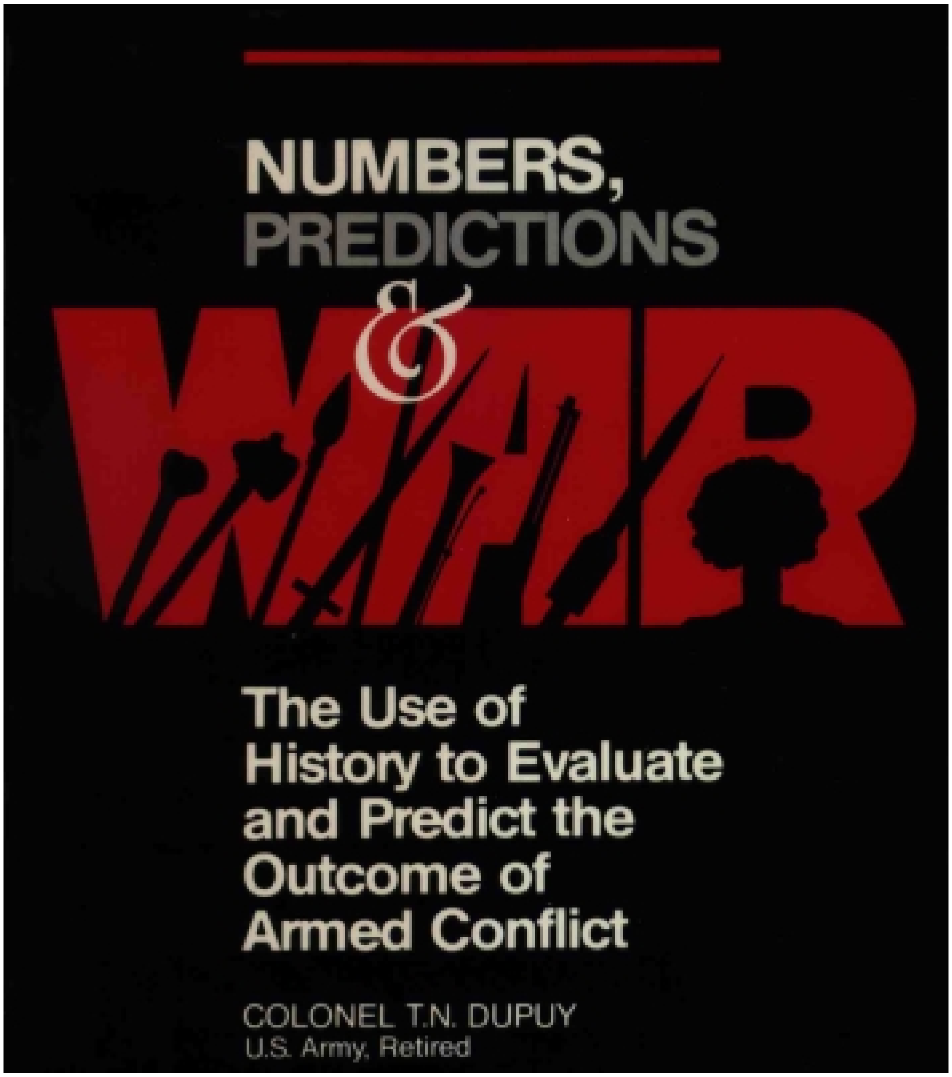
Volume 2, Number 4

December 1998

THE INTERNATIONAL TNDM NEWSLETTER



NUMBERS, PREDICTIONS & WAR

The Use of History to Evaluate and Predict the Outcome of Armed Conflict

COLONEL T.N. DUPUY
U.S. Army, Retired

The Influence of T.N. Dupuy's Research on the Treatment of Ground Combat in RAND's RSAS and JICM Models

Also in this issue:

- Iranian Casualties in the Iran-Iraq War, Part 2
- More on the QJM/TNDM Italian Battles
- How Advance Rates Are Calculated in the TNDM

INTRODUCTION

In tribute to what Trevor Dupuy pioneered and in an effort to pursue what he wanted to achieve, TDI continues to amass historical data and strives to refine the combat variables which go into the TNDM. In this issue of our newsletter Christopher Lawrence, Richard Anderson, José Perez, Susan Rich, and Jay Karamales continue to provide information on these efforts.

As you, our readers, survey the pages of this issue, you may be curious about the total scope of work of TDI. The paragraphs below outline what is missing in applied military history and what TDI is doing to shore up that deficiency. In other words, here is *our core capability*:

1. TDI provides independent, objective, historically–based analyses of modern military campaigns. Operations research, as developed during and right after World War II, was based on recorded, detailed data from battles. It is now nearly extinct. It has been supplanted by weapons and systems effects and performance analyses totally devoid of human factors considerations. As a result the Services, particularly the Army, have only partial answers for the development of operational concepts, battle doctrine, weapons requirements, and organizations. Similarly, because they were not historically validated, the Service models and simulations are skewed. Striving for only measured weapons effects and technical systems capabilities, they miss (or significantly distort) the impact of leadership, training, organization, and psychological factors (such as fear of death) on military units in contact.

2. Over the years, TDI, a successor organization to the Historical Evaluation and Research Organization (HERO), both founded by the late Colonel Trevor N. Dupuy, has compiled a large database from modern military campaigns and battles. Using Colonel Dupuy's methodologies and some new techniques, TDI has developed the following capabilities:

a. Comparison of fighting capabilities of opposing forces (systemic strengths and weaknesses) based on:
    (1) Command and organizational arrangements, leadership, force structure, intelligence, and logistics;
    (2) Training, cultural and psychological profiles, and flow of information;
    (3) Doctrinal flexibility or constraints in utilizing new weapons and technologies.
b. Validation of models or simulations and of scenarios for field exercises. Validation is a process, based on historical data and trends, that assists in determining whether a scenario, model, or simulation is an accurate representation of the real world. TDI has the capability to do this independently or to provide primary source historical data for agency in–house validations.
c. Estimating casualties for combat or other operations.
d. Providing lessons learned from studies of cause and effect chains among responsible players at the political, theater, operational, and tactical levels.
e. Analysis of group behavior (impact of various combat activities on units) and other human factors (historically–based aggregate measure of leadership, training, morale, organizational capacity, and cultural characteristics) in modern battles.
f. Studies, based on historic trends and experiential data, of the specific impact on combat caused by new technology and the improvement in weapons. This enables projections of ways in which future wars should be fought and understanding of what elements constitute "force multipliers."

3. The capabilities listed above merge operations research with historical trends, actual combat data, and real world perspectives creating applied military history in its most useful sense.

Nick Krawciw

CONTENTS

IN HONOR OF THE MEMORY OF THE LATE

Trevor N. Dupuy

Col., USA

International TNDM Newsletter

Publisher
The Dupuy Institute

Editor
Christopher A. Lawrence

Production Manager
Jay Karamales
Olórin Press

Contributing Editors
Richard C. Anderson
Jay Karamales
José Perez
Susan Rich

The Dupuy Institute

Founder
Col. Trevor N. Dupuy

President
Maj. Gen. Nicholas Krawciw

Executive Director
Christopher A. Lawrence

Board of Directors
Dr. George A. Daoust, chairman
Dr. Frances B. Kapper
John D. Kettelle
Dr. Douglas Kinnard
Maj. Gen. Nicholas Krawciw
Maj. Gen. James C. Pfautz
Eugene P. Visco
Dr. Abraham Wolf

Board of Advisors
John D. Kettelle, chairman
Dr. Howard F. Didsbury
Irving Green
Stanley Legro, Esq.
Robert S. Libauer
Dr. R. Ann O'Keefe
Dr. Lester A. Picker

Administrative Offices
The Dupuy Institute
1497 Chain Bridge Rd
Suite 100
McLean, VA 22101 USA
VOX: 703-356-1151
FAX: 703-356-1152
NikatTDI@aol.com

From the Editor...

Just in case you have been watching your mail box closely, you may have noticed that it has been almost 10 months since you saw the last issue of *The International TNDM Newsletter*. There are several reasons for this. First and foremost was that we were not doing any work using the model during that period. Second, the Institute was overloaded with its current project work and a number of new significant marketing efforts. As such, our last issue, the December 1997 issue, came out in late February 1998. We have not produced a new issue since then. As such, this December issue picks up where we left off. For those of you who have a subscription, the subscription is considered to be for 6 issues, vice a calendar year. The original plan was to produce the *Newsletter* every two months. We almost held to that plan for the first nine issues, and then had this extended break. During that time, with the Suppression Contract, Bosnia Studies, Mine Studies and our ongoing support contracts, we were making extensive use of the TNDM and systematically making improvements and updates to it. The nature of our studies over the last year have changed with us temporarily making much less use of the model, so work with the TNDM stopped for a while. We now expect to resume more work with the model. It's uncertain whether it will be at the same level as before, so we are not sure the *Newsletter* will remain bi–monthly or be spaced out further. For those who hold annual support contracts, we intend to extend the dates of the support contract to account for this "blank" period. We will address this to you in private correspondence.

Last month, I gave an extended four–hour TNDM lecture and presentation to a company in East Asia looking to purchase the model. If this occurs, we may be doing some significant additional work on the model, especially if they are looking for some changes to fulfil their specific needs. Again, after reviewing other models, they came to review the TNDM because the other models seems to produce "non–historical" casualty and advance rates and do not measure the impact of human factors on combat. As such, the TNDM still retains a place in the modeling community for those who are interest in real–world representation of combat and wish to address all the major factors that influence battle outcomes, including the human factor.

The lead article of this issue is an informal paper from Paul Davis of RAND on the influence of the QJM on RSAS/JICM. This article was an unsolicited response to a casual phone call I made to him one evening. I am very thankful that Mr. Davis took the time to prepare this article. It was an effort above and beyond the call of duty.

As Mr. Davis was so kind as to prepare an eleven–page article for me, I took the time to compose an article that answers his question on how advance rates are calculated in the TNDM.

Also, for this issue, we are finishing the article from Bill Beuttel at Boeing on the Iran–Iraq War. His original article was long enough that we took the liberty of breaking it into two parts. This article addresses the causes of casualties by weapons effects. We did send copies of the previous issue to the Iranian Embassy in Canada and to Dr. Cordesman of Georgetown University for comment, but to date, neither have chosen to respond. But since the original article was published, the Iranians have issued out a press release stating that they suffered 181,000 people killed in the war (85% of 213,000 during the Revolution and the War). This certainly matches well with Mr. Beuttel's average–based estimate of 188,000 dead. We have yet another article in hand from Mr. Beuttel on chemical weapons and Iranian casualties in the Iran–Iraq War. We will be publishing this in the next issue.

We will be presenting two articles related to Salerno, one in this issue and the other in the next. Back in Volume 1, Issue 6, we published an article by Niklas Zetterling of the Swedish War College on some errors in the original QJM validation database. This article poses two questions: first, was there an error in the original data HERO assembled on Sicily; and second, did this error result in TDI calculating too low a CEV advantage for the Germans. As a result of some other contract work we are doing, we have had the opportunity to review the Salerno engagements, and of course Dr. Zetterling was quite correct. So we have included an article that identifies those corrections that we have made.

The second part of the question will be answered in the next issue. As part of our TNDM demonstration that we did last month, we ended up modeling a part of the Salerno landing as a series of incremental engagements. We will have Mr. Anderson write up what was done and how the results measure with history in the next issue. Like most of our runs (I believe Darwin/Goose Green is the only exception), we ran these engagements only once. We do not tweak the engagements to perfection. This engagement directly points to the issue of time as used in the TNDM, for we have been discussing this some in past issues. As such, there will be a brief postscript to the issue of time in the TNDM that partially adjusts and corrects what I wrote in Volume 2, No. 3 of the *Newsletter*. I hope this provides a clarification to our South African users.

As such, we have made a few small adjustments and corrections to the model, primarily being able to turn "the short engagement" function on and off as needed. This is version 2.05 and will be sent out to our users next month.

We still need to address the issue of the revised armor OLIs, but that will have to wait until the next issue or the one after that. As the OLIs are balanced for current weapons, and validated for WWII weapons, for now we are guardedly comfortable with the situation. However, this is not a problem that we intend to let sit uncorrected. I suspect the solution to the problem now is that we need to revise the armor value formula to adjust the weight tables by historical period, as it appears the primary problem with the revised armor values is that they were done for modern weapons, and no attempt was made to address the WWII period.

Finally, for our *Who is TDI* article, it is time to introduce the President of TDI, General Nicholas Krawciw (ret. USA). General Krawciw joined the Institute in January of 1995, and it was intended that he take over the Institute at the end of the fiscal year. This process was unfortunately hastened by Col. Dupuy's untimely death in June 1995, but Gen. Krawciw has been at the helm since that time.

The articles addressing a TNDM analysis of the Battle of Dom Bütgenbach have been yet further delayed as both Jay Karamales and I have been distracted by other issues, including the need to meet contractual deadlines. We will have it in a future issue, perhaps the next one. We intend to conduct it as an analysis of multi–day division–level battle, and then fight the battle the way it occurred as a series of battalion–level engagements. We then will test the model results to the historical results. This test is also considered to be part of our on-going validation efforts.

As always, I expect to include some articles in the next issue on our battalion–level validation work. We have still to conduct our analysis of the advance rates and a summary conclusion from the first validation. We also need to test all these changes to our second battalion–level validation data base of 123+ battles from 1914 through 1991. Right now, though, we are going back through the TNDM and running the initial 76 battles not using the OLIs (i.e., every man has a OLI of 1 and no weapons are counted). We are then going to compare them to the runs using the OLIs and see which predicts better. While this will not "validate" the OLIs *per se*, if the runs using the OLIs predict better than the runs without them, then we must conclude that the OLIs are helping to improve the predictive capability of the model. If the reverse is the case, well.......

On a final note, The Dupuy Institute and I have signed a contract with Westview Press, a division of Harper-Collins, to write a book entitled *Prokhorovka: The Battle of Kursk.* It will be based on the research we did for the Kursk database. Our old Russian research team has already started gathering participant interviews. It is expected that I will be working on this book "in my spare time" over the next year and hope to complete it by the end of 1999. If anyone knows of a source of funding for TDI to do a "lessons learned" study of the battle, this would go a long way in helping to complete this book.

That is all for now and it is good to be back writing (although I hate editing). If you have any questions, please contact me. Addresses, email addresses, and phone numbers are in the masthead. ⊕

Influence of Trevor Dupuy's Research on the Treatment of Ground Combat in RAND's RSAS and JICM Models

by Paul K. Davis

This paper is about how Trevor Dupuy's research affected RAND's work on a series of combat models from 1982 onward. The paper begins with background on the RAND models, notes Dupuy's broad influence, and then describes how RAND's close–combat models were formulated and calibrated. The next part of the paper addresses points raised in a recent *TNDM Newsletter* article by James Taylor and also corrects some misimpressions.

Background

The RAND Strategy Assessment System (RSAS) was in continuous development from 1982 until about 1992, after which it was succeeded by a post–Cold War version called the Joint Integrated Contingency Model (JICM).[1] The RSAS was an analytical wargaming system describing joint and combined operations in theater and global conflict for the spectrum from conventional through general nuclear war. It represented commanders and political leadership with knowledge–based models. The RSAS could be used as a closed model or as a game with some higher level decisions made by players. The combat model, called CAMPAIGN, could also be used alone, either closed or as a game.[2] It decomposed into portions for air, ground, naval, and strategic–mobility operations.

The JICM resulted from a substantial reprogramming that improved overall coherence, combined features of alternative theater models contained within the RSAS, and provided a single interface. Regrettably, the political and commander–level models were not updated for the post–Cold War period and withered away, but the JICM has an improved treatment of combat and mobility and uses conditional logic to describe adaptive plans. These plans can be seen as minimal commander models. The JICM is used heavily by RAND in studies and exercises for Air Force, Army, OSD, and Joint Staff sponsors. It is also used directly in some war colleges, by OSD(PA&E), by the Korean Institute for Defense Analyses (KIDA), and by the Korean armed forces. RAND also uses START, a more simplified spreadsheet model that draws heavily on the JICM for its ground combat algorithms.[3]

With this background, what follows focuses on ground combat modeling in the RSAS and JICM. It is here that Trevor Dupuy's work had the most effect.

The RSAS/JICM Ground-Combat Models

We began brainstorming the RSAS combat model in 1982.[4] From early on, we set the objective of representing diverse factors that had previously been given short shrift. These included treating maneuver concepts and other aspects of strategy explicitly and representing the Soviet style of theater warfare. We also put a great deal of emphasis on reflecting qualitative factors such as fighting effectiveness and surprise, using history as a source of lessons learned and rough numbers, and being willing to add factors and processes to the model as needed to connect with what military experts really believed to be important at the operational level of warfare.

We were never going to use the RSAS to do weapon system tradeoffs such as those involving alternative tanks, but we *were* going to be doing studies related to the conventional balance, higher–level defense planning, arms control, multi–theater war, various force–improvement proposals, and potential nuclear escalation (Davis and Winnefeld, 1993). In some of these studies, qualitative factors would be crucial.

Two other considerations were important. First, the RSAS was to be fast–running and suitable for extensive uncertainty analysis.[5] Second, we sought to understand results over time and what underlay our assumptions. In part because of this, we did not use the mathematically elegant matrix–equation approaches. Although they had much to recommend them, we were not persuaded that they were so correct as to justify slower run speed and the great delays and complications involved in establishing killer–victim scoreboards.[6] Instead, we started down a path of using unit and weapon–category strengths or scores, and then taking situational factors into account before estimating attrition and movement.[7] This approach remained controversial, but I believe it was correct for our purposes.

Influence of Dupuy's Work

As the reader should have inferred by now, I was strongly influenced from the outset (as my colleagues were later) by Trevor Dupuy's writings (Dupuy, 1979). Indeed, at the invitation of me and Milt Weiner, Trevor visited RAND as a consultant, probably in 1985. We talked subsequently on a number of occasions until his death. We even served together on a panel reviewing modeling issues for the now–defunct Office of Technology Assessment. I made a point of citing Trevor's work in many papers and talks, which he appreciated because so many people in the analytic community failed to take his work as seriously as it deserved. He in turn commented thoughtfully from time to time on our work at RAND. Not surprisingly, he particularly liked a paper critical of DoD modeling (Davis and Blumenthal, 1991). In any case, Trevor understood my appreciation for his work enough to ask me for a letter expressing it when he was building support for the Dupuy Institute. I was delighted to respond. [8]

Against this background, it seems to me looking back that Trevor Dupuy's work affected RSAS development in four ways: (1) by strongly influencing our overall philosophy, particularly with respect to the need to recognize a vast range of factors, including controversial qualitative and even subjective factors such as national fighting effectiveness; (2) by convincing us that historical information was a valuable source of both insight and rough numbers (always controversial); (3) by providing some of those numbers, which we could use along with other information to define and calibrate the baseline models; and (4) by providing history–based "verities" that we could use as challenges, assessing whether the emerging RSAS could generate results consistent with historical tendencies.[9]

The proof of the pudding in modeling, of course, is whether it proves useful. Thinking back, I see many ways in which Dupuy's influence on RAND affected later policy–level work for the DoD. In particular, a number of our studies for OSD and the Joint Staff have highlighted issues and suggested solutions that simply were not on the table of those reluctant to use qualitative and subjective factors. [10] Also, we have used historical examples heavily in our discussion with military officers, which often is valuable in finding common ground, establishing credibility, and communicating complex ideas.

Important Limits of Influence

What did *not* happen is also worth discussing. Although we read *Numbers, Predictions and War* in some detail, my colleagues and I did not see the QJM itself as being useful *for our purposes*. We had many reasons.

First, the QJM was a static model, whereas we needed a simulation generating behavior over time, including the action–reaction behavior of modeled commanders. Further, even the close–combat model used for a time period's fight in a given sector should, in a good combat simulation, be quite different from a static model describing results of an entire battle as calibrated from history. For example, even over relatively short periods such as a day or so, simulation should represent tactical– and operational–level reinforcement, decisions of commanders to withdraw to more defensible positions or reduce flank exposure, and so on. A static model such as the QJM, in contrast, must somehow represent the effects of averaging such events over time. It should not be surprising, then, that Dupuy's historically–based model shows less dramatic dependences on force ratio and other factors than might be found in a strictly local calculation of a simulation.

Second, the original QJM was closely tied to a ground–force–centric image of war and historical data from an era that preceded precision guided weapons (PGMs) for tactical air forces, attack helicopters, and what became missile systems such as MLRS/ATACMS. As a result, it greatly oversimplified and reduced visibility of much of what we were interested in. We did not believe that OLI (or WEI/WUV) methods worked adequately for these matters—especially as we looked ahead.[11]

Third, a central credo of our approach to analysis was appreciation of uncertainty, including recognition that most of the key parameters of combat models are highly uncertain—especially for future battles, but even when looking to past battles, except in special instances (Ardennes? Kursk?) where historians have gone to great lengths to collect information. This meant that we never took seriously the precise numbers we used as baseline values in attrition or other equations. Instead, we planned to do extensive sensitivity analysis (or what we now call exploratory analysis) in which, for example, we would be varying attrition intensities and even qualitative fighting effectiveness substantially. In this context, readers should not be surprised that we saw claims for the early–80s QJM as much too good to be true. It seemed evident that Dupuy had greatly "overused" the available data in a statistical sense.[12] Further, those of us who knew him observed that in his actual work, Trevor went through much more extensive campaign analysis than one might naively think hearing about the QJM. Although the QJM was static, he would identify different phases of a campaign and treat them separately, having noted when reserves were committed or some such, etc. That is, as a good analyst he was doing "off line" much of what we were trying to do explicitly in an analytic war game or simulation.

A fourth factor was the analytical character of the original QJM model. It had been built up from a series of incremental patches with many buried interrelationships and nonlinearities. When at one point we attempted to calibrate using QJM data, we generated curves from the model and found behaviors that made no sense to us phenomenologically.[13]

Fifth and finally, we disagreed with the QJM on theoretical grounds, believing that it mistreated some very phenomena—not only the ones mentioned above in connection with modern warfare such as attack helicopters or tactical air forces with PGMs, but also classic close–combat considerations involving large–scale operational maneuver, force–to–space ratio,[14] combined–arms imbalances, deep battle, and the need to disaggregate so as to estimate attrition separately to different weapon classes (e.g., with artillery being reduced primarily by other artillery). [15] Thus, we were taking Dupuy's research quite seriously, but attempting to move beyond it in many ways.

I have elaborated on these matters to explain why we were at once strongly influenced by Dupuy's insights and historical data, but not motivated to use or calibrate to the QJM *per se*. James Taylor grumps in a recent *TNDM Newsletter* article (Taylor, 1997) about the failure of us and others to do so, but we had good reasons.

Many Sources of Information Were Used

A related consideration here was that we were drawing on *many* sources of information simultaneously, even for historical data. In sketching our original approach to attrition modeling, I personally drew on work of Wainstein (1973) from IDA, Yengst and Smolin (1981) from SAIC, General Chaim Herzog of Israel (Herzog, 1984), David Rowland of the UK's DOAE (now DERA), and others.[16] Bruce Bennett drew on earlier Army reports and models studies associated with the Quick Game developed by Ed Kerlin and others at RAC and the ATLAS model.[17] We also had a fair amount of quantitative information from unclassified Soviet sources regarding rates of advance, repair rates of damaged tanks, durations of operations, and so on. Alan Rehm, who had worked on these matters while at CIA, provided further information on Soviet thinking (e.g., Rehm and Sloan, 1984), as did John Hines working in the Office of Net Assessment and two Afghan officers who had studied in the Soviet Union (Sloan, Jalali, and Wardak, 1985).[18]

There was a large variance in data, both within individual studies such as that of Wainstein, and even more so across authors, who had made different assumptions about orders of battle and the like. Thus, when it came time to write down our attrition equations and calibrate the coefficients, we never even thought about attempting to do anything "rigorous," much less doing so within the particular framework of the QJM alone.[19] Instead, our intention was to incorporate all the important factors and processes, and to draw on the diverse sources of information for "roughly right" baseline numbers with the understanding that RSAS analysis would emphasize uncertainty and not take baseline "predictions" seriously at all.

Bruce Bennett generated the first "official" RSAS ground–combat attrition equations in 1985, using a variety of data, statistical methods, and analytical judgments that we had made after a lengthy internal discussion (Bennett, et al, 1988, pg 57).[20] It was an example of analytic art, not rigorous calibration. Although the model was fully documented, the number crunching details of calibration were not. Over time, however, RSAS users spent a great deal of time comparing RSAS behavior to that of other models, historical examples, and military judgment about specific situations.

Over the years, the RSAS was modified and fine–tuned many times to represent anecdotal and other information from military officers with recent field experience, as well as some newer information from the Soviets or historical analysis. Along the way, RAND also held workshops to discuss particular issues.[21] There were also one–on–one meetings in which Bruce Bennett went through model details and rationale with interested parties. Finally, an RSAS Newsletter (later renamed the Military Science Newsletter) described developments and discussions over time. Similar discussions continue on the JICM model, but the attention, of course, is on future warfare.

Some Misimpressions About the RSAS

Let me now comment briefly on some misperceptions in James' Taylor's interesting article in the *TNDM Newsletter* (Taylor, 1997), which describes Trevor Dupuy's work in terms of a "system picture ." First, as discussed above, we at RAND were quite familiar with Dupuy's work and believed that we understood well what we were doing as we moved on, drawing also on many other sources of information. Second, despite Taylor's impressions, we most assuredly did "recalibrate" when using Dupuy's and other historical data—not in the way he might have suggested, especially if using Dupuy's data as a closed system, but in a way that attempted to disentangle the kinds of nonlinear effects that Taylor correctly notes exist in the QJM.[22]

Second, despite Taylor's impression to the contrary—due probably to our failure to discuss this in the public–release documentation—we used Dupuy's analysis of personnel loss rates versus armored loss rates from the beginning of our work. At the time of the original RSAS development, Dupuy's work was the only good information on how to translate personnel losses into equipment losses, albeit crudely.[23] The RSAS and JICM focus on equipment losses, as do most models, but when called for, we "go backward" and generate estimates of personnel loss rates, which are typically estimated to be several times smaller (a function of simulated repair rates, the type unit, type battle, and other factors).

Third, Taylor puzzles about why RAND did not use the ratio of fractional loss rates to simplify the attrition equations. He is, of course, quite right on the simplification. However, when constructing the RSAS, we were not convinced that the relevant equations should even be symmetric between attacker and defender, which ruins the simplification. Further, as mentioned above, our equations were developed by fitting algorithmic forms, not merely coefficients, to previous models and data.[24] Finally, it was analytically convenient in studies where we varied parameter values to do so for the constants in defender loss rate (a measure of intensity) and ratio of loss rates (a measure of defender advantage). I merely report this, without claiming that our approach in this regard was better or worse than alternatives. My personal preference in special studies of theoretical matters has often been to go for analytical simplicity of precisely the sort Taylor suggests,[25] but a computer model doesn't really care about such aesthetics.

One further point on this topic may be of interest here. In the late 1980s I suggested on theoretical grounds using ratio of fractional loss rates (RLR) as a key variable dictating ground movement rate.[26] Bruce Bennett and I worked out details and the movement model was changed accordingly (Allen, 1992). Somewhat later, Robert Helmbold of the Army's Concepts Analysis Agency reported historical analysis that showed reasonably good correlation between RLR (what he calls FERV) and battle outcomes, including movement.[27]

Finally, a word on documentation. Taylor's article grumbles about what he thought was a lack of documentation. As a general proposition, he is correct: DoD's models (and RAND's) are usually poorly documented. This said, there has been an enormity of documentation available to RSAS and JICM users, especially if one considers unpublished materials, on–line documentation within the program (a predecessor of today's ubiquitous software "assistants"), and opportunities for both workshop– and one–on–one discussions between developers and users. My own lament is that we have usually lacked *consolidated* top–down documentation, particularly as the RSAS and JICM models have continued to evolve. Bennett (1988) and Allen (1992) are among many reports I consider good documentation (as were reports by IDA on TACWAR and IDAHEX), but models in actual use change over time and follow–up documentation is typically delayed, incremental, and unpublished. The moral of the story here is that even in the best of cases there is no substitute for interested parties visiting with developers and discussing matters face–to–face, sometimes looking at the computer screen itself. Impressions from published material are often inadequate and misleading. It does not help that proprietary considerations cause many model builders not to publish critical information. As I write this, I do not know, for example, whether the much simpler TNDM is fully documented in public documents—even though the original QJM (Dupuy, 1979) was laid out in detail. Dupuy (1987) leaves out parameter values.

Current Models and Comparisons

The discussion above has focused on history rather than what exists today. The QJM was improved and clarified over the years. It spawned the TNDM, which incorporates further improvements. The current JICM continues to be an evolving model with data reflecting a myriad of inputs over the last decade. It seems likely that the QJM and JICM ground-combat attrition models are still somewhat similar philosophically, and would often agree fairly well in quantitative predictions for some types of discrete battle. They would disagree sharply in other cases. For example, the RSAS/JICM/START family has a "breakthrough effect" modeled to represent large–scale operations such as those in World War II. If the defender is attempting to hold ground with a poor force–to–space ratio, then when that ratio falls below a threshold, the models predict a breakthrough characterized by a very large non–Lanchesterian attrition to the defender and fast movement rates for the attacker. Movement slows again when the attacker encounters a new defense line, goes too far ahead of its logistics, or reaches its objective for the operation. This was my 1985 attempt (with help of Pat Allen) to represent in the aggregate what would be seen in high resolution as the collapse of a front line due to some penetrations and local encirclements made possible by the inadequate force–to–space ratio worried about by Liddell Hart and others (Liddell-Hart, 1960). Qualitatively, the results of movement and attrition over time in battles looks much like that reported in WW II. In passing, I note that in the RSAS/JICM/START, movement is *anti*correlated with intensity (casualty rate), precisely as Dupuy suggests in one of his verities (Dupuy, 1987, page 157).

The later RSAS, JICM and START models also penalize a combatant with an imbalanced combined–arms mix, to an extent dictated by the situation—including the combined–arms mix and level of the opponent (Allen, 1992). This effect is ignored by many models, even relatively detailed ones. It can be large when, for example, one imagines three 82nd Airborne Divisions trying to defend in the desert against one mechanized division. Models like the QJM and TNDM may correct each side's score for the physical situation, but they do not take into account that one side's effective score should really depend on the character of the opposing force.[28]

There are also differences between the JICM scoring methodology and the OLI used in the TNDM, but I am not acquainted enough with either at this point to comment. The current JICM methodology was developed by Bruce Bennett and is largely heuristic.

There would likely be major differences between JICM and TNDM predictions for relatively complex operations involving, e.g., large–scale maneuver and countermaneuver and other aspects of strategy such as deep and parallel battle. This would depend on how such issues were handled in JICM "war plans" and in offline analysis in the case of TNDM.[29] Fundamentally, after all, JICM is a simulation model generating behavior over time and the TNDM is a static model attempting to capture overall results of a battle. Comparison, then, is difficult and depends sensitively on the analysts using the models.

Looking to the Future

What is most important for current RAND work is that the nature of warfare has changed dramatically over the last decades, especially for U.S. forces. As a result, our studies are often driven by the effectiveness of long–range precision fires rather than close combat. C^4ISR also plays an important role that cannot easily be handled with a single parameter. So also, suppression of air defenses (SEAD) and other special operations matter a great deal to results. We can no longer assume large more or less equally matched combatants. Thus, the relationship at this point between JICM and TNDM ground–combat models is only a small part of the overall story. Unfortunately, historical data is of little use in for "RMAish" effects, i.e., effects associated with the so–called revolution in military affairs. Instead, we must rely on a combination of experimental data, interviews, and high–resolution simulation—tempered by historical and speculative insights about likely action–reaction cycles—to establish the effectiveness numbers and their sensitivity to macroscopic variables. As of this time, the state of the art is poorly developed for doing so.

My own views on the state of military modeling and simulation and the need for a new research can be found in a study that I led for the National Research Council (NRC, 1997) and a new RAND report (Davis and Bigelow, 1998). One theme in both is the need for model *families*—including highly aggregated models such as the TNDM and even simpler models focused on fires, simulation models of varied resolution and character, and special–purpose analytical models. Ideally, we would know how the models in such families relate to each other. In contrast, there are few model families today, they are almost never integrated, and the relationships among members is only seldom well understood. I suspect that high–resolution models, however imperfect, will be increasingly essential—not just because we lack historical data on future warfare, but also because so many of the issues arising are not well reflected in intuitively estimated "scores."[30] So also, experiments will be increasingly crucial, with distributed interactive simulation providing the basis for creating some *synthetic history* that will be a good deal better than nothing. There is much to be done. It would be very nice if Trevor Dupuy were still with us to push the frontiers.

Bibliography[31]

Allen, Patrick D, Paul K. Davis, and Bruce Bennett, *A New Treatment of Attrition, Rates of Advance, and Maneuver Effects...*, unpublished, 1985. Unfortunately, the DoD classified this report. As a result, we did not bother to finish the revisions and publish it formally because of the likely limited circulation it would have.

Allen, Patrick, *Situational Force Scoring: Accounting for Combined Arms Effects in Aggregate Combat Models*, RAND N-3243, 1992. See also his "The Need to Represent a Wide Variety of Battle Types in Air-Ground Combat Models," in *Military Operations Research*, Vol. 1, No. 3, 1995.

Bracken, Jerome, Moshe Kress, and Richard E. Rosenthal (eds.), *Warfare Modeling, Military Operations Research Society*, John Wiley and Sons, Danvers, MA, 1995.

Davis, Paul K. and Cindy Williams, *Improving the Military Content of Strategy Analysis Using Automated War Games: A Technical Approach and an Agenda for Research*, RAND, 1982. This is the earliest reference to RAND's intention to use Dupuy's work. The paper now seems naive to me in many respects, but some of the issues and ideas it raises have an eerily close relationship to problems that remain with us today.

Davis, Paul K., "Applying Artificial Intelligence Techniques to Strategic-Level Gaming and Simulation," in *Modeling and Simulation Methodology in the Artificial Intelligence Era,* edited by M.S. Elzas, T.I. Oren, and B.P. Zeigler, Elsevier, North-Holland, 1996. Reprinted as RAND (N-2752, 1988).

Davis, Paul K., *Toward a Conceptual Framework for Operational Arms Control in Europe's Central Region*, RAND, 1988a.

Davis, Paul K. *The Role of Uncertainty in Assessing the NATO Central-Region Balance,* RAND, 1988b, reprinted also in a study of the balance by the U.S. GAO and CBO.

Davis, Paul K., "Prospects for Military Stability in a Deep-Cuts Regime," in Ian M. Cuthbertson and Peter Volten (ed.), *The Guns Fall Silent: the End of the Cold War and the Future of Conventional Disarmament*, Institute for East-West Security Studies, New York, 1990.

Davis, Paul K. and James A. Winnefeld, *The RAND Strategy Assessment System*, RAND, 1993. This was the original concept study, prior to coding. It included the charge from our government sponsors, particularly the Director of Net Assessment, Andrew Marshall.

Davis, Paul K. and Donald Blumenthal, *The Base of Sand: a White Paper on the State of Military Combat Modeling*, RAND, 1991.

Davis, Paul K. (ed.), *New Challenges in Defense Planning: Rethinking How Much Is Enough*, RAND, 1996 (available as a commercial book).

Davis, Paul K., David Gompert, and Richard Kugler, *Adaptiveness in National Defense: the Basis of a New Framework*, RAND issue paper, 1996.

Dupuy, Trevor N., Attrition: *Forecasting Battle Casualties and Equipment Losses in Modern War*, HERO Books, Arlington, VA, 1990.

Dupuy, Trevor N., *Contributing to the Reliability of the Army War College Model,* HERO*, 1982.*

Dupuy, Trevor N., *Numbers, Predictions, and War*, Bobbs-Merrill, 1979.

Dupuy, Trevor N., *Understanding War*, Paragon House, 1987.

Helmbold, Robert, chapter in Bracken, et al. (1995).

Herzog, Chaim, *The Arab-Israeli Wars,* Vintage Books, New York, 1984.

Hillestad, Richard and Mario Juncosa, *Cutting Some Trees to See the Forest: On Aggregation and Disaggregation in Combat Models*, RAND R-4250, 1993. Reprinted in Bracken et al. (1995).

Kerlin, Edward, Donald Marder, and Dudley Edwards, *Computerized Quick Game: a Theater Level Combat Simulation*, Research Analysis Corporation, Volume 1, 1967.

Liddell-Hart, B.H., "The Ratio of Troops to Space," *Military Review,* 1960.

National Research Council, *Modeling and Simulation, Vol. 9 of Technology for the U.S. Navy and Marine Corps: 2000-2035*, National Academy Press, 1997.

Rehm, Allan S. and John F. Sloan, *Operational-Level Norms*, Science Applications Inc., SAI-84-041-FSRC, 1984.

Sloan, John F., Ali Jalali, and Guhlam Wardak, *Soviet Front Level Planning Methods*, SAIC-85/6100&FSRC, Science Applications Inc., Greenwood Village, CO.

Speight, L.R., D. Rowland, and M.C. Keys, “Manoeuvre Warfare: Force Balance in Relation To Other Factors and To Operational Success,” *Military Operations Research*, Vol. 3, no. 3, 1997.

Taylor, James G., “Consistent Scoring of Weapons and Aggregation of Forces: the Cornerstone of Dupuy’s Quantitative Analysis of Historical Land Battles,” *International TNDM Newsletter*, Vol. 2, No. 2, October 1997.

Wainstein, Leonard, *Some Allied and German Casualty Rates in the European Theater of Operations*, Institute for Defense Analysis, P-989, Arlington, VA, 1973.

Yengst, W.C. and T.G. Smolin, *Conventional Warfare Damage and Casualty Trends*, Science Applications Inc., DNA 001-80-C-0049, La Jolla, CA, 1981.

---

[1] I headed overall RSAS development from 1982 until about 1988 when I shifted attention exclusively to defense planning and analysis. Bruce Bennett was my deputy from early in RSAS development. He took over the lead in 1988 and continued it through the transition to the JICM. The best single point of contact for current aspects of the JICM is Daniel Fox in RAND’s Washington Office (202-296-5000). Nearly everyone in RAND can be reached by e-mail in the form Firstname_Lastname@rand.org, using formal first names.

[2] For description of overall RSAS architecture, rather than the combat–model components, see Davis (1986).

[3] START was developed by Bruce Bennett and Barry Wilson.

[4] I established the philosophical approach and did much of the early theoretical work, including links to Dupuy. I was helped a great deal in this by Robert Howe, Patrick Allen, and Bruce Bennett, who then took the lead in developing and calibrating the model actually programmed, and in making many other improvements over subsequent years. Carl Jones did the programming and integration, and contributed much to the model as well. Pat Allen made major contributions in the mid–to–late 80s, particularly to the “situational scoring” used in the later RSAS, JICM, and START (Allen, 1992).

[5] Such exploratory analysis is a major theme of RAND work. For related philosophy and its implications for higher level defense planning that emphasizes planning under uncertainty and adaptiveness, see the related chapter in Davis (1994) and an issue paper circulated to influence the QDR (Davis et al., 1996).

[6] Advocates of such models (e.g., CEM, TACWAR, IDAHEX, VECTOR) often criticize simpler approaches as though the matrix models are “correct.” These models have mathematical virtues and have long since proved their value in analysis, but “correct” they are not. For example, they depend on highly uncertain bottom–up calibration processes to establish killer–victim matrix data. Further, they have often not incorporated a number of factors we believed in RSAS work to be important.

[7] This tilt was similar in spirit to Dupuy’s use of OLI scores, OSD’s use of WEI/WUVs or ADEs, and simulation work at RAND by Milt Weiner and Lou Wegner (Tally–Totem in the 1970s and Master in the early 1980s). However, we maintained information by weapon category and differentiated sharply among them when estimating attrition.

[8] Letter, Paul K. Davis to T.N. Dupuy, HERO–TNDA–Publishers, 3 January, 1992.

[9] See the verities published some years later in Dupuy (1987) and *Armed Forces Journal.* As I recall, I concluded from the journal article that Dupuy was not well acquainted with simulation models and how the kinds of phenomena he was describing would or would not be seen in simulations. Good use of the RSAS generated results very consistent with most of his verities (e.g., those of pp 174 ff in *Understanding War*). However, to get such results we needed intelligently developed and adaptive operational strategies. Simulations using unimaginative “scripted methods” often flunk his test of verities.

[10] See Davis (1988a) for an example in which qualitative factors had a major impact on recommendations for conventional arms control. The Central Region has long ago disappeared, but the work was well received by policy makers at the time. It depended on understanding the potential implications of reserve forces having an effectiveness in offensive operations that depended strongly on how much training time they had before commitment. Although I do not recall Trevor Dupuy having included that factor in the QJM, doing so was very much in the spirit of his thinking, as he noted to me in conversation after a presentation. For another example of how Dupuy–inspired factors affected policy–level analysis, see Davis (1988b). This work noted how perceptions of the balance could change markedly if one considered that not all non–Soviet Warsaw Pact forces would fight as effectively as their equipment would permit. In the study behind this paper, we also examined the potential effects of some NATO allies performing less well than others. “Surprise attacks” (which really should be named “attacks before the defense prepares adequately”) also played a large role in the study and the subsequent one on arms control.

[11] In time, Dupuy appears to have taken a similar view, as evidenced in his book predicting what would happen in Desert Storm (Dupuy, 1990).

[12] I recall discussing this with Trevor when he visited RAND in the mid 1980s. I noted that, unlike others, I had no quarrel with his approach of applying a model to data, observing anomalies, looking more deeply into those cases, finding additional factors to add into the model, and iterating. That was just real science to my eyes (my background was in theoretical chemistry and physics). However, it was a different matter to then claim that because the iterated model eventually fit the data, it could then be considered predictive. He had come to realize this, of course, was always looking for “new” data, and was enlisting the help of others in the community to improve the rigor of his work. His later book *Understanding War* was a big improvement and I still recommend it to students and other newcomers to combat model-

ing. In my view, however, Trevor never emphasized adequately the considerable variance of results. I have been pleased to see that the TNDM Newsletter often does show such things. The TNDM need not be *reliably* precise and predictive to be very useful.

[13] Later versions of the QJM and TNDM corrected some of these problems. Also, *Understanding War* improved the exposition.

[14] This factor played a crucial role in influential mid–to–late–80s arms–control analysis, although some initial analysis on the so–called operational minimum underestimated the potential ability of small forces—when fighting other small forces—to compensate for a bad force–to–space ratio with good C3I and maneuver capability (Davis, 1990).

[15] Another example was the potential impact of Soviet Operational Maneuver Groups (OMGs), which could not be represented adequately in a straightforward deterministic aggregate–level analysis, but which could be studied if merely one tried hard enough. For a look at our early reasoning on such matters, before actually building the model, see Davis and Williams (1992).

[16] The unpublished Allen, Davis and Bennett (1985) describes some of this effort.

[17] See Kerlin et al, 1967 and Dupuy (1982).

[18] We were also reasonably familiar with models such as CEM, TACWAR, IDAHEX, and VECTOR, but they were not especially useful to us for the purposes discussed here because they represented quite different approaches. The principal exception was IDAHEX, developed by the late Paul Olson, which strongly affected our thinking about maneuver effects.

[19] Yet another consideration was that the DoD was to some extent willing to tolerate and generate ADE scores using WEI/WUV methodology, but was uninterested in Dupuy's OLI alternative.

[20] As examples here, we sought algorithms that would be less dramatically dependent on force ratio than Lanchester equations and that would be different for attacker and defender.

[21] In reading Taylor (1997) I was reminded of one important "shoot–out" workshop in which advocates of the matrix–Lanchester approach argued with those taking the RSAS' "score" approach. Taylor attended this meeting and made very helpful suggestions based on his knowledge from reviewing many prior models.

[22] For a taste of what is involved in this type of work, see Allen (1992), footnotes 4, 5, and 7.

[23] Looking back, I was surprised to see we had not mentioned this in Bennett et al. (1988). Much space had been devoted to it in our unpublished documentation (Allen, Davis, and Bennett, 1985) and I had personally looked for comparable information in sources like Herzog (1984), Soviet, and British sources, without great luck.

[24] Some of this is discussed in Allen (1992), which describes fully the situational scoring methodology adopted for the RSAS, JICM, and START. See especially page 41, including discussion of considerations used in fitting and calibrating.

[25] Davis, Paul K., *Aggregation Disaggregation, and the 3:1 Rule in Ground Combat*, RAND, 1995. Available online at http://ww.rand.org/personal/pdavis.

[26] The essence of the idea is simple: fast movement occurs when the attacker has won a local battle, not when the combatants are still face–to–face "duking it out" at high intensity. The ratio of fractional loss rates is a measure of who is "winning" the local battle. The loss rates we use here include losses calculated separately from air–to–ground attacks by tactical aircraft and helicopters, and missiles.

[27] See Helmbold (1995), which is based on work around 1991, his article on pg 27 of the September, 1997 *Phalanx* newsletter of the Military Operations Research Society, and earlier papers also in *Phalanx*.

[28] This fundamental point is generally lost in score–based discussions. It is developed theoretically in work by RAND colleagues using Lanchester systems for analytic convenience (Hillestad and Juncosa, 1993).

[29] Although TNDM is a static model, applications can be much broader in scope. I was struck, in 1991, by how closely Trevor Dupuy's published analysis anticipating the Desert Storm campaign corresponded to my own thinking, using RSAS concepts, and British analysis performed at the Defence Operational Analysis Organization (DOAE). The DOAE work, by the way, emphasized nationality–dependent fighting–effectiveness factors based on their own historical research, primarily by David Rowland. I have never seen a side–by–side comparison of his work and Dupuy's. For a good recent discussion of related issues, including what the authors call "attacking flair," see Speight, Rowland, and Keys (1997).

[30] Some related discussion of how high– and low–resolution models can complement each other will be included in the appendix volume of a forthcoming Defense Science Board study on tactics and technology for the 21st century.

[31] To order RAND publications search abstracts at the web site http://www.rand.org/PUBS, using the appropriate name syntax (e.g., Smith, J. rather than John Smith).

How Advance Rates Are Calculated in the TNDM

by Christopher A. Lawrence

The advance rate formula for the TNDM is more complicated than the QJM. The original QJM advance rate formula, as published in *Numbers, Predictions and Wars*, was:

> Advance Rate = Standard Rate × General Terrain Factors × Road Quality Factors × Obstacle Factors × Day/Night

In effect there were four lookup tables, one for each factor, which are recreated in the sidebar on the next page. Night advance rates are half of daytime advance rates.

The main point, if one looks at the Advance Rate table, is that advance rate is driven first by force ratio, degraded by posture of defender (whether hasty, prepared or fortified defense), and degraded by attacker force type (armored, mech, infantry, horse cavalry).

The TNDM methodology is:

$$\text{Advance Rate (km/day)} = 1.6 \times Sr \times me \times rm \times hm \times RQ \times RD \times St \times uar \times dn \times Su \times ff$$

Sr = Standard (unmodified) unmodified advance rate (Table 13)

me = Mission Effects Factor. For an attacker making an "all-out" effort, the factor is 1.3. A commensurate increase in the casualties will be incurred.

rm = Terrain Factor as it affects mobility (Table 2)

hm = Weather Factor as it affects mobility (Table 3)

RQ & **RD** = Road Quality and Road Density (Table 14)

St = River or Stream Factor (widths greater than 20 meters (Table 15)

uar = Posture Factors as it affects advance rate (Table 6)

dn = Day/Night Factor. When the time of engagement is less than 24 hours, and all or most in darkness, the standard rate is one-half the normal rate, a factor of 0.5; if the period is entirely daylight, the factor is 1.2; for a 24-hour period, the factor is 1.0.

Su = Surprise Factor (Table 11). For a period of more than one day, the factor is reduced by one–third the second day, by two–thirds the third day, and is not operable thereafter. Fatigue Factors (**ff**): For every day of normal sustained combat the advance capability of a unit declines by 0.016, from a maximum value of 1.0 (See Table 10). It is assumed that this factor cannot be reduced below 0.6. The formula is:

$$ff = 1 - (0.016 \times \text{Days})$$

It is recalculated every day during sustained combat.[1]

Effectively, the differences in the two methodologies can be considered as shown in the table below:

	*QJM as listed in NPW** *Range of Values*	*TNDM* *Range of Values*
Constant	None	1.6
Force Ratio	3 – 60 km	1.5 – 60 km
Main/Max Effort	1.2	1.3
Terrain Factors		
Inf & Combined Arms	.3 – 1.05	.3 – 1.05 **
Armor & Cavalry	.2 – 1.00	.2 – 1.00 **
Weather Factors	Not included	.5 – 1.00
Road Quality	.6 – 1.0	.6 – 1.0
Road Density	.6 – 1.0	.6 – 1.0
River/Stream Factor	.5 – .9	.5 – .9
Posture Factor	.125 – 1.0	.25 – .9 ***
Day/Night Factor	.5 – 1.0	.5 – 1.2
Surprise	Not included	1.0 – 1.6 ****
Fatigue	Not included	.6 – 1.0

* The QJM as used in the 1980s was not the same version as in *Numbers, Predictions, and War*. The formula given for the QJM in *Understanding War* (1987) was:

$$A = sr \times rm \times hm \times RQ \times RD \times ST \times uar \times dn \times Su \times ff \times me$$

These are the exact same variables (less the constant) that are in the TNDM.

** Table clearly has some values adjusted.

*** There is also a 0.0 multiplier for both sides holding (a common situation).

**** 1.0 assumes "no surprise."

Lookup Tables from *Numbers, Predictions, and War*

Standard (Unmodified) Advance Rates

	Rates in km/day			
	Armored Division	Mechzd. Division	Infantry Division or Force	Horse Cav Division or Force
Against Intense Resistance (P/P: 1.0–1.10)				
Hasty Defense/Delay	4.0	4.0	4.0	3.0
Prepared Defense	2.0	2.0	2.0	1.6
Fortified Defense	1.0	1.0	1.0	0.6
Against Strong/Intense Resistance (P/P: 1.11–1.25)				
Hasty Defense/Delay	5.0	4.5	4.5	3.5
Prepared Defense	2.25	2.25	2.25	1.5
Fortified Defense	1.85	1.85	1.85	0.7
Against Strong Resistance (P/P: 1.26–1.45)				
Hasty Defense/Delay	6.0	5.0	5.0	4.0
Prepared Defense	2.5	2.5	2.5	2.0
Fortified Defense	1.5	1.5	1.5	0.8
Against Moderate/Strong Resistance (P/P: 1.46–1.75)				
Hasty Defense/Delay	9.0	7.5	6.5	6.0
Prepared Defense	4.0	3.5	3.0	2.5
Fortified Defense	2.0	2.0	1.75	0.9
Against Moderate Resistance (P/P: 1.76–2.25)				
Hasty Defense/Delay	12.0	10.0	8.0	8.0
Prepared Defense	6.0	5.0	4.0	3.0
Fortified Defense	3.0	2.5	2.0	1.0
Against Sllight/Moderate Resistance (P/P: 2.26–3.0)				
Hasty Defense/Delay	16.0	13.0	10.0	12.0
Prepared Defense	8.0	7.0	5.0	6.0
Fortified Defense	4.0	3.0	2.5	2.0
Against Slight Resistance (P/P: 3.01–4.25)				
Hasty Defense/Delay	20.0	16.0	12.0	15.0
Prepared Defense	10.0	8.0	6.0	7.0
Fortified Defense	5.0	4.0	3.0	4.0
Against Negligible/Slight Resistance (P/P: 4.26–6.00)				
Hasty Defense/Delay	40.0	30.0	18.0	28.0
Prepared Defense	20.0	16.0	10.0	14.0
Fortified Defense	10.0	8.0	6.0	7.0
Against Negligible Resistance (P/P: 6.0 plus)				
Hasty Defense/Delay	60.0	48.0	24.0	40.0
Prepared/Fortified Defense	30.0	24.0	12.0	12.0

Road Quality Factors

Road Quality:	Good Roads	1.0
	Mediocre Roads	0.8
	Poor Roads	0.6
Road Density:	European Standard	1.0
	Moderate Density	0.8
	Sparse	0.6

General Terrain Factors

	Infantry (Combined Arms) Force	Cavalry or Armored Force
Rugged, Heavily Wooded	0.4	0.2
Rugged, Mixed	0.5	0.4
Rugged, Bare	0.6	0.5
Rolling, Heavily Wooded	0.6	0.6
Rolling, Mixed	0.8	0.8
Rolling, Bare	1.0	1.0
Flat, Heavily Wooded	0.7	0.7
Flat, Mixed	0.9	0.9
Flate, Bare, Hard	1.05	1.0
Flat, Desert	0.95	1.0
Desert, Sandy, Dunes	0.3	0.6
Swamp, Jungled	0.3	0.2
Swamp, Mixed or Open	0.4	0.3
Urban	0.7	0.7

Obstacle Factors

	Width (m)	20	50	100	500	
River or Stream:	Fordable	0.9	0.85	0.8	0.7	
	Unfordable	0.85	0.8	0.7	0.5	
Minefields:	Density/km of Front,	**10**	**20**	**50**	**100**	**500**
	to 10 km of depth	0.9	0.8	0.7	0.6	0.5

Note that there is also a Main Effort Factor, which is applicable to no more than one–third of a force of division size (approximately 10,000 men or more) or larger.

a. Main effort sector:	1.2
b. Other sectors:	1.0

So in conclusion, we can state that the new TNDM procedure is very similar to the old QJM procedure. The main differences are that the posture factor has been disaggregated from the original table and put in a separate table, and weather, surprise and fatigue has been added. Beyond that, the overall methodology remains the same and is keyed off of force ratio, heavily modified by terrain and condition factors. Overall, advance rates between the two models remain the same; while the QJM had an upper limit of 60 kilometer per day, the TNDM in ideal circumstances can produce advance rates up to 86.4 kilometers a day, but by the fourth day, this will degrade to 51.4 kilometers a day. Effectively, advance rates under the TNDM use the same methodology, but the effects of weather, surprise and fatigue are now incorporated. 🌐

---

[1] The following exceptions must be considered:

(i) For a defending unit in delay posture there is no change in ff.
(ii) For a withdrawing unit not seriously engaged the ff factor is increase by 0.016 per day.
(iii) For an advancing unit in pursuit and not seriously delayed there is no change in the ff factor.
(iv) The ff factor of a unit in reserve, or inactive, increases by 0.05 per day, up to a maximum value of 1.0.
(v) When a unit in combat, or recently in combat, is reinforced by a unit at least half its size (in numbers of men), with a higher ff factor, it adopts that factor. If the ff factor of the reinforcement is the same as, or lower than, the ff of the reinforced unit, both adopt the ff factor of the reinforced unit.
(vi) When a unit in combat, or recently in combat, is reinforced by a unit less than one-half the size of the original unit, but at least one-quarter its size, both units adopt a factor that is a mean of the two factors. When such a unit has a factor less than the reinforced unit, it adopts the factors of the reinforced unit.
(vii) When a unit in combat, or recently in combat, is reinforced by a unit less than one-quarter its size, the reinforcing unit adopts the ff factors of the reinforced unit.

THE EFFECT OF THE MOBILITY EQUATION AND EVERYTHING ELSE ON ADVANCE RATES

While many other factors are not directly included in the advance rate equation, everything is indirectly included. For example, the mobility equation gives highly mobile forces a combat power advantage. This increased combat power will result in a force having a higher advance rate. The same is true for virtually every factor in the TNDM that influences combat power, from air superiority to terrain to weather to CEV. As they first influence combat power, they influence the P/P ratio that is used to establish the basic advance rate. In many cases, the factors used in calculating the advance rate have been previously applied to calculating the combat power. In effect, some factors applied two (or more) times to influence advance rates.

Therein lies the complication of this "simple" model. It is not a series of lookup tables connected by formulas. As such, one cannot simply just pull a table from the model and use it as is. The model is indeed an entire system. Some factors affect merely one aspect of the model, other factors affect multiple aspects of the model (i.e. combat power, mobility equation, attrition and loss rates). Therefore, one cannot understand the model by just looking at the tables. Furthermore, one cannot take the factors from the model and use them in isolation with another model, unless one validates that new model with the factors included.

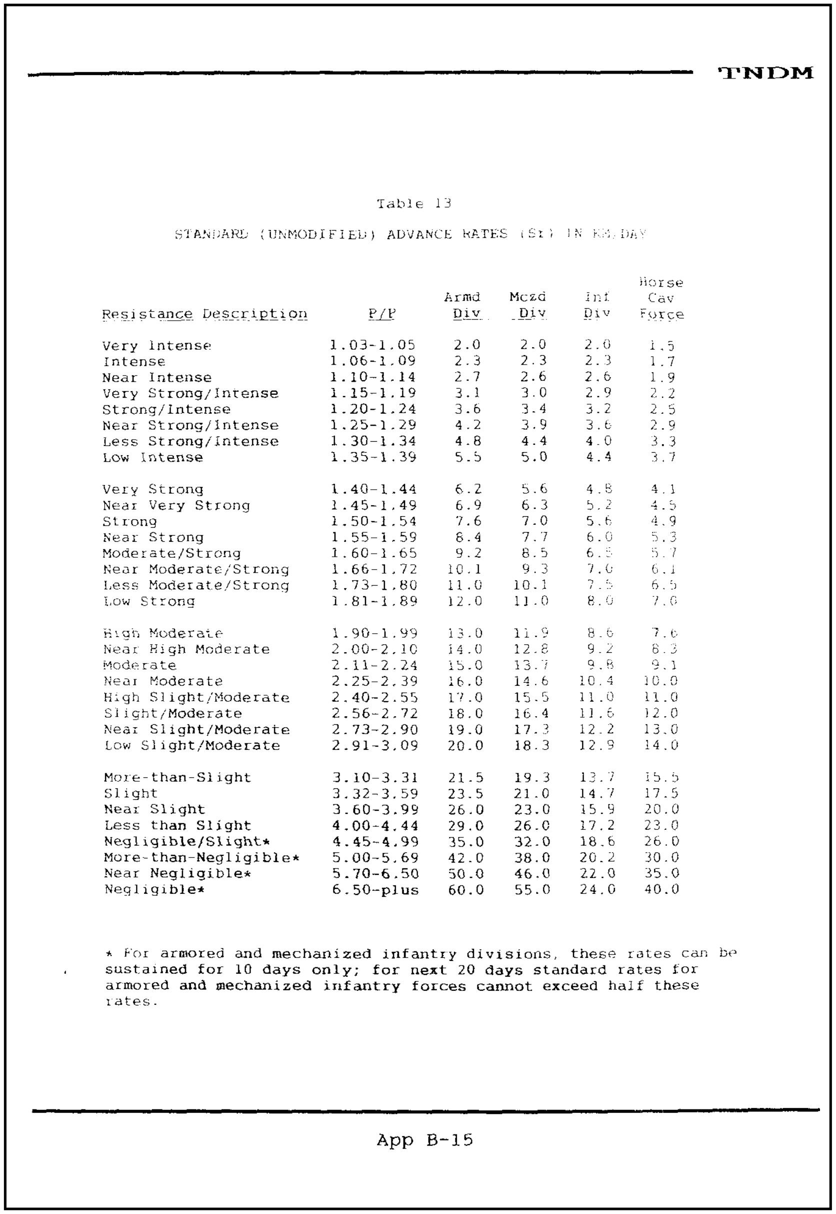
The thing that makes the TNDM work is not that it is "top–down," "aggregate–scored," "made–by–a–genius," or other such theoretical considerations. The thing that makes the TNDM work is that the entire system has been continuously tested to "real–world" (historical) data.

ADVANCE VERITIES FROM *UNDERSTANDING WAR* (pages 158–163)

1. Advance against opposition requires local combat power preponderance.
2. There is no direct relationship between advance rates and force strength ratios.
3. Under comparable conditions, small forces advance faster than larger forces.
4. Advance rates vary inversely with the strength of defender' fortifications.
5. Advance rates are greater for a force that achieves surprise.
6. Advance rates decline daily in sustained operations.
7. Superior relative combat effectiveness increases an attacker;s advance rate.
8. An "all out" effort increases advance rates at a cost in higher casualties.
9. Advance rates are reduced by difficult terrain.
10. Advance rates are reduced by rivers and canals.
11. Advance rates vary positively with the quality and density of roads.
12. Advance rates are reduced by bad weather.
13. Advance rates are lower at night than in daytime.
14. Advance rates are reduced by inadequate supply.
15. Advance rates reflect interactions with friendly and enemy missions.

It is interesting to note that verity 3 (small forces advance faster than large forces) and verity 14 (advance rates are reduced by inadequate supply) are not included in the TNDM advance rate equation. As the TNDM nominally treats logistics limitations as part of the CEV, then it would sort of included under there with a reduced CEV (which would reduce the P/P ratio, reducing advance rates), but this is a weak construct. Verity 3 is simply not addressed. Since the final and still incomplete step of our original battalion–level validation is to look at advance rates, this issue will be examined at that time. As such, it may be the source of generating a lookup table that modifies advance rate by unit size.

Lookup Tables from *Numbers, Predictions, and War*



TNDM

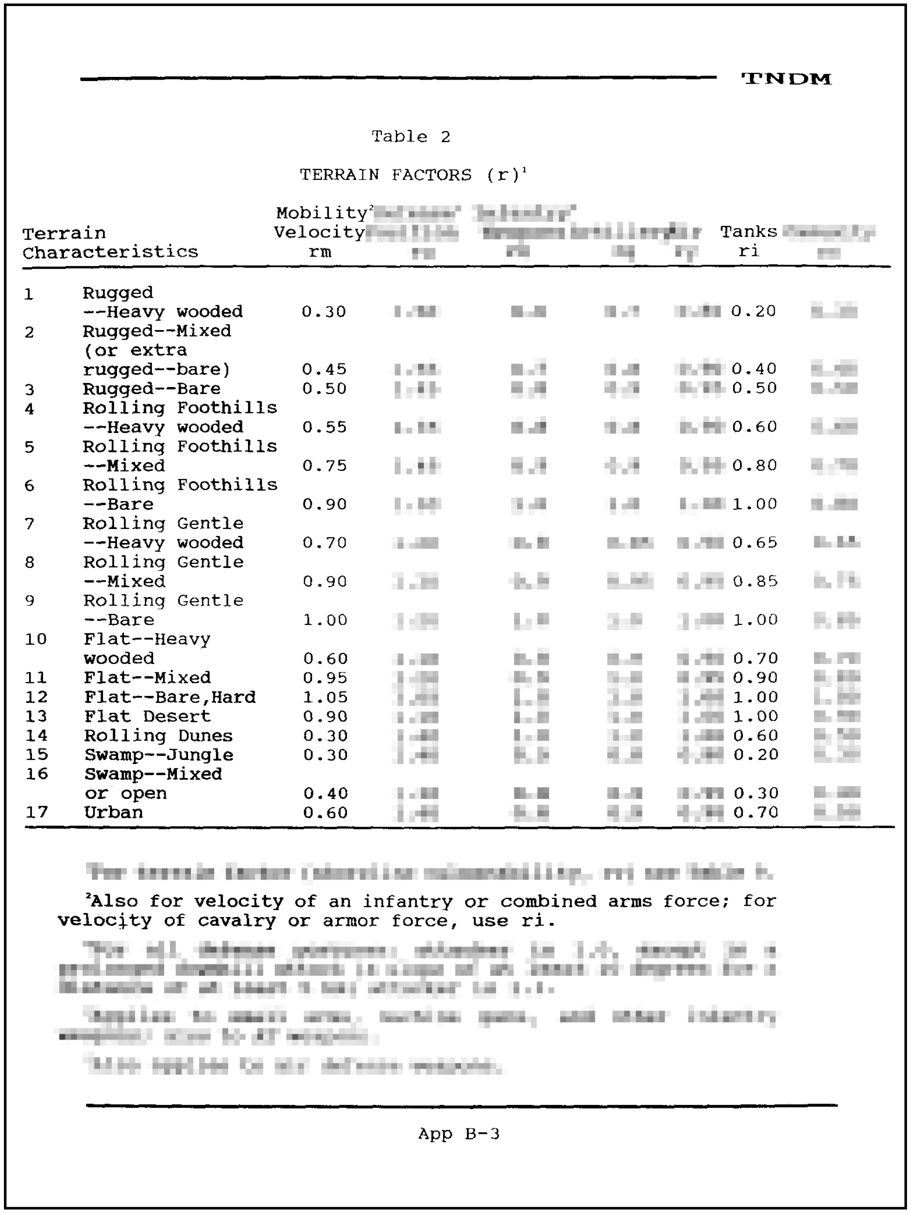
Table 13

STANDARD (UNMODIFIED) ADVANCE RATES (Si) IN KM/DAY

Resistance Description	P/P	Armd Div	Mczd Div	Inf Div	Horse Cav Force
Very Intense	1.03-1.05	2.0	2.0	2.0	1.5
Intense	1.06-1.09	2.3	2.3	2.3	1.7
Near Intense	1.10-1.14	2.7	2.6	2.6	1.9
Very Strong/Intense	1.15-1.19	3.1	3.0	2.9	2.2
Strong/Intense	1.20-1.24	3.6	3.4	3.2	2.5
Near Strong/Intense	1.25-1.29	4.2	3.9	3.6	2.9
Less Strong/Intense	1.30-1.34	4.8	4.4	4.0	3.3
Low Intense	1.35-1.39	5.5	5.0	4.4	3.7
Very Strong	1.40-1.44	6.2	5.6	4.8	4.1
Near Very Strong	1.45-1.49	6.9	6.3	5.2	4.5
Strong	1.50-1.54	7.6	7.0	5.6	4.9
Near Strong	1.55-1.59	8.4	7.7	6.0	5.3
Moderate/Strong	1.60-1.65	9.2	8.5	6.5	5.7
Near Moderate/Strong	1.66-1.72	10.1	9.3	7.0	6.1
Less Moderate/Strong	1.73-1.80	11.0	10.1	7.5	6.5
Low Strong	1.81-1.89	12.0	11.0	8.0	7.0
High Moderate	1.90-1.99	13.0	11.9	8.6	7.6
Near High Moderate	2.00-2.10	14.0	12.8	9.2	8.3
Moderate	2.11-2.24	15.0	13.7	9.8	9.1
Near Moderate	2.25-2.39	16.0	14.6	10.4	10.0
High Slight/Moderate	2.40-2.55	17.0	15.5	11.0	11.0
Slight/Moderate	2.56-2.72	18.0	16.4	11.6	12.0
Near Slight/Moderate	2.73-2.90	19.0	17.3	12.2	13.0
Low Slight/Moderate	2.91-3.09	20.0	18.3	12.9	14.0
More-than-Slight	3.10-3.31	21.5	19.3	13.7	15.5
Slight	3.32-3.59	23.5	21.0	14.7	17.5
Near Slight	3.60-3.99	26.0	23.0	15.9	20.0
Less than Slight	4.00-4.44	29.0	26.0	17.2	23.0
Negligible/Slight*	4.45-4.99	35.0	32.0	18.6	26.0
More-than-Negligible*	5.00-5.69	42.0	38.0	20.2	30.0
Near Negligible*	5.70-6.50	50.0	46.0	22.0	35.0
Negligible*	6.50-plus	60.0	55.0	24.0	40.0

* For armored and mechanized infantry divisions, these rates can be sustained for 10 days only; for next 20 days standard rates for armored and mechanized infantry forces cannot exceed half these rates.

App B-15



TNDM

Table 2

TERRAIN FACTORS (r)[1]

	Terrain Characteristics	Mobility[2] Velocity rm	[redacted]	[redacted]	[redacted]	[redacted]	Tanks ri	[redacted]
1	Rugged --Heavy wooded	0.30	[redacted]	[redacted]	[redacted]	[redacted]	0.20	[redacted]
2	Rugged--Mixed (or extra rugged--bare)	0.45	[redacted]	[redacted]	[redacted]	[redacted]	0.40	[redacted]
3	Rugged--Bare	0.50	[redacted]	[redacted]	[redacted]	[redacted]	0.50	[redacted]
4	Rolling Foothills --Heavy wooded	0.55	[redacted]	[redacted]	[redacted]	[redacted]	0.60	[redacted]
5	Rolling Foothills --Mixed	0.75	[redacted]	[redacted]	[redacted]	[redacted]	0.80	[redacted]
6	Rolling Foothills --Bare	0.90	[redacted]	[redacted]	[redacted]	[redacted]	1.00	[redacted]
7	Rolling Gentle --Heavy wooded	0.70	[redacted]	[redacted]	[redacted]	[redacted]	0.65	[redacted]
8	Rolling Gentle --Mixed	0.90	[redacted]	[redacted]	[redacted]	[redacted]	0.85	[redacted]
9	Rolling Gentle --Bare	1.00	[redacted]	[redacted]	[redacted]	[redacted]	1.00	[redacted]
10	Flat--Heavy wooded	0.60	[redacted]	[redacted]	[redacted]	[redacted]	0.70	[redacted]
11	Flat--Mixed	0.95	[redacted]	[redacted]	[redacted]	[redacted]	0.90	[redacted]
12	Flat--Bare,Hard	1.05	[redacted]	[redacted]	[redacted]	[redacted]	1.00	[redacted]
13	Flat Desert	0.90	[redacted]	[redacted]	[redacted]	[redacted]	1.00	[redacted]
14	Rolling Dunes	0.30	[redacted]	[redacted]	[redacted]	[redacted]	0.60	[redacted]
15	Swamp--Jungle	0.30	[redacted]	[redacted]	[redacted]	[redacted]	0.20	[redacted]
16	Swamp--Mixed or open	0.40	[redacted]	[redacted]	[redacted]	[redacted]	0.30	[redacted]
17	Urban	0.60	[redacted]	[redacted]	[redacted]	[redacted]	0.70	[redacted]

[redacted]

[2] Also for velocity of an infantry or combined arms force; for velocity of cavalry or armor force, use ri.

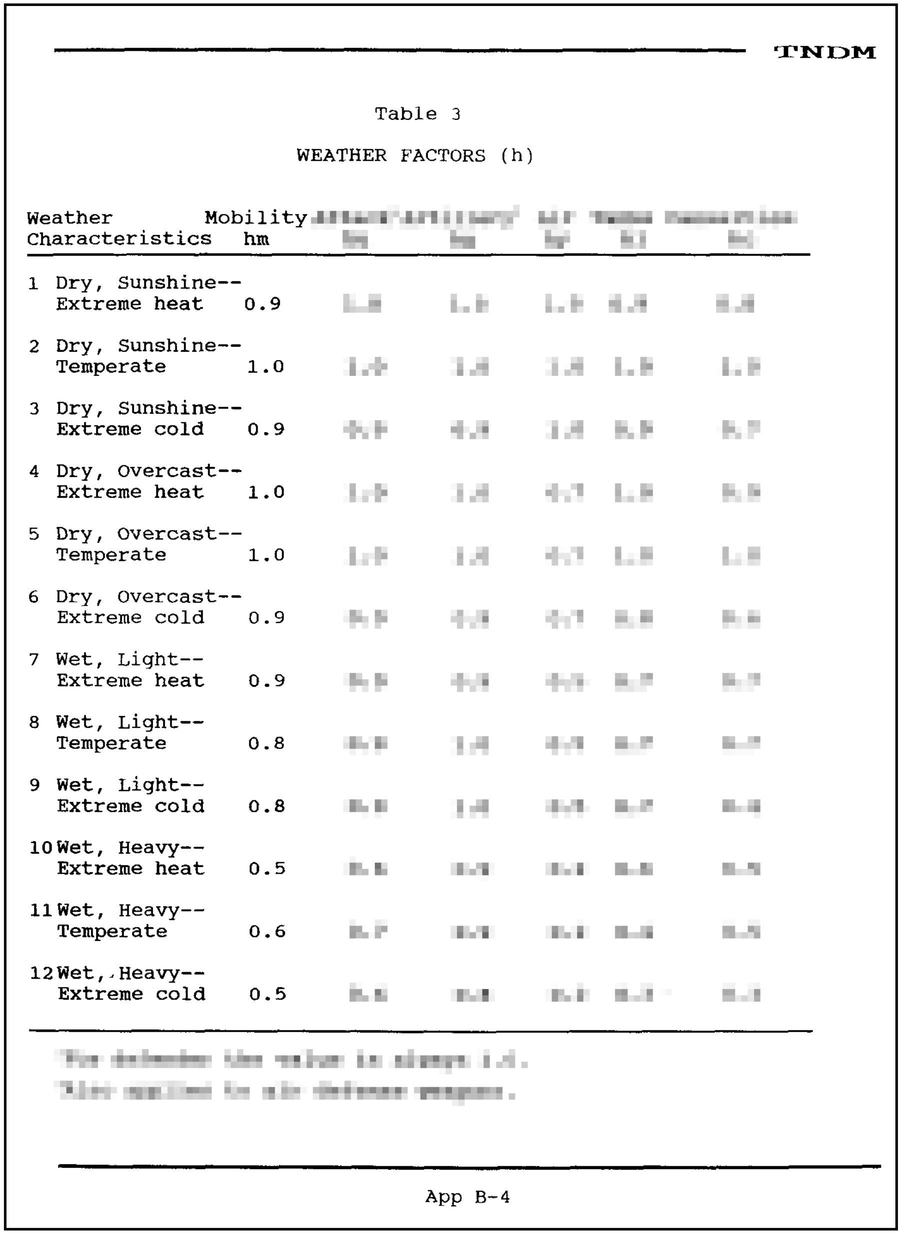
[redacted]

[redacted]

[redacted]

App B-3

Lookup Tables from *Numbers, Predictions, and War (cont.)*



TNDM

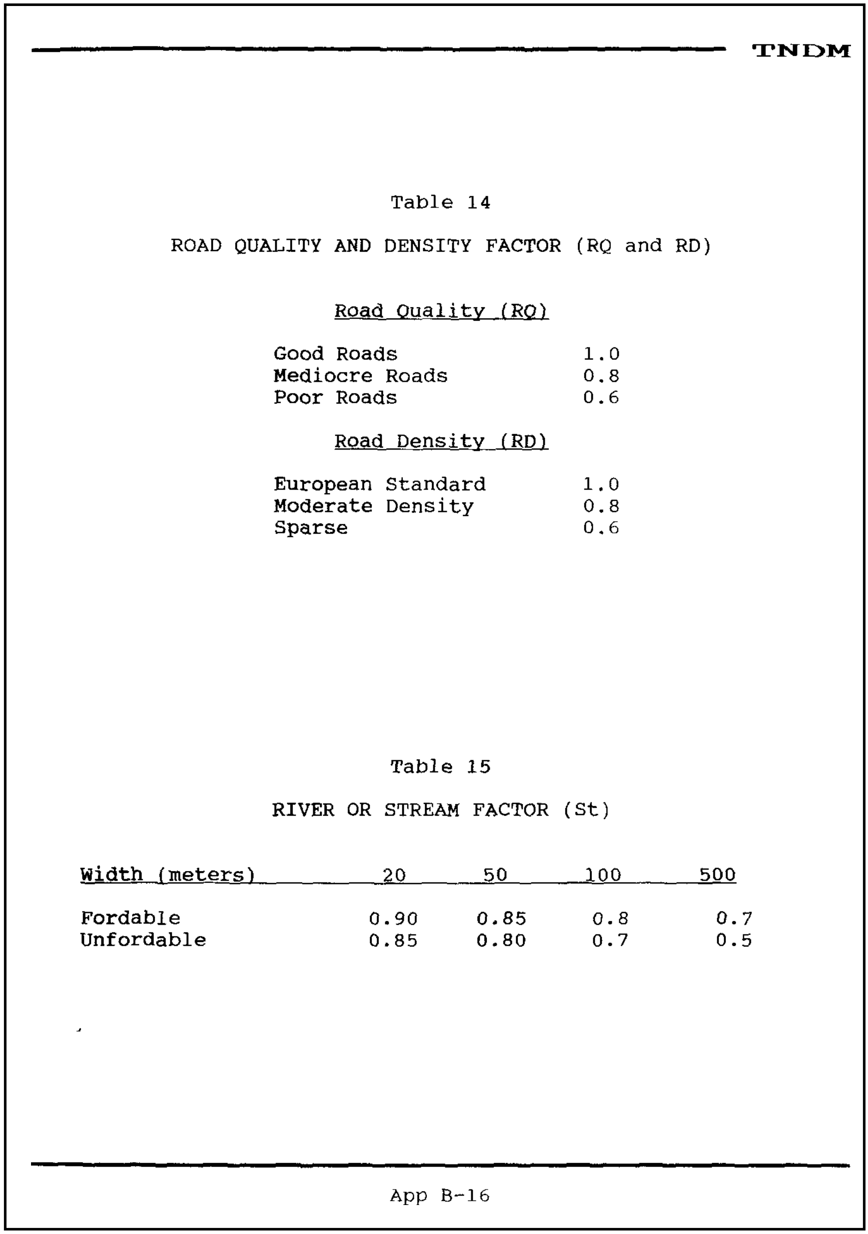
Table 3

WEATHER FACTORS (h)

Weather Characteristics	Mobility hm	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
1 Dry, Sunshine-- Extreme heat	0.9	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
2 Dry, Sunshine-- Temperate	1.0	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
3 Dry, Sunshine-- Extreme cold	0.9	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
4 Dry, Overcast-- Extreme heat	1.0	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
5 Dry, Overcast-- Temperate	1.0	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
6 Dry, Overcast-- Extreme cold	0.9	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
7 Wet, Light-- Extreme heat	0.9	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
8 Wet, Light-- Temperate	0.8	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
9 Wet, Light-- Extreme cold	0.8	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
10 Wet, Heavy-- Extreme heat	0.5	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
11 Wet, Heavy-- Temperate	0.6	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
12 Wet, Heavy-- Extreme cold	0.5	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

[redacted]

App B-4



TNDM

Table 14

ROAD QUALITY AND DENSITY FACTOR (RQ and RD)

<u>Road Quality (RQ)</u>	
Good Roads	1.0
Mediocre Roads	0.8
Poor Roads	0.6

<u>Road Density (RD)</u>	
European Standard	1.0
Moderate Density	0.8
Sparse	0.6

Table 15

RIVER OR STREAM FACTOR (St)

Width (meters)	20	50	100	500
Fordable	0.90	0.85	0.8	0.7
Unfordable	0.85	0.80	0.7	0.5

App B-16

Table 6

POSTURE FACTOR (u) WITH ATTRITION VARIABLES

	Posture Factor						Attrition Variables(uc)[1]			
	Inf.armor	air	arty	S	vul	adv[4]	Atck pers att.	Def pers att.	Atck tank att.	Def tank att.
	ui/un	uy	ug	us	uv	uar				
Attack: Normal Effort[2]										
Standard Defense										
Fortified	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	.4	[redacted]	[redacted]	[redacted]	[redacted]
Prepared	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	.5	[redacted]	[redacted]	[redacted]	[redacted]
Hasty	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	.6	[redacted]	[redacted]	[redacted]	[redacted]
Delay	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	.7	[redacted]	[redacted]	[redacted]	[redacted]
Withdrawal	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	.8	[redacted]	[redacted]	[redacted]	[redacted]
All-Out Defense										
Fortified	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	.3	[redacted]	[redacted]	[redacted]	[redacted]
Prepared	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	.4	[redacted]	[redacted]	[redacted]	[redacted]
Hasty	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	.5	[redacted]	[redacted]	[redacted]	[redacted]
Attack: All-Out Effort[3]										
Standard Defense										
Fortified	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	.5	[redacted]	[redacted]	[redacted]	[redacted]
Prepared	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	.6	[redacted]	[redacted]	[redacted]	[redacted]
Hasty	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	.7	[redacted]	[redacted]	[redacted]	[redacted]
Delay	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	.8	[redacted]	[redacted]	[redacted]	[redacted]
Withdrawal	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	.9	[redacted]	[redacted]	[redacted]	[redacted]
All-Out Defense										
Fortified	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	.4	[redacted]	[redacted]	[redacted]	[redacted]
Prepared	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	.5	[redacted]	[redacted]	[redacted]	[redacted]
Hasty	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	.6	[redacted]	[redacted]	[redacted]	[redacted]
Attack: Secondary										
Standard Defense										
Fortified	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	.3	[redacted]	[redacted]	[redacted]	[redacted]
Prepared	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	.4	[redacted]	[redacted]	[redacted]	[redacted]
Hasty	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	.4	[redacted]	[redacted]	[redacted]	[redacted]
Delay	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	.5	[redacted]	[redacted]	[redacted]	[redacted]
Withdrawal	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	.5	[redacted]	[redacted]	[redacted]	[redacted]
All-Out Defense										
Fortified	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	.25	[redacted]	[redacted]	[redacted]	[redacted]
Prepared	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	.3	[redacted]	[redacted]	[redacted]	[redacted]
Hasty	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	.3	[redacted]	[redacted]	[redacted]	[redacted]
Holding (Both Sides)	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	0.0	[redacted]	[redacted]	[redacted]	[redacted]

Footnotes for this table appear on the following page.

Footnotes to Table 6

[1] Attacker Personnel Attrition; Defender Personnel Attrition; Attacker Tank Attrition; Defender Tank Attrition.

[2] The posture factors determined by the defender's posture are applied to the attacker's weapons (inf, armor, arty, air), posture factor applied to Force Strength, S, is applied to defender's S.

[3] A mission effects factor of 1.3 is applied to the attacker's advance rate. Some special rules apply to the "all-out effort." No more than 35% of the total operation of a force of division size or larger can be assigned to an "all-out effort." That force may attack no longer than 48 hours, after which it must rest for 48 hours or continue at lower intensity for 72 hours before regaining the capability to undertake a main effort.

[4] When advance rate is 10 km/day or more, the defender is automatically in delay or withdrawal posture (0.75 unless otherwise determined).

Table 11

SURPRISE (Su)

	1st Day	2nd Day	3rd Day
A. Operational-Tactical Surprise Factors*			
Mobility (SuM)			
Complete Surprise	[redacted]	[redacted]	[redacted]
Substantial Surprise	[redacted]	[redacted]	[redacted]
Minor Surprise	[redacted]	[redacted]	[redacted]
Surpriser's Vulnerability (SuVa)			
Complete Surprise	[redacted]	[redacted]	[redacted]
Substantial Surprise	[redacted]	[redacted]	[redacted]
Minor Surprise	[redacted]	[redacted]	[redacted]
Surprised's Vulnerability (SuVd)			
Complete Surprise	[redacted]	[redacted]	[redacted]
Substantial Surprise	[redacted]	[redacted]	[redacted]
Minor Surprise	[redacted]	[redacted]	[redacted]
B. Casualty Rates (Suc) (Affects side surprised only)			
Complete Surprise	[redacted]	[redacted]	[redacted]
Substantial Surprise	[redacted]	[redacted]	[redacted]
Minor Surprise	[redacted]	[redacted]	[redacted]
C. Armored Attrition (Sui) (Affects side surprised only)			
Complete Surprise	[redacted]	[redacted]	[redacted]
Substantial Surprise	[redacted]	[redacted]	[redacted]
Minor Surprise	[redacted]	[redacted]	[redacted]
D. Advance Rates (Sua) (Use reciprocals if defender achieves surprise)			
Complete Surprise	1.60	1.40	1.20
Substantial Surprise	1.40	1.27	1.13
Minor Surprise	1.20	1.13	1.05

[redacted]

[redacted]

Table 10

FATIGUE FACTORS (ff)

(Affects advance rates and casualty-inflicting capability)

Day	Factor	Day	Factor
0	1.000	13	0.792
1	0.984	14	0.776
2	0.968	15	0.760
3	0.952	16	0.744
4	0.936	17	0.728
5	0.920	18	0.712
6	0.904	19	0.696
7	0.888	20	0.680
8	0.872	21	0.664
9	0.856	22	0.648
10	0.840	23	0.632
11	0.824	24	0.616
12	0.808	25	0.600

Iranian Casualties in the Iran–Iraq War (1980-1988): A Reappraisal

Pt. 2: Casualty Causes

by H.W. Beuttel

Casualty Causes

The definitive or representative breakdown of Iranian casualty cause to specific Iraqi weapon categories is not known. However, this author will speculate a possible distribution. There is no significant quantified data to support this speculation. It is rather qualitatively derived from extensive study of the nature of the fighting, the conditions of combat, the force structures of the opposing forces, and few quantifiable clues.

Chemical Weapons

The only more or less firm figure we have is that Iraqi chemical weapons accounted for about 4% of Iranian battle casualties. It seems that mustard agents—particularly the infamous and effective Iraqi "dusty" mustard—caused the majority of chemical casualties in the war judging by post war Iranian medical literature where populations of gassed soldiers studied are as high as 1,500.[1] In WWI mustard gas caused 39% of all US gas casualties and 90% of all UK gas casualties (and 14% of all battle casualties) suffered after its introduction in fall 1917.[2] One source gives the interesting statistic that 10–20% of Iranian chemical *deaths* were due to mustard gas.[3] In WWI mustard usually only had a lethality of about 2%.[4]

Other agents were of course used. The Iraqis devised at least two major "cocktails." In 1983–84 they employed a mix of mycotoxin, Yperite and Tabun (GA) in munitions which had 20% lethality. By 1985 they used a blend of cyanide, mustard, Sarin (GB) and Tabun. The latter was claimed three times more lethal.[5] Combining these statistics we may suggest that 20% of Iranian chemical *deaths* were induced by mustard alone, 20% by "Cocktail 1" and 60% by "Cocktail 2." Cyanide based blood agents such as Hydrogen Cyanide (AC) and Cyanogen Chloride (CK) were also used, but lethality was probably low. Of the 63 toxic chemical agents employed in WWI, cyanide was used only once and dropped as too inefficient.[6] Cyanogen chloride was used against Iranian forces at Mehran in July 1987 with little result.

As noted above Iranian casualty experience with toxic agents is in agreement with overall WWI data. It is tempting to apply the other WWI casualty cause distribution (artillery 57%, small arms 38%) to the Iran–Iraq War but other non-WWI elements were present on this battlefield (improved airpower, large numbers of armored fighting vehicles, anti-tank guided missiles, mines, attack helicopters etc) .

Artillery

Artillery seems to have been the major casualty causative agent for Iranian forces during the war. Chronically short of artillery themselves, they faced an adversary who deployed over three times the number of tubes and whose motto was "We Attack with Artillery."[7] A veteran of the war recounted that "every time we sent the Iraqis one rocket, they sent us a hundred in reply."[8] Iraqi artillery inflicted casualties on the high and the low. On 21 June 1981 at Dehlavieh, Dr Mostafa Chamran, the Iranian Minister of Defense, was killed in an Iraqi mortar attack.[9]

In the Gzuyl sector northeast of Basra during 1984 one source reports the Iraqis firing hundreds of thousands of dollars worth of ammunition an hour. Rounds were delivered at a rate of one every two seconds.[10]

In the *Wal al Fajir*–8 fighting, Iraqi artillery crews were known to have fired up to 600 rounds a day in desperate attempts to stem Iranian advance. Iraq used up so much of its entire inventory of artillery ammunition in this fight that it had to scour the world for emergency purchases of new ammunition stocks. A French artillery advisor who was present described how the Iraqis fired air bursts with their French GCT howitzers. "With a single GCT round they could wipe out every Iranian within a kilometer [sic]. This is how they stopped the human waves. They were firing like at Verdun. It was a real massacre."[11] Likewise, 200 Iraqi tanks had to be refitted with new main gun barrels which had been burned out by high rates of fire.[12]

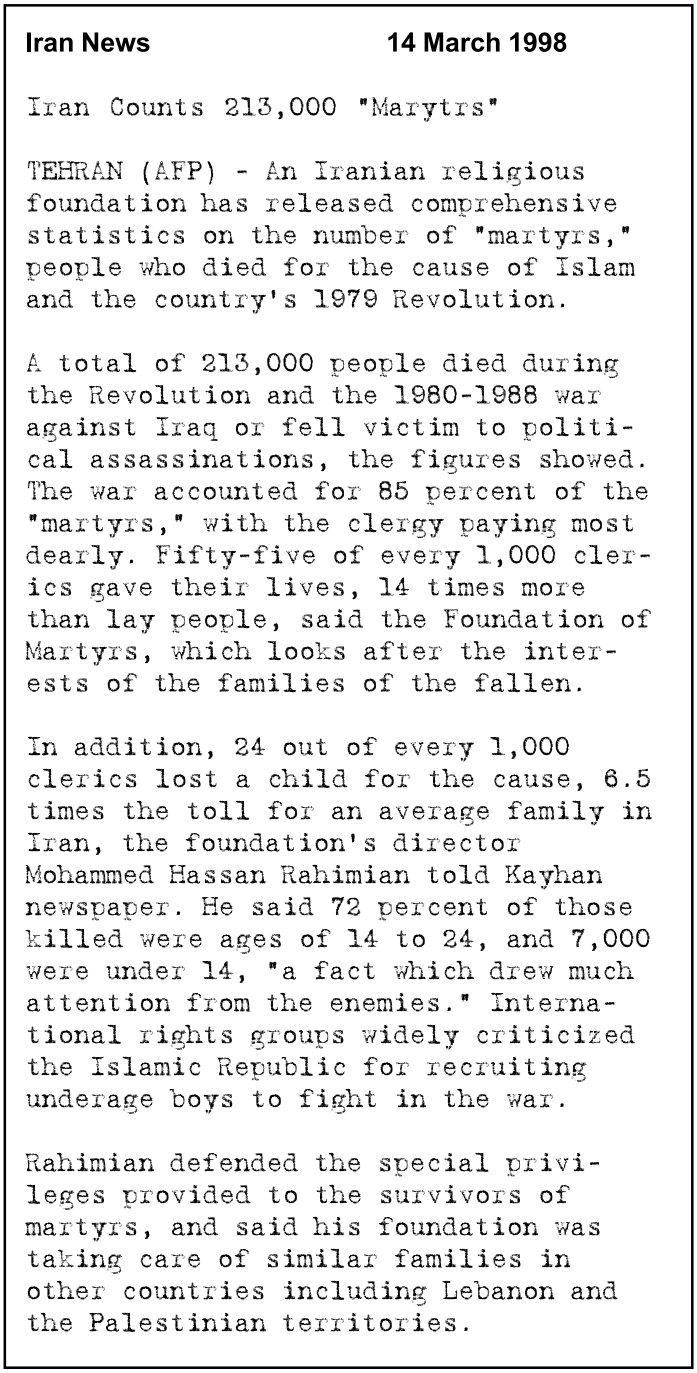
Artillery has accounted for anywhere from 40% to 70% of all casualties in 20th Century Wars.[13] As so many other aspects of the Iran–Iraq War resemble WWII, this author will *speculate* on the basis of no evidence to the contrary that artillery probably accounted for 55% of Iranian casualties. Given WWII lethality (about 19% per casualty incident), then artillery would have accounted for something like 118,400 dead (63% all dead) and 504,751 wounded (53% of all wounded).

Land Mines

Mines played a large role in the Iran–Iraq War and were a significant casualty agent. During the *Fatah al Mobin* offensive of March 1982 an Iraqi officer described the assault of Iranian forces:

"They came at us like a crowd coming out of a mosque

> on a Friday. Soon we were firing into dead men, some draped over the barbed wire fences, and others in piles on the ground, having stepped on mines."[14]



Iran News **14 March 1998**

Iran Counts 213,000 "Marytrs"

TEHRAN (AFP) - An Iranian religious foundation has released comprehensive statistics on the number of "martyrs," people who died for the cause of Islam and the country's 1979 Revolution.

A total of 213,000 people died during the Revolution and the 1980-1988 war against Iraq or fell victim to political assassinations, the figures showed. The war accounted for 85 percent of the "martyrs," with the clergy paying most dearly. Fifty-five of every 1,000 clerics gave their lives, 14 times more than lay people, said the Foundation of Martyrs, which looks after the interests of the families of the fallen.

In addition, 24 out of every 1,000 clerics lost a child for the cause, 6.5 times the toll for an average family in Iran, the foundation's director Mohammed Hassan Rahimian told Kayhan newspaper. He said 72 percent of those killed were ages of 14 to 24, and 7,000 were under 14, "a fact which drew much attention from the enemies." International rights groups widely criticized the Islamic Republic for recruiting underage boys to fight in the war.

Rahimian defended the special privileges provided to the survivors of martyrs, and said his foundation was taking care of similar families in other countries including Lebanon and the Palestinian territories.

Iranian ground forces are conducting massive mine clearing operations over a 17,170 square kilometer region to remove both Iraqi and Iranian minefields planted in the War of Sacred Defense. An estimated 16,000,000 Iraqi mines were laid in 40,000 square kilometers of Iranian territory. In addition there are tens of millions of pieces of unexploded ordnance of calibers from small arms to heavy artillery scattered all over the area. This has also included at least 100 rounds of Iraqi chemical ordnance which has yielded agent types of Tabun, Sarin, Soman, mycotoxins, mustard, cyanide and an unknown toxic agent dubbed "empirite." In addition some sections of Khuzistan were still contaminated as of 1991.[15]

As of April 1994, 5,470 square kilometers had been cleared of 1,710,000 anti-personnel, 470,000 anti–vehicle and 2,347,000 anti–tank mines.[16] By October 1996 12,500 square kilometers had been swept of another 2.5 million mines, but not without a price. Eighty–five Iranian combat engineers have been killed and 361 disabled in these operations.[17] From 1991–1995 mines claimed 6,000 total civilian victims, 2,144 of which were fatalities. In the last six months of 1996 Iran cleared another 7,600 square kilometers of 2,141,000 anti–personnel and 548,000 anti–tank mines. Another 18,350 square kilometers would be cleared in 1997 according to Brigadier General Rahim Ebrahami.[18] Brigadier General Darjazi, commander of Iranian ground forces in the southern and western operational regions, stated in July 1997 that his forces had retrieved and detonated 480,000 anti–personnel, 175,000 anti–vehicle and 291,000 anti–tank mines as well as 377,000 pieces of unexploded ordnance. The bodies of 434 Iraqi MIAs were also recovered during the operations and returned to Iraq.[19] In all some twelve million mines and pieces of unexploded ordnance have been cleared in these efforts. Since the end of the war no less than fifty million mines and pieces of unexploded ordnance have been disposed of according to Major General Naser Arasteh, acting Chief of the Armed Forces Joint Staff. Another grisly result of these operations has been the collateral recovery of the remains of 4,000 Iranian MIAs.[20]

This final fact may provide an indicator of mine warfare casualty effectiveness. 4,000 MIAs have been found in minefields and 23,000 elsewhere. A simple inference is that the 4,000 found in minefields were killed by mines, those found outside minefields were not killed by mines. 4,000 represents 15% of the total MIA bodies recovered so far. This suggests that perhaps as many as 15% of the total MIA may have been killed by mines. This further implies that as many as 15% of total dead were due to mines or 188,000 × .15 = 28,200. If the killed to wounded ratio for post-war civilian incidents—1:1.8—held true in the war, then 50,760 were wounded by mines. This would represent 5% of all wounded (50,760/945,000). It is likely that these represent a much higher proportion of the 200,000 permanently disabled, perhaps as much as 25%. Total killed and wounded percentage would be 78,000/1,133,000 = 7%. This is somewhat higher than US experience in WWII and Korea (4–5%), but not surprising given the number of mines employed. The killed and died of wounds percentage theorized—15%—matches US experience in Vietnam.[21]

Airpower

Iraq claimed its pilots had flown 400,000 sorties of all types during the war.[22] However, it was clearly recognized their sortie effectiveness was not high when it came to inflicting casualties on Iranian troops. Iranian ground forces resorted to night operations and employing camouflage, dispersion and field fortification to neutralize the effects of Iraqi air power. So good were these techniques that Iraqi air averaged less than one Iranian casualty per sortie, even when employing Tu-16 "Blinders" in saturation bombing.[23] Although nothing like full sortie by type breakdown exists, this author's study of the war has counted a representative sample of 26,000 Iraqi sorties against Iranian ground forces. Likewise another representative sample has counted 21,500 against maritime and strategic targets. This gives a proportion of 55% "tactical" vs 45% "strategic" sorties. Given this the Iraqi air force flew something like 220,000 strikes against Iranian ground forces during the war. If we assume from the above that each sortie caused less than one casualty (0.5) then total Iranian casualties from Iraqi airpower were on the order of 110,000. This would result in Iraqi airpower causing some 10% of total Iranian casualties. Applying a standard killed to wounded for casualties from aerial ordnance (.22 KIA, .78 WIA) then Iraqi air accounted for 24,000 dead and 86,000 wounded.[24] These are respectively 13% of all KIA and 9% of all wounded.

These figures, if anything, are probably inflated.

Small Arms and Infantry Weapons

If the above calculations and speculations are roughly right, then small arms and other infantry weapons accounted for approximately 280,000 or 25% of all casualties. This would represent just 15,000 killed (only 8% of all KIA) and 265,000 wounded (28% of all WIA). The only other source I know of where ubiquitous small arms were claimed to cause so few killed in a general sustained conflict is in the case of the British Army in WWII where official UK forces overall statistics credit only 10% of "casualties" (probably meaning KIA) to bullets.[25] Brigadier Ali Samimi, chief of ground forces training support, stated in September 1997 that the average engagement range in the war was 200–300 meters due to the dearth of long range weapons.[26] This is classic small arms range and one would expect more killed from small arms fire.

While the numbers themselves were ultimately derived as a residual from other causes cited above, they present an abnormally low killed to wounded ratio of 1:18 within the category itself. WWII data tended to indicate that generally 25%–42% of those hit by small arms fire were killed.[27] It is likely that Iranian experience more closely resembled these figures than it departed from them. However, we are lumping all infantry weapons (small arms, infantry guns and AT weapons, grenades and mortars) into this category. Grenades and mortars have very low lethality (5% and 10% respectively) yet may account for very large numbers of overall casualties (e.g. 50% in the WWII South Pacific).[28]

Another reason is probably an inflation of the mine and airpower categories. Minefields are always covered by small arms fire and it is likely that some of the 4,000 MIA "mine deaths" I have used above were actually caused by small arms. If I have inflated the mine killed category by, say, 50% then small arms KIA would rise to 20,000 or 11% of all KIA (and reduce mines to 10% of all KIA).

However, this distribution of KIA matches closely US experience in Vietnam where of DoWs (approximating KIAs) 16% were small arms, 65% were shell fragments and 15% were mines. My figures for Iranian KIA are 8%, 63% and 15%. The lower showing of infantry weapons in terms of lethality in Iran's case may be biased by Iraqi airpower (arguably possibly inflated in this study) and chemical weapons employment (neither of which was used against US forces in Vietnam).[29] If Iraqi airpower casualties have been inflated by 100% (based on a 5% casualty effectiveness for WWII airpower), then 27,000 were killed by infantry weapons (14% of all KIA) and 308,000 wounded (33% of all WIA) representing 30% of all combat casualties. Mine and airpower inflation taken into account together would result in infantry weapons inflicting 20% of all KIA (37,000) and 34% of all wounded (325,000). Infantry weapons then inflicted 32% of all battle casualties. This last distribution closely resembles the US in WWII. However, the killed to wounded ratio is still on the order of 1:10. But then a number of other weapons are included in this category which probably accounts for the bias.

Miscellaneous

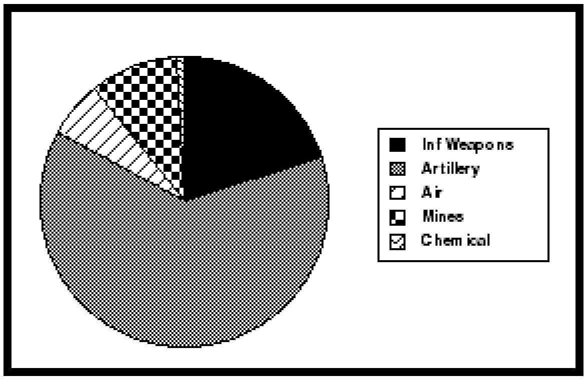
Unique and unusual casualty agents are also represented in the fighting. The Iranian amphibious assault into the Hawizeh marshes in Operation Kheiber in February 1984 using rubber boats and small craft was stopped only by the Iraqis use of high power lines diverted into the marshes to electrify them. During this fighting large numbers of *Pasdaran* infantry were crushed in their foxholes by Iraqi tanks.[30] After the Battle of Beida in Operation Kheiber in which these incidents occurred, General Hisham Sabam al-Fakhri callously ordered the bodies of 3,000 Iranians so killed bulldozed into a mass linear grave as fill for a causeway.[31] These seemingly one time and peculiar casualty causes account for only 0.3% of all casualties.

The war also saw the first deliberate use of directed energy weapons against Iranian forces. There are over 4,000 documented cases of Iranian soldiers suffering eye injuries from Iraqi laser systems. The number of incidents is indicative of deliberate use of non–eyesafe laser rangefinders to sweep attacking Iranian infantry formations specifically for causalty producing effect.[32]

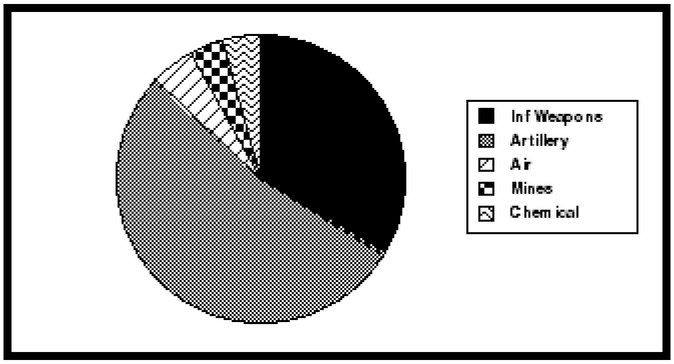
Cold Steel

Cold steel weapons were used in the War of Sacred Defense. In the *Wal Fajir*–8 offensive of February 1986 fighting in the wetlands of the Fao Peninsula often devolved into struggles at extreme close quarters with bayonets, trench knives and entrenching tools much like WWI.[33] In the fghting in Gilan e Qarb in the early part of the war, a local female *Pasdaran* fighter was known to have killed a number of Iraqi soldiers in hand to hand combat with an axe.[34] However, it is unlikely they accounted for any significant percentage of casualties. It was probably on the order of the 0.1% experienced by US forces in WWI.[35] If so, cold steel may have resulted in as many as 1,100 casualties.

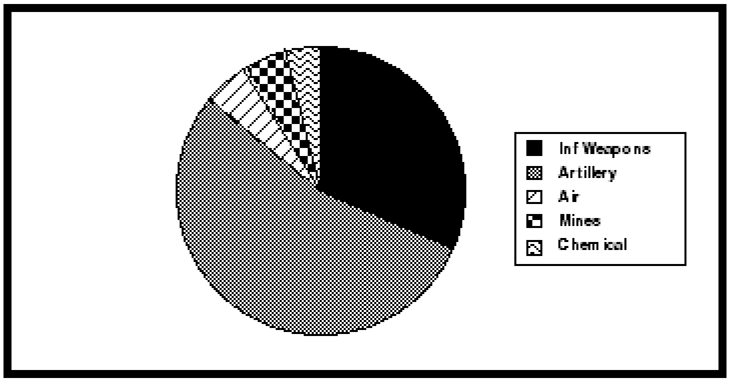
The theorized distribution of casualty agents against Iranian forces is presented in the following graphs.



Causes ~ Killed in Action



Causes ~ Wounded in Action



Causes ~ Total Casualties

The author acknowledges the highly speculative nature of much of the data and argument presented above. It is offered as a preliminary starting point to further study. As such, the author would appreciate hearing from anyone with additional data on this subject. In particular he would invite the Government of the Islamic Republic of Iran to provide any information that would corroborate, correct, or expand on the information presented in this article.

Mr. Beuttel is employed as a military analyst by Boeing Information, Space & Defense Systems. The views and opinions expressed in this article are not necessarily those of the Boeing Company.

---

[1] "Abstracts Obtained from Iran on Medical Research Conducted After the 1980-1988 Iran-Iraq War," www.chronicillnet.org/PGWS/tuite/IRMED/IRANTOC.html.

[2] Charles E. Heller, Chemical Warfare in WWI: The American Experience, 1917-1918, Leavenworth Papers No. 10, Ft Leavenwoth, KS: Combat Studies Institute USAC&GSC, 1984, p. 67; Denis Winter, Death's Men: Soldiers of the Great War, New York: Penguin Viking, 1978, p.124.

[3] "Bis(2-chloroethyl)thioether, $C_4H_8SCI_2$," www.ch.ic.ac.uk/vchemlib/mol/horrible/war/mustard

[4] Anthony Cordesman, The Lessons of Modern War, Volume II: The Iran-Iraq War. Boulder CO: Westview Press, 1990, p. 525, n. 56.

[5] Kenneth R. Timmerman, Death Lobby: How the West Armed Iraq, New York: Houghton Mifflin Company, 1991, pp. 145-146..

[6] Kenneth R. Timmerman, Death Lobby: How the West Armed Iraq, New York:Houghton Mifflin Company, 1991, p. 406-407, n. 3.

[7] Edgar O'Ballance, The Gulf War, London: Brassey's Defense Publishers Ltd, 1988, p. 81.

[8] Cherry Mosteshar, Unveiled, New York: St Martin's Press, 1997, p.162.

[9] "Martyr Chamran, Former Iranian Defense Minister Commemorated," IRNA, 16 June 1998.

[10] Anthony Cordesman, The Lessons of Modern War, Volume II: The Iran-Iraq War. Boulder CO: Westview Press, 1990, pp.445.

[11] Kenneth R. Timmerman, Death Lobby: How the West Armed Iraq, New York: Houghton Mifflin Company, 1991, p. 95.

[12] Anthony Cordesman, The Lessons of Modern War, Volume II: The Iran-Iraq War. Boulder CO: Westview Press, 1990, pp.219-224.

[13] T.N. Dupuy, Attrition: Forecasting Battle Casualties and Equipment Losses in Modern War, Fairfax, VA: HERO Books, 1990, p.59.

[14] Edgar O'Ballance, The Gulf War, London: Brassay's Defense Publishers Ltd, 1988, p. 81.

[15] "IIR 2 762 0059 92 Iranian Anaysis of Iraqi Chemical Ordnance Used During Iran/Iraq War."

[16] "Iran - Military to Launch Mine-Sweeping Operations," USNI Daily Defense News Capsules, 14 April 1994; "Chief of Iran's Ground Forces Outlines Plans for Second Five Year Plan," IRNA, 19 September 1994.

[17] "Iran—Ground Forces Commander on Readiness of the Army," USNI Daily Defense News Capsules, 4 October 1996.

[18] "Iran, Islamic Republic of: Update," United Nation Mine Project Summary Sheet.

[19] "Strict Control of Movements in Southern, Western Borders," IRNA, 16 July 1997.

[20] "Iran—Armed Forces Commander Interviewed on Security," USNI Daily Defense News Capsules, 11 October 1996.

[21] T.N. Dupuy, Attrition: Forecasting Battle Casualties and Equipment Losses in Modern War, Fairfax, VA: HERO Books, 1990, p. 58.

[22] Anthony Cordesman, The Iran-Iraq War and Western Security 1984-87, London: Jane's Publishing Ltd, 1987, p. 478, n. 23.

[23] Anthony Cordesman, The Iran-Iraq War and Western Security 1984-87, London: Jane's Punblishing Ltd, 1987, p. 97.

[24] Average values derived from WWII Pacific and Mediterranean Theaters in Table 67, Gilbert W. Beebe and Michael E. De Bakey, Battle Casualties: Incidence, Mortality and Logistics Considerations, Springfield, IL: Charles C. Thomas Publisher, 1952, p. 157.

[25] John Ellis, World War II: A Statistical Survey, New York: Facts on File, 1993, p. 257. But see his caveats to this data here and in John Ellis, The Sharp End: The Fighting Man in WWII,New York: CHarle's Scribner's Sons, 1980, p. 174.

[26] "Army Was Unprepared When Iraq Invaded, Samimi," Iran News, 28 September 1997.

[27] Average values derived from WWII Pacific and Mediterranean Theaters in Table 67, Gilbert W. Beebe and Michael E. De Bakey, Battle Casualties: Incidence, Mortality and Logistics Considerations, Springfield, IL: Charles C. Thomas Publisher, 1952, p. 157.

[28] Eric Bergerud, Touched By Fire: The Land War in the South Pacific, New York: Viking Penguin, 1996, pp. 319-320.

[29] T.N. Dupuy, Attrition: Forecasting Battle Casualties and Equipment Losses in Modern War, Fairfax, VA: HERO Books, 1990, p. 58.

[30] Anthony Cordesman, The Lessons of Modern War, Volume II: The Iran-Iraq War. Boulder CO: Westview Press, 1990, pp.179-181.

[31] Edgar O'Ballance, The Gulf War, London: Brassey's, 1988, pp. 144-145.

[32] "Iraqi Anti–Personnel Lasers," www.fas.org/irp/gulf/CIA/970129/970110_092596_UI_001.

[33] "Persian Gulf War," FYEO, No. 134, 17 March 1986, p. 134-1.

[34] "Tourism and Noticeable Relics of the Imposed War," Tehran Times, 24 September 1998.

[35] Charles E. Heller, Chemical Warfare in WWI: The American Experience, 1917-1918, Leavenworth Papers No. 10, Ft Leavenwoth, KS: Combat Studies Institute USAC&GSC, 1984, pp. 91-92.

More on the QJM/TNDM Italian Battles

by Richard C. Anderson, Jr.

In regard to Niklas Zetterling's Article and Christopher Lawrence's reponse (*Newsletter* Volume 1, Number 6) I would like to add a few observations of my own. Recently I have had occasion to revisit the Allied and German records for Italy in general and for the Battle of Salerno in particular. What I found is relevent in both an analytical and an historical sense.

The Salerno Order of Battle

The first and most evident observation that I was able to make of the Allied and German Order of Battle for the Salerno engagements was that it was incorrect. The following observations all relate to the table found on page 25 of Volume 1, Number 6.

The divisional totals are misleading. The US had one infantry division (the 36th) and two–thirds of a second (the 45th, minus the 180th RCT and one battalion of the 157th Infantry) available during the major stages of the battle (9–15 September 1943). The 82nd Airborne Division was represented solely by elements of two parachute infantry regiments that were dropped as emergency reinforcements on 13–14 September. The British 7th Armored Division did not begin to arrive until 15–16 September and was not fully closed in the beachhead until 18–19 September.

The German situation was more complicated. Only a single panzer division, the 16th, under the command of the LXXVI Panzer Corps was present on 9 September. On 10 September elements of the Hermann Göring Parachute Panzer Division, with elements of the 15th Panzergrenadier Division under tactical command, began arriving from the vicinity of Naples. Major elements of the Herman Göring Division (with its subordinated elements of the 15th Panzergrenadier Division) were in place and had relieved elements of the 16th Panzer Division opposing the British beaches by 11 September. At the same time the 29th Panzergrenandier Division beagn arriving from Calabria and took up positions opposite the US 36th Divisions in and south of Altavilla, again relieving elements of the 16th Panzer Division. By 11–12 September the German forces in the northern sector of the beachhead were under the command of the XIV Panzer Corps (Herman Göring Division (-), elements of the 15th Panzergrenadier Division and elements of the 3rd Panzergrenadier Division), while the LXXVI Panzer Corps commanded the 16th Panzer Division, 29th Panzergrenadier Division, and elements of the 26th Panzer Division. Unfortunately for the Germans the 16th Panzer Division's zone was split by the boundary between the XIV and LXXVI Corps, both of whom appear to have had operational control over different elements of the division. Needless to say, the German command and control problems in this action were tremendous.[1]

The artillery totals given in the table are almost inexplicable. The numbers of SP 75mm howizers is a bit fuzzy, inasmuch as this was a non–standardized weapon on a half–track chassis. It was allocated to the infantry regimental cannon company (6 tubes) and was also issued to tank and tank destroyer battalions as a stopgap until purpose designed systems could be brought into production. The 105mm SP was also present on a half–track chassis in the regimental cannon company (2 tubes) and on a full–track chassis in the armored field artillery battalion (18 tubes). The towed 105mm artillery was present in the five field artillery battalions present of the 36th and 45th divisions and in a single non–divisional battalion assigned to the VI Corps. The 155mm howitzers were only present in the two divisional field artillery battalions, the general support artillery assigned to the VI Corps, the 36th Field Artillery Regiment, did not arrive until 16 September. No 155mm gun battalions landed in Italy until October 1943. The US artillery figures should approximately be as follows:

75mm Howitzer (SP)
  2 per infantry battalion = 28
  6 per tank battalion = 12
  Total = 40
105mm Howitzer (SP)
  2 per infantry regiment = 10
  1 armored FA battalion[2] = 18
  5 divisional FA battalions = 60
  1 non-divisional FA battalion = 12
  Total = 100
155mm Howitzer
  2 divisional FA battalions = 24
3" Tank Destroyer
  3 battalions = 108

Thus, the US artillery strength is approximately 272 versus 525 as given in the chart.

---

[1] Exacerbating the German command and control problems was the fact that the Tenth Army, which was in overall command of the XIV Panzer Corps and LXXVI Panzer Corps, had only been in existence for about six weeks. The army's signal regiment was only partly organized and its quartermaster services were almost nonexistent.

[2] Arrived 13 September, 1 battery in action 13-15 September.

The British artillery figures are also suspect. Each of the British divisions present, the 46th and 56th, had three regiments (battalions in US parlance) of 25–pounder gun–howitzers for a total of 72 per division. There is no evidence of the prsence of the British 3–inch howitzer, except possibly on a tank chassis in the support tank role attached to the tank troop headquarters of the armor regiment (battalion) attached to the X Corps (possibly 8 tubes). The X Corps had a single medium regiment (battalion) attached with either 4.5 inch guns or 5.5 inch gun–howitzers or a mixture of the two (16 tubes). The British did not have any 7.2 inch howitzers or 155mm guns at Salerno. I do not know where the figure for British 75mm howitzers is from, although it is possible that some may have been present with the corps armored car regiment.

Thus the British artillery strength is approximately 168 versus 321 as given in the chart.

The German artillery types are highly suspect. As Niklas Zetterling deduced, there was no German corps or army artillery present at Salerno. Neither the XIV or LXXVI Corps had Heeres (army) artillery attached. The two battalions of the 71st Nebelwerfer regiment and one battery of 170mm guns (previously attached to the 15th Panzergrenadier Division) were all out of action, refurbishing and replenishing equipment in the vicinity of Naples. However, US intelligence sources located 42 Italian coastal gun positions, including three 149mm (not 132mm) railway guns defending the beaches. These positions were taken over by German personnel on the night before the invasion. That they fired at all in the circumstances is a comment on the professionalism of the German Army. The remaining German artillery available was with the divisional elements that arrived to defend against the invasion forces. The following artillery strengths are known for the German forces at Salerno:

16th Panzer Division (as of 3 September):
  14 75mm infantry support howitzers
  11 150mm SP infantry support howitzers
  10 105mm howitzers
  8 105mm SP howitzers
  4 105mm guns
  8 150mm howitzers
  5 150mm SP howitzers
  5 88mm AA guns
26th Panzer Division (as of 12 September):
  15 75mm infantry support howitzers
  12 150mm infantry support howitzers
  6 105mm SP howitzers
  12 105mm howitzers
  10 150mm SP howitzers
  4 150mm howitzers
Herman Göring Parachute Panzer Division (as of 13 September):
  6-8 75mm infantry support howitzers
  8 150mm infantry support howitzers
  24 105mm howitzers
  12 105mm SP howitzers
  4 105mm guns
  8 150mm howitzers
  6 150mm SP howitzers
  6 150mm multiple rocket launchers
  12 88mm AA guns
29th Panzer Grenadier Division
  106 artillery pieces (types unknown)
15th Panzer Grenadier Division (elements):
  10-12 105mm howitzers
3d Panzer Grenadier Division
  6 150mm infantry support howitzers
Non-divisional:
  501st Army Flak Battalion (probably 20mm and 37mm AA only)
  I/49th Flak Battalion (probably 8 88mm AA guns)

Thus, German artillery strength is about 342 tubes versus 394 as given in the chart.[3]

Armor strengths are equally suspect for both the Allied and German forces. It should be noted however, that the original QJM database considered wheeled armored cars to be the equivalent of a light tank.

Only two US armor battalions were assigned to the initial invasion force, with a total of 108 medium and 34 light tanks. The British X Corps had a single armor regiment (battalion) assigned with approximately 67 medium and 10 light tanks. Thus, the Allies had some 175 medium tanks versus 488 as given in the chart and 44 light tanks versus 236 (including an unknown number of armored cars) as given in the chart.

German armor strength was as follows (operational/in repair as of the date given):

16th Panzer Division (8 September):
  7/0 Panzer III flamethrower tanks
  12/0 Panzer IV short
  86/6 Panzer IV long
  37/3 assault guns
29th Panzer Grenadier Division (1 September):
  32/5 assault guns
  17/4 SP antitank
  3/0 Panzer III
26th Panzer Division (5 September):
  11/? assault guns
  10/? Panzer III
Herman Goering Parachute Panzer Division (7 September):
  5/? Panzer IV short
  11/? Panzer IV long
  5/? Panzer III long
  1/? Panzer III 75mm
  21/? assault guns
  3/? SP antitank

(cont. on next page)

---

[3] However, the number given for the 29th Panzergrenadier Division appears to be suspiciously high and is not well defined. Hopefully further research may clarify the status of this division.

15th Panzergrenadier Division (8 September):
 6/? Panzer IV long
 18/? assault guns

Total 285/18 medium tanks, SP antitank, and assault guns. This number actually agrees very well with the 290 medium tanks given in the chart. I have not looked closely at the number of German armored cars but suspect that it is fairly close to that given in the charts.

In general it appears that the original QJM Database got the numbers of major items of equipment right for the Germans, even if it flubbed on the details. On the other hand, the numbers and details are highly suspect for the Allied major items of equipment. Just as a first order "guestimate" I would say that this probably reduces the German CEV to some extent; however, missing from the formula is the Allied naval gunfire support which, although negligible in impact in the initial stages of the battle, had a strong influence on the later stages of the battle.

Hopefully, with a little more research and time, we will be able to go back and revalidate these engagements. In the meantime I hope that this has clarified some of the questions raised bout the Italian QJM Database. 🌐

British soldiers advance through an Italian town.

TDI Profile:

Nicholas Krawciw

by Susan Rich

Major General Nicholas S. H. Krawciw, U.S. Army, Ret., has been the President of the Dupuy Institute since January, 1995. He is also the Secretary's of Defense Senior Military Representative to Ukraine.

General Krawciw was born on November 28, 1935 in Lviv, Galicia, Ukraine, and graduated from the United States Military Academy at West Point in 1959. He received an MS in International Affairs from George Washington University, which he completed while attending the School of Naval Command and Staff at the Naval War College in 1970. He received a fellowship at the Hoover Institution on War, Revolution and Peace at Stanford University in 1976 during his Army War College year. In 1982 he also completed America's highest level diplomatic school, the Senior Seminar, Department of State.

General Krawciw served two combat tours with armored cavalry in Vietnam (1962–63 and 1968–69). During his first combat tour he was seriously wounded in action. His combat awards include three Silver Stars, a Distinguished Flying Cross, four Bronze Stars (two for valor), and a Purple Heart. Between his two Vietnam tours he was a tactical officer and leadership instructor at the US Military Academy at West Point, New York. During this time he also was a co–inventor of spaced armor produced by Aero Jet General Corporation for most of the pilot seats of the Cobra and HU–1 (Huey) series of helicopters.

From 1972 to 1974 General Krawciw participated in peace keeping operations as the Senior U.S. Army Observer and Chief Operations Officer with the United Nations Truce Supervision Organization (UNTSO) in and around Israel. This duty included the period of the Yom Kippur War and its aftermath. He was a member of the UN team that witnessed the Israeli attack on the port city of Suez. It was at this time that he met Trevor Dupuy.

General Krawciw spent a total of 31 years in command and staff positions in the U.S. Army before he retired on 1 July, 1990. He commanded the First Squadron, Second Armored Cavalry (1974–75) along what was at that time the boundary with the Warsaw Pact. As a colonel, he commanded the largest combat brigade in the US Army, Europe, the First Brigade of the Third Armored Division (1979–81). He served as Assistant Division Commander (1984–85) and later Commander (1987–89) of the Third Infantry Division, Mechanized, a forward deployed "heavy" division in Germany.


Gen. Krawciw as a Brigadier General in Germany in 1984.

Other senior staff positions held by General Krawciw included an assignment as Director for Concepts and Doctrine at the US Army Training and Doctrine Command (1977–79), service as the Military Assistant to the Deputy Secretary of Defense (1982–84), and the Executive Officer to the Supreme Allied Commander at SHAPE in NATO (in 1985–86). In 1990, just prior to his retirement from the U.S. Army, he became the Director for NATO Policy in the International Security Policy Office of the Secretary of Defense in Washington, D.C. In 1992 and 1993 General Krawciw worked for the Council of Advisors to the Parliament of Ukraine in Kyiv, where he was an advisor on defense matters for the Ministry of Defense.

Nick Krawciw is the Co–Founder and President of the Supervisory Board of the International Institute on Global and Regional Security, one of the first independent "think tanks" in Kiev. He is also a member of the Advisory Council of the Harvard Ukrainian National Security Program. He acts as a consultant on matters pertaining to Ukraine in the office of the Secretary of Defense. His work has included attending exercises both here and in Ukraine and extensive interface with all levels of the Ukrainian defense establishment.

Involvement with NATO requires General Krawciw to spend much of his time flying to destinations around the world. He recently traveled to Odessa on the Black Sea for Exercise "Sea Breeze 98" hosted by the Ukrainian Navy and the US Sixth Fleet. Ships and marines from Bulgaria, Romania, and Turkey participated in this exercise, which involved a disaster relief scenario.

Nick Krawciw lives in Annandale, Virginia. He is married to Christina Kwasowska and has three children: Alexandra (a writer–biologist, working in Alexandria, VA), Andy (a captain and A–10 pilot in the U.S. Air Force), and Paul (a student at Dickinson College in Carlisle, PA).