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COMBAT MODELING IN THE MLR COEA PHASE II

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ABSTRACT

This paper describes the analytic process that was used in the Major Regional Contingency (MRC) portion of the Medium Lift Replacement (MLR) Cost and Operational Effectiveness Analysis (COEA) Phase II. Emphasis is placed on how the combat modeling portion of that analysis fits in with the other sections of the MRC analysis process. The bulk of the combat modeling was performed by the BDM Corporation with assistance from the Marine Corps Combat Development Command (MCCDC) and Headquarters Marine Corps (HQMC).

1 BACKGROUND

The current US Marine Corps medium lift helicopter fleet, consisting of CH-46E and CH-53D aircraft, is aging. It is not capable of providing the operational performance required and necessitates intensive personnel resources to operate and maintain.

The MV-22 Osprey is a tilt rotor aircraft capable of carrying 24 combat loaded Marines at speeds in excess of 270 kts. It can carry external loads in excess of 10,000 pounds. The Osprey is equipped with modern survivability features and can self-deploy to all areas of interest.

The MV-22 is probably the most analyzed system in the history of the DoD acquisition process. Previous analyses have been performed by the Institute for Defense Analyses (IDA) and the Center for Naval Analyses (CNA) among others.

The present COEA was directed by the Assistant Secretary of the Navy for Research, Development and Acquisition, ASN(RD&A), to support a September, 1994 Defense Acquisition Board (DAB) decision. The priorities of this COEA were to: incorporate USMC maneuver warfare doctrine into the analysis; use multiple Measures of Effectiveness (MOEs); include an analysis of speed and self-deployability; examine a full range of operational scenarios; identify the contributions of alternative aircraft at both the tactical and operational level of war; and, include an analysis of mixed fleets as possible alternatives.

Alternatives in the COEA were:

- MV-22
- EH-101 A2
- S-92 V3
- CH-47 A1.

2 PROCESS OVERVIEW

The analysis process consisted of four partially overlapping phases. The first, which became known as the Supplemental Analysis, was conducted at MCCDC during April-May 1994. This phase's purpose was to develop Courses of Action and to document the maneuver warfare decision processes used by Marine Commanders in selected tactical situations. The second phase consisted in running an ensemble of supporting combat models culminating in the execution of the Corps Battle Analyzer (CORBAN) combat simulator. Phase 3 was an accreditation process for the primary combat models used in the process. The fourth phase was an analysis of the combat model results in order to abstract from particular scenarios to the general, incorporate other analyses and synthesize the results in the final report.

3 SUPPLEMENTAL ANALYSIS

The Supplemental Analysis was conducted in two parts. The first of these was in a seminar format where Courses of Action and Tactical Situations (TACSITs) were developed. During this part, MOEs were developed and went through an initial refinement. The second part of the Supplemental Analysis was centered around an interactive, force-on-force combat simulation using the Joint Conflict Model (JCM). The JCM wargame included multi-service participation and used a Defense Intelligence Agency (DIA) and Joint Staff approved threat and scenario. The decision processes used in the wargame were carefully documented in a format suitable for inclusion in the combat models.

4 COMBAT MODELING

The Combat Modeling phase of the analysis used several ancillary models, carefully chosen to provide the appropriate input to the main assessor of combat outcome, CORBAN.

4.1 ESAMS, RADGUNS AND JSEM

These three models were run at the Naval Weapons Center, China Lake. The Enhanced Surface to Air Missile Simulation (ESAMS) was used to calculate one-on-one missile probability of acquisition as a function of aspect angle and range. The Radar Directed Gun Simulation (RADGUNS) performed a similar function for gun systems. The Joint Service Endgame Model (JSEM) was then employed to determine one-on-one probability of kill as a function of range.

4.2 TACEM

The Tactical Engagement Model (TACEM), a stochastic model, was run by BDM to assess many-on-many kills of aircraft by air defense assets. For this portion of the analysis, the actual air defense laydown and flight routes, determined in part by the JCM gaming, were used. Other inputs came from the Amphibious Assault Model and the Weapons Assessment Model described below.

4.3 AAM

The Amphibious Assault Model (AAM), a stochastic model, was used by BDM to determine combat build-up by aviation delivered assets. AAM was used at two stages during the modeling process. In the first stage, using serial assignment tables supplied by the Marine Corps, ship and landing zone characteristics, the model determined wave make-up. In the second stage, aircraft attrition from TACEM was provided and the model calculated combat build-up rates.

4.4 WAM

The Weapons Assessment Model (WAM), another BDM product, was employed to determine the attrition of air defense assets. This stochastic model determined the effect of area fire and precision munitions on ground based air defense gun and missile systems.

4.5 CORBAN

The center-piece of the combat modeling process was the Corps Battle Analyzer (CORBAN). CORBAN is a deterministic, air-ground combat model with resolution down to the battalion level. CORBAN has been extensively used within the military operations analysis community. CORBAN was employed to determine the operational situations (OPSITs) in which the TACSITs described above were embedded. CORBAN was selected for this purpose since it represents the entities of interest and their interactions, could simulate a sufficient time interval, was reasonably well documented and especially because it was capable of accommodating the decision processes characterizing a maneuver warfare environment. The latter is possible since CORBAN uses decision trees as one of its inputs. The nature and criteria for such decisions as how to identify a gap, which gaps to exploit and when, why and how to change a Course of Action were extracted from the Supplemental Analysis phase of the analysis, at least for the specific situations being analyzed. These were then converted into CORBAN meta-language with the assistance of Marine Corps personnel. These inputs were further reviewed by MCCDC and the COEA Oversight Board.

CORBAN was run for each of the alternatives and each of the OPSITs, where possible. Such MOEs as Loss Exchange Ratios (LER), battalions trapped, casualties to the assault force, and time to complete the mission were then derivable directly from the results. Several others such as aircraft lost could be obtained from other model runs e.g., aircraft losses to air defense systems were derivable from AAM output. Sensitivity excursions on the latter type of results was relatively easy to calculate.

5 ACCREDITATION

In accordance with current DoD guidance, the Oversight Board chartered an Accreditation Team to assess the modeling support proposed to be utilized in the COEA. The team included representatives from Studies and Analysis Division, MCCDC; the Marine Corps Modeling and Simulation Management Office; Assessment Division, Deputy Chief of Naval Operations for Resources, Warfare Requirements, and Assessment (OPVAV N81); Space and Naval Warfare Systems Command (SPAWAR); the Center for Naval Analyses; and the U.S. Army Concepts Analysis Agency. The team concentrated on three of the models: AAM, TACEM and CORBAN. Other models used in the COEA were only examined to determine the appropriateness of their output as input to these models.

The Oversight Board approved the following criteria as the basis for model assessments:

- Availability of models and data
- Model validation and verification
- Data certification
- Model resolution and fidelity
- Qualification of analysts employing the models
- Model coalition
- Overall model suitability

-Capability of modeling Operational Maneuver
-Appropriateness for MOEs.

The assessment process included a literature search, interviews, demonstrations and graphic presentations. The team constructed a conceptual understanding of the data flow and functional algorithms associated with the modeling methodology.

6 ANALYSIS OF RESULTS

Analysis of the combat modelling results was another major challenge of this study. Attempts were made to isolate essential characteristics of the aircraft from artifacts of the scenario as well as to extrapolate to other initial conditions and scenarios. Methods presenting the results for both the MRC and non-MRC cases were also developed along with some unique approaches to cost effectiveness trade-offs.

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