate M&S technologies to members of Congress and their staffs.

Defense Modeling and Simulation Office (DMSO)

Following the work that DARPA and the Army accomplished in simulator networking, to include Simulator Networking (SIMNET), the Department of Defense created the Defense Modeling and Simulation Office (DMSO) to bring focus to the simulation efforts of the military services. The need for enabling technologies such as DIS and HLA, and protocols became apparent if the military was to move into the Live-Virtual-Constructive simulation domains. Col Jim Shiflett, the first Technical Director of DMSO, was the prime mover in establishing simulation networking standards Initiatives with IEEE and SISO followed. Bill Waite, AEgis Corporation, worked tirelessly in promoting standards, a *Body of Knowledge* in M&S and NTSA M&S Certification.

Team Orlando

Team Orlando is a unique collaborative alliance formed by the leading military simulation commands, and supplemented, supported and augmented by academic and industry leaders in the modeling and simulation, human performance and training domains. (Team Orlando website). The major military acquisition commands are located in the CFRP. Beyond the environs of the Pentagon, Orlando is the next "node" where the military services unify to research, acquire and provide logistic support for simulators. Team Orlando represents a "joint" (small "j"), loosely-coupled federation where the services maintain their identity and reporting chain of command but share resources, technology and "know-how": a model for other Department of Defense organizations. Team Orlando began with a

joint agreement signed by the Secretaries of the Army and the Navy in 1950 for the purpose of sharing training technology, talent and to work jointly on specific projects. The Army Participation Group moved to Orlando in the relocation from Sands Point in 1965. Soon the Marines and Air Force representatives joined the nucleus of simulator talent and Team Orlando continues to grow. ***This unique sharing of talent has spawned many projects utilizing common technologies. One such example is the Multiple Integrated Laser Engagement System (MILES), developed by Al Marshall in the Navy Labs for the Army and Marine Corps, with his team including University of Central Florida (UCF) researchers. MILES is used extensively by the war fighters and has "spin-offs" in homeland security and entertainment, i.e. Laser Tag.***

National Training and Simulation Association Orchestration of I/ITSEC, M&S Certification and Outreach

As described earlier, the management of I/ITSEC went through an evolution and has stabilized under the National Training and Simulation (NTSA), an affiliate of the National Defense Industry Association (NDIA). Considerable effort goes into the planning and execution of a successful I/ITSEC. Volunteers show no hesitancy to work the various committees, etc. Over the years, Barbara McDaniel, NTSA Staff, has been the continuity, given changing directors. Of significance, NTSA under the guidance of Executive Director Admiral (Ret) Fred Lewis, instituted the Certified Modeling and Simulation Professional (CMSP) Program for practicing professionals, a unique program that recognizes a knowledge/skill set of value to the industry.

In the mid-1990's, Admiral (Ret) John Disher, a former NTSA Executive Director, led a group of simulation and training professionals through Russia and the Ukraine to observe what the former Soviet Union countries were doing in M&S. He was the first to "pierce the veil" of mystery concerning Russian simulation technologies. In addition to the I/ITSEC Conference, NTSA conducts other pertinent conferences, awards scholarships to students and interacts with members of Congress. One critical issue needing focus and on the NTSA agenda is the establishment of a North American Industry Classification Code (NAICS) for M&S which would enable economists to more accurately estimate the number of people working in that industry.

The ever-expanding universe of M&S is accelerated through conferences held throughout the world. MODSIM World, held in the Tidewater area is an example of M&S tailored to the needs of the region, coupled with national goal initiatives. Annual M&S conferences take place in Europe, Asia, Australia and throughout the United States, covering the globe.

National Center for Simulation (NCS)

In February, 1993, President Clinton and Vice President Gore unveiled "Technology for America's Economic Growth, A New Direction to Build Economic Strength." Under the Technology Reinvestment Project, the Training and Simulation Technology Consortium (TSTC) was created in Central Florida via a successful proposal submitted to the Advanced Research Project Agency (ARPA). Eight original members of the consortium included four M&S companies and four Government organizations. The latter included the Naval Training Systems Center, National Aeronautics and Space Administration, Army Simulation, Training and Instrumentation Command and the University of Central Florida. The mission of TSTC was to transfer Department of Defense technology to industry and other Federal agencies. The NASA Program Manager was Priscilla Elfrey. Service principals were Col. John Gravois and Dave Manning (Army), Hank Okraski and Janet Weisenford (Navy). Because of the national interest in M&S and its diverse application potential, TSTC was renamed the National Center for Simulation (NCS). Today, NCS has over 250 members and receives strong support from UCF and the Florida High Technology Corridor Council (FHTCC) to execute its mission. NCS has been instrumental in developing M&S education programs including an M&S curriculum and industry certification for high school and technical school students. The NCS President/CEO, Lt. Gen (Air Force- Retired) Tom Baptiste led the initiative, with Congressional support, to provide for new UCF facilities to accommodate an expanding Government workforce in Central Florida, reducing the vulnerability to Base Relocation and Closure (BRAC) decisions.

Economic Impact of M&S on Florida's Economy

Modeling and Simulation (M&S) is a national critical technology. It is a rapidly growing technology with a myriad of applications including military, medical, homeland security, manufacturing, transportation, entertainment, sports, etc. There are several centers of M&S throughout the country but the epicenter is Central Florida where the military services perform research, acquire and support training systems for live, virtual and constructive training. Modeling, Simulation and Training (MS&T) has a tremendous economic impact on Florida. The sector generated more than $11.6 billion in total sales in Florida. The direct effect of the activities resulted in more than $5.66 billion in sales. The sector directly employs more than 30,000 with an average annual salary of approximately $78,341. In 2015, the MS&T sector contributed more than 73,802 total jobs to Florida's economy, more than $6 billion to Florida's regional GDP, and more than $11.6 billion in state sales (economic output) activity. (FHTCC). Add to it the number employed in the entertainment and health care simulation industries and the figure becomes very large-and growing. M&S has become a large business, requiring a wide spectrum of skill- sets. Florida has long been known for its citrus production, agriculture and most recognized entertainment attractions but M&S is part of the "rest of the story".

The M&S Workforce Development Model

The simulation industry recognized the need to develop a viable workforce with the necessary skill- sets to support M&S. The National Center for Simulation (NCS) embarked on a course to ensure that resources would be available to support the industry. NCS, in conjunction with its Government, industry and academic partners, developed a workforce model to serve as a common baseline and objectives necessary to plan for the future workforce. The model is shown in Figure 4.

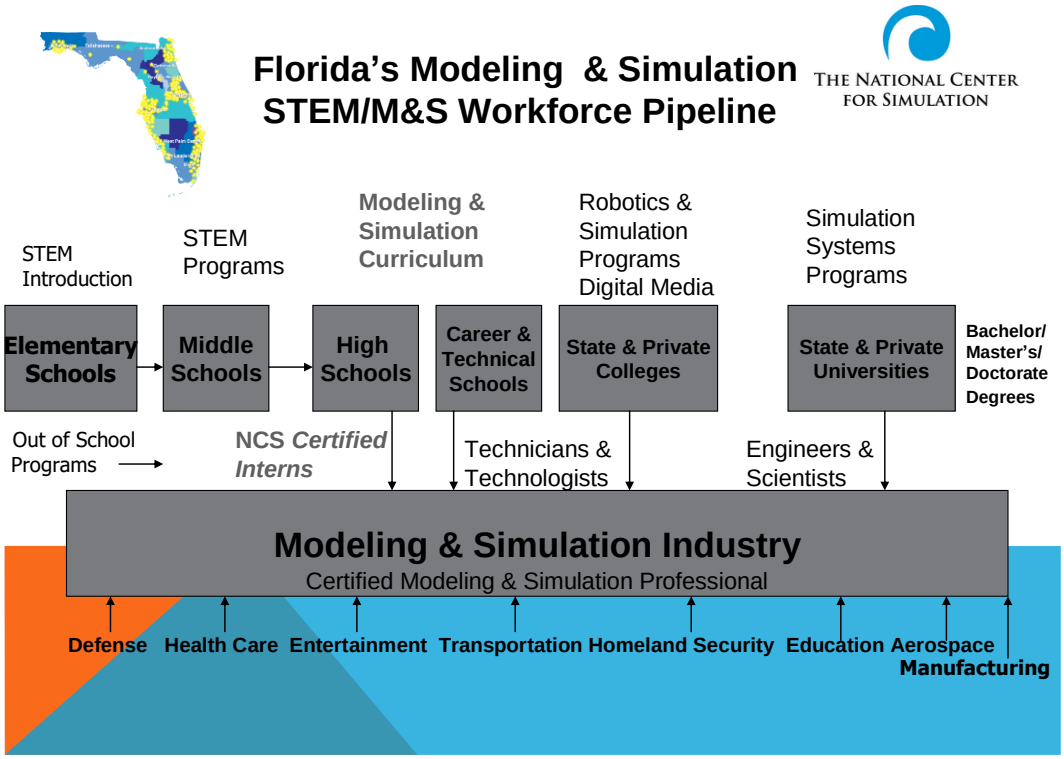

Figure 4- Florida Education & Workforce Development Model

At the time of the "Big-Bang", the major employer in the M&S industry was military simulation companies as compared to the current wide spectrum of applications. Medical and entertainment uses are growing rapidly, particularly in Florida with its Medical City and the theme parks in the Orlando area.
Major components of the model include an M&S curriculum, built upon a curriculum developed by Old Dominion University, and an industry M&S Certification for high school and technical school students. The Florida M&S curriculum, framework, standards and industry certification were approved by the Florida Department of Education. The Certification is limited to Florida students in CY 2016 but will be available nation-wide in 2017. NTSA offers a professional certification (CMSP) for practicing "simulationists". (Okraski-ITEA).

PROJECTIONS FOR THE FUTURE OF M&S

The military services will continue with the development and implementation of Live-Virtual- Constructive (L-V-C) simulation and these will be showcased at future I/ITSECs. More research will be focused on human behavior. "Telling the story" will lead to more effective training. The entertainment world does this very effectively by "suspending disbelief" for the duration of the experience. The military needs to do this more routinely in this era of video games where players are accustomed to and appreciate immersion. Hardware and software technologies will be furnished by the commercial suppliers as technology will change at an even more rapid rate to keep up with consumer market demands. Brain wave analysis will provide new insight into human behavior and responses. Eventually, brain wave activity will provide a way to measure of transfer of training from the simulated to the real world. M&S will continue to find new applications beyond the military in medicine, mental health, space exploration, world politics, education, genetics, crime investigations, global market analysis, robotics and other exciting fields.

LESSONS LEARNED

What was perceived in 1964 as a bad decision to relocate NTDC did not result in a bad outcome. The relocation of the Navy and Army units to Orlando, on the surface, made little or no sense. The decision was not based on a "vision" to grow M&S: it was strictly political.

Team Orlando evolved through the recognized benefits of sharing technology and simulation "know-how". It became "one-stop shopping" for those in need of the technology. Military services were attracted to the nucleus because of those reasons and as the critical mass began to grow with industry and academia joining the community. I/ITSEC became the showplace for the technology and was/is the "social medium" for the industry.

Team Orlando cannot survive or grow if the services decide to relocate one or more of its members. Threats to moving the Navy came in 1972 and in 1993. The latter was the result of a BRAC decisions. Moving the Army continues to be entertained by some. Lt Gen. (USAF-Ret) Tom Baptiste, NCS President/CEO, is the driving force, along with UCF and the Florida legislature, to have the State of Florida construct a building for UCF that will be occupied by the Army: rent free. The lesson is to remain ever vigilant. What may be perceived as optimized organizational changes may not be the best for the M&S Industry, military readiness or the nation. NAWCTSD avoided a BRAC relocation in 1993 by the intervention of a senior DOD official, and years prior a planned move to the Florida Gulf Coast was blunted by Congressman Lou Frey.

I/ITSEC will continue to function and grow in diversity of applications, with more emphasis on growing the workforce. What began as a problem-solving event in 1966 has been re-molded, but the need for continuous systems improvement still exists. Other industry/ government forums have "spun-off" such as the Training and Simulation Industry Symposium (TSIS), Procurement Administrative Lead Time (PALT) and Integrated Product Teams (IPTs) to fill the information flow and problem-solving void that existed fifty years ago.

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