Also in this issue:

- Technology and the Human Factor in War
- History and Publications of TN Dupuy and HERO
- The Quantified Judgement Model (Boeing version)
- A Rebuttal to “Force XXI and the Theory of Winning”
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 seventh issue of our newsletter Christopher Lawrence, Dave Bongard, Richard Anderson, José Perez, Jay Karamales, and Susan Rich 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.
CONTENTS

From the Editor
Christopher A. Lawrence ................................................................. 4

Technology and the Human Factor in War
Trevor N. Dupuy ........................................................................... 6

Published Books by Trevor N. Dupuy
Susan Rich .................................................................................... 12

Published Books by R. Ernest Dupuy
Susan Rich .................................................................................... 14

A Brief History of Trevor N. Dupuy’s Organizations
Christopher A. Lawrence .............................................................. 15

List of HERO, DMSI, TNDA, and TDI Reports
Susan Rich .................................................................................... 21

Articles by Trevor N. Dupuy
Susan Rich .................................................................................... 26

The Quantified Judgement Model (Boeing Version): A Background and Utility Summary
H.W. Beuttel, Boeing Information and Defense Systems ................................. 32

Letter to the Editor
Niklas Zetterling, Swedish War College .................................................. 34

A Rebuttal to “Force XXI and the Theory”
Christopher A. Lawrence ................................................................ 35

Who is TDI? Trevor N. Dupuy Profile
Susan Rich .................................................................................... 39

Note: Minor revisions, updates, and corrections were made to this newsletter in December 1998.

In honor of the memory of the late

Trevor N. Dupuy
Col., USA

August 1997
From the Editor...

The picture of Trevor N. Dupuy on the cover was taken on 4 June 1995. In addition to being a very good picture of Col. Dupuy, it is also the last picture taken of Col. Dupuy. It was taken, one day before his death, by Gary Schofield, a professional artist. You can see one of Mr. Schofield’s paintings, *The Pentagon Full Honors Ceremony*, in the Hall of Heroes in the Pentagon.

At the suggestion of Dr. Paul Berenson, TRADOC, we have published an article written by Trevor N. Dupuy that was never before published called “Technology and the Human Factor in War.” As you will read, this article again makes the forceful argument that you need to be able to model the human factors if you are going to model combat.

We have also included a series of background articles on Col. Dupuy. According to the best count we could assemble, he wrote or co–authored 86 books during his life. Granted, much of that count is inflated by three multi–volume series of thin books that accounted for 43 of those books, but that still leaves over 40 other full–length books. He wrote all but two of those books between 1956 and 1994, averaging well over two books a year. In the last ten years of his life he managed to publish ten books. We also have in our files three unfinished manuscripts. Just to provide a complete record, we also listed the 13 books authored or co–authored by his father.

During his tenure as President of TNDA/HERO/DMSI, Col. Dupuy’s organizations produced more than 140 reports, some of which we have not been able to identify. The Dupuy Institute has produced more than 20 additional reports. We include in this issue a list of the 200 articles written by Trevor Dupuy. Many of these have not been published, and some were published but we don’t know when or where. We suspect that there are some articles published that we are not aware of.

Just to assemble a “definitive” list of Trevor Dupuy’s work was a major effort. All these writings are listed here thanks to the help of our “chief librarian,” Susan Rich. I’ve also provided a brief history of Trevor’s organizations in case someone is getting confused with all the “alphabet soup.” This hopefully provides a concise summary of his life’s work. It is as impressive a body of work as anyone has produced in recent times. If you have not done so already, I cannot stress the value of reading *Understanding War*. I consider it his best work, really a good compilation and explanation of all that he had done, and a very under–recognized book. Unfortunately, it is no longer in print.

We are also presenting here another article from outside the institute. The article is by Bill Buettell from Boeing Defense and Space Group and describes how and why Boeing has been using the QJM. Mr. Buettel heads up the modeling group at Boeing, and has been using a Boeing modified version of the QJM for their work for years.

The Quantified Judgement Model (QJM) is Trevor Dupuy’s previous model of combat, from which the TNDM evolved. As the article points out, one of the advantages of the QJM is that it is quick and easy to run. While this “best bang for the buck” feature is a major advantage of the QJM/TNDM, our sense of pride often keeps us from stressing this feature. We would like to think that we are the best model, bar none.

We also have a “Letter to the Editor” from Niklas Zetterling in response to our last issue. He wrote it as a personal letter to me, not for publication, but I got him to agree to let us publish it even though he didn’t have a chance to “polish” it up.

I have also included an internal memorandum (disguised as an article) that I wrote in preparation for responding to an article in *Army Times* magazine. Unfortunately, we did not see the article until a considerable time after it had been published, so writing a rebuttal letter would probably have been irrelevant, but I believe the reader will find the rebuttal interesting. Of course, we are not allowed to reprint the original article but it’s in the June 1996 issue of *Army Times*.

In the next issue, I expect to include some more articles on our battalion–level validation. We have still to conduct our analysis of the advance rates and formulation of a summary conclusion. We also expect to include our TNDM analysis of the battle of Dom Bütgenbach, which we are currently working on. We are conducting an analysis as a multi–day division–level battle, and then we will fight the battle the way it actually occurred: as a
series of battalion–level engagements. We will then test the model results to the historical results. This test is part of our on–going validation effort. We also need to test all these changes to our second battalion–level validation data base of 123 battles (and growing) from 1914 through 1991. This will be filling in the back pages of the Newsletter for several more issues. I also expect to have some more “outside” articles for the next issue.

One of our customers has specifically requested that we look further into the issue of “Time” of battles. I intend to address that in some depth in the next issue. They are also interested in what we’ve done on a Naval TNDM, so I will address that in either the next issue or the one after that.

That is all for now. If you have any questions, please contact me. Addresses, E-mail addresses, and phone numbers are in the masthead.

[Signature]
Technology and the Human Factor in War
by Trevor N. Dupuy

The Debate

It has become evident to many military theorists that technology has become increasingly important in war. In fact (even though many soldiers would not like to admit it) most such theorists believe that technology has actually reduced the significance of the human factor in war. In other words, the more advanced our military technology, these “technocrats” believe, the less we need to worry about the professional capability and competence of generals, admirals, soldiers, sailors, and airmen.

The technocrats believe that the results of the Kuwait, or Gulf, War of 1991 have confirmed their conviction. They cite the contribution to those results of the UN (mainly US) command of the air, stealth aircraft, sophisticated guided missiles, and general electronic superiority. They believe that it was technology which simply made irrelevant the recent combat experience of the Iraqis in their long war with Iran.

Yet there are a few humanist military theorists who believe that the technocrats have totally misread the lessons of this century’s wars! They agree that, while technology was important in the overwhelming UN victory, the principal reason for the tremendous margin of UN superiority was the better training, skill, and dedication of UN forces (again, mainly US).

And so the debate rests. Both sides believe that the result of the Kuwait War favors their point of view. Nevertheless, an objective assessment of the literature in professional military journals, of doctrinal trends in the US services, and (above all) of trends in the US defense budget, suggest that the technocrats have stronger arguments than the humanists—or at least have been more convincing in presenting their arguments.

I suggest, however, that a completely impartial comparison of the Kuwait War results with those of other recent wars, and with some of the phenomena of World War II, shows that the humanists should not yet concede the debate.

I am a humanist, who is also convinced that technology is as important today in war as it ever was (and it has always been important), and that any national or military leader who neglects military technology does so to his peril and that of his country. But, paradoxically, perhaps to an extent even greater than ever before, the quality of military men is what wins wars and preserves nations.

To elevate the debate beyond generalities, and demonstrate convincingly that the human factor is at least as important as technology in war, I shall review eight instances in this past century when a military force has been successful because of the quality if its people, even though the other side was at least equal or superior in the technological sophistication of its weapons. The examples I shall use are:

- Germany vs. the USSR in World War II
- Germany vs. the West in World War II
- The Vietnam War, 1965-1973
- Britain vs. Argentina in the Falklands 1982
- South Africans vs. Angolans and Cubans, 1987-88
- The US vs. Iraq, 1991

The demonstration will be based upon a marshalling of historical facts, then analyzing those facts by means of a little simple arithmetic.

Relative Combat Effectiveness Value (CEV)

The purpose of the arithmetic is to calculate relative combat effectiveness values (CEVs) of two opposing military forces. Let me digress to set up the arithmetic.

Although some people who hail from south of the Mason–Dixon Line may be reluctant to accept the fact, statistics prove that the fighting quality of Northern soldiers and Southern soldiers was virtually equal in the American Civil War. (I invite those who might disagree to look at Livermore’s Numbers and Losses in the Civil War). That assumption of equality of the opposing troop quality in the Civil War enables me to assert that the successful side in every important battle in the Civil War was successful either because of numerical superiority or superior generalship. Three of Lee’s battles make the point:

- Despite being outnumbered, Lee won at Antietam. (Though Antietam is sometimes claimed as a Union victory, Lee, the defender, held the battlefield; McClellan, the attacker, was repulsed.) The main reason for Lee’s success was that on a scale of leadership his generalship was worth 10, while McClellan was barely a 6.
- Despite being outnumbered, Lee won at Chancellorsville because he was a 10 to Hooker’s 5.
- Lee lost at Gettysburg mainly because he was outnumbered. Also relevant: Meade did not lose his nerve (like McClellan and Hooker) with generalship worth 8 to match Lee’s 8.

Let me use Antietam to show the arithmetic involved in those simple analyses of a rather complex subject:

The numerical strength of McClellan’s army was 89,000; Lee’s army was only 39,000 strong, but had the
multiplier benefit of defensive posture. This enables us to calculate the theoretical combat power ratio of the Union Army to the Confederate Army as 1.4:1.0. In other words, with substantial preponderance of force, the Union Army should have been successful. (The combat power ratio of Confederates to Northerners, of course, was the reciprocal, or 0.71:1.0.)

However, Lee held the battlefield, and a calculation of the actual combat power ratio of the two sides (based on accomplishment of mission, gaining or holding ground, and casualties) was a scant, but clearcut: 1.16:1.0 in favor of the Confederates. A ratio of the actual combat power ratio of the Confederate/Union armies (1.16) to their theoretical combat power (0.71) gives us a value of 1.63. This is the relative combat effectiveness of the Lee’s army to McClellan’s army on that bloody day. But, if we agree that the quality of the troops was the same, then the differential must essentially be in the quality of the opposing generals. Thus, Lee was a 10 to McClellan’s 6.

The simple arithmetic equation on which the above analysis was based is as follows:

\[
CEV = \frac{(R/R)}{(P/P)}
\]

When: CEV is relative Combat Effectiveness Value
R/R is the actual combat power ratio
P/P is the theoretical combat power ratio.

At Antietam the equation was: 1.63=1.16/0.71.
We’ll be revisiting that equation in connection with each of our examples of the relative importance of technology and human factors.

Airpower and Technology

However, one more digression is required before we look at the examples. Airpower was important in all eight of the 20th Century examples listed above. Offhand it would seem that the exercise of air superiority by one side or the other is a manifestation of technological superiority. Nevertheless, there are a few examples of an air force gaining air superiority with equivalent, or even inferior aircraft (in quality or numbers) because of the skill of the pilots.

However, the instances of such a phenomenon are rare. It can be safely asserted that, in the examples used in the following comparisons, the ability to exercise air superiority was essentially a technological superiority (even though in some instances it was magnified by human quality superiority). The one possible exception might be the Eastern Front in World War II, where a slight German technological superiority in the air was offset by larger numbers of Soviet aircraft, thanks in large part to Lend–Lease assistance from the United States and Great Britain.

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1This calculation is automatic in analyses of historical battles by the Tactical Numerical Deterministic Model (TNDM).

The Battle of Kursk, 5–18 July, 1943

Following the surrender of the German Sixth Army at Stalingrad, on 2 February, 1943, the Soviets mounted a major winter offensive in south–central Russia and Ukraine which reconquered large areas which the Germans had overrun in 1941 and 1942. A brilliant counteroffensive by German Marshal Erich von Manstein’s Army Group South halted the Soviet advance, and recaptured the city of Kharkov in mid–March. The end of these operations left the Soviets holding a huge bulge, or salient, jutting westward around the Russian city of Kursk, northwest of Kharkov.

The Germans promptly prepared a new offensive to cut off the Kursk salient. The Soviets energetically built field fortifications to defend the salient against expected German attacks. The German plan was for simultaneous offensives against the northern and southern shoulders of the base of the Kursk salient. Field Marshal Gunther von Kluge’s Army Group Center, would drive south from the vicinity of Orel, while Manstein’s Army Group South pushed north from the Kharkov area. The offensive was originally scheduled for early May, but postponements by Hitler, to equip his forces with new tanks, delayed the operation for two months. The Soviets took advantage of the delays to further improve their already formidable defenses.

The German attacks finally began on 5 July. In the north General Walter Model’s German Ninth Army was soon halted by Marshal Konstantin Rokossovski’s Army Group Center. In the south, however, German General Hermann Hoth’s Fourth Panzer Army and a provisional army commanded by General Werner Kempf, were more successful against the Voronezh Army Group of General Nikolai Vatutin. For more than a week the XLVIII Panzer Corps advanced steadily toward Oboyan and Kursk through the most heavily fortified region since the Western Front of 1918. While the Germans suffered severe casualties, they inflicted horrible losses on the defending Soviets. Advancing similarly further east, the II SS–Panzer Corps, in the largest tank battle in history, repulsed a vigorous Soviet armored counterattack at Prokhorovka on July 12–13, but was unable to continue to advance.

The principal reason for the German halt was the fact that the Soviets had thrown into the battle General Ivan Konev’s Steppe Army Group, which had been in reserve. The exhausted, heavily outnumbered Germans had no comparable reserves to commit to reinvigorate their offensive.

A comparison of forces and losses of the Soviet Voronezh Army Group and German Army Group South on the south face of the Kursk Salient is shown below. The strengths are averages over the 12 days of the battle, taking into consideration initial strengths, losses, and reinforcements.

A comparison of the casualty tradeoff can be found by dividing Soviet casualties by German strength, and German losses by Soviet strength. On that basis, 100 Germans inflicted 5.8 casualties per day on the Soviets, while 100 Soviets inflicted 1.2 casualties per day on the Germans, a tradeoff of 4.9 to 1.0.
The statistics for the 8-day offensive of the German XLVIII Panzer Corps toward Oboyan are shown below. Also shown is the relative combat effectiveness value (CEV) of Germans and Soviets, as calculated by the TNDM. As was the case for the Battle of Antietam, this is derived from a mathematical comparison of the theoretical combat power ratio of the two forces (simply considering numbers and weapons characteristics), and the actual combat power ratios reflected by the battle results:

The calculated CEVs suggest that 100 German troops were the combat equivalent of 240 Soviet troops, comparably equipped. The casualty tradeoff in this battle shows that 100 Germans inflicted 5.15 casualties per day on the Soviets, while 100 Soviets inflicted 1.11 casualties per day on the Germans, a tradeoff of 4.64. It is a rule of thumb that the casualty tradeoff is usually about the square of the CEV.

A similar comparison can be made of the two-day battle of Prokhorovka. Soviet accounts of that battle have claimed this as a great victory by the Soviet Fifth Guards Tank Army over the German II SS-Panzer Corps. In fact, since the German advance was halted, the outcome is close to a draw, but with the advantage clearly in favor of the Germans.

The casualty tradeoff shows that 100 Germans inflicted 7.7 casualties per day on the Soviets, while 100 Soviets inflicted 1.0 casualties per day on the Germans, for a tradeoff value of 7.7.

When the German offensive began, they had a slight degree of local air superiority. This was soon reversed by German and Soviet shifts of air elements, and during most of the offensive, the Soviets had a slender margin of air superiority. In terms of technology, the Germans probably had a slight overall advantage. However, the Soviets had more tanks and, furthermore, their T–34 was superior to any tank the Germans had available at the time. The CEV calculations demonstrate that the Germans had a great

2The initial tank strength of the Voronezh Army Group was about 1,100 tanks. About 3,000 additional Soviet tanks joined the battle between 6 and 12 July. At the end of the battle there were about 1,800 Soviet tanks operational in the battle area; at the same time there were about 1,000 German tanks still operational.

3The relative combat effectiveness value of each force is calculated in comparison to 1.0. Thus the CEV of the Germans is 2.40:1.0, while that of the Soviets is 0.42:1.0. The opposing CEVs are always the reciprocals of each other.

Qualitative superiority over the Russians, despite near-equality in technology, and despite Soviet air superiority. The Germans lost the battle, but only because they were overwhelmed by Soviet numbers.

German Performance, Western Europe, 1943–1945

Beginning with operations between Salerno and Naples in September, 1943, through engagements in the closing days of the battle of the Bulge in January, 1945, the pattern of German performance against the Western Allies was consistent. Some German units were better than others, and a few Allied units were as good as the best of the Germans. But on the average, German performance, as measured by CEV and casualty tradeoff, was better than the Western allies by a CEV factor averaging about 1.2 and a casualty tradeoff factor averaging about 1.5. Listed below are ten engagements from Italy and Northwest Europe during that 1944.

Technologically, German forces and those of the Western Allies were comparable. The Germans had a higher proportion of armored combat vehicles, and their best tanks were considerably better than the best American and British tanks, but the advantages were at least offset by the greater quantity of Allied armor, and greater sophistication of much of the Allied equipment. The Allies were increasingly able to achieve and maintain air superiority during this period of slightly less than two years.

The combination of vast superiority in numbers of troops and equipment, and in increasing Allied air superiority, enabled the Allies to fight their way slowly up the Italian boot, and between June and December, 1944, to drive from the Normandy beaches to the frontier of Germany. Yet the presence or absence of Allied air support made little difference in terms of either CEVs or casualty tradeoff values. Despite the defeats inflicted on them by the numerically superior Allies during the latter part of 1944, in December the Germans were able to mount a major offensive that nearly destroyed an American army corps, and threatened to drive at least a portion of the Allied armies into the sea.

Clearly, in their battles against the Soviets and the western Allies, the Germans demonstrated that quality of combat troops was able consistently to overcome Allied
technological and air superiority. It was Allied numbers, not technology, that defeated the quantitatively superior Germans.

The Six-Day War, 1967

The remarkable Israeli victories over far more numerous Arab opponents—Egyptian, Jordanian, and Syrian—in June, 1967 revealed an Israeli combat superiority that had not been suspected in the United States, the Soviet Union or Western Europe. This superiority was equally awesome on the ground as in the air. (By beginning the war with a surprise attack which almost wiped out the Egyptian Air Force, the Israelis avoided a serious contest with the one Arab air force large enough, and possibly effective enough, to challenge them.)

The results of the three brief campaigns are summarized in the table below:

<table>
<thead>
<tr>
<th>Forces</th>
<th>Troops</th>
<th>Tanks</th>
<th>Troops %/Day</th>
<th>Tanks %/Day</th>
<th>CEV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Egyptians</td>
<td>300,000</td>
<td>800</td>
<td>1.76</td>
<td>0.39</td>
<td>1.90</td>
</tr>
<tr>
<td>Israelis</td>
<td>150,000</td>
<td>80</td>
<td>1.67</td>
<td>0.39</td>
<td>1.90</td>
</tr>
<tr>
<td>Jordanians</td>
<td>55,000</td>
<td>288</td>
<td>1.17</td>
<td>0.89</td>
<td>1.68</td>
</tr>
<tr>
<td>Israelis</td>
<td>40,000</td>
<td>200</td>
<td>2.95</td>
<td>2.50</td>
<td>1.68</td>
</tr>
<tr>
<td>Syrians</td>
<td>63,000</td>
<td>750</td>
<td>1.87</td>
<td>1.48</td>
<td>0.42</td>
</tr>
<tr>
<td>Israelis</td>
<td>40,000</td>
<td>300</td>
<td>1.56</td>
<td>0.95</td>
<td>2.40</td>
</tr>
</tbody>
</table>

It should be noted that some Israelis who fought against the Egyptians and Jordanians also fought against the Syrians. Thus, the overall Arab numerical superiority was greater than would be suggested by adding the above strength figures, and was approximately 328,000 to 200,000.

It should also be noted that the technological sophistication of the Israeli and Arab ground forces was comparable. The only significant technological advantage of the Israelis was their unchallenged command of the air. (In terms of battle outcomes, it was irrelevant how they had achieved air superiority.) In fact this was a very significant advantage, the full import of which would not be realized until the next Arab–Israeli war.

The results of the Six Day War do not provide an unequivocal basis for determining the relative importance of human factors and technological superiority (as evidenced in the air). Clearly a major factor in the Israeli victories was the superior performance of their ground forces due mainly to human factors. At least as important in those victories was Israeli command of the air, in which both technology and human factors both played a part.

The October War, 1973

A better basis for comparing the relative importance of human factors and technology is provided by the results of the October War of 1973 (known to Arabs as the War of Ramadan, and to Israelis as the Yom Kippur War). In this war the Israeli unquestioned superiority in the air was largely offset by the Arabs possessing highly sophisticated Soviet air defense weapons.

One important lesson of this war was a reassessment of Israeli contempt for the fighting quality of Arab ground forces (which had stemmed from the ease with which they had won their ground victories in 1967). When Arab ground troops were protected from Israeli air superiority by their air defense weapons, they fought well and bravely, demonstrating that Israeli control of the air had been even more significant in 1967 than anyone had then recognized.

It should be noted that the total Arab (and Israeli) forces are those shown in the first two comparisons, above. A Jordanian brigade and two Iraqi divisions formed relatively minor elements of the forces under Syrian command (although their presence on the ground was significant in enabling the Syrians to maintain a defensive line when the Israelis threatened a breakthrough around 20 October). For the comparison of Jordanians and Iraqis the total strength is the total of the forces in the battles (two each) on which these comparisons are based.

One other thing to note is how the Israelis, possibly unconsciously, confirmed that validity of their CEVs with respect to Egyptians and Syrians by the numerical strengths of their deployments to the two fronts. Since the war ended up in a virtual stalemate on both fronts, the overall strength figures suggest rough equivalence of combat capability.

The CEV values shown in the above table are very significant in relation to the debate about human factors and technology. There was little if anything to choose between the technological sophistication of the two sides. The Arabs had more tanks than the Israelis, but (as Israeli General Avraham Adan once told the author) there was little difference in the quality of the tanks. The Israelis again had command of the air, but this was neutralized immediately over the battlefields by the Soviet air defense equipment effectively manned by the Arabs. Thus, while technology was of the utmost importance to both sides, enabling each side to prevent the enemy from gaining a significant advantage, the true determinant of battlefield outcomes was the fighting quality of the troops. And, while the Arabs fought bravely, the Israelis fought much more effectively. Human factors made the difference.

Israeli Invasion of Lebanon, 1982

In terms of the debate about the relative importance of human factors and technology, there are two significant aspects to this small war, in which Syrian forces and PLO guerrillas were the Arab participants. In the first place, the Israelis showed that their air technology was superior to the Syrian air defense technology. As a result, they regained complete control of the skies over the battlefields. Secondly, it provides an opportunity to include a highly relevant quotation.

The statistical comparison shows the results of the two
major battles fought between Syrians and Israelis:

<table>
<thead>
<tr>
<th>Forces</th>
<th>Strengths</th>
<th>Troops</th>
<th>Tanks</th>
<th>%/Day</th>
<th>Troops</th>
<th>Tanks</th>
<th>%/Day</th>
<th>CEV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Syrians</td>
<td>30,000</td>
<td>600</td>
<td>4,150</td>
<td>4.61</td>
<td>400</td>
<td>22.22</td>
<td>0.36</td>
<td></td>
</tr>
<tr>
<td>Israelis</td>
<td>35,000</td>
<td>800</td>
<td>1,080</td>
<td>1.03</td>
<td>35</td>
<td>1.25</td>
<td>2.75</td>
<td></td>
</tr>
</tbody>
</table>

In assessing the above statistics, a quotation from the Israeli Chief of Staff, General Rafael Eytan, is relevant. In late 1982 a group of retired American generals visited Israel and the battlefields in Lebanon. Just before they left for home, they had a meeting with General Eytan. One of the American generals asked Eytan the following question:

“Since the Syrians were equipped with Soviet weapons, and your troops were equipped with American (or American–type) weapons, isn’t the overwhelming Israeli victory an indication of the superiority of American weapons technology over Soviet weapons technology?”

Eytan’s reply was classic:

“If we had had their weapons, and they had had ours, the result would have been absolutely the same.”

One need not question how the Israeli Chief of Staff assessed the relative importance of the technology and human factors.

Falkland Islands War, 1982

It is difficult to get reliable data on the Falkland Islands War of 1982. Furthermore, the author of this article had not undertaken the kind of detailed analysis of such data as is available. However, it is evident from the information that is available about that war that its results were consistent with those of the other examples examined in this article.

The total strength of Argentine forces in the Falklands at the time of the British counter–invasion was slightly more than 13,000. The British appear to have landed close to 6,400 troops, although it may have been fewer. In any event, it is evident that not more than 50% of the total forces available to both sides were actually committed to battle. The Argentine surrender came 27 days after the British landings, but there were probably no more than six days of actual combat. During these battles the British performed admirably, the Argentineans performed miserably. (Save for their Air Force, which seems to have fought with considerable gallantry and effectiveness, at the extreme limit of its range.) The British CEV in ground combat was probably between 2.5 and 4.0. The statistics were at least close to those presented below:

<table>
<thead>
<tr>
<th>Forces</th>
<th>Strengths</th>
<th>Troops</th>
<th>Tanks</th>
<th>%/Day</th>
<th>Troops</th>
<th>Tanks</th>
<th>%/Day</th>
<th>CEV</th>
</tr>
</thead>
<tbody>
<tr>
<td>British</td>
<td>3,200</td>
<td>0</td>
<td>599</td>
<td>3.12</td>
<td>0</td>
<td>0.00</td>
<td>2.90</td>
<td></td>
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</tbody>
</table>


Neither the political reasons for, nor political results of, the South African military interventions in Angola in the 1970s, and again in the late 1980s, need concern us in our consideration of the relative significance of technology and of human factors. The combat results of those interventions, particularly in 1987–1988 are, however, very relevant.

The operations between elements of the South African Defense Force (SADF) and forces of the Popular Movement for the Liberation of Angola (FAPLA) took place in southeast Angola, generally in the region east of the city of Cuito–Cuanavale. Operating with the SADF units were a few small units of Jonas Savimbi’s National Union for the Total Independence of Angola (UNITA). To provide air support to the SADF and UNITA ground forces, it would have been necessary for the South Africans to establish air bases either in Botswana, Southwest Africa (Namibia), or in Angola itself. For reasons that were largely political, they decided not to do that, and thus operated under conditions of FAPLA air supremacy. This led them, despite terrain generally unsuited for armored warfare, to use a high proportion of armored vehicles (mostly light armored cars) to provide their ground troops with some protection from air attack.

Summarized below are the results of three battles east of Cuito–Cuanavale in late 1987 and early 1988. Included with FAPLA forces are a few Cubans (mostly in armored units); included with the SADF forces are a few UNITA units (all infantry).

<table>
<thead>
<tr>
<th>Forces</th>
<th>Strengths</th>
<th>Troops</th>
<th>Tanks</th>
<th>%/Day</th>
<th>Troops</th>
<th>Tanks</th>
<th>%/Day</th>
<th>CEV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Battle of Lomba</td>
<td>FAPLA</td>
<td>2,264</td>
<td>28</td>
<td>120</td>
<td>5.35</td>
<td>6</td>
<td>21.43</td>
<td>0.17</td>
</tr>
<tr>
<td>SADF</td>
<td>1,199</td>
<td>38</td>
<td>9</td>
<td>0.75</td>
<td>1</td>
<td>2.63</td>
<td>5.95</td>
<td></td>
</tr>
<tr>
<td>Battle of Cuatir</td>
<td>FAPLA</td>
<td>2,329</td>
<td>33</td>
<td>150</td>
<td>6.44</td>
<td>10</td>
<td>30.30</td>
<td>0.17</td>
</tr>
<tr>
<td>SADF</td>
<td>2,706</td>
<td>104</td>
<td>23</td>
<td>0.85</td>
<td>1</td>
<td>0.96</td>
<td>5.88</td>
<td></td>
</tr>
<tr>
<td>Battle of Lipinda</td>
<td>FAPLA</td>
<td>2,263</td>
<td>23</td>
<td>200</td>
<td>8.84</td>
<td>7</td>
<td>30.43</td>
<td>0.16</td>
</tr>
<tr>
<td>SADF</td>
<td>1,213</td>
<td>41</td>
<td>2</td>
<td>0.16</td>
<td>0</td>
<td>0.00</td>
<td>6.23</td>
<td></td>
</tr>
</tbody>
</table>

FAPLA had complete command of air, and substantial numbers of MiG–21 and MiG–23 sorties were flown against the South Africans in all of these battles. This technological superiority was probably partly offset by greater South African EW (electronic warfare) capability. The ability of the South Africans to operate effectively despite hostile air superiority was reminiscent of that of the Germans in World War II. It was a further demonstration that, no matter how important technology may be, the fighting quality of the troops is even more important.

The tank figures include armored cars. In the first of the three battles considered, FAPLA had by far the more powerful and more numerous medium tanks (20 to 0). In the other two, SADF had a slight or significant advantage in medium tank numbers and quality. But it didn’t seem to make much difference in the outcomes.

Kuwait War, 1991

The previous seven examples permit us to examine the results of Kuwait (or Second Gulf) War with more objectivity.
than might otherwise have possible.

First, let’s look at the statistics. Note that the comparison shown below is for four days of ground combat, February 24–28, and shows only operations of US forces against the Iraqis.

<table>
<thead>
<tr>
<th>Forces</th>
<th>Strengths</th>
<th>Losses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Troops</td>
<td>Troops</td>
</tr>
<tr>
<td>Iraqi Forces</td>
<td>350,000</td>
<td>3,500</td>
</tr>
<tr>
<td>UN Forces</td>
<td>300,000</td>
<td>3,000</td>
</tr>
</tbody>
</table>

* Ground combat killed, wounded, and captured in combat (estimate)

There can be no question that the single most important contribution to the overwhelming victory of US and other UN forces was the air war that preceded, and accompanied, the ground operations. But two comments are in order. The air war alone could not have forced the Iraqis to surrender. On the other hand, it is evident that, even without the air war, US forces would have readily overwhelmed the Iraqis, probably in more than four days, and with more than 285 casualties. But the outcome would have been hardly less one-sided.

The Vietnam War, 1965-1973

It is impossible to make the kind of mathematical analysis for the Vietnam War as has been done in the examples considered above. The reason is that we don’t have any good data on the Vietcong–North Vietnamese forces.

However, such quantitative analysis really isn’t necessary. There can be no doubt that one of the opponents was a superpower, the most technologically advanced nation on earth, while the other side was what Lyndon Johnson called a “raggedy-ass little nation,” a typical representative of “the third world.”

Furthermore, even if we were able to make the analyses, they would very possibly be misinterpreted. It can be argued (possibly with some exaggeration) that the Americans won all of the battles. The detailed engagement analyses could only confirm this fact. Yet it is unquestionable that the United States, despite airpower and all other manifestations of technological superiority, lost the war. The human factor—as represented by the quality of American political (and to a lesser extent military) leadership on the one side, and the determination of the North Vietnamese on the other side—was responsible for this defeat.

Conclusion

In a recent article in the Armed Forces Journal International Col. Philip S. Neilinger, USAF, wrote: “Military operations are extremely difficult, if not impossible, for the side that doesn’t control the sky.” From what we have seen, this is only partly true. And while there can be no question that operations will always be difficult to some extent for the side that doesn’t control the sky, the degree of difficulty depends to a great degree upon the training and determination of the troops.

What we have seen above also enables us to view with a better perspective Colonel Neilinger’s subsequent quote from British Field Marshal Montgomery: “If we lose the war in the air, we lose the war and we lose it quickly.” That statement was true for Montgomery, and for the Allied troops in World War II. But it was emphatically not true for the Germans.

The examples we have seen from relatively recent wars, therefore, enable us to establish priorities on assuring readiness for war. It is without question important for us to equip our troops with weapons and other materiel which can match, or come close to matching, the technological quality of the opposition’s materiel. We must realize that we cannot—as some people seem to think—buy good forces, by technology alone. Even more important is to assure the fighting quality of the troops. That must be, by far, our first priority in peacetime budgets and in peacetime military activities of all sorts.
Published Books by
Trevor N. Dupuy
by Susan Rich

• TO THE COLORS; THE WAY OF LIFE OF AN ARMY OFFICER (with R.E. Dupuy), Chicago, 1942

• FAITHFUL AND TRUE; HISTORY OF THE 5TH FIELD ARTILLERY, Schwabisch-Hall, Germany, 1949

• CAMPAIGNS OF THE FRENCH REVOLUTION AND OF NAPOLEON, Cambridge, MA, 1956

• BRAVE MEN AND GREAT CAPTAINS (with R. E. Dupuy), New York, 1960, 1984, 1993


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• MILITARY HISTORY OF WORLD WAR II, 18 Vols., New York, 1962-65
  Vol 1—European Land Battles: 1939–1943
  Vol 2—European Land Battles: 1944–1945
  Vol 3—Land Battles: North Africa, Sicily, and Italy
  Vol 4—The Naval War in the West: The Raiders
  Vol 5—The Naval War in the West: The Wolf Packs
  Vol 6—The Air War in the West: Sep 1939–May 1941
  Vol 7—The Air War in the West: Jun 1941–April 1945
  Vol 8—Asiatic Land Battles: Expansion of Japan in Asia
  Vol 9—Asiatic Land Battles: Japanese Ambitions in the Pacific
  Vol 10—Asiatic Land Battles: Allied Victories in China and Burma
  Vol 11—The Naval War in the Pacific: Rising Sun of Nippon
  Vol 12—The Naval War in the Pacific: On to Tokyo
  Vol 13—The Air War in the Pacific: Air Power Leads the Way
  Vol 14—The Air War in the Pacific: Victory in the Air
  Vol 15—European Resistance Movements
  Vol 16—Asian and Axis Resistance Movements
  Vol 17—Leaders of World War II
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• COMPACT HISTORY OF THE REVOLUTIONARY WAR (with R. E. Dupuy), New York, 1963

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  Vol 1—1915–1917
  Vol 5—The Campaigns on the Turkish Front
  Vol 6—Campaigns in Southern Europe
  Vol 7—1918: The German Offensives
  Vol 8—1918: Decision in the West
  Vol 9—Naval and Overseas War, 1914–1915
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• MODERN LIBRARIES FOR MODERN COLLEGES: RESEARCH STRATEGIES FOR DESIGN AND DEVELOPMENT, Washington, D.C., 1968

• FERMENT IN COLLEGE LIBRARIES: THE IMPACT OF INFORMATION TECHNOLOGY, Washington, D.C., 1968

• MEDIAPOWER: A COLLEGE PLANS FOR AN INTEGRATED MEDIA SERVICE SYSTEM, Washington, D.C., 1968

• MILITARY HISTORY OF THE CHINESE CIVIL WAR, New York, 1969

• THE MILITARY LIFE OF ALEXANDER THE GREAT, New York, 1969

• THE MILITARY LIFE OF HANNIBAL, New York, 1969

• THE MILITARY LIFE OF JULIUS CAESAR, New York, 1969

• THE MILITARY LIFE OF GENGHIS KHAN, New York, 1969

• THE MILITARY LIFE OF GUSTAVUS ADOLPHUS, New York, 1969

• THE MILITARY LIFE OF FREDERICK THE GREAT, New York, 1969

• THE MILITARY LIFE OF GEORGE WASHINGTON, New York, 1969
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<td>GREAT BATTLES OF THE EASTERN FRONT</td>
<td>(with Paul Martell), New York, 1982</td>
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<td>OPTIONS OF COMMAND</td>
<td>New York, 1984</td>
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<td>UNDERSTANDING DEFEAT</td>
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<td>ATTRITION: FORECASTING BATTLE CASUALTIES AND EQUIPMENT LOSSES IN MODERN WAR</td>
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<td>IF WAR COMES: HOW TO DEFEAT SADDAM HUSSEIN</td>
<td>Virginia, 1991</td>
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<td>FUTURE WARS: THE WORLD’S MOST DANGEROUS FLASHPOINTS</td>
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<td>ENCYCLOPEDIA OF MILITARY BIOGRAPHY</td>
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<td>INTERNATIONAL MILITARY AND DEFENSE ENCYCLOPEDIA, (Brassey’s) 6 Vols., Editor in Chief, New York, 1992</td>
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<td>HITLER’S LAST GAMBLE</td>
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<td>GREAT CAPTAINS AND MODERN WAR</td>
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- IF WAR COMES (with George Fielding Eliot). Published by Macmillan, 1938
- WHERE THEY HAVE TROD. Published by Stokes, 1940
- WORLD IN ARMS. Published by Cassell’s, 1940
- CIVIL DEFENSE OF THE UNITED STATES (with Hodding Carter). Published by Farrar & Rinehart, 1942
- TO THE COLOURS: THE WAY OF LIFE OF AN ARMY OFFICER (with T.N. Dupuy), Chicago, 1942
- ST. VITH: LION IN THE WAY. Published by Infantry Journal Press, 1949
- PERISH BY THE SWORD. Published by Military Service, 1949
- MEN OF WEST POINT. Published by Sloane, 1951
- BRAVE MEN AND GREAT CAPTAINS (with T.N. Dupuy), New York, 1960, 1984, 1993
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- AN OUTLINE HISTORY OF THE AMERICAN REVOLUTION (with T.N. Dupuy), New York, 1975
- ENCYCLOPEDIA OF MILITARY HISTORY (with T.N. Dupuy), New York, 1975, 1986, 1993
- THE AMERICAN REVOLUTION: A GLOBAL WAR (with Grace P. Hayes, Gay M. Hammerman). Published by David McKay, 1987
A Brief History of Trevor N. Dupuy’s Organizations
by Christopher A. Lawrence

Trevor N. Dupuy was a career military officer and West Point graduate who had served a full 20 year career in the military and retired in 1958 as a full colonel. While serving as an active duty officer, Col. Dupuy authored/co–authored three books. His father had developed a reputation as an historian already, having eight books to his credit. They had both had extensive senior staff assignments in the US Army and had both developed strong professional reputations. Col. Dupuy then taught at University of Rangoon in Burma from 1958 to 1960. His desk from the University came back with him and became his desk for the rest of his life. This solidly built but somewhat worn desk is now used by General Krawciw as he continues Trevor Dupuy’s work.

It was after he returned from Rangoon (and perhaps even towards the end of his tenure there) that Col. Dupuy started his prolific publication of books, adding four more books to his total (two of them with his father). His works at this time consisted mostly of general military and battle histories.

In 1962 he was contracted by Franklin Watts Publishing to prepare a general 18–volume history of World War II for younger readers. This eventually lead to two series of books on World Wars I and II and one on Military Lives that totaled some 42 books. These books were not scholarly works, but there were certainly influential. For example, when I was 12, I read the entire World War II series, unaware that this interest in history would grow to an obsession and later a profession. It is unfortunate, considering the almost complete dearth of military history for young people, that all of these series are currently out of print.

In 1962 Col. Dupuy went into business for himself, establishing the Historical Evaluation Research Organization (HERO). Its office was in the Georgetown area of Washington, D.C. This company conducted research for the US armed forces and produced military history books. It appears, in fact, from a review of the work the company performed that a significant part of the corporation’s function was to write books, leading to a very prolific period from 1962 to 1970 where Trevor Dupuy wrote over 50 books on general military history. At this time, some of his books were being co–authored with his father, R. Ernest Dupuy. It was Trevor’s claim that they shared their work by having Trevor do the research while his father did the writing.

It was clear that book writing was intended to be a major source of income for, and product of, HERO, but it was also clear from the beginning that Trevor was looking to make HERO an historically–based RAND. The first HERO report was A Preliminary, Interpretive Survey of the History of Command and Control for Sandia Laboratories. This report listed four staff members, including Charles B. MacDonald, and 11 other consultants, advisors, and assistants, including Martin Blumenson. R. Ernest Dupuy edited the report.

The organization quickly moved into arms control issues, guerrilla warfare, effects of nuclear war, and a whole range of current relevant discussions. The second HERO report lists the company’s board of directors as R. Ernest Dupuy, Trevor N. Dupuy, H. Struve Hensel, Charles T. Lanham, Jr., Louis Morton, Forrest Pogue, Theodore Ropp, and James Russell. It lists the chairman of the board as Louis Morton, the President and Executive Director as Trevor N. Dupuy, and Secretary and Treasurer as Jean D. Brennan. It also mentions an “Associate Staff” of 52 members, including Charles MacDonald and Martin Blumenson, and a “professional permanent staff” of 12 people, including Trevor Dupuy, R. Ernest Dupuy, and two ladies who would be the backbone of HERO for the next two decades: Grace P. Hayes and Gay M. Hammerman. Grace Hayes already had two books on naval history to her credit. Also listed is Mary R. Mayo, who would remain a HERO research assistant until sometime in 1966. This mix of two experienced female military historians (Hayes and Hammerman) and a number of different retired military officers would serve as the backbone of HERO until the 1980s.

Early on came the first of a series of reports that started the analytical trend that later defined the organization, which was the four–volume report Historical Trends Related to Weapons Lethality prepared for the Combat Developments Command. The Combat Developments Command was one of the seed organizations for the US Army Concepts Analysis Agency (CAA). The report listed 29 study participants, including S.L.A. Marshall and Chester G. Starr. It appears that most were consultants, with the only people clearly listed as staff members being Trevor N. Dupuy, Grace Hayes, and
Gay Hammerman. This work, published in October 1964, first used “Theoretical Lethality Indices” and was in essence the detailed analysis of weapons lethality over time that was used as the basis for the book *Evolution of Weapons and Warfare*.

In 1965, HERO produced a report on *US Alternatives in Vietnam*. Withdrawal was not one of them. It was based on a conference organized by HERO, and attendees included Henry Cabot Lodge, Robert L. Utley, and Dr. Daniel Ellsberg (later of Pentagon Papers fame). The HERO staff was listed in the back as six people, with Trevor N. Dupuy as Executive Director and Mr. Murray Dyer as Deputy Executive Director. This is the only report that mentions his name.

In 1965 and 1967, among a number of reports, Angus M. Fraser, Col, USMC, Ret. is listed as HERO Coordinator of Military Studies. There appear to have been a steady five or six staff members and a number of consultants in each study. S.L.A. Marshall is regularly used as a consultant, as was R. Ernest Dupuy. In 1966 there was a report on *Historical Analysis of Wartime Replacement Requirements: Experience for Selected Major items of Combat Equipment* prepared for Research Analysis Corporation (RAC) that first extensively used primary source material gathered from the unit records in the National Archives. It also established the equipment loss rates relative to casualties rates for different postures. In 1967, HERO published under contract with RAC *Average Casualty Rate for War Games, Based On Historical Combat Data*. It was during this study that Grace P. Hayes replaced Col. Fraser as coordinator. Col. Fraser would still occasionally feature as a consultant in later reports. Mrs. Hayes continued in this role throughout her career with HERO, until she retired. At the same time HERO produced another report for RAC called *Developing a Methodology to Describe the Relationship of Mobility to Combat Effectiveness*. This report effectively worked out the difference between actual lethality and theoretical lethality, including dispersion. The elements that make up the QJM/TNDM were slowly being assembled: Dupuy and his associates had established TLIs, casualty rates, equipment losses based upon posture, dispersion, and detailed primary source research.

Sometime around 1970, the HERO office moved to Dunn Loring Virginia, where it remained until the 1980s. It was also around this time (actually 1967) that Trevor N. Dupuy and Associates (TNDA) was created as the corporate shell for HERO. It remained the corporate shell for HERO until it sold its stock and assets to Data Memory Systems, Incorporated, in 1983.

The QJM clearly had come into being by 1970, and is detailed in the HERO report *Use of Historical Data in Evaluating Military Effectiveness*. This report also marked the beginning of the process of researching and detailing the battles that served as the basis for validation of his models. Joining him in these efforts were Miss Lucille Petterson, and occasionally Dr. Robert McQuie, Col. Harold Quakenbush, USA retired, Dr. Janice Fain and her husband, Dr. Andrew Fain, among others. This report detailed 42 engagements, including 34 from the Italian Campaign and 8 from Okinawa. These engagements were analyzed using the Quantified Judgement Method, or QJM. The QJM consisted of 13 equations measuring Combat Power, Force Potential, Force Strength, Mobility, Vulnerability, Exposure, Combat Power, Momentum, Combat Power (Expanded), Force Strength (expanded), Casualty Effectiveness, Spatial Effectiveness, and Result. OLIs had been developed and were being used. Twenty-eight factors were used for each engagement, including a factor for supply status, morale, leadership, and training and experience. These were usually rated at 1.0. The basic formulae for the TLI and the dispersion factors for OLIs existed. Tables for posture, morale, terrain, weather, season, and air superiority all existed in pretty much the form that was later published in *Numbers, Predictions and War*. At the end of the document is an appendix that evaluates the source of the quantitative data. In most cases the factors were based upon “professional judgement,” something that has often not been fully understood about the model, and has been a source of controversy. It is also an area where I feel the model could be improved, if properly budgeted and researched. I suspect that the report’s fourth volume, *Statistical Inference in Analysis of Combat*, was prepared by Robert McQuie. This was an attempt to provide some form of statistical analysis of the data used in the model. By this time, Trevor’s father had truly retired to do writing, and Grace Hayes had become his “right hand man.”

In 1971 and 1972, a series of large studies were funded primarily by the US Air Force but also by the United Kingdom on individual battles and on the effects of the air campaign as related to ground combat in WWII. This was sort of the end of the “general history writing phase” of HERO. This can be seen by the change in publishing that resulted in an end to general readership books like the *Military Lives* series and the publication instead of the *World Almanac of Military Power* every two years and the production of such periodicals as the *Combat Data Subscription Service*.

During this period HERO supported an analytical staff of at least a half dozen people, with the core consisting of Grace Hayes, Gay Hammerman, Paul Martell, and Col. John A. Andrews, USAF, Ret. Paul Martell provided the institute with its “sovietology” expert, as Mr. Martell, which was a pseudonym, was a Polish intelligence officer who had defected to the US.

This was also the period during which HERO began analysis of the Middle East wars. After the Yom Kippur War, Trevor N. Dupuy began to travel extensively in the Mideast and established strong personal contacts with many senior Israeli and Egyptian generals, and with some Syrian and Jordanian generals as well. Having developed the QJM from the extensive WWII data at the beginning of the decade, he then similarly tested the QJM to the 1967 and 1973 Arab–Israeli Wars, and clearly established the model was indeed applicable for modern combat (at least through 1973).

This was also the period during which Trevor N. Dupuy became widely introduced to the US Army analytical community. While most of his work was initially funded by the Air Force, its focus on ground combat made it mostly appli-
cable to the US Army. Trevor’s attempts to get the QJM accepted by the Army’s military operations research community met with limited success, although he received considerable support from the active duty military. Many professional military were embarrassed by the “unusual” and ahistorical results provided by many of the early combat models.

It was also in the early 1970s that many of the professional contacts were made that would later influence the work and direction of Trevor’s companies in the 1980s and 1990s. These contacts included Col. John Brinkerhoff at CAA, who later would become co-founder and vice president of DMSI; Col. Nicholas Krawciw with the UN observer force in the Middle East, who would later become President of The Dupuy Institute; and Col. William A. Lawrence at CAA, who was already my father.

The study of the effects of air interdiction dominated HERO’s activities from 1970 through 1972. This work allowed the development of the staff and the research capability to conduct a series of analyses of the basic problems of measuring combat. From 1973 through 1979, HERO published studies on ammunition expenditure, effects of barriers, effects of surprise in combat, studies of breakthrough operations, artillery effectiveness, Soviet combat performance, effects of smoke and dust on combat, effects of fatigue and losses, and effects of fortifications. These studies were all excellent “first steps” in the study of the problems of modeling land combat. Unfortunately, however, the pattern that would persist throughout the organization’s history was developing. There was never a second step. The historians (and some OR people) would gather the data, do some preliminary analysis, and present the reports. The analytical community would then use it for further analysis and their own purposes, but HERO was not allowed to continue its analysis and work so that a more definitive and useful study could be made. All HERO reports tended to be “incomplete” because the commitment to long-term research, which is required to obtain a result, was not made by the contracting offices. As a result, a series of excellent in-depth studies were done for a wide range of customers, but no continuous research effort was underway that would produce a definitive and conclusive result. In my opinion, this lack of steady work and the “task” funded nature of the work was a major limitation to HERO’s effort, and eviscerated many promising lines of research. Much greater material results could have been obtained from this historical research had there been a more far-seeing policy on the part of many DOD agencies.

During the early 1970s, Trevor Dupuy began publishing the results of his QJM work with the books *Numbers, Predictions, and War* and *Evolution of Weapons and Warfare*. The publication of *Numbers, Predictions and War* resulted in the “paper and pencil” version of the QJM being effectively public domain. His Middle East work produced the excellent *Elusive Victory* and later *Flawed Victory*. At this point, HERO was no longer a book writing and analytical house, but was now a historical analysis house that was publishing books culled from its analyses. This trend would continue until the establishment of The Dupuy Institute. Of course, HERO also produced a number of significant non-analytical historical works, including the massive *Encyclopedia of Military History*, but this type of work was clearly no longer the company’s major thrust.

Unfortunately, in many people’s minds, all of HERO’s work was associated with the QJM. Even though from the early 1970s and on it does not appear that the QJM and QJM analysis ever made up over 25% of the organization’s work, and often was much less than that, HERO, Trevor and the QJM became inseparable in the popular perception. This appears to have led many people to ignore the otherwise valuable research and analysis being performed, simply because they didn’t like the model. They forget that the rest of the company’s work was research and analysis not related to the combat model.

In the late 1970s, HERO added two staff members that would have a significant impact on the organization. These were Col. John Sloan, a sovietologist who was Vice President of Tnda from 1976 to 1979, and C. Curtiss Johnson, who was already an established author. Also in this period, a number of other historians worked for the organization, including Edward Oppenheimer and Richard G. Sheridan. By the early 1980s the HERO organization had an experienced and reputable staff, a considerable body of work, and an established reputation. In the early 1980s two more junior researchers were added to the staff who would play a role in the future of the organization. These were Arnold Dupuy, one of Trevor’s nine children, and Brian Bader. In 1983 Grace Hayes retired and Curt Johnson became the Executive Director of Research. The organization was a mature established research and analytical house with around a dozen employees.

But HERO had reached its limit as a business. It had a uneven but steady flow of work coming in but was clearly not going to become any larger or more influential without some shift in direction. As a result of the QJM being rejected by the analytical community, the level of work in the organization declined in the early eighties, but it still maintained its core staff and capabilities.

In 1983 Col. John Brinkerhoff, now retired after a stint as the Deputy Assistant Secretary of Defense for Reserve Affairs, decided that HERO would serve as an ideal base to build up a large analytical house like Booz-Allen or BDM. This meant that the organization would have to expand beyond its historical work and go into a wide range of analytical and operations research work. It was also intended to expand the organization into more commercial work, including computerized wargames. Col. Brinkerhoff supported this vision with a major injection of funding from his own pocket and created a new corporate over-body called Data Memory Systems, Inc. (DMSI). Trevor N. Dupuy was President of DMSI with Col. John Brinkerhoff as Vice-President. HERO was maintained as a division within the organization, with Curt Johnson as the head. This led to a very dramatic, dynamic, and expansionist phase than eventually would lead to the overextension and demise of the organization. At this
point, the corporate entity TNDA was retired. HERO Books, a private publishing company, was also created and infused with cash, with Guy Clifton as its head. It was a separate business from DMSI.

HERO/DMSI began to start assembling its data into databases, including the Land Warfare Database (LWDB) and the QJM database. These databases were originally "paper" databases, but eventually several of them were computerized. The QJM was computerized, the original programming work completed in BASIC by José Perez in 1985. It was actually the BASIC programming code that was copyrighted, as the model was public domain. A Database Division was established under Col. Peter Clark, USAF, Ret. in 1984, and this division eventually became the Combat Analysis Division (CAD) which was responsible for running, maintaining, and using the QJM. The organization added a third division with the Professional Education Division (PED), leaving the organization staffed with HEROs, CADs and PED'ophiles.

Sadly, in 1985 Paul Martell died suddenly of a heart attack while on a trip. Before he died, he had co-authored two books with Trevor Dupuy—Great Battles of the Eastern Front and Flawed Victory—and had written on his experiences as a defector. Much of the work of HERO and DMSI was never really completed due to the lack of follow-up work or steady funding from the government. So, for example, the Ardennes Campaign Simulation Database, the largest database of ground combat, was created by DMSI under contract from CAA, and then never further analyzed or explored by DMSI. No budget was provided to do so. It has been used for two other efforts—the model validation work of CAA, and an attempt by Dr. Jerome Bracken to find out whether Lanchester’s square law is visible. But the people who best knew and understood the data were never funded to do any further analysis with it.

At TDI, we have been using some of this untapped data for our analysis. For example, when we were tasked by the Joint Chiefs of Staff to provide an estimate of casualties for the Bosnia peacekeeping effort, we went back to an report called Casualty Estimates for Contingency Operations, again prepared under contract for CAA. Created in 1985, it was basically an unorganized paper database of incidents, skirmishes, battles, campaigns, and wars since 1945. As far as I know, it never really succeeded in answering any question that anyone was asking at the time, so this unstructured database was never used for any analytical purpose. But it turned out to be invaluable for starting the Modern Contingency Operations Database (MCODB) that was used to produce our historically-based estimate of US casualties in the Bosnia operation. We were able to create such a data base in ten days only because of the existence of this previous study. We also used some of the research to help develop our Battalion-Level Operations Database (BLODB). But as is typical with the nature of this effort, after completing our Bosnia estimate, no further budget was provided to develop and improve the database for future use. The Institute currently has a similar situation with the Kursk Database, which was completed in March of this year. Again, no funding for any further analysis has been approved. TDI could easily spend a dozen man-years just “fleshing out” and analyzing the data that has been gathered over the last 35 years by HERO and its descendent organizations.

Unfortunately, this was the pattern throughout the history of HERO. Many of the studies produced were very good first steps, but the second step was never taken. In part, this appears because the analytical community wanted HERO to gather the data and they would provide the analysis. Operations researchers didn’t want to soil their hands researching operations. Apparently no one trusted the historians to think, or perhaps the fear was that they would produce the wrong answer. This unwillingness to listen to the students of history resulted in the DOD modeling community heading down a path over the last 40 years that has led to a complicated and expensive series of models that address only half the factors that make up combat, because they do not address human factors. Any combat model developed should start by addressing human factors. Unfortunately, Trevor N. Dupuy and HERO were never able to win this argument.

In 1986, the organization tried to expand even further afield with the addition of Andrew Wittner, also originally with CAA, as the VP of Business Development. It was also at this time that Trevor N. Dupuy published what I consider his most important work, Understanding War, which effectively encapsulated much of his work and knowledge developed over the last 25 years. Unfortunately the organization had become a three-ring circus, with historical research, book writing, model development, and defense analysis work being done alongside various stock offerings, legal research services, international trade, commercial game design, magazine publications, and many other new business ideas, most which never generated any significant revenue. From 1986 through 1988 the staff expanded rapidly, with the noticeable additions being Vince Hawkins, Dave Bongard, myself (Chris Lawrence), Jay Karamales, and Richard Anderson. The largest project within HERO was the Ardennes Campaign Simulation Database, headed by me, and later by Brian Bader after my resignation. It was also at this time that the QJM was reprogrammed into Pascal, courtesy of one of our customers. This Pascal code was donated to DMSI.

By this time the cracks in the structure were quite visible. The organization had moved to large new offices in Fairfax, Virginia, and had built the staff up to over 20 employees. But it had acquired considerable debt to pay for the additional expansion and was vulnerable if there was a downturn in business.

Worse, the organization was at war with itself over its future and direction. It was being torn between the historians and the business development people. The historians were interested in conducting the core business of HERO, while the business development people were interested in rapid expansion into virtually any business area. The organizational structure had become top-heavy and confused, with a president and two vice presidents all heading in different direc-
tions, and the two divisions that actually did the work headed by managers who did not have the authority or clout of the VPs. The senior heads of the corporation had their pet projects, using staff and time, and these projects operated outside of the working divisions. This was all amplified by bitter management fights that took their toll. John Brinkerhoff left in early 1987, Andy Wittner left in early 1988, Chuck Hawkins came in as an investor and vice president, while Curt Johnson and Pete Clark moved up to fill the vice president slots. In 1988, the business of HERO/DMSI had peaked. Its best “year” was the second half of 1987 and first half 1988, when its revenue peaked above a million dollars.

The organization reached its peak size in 1988, when it had 25 full–time, part–time, and temporary employees, of which around 15 were full–time. Most of the people associated with this newsletter and with TDI were employed by DMSI during this time (Dave Bongard, Richard Anderson, Jay Karamales, José Perez, Curt Johnson and myself).

This period of growth was followed by a rapid period of decline, with a dizzying array of stock buy–outs, changes of management, and arguments on how the downsizing should occur. The marketing effort was diluted and work took second place to the management activities. The receipts began to decline. Of course the debt was still there, creating a major financial problem for the corporation. At this point the research staff started leaving, with Curt Johnson being the first out the door in late 1988. I was next in early 1989, followed by Jay Karamales, Richard Anderson, and others. In 1989 Col. Ken Moll, US Army, Ret. joined the corporation as the senior vice president, but he was unable to halt the decline. In 1990, Trevor Dupuy quit his own corporation in a management dispute with Col. Moll and Chuck Hawkins. Much of the remaining staff followed Trevor out the door to his new organization. Brain Bader remained, holding the dubious distinction of being the last Director of HERO.

At this point, Trevor N. Dupuy reactivated TNDA and went back into business. He quickly rebuilt the core business of HERO, bringing on Curt Johnson, Richard Anderson, Dave Bongard, Jay Karamales, Arnold Dupuy, and Guy Clifton. The stock in HERO books was traded for stock in DMSI so that HERO books went with Trevor to TNDA and Col. Dupuy no longer held stock in the organizations he had founded, HERO/DMSI. He also oversaw a major revision to the QJM.

Dr. James Taylor of the Naval Post–Graduate School had been contracted by the Jet Propulsion Laboratory to do some work on applying differential Lanchester equations, using the QJM as a workhorse. This work was integrated with the old QJM formulae, programmed by José Perez in Pascal, and modified with additional work by Trevor and Chip Sayers.

But the disputes with DMSI continued, with arguments over “non–competition” agreements and ownership of property. DMSI filed two legal suits against TNDA. One of the suits even listed Trevor’s desk from Burma as a corporate asset taken from DMSI. Still, TNDA briefly flourished, producing the Attrition Handbook and the accurate predictions of the Gulf War published in If War Comes along with several other books. At this point Trevor was heading back to his basic concept of using the organization to publish books along with doing DOD analytical work. This might even have succeeded had the Gulf War lasted longer. Some 500,000 paperback copies of If War Comes had been printed and the book climbed onto the New York Times best seller list just as the war ended. This period from mid–1990 to mid–1992 saw the production of five books, including the six volume International Military and Defense Encyclopedia.

By then, however, the Berlin Wall had fallen and the US defense industry was undergoing budget cuts, with studies and analysis taking the first hits. There were now two historical analysis organizations competing for a shrinking slice of the pie, and busily engaged in a legal dispute with each other. Too late the two organizations settled their differences out of court, but declining revenues, the accumulated debts, the costs of the legal fight, and the distractions caused by these disputes rendered both organizations no longer viable. They both closed their doors, with TNDA filing bankruptcy in 1992 and DMSI effectively shutting down that same year and filing bankruptcy in 1994, after they had sold off their remaining assets. From these ashes, Trevor started The Dupuy Institute in 1992 as a non–profit 501(c)(3) organization. It was literally operating out of his basement, and again started work on book contracts. Col. George Daoust was the executive director of TDI and Dave Bongard was its one employee. The advent of the Kursk Database contract in mid–1993, put together with the help of John Sloan, allowed me to come back to work for Col. Dupuy, increase our staff, and leave the basement. In 1993 HERO Books was reconstituted by Trevor’s son, Arnold Dupuy, as an independent for–profit venture. He currently operates it as a part–time business under the name NOVA Publications. In 1994 Hitler’s Last Gamble was published. It is the only book prepared by TDI and was Trevor’s last published book, co–authored by Richard Anderson and Dave Bongard. It was developed from the data gathered during the Ardennes project at DMSI.

In January 1995, aware of his declining health, Col. Dupuy brought in Major General Nicholas Krawciw, US Army, Ret., to take over has head of the institute. Trevor N. Dupuy died on 5 June 1995, and General Krawciw took over as President of the Institute. In the middle of 1996, we adopted our current management structure with myself as Executive Director and George Daoust as Chairman of the Board of Directors.

One of goals of HERO/TNDA/DMSI/TDI has been to learn lessons from history. There are many such lessons to be learned. There is obviously still a need, even if unrecognized, for an historical/analytical organization. Such an organization cannot exist off of book revenues. It must be funded by contractual defense work in order to survive with adequate and competent staff. The organization is stronger, and the caliber of the staff higher, if there is some continuous level of support over the years.

As I see it, the Dupuy organizations went through six stages of their existence. They are:
1962—1970 A book-writing and historical analysis organization
1970—1983 An historical/analytical organization that also wrote books (a RAND-like think tank)
1989—1990 Collapse
1990—1992 An attempt to re-establish the original HERO based upon book writing.
1992—present An historical/analytical organization (a RAND–like think tank).

TDI continues to operate with original HERO staff including Curt Johnson, Dave Bongard, Jay Karamales, Richard Anderson, José Perez, and myself. We have all been associated with Trevor’s companies and work for over a decade. Trevor left an organization that contained the corporate knowledge and the ideals for quality historical research that he had envisioned when he established HERO 35 years ago. TDI is the successor organization to HERO.

From first to last: Trevor N. Dupuy talks to Brian Bader, last director of HERO, on 4 June 1995.
List of HERO, DMSI, TNDA, and TDI Reports
by Susan Rich

1. HERO/DMSI REPORTS 1962 - 1990

1. A Preliminary, Interpretive Survey of the History of Command and Control (2 Volumes) (1963) (Sandia)


3. Responses to Violations of Arms Control and Disarmament Agreements (Vols I-IV Unclassified; Vol V, Top Secret Appendix) (1964) (ACDA)

4. Historical Trends Related to Weapons Lethality (4 Volumes) (1964) (AVTAC of CDC)

5. Holidays: Days of Significance for All Americans (1964) (F.Watts)


7. US Alternatives in Vietnam (1965) (Conf. at IDCAF)


11.1 A Quarterly Compilation of Legislative Abstracts on National Defense, Vol.0, No.0 (1965)

12. Isolating the Guerrilla (Vol. I, Confidential; Vols II-III, Limited Distribution) (1965) (ARO)

13. Development of a Public Information Program on Temporarily Incapacitating Chemical and Biological Agents (Confidential) (1966) (US Army)


16. Average Casualty Rates for Wargames, Based on Historical Combat Data (3 Volumes) (1967) (RAC)

17. Developing a Methodology to Describe the Relationship of Mobility to Effectiveness (2 Volumes) (1967) (RAC)

18. Military History of World War I (1967) (Franklin Watts)


20. Comparative Analysis of Armored Conflict Experience (3 Volumes) (Secret) (1967) (PA&E)


22. A Study to Develop a Research Program for the Design & Development of Modern College Libraries (1968) (OE)

23. Report to Chairman on Conference of Smithsonian Institution Armed Forces Museum and Study Center Advisory Board (Belmont Report) (1967) (Smithsonian)


31. Historical Data on Tactical Air Operations—Interdiction from Falaise to Westwall, 1944 (1970) (AFS&A)
<table>
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<th>Number</th>
<th>Title</th>
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<td>32</td>
<td>Use of Historical Data in Evaluating Military Effectiveness (4 volumes)</td>
<td>1970</td>
<td>(AFS&amp;A)</td>
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<tr>
<td>33A</td>
<td>Allied Air Interdiction Against Axis Forces in Tunisia, Feb-May, 1943</td>
<td>1971</td>
<td>(AFS&amp;A)</td>
</tr>
<tr>
<td>33B</td>
<td>Allied Air Interdiction for Operation HUSKY (Sicily), May-Aug, 1943</td>
<td>1971</td>
<td>(AFS&amp;E)</td>
</tr>
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<td>33C</td>
<td>Allied Air Interdiction Against Axis Forces Pre-Invasion, Northwest</td>
<td>1944</td>
<td>(AFS&amp;A)</td>
</tr>
<tr>
<td>33D</td>
<td>Allied Air Interdiction in Support of OVERLORD, 6 June - 25 Aug, 1944</td>
<td>1971</td>
<td>(AFS&amp;A)</td>
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<td>33E</td>
<td>Allied Air Interdiction from Falaise to Westwall, 14 Aug - 14 Sept. 44</td>
<td>1971</td>
<td>(AFS&amp;A)</td>
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<tr>
<td>34</td>
<td>A Study of the Relationship of Tactical Air Support Operations to</td>
<td>1971</td>
<td>(DOAE)</td>
</tr>
<tr>
<td>35A</td>
<td>Tactical Air Interdiction, World War II: France (1972) (AFS&amp;A)</td>
<td>1972</td>
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<td>Tactical Air Interdiction, World War II: Germany (1972) (AFS&amp;A)</td>
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<td>Tactical Air Interdiction, World War II: Italy (1971) (AFS&amp;A)</td>
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<td>36</td>
<td>Opposed Rates of Advance of Large Forces in Europe</td>
<td>1972</td>
<td>(DCSOPS)</td>
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<tr>
<td>37</td>
<td>Familiarization Program - The Founders Project</td>
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<td>38</td>
<td>Historical Bibliography of Warfare in the Middle East (1972)</td>
<td>1972</td>
<td>(Battelle)</td>
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<tr>
<td>39</td>
<td>A Reporting System for Allied Command Europe (ACE) (1972) (SHAPE)</td>
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<td>40</td>
<td>Manual of Historical Data for Input to &amp; Development of Air and</td>
<td>1973</td>
<td>(AFS&amp;A)</td>
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<td>41</td>
<td>Rates of Expenditure of Ammunition in Relation to Posture (1973)</td>
<td>1973</td>
<td>(SHAPE)</td>
</tr>
<tr>
<td>42</td>
<td>Feasibility Study for Net Assessment of Effectiveness of NATO-Warsaw</td>
<td>1973</td>
<td>(DIA)</td>
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<tr>
<td>43</td>
<td>A Selective Historical Evaluation of the Qualitative-Quantitative</td>
<td>1973</td>
<td>(Braddock, Dunn &amp; McDonald)</td>
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<td></td>
<td>Effectiveness of the Employment of Unconventional Forces and/or</td>
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<td>Resources in Support of National Policy (1973)</td>
<td></td>
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<td>44</td>
<td>Analysis of Operational Criteria &amp; User Requirements of a Naval Air</td>
<td>1974</td>
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<td>Reporting System (1974)</td>
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<td>Historical Evaluation of Barrier Effectiveness (1974) (CAA)</td>
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<td>46</td>
<td>The Terrorist &amp; Sabotage Threat to US Nuclear Programs (1974) (Sandia)</td>
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<td>47</td>
<td>A Small Data Base of Tactical Airport in Historical Combat (1975)</td>
<td>1975</td>
<td>(PA&amp;E)</td>
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<td>48</td>
<td>German &amp; Soviet Replacement Systems in World War II (1975) (OASDM&amp;RA)</td>
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<td>The October War in the Middle East (October, 1973) in Historical</td>
<td>1976</td>
<td>(NA)</td>
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<td></td>
<td>Perspective (1976)</td>
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<td>Combat Data Subscription Service, (2 volumes) (1975) (A quarterly</td>
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<td>A Survey of Quick Wins in Modern War (1975) (NA)</td>
<td>1975</td>
<td></td>
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<td>52</td>
<td>A Study of Breakthrough Operations (1976) (DNA/Sandia)</td>
<td>1976</td>
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<td>53</td>
<td>The Quantified Judgement Model of Analysis of Historical Combat Data;</td>
<td>1976</td>
<td>(Sandia)</td>
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<td></td>
<td>A Monograph</td>
<td></td>
<td></td>
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<tr>
<td>54</td>
<td>Comparative Analysis of Arab and Israeli Combat Performance, 1967 &amp;</td>
<td>1976</td>
<td>(OASDI)</td>
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<td></td>
<td>1973 Wars (1976)</td>
<td></td>
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<td>55</td>
<td>Artillery Survivability in Modern War (1976) (Sandia)</td>
<td>1976</td>
<td></td>
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<tr>
<td>55A</td>
<td>Artillery Fire and Effect, US Ninth Army, Roer River Crossing, Feb</td>
<td>1977</td>
<td>(DNA)</td>
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<tr>
<td></td>
<td>1945</td>
<td></td>
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<td>57</td>
<td>Studies on Soviet Combat Performance (1977) (NA)</td>
<td>1977</td>
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<td>58</td>
<td>Assessment of the Danger of Surprise Attack in Europe, and NATO</td>
<td>1977</td>
<td>(AFSA)</td>
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<td></td>
<td>Vulnerability to Surprise (1977)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>59</td>
<td>Historical Scenarios of Soviet Breakthrough Efforts in World War II</td>
<td>1977</td>
<td>(AFS&amp;A)</td>
</tr>
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<td>60</td>
<td>Availability of Historical Data Concerning Soviet Air Defense</td>
<td>1978</td>
<td>(Sandia)</td>
</tr>
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<td></td>
<td>Experience (1978)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>61</td>
<td>Analysis of the Implications of Surprise in Scenarios of Conventional</td>
<td>1978</td>
<td>(Sandia)</td>
</tr>
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<td></td>
<td>and Tactical Nuclear Combat in Europe</td>
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62. Search for Historical Records of High Rate Artillery Fire in Combat Situations (2 volumes) (1978) (HEL)
63. Effects of Smoke & Dust on Combat Performance (AMSAA)
64. Target Positioning Assessment (1978) (Batelle)
65. Effects of Combat Losses & Fatigue on Operational Performance (1978) (TRADOC)
66. Observations on Defense Against the V-1 Missile (1978) (Sandia)
68. Historical Trends in Artillery Vulnerability (1979) (Sandia)
69. Navy Nuclear Test Personnel Review
70. Development of Soviet Air Defense Doctrine & Practice (1979) (Sandia)
71. The Value of Field Fortifications in Modern Warfare (1979) (DNA)
72. A Historical Analysis of the Effectiveness of Tactical Operations Against and in Support of Armored Forces (1980) (Sandia)
73. The Impact of Nuclear Weapons Employment on the Factors of Combat (1980) (Sandia)
74. German and Allied Army Reserves in 1914 (1980) (MRA&L)
75. The Preparedness Debate: 1914-1916 (1979) (MRA&L)
76. Comments on “Plumbbob” and “Shot Smoky” (1980) (JRB)
77. The Soviet Threat in the Middle East: Perceptions in the Region (1980) (ISA)
78. Potential Warsaw Pact Invasion of Switzerland; Quantified Judgment Analysis (1980) (SGSO)
79A. Nuclear Concepts: The Concept of the Equivalence of Strategic Forces
79B. Nuclear Concepts: The Deterrence Concept
79C. Nuclear Weapons Proliferation: Impact and Response
79D. The Concept of Stability
79E. The Concept of Nuclear Threshold
80. Relevance of Selected Non-Nuclear Experience to Possible Future Employment of Nuclear Weapons (1980) (DNA)
81. Soldier Capability: Army Combat Effectiveness (SCACE); Historical Combat Data and Analysis (1980) (Batelle)
82. The Factors of Combat (1980) (DNA)
85. Potential Military Aggression Against Jordan (QIM Analysis) (1981) (Keyadah)
90. A Study of War Termination (1982) (DNA)
91. Naval QIM Feasibility Study (1982) (DNA)
95. HERO Land Warfare Data Base (6 volumes) (1983) (CAA)
96. Unknown
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<tr>
<td>97</td>
<td>Toward an Overview of Modern Chemical/Conventional Combat: A Conference Based on Historical Experience</td>
<td></td>
<td></td>
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<tr>
<td>98</td>
<td>Contributing to the Reliability of the Army War College Model (3 volumes &amp; preliminary report) (1983) (AWC)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>99</td>
<td>Historical Survey of Casualties in Different Size Units in Modern Combat (1982) (TRASANA)</td>
<td></td>
<td></td>
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<tr>
<td>100</td>
<td>The QJM Data Base (3 volumes) (1985)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>101</td>
<td>Implications of the Present Knowledge and Past Experience for a Possible Future Chemical/Conventional Conflict (1985) (IDA)</td>
<td></td>
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<tr>
<td>103</td>
<td>JESS Data Base (3 volumes) (1984) (JPL)</td>
<td></td>
<td></td>
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<td>104</td>
<td>Unknown</td>
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<td>105</td>
<td>Human Impact of Technological Innovation on the Battlefield (1984) (USAMRDC)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>106</td>
<td>Casualty Estimates for Contingencies (2 volumes) (1985) (CAA &amp; DCSPERS)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>107</td>
<td>Historical Analysis of Reserve Components, Tank Bns Equipment Problems for Korean War Mobilization (1985) (LMI)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>108</td>
<td>Cold Weather Combat, Analogy to Chemical Combat (1985) (OASDR&amp;E)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>109</td>
<td>Methodology for Extending Emergency Command Requirements for a Situation D Emergency (1985) (CCAC GP)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>110</td>
<td>Mission Accomplishment by Divisions &amp; Their Component Maneuver Elements (1987) (JPL)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>111</td>
<td>Combat History Analysis, History Study Efforts (5 volumes) (CHASE) (1986) (CAA)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>113</td>
<td>Understanding Soviet Armed Forces (1987)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>115</td>
<td>History of OTEA</td>
<td></td>
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<tr>
<td>115A</td>
<td>History of OTEA</td>
<td></td>
<td></td>
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<tr>
<td>116A</td>
<td>Summary Listing, Test Measures, Conditions and Resources List (1987) (OTEA)</td>
<td></td>
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</tr>
<tr>
<td>117B</td>
<td>New Engagement Data for the Breakpoints Data Base (1988) (CAA)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>118</td>
<td>The Relationship Between Technology Trends and the Size &amp; Composition of Military Forces (1987) (Sandia)</td>
<td></td>
<td></td>
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<tr>
<td>119</td>
<td>Combat Data Base Survey for MAPPS (1987) (Oak Ridge)</td>
<td></td>
<td></td>
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<tr>
<td>120</td>
<td>Ardennes Data Base (1990) (CAA)</td>
<td></td>
<td></td>
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<tr>
<td>120.1</td>
<td>Ardennes Campaign Simulation Data Base (ACSDB) User’s Guide (Dec. 1989) (CAA)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>120.2</td>
<td>The Ardennes Campaign Simulation Data Base (ACSDB) Final Report (Feb. 1990) (CAA)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>121</td>
<td>Comparison of Differences of Relative Combat Effectiveness of National Forces in Offensive &amp; Defensive Posture (1988) (DOAE)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>122</td>
<td>Examination of Historical Air Defense Performance (1988) (Sandia)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>124</td>
<td>The Quantified Judgement Model in Low Intensity Conflict Application (1988) (CIA)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**II. TNDA REPORTS 1990 - 1992**

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Date</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>125</td>
<td>Current Military Trends in Historical Perspective (1990) (Boeing)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>126</td>
<td>Report on Pre-war Forecasting (1991)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>127</td>
<td>Unknown</td>
<td></td>
<td></td>
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<tr>
<td>128</td>
<td>Unknown</td>
<td></td>
<td></td>
</tr>
<tr>
<td>129</td>
<td>Testimony of Col. T.N. Dupuy, USA, Ret. Before the House Armed Services Committee (1990)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
III. TDI REPORTS 1992 - Present

A-1. Road Map for Developing a Comprehensive Wargame Utilizing Historical Experience and Data (Jun. 1993) (AFSC)


A-3. Air Model Historical Data Study (Statement of Work) (Aug. 1995) (AFSC)


B-1. Peacekeeping in Bosnia: Fatality Estimates (Preliminary and Final Reports (Nov. 1995) (JCS)

E-1. Database User’s Guide for the Capture Rate Study (Sept. 1998) (CAA)

E-2. List of Candidate Conflicts for the Capture Rate Study (Sept. 1998) (CAA)


K-4. Draft Data Base Conventions for The Battle of Kursk; Southern Front: A Validation Data Base (Apr. 1994) (CAA)


K-11. Soviet Barriers and Fortifications on the Southern Front Battle of Kursk 4-18 July, 1943: A Supplemental Appendix to the Kursk Data Base

M-1. Military Consequences of Landmine Restrictions (Apr. 1996) (JCS)


S-1. Suppression Study


T-5. The Tactical Numerical Deterministic Model (TNDM) A General Theoretical Description and Hardware and Software requirements (Oct. 1994)


Articles by Trevor N. Dupuy
by Susan Rich

A-10 Advance Rates in Combat.


A-80 Compiling Engagement Data for the Arab-Israeli Wars.

A-110 Armaments; Nuclear & Chemical Weapons in the XXth Century; Political and Strategic Aspects.

A-120 Thoughts on an Arab Peace Initiative.

A-130 Artificial Intelligence for the Armed Forces. Published in Army, Feb. 1984 under the title “Military History Is Key.”


A-190 A New Attrition Methodology for Models of On-Ground Combat (with James G. Taylor).

A-200 Some Facts About Attrition in War.


B-10 A New Approach to Battle Termination Methodology.

B-20 Battlefield Interaction of Weapons, Tactics, and Doctrine.

B-21 Battlefield Management; The Historical Legacy.

B-30 Military Analysis of the Bekaa Valley Battle.


B-100 The Fundamental Information Base for Modeling Human Behavior In Combat.

B-120 Avoiding the Bosnia-Herzegovina Quagmire.

B-125 Future, Present and Past Wars.

B-127 Military Options in Bosnia.


B-130 Are We Helpless Against Bold Aggression? Implications of Failure in Bosnia.

C-0 The Calculus of Battle.

C-5 The Military Historian As A Domain Specialist for Case-Based Reasoning.

C-20 Julius Caesar (lecture paper).

C-60 The Element of Chance in Combat Models.

C-70 China, December 1945.


C-100 Clausewitz’s Deterministic, Predictive Theory of Combat.

C-120 Clausewitz and Military Theory.

C-128 Combat Effectiveness.

C-140 Combat Effectiveness and Characteristics of Society.

C-145 Using the Concept of Relative Combat Effectiveness for Military Analysis.

C-160 A Methodology Consistently Relating Combat Power Ratios to Battlefield Results.

C-180 Criticisms of Combat Models Cite Unreliability of Results. Published in Army, Mar. 1985.

C-190 The Phenomenon of Combat Effectiveness.

C-240 In Search of an American Philosophy of Command and Control.


C-300 From Continental Army to Global Superpower; 200 Years in Defense of Freedom.

C-320 Military History and Case-Based Reasoning: A New
Approach to the Application of Artificial Intelligence to Battlefield Decision-Making.

C-370  A Promise Fulfilled in the CBI (with R. E. Dupuy).

C-375  Why American Military Capability is Not Good Enough.

D-1  Criteria for Defeat in Battle (with Robert McQuie, Charles B. MacDonald and Hugh M. Cole).

D-10  The Problem of Defining Models, Simulations and Games For Military Purposes.

D-20  Yes Indeed; What About the Draft?

E-1.1  Mearshimer. Published in International Security, Summer 1989.


E-10  Quantifying Combat Effectiveness of Divisions in World War II.

E-30  Electronic Warfare and the Battle of Kursk. Published in Armed Forces Journal International, Feb. 1979

E-40  Even Your Best Friends.


F-10  Flags and Patriotism.

F-30  Force Ratios and Behavioral Considerations in Ground Combat Models.

F-31  Outnumbered and Winning; Force Multipliers in History.

F-32  Yes, Virginia, There Really Are Multipliers!

F-40  Report on Pre-War Forecasting: Accuracy of Pre-Kuwait War Forecasts.

F-50  Forecasting on the Basis of Historical Combat Trends.

F-60  Friction in War.

F-70  The Frustrations of a Military History Analyst.

F-80  Introduction for Japanese version of Future Wars.

G-1  History, Reform, and General Staffs.

G-10  The Current Implications of German Military Excellence. Published in US Strategic Review, Fall 1976.

G-20  Prussian-German General Staff.

G-50  Assessing the War in the Gulf.

G-51  Estimates of Possible Casualties in a War Between United Nations Forces and Iraq (with Curt Johnson).

H-1  History, Mysticism, and the Holy Grail.

H-5  Technology and The Human Factor In War.

H-10  Renegade or Patriot? The Case of Major Haddad of “Free Lebanon.”

H-30  The Hexagon in Combat Simulations.

H-40  Relevance of Historical Combat Data to Future Tactical Nuclear Warfare.

H-50  Historical Military Operations in the Middle East.

H-60  History and Modern Battle. Published in Army, Nov. 1982.

H-70  The Uses of History.

H-80  Human Factors Without Human Experience: A Case Study in Combat Simulation Unreliability.

H-85  Budget Implications of Human Factors and Technology in Modern War.

H-90  Combat Hypotheses Derived From Military History Analysis.

I-1  The INF Treaty and the Quantified Model.

I-10  Measuring Combat Intensity.

I-20  Thoughts on Tactical Intelligence.


J-1  The Characteristics of JTLS.

J-20  A Possible Iraqi Invasion of Jordan.

J-20  A Possible Iraqi Invasion of Jordan.


K-5  Are We On The Brink of War With Korea?

K-8  Kuwait War: A Preliminary Assessment.


K-20 Liberating Kuwait: Not Easy; Not Formidable; But Necessary.

L-10 LNK Paradigm, Comments, “A Design for a Battlefield Situation Assessment System.”

L-30 Basic Concepts of Land Combat.

L-40 Analysis of a Land Warfare Data Base.

L-50 Landpower - Its Historical Importance.


L-70 Leadership, Politics, and Cowardice.

L-80 Is American Military Leadership Pedestrian and Unimaginative?

L-85 The Failure of American Military Leadership.

L-90 Players and Kibitzers; The Complexities of Withdrawal of Occupation Forces From Lebanon.

L-100 The War in Lebanon: In Search of Truth In Reporting (with Paul Martell).

L-110 Weapon Lethality and Effective Firepower on the Modern Battlefield. Published in Army, Feb. 1979 under the title “Military Weaponry: How Lethal?”

L-115 Could Lee Have Won At Gettysburg?


L-130 Churchill and Liddell Hart; Civilian Writers Who Have Influenced Military Affairs. Published in Army, Aug. 1966 under the title “The Selective Memoirs of Liddell Hart.”


L-150 Reflections on the Louisiana and Other Maneuvers.

M-1 Maneuver Lessons: The Arab-Israeli Wars.

M-20 Measures of Effectiveness.


M-40 How to Lose - Or Win - Friends and Influence in the Middle East.

M-50 Middle East Peace is Possible.

M-60 A Proposed Step Toward Middle East Peace. Published in Strategic Review, Fall 1981.

M-70 A Case Study in Military History.

M-80 An Introduction to Military Historical Analysis.

M-100 Military History; The Essence of Military Science.

M-120 Military History: Laboratory of the Soldier; Empirical Basis for a Theory of Combat.

M-130 The Practical Relevance of Military History to Problems of Modern Combat.

M-140 The Relevance of Military History.

M-150 Why We Do Not Learn From Military History.

M-170 Military Service in a Democracy: The Obligation to Serve vs. the Voluntary “Tradition”?


M-190 The Defensive Might of Infantry; Contribution of Combat Multipliers.

M-200 Coming to Grips With Battlefield “Multipliers” - By Use of the Quantified Judgement Model.

M-205 Outnumbered and Winning; Force Multipliers in History.

M-210 A Practical Approach to Force Multipliers.

M-220 Let’s Get Serious About Combat Multipliers.

M-230 Mobile Defense, Forward Strategy, and Military Reform; Confusion Among the Critics.

M-240 Mobile Defense, Forward Strategy, and Military Reform; Confusion Among the Critics.

M-250 The Problem of Defining Models, Simulations and Games for Military Purposes.

N-10  The New Debate: NATO’s Deep Strike; Strategy For Victory or Defeat?

N-20  The Problem of NATO Forward Defense.


N-35  Prospects for a North-South War.

N-40  Comments on Gold-Struve Article: “The Nuclear Battlefield.”

N-70  Preservation of the North Anna Battlefield.

O-1  A Military Analysis of the October War.

O-10  The War of Ramadan: An Arab Perspective of the October War. Published in *Army*, Mar. 1975.

O-20  Preliminary QJMA Analyses of October War Data.


P-10  Perceptions Of The Next War: Historical Perspective on Adjustment of Doctrine and Tactics to Weapons. Published in *Armed Forces Journal International*, May 1980.


P-30  The Nature of Military Power.

P-35  Report on Pre-War Forecasting.

P-40  The Principles of War.

P-50  Some Thoughts on Combat Principles.

P-60  The Crisis in American Professionalism: Accusations and Remedies.

P-75  A Question of Professionalism in Today’s Army. Published in *Army*, Jul. 1982, under the pen name Alexander Ross.

P-90  A Comparison of the Combat Potentialities of the United States and the Soviet Union.

Q-10  Quantitative Analysis of War Experience.

Q-20  Quantitative Historical Analysis to Determine the Influence of Behavioral Factors on Combat Outcomes.

Q-110  A New Attrition Methodology for Models of Air-Ground Combat (with James G. Taylor).

Q-130  Mythos or Verity? The Quantified Judgment Model and German Combat Effectiveness.


Q-160  The Quantified Judgment Model: Observations and Descriptions.

Q-260  The Quantified Judgment Model; A Theory of Combat.

R-1  Thoughts on the Road Problem in a Future War in Europe.


R-15  Using the Concept of Relative Combat Effectiveness for Military Analysis.

S-20  The Scherhorn Episode.


S-70  At Last! Systematic, Reliable Simulation of Combat

S-80  A Fallacy of American Combat Simulations; Rates of Advance Are NOT Proportional to Force Ratios.

S-90  Preliminary QJMA Analysis of Six-Day War.


S-120  A New Square Law?


S-140  Across the Suez (Operation “Strongheart.”)
S-160  Realistic Simulation of Suppression and Attrition Effects of Artillery and Air-Delivered Firepower.

S-170  Observations on Suppression in Combat.

S-180  Historical Literature and Data on Suppression in Combat.


S-200  Significance and Effects of Surprise in Modern War.

S-210  Thoughts on Surprise Scenarios for a Future War in Europe.

S-220  The Synergism of History and Operations Research: A Case Study: German Combat Performance in Two World Wars.

T-10  A Theory of Combat.

T-35  Tank Loss Exchange Ratios.

T-40 Toward a Viable Doctrine of Tactical Nuclear Combat. Published in Ordnance, Nov./Dec. 1968 under the title “Tactical Nuclear Combat.”


T-70 The Influence of Technology on War Since 1945. Published in Marine Corps Gazette, Sept. 1983.

T-90 Interaction of Technology and Human Factors in War.

T-95 Technology and the Human Factor in War.

T-100 Modern Weapons Technology and the Simulation of Modern Combat in the 1980s.

T-110 Weapons, Technology and the History of Tactical Innovation.


T-140 Analyzing Trends in Modern Ground Combat.

U-1 Understanding War From Historical Experience (with Arnold C. Dupuy.) Published in Phalanx, Dec. 1984.


V-0 Military History and Validation of Combat Models.

V-1 The Timeless Verities of Combat.

V-10 Veterans Day.


W-15 War, Civilization, and History. Published in the Baltimore Sun, May 15, 1992, under the title “We Are Less Warlike, if Not Kinder and Gentler.”

W-20 War Since 1945.

W-50 The Warrior and Morality in War.

W-70 Washington and Greene.

W-80 Thoughts on the Effect of Weather on Combat Outcomes.

W-90 The West and the Tide of History.

W-100 Women in Combat: The Challenge of the 1980’s: Are Women Combat-Ready?


W-130 World War I.

W-140 The War Against Japan.

NB-1 Estimates of Possible US Casualties in a War Between United Nations Forces and Iraq (with Curt Johnson.)

NB-2 Estimates of Possible US Battle Casualties in Three Excursions of Gulf War Scenarios (With Curt Johnson and David L. Bongard.)

BOOK REVIEWS BY TREVOR N. DUPUY


DESERT VICTORY; THE WAR FOR KUWAIT. By Norman Friedman, Naval Institute Press, Annapolis, Md., 1991.

Greetings to all QJM/TNDM users. This article provides the background on some highly successful uses and modifications of QJM that have been undertaken by Boeing Defense & Space Group (D&SG) Strategic Analysis organization over the last few years. QJM was originally acquired by Boeing Aerospace Company in the mid-1980s from Data Memory Systems Inc. This of course was the Pascal code of version 3.1. The model was used a number of times in analytical studies, but was not prominent in the Boeing stable of constructive models of military operations.

Things changed in the early 1990s. The general downsizing of the US defense industry with the end of the Cold War affected Boeing D&SG as it did other military contractors. As the personnel strength of organizations shrank many modeling tools became inactive. The times were also changing in other ways. There was a growing emphasis on deductive rather than inductive warfighting analysis. Simply put, the military wanted to know the effects of new products or weapon systems on joint warfighting at theater or campaign levels rather than their benefits at a one on one or few on few level of resolution. The latter was the province of large, detailed computer based simulations such as CASTFOREM or MIL–AASPEM. The other was entirely new and called for simple, rapid turn around, aggregated modeling.

The first test of this new analytical environment came in the US Air Force Multi–Role Fighter Request for Information (RFI) in 1991. This analysis required the modeling of three theater level combat scenarios and the generation of data not only on the air campaign, but also its effects on the ground war. While Boeing D&SG could well analyze the air component using the OME III (Optimal–Marginal Evaluator III) air campaign simulation model, the ground war representation was problematic. It was here that QJM entered the arena.

It was suggested that QJM could be modified to accept one of OME III outputs (basically a sortie/kill schedule) as an expected value for high performance ground attack aircraft. However, for various reasons, the Pascal version of the model was unsuitable for this. The modification was accomplished by rehosting QJM in an automated LOTUS spreadsheet environment where all battle dynamics would be highly visible. Specialized output files were also devised. To make a long story short, literally hundreds of runs were made in a batch mode reading DOS files from OME III output into the spreadsheet and then fighting the ground war under normal QJM methodology. MRF Program office personnel indicated that the resulting data was far more timely, detailed, and insightful than results obtained by many Boeing competitors in the RFI using other models and methodologies.

As Boeing D&SG reorganized in the early 1990s, QJM came into more prominence as an analytical tool. Fast paced and rapid analysis became a requirement under the shrinking defense budget as a means of advocacy for weapon systems and defense programs. There was literally no time to run “big” models. In 1992, Boeing D&SG initiated its Combined Arms Study project. This was a broad brush, high level analytical effort focused on theater joint warfighting requirements under radically new scenario conditions. QJM assumed a premier role in this effort and was soon joined by a Boeing developed fast turn model—the Major Regional Conflict Air Campaign Model (MRC). Using these two models in harness, over five hundred “runs” were made during 1993 alone in support of Boeing efforts to focus product line emphasis, provide alternative analyses associated with the Bottom Up Review, and support of internal and external customers. During this time further modifications and improvements to the model were made. Special accumulators were devised to track data of interest such as “killed by ground” vs “killed by air” statistics. Artillery–delivered “smart munitions” effects were added as were modifications as to how attack helicopters were “played.”

During this period the MRC–QJM team was used to quickly evaluate a wide variety of scenarios and effects of new weapon systems. Among these were the Conventional Air Launched Cruise Missile (CALCM), Advanced Airborne Command and Control (A2C2), Joint Direct Attack Munition (JDAM), Advanced Short Takeoff Vertical Landing (ASTOVL) fighters, bomber delivered sensor fused weapons (SFW), bomber fleet structure studies, and literally dozens of other topics.

In 1994 Boeing D&SG Strategic Analysis organization was called upon by Boeing Helicopters to assist in the analysis of the RAH-66 Comanche reconnaissance–attack helicopter. This led to the most extensive modification of the model to date. A major question as to the value of reconnaissance and the role Comanche and other reconnaissance, surveillance and target acquisition (RSTA) systems contributes to battle outcomes was being debated within the US Army. There was no methodology in place within models to assess this in general. Colonel Dupuy felt that “intelligence” was an “intangible; probably individually incalculable” factor in combat. While this probably remains true due to the human cognitive processes involved in the perception of “intelli-

gence,” we felt that he would agree that sensors and reconnaissance assets could be scored under QJM methodology much like weapons. This required a scoring methodology for sensors and recon platforms, the modification of input files to account for and track some twenty RSTA categories which include night vision devices, ground surveillance radars, airborne imagers, scouts, recon vehicles, recon helicopters, SIGINT collectors, and others. The sensor profiles of opposing forces are compared in a calculation that accounts for effects of weather, terrain, force size, command and control effectiveness, and camouflage and deception. There was then the question of how to apply the resulting factor. Embedded in the classic QJM historical Combat Effectiveness Value (CEV) are any number of intangible or hitherto uncalculated factors such as leadership, command and control and certainly the reconnaissance effectiveness of the force. It was felt that the reconnaissance factor could be most appropriately used in a manner similar to a Combat Effectiveness Value (CEV) influencing Combat Power and attrition rates.

The modification was highly successful in supporting the RAH–66 Comanche program and provided valuable insights as to the relative “worth” of various sensor profiles, army aviation force structure alternatives, and the influence of RSTA in battles pitting US forces against a diverse population of adversary forces in the near to far term.

Since then, the Boeing QJM continues to be a prominent tool for analytical studies. Most recently, QJM is again being called upon along with its partner MRC for a new series of campaign analyses. There are also preliminary plans for a Boeing “Super QJM” hosted in an advanced computing environment with graphical user interfaces and expanded capabilities. At the same time we are highly interested in the exciting new methodologies, databases, and capabilities inherent in the TNDM, and have been in dialogue with The Dupuy Institute regarding mutually beneficial relationships.

QJM is not the only model used for Boeing analytical studies. Many other tools of differing complexity, resolution, and purpose are required in Boeing D&SG studies. However, QJM remains one of the first and the last models run in many cases.

QJM has served Boeing Defense & Space Group well in providing rapid, detailed, and insightful data in support of a diversity of studies no other one model could have accomplished. Its inherently flexible and agile methodology is adaptable to change and growth with little expenditure of time and resources. Its historically validated database substructure provides a powerful tool for top level analyses of future warfighting situations.
Dear Mr. Lawrence,

I have received the new issue of the TDI newsletter and it was of course with great interest I read your comments on my article. I have only two remarks on your reply. The first is that I am glad you took up the differences in casualty reporting. The second is that I am not a professor. Probably my title, “senior researcher” is quite misleading. As you are aware of I previously worked at the Swedish National Defence Research Establishment (Foa). Since the War College is still in a transition period to a more academic organization, I have opted to retain my title from the Foa. That title is awarded if qualified scientific reports or articles have been published in sufficient quantity and quality.

To me titles have very little meaning, and I don’t bother about it in what has been written, but in the future it might be good not to “overqualify” my titles.

It was very interesting to read the articles on armour. I have not been really satisfied with the way TNDM treats armour, but neither have I recognized any simple solutions to the problems. One problem which has bearing upon the CEV calculations is the low values for the German Panther tank (even though it has no effect on the engagements in Italy I discussed in my article since there were no Panthers there at that time). The OLI values given in the table on page 33 suggest that the T-34/85 was better than (using the old OLIs) or much better (using the new OLIs) than the Panther. This is a conclusion I believe few T-34/85 tank crews would agree upon.

I think there are several reasons for the problems with AFV OLIs. First of all a punishment factor based on the weight of the vehicle is a rather coarse method. But I think the fundamental problem is that “soft” and “hard” targets are different in important aspects. For modelling purposes “soft” targets, and weapons designed to hit such targets, are much more linear than “hard” targets. A 50% increase in armour protection on a Sherman tank would be practically no benefit at all if main enemy antitank system is the Pak 43 8,8 cm L71 gun. It would however make considerable difference if the main enemy is the Pak 40 7.5 cm L46 gun. This also hits upon another problem. Not only has AFV combat more step like functions if it is to be simulated in a computer program but the effects of systems tend to be more relative than absolute compared to “soft” targets. This results in a much more complicated problem, especially when trying to develop algorithms. I have been working on a program for WWII battalion level ground combat and I am working with separate capabilities and effects against armour and other weapons. It has proved quite complicated to combine these and I can well understand if you are reluctant to discontinue using a single OLI value for a system.

Sincerely

Niklas Zetterling
A Rebuttal to “Force XXI and the Theory of Winning Outnumbered”

by Christopher A. Lawrence

I was recently shown an article by Lt. Col Leonhard in the June 1996 issue of Army called “Force XXI and the Theory of Winning Outnumbered.” Unfortunately it was published more than a year before I saw it, so there was not much point to writing a letter to the editor. Instead, I will address it in this newsletter.

The author quoted Trevor, and then constructed a database of battles from some questionable secondary sources. From this database he discovered that 56.5% of the battles were won by the side with the smaller number of soldiers. He also discovered that the defense won 24.5% of the time. He therefore concludes that “...in battle, the smaller side wins more than half the time” and “Numbers were apparently not just irrelevant, but actually seemed harmful to the cause” and “...increased mass on a single battlefield simply increases friendly casualties” and “too often, we have accepted the received wisdom that large numbers win battles, despite evidence to the contrary” and finally “to divorce ourselves from attrition theory—demonstrably fictitious in its bloody conclusions—is a necessary step for the Army to take as an institution.”

The Land Warfare Database rates mission success for each side (attacker and defender) by a 10 point scale. I decided to use this database (which is developed from a combination of primary and secondary sources) to measure winners and losers based upon force ratios. Like Col. Leonhard, I used the aggregate personnel strengths for comparisons, and did not look at any other factors except whether the unit was the attacker or defender. I certainly didn’t look at how the force was armed, trained, deployed, or led.

To calculate winner or loser, I assigned a value of “+1” to a battle if the attacker’s mission accomplishment score was greater than the defender’s score, a value of “0” if both scores were the same, and a value of “-1” if the defender’s mission accomplishment score is greater than the attacker’s.

I also created a second field which measured the difference between the two mission accomplishment scores, with the positive value being attacker wins and the negative values being defender wins. The larger the value, the greater the win.

I found that the attacker won in 367 out of 605 cases (61% of the time), the result was drawn in 41 cases (7%), and the defender won in 197 cases (32%).

Force ratios were calculated by dividing the defender’s strength into the attacker’s strength. Therefore, a force ratio greater than 1 means the attacker is stronger than the defender, while a force ratio less than 1 means the defender is stronger. There are eleven cases where the force ratio is 1.

The following matrix shows the results of the database:

<table>
<thead>
<tr>
<th>Force Ratio</th>
<th>&gt; 1</th>
<th>1</th>
<th>&lt; 1</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attacker Won</td>
<td>271</td>
<td>7</td>
<td>89</td>
<td>367</td>
</tr>
<tr>
<td>Draw</td>
<td>35</td>
<td></td>
<td>6</td>
<td>41</td>
</tr>
<tr>
<td>Defender Won</td>
<td>126</td>
<td>4</td>
<td>67</td>
<td>197</td>
</tr>
<tr>
<td>Total</td>
<td>432</td>
<td>11</td>
<td>162</td>
<td>605</td>
</tr>
</tbody>
</table>

Overall, the larger side won 56% of the time (271 + 67) while the smaller side won 36% of the time (89 + 126). The sides were equal or the result was a draw in 52 cases (9%).

Leaving out the draws and battles where the two sides were equal, then the larger side won 61% of the time over the smaller side. This matches Trevor’s figures which Col. Leonhard quotes. This database was certainly the source of Trevor’s figures as quoted in Col. Leonhard’s article.

Looking further into these figures, in the 367 cases where the attacker won, he had superior numbers 74% of the time. This would indicate a strong bias in favor of numbers for the attacking force.

In the 193 cases where the defender won, 64% of the time they were numerically inferior. This would indicate that the defense is the stronger form of combat.

Col. Leonhard questions whether “defense is a stronger form of combat than the attack.” He assumed that this would be shown by the defense winning more often than not. But, as more often than not, the force with the inferior strength assumes the defense, one would expect is a law of numbers to be at play here and that the defense would lose more often than not. Both his database and the LWDB show this.

The point is that for the attacker to win, he had to outnumber the defender 74% of the time, while the defender was able to win while outnumbered 64% of the time.

Col. Leonhard’s data goes from ancient times to around 1900, I gather. Needless to say, getting accurate data before 1800 gets a little difficult, and getting accurate data before 1600 is real tricky.

In the LWDB, 364 of the engagements (60%) are from this century. While I am not happy with the “representativeness” of the data in the LWDB, it is certainly better than what Col. Leonhard has gathered. While I also would like to improve the quality of the data in parts of the LWDB, again, its sourcing and work is superior to the various secondary source battle books that he has used.

Looking at the data over time shows the following:

(continued on next page)
As each side was rated with a mission accomplishment score of 1–10, I created a series of graphs based upon that score as the X axis. This was done by subtracting the defender’s score from the attacker’s score. A positive value is an attacker win, a “0” is a draw, and a negative value is a defender win. The larger the absolute value of the score, the larger the victory.

<table>
<thead>
<tr>
<th>Force Ratio</th>
<th>Force Ratio</th>
<th>% Attacker Wins &gt;= 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;= 1</td>
<td>&lt; 1</td>
<td></td>
</tr>
<tr>
<td>1600-1699</td>
<td>16</td>
<td>18</td>
</tr>
<tr>
<td>1700-1799</td>
<td>25</td>
<td>16</td>
</tr>
<tr>
<td>1800-1899</td>
<td>47</td>
<td>17</td>
</tr>
<tr>
<td>1900-1920</td>
<td>69</td>
<td>13</td>
</tr>
<tr>
<td>1937-1945</td>
<td>104</td>
<td>8</td>
</tr>
<tr>
<td>1967-1973</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>278</td>
<td>89</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Force Ratio</th>
<th>Force Ratio</th>
<th>% Defender Wins &gt;= 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;= 1</td>
<td>&lt; 1</td>
<td></td>
</tr>
<tr>
<td>1600-1699</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1700-1799</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1800-1899</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>1900-1920</td>
<td>13</td>
<td>1</td>
</tr>
<tr>
<td>1937-1945</td>
<td>17</td>
<td>0</td>
</tr>
<tr>
<td>1967-1973</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>130</td>
<td>67</td>
</tr>
</tbody>
</table>

I think these make the point. They are even beginning to look like some form of distribution curve.

I have also used the computer to count the number of cases for each “degree of winning.” These follow:

<table>
<thead>
<tr>
<th>Force Ratio</th>
<th>Force Ratio</th>
<th>% Defend the Force Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;= 1</td>
<td>&lt; 1</td>
<td></td>
</tr>
<tr>
<td>1600-1699</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>1700-1799</td>
<td>11</td>
<td>13</td>
</tr>
<tr>
<td>1800-1899</td>
<td>38</td>
<td>20</td>
</tr>
<tr>
<td>1900-1920</td>
<td>30</td>
<td>13</td>
</tr>
<tr>
<td>1937-1945</td>
<td>33</td>
<td>10</td>
</tr>
<tr>
<td>1967-1973</td>
<td>11</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>130</td>
<td>67</td>
</tr>
</tbody>
</table>
I put these both on the same scale, so the results are easy to compare. Only the area of truly great wins (value of 8) does the smaller force appear to do as well in the attack. In most of these cases, the winner was wearing kilts and swinging claymores. I do not propose that we make these changes for Force XXI.

Finally I have graphed the “Degree of Winning and Losing by Force Ratio, using the average of the total strength ratio,” as displayed in the following charts:

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Finally, I printed out a collection of charts using the 14 “Wars” as I defined in my previous article. I also decided to play with all my various functions in the software, so you get the charts by averages, counts, standard deviation, etc. Improved software usually does not result in increased efficiency, merely an increase amount of paper produced. Remember, “−1” means the defender won, “0” is a draw, and “+1” is an attacker win. The charts appear on the following page.
This last graph is interesting in that it shows that in no case is the winner less than \( \frac{1}{4} \) the strength of the loser. This would clearly indicate that numbers count absolutely when you have less than \( \frac{1}{4} \) the strength of the enemy. ☺️
Trevor Nevitt Dupuy was born in New York on May 3, 1916. He attended the US Military Academy in West Point, graduating in the class of 1938. During WWII he commanded a US artillery battalion, a Chinese artillery group, and the artillery of the British 36th Division. He was always proud of the fact that he had more combat time in Burma than any other American, and received numerous decorations for valor from the US, British, and Chinese governments.

After the war Trevor served on the War Department General Staff, OPD from 1945 to 1947, and as military assistant to the Under Secretary of the Army from 1947 to 1948. He was a member of the original SHAPE staff in Paris under Generals Eisenhower and Ridgway from 1950 to 1952.

Between 1952 and 1956 Trevor was a member of the founding faculty of the Harvard Defense Studies Program. In 1956 he became Director of the Ohio State Military Studies Program. In 1958, after retiring from active military duty, he served as a visiting professor in the International Relations Program at Rangoon University in Burma.

Trevor came by his interest in military history through his father, who was a prominent military historian and a career army officer. Trevor wrote, “I was brought up by my father to be both a soldier and a military historian. To him the two were inseparable, and that is the way it has always been for me.”

His writing career began in 1952, when the Army reinstated the teaching of military history in ROTC courses, and Trevor received a faculty appointment at Harvard University as a professor of Military Science and Tactics. Because there was no text, Trevor asked his father to help him write a textbook to be used by his students. They each wrote a chapter every two weeks, and each week Trevor mimeographed the new chapter to distribute to his students. By the end of the academic year, the father and son had completed the two–volume textbook, *Military Heritage of America*, the first of many such endeavors.

From 1960 to 1962 Trevor worked for the Institute of Defense Analysis. In 1962 he formed the first of his research companies, Historical Evaluation and Research Organization (HERO), of which he remained President and Executive Director until 1983. From 1967 to 1983 he was also President of T. N. Dupuy Associates Inc. (TNDA), which became the parent organization for HERO. In 1983, TNDA sold its assets (including HERO) to a new corporation he formed called Data Memory Systems, Inc. (DMSI). Trevor was the president and largest stockholder in DMSI. In 1990, he resigned from DMSI, sold his stock and reactivated TNDA. In 1992 TNDA was closed out, and Trevor established the non-profit corporation The Dupuy Institute (TDI). The non-profit status was merely recognizing what had been the financial status of all his companies over the last 30 years.

During these years he became a prolific author and lecturer on many subjects, giving lectures at war colleges and official and private defense analysis agencies in more than 20 countries on five continents. His combat experience in the far East gave him a practical outlook, which tempered his theoretical orientation. He was a reflective and independent thinker who was enthralled by the political aspects of military power and who possessed unique energy, creativity, concentration and perseverance. He also had the uncanny ability to take some data and instantly derive a new meaning or relationship that was not obvious, but almost always turned out to be correct. He challenged conventional wisdom with a completely new outlook for the empirical study of combat.

Through the years his interest in military history analysis grew as he discovered continuous trends and patterns in the historical accounts he read and wrote. He believed the lessons of previous combat could and should be used as a basis for winning the next war. But he also recognized that analysis of military history was ignored in the US approach to almost all issues of national security and military problems, although it was relevant to most. He perceived that the current methodology and models used in the US failed because they lacked realism; they attempted to evaluate human behavior in combat according to theoretical design characteristics without consideration of how human beings actually behaved in real combat. He saw that it was futile to do accurate combat experiments in any controlled peacetime environment because it was impossible to recreate the very pervasive aspect of fear in a lethal environment. Therefore, he often said, military history must instead be considered the only real laboratory of the soldier.

The development of the Quantified Judgment Method of Analysis began in 1964, when HERO performed a study for the Army’s Combat Developments Command called
“Historical Trends Related to Weapons Lethality.” The study involved developing a process to compare the lethality of weapons over the course of history. This resulted in a measurement scale providing “theoretical lethality indices.” Awareness of the dynamic interrelationship among dispersion, mobility, and firepower led to the development of further measurement scales, and subsequently to the QJM model, and later the TNDM.

In most fields of human endeavor, new developments are unlikely to receive immediate endorsement by the authorities in that field, and the QJM was no exception. One of Trevor’s greatest frustrations was his inability to get the US Defense establishment to pay more attention to the results of his historical analysis. He was impatient with people who did not recognize the wisdom of his insights, and his criticism tended to be explicit. In Europe and the Middle East he was considered an eminent person and became the confidant of chiefs of staff and defense ministers. In the US, while many agencies valued his research and insights, they often downplayed the value of his analysis, as it was not based on “traditional” operations research methods. In fact, he was often prevented from following his frequent creative urges by the pressure of meeting payrolls and deadlines. Yet although he could easily have sold out for the comfort of a stable job, he believed that his independence was a prerequisite for pursuing his work. Besides, he was not really interested in making money; what he really wanted was recognition of the validity of his theories about the historical analysis of combat. For over 30 years he persevered in this cause despite indifference, opposition and lack of reward, hoping to advance the use of history to protect both national and global security.

When Trevor died on June 5, 1995, he left many projects unfinished, but there were four that he had especially hoped to complete. These included a critical and comprehensive biography of Douglas MacArthur, and a book entitled The Fighting Generals, about the interaction of Stilwell and Chennault in East Asia in WWII. Another book project, The Documented History of the US Armed Forces was 90% complete when he died, and the manuscript now occupies four and a half linear feet of file cabinets in the office at TDI. The fourth unfinished project was his own autobiography, which he thought could be interesting in light of his very unusual combat experience in Burma during WWII, his work as a staff officer in high–level staffs which involved significant critical matters during the Cold War, and his travels and adventures as an author, lecturer and military analyst in later years. He had planned to call this book A Footnote to History.

Trevor has been characterized as a genius and a prophet. His contributions to the store of human knowledge in terms of the derivation of a theory of combat and philosophy of war are of outstanding value. He is the author or co–author of more than 80 books and more than 100 articles published in professional and military journals in many countries. The Departments of State and Defense sought his viewpoint when war broke out in the Persian Gulf, and he was asked to give his advice to the US Congress on several occasions. The media also sought him, and he appeared on more than 30 television and radio shows, including the “Today Show,” the “Larry King Show,” the major networks, C–Span and Cable News Network. He was recognized as one of the very few people who was truly qualified to interpret international crises while they developed, and at the time of his death, was considered one of the world’s leading military historians. Those of us here at TDI, his loyal friends and employees, are continually aware of his influence. We retain a keen respect for the intricate quality and amazing quantity of catalogued historical knowledge he left under our care. We are challenged by what he left for us to fathom without him.

“My personal feeling is that if I have done anything worthwhile, it is in military theory and the relationship of the elements of historical experience to theory.”

—Trevor Dupuy