

Systems Analysis  
and  
Modeling in Defense

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Development, Trends, and Issues

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Development, Trends, and Issues

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## PREFACE

This book contains the proceedings of an international symposium devoted to *Modeling and Analysis of Defense Processes* in the context of land/air warfare. It was sponsored by Panel VII (on Defense Applications of Operational Research) of NATO's Defense Research Group (DRG) and took place 27-29 July 1982 at NATO headquarters in Brussels.

Except perhaps for the *Theater-Level Gaming and Analysis Workshop*, sponsored by the Office of United States Naval Research in 1977<sup>1</sup>, this symposium was the first international scientific meeting on Operations Research/Systems Analysis in the area of land/air warfare since the conference on *Modeling Land Battle Systems for Military Planning*<sup>2</sup> sponsored by NATO's Special Programme Panel on Systems Science in 1974. That conference dealt primarily with modeling small unit (company, battalion) engagements and, to a lesser extent, large unit (corps, theater) campaigns with principal emphasis on attrition processes and movement in combat. It was considered as rather successful in that it revealed the state-of-the art around 1972 and identified problem areas and promising approaches for future developments.

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<sup>1</sup>With regard to foreign attendance, this workshop was largely limited to participants from the United Kingdom and the Federal Republic of Germany (see L.J. Low: *Theater-Level Gaming and Analysis Workshop for Force Planning, Vol II-Summary, Discussion of Issues and Requirements for Research*, SRI-Report, May, 1981).

<sup>2</sup>Huber, R.K., Jones, L.F., Reine, E., (Eds.): *Military Strategy and Tactics-Computer Modeling of Land War Problems.*, Plenum Press, New York - London, 1975.

Since then some of the suggested developments have been pursued. In addition, a significant amount of analytical and experimental resources has been devoted to understanding and modeling a number of other military processes which influence the dynamics and outcomes of battles and campaigns such as command and control, communications, intelligence, electronic warfare, and combat service support. Also, the empirical evidence that had become available through the rather extensive application of battle simulations revealed some hitherto largely unknown structural model properties that require careful consideration in the design of model experiments and the analysis of their results lest faulty conclusions should be arrived at.

Thus, as early as summer 1978 some of the participants of the 1974 conference suggested that a follow-up event should be organized. Subsequently, several meetings involving Dr. Seth Bonder of Vector Research, Dr. David P. Dare of the UK Defense Operational Analysis Establishment (DOAE), Mr. Klaus Niemeyer of Germany's defense analysis organization IABG, and this editor led to a proposal being submitted to Panel VII in 1980. At its June 1981 meeting Panel VII agreed to sponsor a three day symposium with the following objectives: (1) Determine the current status, identify future research directions, and provide for the exchange of ideas among NATO analysts on models and methods used to assist in defense planning with primary emphasis on non-attrition processes; (2) Based on national studies, exchange analytical results, information etc. on relevant NATO defense planning issues.

In response to the call for papers issued in July 1981, altogether 119 abstracts were submitted by analysts and researchers of 11 nations and NATO institutions. From those, 53 were selected in January 1982 by a committee composed of General P. Naslin (head of NATO's Defense Research Section), Mr. J. J. Meinardi (Chairman of Panel VII), and this editor supported by Dr. D. P. Dare of DOAE and Dr. W. B. Payne of the U.S. Army TRADOC Systems Analysis Activity. In order to provide within the available time for a maximum exchange of mutual experience and knowledge, the papers were allocated to three workshops meeting in parallel in which they were presented in summary fashion as a departure for discussion.

Workshop A, chaired by Dr. Bonder, was devoted to *Modeling Methodology*. It looked into new air/land warfare models and modeling approaches and discussed the modeling of command, control, and communication of tactical intel-

ligence, and of electronic warfare as a means to degrade the quality of those processes.

Workshop B, chaired by Dr. Dare, addressed problems related to the *Methodology of Analysis* such as how to cope with the variance of model results, the impact of combat parameters (in particular also of non-weapon-system parameters such as terrain and tactics), the interpretation of simulation results and histories, and the result to be obtained from exercises and field experiments, and also the techniques of data aggregation particularly with respect to the linkages in model hierarchies.

Workshop C, chaired by Dr. Payne, looked into special *Analysis Issues* related to system acquisition, force design, and contingency planning, to tactics and operational concepts, and to force readiness and sustainability.

In addition to the three workshops, there was a special plenary session on modeling and analysis of nuclear and chemical weapon effects. Since this was regarded to be a largely novel or even unknown area of application, at least to most of the European analysts, it was thought that every participant ought to have the opportunity to attend the respective presentations. That special session also featured a film presented by Prof. R. W. Shephard of the Royal Military College of Science. It reenacted, in animated form, a tank battle as it had occurred in a UK field trial in West Germany and which illustrated rather dramatically the swiftness of such battles and the impact of tactics/terrain interactions on the battle outcome.

For the presentation in this book, papers are grouped into four sections which, by and large, reflect the structure of the symposium. The Introductory Section presents the keynote address by John W. Gibson, formerly Under Secretary in the UK Cabinet Office and presently Chief Operations Research Division, SHAPE Technical Centre, and the conference director's observations. Section 2, 3 and 4 mostly contain the papers presented in the three workshops A, B and C. Each section opens with an assessment of the findings of the respective workshop by the session chairman which had been presented in the final plenary session of the symposium. Section 2 (on New Model Developments) also contains the papers of the special plenary session on nuclear and chemical effects. The papers related to the U.S. Army's Model Improvement Program (AMIP), even though they had been presented in Workshop A, are included in section 3 (on Modeling Issues and Analysis of Results). This is because, at the present time, AMIP reflects a

modeling philosophy rather than being an operational model family.

I am extremely grateful to NATO's Defense Research Group and its Panel VII on Defense Applications of Operational Research for their sponsorship and support of a rather successful symposium that was attended by 118 scientists and military operations analysts from 11 NATO nations and six NATO institutions and commands. In particular, I would like to thank the head of NATO's Defense Research Section, General Pierre Naslin, and the Chairman of Panel VII, Jan J. Meinardi, for their support in bringing about this symposium, and to the Points of Contact for their help in soliciting contributions. Mr. Hans Bakland of the Defense Research Section carried the brunt of the organizational efforts. Thanks to his tireless activity the symposium turned out to be a perfect operation. I am also indebted to Dr. H. Wieck, the ambassador to NATO of the Federal Republic of Germany, and his attaché Mr. L. F. Himburg, for their interest in the symposium and a most delightful reception.

Last but not least, I have to thank Drs. Seth Bonder, David P. Dare and Wilbur B. Payne who have, for almost four years, spent considerable amounts of their valuable time helping me to structure, prepare and run this symposium.

This book represents the work of around seventy authors, as well as the efforts of the workshop chairmen and their rapporteurs. It is a pleasure to acknowledge their contributions and cooperation. And I must not forget my secretary Miss Sobottka, for her diligent work in compiling and retyping some of the papers. Also I am indebted to Plenum Publishing Company for its patience and helpfulness throughout the process by which these proceedings were produced.

Reiner K. Huber

Neubiberg  
May, 1983

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