DSIAC TECHNICAL INQUIRY (TI) RESPONSE REPORT

U.S. Department of Defense (DoD) Campaign Level Combat Analysis

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ABOUT DSIAC

The Defense Systems Information Analysis Center (DSIAC) is a U.S. Department of Defense information analysis center sponsored by the Defense Technical Information Center. DSIAC is operated by SURVICE Engineering Company under contract FA8075-14-D-0001.

DSIAC serves as the national clearinghouse for worldwide scientific and technical information for weapon systems; survivability and vulnerability; reliability, maintainability, quality, supportability, and interoperability; advanced materials; military sensing; autonomous systems; energetics; directed energy; and non-lethal weapons. We collect, analyze, synthesize, and disseminate related technical information and data for each of these focus areas.

A chief service of DSIAC is free technical inquiry (TI) research, limited to 4 research hours per inquiry. This TI response report summarizes the research findings of one such inquiry. For more information about DSIAC and our TI service, please visit www.DSIAC.org.

ABSTRACT

Defense Systems Information Analysis Center staff worked in conjunction with modeling and simulation subject matter experts embedded in the U.S. Department of Defense to compile knowledge on current campaign level mission analysis packages and procedures. A summary of findings and supplementary research on mission analysis tools was compiled from the Defense Technical Information Center Research and Engineering Gateway and sent to the inquirer.

Contents

1.0 TI Request

1.1 SUBJECT: Mission Analysis Tools

1.2 DESCRIPTION

The inquirer requested a review of simulation and analysis tools currently utilized or developed by the U.S. Department of Defense (DoD) for mission and campaign level combat analysis [1]. The inquirer's primary interest was in simulation and analysis tools that currently handle ground and air assets (e.g., rotorcraft).

2.0 TI Response

Defense Systems Information Analysis (DSIAC) staff completed searches in open and closed source information databases and worked in conjunction with modeling and simulation subject matter experts embedded in the DoD to identify information relevant to the inquirer's request. DSIAC identified three current mainstream simulation/analysis tools utilized by the DoD at campaign level combat analysis.

2.1 WAR GAMING AND MILITARY SIMULATION MODEL HISTORY

While conducting research for current combat analysis tools, DSIAC staff located a summary document that included historical modeling and simulation history. To reference this historical catalog of war gaming and military simulation models, please see Quattromani at the following link: http://www.dtic.mil/docs/citations/ADA115950 [2].

2.2 COMBAT ANALYSIS SIMULATION/ANALYSIS TOOLS

2.1.1 Combined Arms and Support Task Force Evaluation Model (CASTFOREM) - Ground

Excerpt from CACI Advanced Simulation Lab [3]:

> CASTFOREM is a stochastic, event-sequenced, opposing forces simulation of ground combat involving up to a Blue battalion task force and a Red regiment. The model can be used in either batch or interactive modes with variable unit resolution down to the individual weapon system level. Resolution of terrain is also variable. Battlefield environments to be modeled include static weather, dynamic obscurants (e.g., smoke and dust), nuclear and chemical contaminants, and electronic warfare.
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> All combat support and combat service support units and functions, which interact with and affect the combat activities of maneuver units are represented in the model. The model contains, in the form of decision table, the command control logic to make tactical decisions, which generate orders, reports and request for support. These decision table outputs, in turn, control the actions of units of resolution.
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> CASTFOREM represents the detailed operations of the combined arms and support task force for periods of approximately 60 minutes. It is used to determine the effectiveness of units and to estimate the level of attrition for personnel and equipment.

2.2.2 Advanced Tactical Combat (ATCOM) - Air/Rotorcraft

Excerpt from "Advanced Tactical Combat (ATCOM) Team Behavior Modeling of the Apache Longbow" by Bill Baker [4]:

> Fighting rotorcraft on today's battlefields requires rotorcraft teams to accurately assess situations quickly and react accordingly in as coordinated and coherent a fashion as possible. Likewise, the recognition that today's combat models must not only attempt to simulate individual friendly and threat system interactions on a given battlefield but must also emulate to some degree the interplay and effective force multipliers produced by groups of like systems acting in unison with a common objective. The advent of effective digital communications, which provides the capability to share amongst team members unprecedented amounts of data, has made team modeling all the more important. Of course, the mere knowledge of the existence of useful data and its efficient distribution does not guarantee a team an advantage. The information at hand must be condensed into a realizable plan at some stage. The response and performance of an individual team is only as good as the tactical decisions made by the air mission commander (AMC) during available planning cycles whether prolonged or ad hoc in nature. The ATCOM model enhancements attempt to emulate the AMC in terms of knowledge, decision making, and actions. Modeling the use of the appropriate tactics, techniques, and procedures (TTP) is an important component to building such a team-based simulated entity.

2.2.3 COMBATXXI

Excerpt from "COMBATXXI" [5]:

> COMBATXXI is a stochastic, high-resolution simulation representing land and amphibious warfare from Soldier to brigade combat team. The simulation is a synergy of the physical model, context of the scenarios, and requisite performance and characteristic data to represent the systems. The basic unit of resolution is an individual Soldier or weapons system. Most vehicles may be portrayed as a monolithic entity or further resolved into explicit portrayal of vehicle, crewmembers, and mounted passengers. COMBATXXI represents these individual entities and platforms along with appropriate representative systems from echelons above brigade (EAB) and Joint assets. COMBATXXI is a closed-form

simulation – there is no human interaction with the simulation once it starts running. Since it is closed form (or constructive), sophisticated decision-making and behavior mechanisms must be in place before model execution.

COMBATXXI has the essential capabilities necessary to represent a combined arms military operation with the appropriate representation of Joint/EAB assets. Key functionality in COMBATXXI includes Joint/Army sensors, intelligence, HUMINT/ambiguity, ground maneuver, direct/indirect fire, mines and improvised explosive devices, air defense, ambush, dismounted operations, urban operations, amphibious operations, fixed/rotary wing, manned and unmanned assets, sustainment, maintenance, engineers, communications, and terrain effects. COMBATXXI uses validated, data-driven algorithms for fundamental models, such as sensing and attrition. TRAC uses certified performance data from the Army Material System Analysis Activity (AMSAA) as input to these models. Operational data (for example, tactics, techniques, and procedures (TTP)) that drive the combat actions/activities come from subject matter experts, such as the TRADOC Centers of Excellence and the TRADOC G2 Intelligence Support Activity (TRISA).

TRAC uses COMBATXXI as one of its analytic tools to enable informing decisions about concept development, acquisition, force design, force mix, and/or TTP development. COMBATXXI is not a predictive simulation; rather, it is a comparative analysis tool. It is executed through multiple replications to statistically bound the solution set. This simulation enables an analyst to understand how a specific capability or concept might contribute to a military operation relative to a baseline. TRAC conducts effectiveness analysis of military operations and as such TRAC's combat simulations focus on representing the effect of a capability rather than real-world representation (that is, modeling the physics of a missile in flight is not required to understand the effect a missile has in a combat operation). The effect, as the performance characteristics and the operational employment determine, provides the means for analysts to conduct comparative analysis.

REFERENCES

[1] DSIAC. "U.S. Department of Defense Campaign Level Combat Analysis." https://www.dsiac.org/resources/notable-ti/us-department-defense-campaign-level-combat-analysis, 3 April 2018.

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[3] CACI Advanced Simulation Lab. "CASTFOREM." SimScript Modeling and Simulation Tools, http://www.simscript.com/solutions/military/CASTFOREM.html, accessed April 2018.

[4] Baker, B. "Advanced Tactical Combat Model (ATCOM) Team Behavior Modeling of the Apache Longbow." American Helicopter Society 57th Annual Forum, Washington, D.C., 9 May 2001, https://vtol.org/store/product/advanced-tactical-combat-model-atcom-team-behavior-modeling-of-the-apache-longbow-4520.cfm, accessed April 2018.

[5] PDF Document. "COMBATXXI." http://www.trac.army.mil/COMBATXXI.pdf, accessed April 2018.