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CONVENTIONAL ATTRITION AND BATTLE  
TERMINATION CRITERIA

Interim Report

Prepared for the Defense Nuclear Agency  
Contract No. DNA001-81-C-0283

December 1981

**HISTORICAL EVALUATION AND RESEARCH ORGANIZATION**  
A DIVISION OF T. N. DUPUY ASSOCIATES, INC.

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# CONVENTIONAL ATTRITION AND BATTLE TERMINATION CRITERIA

## Interim Report

Contract No. DNA001-81-C-0283

The Historical Evaluation and Research Organization (HERO) first became involved in the PACOM TNF Improvement Study (prepared jointly by Science Applications, Inc., BDM Corporation, R&D Associates, Systems Planning and Analysis and TRW) when a report entitled Conventional Warfare Damage and Casualty Trends, written by W.C. Yengst and T.G. Smolin of Science Applications, Inc., was reviewed by the HERO staff at the request of the Defense Nuclear Agency. Serious errors and deficiencies were found in the report and its conclusions. Specific comments were submitted to the Defense Nuclear Agency, sponsor of the project, both orally and in writing. It was demonstrated that since the PACOM study is based on the SAI report, its conclusions and recommendations are based on a false hypothesis.

The PACOM Study includes several scenarios involving land combat, in which advance rates of an attacker are predicted, and casualty rates of both sides are assessed. In one week, a team of HERO researchers took the raw data of force arrays from the Northeast Asia scenario, developed inputs for the Quantified Judgment Model (QJM), and ran the main effort of that scenario. The results were dramatically different from the results that had been predicted by the original PACOM TNF Improvement study. As a result of these preliminary investigations DNA assigned to HERO four tasks:

1. Use the QJM and the HERO data base to reassess the land engagements developed for the original study.
2. Compare HERO results with those of the PACOM study, compare the two methodologies that led to these results, and identify the problems with the methodologies.

3. Evaluate the validity of using casualties, equipment losses, and collateral damage as criteria for conflict termination.
4. Review the data available and determine if comparable methodologies can be developed for naval warfare.

Progress on these four tasks is summarized below.

1. Reassessment of Land Engagements.

- The Northeast Scenario.

The conditions pertaining during the operation were reviewed to identify the operational and environmental factors that are relevant to the Quantified Judgment Model (QJM). Values for these factors were determined and are ready for the computer analysis. For all conventional weapons that are in the inventories of the opposing forces and will be used in the scenarios, Operations Lethality Indexes have been calculated. Running of the scenarios (without surprise and with substantial surprise) is awaiting receipt of tables of organization and equipment from the Defense Nuclear Agency.

- The Southwest Scenario

Operational and environmental factors have been identified and values determined as for the northeast scenario. Some OLI's have been calculated. Completion of this step awaits the receipt of significant data and particularly of the relevant tables of organization and equipment, without which preparations for the QJM analyses cannot be completed.

2. Comparison and Analysis of Methodologies.

Task 2 cannot be begun until after Task 1 has been completed.

3. Evaluation of War Termination Methodologies.

- a. As indicated above, a review of the SAI report indicated that the hypothesis on the relationship between casualty levels and war termination derived from a methodology that was seriously flawed and that consequently the hypothesis itself is not useful.

- b. HERO has sought to learn whether another, valid methodology can be developed for using casualty levels, equipment losses, and collateral damage as indicators of the imminence of war termination. Such a methodology would have obvious operational value. The first step in

the search for a valid methodology has been a survey of literature in the field of war termination studies. From a preliminary survey a bibliography of pertinent works has been prepared. It is attached as Annex A. All but one of the works in this bibliography has been located and carefully examined.

c. On the basis of this literature survey it may be said that, although several mathematical models for war termination have been devised by various authors, there is none that is valid and useful, except for heuristic purposes. None can claim to be valid for predictive purposes. Specifically, neither of two models based on a relationship between casualties and war termination (Klingberg 1966 and Voevodsky 1969) has won acceptance by analysts in the field, and neither appears promising to HERO researchers on the basis of preliminary examination.

d. In continuing its research on war termination HERO will focus its efforts on those past conflicts that appear relevant to PACOM concerns. Some useful conclusions are anticipated, but it must be stated that, given the nature of the factors affecting war termination, a valid quantitative model (in which levels of casualties, equipment loss, and collateral damage can be used as adequately reliable predictors of war termination) may not be attainable.

e. HERO's research will seek other possible indicators and possible relationships among indicators that will help policymakers forecast the likelihood of a participant's seeking termination of war.

#### 4. Data for Development of a Naval Attrition Model.

Research was done at the Washington Navy Yard and The Army Library. The purpose of the research was to determine if there is data available from which a deterministic model to project casualties in naval engagements might be developed, and then validated by the results of actual historical engagements. It was determined that there is enough data on individual ships to evaluate quantitatively their effectiveness as offensive weapons platforms, and their ability to survive any type of attack. There are sufficient records in the Navy archives to validate any model developed. The following is a tentative list of inputs that would be required for an attrition model. The list is in

four categories: ships' data, weapons data, environmental data, and operational data.

A. Ships' Data

1. Speed
2. Type of propulsion
3. Complement
4. Range
5. Displacement
6. Armor
7. EW Capacity
8. Number and types of weapons
9. Ammunition quantities, rounds by type
10. Vulnerability of explosive storage (Magazines, POL)
11. Watertight compartments
12. Damage control
13. Number and capacity of bilge pumps
14. Number of screws or water jets
15. Crew experience
16. Turning radius

B. Weapons Data

1. Aircraft (by Type)
  - a. number
  - b. launching speed
  - c. rate of climb
  - d. operational ceiling
  - e. number and type of weapons (broken down and quantified under criteria to be developed.
  - f. EW capacity
  - g. range
  - h. weight
2. Guns (Types by caliber)
  - a. number
  - b. rate of fire
  - c. targets/strike

- d. relative incapacitating effect.
  - e. effective range
  - f. muzzle velocity
  - g. accuracy
  - h. reliability
  - i. number of barrels
  - j. number of charges
3. Torpedoes and Missiles (by Type)
- a. number
  - b. diameter
  - c. targets/strike
  - d. effective range
  - e. maximum speed
  - f. reliability
  - g. type of guidance
  - h. warhead weight
  - i. fuel
  - j. mixture method
  - k. type of fuze
  - l. type of launch platform
  - m. warhead dynamics
4. Mines (by Type)
- a. number
  - b. yield (in terms of tons of TNT)
5. Bombs (by Type)
- a. number
  - b. guidance
  - c. yield
  - d. weight

C. Environmental Data

- 1. weather
- 2. sea
- 3. visibility
- 4. cloud ceiling
- 5. day/night
- 6. season

7. sun position
8. air superiority
9. minefields

D. Operational Data

1. total size of force
2. types of units in force
3. formation
4. surprise
5. national combat effectiveness
6. logistics
7. fire control method
8. weather
9. seas
10. air superiority
11. vulnerability



Annex A

Preliminary Bibliography for War Termination

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