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COMPARATIVE ANALYSIS
 ARAB AND ISRAELI COMBAT PERFORMANCE
 1967 AND 1973 WARS

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54 Comparative Analysis: Arab and Israeli
 Combat Performance 1967 and 1973 Wars
 (1976)

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HISTORICAL EVALUATION AND RESEARCH ORGANIZATION

ERRATA

Comparative Analysis
Arab and Israeli Combat Performance
1967 and 1973 Wars

<u>Page</u>	<u>Figure</u>	<u>Change</u>
7	2	Column 7 heading from 1/12 Div to read 1/8 Div 1/36 Bde 1/24 Bde
9	6	Eng. No. 67-2 should read Abu Ageila-ūm Katef
10	8	June 8, columns 3 and 4 should read 10.1(100) and 10.1(4) respectively
10	9	June 5 line should read across: 28, 78, (1)18, 1(46), (10), (32), ..., .., .., ..
23	33	For engagements 22, 23, 24, change Arab CEV column to read down: 1.70, 0.73, 0.26
23	33	For engagements 22, 23, 24, change Israeli CEV column to read down: 0.59, 1.36, 3.85
24	35	For 1967 - West Bank (far left column) change Israeli CEV to 1.95 (far right column)
26	last para.	Change first line to read: In 1970, following an equally dismal performance against Jordan, there had been one more coup d'etat, led this time by the then Minister of War, Air Force General Hafez al Assad.

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COMPARATIVE ANALYSIS, ARAB AND ISRAELI COMBAT PERFORMANCE
1967 AND 1973 WARS

A HERO Report

INTRODUCTION

OBJECTIVE

The purpose of this study by the Historical Evaluation and Research Organization (HERO), was stated in the Task Order to be as follows:

Utilizing data already available to HERO, with such additions and refinements as are mutually agreed by HERO and OASD(I) to be necessary and feasible within budgetary limits of the study, HERO will analyze approximately ten engagements, each, at brigade level or higher, for the 1967 Six Day War, and the 1973 October War, employing both the Quantified Judgment Method of Analysis of Historical Combat Data (QJMA) and qualitative historical analytical techniques, in order to ascertain the following:

- a. Relative combat effectiveness of the opposed forces in each engagement;
- b. Patterns or differences in relative combat effectiveness of different Arab units and armies;
- c. Patterns or differences between relative Arab-Israeli combat performance in 1967 and in 1973;
- d. The extent to which Arab and Israeli relative performance changed between offensive and defensive postures;
- e. The extent to which the presence or lack of airpower appears to have influenced combat outcomes;
- f. The extent to which outcomes were influenced by any other variables of combat.

The tasks to be performed and the procedures to be followed, according to the Task Order, were:

1. Compilation of data; to include such additions or refinements of existing HERO data as may be necessary, assuring compatibility, to the extent possible, with data used in ongoing analyses of the Middle East Balance;
2. Quantitative analysis of the 1967 War data by QJM;
3. Qualitative analysis of 1967 War data;
4. Quantitative analysis of 1973 War data by QJM;
5. Qualitative analysis of 1973 War data;
6. Comparative evaluation of results of steps 2-5, inclusive;
7. Preparation of Report.

DATA SOURCES

In the performance of Step 1, data on the 1973 war already available to HERO was reviewed and refined on the basis of information collected for a report on "The Middle East War in Historical Perspective," prepared for the Director of Net Assessment, Department of Defense, and additional information received in conversations with Major General Avraham Adan, Israeli Army, and Colonel Avraham Ayalon, Israeli Army.

Data on the 1967 War is that compiled in an unpublished operational narrative of that war prepared by Colonel T.N. Dupuy, USA, Ret., with assistance of members of the HERO staff, which has been reviewed and commented on by military officials of the Israeli, Egyptian and Jordanian armed forces.

A cursory check of some items of classified data on the October War led to a conclusion that the HERO unclassified data is probably just as accurate; thus no classified data was used in the study, and accordingly this report is not classified.

PARTICIPANTS

Most of the work on this study and this report was done by Colonel T.N. Dupuy, USA, Ret., and Colonel John A.C. Andrews, USAF, Ret. Contributions to the study were also made by Grace P. Hayes and Vivian Lyons, of the HERO staff. The undersigned takes full responsibility for the results of the study and this report.

Dunn Loring, Virginia
15 June 1976

T.N. Dupuy
Executive Director

COMBAT PERFORMANCES IN THE 1967 WAR

THE DATA

Figure 1 is a summary of major statistical data of the 1967 "Six Day War," including overall strengths and losses of personnel and selected major items of equipment for all major participants. Figures 2, 3, 4, and 5 present more detailed listings of the principal varieties of weapons and combat equipment estimated to be on hand in the Israeli, Egyptian, Jordanian and Syrian armies as of 1 June 1967, showing presumed allocations to major combat formations, such as divisions and brigades.

Figure 6 is a listing of all major engagements on all three fronts, between June 5 and June 10. Figure 7 is an estimated breakdown of the presumed total Israeli and Egyptian casualties on the Sinai front, with allocations to days and engagements based upon professional historical and military judgment in consideration of the Dupuy detailed narrative of operations cited under "Data sources" in the Introduction to this report. Figure 8 is a comparable breakdown of presumed Israeli and Egyptian tank losses on the Sinai front, by day and by engagement. Figure 9 is a comparable breakdown of estimated direct air support allocations by the Israeli and Egyptian air forces, also related to engagements and dates.

Figures 10, 11, and 12 provide comparable data estimates for the Jordan, West Bank, Front, June 5-7, 1967. Figures 13, 14, and 15 provide comparable data estimates for the Syrian, Golan, Front, June 9-10, 1967.

Available resources of time and funds permitted analysis of only twelve engagements of the 1967 War—four on each front. This was a total of two more 1967 War engagement analyses than was provided for in the Task Order.

DATA ANALYSIS

Figure 16 is a sample engagement data sheet for Engagement 67-1, the Battle of Rafa, June 6, 1967. Figure 17 is a sample engagement calculation sheet for the engagement, showing the application of the data to the formulae of the Quantified Judgment Model (QJM). The entries for Figure 18, "Preliminary 1967 Arab-Israeli War Analysis," are derived from these and comparable data and calculation sheets for the other eleven engagements. That figure provides a summation of the QJM analyses of these engagements, and is the essence of this study's quantitative analysis of the 1967 War.

The columns of Figure 18 are described as follows:

1. Engagement number (see Figure 6)
2. Numerical manpower comparison (Arab with respect to Israeli)
3. Firepower comparison ratio
4. Relative Combat Power, basic calculation, in which all readily-identifiable combat variables have been considered;
5. The effects of surprise, reflecting effects of surprise on relative mobility and vulnerabilities of the opponents as calculated for World War II engagements.¹
6. Modified Combat Power Ratio (to reflect effects of surprise)
7. Engagement outcomes
8. Effective Combat Power Ratio; the ratio that would have been required for average ratio-result relationship in World War II engagement data base ($(R - R)/5 + 1$)
9. Arab Combat Effectiveness Value (CEV); calculated by dividing entry in column 8 by that in column 6.
10. Israeli CEV (reciprocal of Arab CEV)

¹See, T.N. Dupuy, The Quantified Judgment Method of Analysis of Historical Combat Data. HERO, Dunn Loring, Va., 1976.

During the process of analysis of the data in Figure 18, and that of Figure 34 (containing similar analytical data from 1973 War engagement analyses), three analytical hypotheses have been formulated:

1. Arab performance in situations and circumstances in which they were following carefully prepared pre-war plans was substantially better than when coping with unanticipated combat situations; this ability is estimated at about a 30% improvement over standard performance in pre-planned operations.²

2. The effects of surprise in 1967 and 1973 combat situations was clearly more significant than it had been in combat between the Germans and the Western Allies in 1943 and 1944; this increase appeared to be proportional to the greater average dispersion of troops in these wars (about 4,000 square meters per man) than in World War II (about 3,000 square meters per man). This enhanced value of surprise in an increasingly scientific-technical environment seems to be consistent with Soviet assessments, as represented by the following quotation from Scientific-Technical Progress and the Revolution in Military Affairs by Colonel General N.A. Lomov (Moscow, 1973):

Scientific-technical progress is the material basis of those revolutionary changes which have occurred in the Soviet Armed Forces in recent years. . . . /This/ revolution in military affairs to a significant degree has raised the importance of surprise. High combat readiness of the Soviet Armed Forces is caused by the most important of all the tasks confronting them—that is, to thwart the intentions and provide a decisive and complete defeat to any aggressor. The present capabilities of the Soviet Armed Forces make it possible to solve this problem.

3. The disruptive effects of surprise evidently continue for at least two days after the surprise is achieved. For the first day it is about two-thirds the disruptive effect of the surprise as calculated for the day it occurs, and about one-third the initial surprise disruptive effect on the second day after surprise is achieved.

The application of these hypotheses to the analytical results of Figure 18 provides somewhat refined values for combat effectiveness, as shown in Figure 19.

The refined analysis reflected by the values in Figure 19 shows remarkably consistent values in relative combat effectiveness of the opponents within each of the three sets of four engagements on the three separate fronts. It shows that the Israeli combat effectiveness superiority over the Egyptians was on the average 96%, or a CEV of 1.96; their superiority over the Jordanians was on the average 63%, or a CEV of 1.63; Israeli superiority over the Syrians was on the average 313%, or a CEV of 4.13.

Normalizing these relationships on the Syrian performance provides the following interesting comparison:

Israelis	4.13	(1.63)	(1.96)	
Jordanian	2.53	(1.00)	--	(1.20)
Egyptian	2.11	--	(1.00)	(1.00)
Syrian	1.00			

²This phenomenon has also been noted in World War II engagements between Russian and German forces, supporting a more general hypothesis: when a force of lower combat effectiveness is able to seize the initiative and operate in accordance with carefully prepared plans for either offense or defense, the combat effectiveness differential is reduced by one-third.

Figure 1. APPROXIMATE FORCE STRENGTHS, SIX-DAY WAR, 1967

Available	Israel	Total Arabs	Egypt	Jordan	Syria	Iraq
Mobilized Manpower	210,000	309,000	200,000	46,000	63,000	--
Tanks	1,000 ^a	2,337	1,300 ^d	287 ^f	750	--
APC	1,500 ^b	1,845	1,050	210	585	--
Artillery Pieces	203	962	575	72	315	--
SAM	50	160	160	0	0	--
AA Guns	550	2,050 ⁺	950	?	1,100	--
Combat Aircraft	286 ^c	682	431 ^e	18	127 ^g	106

^a200 M-48, 250 Centurions, 150 AMX-13, 400 Sherman-Super Sherman.

^bHalftracks.

^cIncludes 92 Mirage, 24 Super Mystere, 72 Mystere, 55 Ouragan, 24 light bombers.

^dIncludes 400 T-34, 450 T-54/55, 100 Su-100, 100 JS-3.

^eIncludes 55 Su-7, 163 MiG-21, 40 MiG-19, 100 MiG-15/17, 30 Tu-16, 43 Il-28; short of pilots.

^fIncludes 200 M-48, 80 Centurions.

^gIncludes 40 supersonic, 68 MiG-15/17, 15 Tu-16, 4 Il-28.

Figure 2. ESTIMATED ISRAELI ARMAMENT SUMMARIES, 1967

	Inf Bde	Meczd Bde	Armd Bde	Armd Rgt	Arty Rgt	1/12 Div 1/36 Bde Misc Units	9 Arty Rgts	2 Armd Rgts	14 Inf/Para Bde	2 Meczd Bde	8 Armd Bde	Totals
Personnel	4,300	4,300	3,600	2,000	1,000	25,000	9,000	4,000	60,200	8,600	28,800	135,600
Pistol	430	430	360	200	100	2,500	900	400	6,020	860	2,880	13,560
Rifle	3,870	3,870	3,240	1,800	900	22,500	8,100	3,600	54,180	7,740	25,920	122,040
Machine Gun, lt	120	80	40	30	10	250	270	60	1,680	160	320	2,740
Machine Gun, hvy	80	60	40	30	20	420	270	60	1,120	120	320	2,310
Mortar, 81mm	20	10	..	..	..	..	..	..	280	20	..	300
Mortar, 4.2"	12	8	..	..	..	..	..	..	168	16	..	184
Bazooka	20	10	..	..	5	45	45	..	280	20	..	390
AT Missile SS-10/11	12	4	..	..	..	78	..	..	168	8	..	254
RR, 106mm	6	4	..	..	..	..	..	..	84	8	..	92
APC, Halftrack	50	200	20	12	3	126	27	24	700	400	160	1,437
AA, lt, 20mm	16	12	12	6	2	140	18	12	224	24	96	514
AA, lt, 40mm	..	..	..	..	4	76	36	..	..	..	..	112
Hawk	..	..	..	..	..	50	..	..	..	..	..	50
How, 105mm	..	..	..	..	..	..	(4)96	..	..	..	..	96
How, 155mm	..	..	..	..	..	..	(3)72	..	..	..	..	72
Gun, 155mm	..	..	..	..	..	..	(1)24	..	..	..	..	24
Gun, 175mm	..	..	..	..	..	..	(1)12	..	..	..	..	12
Tanks	10	30	90	40	..	..	..	80	140	60	720	1,000
AMX-113	..	10	(30)	(40)(10)	..	..	..	(80)(20)	..	20	(240)	150
M-48 (90)	..	..	..	..	..	..	..	..	..	..	..	200
Super Sherman	10	20	(90)(60)	(30)	..	..	..	(60)	140	40	(720)(480)	400
Centurion	..	..	..	..	..	..	..	..	..	..	..	250
APC, Halftrack	50	200	20	12	3	125	27	24	700	400	160	1,436
Trucks	150	150	150	75	100	2,500	900	150	2,100	300	1,200	8,586
SP Mounts	30	30	38	19	25	200	225	38	420	76	304	1,263

Figure 3. ESTIMATED EGYPTIAN ARMAMENT SUMMARIES, 1967

	Inf Div	Tank Div	Tank Bde	Inf Bde	Arty Rgt	1/10 Div Misc Units	15 Arty Rgts	5 Inf Divs	2 Tank Divs	5 Inf Bdes	7 Tank Bdes	Totals
Personnel	10,000	10,000	3,500	4,000	1,000	15,000	15,000	50,000	20,000	20,000	24,500	144,500
Pistol	1,000	1,000	350	400	100	1,500	1,500	5,000	2,000	2,000	2,450	14,450
Rifle	9,000	9,000	3,150	3,600	900	13,500	13,500	45,000	18,000	18,000	22,050	130,050
Machine Gun, lt	360	270	85	120	75	200	1,125	1,800	540	600	595	4,860
Machine Gun, hvy	240	160	55	80	75	150	1,125	1,200	320	400	385	3,580
Mortar, 2"	20	10	12	10	..	50	..	100	20	50	84	304
Mortar, 82mm	50	..	..	16	..	..	..	250	..	80	..	330
Mortar, 120mm	12	..	..	4	..	..	..	60	..	20	..	80
RL, 40mm	50	10	..	16	10	100	150	250	20	80	..	600
GAT, 85mm	48	24	..	24	..	..	..	240	48	120	..	408
Schmel AT Missile	24	12	..	8	..	..	..	120	24	40	..	184
RR, 107mm	24	12	..	8	..	..	..	120	24	40	..	184
AMG ZPU-2	9	9	6	6	6	100	90	45	18	30	42	325
AAMG ZPU-4	9	9	..	..	..	100	..	45	18	..	..	163
AA, 37mm	6	6	..	..	..	50	..	30	12	..	..	92
AA, 57mm	12	6	..	..	..	50	..	60	12	..	..	122
AA, 85mm	..	..	..	..	..	..	(5)120	..	..	..	..	120
Mortar, 240mm	..	..	..	..	..	..	(4)96	..	..	..	..	96
How, 122mm	54	36	..	..	..	..	(3)72	270	72	..	..	414
Gun How, 15 mm	12	..	..	..	..	..	(2)48	60	..	..	..	108
Gun, 130mm	..	..	..	..	..	..	(1)24	..	..	..	..	24
AT Su-100 SP	12	10	..	4	..	..	..	60	20	20	..	100
JS-3	12	10	..	4	..	..	..	60	20	20	..	100
PT-76	..	30	10	..	..	..	..	60	..	..	70	130
T-34	20	100	30	..	..	..	..	100	200	..	210	510
T-54/55	..	150	50	..	..	..	..	..	300	..	350	650
APC BTR-50	120	30	10	30	3	..	45	600	60	150	70	925
APC BTR-152	20	10	2	..	..	..	..	100	20	..	14	134
Truck	800	600	200	250	100	500	1,500	4,000	1,800	1,250	1,400	10,450
Motorcycle	60	50	20	20	..	30	..	300	100	100	140	670
SP Mount	36	30	..	10	12	50	180	180	60	50	..	520

Figure 4. ESTIMATED JORDANIAN ARMAMENT SUMMARIES, 1967

	Inf Bde	Armd Bde	Arty Bn	1/10 Bde Misc Units	8 Inf Bdes	2 Armd Bdes	4 Arty Bns	Totals
Personnel	4,500	4,000	500	2,000	36,000	8,000	2,000	48,000
Pistol	450	400	50	200	3,600	800	200	4,800
Rifle	4,050	3,600	450	1,800	32,400	7,200	1,800	43,200
Machine Gun, lt	120	40	10	25	960	80	40	1,105
Machine Gun, hvy	80	40	20	42	640	80	80	842
Mortar, 81mm	20	10	..	..	160	20	..	180
Mortar 4.2"	12	8	..	..	96	16	..	112
Bazooka	20	10	5	10	160	20	20	210
RR, 106mm	6	4	..	..	48	8	..	56
AA, lt, 20mm	16	12	6	12	128	24	24	188
AA, lt, 40mm	..	..	..	12	..	..	..	12
Gun, 25 pdr	12	..	..	..	(6)72	..	..	72
How, 105mm	..	..	(12)	..	(2)24	..	(1)12	36
How, 155mm	..	..	..	..	..	..	(2)24	24
Gun, 155mm	..	..	(8)	..	..	..	(1) 8	8
Tanks	..	..	..	..	..	..	..	240
M-48	..	90	..	..	..	180	..	180
Centurion	..	30	..	..	..	60	..	60
Trucks	150	150	50	250	1,200	300	20	1,770
SP Mounts	20	20	..	20	160	40	..	220
APC, M113, Saracen	50	20	..	10	400	40	..	540

Figure 5. ESTIMATED SYRIAN ARMAMENT SUMMARIES, 1967

	Inf Bde	Meczd Bde	Tank Bde	Arty Rgt	1/11 Bde Misc Units	10 Arty Bde	6 Inf Bde	3 Meczd Bde	3 Tank Bde	Totals
Personnel	4,000	4,500	3,500	800	4,000	8,000	24,000	13,500	10,500	60,000
Pistol	400	450	350	80	400	800	2,400	1,350	1,050	6,000
Rifle	3,600	4,050	3,150	720	3,600	7,200	21,600	12,150	9,450	54,000
Machine Gun, lt	270	300	85	75	50	750	1,620	900	255	3,575
Machine Gun, hvy	160	180	55	75	40	750	960	900	165	2,815
Mortar, 82mm	20	20	..	..	..	..	120	60	..	180
Mortar, 120mm	4	4	..	..	..	..	24	12	..	36
RL, 40mm	16	16	10	10	25	100	96	48	30	299
GAT, 85mm	32	32	..	..	..	..	192	96	..	288
RR, 107mm	8	8	8	..	..	..	48	24	24	96
AAMG ZPU-2	6	6	3	6	25	60	36	18	9	148
AAMG ZPU-4	6	6	3	..	25	..	36	18	9	88
AA, 37mm	4	4	4	..	20	..	24	12	12	68
AA, 57mm	4	4	..	..	20	..	24	12	..	56
AA, 85mm	..	..	..	..	(2)48	..	..	..	..	48
Mortar, 240mm	..	..	..	..	..	(1)24	..	..	..	24
Katushya	..	..	..	..	..	(1) 8	..	..	..	8
How, 122mm	12	12	..	..	..	(4)96	72	36	..	204
Gun How, 152mm	..	..	..	..	..	(3)72	..	..	..	72
Gun, 130mm	..	..	..	..	..	(1)24	..	..	..	24
AT Su-100 SP	12	12	12	..	..	..	72	36	36	144
JS-3	8	8	24	..	..	..	48	24	72	144
PT 76	..	10	10	..	..	..	..	30	30	60
T-34	30	..	30	..	..	..	180	..	90	270
T-54/55	..	60	60	..	..	..	..	180	180	360
APC BTR-50	40	60	20	3	10	30	240	180	60	520
APC BTR-152	10	10	5	..	2	..	60	30	15	107
Truck	250	275	250	100	120	1,000	1,500	825	750	4,195
Motorcycle	20	20	20	..	10	..	120	60	60	250
SP Mount	10	20	10	12	12	120	60	60	30	282

Figure 6. ENGAGEMENTS, SIX-DAY WAR, JUNE 1967

Eng No	Date	Engagement Designation	Arab Forces	Israeli Forces
<u>Sinai</u>			<u>Egyptian</u>	
67- 1	5	Rafah	PLA & 7 Inf Div	Tal's Div
67- 2	5/6	Aby Ageila-Um Katef	2 Inf Div	Sharon's Div
67- 3	5-7	Gaza Strip	PLA Div	Tal's Div
67- 4	5/6	El Arish	7 Inf Div	Tal's Div
67- 5	5/6	Bir Lahfan	3 Inf Div	Yoffe's Div
67- 6	6	Jebel Libni	3 Inf Div	Yoffe's Div
67- 7	7	Bir Hama-Bir Gifgafa	3 Inf Div & 21 Tank Div	Tal's Div
67- 8	7	Bir Hassna-Bir Thamada	3 Inf Div & 4 Tank Div	Yoffe's Div
67- 9	7/8	Mitla Pass	3 Inf, 6 Inf Divs	Yoffe's Div
67-10	8	Bir Gifgafa	4 Tank Div	Tal's Div
67-10.1	8	Nakhl	6 Meczd Div	Sharon's Div
<u>Jerusalem- West Bank</u>			<u>Jordanian</u>	
67-11	5-7	Jerusalem	Jerusalem Bde(+)	Central Command
67-12	5/6	Jenin	25 Inf Bde	Peled's Div
67-13	6/7	Kabatiya	40 Armd Bde, 25 Inf Bde	Peled's Div
67-14	6/7	Tilfit-Zababida	40 Armd Bde, 25 Inf Bde	Ram's Bde
67-15	7	Nablus	Brigade equiv	Ram's Bde, Kochva's Bde
<u>Golan Hts</u>			<u>Syrian</u>	
67-21	9	Zaoura-Kala	11 Inf Bde	Mendler's Bde
67-22	9	Tel Fahar	11 Inf Bde	Golani Bde
67-23	9	Rawiya	8 Inf Bde	Ram's Bde
67-24	10	Banias-Masaada	11 Inf Bde	Golani Bde
67-25	10	Kuneitra	Syrian Meczd Bde	Mendler's Bde
67-26	10	Boutmiya	Syrian Armd Bde	Peled's Div

Figure 7. ESTIMATED ALLOCATION OF BATTLE CASUALTIES, SINAI FRONT, JUNE 5-8, 1967, INCLUSIVE

Date	Engagements								Egyptian			Israeli		
	Egypt	Israel	Egypt	Israel	Egypt	Israel	Egypt	Israel	Daily Eng	Daily Misc	Cumulative	Daily Eng	Daily Misc	Cumulative
June 5	(1) 3,000	(1) 500	(2) 1,000	(2) 200	(3) 250	(3) 45	(4) 250	(4) 85	3,000	..	3,000	500	..	500
	..	..	..	..	..	..	..	..	1,500	..	4,500	300	30	860
6	(5) 500	(5) 50	..	..	(3) 500	(3) 20	..	..	500	500	5,500	20	..	880
	..	..	..	..	..	..	..	..	500	..	6,000	50	..	930
7	(6) 500	(6) 40	(7) 600	(7) 45	(8) 600	(8) 30	..	..	1,700	1,500	9,200	115	10	1,045
	..	..	..	..	..	..	(9) 600	(9) 60	600	..	9,800	60	..	1,105
8	(10) 500	(10) 40	(11) 684	(11) 24	..	..	..	..	1,184	1,900	12,884	64	15	1,194

Figure 8. ESTIMATED ALLOCATION OF TANK LOSSES, SINAI FRONT, JUNE 5-8, 1967, INCLUSIVE

Date	Engagement								Egyptian				Israeli			
	Egypt	Israel	Egypt	Israel	Egypt	Israel	Egypt	Israel	Daily Loss	Cum Loss	Daily Return	Cum Net Loss	Daily Loss	Cum Loss	Daily Return	Cum Net Loss
June 5	(1) 70	(1) 15	(2) 40	(2) 19	(3) 60	(3) 4	(4) 80	(4) 13	70	70	..	70	15	15	..	15
	..	..	..	..	..	..	..	..	180	250	..	250	36	51	..	51
6	(5) 30	(5) 11	..	..	(3) 30	(3) 4	..	..	30	280	5	275	4	55	2	53
	..	..	..	..	..	..	..	..	30	310	..	305	11	66	..	64
7	(6) 30	(6) 10	(7) 30	(7) 5	(8) 30	(8) 10	..	..	90	400	18	377	25	91	6	83
	..	..	..	..	..	..	(9) 100	(9) 16	100	500	..	477	16	107	..	99
8	(10) 100	(10) 11	(11) 100	(11) 4	..	..	..	..	200	700	27	650	15	122	9	105
	..	..	..	..	..	..	..	..	..	..	10	640	..	..	44	61

Figure 9. ESTIMATED CLOSE AIR SUPPORT FIGHTER-BOMBER SORTIES SUEZ-SINAI FRONT, JUNE 5-8, 1967, INCLUSIVE

Date	Available Sorties		Engagements									
	Egypt	Israel	Egypt	Israel	Egypt	Israel	Egypt	Israel	Egypt	Israel		
June 5	61	78	(1) 51	(1) 78	..	..	(2) 0	(2) 0	(3) 10	(3) 38	(4) 0	(4) 38

6	20	152	(5) 20	(5) 76	..	..	..	..	..	..	..	..
7	0	152	(6) 0	(6) 52	(7) 0	(7) 40	(8) 0	(8) 40	..	..	..	..
	..	..	..	..	..	..	..	..	..	..	(9) 0	(9) 20
8	0	245	(10) 0	(10) 123	(11) 0	(11) 122	..	..	..	..	..	..

Figure 10. ESTIMATED ALLOCATION OF BATTLE CASUALTIES, JORDAN FRONT, JUNE 5-7, 1967, INCLUSIVE

Date	Engagements								Jordanian			Israeli		
	Jordan	Israel	Jordan	Israel	Jordan	Israel	Jordan	Israel	Daily Eng	Daily Misc	Cumulative	Daily Eng	Daily Misc	Cumulative
June 5	(11) 1,500	(11) 600	(12) 800	(12) 400	..	..	..	..	1,500	1,000	3,000	600	100	700
	..	..	..	..	..	..	..	..	800	1,200	4,500	400	..	1,100
6	(11) 1,000	(11) 800	..	..	(13) 1,000	(13) 550	(14) 500	(14) 253	2,500	1,000	8,000	1,603	100	2,803
	..	..	..	..	..	..	..	..	..	1,000	9,000	..	..	..
7	(11) 1,000	(11) 350	(15) 1,000	(15) 600	..	..	..	..	2,000	2,000	13,000	950	100	3,853

Figure 11. ESTIMATED ALLOCATION OF TANK LOSSES, JORDAN FRONT, JUNE 5-7, 1967, INCLUSIVE

Date	Engagement								Jordanian				Israeli			
	Jordan	Israel	Jordan	Israel	Jordan	Israel	Jordan	Israel	Daily Loss	Cum Loss	Daily Return	Cum Net Loss	Daily Loss	Cum Loss	Daily Return	Cum Net Loss
June 5	(11)50	(11)20	(12)40	(12)18	..	..	..	..	50	50	..	50	20	20	..	20
	..	..	..	..	..	..	..	..	40	90	..	90	18	38	..	38
6	(11)20	(11)10	..	..	(13)44	(13)18	(14)36	(14)18	100	190	6	184	46	84	6	78
7	(11)20	(11)10	(15)46	(15)18	..	..	..	..	66	256	12	238	28	112	10	96
											10	228			40	56

Figure 12. ESTIMATED CLOSE AIR SUPPORT FIGHTER-BOMBER SORTIES JORDANIAN FRONT, JUNE 5-7, 1967, INCLUSIVE

Date	Available Sorties		Engagements							
	Jordan	Israel	Jordan	Israel	Jordan	Israel	Jordan	Israel	Jordan	Israel
June 5	11	76	(11) 11	(11) 38	..	..	..	..	..	..
	..	..	..	38	(12) 0	(12) 0	..	..	..	..
6	0	112	(11) 0	(11) 40	..	..	(13) 0	(13) 21	(14) 0	(14) 21
	..	..	..	30	..	..	..	..	..	..
7	0	104	(11) 0	(11) 52	(15) 0	(15) 52	..	..	..	..

Figure 13. ESTIMATED ALLOCATION OF BATTLE CASUALTIES, GOLAN FRONT, JUNE 9-10, 1967, INCLUSIVE

Date	Engagements								Syrian		Israeli			
	Syria	Israel	Syria	Israel	Syria	Israel	Syria	Israel	Daily Eng	Misc	Cumulative	Daily Eng	Misc	Cumulative
June 9	(21)1,000	(21)100	(22)1,500	(22)150	(22) 600	(23) 68	..	..	2,500	1,000	3,500	250	..	250
	..	..	..	..	..	..	..	..	600	400	4,500	68	..	318
10	(24) 500	(24) 50	(25) 500	(25) 50	(26) 500	(26) 50	..	..	1,500	600	6,600	150	..	468

Figure 14. ESTIMATED ALLOCATION OF TANK LOSSES, SYRIAN FRONT, JUNE 9-10, 1967, INCLUSIVE

Date	Engagement								Syrian				Israeli			
	Syria	Israel	Syria	Israel	Syria	Israel	Syria	Israel	Daily Loss	Cum Loss	Daily Return	Cum Net Loss	Daily Loss	Cum Loss	Daily Return	Cum Net Loss
June 9	(21)15	(21)40	(22)10	(22) 5	..	..	..	..	25	25	..	25	45	45	..	45
	..	..	..	..	(23)10	(23)10	..	..	10	35	..	35	10	55	..	55
10	(24)15	(24)35	(25)20	(25)35	(26)30	(26)35	..	..	65	100	3	97	105	160	6	154
											5	92			74	80

Figure 15. ESTIMATED CLOSE AIR SUPPORT FIGHTER-BOMBER SORTIES GOLAN FRONT, JUNE 9-10, 1967, INCLUSIVE

Date	Available Sorties		Engagements							
	Syria	Israel	Syria	Israel	Syria	Israel	Syria	Israel	Syria	Israel
June 9	0	238	(21) 0	(21)119	(22) 0	(22)119	..	..	..	..
							(23) 0	(23) 0		
10	0	231	(24) 0	(24) 77	(25) 0	(25) 77	(26) 0	(26) 77		

Figure 16. ENGAGEMENT DATA CALCULATION INPUT SHEET

Engagement No: 67-1 Date of Calc: 17 May '76
 Engagement Date: 5 June 1967
 Terrain: Flat Mixed/Desert
 Posture: Fort/ Prepared Defense
 Weather: Hot, Dry
 Season: Spring
 Unit: 7th Div (-) & PLA Div (-), Egypt
 Depth: 8.8 Q: -45
 Personnel Losses: 3,000
 Tank Losses: 70
 Mission Factor: 2

Engagement No: 67-1 Date of Calc: 17 May '76
 Engagement Date: 5 June 1967
 Terrain: Flat Mixed/Desert
 Posture: Attack
 Weather: Hot, Dry
 Season: Spring
 Unit: Tal Div, Israel
 Depth: 8.8 Q: 45
 Personnel Losses: 500
 Tank Losses: 15
 Mission Factor: 9

	OLI	Number	Total OLI
N Personnel		19,500	
W _s Pistol, Beretta	0.03	1,950	59
Rifle, AK-47	0.26	17,550	4,563
W _{mg} MG Lt., SGM 7.62	0.58	485	281
MG Hvy., DK 12.7	0.89	323	287
W _{hw} Mortar, 50mm	27	48	1,296
Mortar, 82mm	44	47	2,068
Mortar, 120mm	58	12	696
APC, BTR-50	58	109	6,322
APC, BTR-152	23	9	207
W _{gi} RL, 40mm	20	60	1,200
Schmel AT Missile	34	23	782
RR, 107mm	101	23	2,323
Gun AT, D-48, 85mm	192	62	11,904
Gun, 100mm	229	12	2,748
How, M-38, 122mm	159	52	8,268
Gun How, D-20, 152mm	231	4	924
W _{gy} MMG, ZPU-2	27	36	972
AAMG, ZPU-4	37	16	592
AAG, 37mm	66	8	528
Gun AA S-60, 57mm	168	10	1,680
W _i Gun, AT, SP, SU-100 (TD)	388	12	4,656
Tank Hvy, T-10/JS-3 av.	281	12	3,372
Tank Lt, PT-76	212	13	2,756
Tank, T-34	280	45	12,600
Tank, Sherman	210	50	10,500
Tank, T-54)			
Tank, T-55) av.	505	65	32,825
W _y MiG-17	731	18/2	6,579
Total OLI			120,988
J Trucks		1,209	
APC, Tack, Halftrack		155	
Motorcycle		88	
Helicopters		22	

	OLI	Number	Total OLI
N Personnel		19,520	
W _s Pistol, cal .45	0.02	1,952	39
Rifle, Galil	0.22	17,568	3,865
W _{mg} Machine gun, cal 7.62mm	0.82	283	232
Machine gun, cal 12.7mm	1.04	292	304
W _{hw} Mortar, 81mm	50	20	1,000
Mortar, 4.2" (107mm)	90	12	1,080
Halftrack, M3	27	125	3,375
W _{gi} Bazooka	14	41	574
ATM SS 10/11	34	18	612
RR-SP, 106mm	133	6	798
W _g How SP, 105mm	160	48	7,680
How SP, 155mm	235	24	5,640
Gun SP, 155mm	303	12	3,636
W _{gy} Gun AA, SP, Lt 20mm	124	67	8,308
Gun AA, SP, Lt 40mm	146	20	2,920
SAM, Hawk	300	4	1,200
W _i Tank, M4 (105mm)	470	45	21,150
Tank, M48 (90mm)	474	45	21,330
Tank, Centurion	536	45	24,120
Tank, AMX-13 (90mm)	321	105	33,705
W _y Mystere IV	1,404	23/2	17,963
Super-Mystere	1,562	23/2	16,146
Total OLI			175,677
J Trucks		1,105	
APC, Track, Halftrack		361	
Helicopters		39	

Figure 17. MODEL (ENGAGEMENT) CALCULATION FORM

Engagement: No. 67-1 Engagement Date: 5 June 1967
 Egyptian Unit: 7th Div(-), PLA Div (-) Posture: Fort/Prep Def
 Mission Factor 2

Calculation Date: 17 May 1976
 Israeli Unit: Tal Division Posture: Attack
 Mission Factor 9

$$S_f = (W_s + W_{mg} + W_{hw} + W_{gi}) \times r_n$$

$$(4622 + 568 + 10589 + 16209) \times .95 = \underline{30,389}$$

$$(W_g + W_{gy}) (r_{wg} \times h_{wg} \times z_{wg} \times w_{yg})$$

$$(11970 + 3772)(1 \times 1 \times 1 \times .9) = \underline{14,141}$$

$$W_i \times r_{wi} \times h_{wi}$$

$$66709 \times .95 \times 1 = \underline{63,373}$$

$$W_y \times r_{wy} \times h_{wy} \times z_{wy} \times w_{yy}$$

$$6579 \times 1 \times 1 \times 1 \times .8 = \underline{5,263}$$

$$S_f \text{ (total)} = \underline{113,166}$$

$$S_e = (W_s + W_{mg} + W_{hw} + W_{gi}) \times r_n$$

$$(3904 + 536 + 6455 + 1984) \times .95 = \underline{11,285}$$

$$(W_g + W_{gy}) (r_{wg} \times h_{wg} \times z_{wg} \times w_{yg})$$

$$[6956 + 6579 + (12425 - 6579)/2] \times 1 \times 1 \times 1 \times 1.1 = \underline{29,105}$$

$$W_i \times r_{wi} \times h_{wi}$$

$$100,305 \times .95 \times 1 = \underline{95,290}$$

$$W_y \times r_{wy} \times h_{wy} \times z_{wy} \times w_{yy}$$

$$34109 \times 1 \times 1 \times 1 \times 1.1 = \underline{37,520}$$

$$S_e \text{ (total)} = \underline{173,200}$$

$$V_f = N_f \times u_v/r_u \times \sqrt{S_e/S_f} \times v_y \times v_r$$

$$19500 \times .55/1.19 \times 1.2371 \times 1.1 \times 1$$

$$v_f = 1 - V_f/S_f = \underline{1-.1094}$$

$$v_f = \underline{0.8906}$$

$$V_e = N_e \times u_v/r_u \times \sqrt{S_f/S_e} \times v_y \times v_r$$

$$19520 \times 1/1 \times .8083 \times .9 \times 1$$

$$v_e = 1 - V_e/S_e = \underline{1-.0798}$$

$$v_e = \underline{.9202}$$

$$\text{Mobility Factor } (N_f + 12J + W_i) \times m_{yf}/N_f \quad M_f$$

$$[9600 + 12(1209 + 310 + 220) + 66709] \times .9/19500 \quad M_f$$

$$m_d = 1 \quad m_a = \sqrt{M_a/M_d} = \sqrt{1.6615}$$

$$M_f = \underline{4.9664}$$

$$M_a = \underline{1.2890}$$

$$\text{Mobility Factor } (N_e + 12J + W_i) \times m_{ye}/N_e \quad M_e$$

$$[9520 + 12(1105 + 722 + 390) + 100305] \times 1.1/19520 \quad M_e$$

$$m_a = M_a - (1 - r_m \times h_m)(M_a - 1)$$

$$1.289 - (1 - .95 \times 1)(1.289)$$

$$M_e = \underline{8.2516}$$

$$M_a = \underline{1.2745}$$

$$P_f = S_f \times m \times l \times e \times t \times o \times b \times u_s \times r_u \times h_u \times z_u \times v_f$$

$$113,166 \times 1 \times 1 \times 1 \times 1 \times 1 \times 1.55 \times 1.19 \times 1 \times 1 \times .7812$$

$$P_f = \underline{185,900}$$

$$P_e = S_e \times m \times l \times e \times t \times o \times b \times u_s \times r_u \times h_u \times z_u \times v_e$$

$$173,200 \times 1.2745 \times 1 \times 1 \times 1 \times 1 \times 1 \times 1 \times 1 \times 1 \times .9202$$

$$P_e = \underline{203,128}$$

$$P_f/P_e = \underline{0.92}$$

$$P_e/P_f = \underline{1.09}$$

Effects of Surprise

$$M_a = \sqrt{1.6615 \times 3} = 2.2326 \quad m_a = 2.1710$$

$$v_f = 1 - (2 \times .1094) = 0.7812$$

$$v_e = 1 - (.6 \times .0798) = .9521$$

$$P_f = 163,063$$

$$P_e = 364.655$$

$$P_f/P_e = 0.4472$$

$$P_e/P_e = 2.2363$$

Result Calculations

$$Q = 45, D_f = 8.8, Cas_f = 3,000, Cas_e = 500$$

$$E_{fsp} = \frac{\sqrt{(S_e \times u_{se}) / (S_f \times u_{sf})} \times (4Q + D_e) / 3D_e}{\sqrt{1.5305 \times 1.55 \times (4 \times 45 + 8.8) / 3 \times 8.8}}$$

$$= \underline{-2.5538}$$

$$E_{esp} = \frac{\sqrt{(S_f \times u_{sf}) / (S_e \times u_{se})} \times (4Q + D_f) / 3D_e}{\sqrt{.6534 \times 1.55 \times (4 \times 45 + 8.8) / 3 \times 8.8}}$$

$$= \underline{2.666}$$

$$E_{fcas} = v_e^2 \left[\frac{\sqrt{(Cas_e \times u_{se}/S_e) / (Cas_f \times u_{sf}/S_f)} - \sqrt{100Cas_e/N_e}}{\sqrt{3000 \times 1.5305 \times 1.55 / 3000} - \sqrt{300000/19500}} \right]$$

$$.9065 \left[\frac{\sqrt{500 \times 1.5305 \times 1.55 / 3000} - \sqrt{100 \times 500 / 19500}}{\sqrt{3000 \times 1.5305 \times 1.55 / 3000} - \sqrt{300000/19500}} \right] = \underline{-3.1865}$$

$$E_{ecas} = v_f^2 \left[\frac{\sqrt{(Cas_f \times u_{sf}/S_f) / (Cas_e \times u_{se}/S_e)} - \sqrt{100Cas_f/N_f}}{\sqrt{3000 \times 1.5305 \times 1.55 \times 500} - \sqrt{500 \times 19520}} \right]$$

$$.6103 \left[\frac{\sqrt{3000 \times 1.5305 \times 1.55 \times 500} - \sqrt{500 \times 19520}}{\sqrt{3000 \times 1.5305 \times 1.55 \times 500} - \sqrt{500 \times 19520}} \right] = \underline{.5224}$$

$$R_f = MF_f + E_{fsp} + E_{fcas} = 2 - 2.55 - 3.19 = \underline{-3.7403}$$

$$R_e = MF_e + E_{esp} + E_{ecas} = 9 + 2.67 + .52 = \underline{12.19}$$

$$R_f - R_e = \underline{-15.93}$$

$$R_e - R_f = \underline{+15.93}$$

Figure 18. PRELIMINARY 1967 ARAB-ISRAELI WAR ANALYSIS

Engagement	N_a/N_i	Fire-power	P/P	Sur-prise	P/P (S&D)	R - R	Effect P/P	Arab CEV	Israeli CEV	Average
1. Rafa	1.00	0.69	0.92	0.49	0.45	-15.93	0.24	0.53	1.87	
2. Abu Ageila	0.96	1.06	1.80	0.32	0.58	-11.58	0.30	0.52	1.92	
3. Gaza	1.44	0.96	1.41	0.51	0.72	-14.29	0.26	0.36	2.77	
5. Bir Lahfan	0.96	0.53	0.65	.	0.65	-16.85	0.23	0.35	2.83	2.35
11. Jerusalem	0.49	0.42	0.71	0.84	0.60	-8.70	0.36	0.60	1.67	
12. Jenin	0.57	0.34	0.51	0.84	0.43	-9.91	0.34	0.67	1.49	
13. Kabatiya	0.77	0.67	0.83	.	0.83	-6.90	0.42	0.51	1.98	
14. Zababida	1.02	0.57	0.80	.	0.80	-7.98	0.38	0.47	2.11	1.81
21. Qala	1.09	0.43	0.56	.	0.56	-17.87	0.22	0.39	2.56	
22. Tel Fahar	1.11	0.55	0.75	.	0.75	-17.36	0.22	0.29	3.45	
23. Rawiya	1.00	1.77	3.69	0.42	1.55	-12.04	0.29	0.19	5.34	
24. Banyas M.	0.78	0.60	0.85	.	0.85	-15.78	0.24	0.28	3.53	3.71

Figure 19. 1967 ARAB-ISRAELI WAR ANALYSIS—REFINED

Engagement	N_a/N_i	Fire-power	Arab Set-Piece Factor	P/P	Sur-prise	Disrup-tion	P/P (S&D)	R - R	Effect P/P	CEVs		Average
										Arab	Israeli	
1. Rafa	1.00	0.69	1.3	1.20	0.37	.	0.44	-15.93	0.24	0.54	1.84	
2. Abu Ageila	0.96	1.06	1.3	2.34	0.24	.	0.56	-11.58	0.30	0.53	1.87	
3. Gaza	1.44	0.96	1.3	1.48	0.38	0.31	0.51	-14.29	0.26	0.51	1.96	
5. Bir Lahfan	0.96	0.53	.	0.65	.	0.77	0.50	-16.85	0.23	0.46	2.18	1.96
										1st half average: 1.86		
										2d half average: 2.07		
11. Jerusalem	0.49	0.42	1.3	0.92	0.67	.	0.61	-8.70	0.36	0.59	1.69	
12. Jenin	0.57	0.34	1.3	0.66	0.63	.	0.42	-9.91	0.34	0.81	1.24	
13. Kabatiya	0.77	0.67	.	0.67	.	0.74	0.50	-6.90	0.42	0.57	1.76	
14. Zababida	1.02	0.57	.	0.80	.	0.87	0.70	-7.98	0.38	0.54	1.84	1.63
										1st half average: 1.47		
										2d half average: 1.76		
21. Qala	1.09	0.43	1.3	0.73	.	.	0.73	-17.87	0.22	0.30	3.34	
22. Tel Fahar	1.11	0.55	1.3	0.98	.	.	0.98	-17.36	0.22	0.23	4.38	
23. Rawiya	1.00	1.77	1.3	4.75	0.32	.	1.53	-12.04	0.29	0.19	5.28	
24. Banyas M.	0.78	0.60	.	0.85	.	.	0.85	-15.78	0.24	0.28	3.53	4.13
										1st half average: 3.86		
										2d half average: 4.41		