

DEPARTMENT OF THE AIR FORCE

**PRESENTATION TO THE COMMITTEE ON ARMED SERVICES
SUBCOMMITTEE ON READINESS**

UNITED STATES HOUSE OF REPRESENTATIVES

**SUBJECT: MODELING AND SIMULATION IN MILITARY TRAINING AND
READINESS**

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20 JULY 2010

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UNITED STATES HOUSE OF REPRESENTATIVES**

The United States Air Force has been continuously deployed in support of combat operations for almost 19 years, proudly defending our nation's interests and way of life. Achieving and maintaining the readiness of our force in today's complex operating environment requires flexible training capabilities that closely replicate the conditions in which our airmen will operate. We increasingly rely on Modeling and Simulation (M&S) to meet these challenges in efficient and cost effective ways. Today's simulation provides an unprecedented level of training system integration needed to rehearse the full range of military operations in realistic and challenging environments. Our goal is to produce effective and proficient operators in the quickest and most efficient manner possible.

The Air Force has a long history of using modeling and simulation to conduct operations analysis, weapon systems test and evaluation, Command and Control (C2), and weapon systems training at the tactical, operational and strategic levels. Today, we continue that legacy by integrating air, space, and cyberspace simulation into an effective network with our joint forces and coalition and allied partners.

The Air Force has an even longer history of using simulators to train aviators, like the old Link Trainers of WWII, and has consistently improved and expanded upon that capability to include weapon system, mission, and emergency procedures training to complement live-fly training for our aviators. Today, we use simulation and system-of-systems integration to train for almost every type of mission we execute. As virtual technologies have evolved, we have expanded from simple to complex simulators, and networked Live, Virtual, and Constructive (LVC) architectures to address today's training shortfalls with emerging mission requirements. For more than thirteen years, we have championed the use of integrated Live, Virtual, and

Constructive simulator training technologies to conduct distributed mission operations connecting geographically separated units into common operating environments. Today's high fidelity simulators provide presentations which closely replicate our live environment and allow us to rehearse for specific mission requirements in high threat environments. In doing so, we are able to cost-effectively provide realistic and repeatable training not otherwise achievable. However, this high fidelity technology requires significant investment in development, acquisition and maintenance. This is especially true for the new fifth generation of weapon systems like the F-22, F-35, emerging ISR, and Cyber Operations systems where training requirements often exceed current live training capabilities.

Quantifying the potential savings in training costs provided by modeling and simulation versus live operations can be difficult to measure because of the complexity inherent in the comparison. We use modeling and simulation to complement and expand upon our live training opportunities, but it should not be viewed as a one-for-one substitute for live fly events. Investments are being made to expand upon our networked simulation capabilities to fill training gaps and provide additional training with our joint and coalition partners while adding the realism of a joint warfighting environment.

Our combat air forces include a range of Live, Virtual, and Constructive Modeling & Simulation to fully integrate Air Force and Joint Service/Coalition training, from focused qualification training to large force integrated exercises. The Air National Guard and Air Force Reserve Distributed Training Operations Center in Des Moines, Iowa, provides full mission simulator training to active and reserve component warfighters and their Army mission partners. For large force team training, Air Combat Command's Distributed Mission Operations Center

(DMOC) in Albuquerque, New Mexico, conducts Virtual Flag Training Program and mission rehearsal events with joint, large force exercise scenarios. For example, in 2009, Airborne Warning and Control System (AWACS) crews conducted 1,968 training events in Virtual Flag, and the Joint Surveillance and Targeting Attack Radar System (JSTARS) accomplished 760 training events. Our annual Coalition Virtual Flag event each September incorporates warfighters, simulators, and simulator systems from Australia, Canada and the United Kingdom.

In line with the commercial airline industry, Air Mobility Command uses full motion simulators with six-degrees of freedom providing realistic training that permits us to decrease the number of live training flights. For example, the KC-10 air refueling aircraft simulators have allowed us to decrease the number of flights required to produce a mission ready pilot. The initial qualification syllabus prior to 2005 consisted of 17 simulator lessons and nine flights. The current syllabus increases the simulator lessons to 23 and decreases flights to six. The use of FAA-certified Air Force simulators maximizes training, reduces "wear-n-tear" costs and takes fewer aircraft away from higher priority operational missions. However, we must remember that such high fidelity simulation requires significant investment—especially up front.

The advances that modeling & simulation technologies bring to readiness training have created both security and releasability challenges in the joint and coalition arenas that must be met before we can fully capitalize on the promise of networked training. Highly classified weapon system capabilities are often compartmented into different classification levels to protect mission capabilities or design features, such as stealth. This limits the integration of their simulators with other systems to reduce potential exploitation risk through intentional or accidental exposure. While technologies are available to make this integration possible, the

result may significantly degrade mission capabilities to the point of “negative training”. Effective technical guards are often constructed at significant cost but with little hope of re-use, so finding a joint solution has become a priority for the defense training community and specifically for advanced Air Force systems. To meet this challenge, we have joined with the Navy and U.S. Joint Forces Command to continue joint research into establishing effective and cost-efficient solutions for networked training. This is especially important as we look for methods to safely and affordably integrate the training of fifth-generation aircraft and advanced ISR platforms. Current airspace and training range restrictions increasingly limit most aspects of live fly training. To mitigate this training limitation, the Air Force is supporting research into the ability to “inject” battlefield effects and simulated threats into live aircraft systems.

Additional efforts are underway to increase space modeling and simulation capabilities. Headquarters Air Force Space Command and the Space and Missile Systems Center (SMC) have established a vision for a single Standard Space Trainer (SST). The SST employs commercial off the shelf (COTS) systems and hardware and provides a standardized set of advanced training, instructional, and simulation capabilities. SST will be LVC compatible and connect through the DMOC-S at Schriever AFB, CO.

AFSPC has also embarked on a Chief of Staff of the Air Force (CSAF) supported effort with USSTRATCOM, USNORTHCOM, USJFCOM, Air Force Agency for Modeling and Simulation (AFAMS), and SMC to establish the All Things Space (ATS) program. ATS will deliver high fidelity space M&S to support exercises and operational training from tactical to campaign level events, operational planning, and future capabilities to ensure the DoD is capable of meeting current and future threats in space. ATS will provide persistent, distributed,

integrated space training & exercise capability that is dynamic, scalable and affordable within the Joint Environment.

Headquarters Pacific Air Forces (PACAF) uses M&S to enhance warfighter readiness. During exercises Key Resolve and Ulchi Freedom Guardian in Korea, mission crews accomplished training in their Joint Surveillance and Targeting Attack Radar System (JSTARS) simulators at Robins AFB, Georgia, while linked to the PACAF Air Operations Center and the land component on the Korean peninsula.

Modeling and simulation is increasingly being applied to air-to-ground missions. Air Force Research Laboratory created the first Joint Terminal Attack Controller Training and Rehearsal System (JTAC TRS) training capability for the JTAC community. The research program produced both a 360 degree field of view dome and a smaller (220 degree field of view) training testbed. They have been used in a variety of live, virtual and constructive events including the first-ever connection of live F-16's and virtual JTAC's. The testbeds provide an ideal environment to investigate current JTAC training methods to determine effective live versus simulation tradeoffs and associated cost savings. These innovative capabilities will be incorporated into the Joint Terminal Control Training and Rehearsal System (JTC TRS) and will help training requirements for the planned growth to 1,300 JTACs. Geographically separated JTACs, Combat Control Team air traffic controllers and close air support platforms will be able to conduct complex Joint Close Air Support (JCAS) training scenarios that include integrating with nearby ground forces.

Air Force Special Operations Command has also integrated virtual aircraft simulators and Joint Terminal Controller simulators with live and constructive forces to support operational readiness and pre-deployment training. In exercise Emerald Warrior, a Joint National Training

Capability mission rehearsal exercise, U.S. Special Operations Command (USSOCOM) linked air and ground simulators at Hurlburt Field, Florida and Camp Lejeune, North Carolina with live USMC F/A-18 fighter aircraft and ground teams on Eglin Range, Florida to conduct a typical theater mission rehearsal scenario. This enabled USAF, USMC and USSOCOM to conduct integrated joint fires tactics, techniques and procedures training at a reduced cost.

Modeling and Simulation systems are critical to the expansion and transformation of our current and future warfighter readiness. Again, in many cases it is the only way to adequately train our airmen. M&S technology should be seen as a complement, not a substitute, for live military training. While it cannot completely replace complex human interactions, M&S allows us to train, test and experiment key warfighting competencies we normally cannot accomplish through live exercises alone.