USC Institute for Creative Technologies

20 YEARS IN EXCELLENCE IN SUPPORTING THE DOD AND SOCIETY.

For 20 years, the Army's Institute for Creative Technologies at USC has been at the forefront of basic and applied research in immersive technology, simulation, computer graphics, artificial intelligence, and narrative. And for 20 years, ICT has leveraged this multi-disciplinary research to solve real-world problems facing service members, students, and society.

Dedicated to finding new ways to teach, train, help, and heal, ICT researchers continue to explore and expand how people engage with technology. In turn, the immersive prototypes built on this knowledge provide engaging experiences that help users improve decision-making, leadership, and coping skills. Whether it is developing next-generation 3D terrain capabilities for the military (One World Terrain, p. 30), virtual reality exposure therapy for patients with post-traumatic stress (Bravemind, p. 28), or lowering the cost bar on head-mounted displays prompting the emerging VR and AR spaces to-date (p. 23), ICT brings together government, academia, and the entertainment industry to build experiences that matter.

The Institute was established in 1999 as a DoD-sponsored University Affiliated Research Center (UARC). ICT is working in collaboration with the Natick Soldier Systems Center and the Army Research Laboratory (ARL) of the U.S. Army Combat Capabilities Development Command to establish new capabilities for the Army of 2030 and beyond. The U.S. Army selected the University of Southern California as a strategic partner because of the university's unique confluence of scientific capabilities, immersive creativity, and entertainment industry relationships. This unique confluence not only allows ICT to provide the DoD with new knowledge, but it gives military subject matter experts the opportunity to work with scientists and artists, resulting in prototypes that successfully transition into the hands of warfighters.

ICT boasts an excellent faculty of innovative leadership and has produced significant projects that have inspired the advancement of revolutionary technologies such as the Oculus Rift, Microsoft's Cognitive Services, forward-looking 'deepfake' detection, and more. The Institute's faculty roster teaches courses on the USC campus, holds elected positions of command in relevant associations, publishes regularly in leading international scientific publications and has been recognized as trailblazers in their respective professional societies. In addition to its academic and scientific credentials, ICT is aligned with the Army's Synthetic Training Environment Cross Function Team (CFT), other CFTs, and the Army's Artificial Intelligence Task Force.

With pioneering research and advanced prototypes, the USC Institute for Creative Technologies will continue to find new and better ways to teach, train, help, and heal – making an impact today while paving the way for the future.

210

ICT disclosures
that have resulted in
27 patents
from 1999 to 2019.

1,800+

ICT peer-reviewed research published in top tier scientific and academic publications such as Association for Computing Machinery, Institute of Electrical and Electronics Engineers (IEEE), Nature Neuroscience, Journal of American Medical Association (JAMA) and more.

140+

Honors & Awards highlighting faculty and staff. Key highlights include the Robert S. Engelmore Memorial Lecture Award from Association of the Advancement of Artificial Intelligence (AAAI) and The Academy of Motion Picture Arts' Scientific and Engineering Academy Awards.

34

Millions of dollars saved by applying ICT Natural Language technologies to a single U.S. Army project.

65

ICT prototypes
impacting Army programs including One World Terrain, DS2A, Suite of ELITE SHARP Trainers, UrbanSim, CVIT, SDC-R, Bravemind, VACG and more.

46

Internationally recognized researchers including 3 AAAI fellows, 2 Cognitive Science fellows, 2 AAAS fellows, an IEEE fellow, 2 Kurzweil prizes, 3 dozen of conference chair positions, and 2 SciTech Academy Awards.

60,000+

Science and technology citations for publications received since ICT opened its doors in 1999.

270,000

Service members train, use, or benefit from Army and DoD-sponsored research created by ICT. Results of these efforts have benefitted service members in counter IED awareness, interpersonal communication skills, simulated terrain generation, serious decision games, and bilateral communication.

HISTORICAL ACHIEVEMENTS.

The Institute has produced a long line of applications that have impacted not only the Army, but also other services and society, as well. In many cases, these applications are based on fundamental research discoveries and investments made by the Army to create the knowledge necessary for the application.

ICT's excellence in research and advanced technologies has led to the acceleration of multi-sense technologies, cognitive architectures, and the entire virtual reality industry.

1999-2019

1999

Grand Opening

The birth of ICT, launching themed initiatives that focus on graphics sound, character, story, and AI research.

VIRTUAL HUMANS

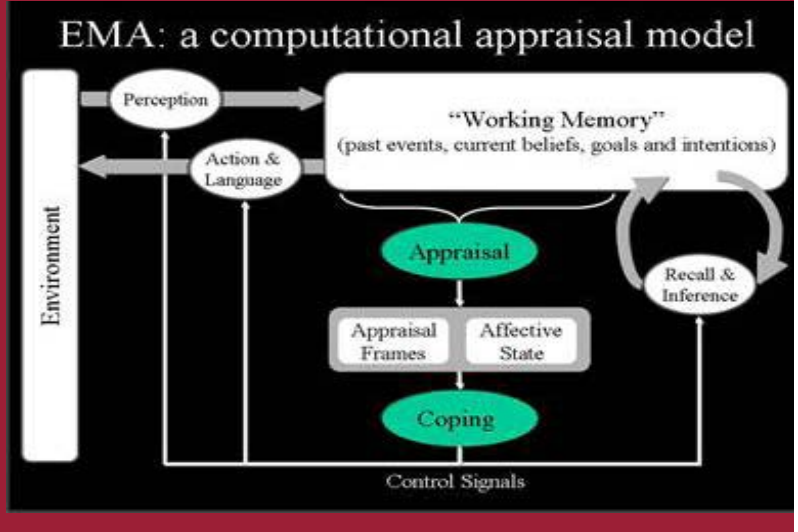
ICT advances research in computer-generated characters that use language, have appropriate gestures, show emotion, and react to verbal and non-verbal stimuli. Widely considered the most comprehensive research project of its kind and led to an explosion of virtual human research by greatly enhancing the modularity of such systems and allowing the sharing of software components across groups. The software is used by dozens of research groups across the world in their virtual human applications and research.

2000

Emotion Modeling (EMA) 2000

One of the first, and most comprehensive computational models of human emotion provided virtual humans with the ability to exhibit and understand human emotions.

ICT research in computational models of emotion has helped influence the inclusion of emotional factors into cognitive architectures such as Soar (Soar has been used in many DoD simulation systems through the work of SoarTech) and research on the emotional behavior of non-player-characters in computer games. More broadly, this research has led to advances and shaped the field of Affective Computing.



2003

Mission Rehearsal Exercise

Mission Rehearsal Exercise (MRE) is ICT's earliest virtual human project combining artificial intelligence software and basic research to create simulated scenarios used to teach young officers to make decisions. The project was developed in SOAR, a cognitive architecture that has served as one of the precursors of Sigma, an integrated computational model of intelligent behavior. By focusing on modeling human behavior and on integrating a range of virtual human related capabilities into a single system (e.g., emotion modeling, task modeling, perception, dialogue management, nonverbal behavior, etc.), MRE has been highly influential in today's use of avatars and virtual humans to support individual team training applications.

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2003

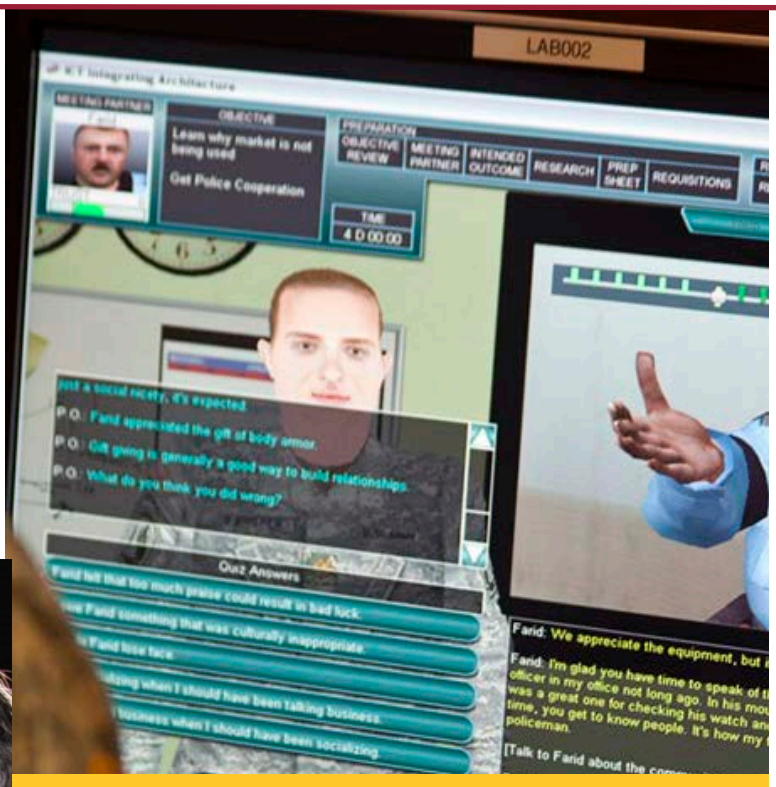
Joint Fires and Effects Training System (JFETS) 2003

Earliest adoption of virtual and simulated displays for training Army observers at Fort Still.

2004

SLIM ES3 2004

A web-delivered, web-enabled, combat patrol training tool for U.S. ground forces, providing Active Surveillance, Threat Indicator Identification and Information Operations.



BiLAT 2004

A simulator for negotiation training that uses game technology and in contrast to earlier game-based systems development, was driven by Iraq early security and stability operational needs.

Bravemind 2004

Bravemind is a basic and applied research effort utilizing virtual reality exposure therapy in providing relief from post-traumatic stress. ICT researchers added to this therapy by leveraging virtual art assets that were originally built for gaming for creating virtual environments in head-mounted displays. The work was originally supported by funding from the DoD and later support came from the Army and Navy/Marine Corps.

Sgt John Blackwell 2004

SGT John Blackwell, a virtual human, was created for the 2004 Army Science Conference, as a demo of ICT virtual human technology, including spoken question-answering ability, and a mixed-reality presentation on a transparent screen. The project accelerated ongoing efforts to present an engaging, interactive avatar combining natural language and speech recognition with audio-driven, real-time facial animation research. It also helped evolve the use of tools for building question-answering characters, a primary resource in the further development of virtual human characters at ICT.

2004

High Dynamic Range Imaging

High Dynamic Range Imaging is the ICT Vision & Graphics Lab's first efforts in basic research that helped pioneer the trajectory in high dynamic range imaging, a technique used in imaging and photography to reproduce a greater dynamic range of luminosity than what is possible with standard digital imaging or photographic techniques.

The work proposed methods for using HDR images as texture maps in real-time graphics applications and are used in modern technology today like cell phones, GPU's, image editing software, video games, consumer TV sets and in digital cinema. Present benefits of these developments have increased capabilities in visualization efforts for the Army, specifically in setting the foundation of its Synthetic Training Environment with One World Terrain, a research effort providing 3D terrain services replicating the coverage and complexities of the operational environment.



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2005

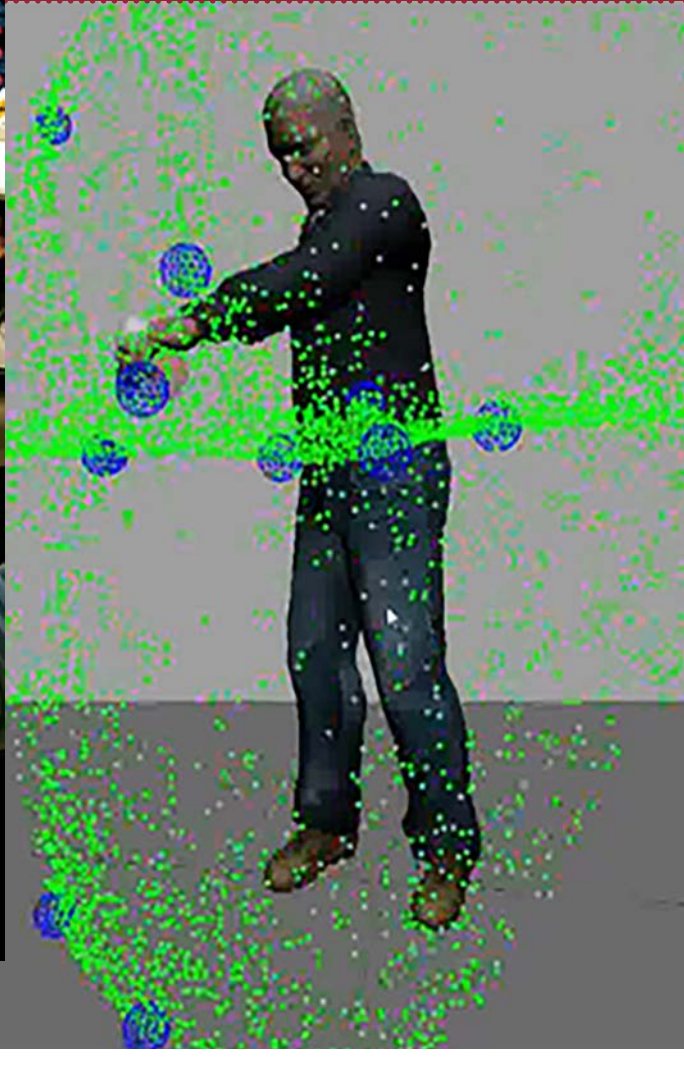
Full Spectrum Warrior

2005

Full Spectrum Warrior (FSW) is a squad-based, tactical-action game that places the player into the 21st century set in a Middle Eastern MOUT environment.

SmartBody 2005

The SmartBody basic research program discovered the knowledge and modular framework architecture for virtual human animation that accelerated industry capabilities. SmartBody algorithm software has been shared with hundreds of thousands of users, received over 400 academic citations and is a critical application used in Army/ICT projects such as SimSensei, SimCoach, Stability and Support Operations (SASO), SPSS, Responsive Virtual Human Guide, Emergent Leader Immersive Training Environment (ELITE), and Immersive Naval Office Training System (INOTS).



UrbanSim 2006

This game-based training software models social entities, individuals or groups, as goal-seeking decision-makers that can have beliefs about other entities for practicing the art of mission command. The demand signal came from the Army's Command Prep course at Fort Leavenworth and the need to improve commander and staff training in preparation for deployment to Iraq.

2006

2007

Sergeant Star 2007

A recruiting tool developed in collaboration with Accessions Command to support Army recruitment requirements. The Sergeant Star prototype incorporated technologies developed under ICT's 6.1 and 6.2 research portfolio such as enhanced graphics and natural language processing. Sergeant Star was seen by over 75,000 people from 2007-2009.

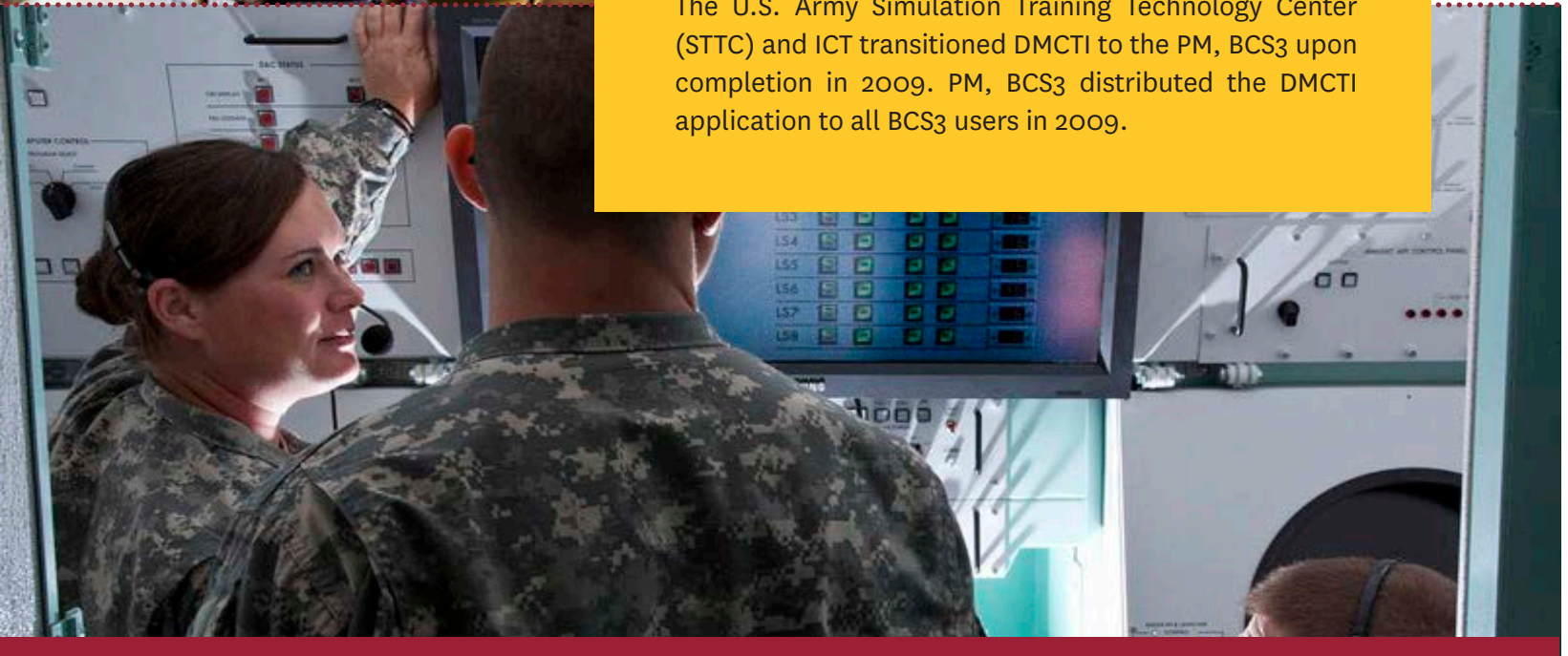
Lessons learned from developing this application paved the way for the creation of enhanced virtual human characters which have subsequently been integrated in a number of Army training applications.

2008

DMCTI 2008

Distribution Management Cognitive Training Initiative. The DMCTI practice exercises were designed to help logisticians develop the skills required to exploit the capabilities of logistics C2 systems and management tools such as the Battle Command Sustainment Support System (BCS3) and TransLog Web.

The DMCTI was the recipient of the US Army Modeling and Simulation Award for training excellence in 2008. The U.S. Army Simulation Training Technology Center (STTC) and ICT transitioned DMCTI to the PM, BCS3 upon completion in 2009. PM, BCS3 distributed the DMCTI application to all BCS3 users in 2009.



CAD-TS, ECS2 2008

Cognitive Air Defense–Training System, Engagement Control Station Simulation – Trained and assessed soldiers' abilities to recognize and respond to perceived threats with complete situational awareness. Transitioned to the USAADASCH at Fort Still in 2010.

2008

Gunslinger

Gunslinger combined ICT's virtual human technology with Hollywood storytelling and set building into an engaging, mixed-reality, story-driven experience, where a single participant could play the hero in a wild west setting by interacting both verbally and non-verbally with multiple virtual characters. The project combined components from select ICT basic research modules designed to emphasize natural language interaction and nonverbal behaviors and perception.

The development of Gunslinger prompted successor projects integrating the technology used to develop Combat Hunter Action and Observation Simulation (CHAOS), Emergent Leader Immersive Training Environment (ELITE), Responsive Virtual Human Museum Guides and the release of the Virtual Human Toolkit, the basis of all ICT virtual human projects.

MCIT 2009

Mobile Counter IED Training System developed to improve counter IED training. 10 systems deployed to the Army, Marine Corps and NATO training commands responsible for deploying allied forces to Iraq.

INOTS 2009

Immersive Naval Office Training System developed with Office of Naval Research (ONR), Naval Service Training Command (NSTC) and Officer Training Command - Newport (OTCN) as a mixed reality training environment targeting leadership and basic counseling skills for junior leaders in the U.S. Navy.

INOTS was installed at OTCN in August 2011 and has been used to train tens of thousands of naval personnel attending the Division Officer Leadership Course (DOLC) and the Officer Development School (ODS). A unique version of INOTS called the Emergent Leader Immersive Training Environment (ELITE) was developed for the Army and tested at Ft. Benning in 2011. A laptop version of the INOTS mixed reality environment was developed in 2014-2015 and transitioned to OTCN in 2016.

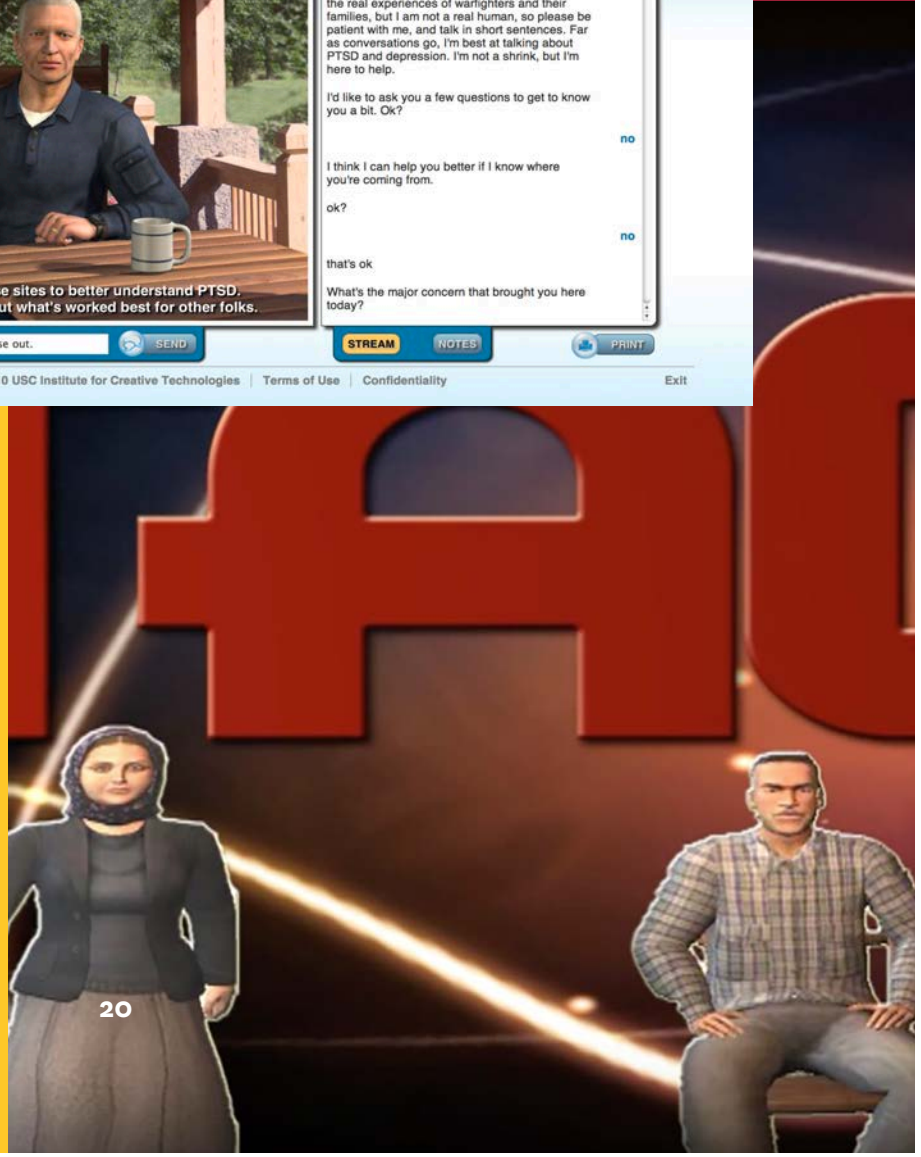
2009

SimCoach 2009

Designed to attract and engage military service members, veterans, and their significant others who might not otherwise seek help. Aimed to motivate users in taking the first step and seeking information and advice with regard to their healthcare and their general personal welfare. SimCoach was ICT's first web-based interactive virtual human and has since been incorporated into the Braveheart website, a Veteran support initiative of the Atlanta Braves and Emory University.

TAC-Q 2009

Tactical Questioning System utilized advanced virtual human technologies and provided a realistic, 3D immersive environment where HUMINT collectors could engage in free-flowing conversations with intelligent virtual humans. The STTC and ICT transitioned the TAC-Q system to PEO STRI (PM ConSim) in 2010 where it was further developed and integrated by private industry into the Intelligence Electronic Warfare Tactical Proficiency Trainer (IEWTPT).



2010

Light Stage 2010

ICT's Vision & Graphics Lab pioneered the use of the Light Stage, a high definition capture of actors allowing them to be placed in any environment real or virtual, recognized with an Academy Award® for its use in films including Avatar, Benjamin Button and Spider-Man™ 2.

COPA 2010

The "Choice of Plausible Alternatives" (COPA) evaluation of commonsense causal reasoning was published and, in the years since, has played an instrumental role in advancing research on automated question-answering and deep neural network language models in both academia and industry. In 2019, the COPA evaluation became a component task of the SuperGLUE benchmark for General-Purpose Language Understanding Systems and has been used in industry research by IBM, Facebook, Google, OpenAI, and Microsoft, among others.

ELITE 2010

Based on the original INOTS system, Emerging Leader Immersive Training Environment for leader development is a mixed reality environment providing junior leaders an opportunity to learn, practice and assess interpersonal communication skills in basic counseling. The Army's training application has been incorporated in leader development courses at Fort Benning & West Point.

2011

NDT 2011

New Dimensions in Testimony is an initiative in collaboration with the USC Shoah Foundation to record and display testimony in a way that will continue the dialogue between Holocaust survivors and learners far into the future.

MultiSense/SimSensei 2011

Pioneering efforts within DARPA's Detection and Computational Analysis of Psychological Signals (DCAPS) project, SimSensei encompasses advances in artificial intelligence fields of machine learning, natural language processing, and computer vision used to identify psychological distress such as depression, anxiety, and PTS symptoms. This technology has been incorporated into several projects and has also influenced the development of commercial architectures, such as Microsoft's PSI architecture.

2012

Mixed Reality Lab

ICT's Mixed Reality Lab's pioneering work in discovering integrated technology requirements and prototyping hardware and software solutions laid the groundwork for making low-cost VR a reality.

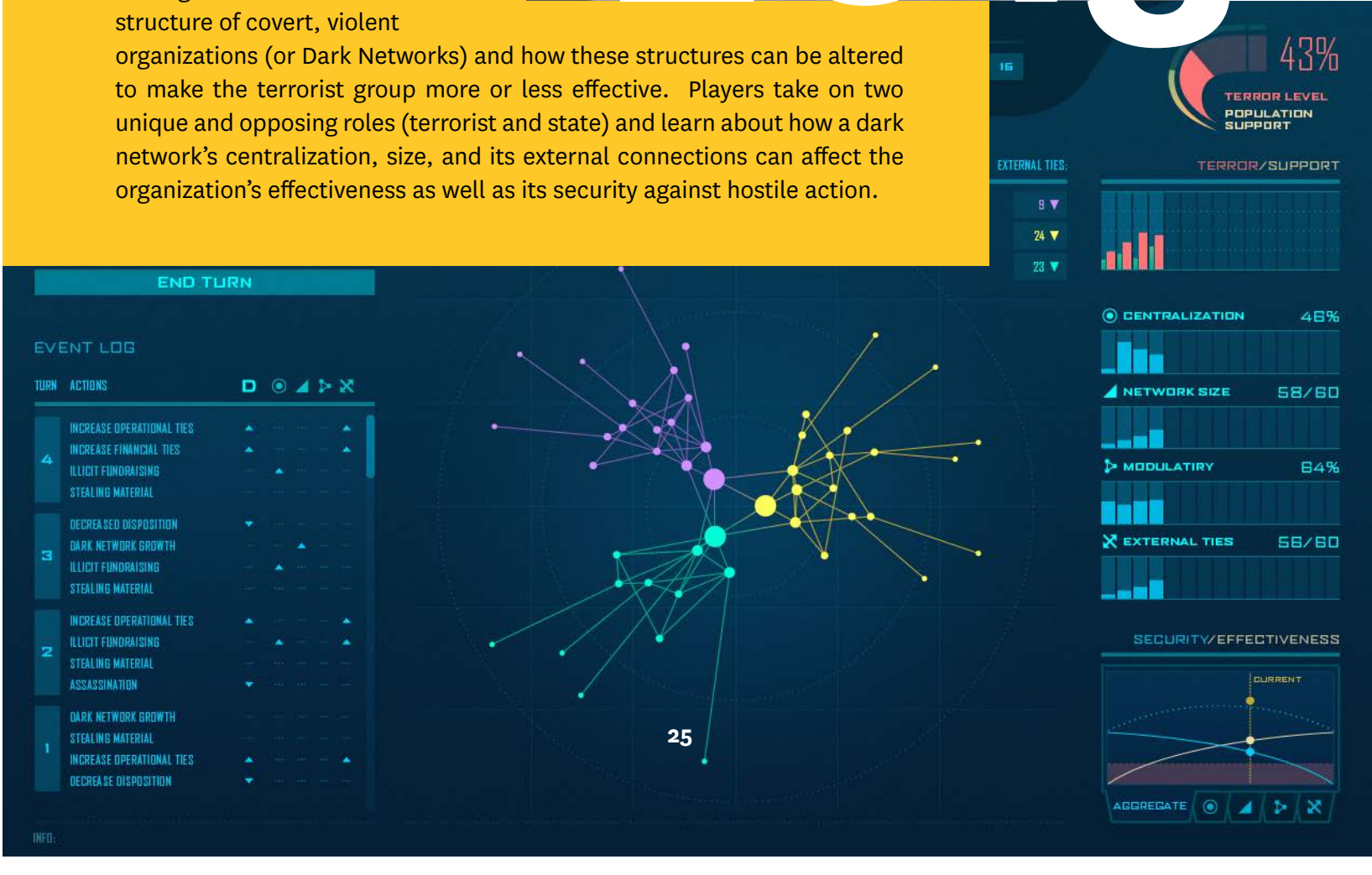
The demand signal came directly from Dr. Blake, PEO STRI, as service members had been tethered by heavy training tools and previous VR hardware was hampered by huge cost and narrow field of view. The lab developed phone and tablet-based immersive viewers and a wide FOV open-source headset that reduced the cost from $15K to a few hundred dollars. This effort informed the emerging virtual and augmented reality spaces to-date, resulting in off-the-shelf solutions like Oculus Rift, Google Cardboard, Samsung Gear, and transforming the industry.

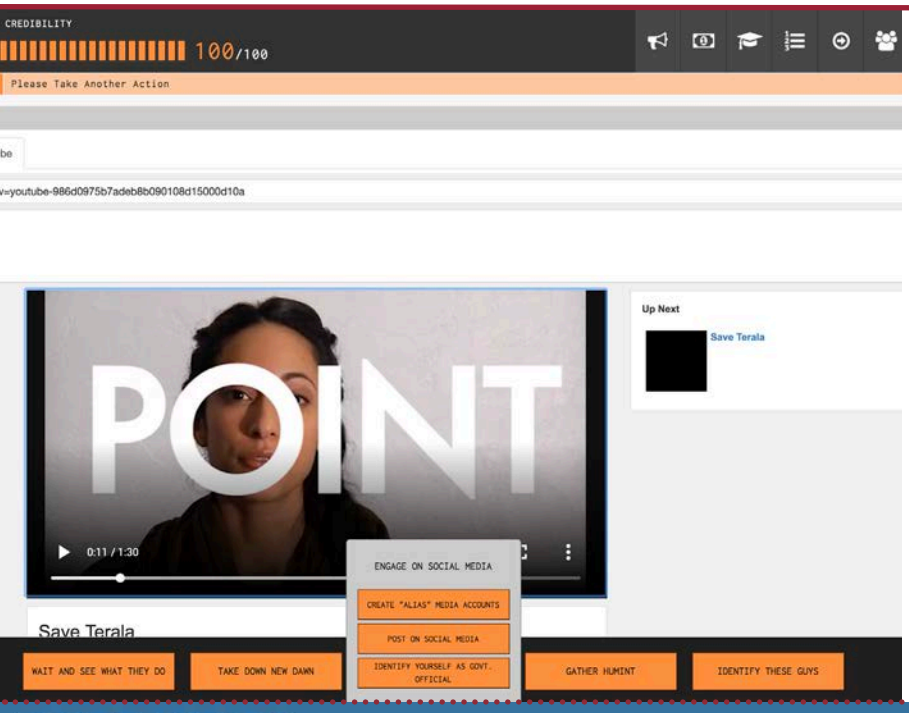
DisasterSim 2013

DisasterSim is a game-based training tool focused on international disaster relief. Trainees take on the role of a joint task force staff member coordinating the US Department of Defense's (DoD) humanitarian aid and disaster relief efforts in a foreign country following a natural disaster.

Dark Networks 2013

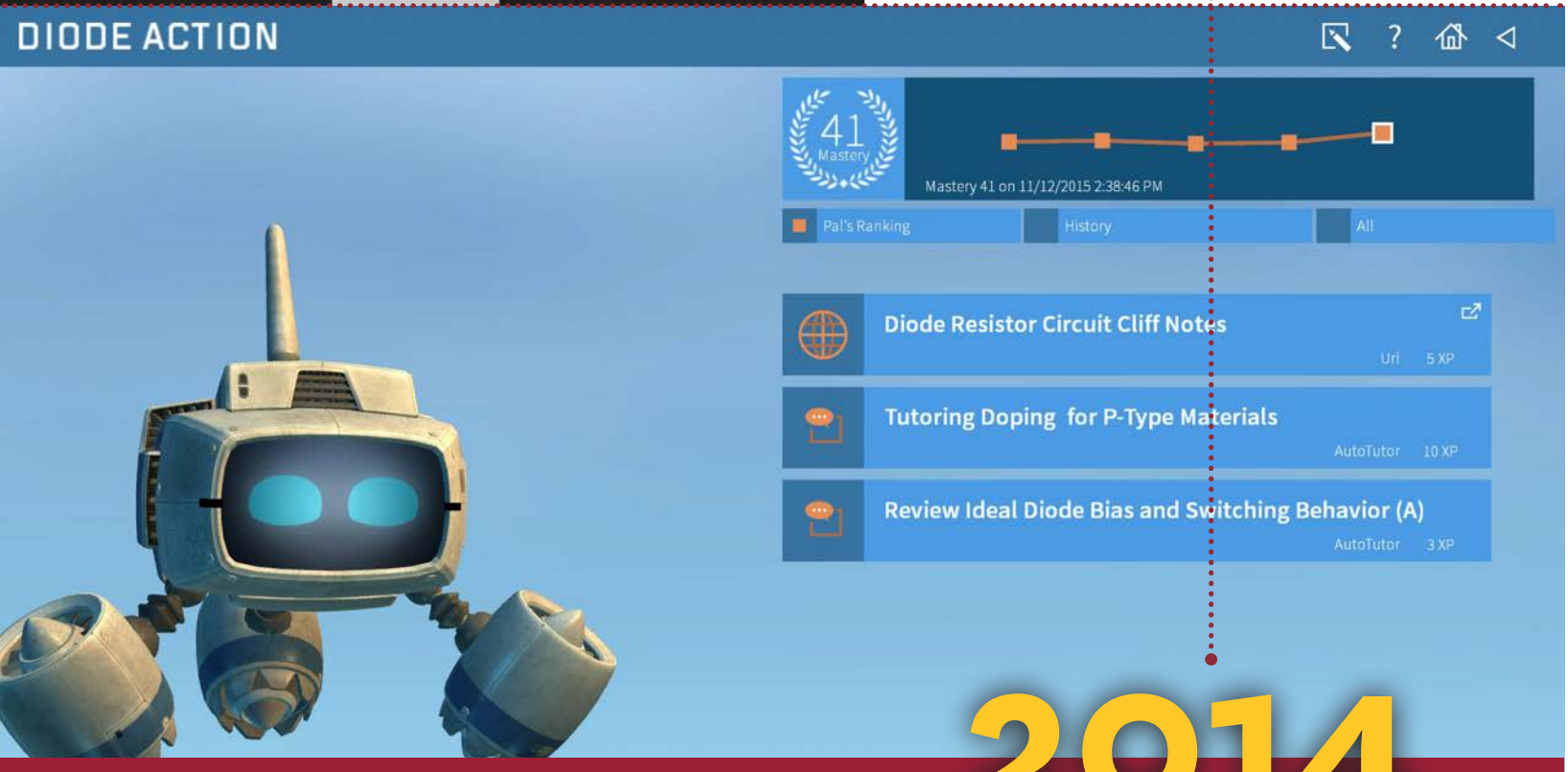
Dark Networks is a two-player, web-based game focused on the organizational network structure of covert, violent organizations (or Dark Networks) and how these structures can be altered to make the terrorist group more or less effective. Players take on two unique and opposing roles (terrorist and state) and learn about how a dark network's centralization, size, and its external connections can affect the organization's effectiveness as well as its security against hostile action.





CounterNet 2014

CounterNet is a single-player, web-based counter-terrorism game that teaches cybersecurity students and personnel how to identify, track, counter and thwart online terrorist activity. It focuses on how terrorists use the internet and social media for various purposes, including: propaganda, financing, training, planning, execution of attacks, recruitment, incitement, radicalization, spreading public information, and secret communication.



2014

PAL3 2014

Personal Assistant for Life Long Learning is a system for delivering engaging and accessible education via mobile devices. PAL3 uses a persistent record of your training, educational experiences, and knowledge of career aspirations together with a library of learning resources containing custom content and pre-existing tutoring systems.

2015

Rapid Avatar Capture 2015

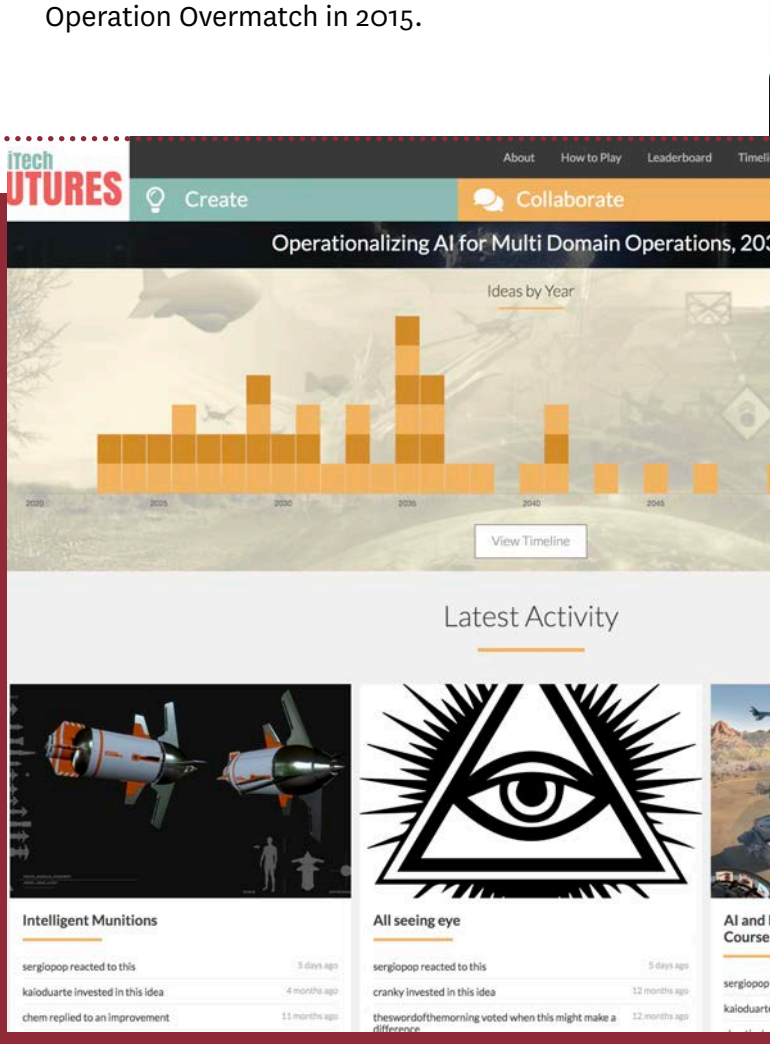
Generates photorealistic, 3D characters of real people into virtual humans in less than 30 minutes.

ESP 2015

Early Synthetic Prototyping created both multi-player and standalone systems that allowed future combat systems to be virtually tested by end users, it was transitioned to Operation Overmatch in 2015.

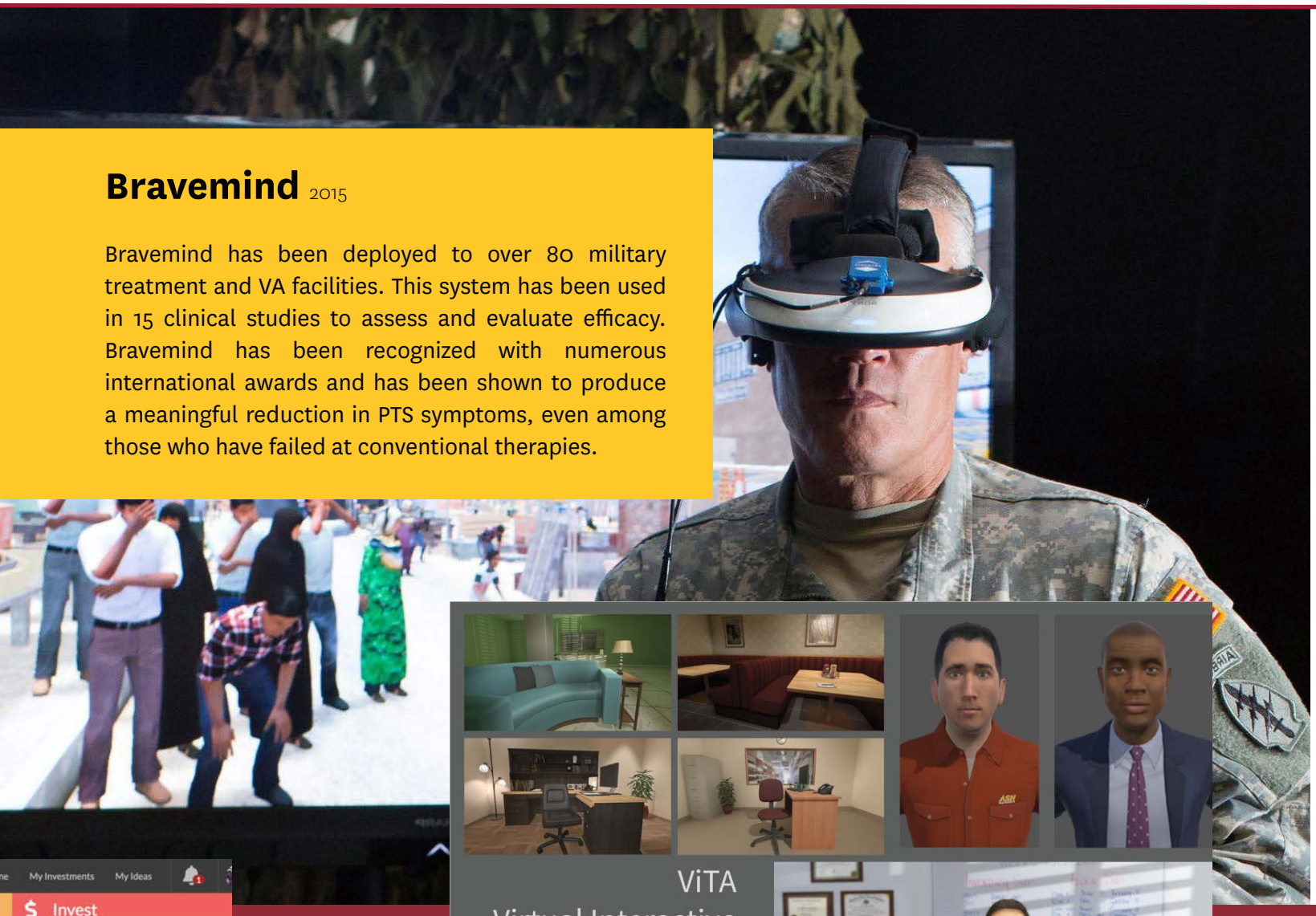
SciTech Futures 2015

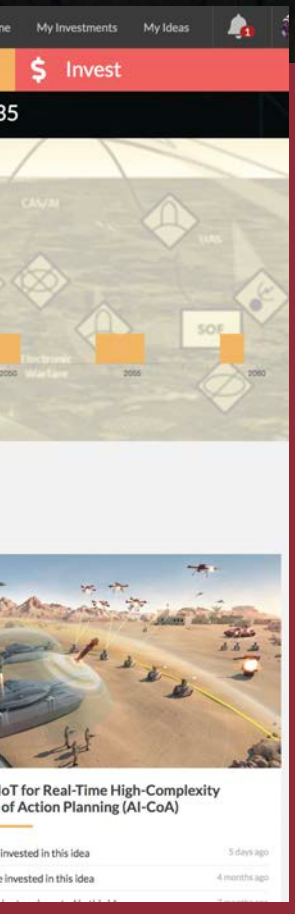
An ASA(ALT) funded research project that helps Army leaders ideate in the S&T space while identifying blind spots in Army planning. The project uses a combination of interactive gaming and crowdsourced ideation to explore possible future (20-30 years out) threats. ICT also collaborates with writers and concept artists, with the latter group providing visuals in near real-time during gaming exercises. This combination of crowdsourcing, gaming, and concept art provides alternatives to traditional Army wargaming/future forecasting.



Bravemind 2015

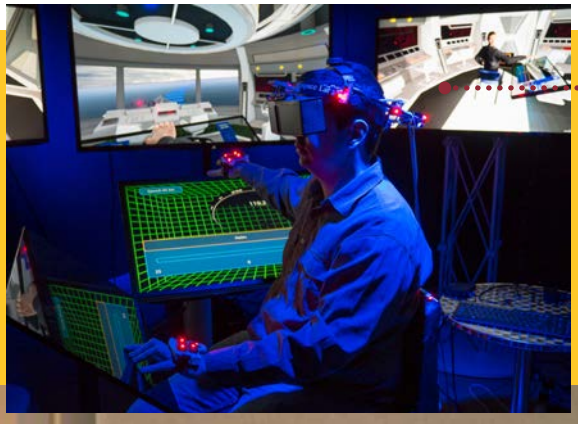
Bravemind has been deployed to over 80 military treatment and VA facilities. This system has been used in 15 clinical studies to assess and evaluate efficacy. Bravemind has been recognized with numerous international awards and has been shown to produce a meaningful reduction in PTS symptoms, even among those who have failed at conventional therapies.





ViTA 2015

The Virtual Interactive Training Agent is a virtual reality job interview practice system for building competence and reducing anxiety in young adults with Autism Spectrum Disorder (ASD) and other developmental disabilities. It was developed by the ICT in partnership with the Dan Marino Foundation (DMF) and is currently used in over 170 facilities. A similar version was developed and adapted for military service members and veterans and is currently used at the U.S. Vets center in Los Angeles.



Project BlueShark 2016

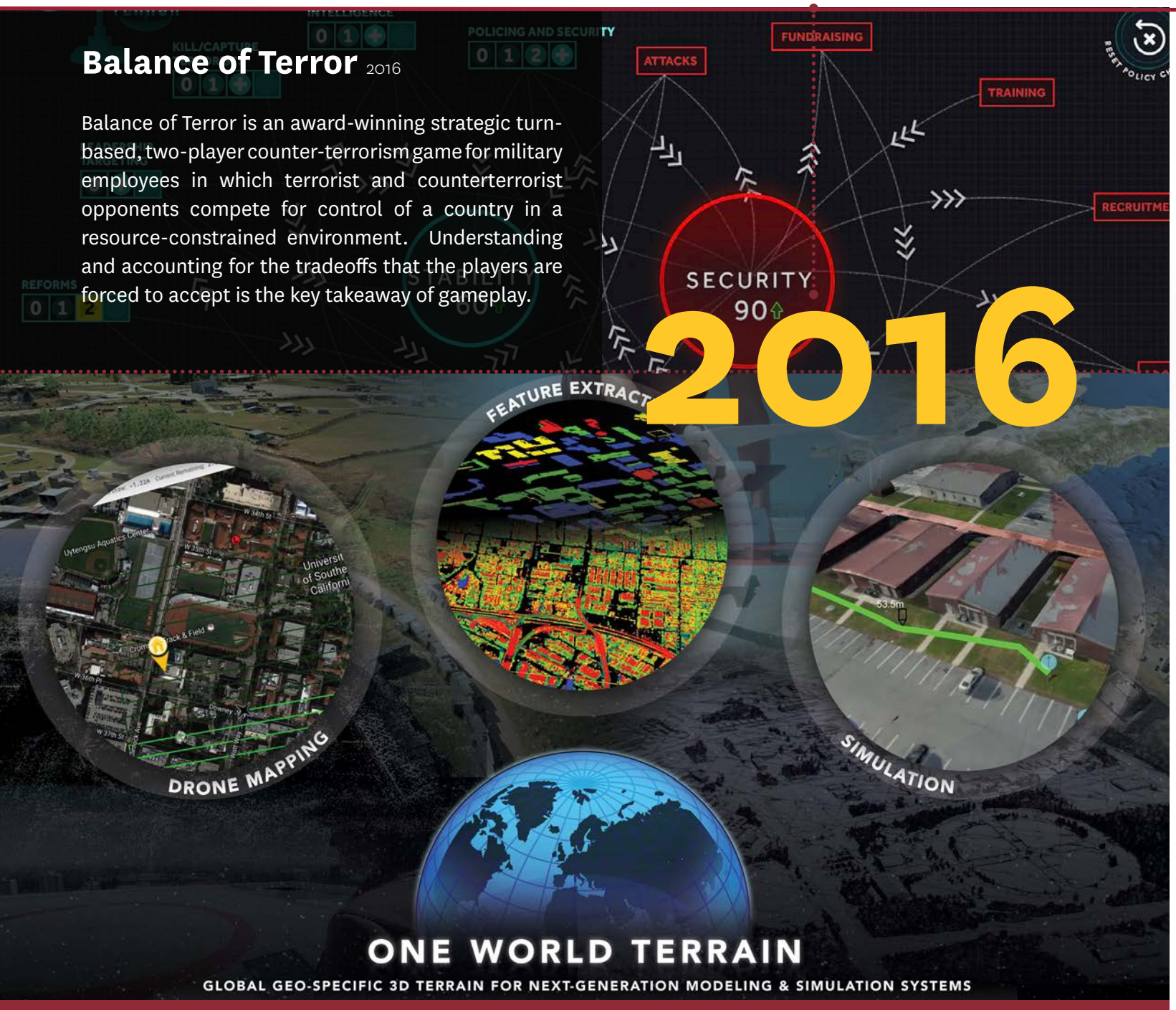
While this "future communications and collaboration environment" was created for the Office of Naval Research, it was tested by a wide range of Army leadership, and helped inform follow-on activities such as Early Synthetic Prototyping and the Synthetic Training Environment.

ELITE SHARP 2016

Three laptop-based training applications developed using the ELITE platform. Bystander Resource Assessment and Virtual Exercise (BRAVE), Command Team Trainer (CTT), and Prevention and Outreach Simulation Trainer (POST). The three applications were developed from an Army SHARP Academy demand for enhanced training applications that addressed critical issues within the Army. The ELITE SHARP CTT received the 2016 Office of Personnel Management and Kansas City Federal Executive Board Innovation Award. The STTC and ICT have transitioned all three ELITE SHARP applications to PEO STRI and the AGfT portfolio of approved Army training applications. It is currently used at the SHARP Academy and major Army commands and bases.

Balance of Terror 2016

Balance of Terror is an award-winning strategic turn-based, two-player counter-terrorism game for military employees in which terrorist and counterterrorist opponents compete for control of a country in a resource-constrained environment. Understanding and accounting for the tradeoffs that the players are forced to accept is the key takeaway of gameplay.



One World Terrain (OWT) 2016

One World Terrain is an Army effort that provides cutting-edge 3D global terrain capabilities and services to the warfighter for training and operations. The OWT pipeline covers all phases of 3D geospatial research and production, replicating the complexities of the operational environment and ensuring decision-makers receive up-to-date geospatial data at the point of need. Researchers are currently making strides in automatic feature attribution for simulation and geospatial intelligence, storage and distribution solutions, and optimization of terrain models for operational users.

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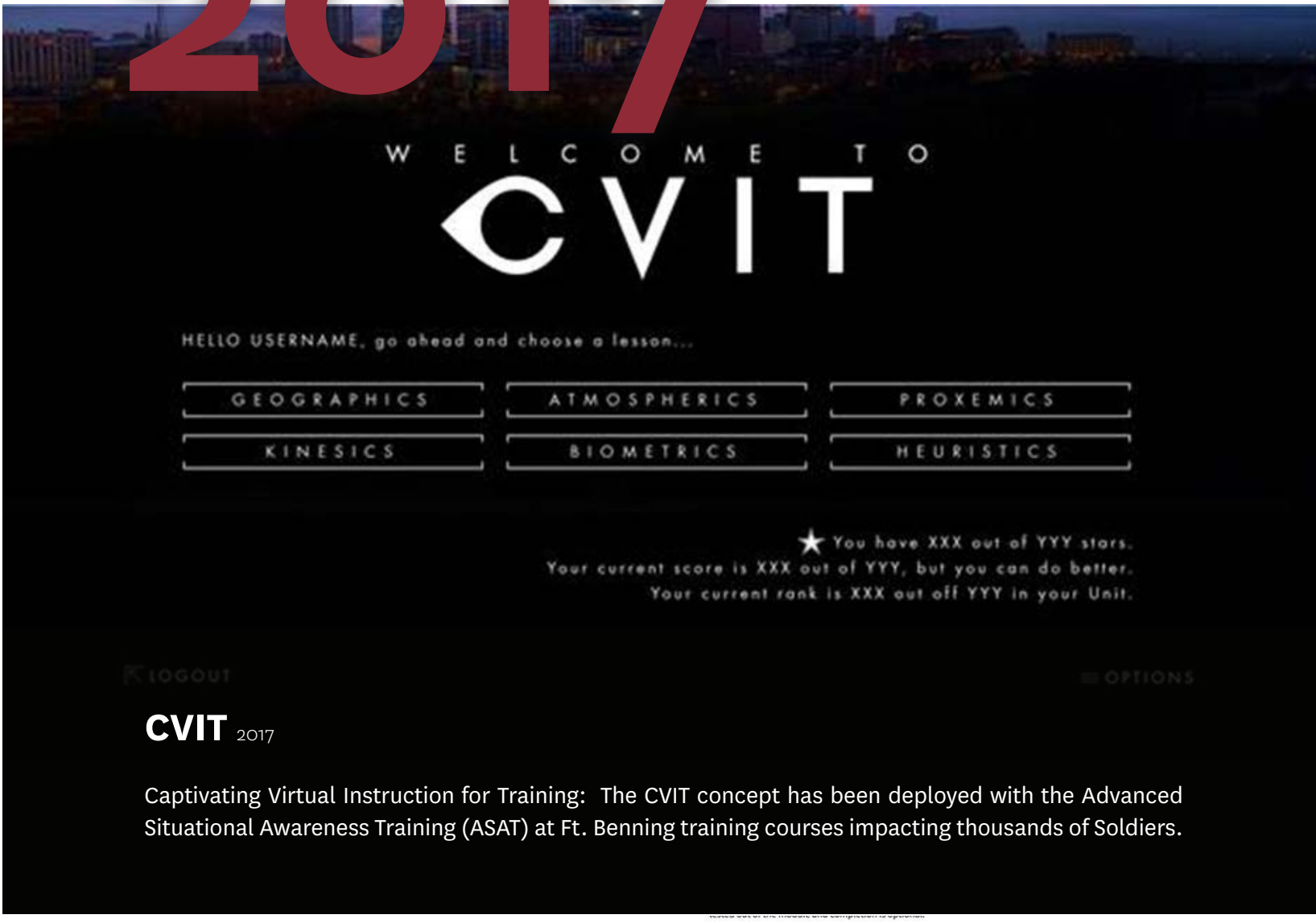
2017

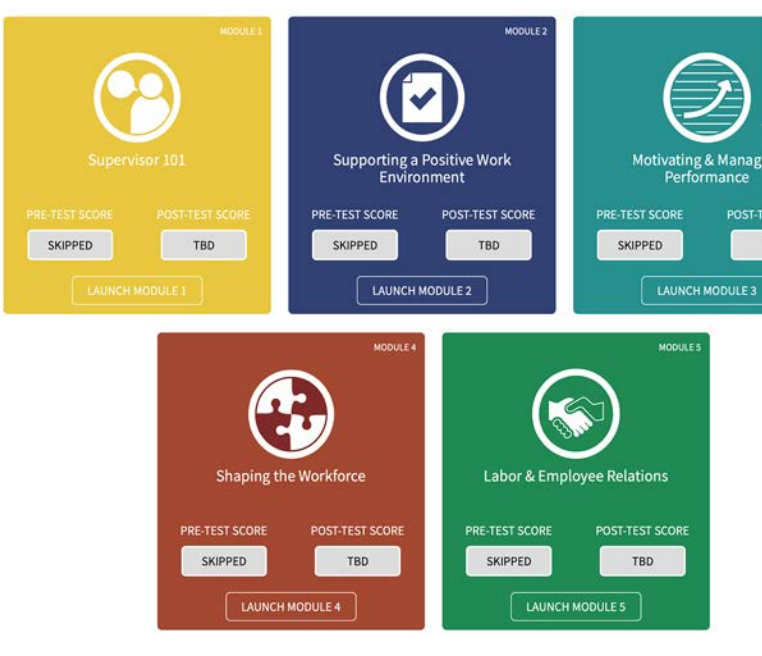


CVIT 2017

Captivating Virtual Instruction for Training: The CVIT concept has been deployed with the Advanced Situational Awareness Training (ASAT) at Ft. Benning training courses impacting thousands of Soldiers.

SDC-R 2017

Supervisor Development Course, Refresher: Requested by Army to improve and reduce 40 hour required training course for Army senior leaders (~ 11,000) required to take the course every three years. The SDC-R course is now less than eight hours with the same or better learning outcomes and has transition to Army program.



OWT 2017-2019

The One World Terrain development platform is included in the Army's Synthetic Training Environment (STE). Transition and release of the first software version of Aerial Terrain Line of Sight Analysis System (ATLAS) supporting terrain visualization,line-of-sight, cover/concealment and route planning simulation capability.

Between 2017 – 2019, trained 19 Army, Marine Corps, ARSOF and NSW units with how to collect data, process and use it at the point of need for training and operations.

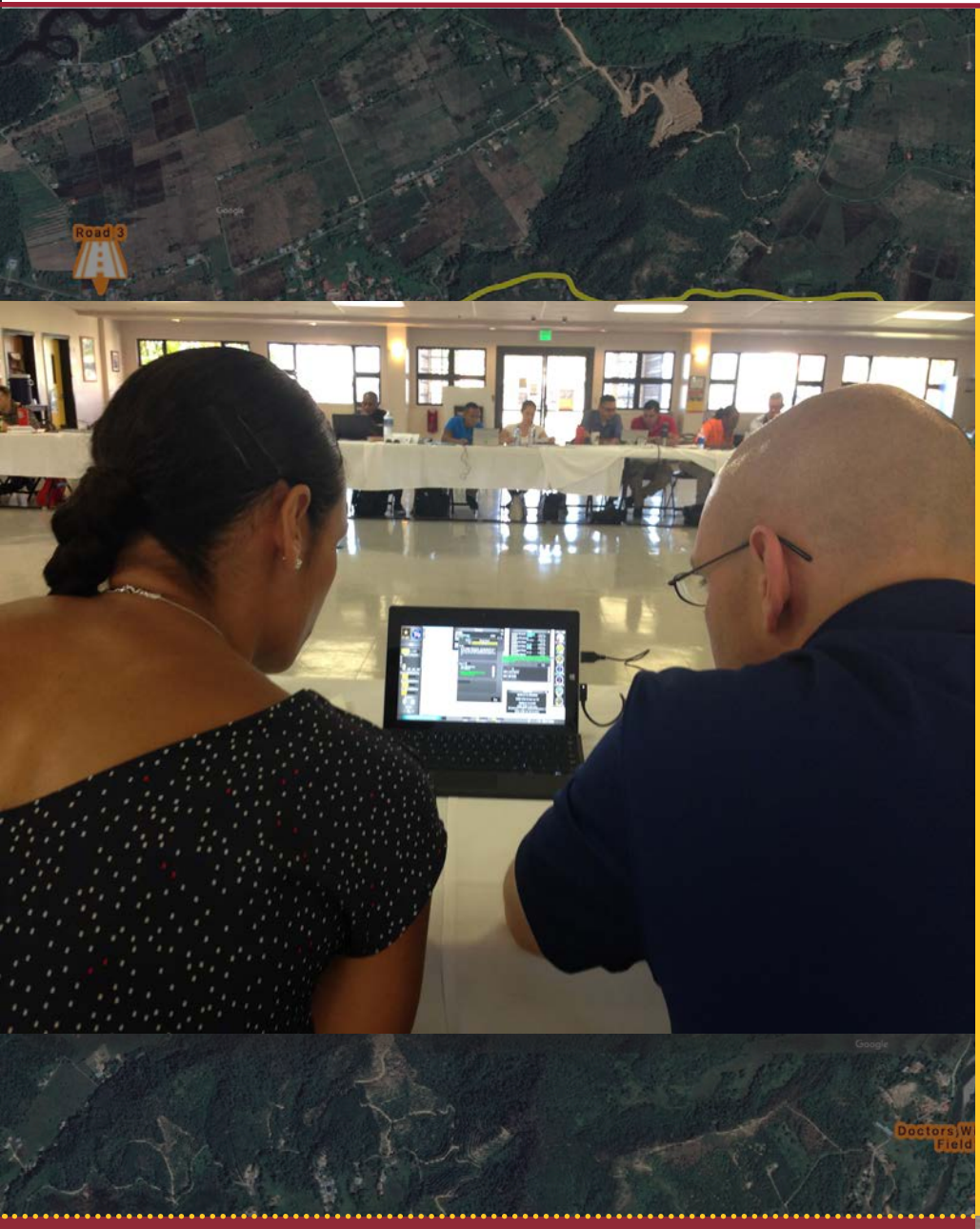
IAOC 2017

The Intelligence Architecture Online Course (IAOC) teaches Intelligence Architecture with videos, knowledge checks, missions, achievements, flashcards, and a library of official doctrine. The mission takes users through the experience of working in a Brigade Intelligence Support Element (BISE), where they can play each of the 9 different roles within the BISE.

2018

DS2A 2018

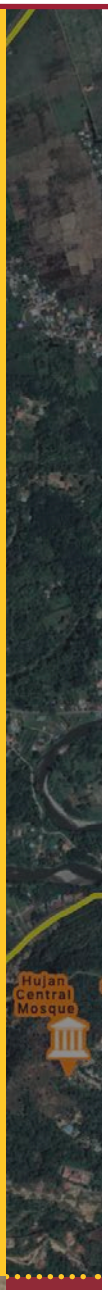
Digital Survivor of Sexual Assault is an interactive SHARP training system based on the international recognized Holocaust survivor New Dimension in Testimony application. DS2A provides an engaging, realistic and emotional impactful experience with questions and answers from a survivor of rape and hazing.



RLDP 2018

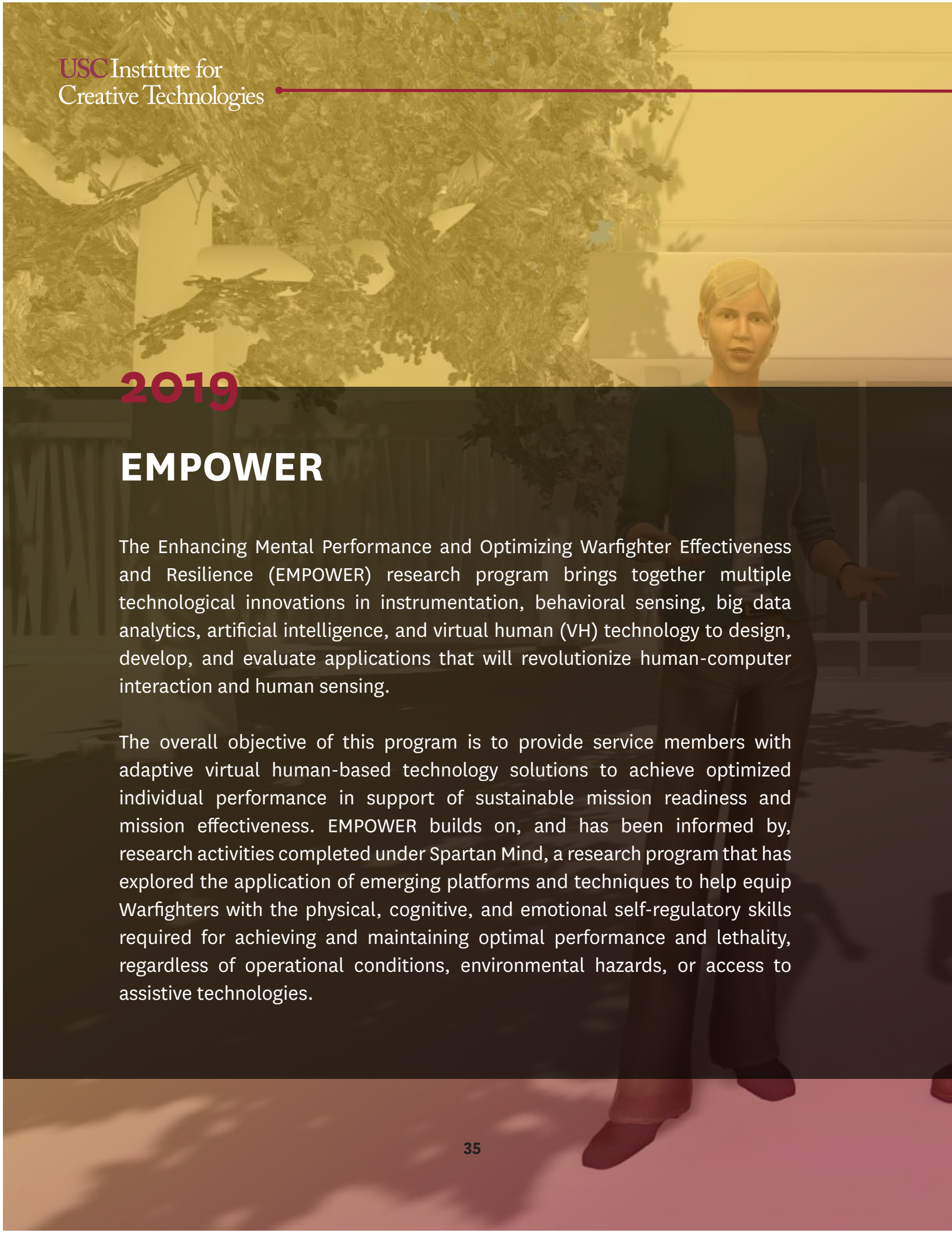
ICT in collaboration with the U.S. Army-Pacific (USARPAC) RLDP, developed a HA/DR interactive game scenario for student groups to use in a RLDP 19-03 class presentation. The team successfully delivered and presented 19-03 game scenario to 33 RLDP students and 5 senior mentors, including retired Major General William S. Chen.

RLDP 19-03 game scenario was extremely well received by RLDP leadership, senior mentorship, and student player groups. After Action Review (AAR) feedback from the five student groups was collected by the USC ICT development team to inform future development of RLDP scenarios.



OWT 2018

One World Terrain included in Marine Corps Tactical Decision Kits (TDKs), allowing the creation of training, mission planning, and rehearsal simulations capabilities for 27 Infantry Battalions and other Marine Corps and Navy organizations. Developed and deployed four (4) improved versions of the UAS aerial collection Rapid Aerial Photogrammetric Terrain Reconstruction System (RAPTRS) software. Machine-learning classification of the data to automatically extract features including roads, buildings, vegetation, and materials.



2019

EMPOWER

The Enhancing Mental Performance and Optimizing Warfighter Effectiveness and Resilience (EMPOWER) research program brings together multiple technological innovations in instrumentation, behavioral sensing, big data analytics, artificial intelligence, and virtual human (VH) technology to design, develop, and evaluate applications that will revolutionize human-computer interaction and human sensing.

The overall objective of this program is to provide service members with adaptive virtual human-based technology solutions to achieve optimized individual performance in support of sustainable mission readiness and mission effectiveness. EMPOWER builds on, and has been informed by, research activities completed under Spartan Mind, a research program that has explored the application of emerging platforms and techniques to help equip Warfighters with the physical, cognitive, and emotional self-regulatory skills required for achieving and maintaining optimal performance and lethality, regardless of operational conditions, environmental hazards, or access to assistive technologies.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VACG 2019

The VACG project was developed by ICT in collaboration with the Army Acquisition Support Center (ASC) in order to provide a digital forum for Army acquisition professionals to quickly and accurately obtain career advice and guidance.

The VACG is a web-based system that features an integrated, interactive ICT virtual character who serves as a personalized career mentor and virtual helpdesk. Much of the technology that drives the VACG was in fact developed from previous ICT basic and applied research projects incorporated in ICT's SimCoach and RoundTable platforms. The technologies used in VACG include web-based virtual humans and comprehensive web-based tools for interaction design. STTC and ICT transitioned VACG to ASC where it was put in operation to support the ASC workforce in 2019.

2019

USC Center for Body Computing 2019

Over the past several years ICT has built out additional capability in establishing cutting edge military human performance research and solutions through a partnership with the USC Center for Body Computing (CBC), an established leader in digital health and human performance research and innovation. The CBC aggregates and creates new best in breed connected technologies and software to study human performance holistically (mind and body), accurately and continuously. This partnership leverages ICT's military knowledge and relationships with the CBC's research methods and tools to help meet fundamental challenges in the military, like enhancing squad lethality.

OWT 2019

First use case of the ATLAS Minimum Safe Distance (MSD) software tool. Tested, validated and fielded the capability to use OWT data in the Android Tactical Assault Kit (ATAK). Transitioned and supported OWT training, delivery and collaboration with over 50 USA, USMC, USN, USAF, DHS, SOF, and other Government agencies. Continued AI-based research to extract relevant attribution from the foundation data and make it of use to mission command, intelligence, operational, training and simulation systems.

USC Institute for
Creative Technologies

12015 E Waterfront Dr
Los Angeles, CA 90094

ict.usc.edu