

## THEATER AIR COMMAND AND CONTROL SIMULATION FACILITY

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### ABSTRACT

The Theater Air Command and Control Simulation Facility (TACCSF) is the world's largest operator-in-the-loop air defense simulation. The facility was originally built by the Office of the Secretary of Defense to study aircraft identification problems in Central Europe. Since 1989, the United States Air Force (USAF) Air Combat Command (ACC) has owned and operated the facility which has been used to support joint service test and evaluation and training. The TACCSF maintains 65 command and control and weapons systems consoles and cockpits which represent key elements of the USAF and Army Integrated Air Defense System (IADS). Each of these devices operate on a common internal network allowing combat-ready crews to "fight" realistic theater-level offensive and defensive scenarios. Extensive data collection, reduction, and analysis capability is available for a wide range of users. The TACCSF has been linked to several joint simulation facilities and live field equipment over wide-band landlines and satellite communications (SATCOM) where scenario objects and events are exchanged using Distributed Interactive Simulation (DIS) protocols. The simulation network, which includes TACCSF, is being used by the USAF to conduct theater missile defense (TMD) analysis and training with emphasis on attack operations; active defense; and battle management, command, control, communications, computers, and intelligence (BMC<sup>2</sup>I).

### 1 INTRODUCTION

The mission of the TACCSF is to provide a realistic simulation environment for the systems development and operational communities to assist in refining requirements, concepts of operation, and operations plans. Weapons controllers, fighter pilots, and surface-to-air missile (SAM) operators are brought together for education and training in a variety of mission areas. The TACCSF has been used frequently to evaluate the value of new or modified systems, tactics, and procedures.

The internal system's architecture consists of simulations of intelligence systems, Air Operations Center (AOC), Control and Reporting Center (CRC), Control and Reporting Post (CRP), Joint Surveillance, Targeting and Attack Radar System (J-STARS), RC-135 Advanced Sensor, E-3 Airborne Warning and Control System (AWACS), Airborne Laser (ABL), F-15E, F-15Cs, AN/TSQ-73 Brigade Fire Direction Center (FDC), PATRIOT Information Coordination Central (ICC) and fire units, HAWK battalion and fire units, and unattended ground sensors (UGS). Realistic voice and tactical data links are provided for exchange of information between crews. Figure 1 shows the current TACCSF internal architecture.

The TACCSF is capable of conducting scenarios with several thousand simultaneous air and surface objects interacting in a complex electronic countermeasures (ECM) environment. Given the characteristics of the TACCSF, it is considered an operation/mission simulation which allows the user to focus on command and control and force application issues. With respect to the hierarchy of models and simulations, the TACCSF also contains engineering-level models which address sub-system performance and engagement-level models which support few-on-few interactions.

### 2 PAST USAGE

There has been a wide variety of users at the TACCSF in the past. The facility has been used by Air Force and joint test teams to find ways to improve the interaction between air defense fighters and SAMs, survivability, cooperative and non-cooperative identification systems, and airspace control procedures. The US Army Air Defense Artillery School at Fort Bliss, Texas, has sent its HAWK and PATRIOT officers to the TACCSF to expose them to joint air defense systems and procedures in very dense track and ECM environments. The US Air Force Weapons School has started sending its AWACS weapons controllers to TACCSF for joint operations training at the theater level. The US Joint Warfighting Center (JWFC), in

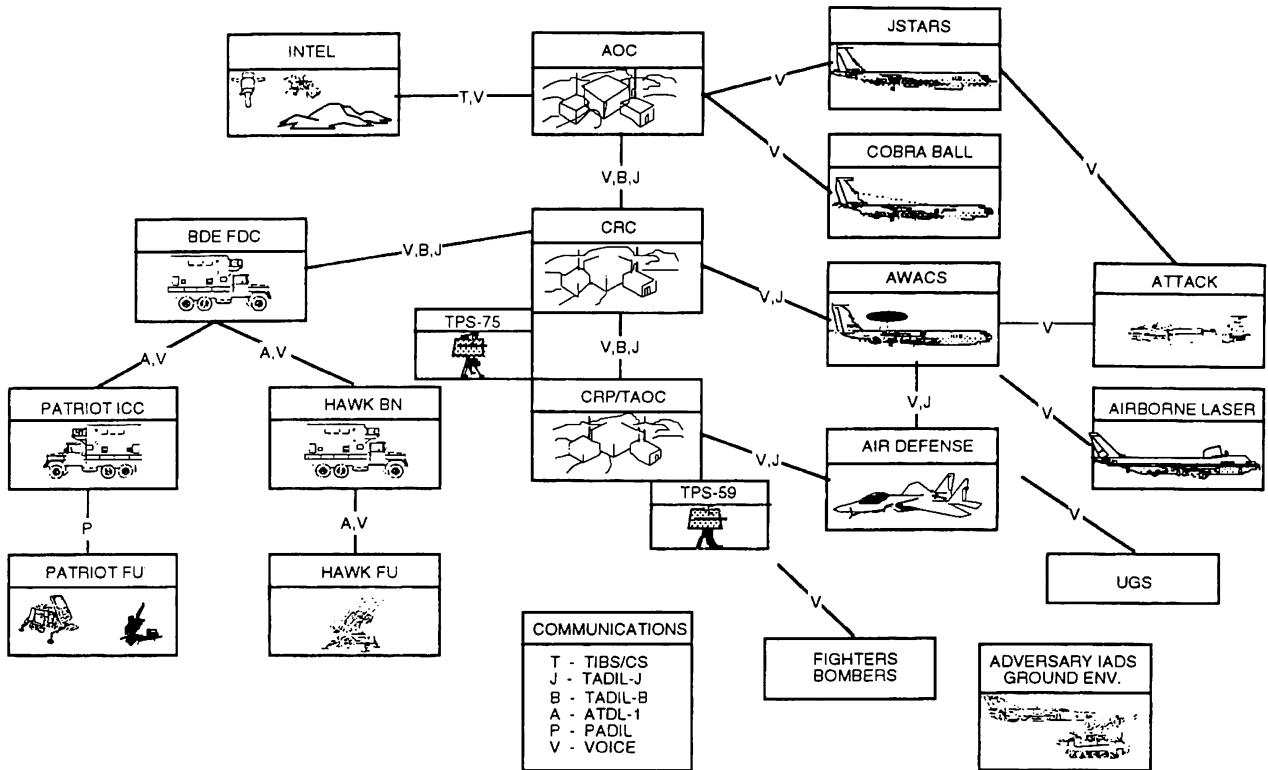


Figure 1. TACCSF Simulations

conjunction with Forces Command (FORSCOM), has begun to use the TACCSF to feed and interact with actual equipment in the field to support Joint Systems Training Exercises (JSTEs). In 1993, TACCSF conducted its first formal simulation test in support of the Air Force TMD program.

### 3 FUTURE ACTIVITIES

#### 3.1 Theater Missile Defense

Operation DESERT STORM proved that the theater ballistic missile (TBM) and its transporter-erector launchers (TELs) are a difficult target set. The proliferation and increasing capability of TBMs and cruise missiles and the results of the "Scud-hunting" campaign in Operation DESERT STORM have brought additional attention to the TMD mission area. There are a myriad of current and proposed new systems and procedures which may contribute to countering the missile threat. With tightening defense budgets and increasing complexity of the threat, the military must find better ways to test new systems and train its crews. Simulation shows great promise in meeting future analysis, training, and mission re-

hearsal requirements. TACCSF is already being used to meet these needs.

In January 1993, the USAF ACC conducted its first TMD Operations Concept Demonstration. Actual systems were taken to the field to examine ways to pass information from sensors to shooters who were attacking simulated TELs which had launched missiles. Soon thereafter, TACCSF was used to conduct a simulated test with models of systems actually used in the field. At TACCSF, these systems were placed in a Southwest Asia scenario to gain insights on performance in a more stressing environment. Results from the field and simulation tests have already led to more effective procedures and tactics for performing the TMD attack operations mission.

This was the first phase of an on-going live demonstration and simulation test program which is founded on a process which has been referred to as "simulate-test-simulate." The idea is to simulate first to plan, scope, and rehearse the live test; go to the field to collect actual performance data; then use live data to validate the models and simulations. Finally, the results of the live test are extended into more stressing environments which cannot be created on the live range due to cost, security, safety, and scheduling constraints.

### 3.1.1 Simulation Networking

In order to create the simulation architecture necessary to examine broad mission areas like TMD, the TACCSF is installing links to other simulation facilities. The main reasons for developing these networks are as follows:

- 1) Take advantage of existing infrastructure, expertise, and data bases.
- 2) Improve the quality (fidelity) of the simulation.
- 3) Provide common environments and scenarios in which the models and operators may interact.

organizations, like the Defense Modeling and Simulation Office (DMSO). Most of these networks are exchanging scenario information using DIS protocols which are becoming a national standard and may be adopted in the future as an international standard. DIS workshops and working group meetings are held regularly in the US under the sponsorship of DMSO and the US Army Simulation, Training and Instrumentation Command (STRICOM) to promote software and network standards. The TACCSF is actively involved in DIS user/sponsors development, verification, and validation activities. Figure 2 shows several of the key facilities which have been linked or are in the process of being linked to establish a joint network for testing and training.

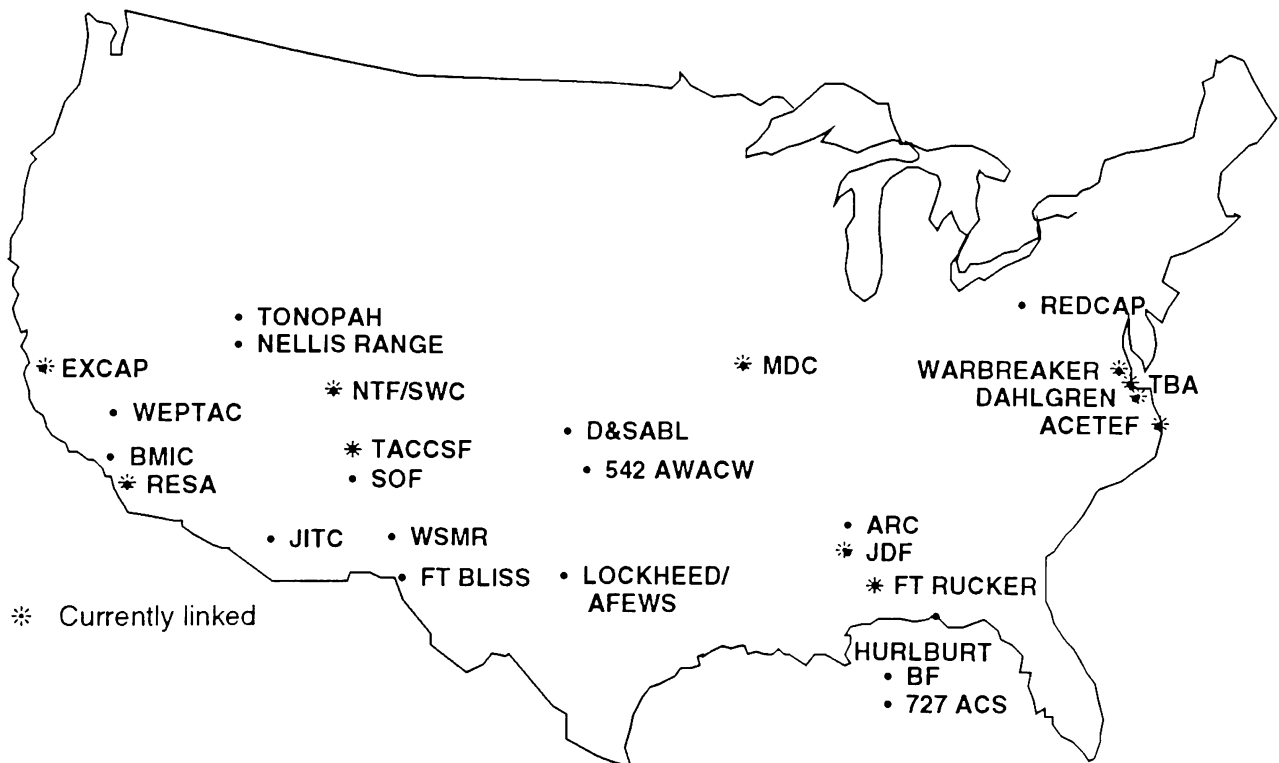


Figure 2. Near-Term Simulation Network

There are several US sponsors who are creating networks around the country. The most prominent is the Advanced Research Projects Agency (ARPA) which is sponsoring the WAR BREAKER and Defense Simulation Networks (DSI) networks. The purpose of WAR BREAKER is to develop new technologies to find, attack, and destroy "time-critical" mobile targets, of which TBM TELs are one of the target sets. The Army, Navy, and Air Force are developing other networks under the sponsorship of each service and other Department of Defense

### SUMMARY

TACCSF is a large-scale operation which provides fully-integrated, constructive, virtual, and live simulations for a variety of customers. ACC has designated the TACCSF as a center for theater air and missile defense analysis. TACCSF intends to use distributed simulation networking to support testing and training in critical mission areas. Detachment 4 and its contractors, Martin Marietta Corporation and BDM International, are dedicated to advancing

simulation technologies which may contribute to the USAF and joint services. Lessons learned from these endeavors will be made available to operations and development communities.

DIS shows great promise for a wide range of simulation applications. The US modeling and simulation community is making excellent progress in developing technology and convincing the users of the utility of simulations. The TACCSF is committed to use advanced simulation technologies to:

- 1) Enhance live operations.
- 2) Improve operational planning, tactics development, training, and testing.
- 3) Provide reliable data which can be used to refine systems and architecture requirements.
- 4) Provide quantitative and qualitative information which may be used to make better investment strategy decisions.

#### ADDITIONAL ABBREVIATIONS

ACETEF .....	Air Combat Environment Test and Evaluation Facility
ACS .....	Aircraft Control Squadron
AFEWES .....	Air Force Electronic Warfare Evaluation Simulation
ARC .....	Advanced Research Center
AWACW .....	Airborne Warning and Control Wing
BF .....	Blue Flag
BMIC .....	Battle Management Interoperability Center
BN .....	Battalion
D&SABL .....	Depth and Simultaneous Attack Battle Laboratory
EXCAP .....	Exercise Capability
FU .....	Fire Unit
JDF .....	Joint Development Facility
JITC .....	Joint Interoperability Test Center
MDC .....	McDonnell Douglas Corporation
NTF .....	National Test Facility

REDCAP .....	Real-time Electromagnetic Digitally Controlled Analyzer Processor
RESA .....	Research, Evaluation, and Systems Analysis
SOF .....	Special Operations Forces
SWC .....	Space Warfare Center
TAOC .....	Tactical Air Operations Center
TBA .....	Theater Battle Arena
WEPTAC .....	Weapons and Tactics Analysis Center
WSMR .....	White Sands Missile Range

#### AUTHOR BIBLIOGRAPHIES

**Lieutenant Colonel Dennis L. Lester** is currently Commander of Detachment 4 which manages and operates the TACCSF. He is a former F-15 pilot with operational assignments at Holloman Air Force Base, New Mexico; Soesterberg Air Base, the Netherlands; and Langley Air Force Base, Virginia. He is on his second tour at Kirtland Air Force Base, New Mexico, where he has been involved for over 5 years in the development of advanced distributed simulation for joint test and evaluation and training.

**First Lieutenant Loni L. Van Veldhuizen** is currently the Configuration Management and Quality Assurance Specialist for TACCSF. She is a Communications Computer Officer whose previous assignment was at the Imagery Intelligence Directorate of the Strategic Computer Communications Center, Offutt Air Force Base, Nebraska. She is also the node manager for TACCSF's Advanced Sensor Simulation and has been a participant in distributed simulations and training exercises for the past 2 years.