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Measuring the Military Balance in Central Europe

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A collection of articles on the historical, operational, doctrinal, and theoretical aspects of intelligence.

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The subject of this article is the Number Two intelligence problem engaging the United States. Specialists in the calculation of the threat posed by the field forces of the USSR and its Warsaw Pact allies will be quick to recognize its importance and will set aside the time necessary to read it; the general reader may need some encouragement.

First of all, not every reader will need to understand nor even to read all of the technical charts and formulae with which the author has paved the course of his argument; most of these are elaborate footbridges essential to the firm footing of the specialist. If some readers find their eyes glazing over as they approach these bridges, the prose at the other side will help them resume the journey with little loss in equilibrium.

Second, non-military analysts will be rewarded for their persistence in reading on by the discovery of a problem within a problem. Those civilians who delight in quoting Clemenceau on the management of war may be moved to engage themselves more deeply in the issue. If so, they can find no better guide than the author, himself a living refutation of the mordant aphorism that "war is too important to be left to generals." His writing is clear, his grasp is firm, his step sure, and his mission worthy and purposeful.

Finally, the reader who perseveres in following this well-lighted labyrinth will arrive at its conclusion a better informed public servant. The truly concerned public servant will be inspired, as the author urges, to master the techniques of force balance assessment essential to dealing with what may become the Number One national intelligence problem of the 1980s.

The Editors

MEASURING THE MILITARY BALANCE IN CENTRAL EUROPE

Paul F. Gorman
Major General, USA

The National Intelligence Officer for Conventional Forces is a misnamed anomaly—not an intelligence officer, but a professional soldier, little experienced in intelligence production, presiding over estimates which include such non-conventional forces as Soviet and Chinese units armed with intermediate-range ballistic missiles or other nuclear or chemical weaponry. I have received mail for NIO/Continental Forces, which title is evocative but elides the naval dimensions of the job. Perhaps the label might be more precisely "NIO for General Purpose Forces." But I concede that much can be said for the colleague who proposed: "NIO for Conventional Notions." *

* Perhaps at the author's instigation, the Director of Central Intelligence redesignated his office "NIO for General Purpose Forces" effective 1 October 1979—Editor.

It is at least true that NIO 'CF's principal product, National Intelligence Estimate 11-14-XX, *Warsaw Pact Forces Opposite NATO*, is one of the intelligence community's lapidary displays, each gem of data well smoothed and polished by interagency tumbling, in a Benvenuto Cellini setting of prose. Yet most Directors have found exploration of NIE 11-14 onerous, even tedious. "What does all that divisions stuff mean? What does it all add up to?," more than one has asked in exasperation. The answer to that question remains most unsatisfying. Here follows one of those chutzpah exercises now chic in Washington—the apprentice presumes to instruct.

In the first place, none of the NIEs in the 11-14 series address directly the military balance, that is, assess the equilibrium or disequilibrium of forces. They have not judged "who is ahead?," as have NIEs of the 11-3/8 series, treating the strategic balance. Hence, NIE 11-14 offers no direct answer to questions usually put to the Director by members of Congress who seek comparative rankings—superiority, parity, inferiority—of the sort to which the SALT debates have accustomed them. Rather, over the past decade the NIEs 11-14 have concentrated on describing those land, sea, and air forces which might figure in Soviet combat operations, and estimating their capabilities. NIE 11-14-71 (9 September 1971), *Warsaw Pact Forces for Operations in Eurasia*, dealt, *inter alia*, with the Soviet Union's allocation of forces among its commitments to the Warsaw Pact and its military requirements along its border with China. The next major revision, NIE 11-14-75 (4 September 1975), entitled *Warsaw Pact Forces Opposite NATO*, focused more specifically on Soviet capabilities for military operations within Central Europe.

The latest document in the series, NIE 11-14-79 (31 January 1979), bears the same title as its predecessor, and preserves its narrower focus. I would judge the 1979 version better presented than its predecessors—it is assuredly more graphic; there seems to have been a great deal of effort expended on summarizing and portraying data in forms meaningful to the uninitiate; and there is an excellent section describing how the Soviets might launch a conventional attack in Europe. But despite the attempts of some of the intelligence community to have NIE 11-14-79 essay an explicit comparison between Warsaw Pact and NATO's military capabilities, DIA and the military services blocked any inclusion of what they term "net assessment," and the NIE is therefore mute on the question basic to most policy issues: How does the Warsaw Pact stack up militarily against NATO?

CIA has tried its hand at an answer. In August 1977 the Directorate of Intelligence published a paper by James O. Carson of OSR on *The Balance of Forces in Central Europe*.¹ Carson reassured that:

The balance of military power in Central Europe—especially as it contributes to deterrence there—is not fragile. NATO's military deterrence is multifaceted, being based on conventional forces as well as tactical and strategic nuclear weapons. A shift in the military balance great enough to significantly reduce deterrence in Europe would require achievement of a major technological breakthrough by one side or a major shift in numerical force ratios.

He went on to warn, however, of a gradually shifting balance as the Soviets overcame their technological inferiority and modernized their numerically superior forces, with potentially serious consequences:

The most serious results of the shift in the balance of forces in Central Europe could arise from both sides' perception of that evolving balance.

¹SR 77-10100, August 1977, SECRET.

There is a growing but largely unsubstantiated impression in the West that the vigorous, ongoing Soviet modernization effort constitutes a major conventional arms buildup which has caused the balance to shift radically... should it become widely accepted that the balance has dramatically shifted, this view could depress NATO confidence and in turn increase Soviet assertiveness. Such a development could ultimately increase the risk of war through Soviet miscalculation.

One European who perceives such an alarming shift in the balance is the Belgian general, Robert Close, who in his 1977 book, *L'Europe Sans Defense?* wrote:

For years, Europe was content to rely on American protection guaranteed by monopoly of the supreme weapon and the nuclear shield.

This reassuring situation is a thing of the past now that thermonuclear parity has become a reality and mutuality immobilizes and paralyzes the nuclear arsenals of the two superpowers.

As a result, conventional forces have reassumed their full importance. The overwhelming Soviet superiority gained by constant qualitative and quantitative improvement confirms a definite shift in the balance of forces, the guarantor of an uneasy peace at a time when competition between the two opposing systems continues without respite, in spite of "detente" to which we hear daily reference.²

Similar views have been expressed by General Sir John Hackett (who has NATO forces fight a successful conventional defense in his *World War III*, but his "future-history" is predicated on NATO's moving vigorously in the early 1980s to redress a shifting balance), and Admiral of the Fleet Sir Peter Hill-Norton (in *No Soft Options* Hill-Norton sees public misconceptions of even "purely factual" NATO issues like the balance of conventional forces as cause for lack of political will to translate NATO's demographic and economic advantages into resources for deterrence, forward defense, and detente).³

The point is not whether lots of new Russian tanks make West Europeans nervous, or whether speculations about how the Soviets might use their growing conventional advantage are well-founded, but simply whether, with such huge American stakes at play in a game of perceptions, the U.S. intelligence community ought seriously to consider addressing squarely the potential source of misperception, and to produce a national intelligence estimate of the military balance.

Congress is looking for such an estimate. No Senator or Representative preparing to vote on U.S. appropriations for the defense of NATO is likely to be content with a one-sided description of Warsaw Pact capabilities. All are aware that in gross resources

² Close, General Robert, *L'Europe Sans Defense?*, Editions Arts & Voyages, Paris, 1976 (issued 1977). Available in English from U.S. Joint Publications Research Service, JPRS L/7120, 12 May 1977. Quote is from latter, p. 243.

³ Hackett, General Sir John Winthrop, et al., *The Third World War: A Future History*, London, 1978. Hill-Norton, Adm. Sir Peter, *No Soft Options: The Political-Military Realities of NATO*, Montreal, 1978, who quotes Clausewitz:

The possession of military or economic power is only of value if supported by political will and the readiness of the people to provide the means to defend their way of life and conception of democracy.

Cf., Howard, M., "The Forgotten Dimensions of Strategy," *Foreign Affairs*, July 1979, pp. 975-986.

NATO is far stronger than the Pact: 200 million more people, 3 times the GNP, 70% higher GNP per capita. Is there a genuine need for American manpower and money to buttress NATO? Of course intelligence community witnesses before Congressional committees inquiring into such questions can duck being responsible for "net assessment," deferring to the Department of Defense or the JCS for treatment of the military balance in Central Europe. But to demur is not to escape criticism. In fact, any intelligence officer who forays into a discussion of Warsaw Pact forces, on the Hill or elsewhere among policy makers, should anticipate taking knocks for our intelligence estimates, and being identified as probable cause for future insufficiency in U.S. policy.

Much has been published by the gemmating staffs of the U.S. Congress on these issues. For example, the Congressional Budget Office has published an information booklet "Assessing the NATO/Warsaw Pact Military Balance,"⁴ an inquiry into methodology, based on a comprehensive review of unclassified sources. This monograph argues that past estimates of the balance have been tilted toward "optimism" or "pessimism." Without singling out any intelligence agency, the authors perceive a "new pessimism" in vogue, part of a long-standing cycle of optimism-to-pessimism, reflecting current events and U.S. responses.

One of the authors cited in the CBO study, and one of the leading American commentators on the NATO/Warsaw Pact Military Balance, is also a Congressional staffer: John M. Collins, a retired military officer, now strategic analyst for the Research Staff of the Library of Congress, who has published comprehensive studies of the NATO Pact balance (for example, his *American and Soviet Military Trends*,⁵ and his *Imbalance of Power*).⁶ Generally speaking, Collins' technique seems to be to inform himself from finished intelligence, but then to use relevant unclassified data to generate comparative data on selected measures of current military forces, and to depict trends pertaining thereto. At Figure 1 are some graphs from his *Military Trends*.⁷ In the same publication, Collins develops a sort of balance sheet between the United States and the Soviet Union, leading to a "standing" for 1970 and 1977 respectively.⁸ (Table I.)

Anthony Cordesman, former Assistant to the Deputy Secretary of Defense and Secretary of the Defense Intelligence Board, wrote the preface and summary—termed a "net assessment appraisal"—for Collins' recent book, *Imbalance of Power*, in which he points out that Collins labored under grave difficulties from the lack of objective intelligence. As far as Cordesman is concerned, Collins' *bete noir* is the Defense Intelligence Agency which, in his view, "has been the key link in shaping all free world estimates of Soviet forces... DIA tends to credit the Soviet Union with capability when it does not know, and has a long tradition of providing answers

⁴ CBO, *Assessing the NATO/Warsaw Pact Military Balance*, (Budget Issue Paper for FY-79), GPO, Washington, December 1977. N.B: The CBO authors, James Blaker and Andrew Hamilton, who worked for John E. Koehler, point out that (p. xvii) "the brighter assessments are optimistic only in comparison with the more pessimistic ones. Few if any of the numbers or ratios used in them demonstrate a clear NATO advantage. They do, however, suggest a closer balance...."

⁵ Collins, John M. *American and Soviet Military Trends*, the Center for Strategic and International Studies, Washington, D. C., 1978. Cf., Collins and Chivat, J.S., *The United States/Soviet Military Balance*, Library of Congress, Jan. 27, 1976.

⁶ Collins, J. M., and Cordesman, Anthony, *Imbalance of Power*, Presidio Press, San Rafael, California, 1978.

⁷ Collins, *Trends*, p. 118

⁸ *Ibid.*, pp. 359-361.

The Military Balance

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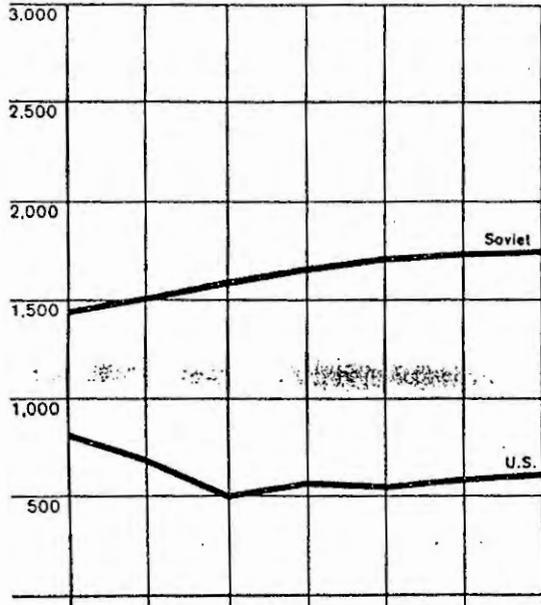
Selected Ground Force Strengths Compared
Statistical Summary (Note Different Scales)

Figure 1

Adapted from Collins, J.M.
American and Soviet Military Trends
Washington, 1978

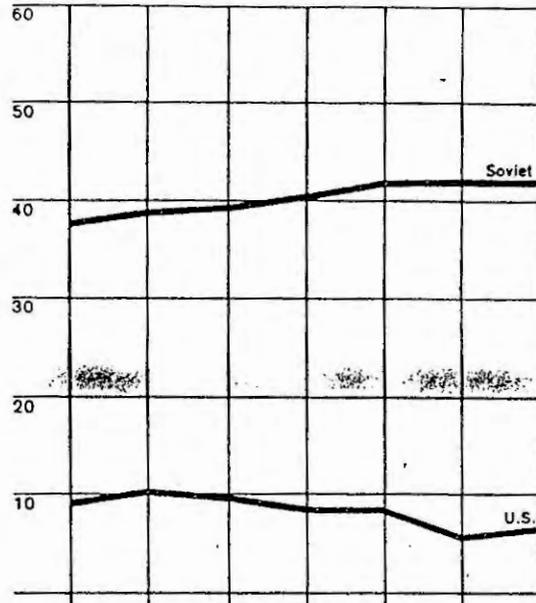
Deployable Manpower

Thousands



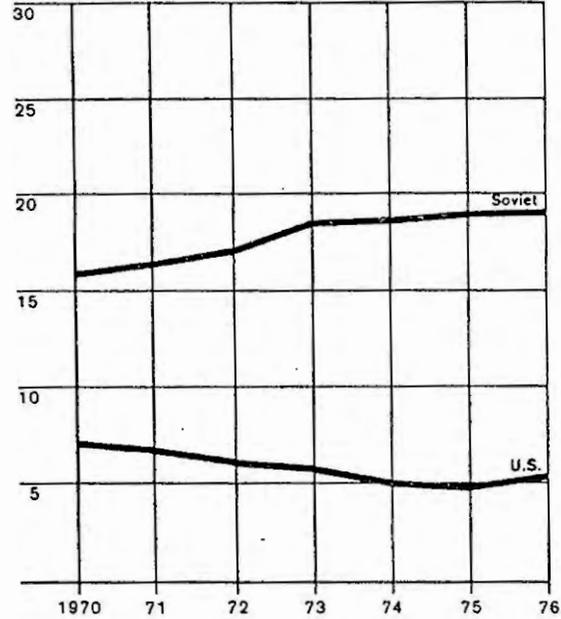
Medium Tanks

Thousands



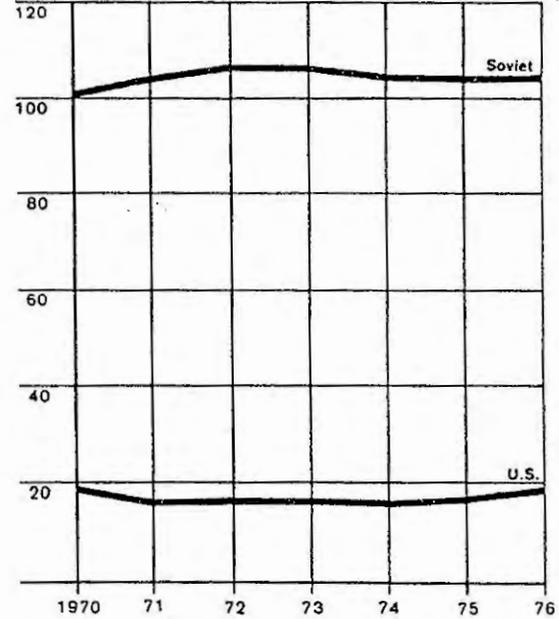
Field Artillery

Thousands



Ready Divisions

Number



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Table I

	1970 ^a			1977 ^a		
	NATO	Warsaw Pact	NATO Standing	NATO	Warsaw Pact	NATO Standing
Personnel ^b	1,523,300	1,190,000	+333,000	1,409,000	1,600,000	-191,000
Divisions ^c						
Committed ^d						
Armor	8	24	- 16	8	24	- 16
Other	22	28	- 6	28	26	+ 2
Total	30	52	- 22	36	50	- 14
Ready Reinforcements ^e						
Armor	2	14	- 12	2	10	- 8
Other	10	7	+ 3	10	6	+ 4
Total	12	21	- 9	12	16	- 4
Sub-total	42	73	- 31	48	66	- 18
First-line Reserves ^f						
Armor	2	2	par	2	6	- 4
Other	11	13	- 2	11	18	- 7
Total	13	15	- 2	13	24	- 11
Total Divisions	55	88	- 33	61	90	- 29
Medium Tanks ^g	6,535	14,500	-7,965	7,400	22,000	-14,600
Tactical Aircraft ^h						
Bombers	15	100	- 85	185	100	+ 85
Ground Attack	1,640	800	+ 840	1,500	800	+ 700
Interceptors	470	1,600	-1,130	400	1,700	-1,300
Total	2,125	2,500	- 375	2,085	2,600	- 515
MRBM/IRBM	0	650	- 650	0	550	- 550

^a Personnel strengths are active forces only for U.S./NATO, but include Soviet Category III divisions.

^b U.S., West German, and Soviet divisions have increased in size since 1970. Three German divisions, for example, had only two brigades each at that time. All 12 now have three brigades. The British Army has the same total number of brigades as in 1970, but has added a division headquarters.

These charts do not reflect NATO's increased strength in separate brigades and regiments, which are included in some computations as "division equivalents." The IISS *Military Balance, 1977-1978*, for example, shows 27 NATO divisions (excluding France), including 10 armored divisions, by counting division equivalents (3 brigades-1 division).

^c U.S./NATO committed divisions include all active divisions in NATO's center sector. SOVIET/Warsaw Pact counterparts are limited to divisions in East Germany, Czechoslovakia, and Poland. All are Category I.

^d U.S./NATO ready reinforcements include all other active U.S. Army divisions, less one in Korea; two U.S. Marine Corps Amphibious Force (MAF) division/wing teams; six French divisions; and one British division in the U.K. Soviet lists are restricted to Category I and II divisions in the Baltic, Belorussian, and Carpathian Military Districts. There are no satellite state divisions in this class.

^e U.S./NATO first-line reserves include one active U.S. Army division; two U.S. Marine MAFs; all eight U.S. National Guard divisions; and one Dutch reserve division. Warsaw Pact forces are Category III divisions, including those in the Baltic, Belorussian, and Carpathian Military Districts of European Russia. Every U.S. division, active and reserve component, is shown. The Soviet Union has 112 others, some Categories I and II. Many of those would be available for service in Central Europe if a crisis arose.

^f U.S./NATO medium tank statistics include U.S. prepositioned stocks in unit sets (POMCUS), war reserve stocks (PWRMS), plus 130 in divisions that serve as maintenance float. The number of Warsaw Pact reserve stock tanks is not ascertainable.

^g Aircraft statistics exclude U.S. dual-based forces in CONUS.

^h NATO and Warsaw Pact comparisons include the United States and Soviet Union. French Army and Air Force totals are included in all categories, even though those forces are not under NATO control and only two divisions are deployed in Germany.

whether it has sufficient data or not. It also has a tendency to mirror-image Soviet capabilities against those of U.S. forces or technology when it lacks actual intelligence, without indicating that such mirror-imaging is the actual source of its estimates. And these tendencies are compounded by other problems which affect the validity of intelligence estimates.

1. Both military and civilian bureaucracies need high estimates of the threat to justify force levels, new weapons, and defense research. With some exceptions, most users of intelligence want high estimates of the threat.
2. Intelligence officers are compartmented specialists. They often lack practical experience with the real world problems in the threat forces they describe. They lack the background and training to judge what might go wrong with threat forces and plans.
3. Few intelligence officers have extensive training in measuring military effectiveness. They are not familiar with test and evaluation techniques, historical research on weapons or force effectiveness, or operations research. They usually are prevented from comparing U.S. and foreign systems by informal pressures from the Joint Chiefs, the service staffs, or civilian decision makers.
4. Intelligence officers are rarely required to compare U.S., Allied, and threat forces directly. In general, they generate data using different standards, measurement methods, assumptions, and definitions from United States forces data. These differences often lead to estimates which disguise biases in favor of threat forces. Such biases include exaggerated estimates of threat sortie rates, kill probabilities, rates of fire, readiness, circular errors of probability, system reliability, mobilization and build-up rates, and munitions stocks.
5. DIA evolved from service intelligence branches with a tradition that intelligence counted the strength of the threat and estimated its location, but did not judge its comparative tactical and military effectiveness. This was partly the result of pressures by the more prestigious plans and operations branches of the military services and the Joint Staff to cause the intelligence branches to stay away from estimates reflecting on U.S. capabilities. Accordingly, in spite of recent major efforts at reform, intelligence still tends to concentrate too much on enemy order-of-battle and technical performance of threat equipment, and to pay too little attention to threat training, build-up capability, tactics, operations and maintenance and similar "soft" factors.
6. In contrast, many intelligence officers have personal experience with our allies. They see them (warts and all) and often with more than a touch of American parochialism. Many intelligence users also have no incentive to seek high estimates of Allied capability. The justification for U.S. programs is as much the lack of Allied capabilities as the presence of threat capabilities. This leads to an inverse tendency of U.S. intelligence to underestimate Allied capabilities.
7. Estimates of threat capabilities are increasingly dependent on estimates of technology and weapons systems performance. Many aspects of weapons performance are, however, not even theoretically visible or detectable through intelligence sources. For example, it is extremely difficult to estimate factors like reliability, mean time between failures (MTBF), and

equipment availability rates even for U.S. systems until they are proven in war. Few weapons have ever approached their estimated or theoretical technical performance capability in actual combat, yet experts continue to act as if the "next" system would behave without problems.

8. Users have demanded and received intrinsically impossible estimates of threat capabilities which go far into the future, or into unknowable areas of speculation. The Office of Defense Research and Engineering, for example, has forced DIA to make predictions of Soviet capability that go so far into the future where it is unlikely the Soviets have such plans. Since the only data available are U.S. plans or capabilities, DIA is forced to "mirror image." It is not surprising that the intelligence officers forced to do such work have tended to make guesses which maximize threat capabilities.
9. These tendencies are compounded when intelligence estimates threat capabilities for future years. These involve the greatest areas of uncertainty and are most subject to the tendency to assume high capability in the absence of concrete knowledge. This is why estimates of trends in Soviet forces tend to be so bleak. The enemy we know is invariably preferable to the enemy we will know.*

Some of Cordesman's critique appears to be cogent, and I suppose most DIA analysts would plead guilty to at least one or two of his charges. But to be fair to DIA, we should be clear that, if it lurks Cyclops-like in a narrow estimative cave, it does so because of the DoD and JCS Olympians who set bounds on its nature, and direct its destiny. More to the point, if DIA's monocular vision has distorted the prowess of Soviet conventional forces, it has done so not by magnification, but by diminution. Over the years, DIA has probably *understated* capabilities of Soviet conventional forces.

The reader may recall earlier articles in this journal which drew attention to the intelligence community's persistent underestimation of Soviet strategic forces.¹⁰ There is a growing body of evidence that a similar lacuna exists vis-a-vis Soviet general purpose forces. For example, the U.S. Navy's latest *Net Assessment of the United States and Soviet Navies*¹¹ shows that the principal DIA document setting forth estimates of future Soviet naval forces, the Defense Intelligence Projections for Planning (DIPP), underestimated in its projections the assessed Soviet order-of-battle for any given year over the past eight. On page 9 are three of the charts used in NA 78.

It is doubtful that a comparable analysis of DIPP land force projections would disclose a similar gap with assessed Soviet land force order of battle over the last ten years, simply because the DIPP has been counting mainly manpower and divisions. In 1975 OSR published an analysis pointing to qualitative changes in Soviet Theater Forces which were affecting the balance.¹² Philip A. Karber of the BDM Corporation,

* Cordesman, *Imbalance of Power*, xv-xvii.

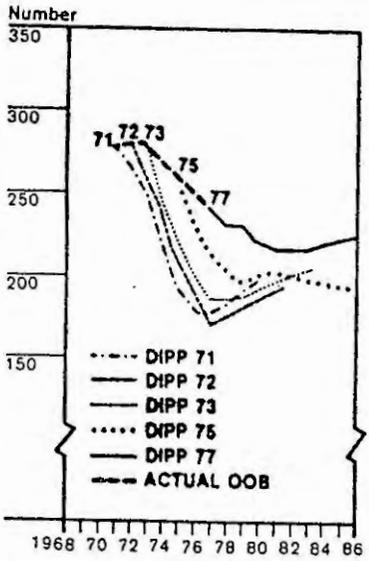
¹⁰ Cf. CIA, *Studies in Intelligence*: Taylor, Jack H., "Wohlstetter, Soviet Strategic Forces, and NIEs," Vol. 19, No. 1, Spring 1975, pp. 1-8; Cowey, Ross, "More on Military Estimates," Vol. 19, No. 2, Summer 1975, pp. 21-23; Sullivan, David S., "Improving Strategic Intelligence Methodology," Vol. 20, No. 3-S, Fall 1976, pp. 37-66; Robinson, Ray "Avoidable Errors: Forecasts of the Growth of Soviet Naval Strategic Missile Forces," Vol. 20, No. 3-S, Fall 1976, pp. 69-83. (The latter two articles are from compartmented supplements—Editor.)

¹¹ U.S. Navy, *Net Assessment of the United States and Soviet Navies (U) (NA-78)*, Vol. 1, Chapter 5, "Uncertainties in Projections," pp. 50-51.

¹² Neely, W., "Expansion and Modernization in the Soviet Theater Forces," OSR, SR IR 75-14, September 1975. Classified SECRET.

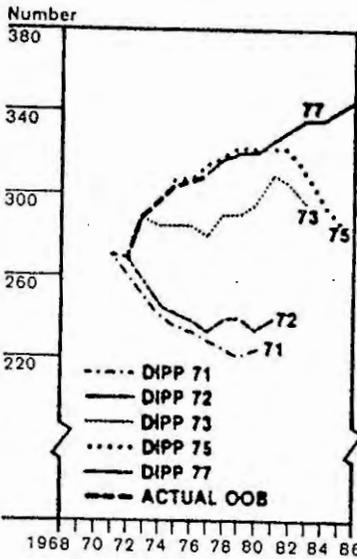
Figure 2

Soviet General Purpose Submarines



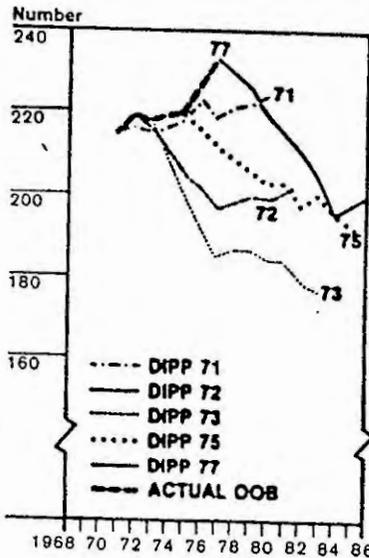
This figure shows the number of general purpose submarines projected in DIPP-71, DIPP-72, DIPP-73, DIPP-75, and DIPP-77. In each successive projection there has tended to be a sizable increase in the number projected for any given year, although the actual totals do indicate the downward trend in numbers noted previously in this report.

Soviet Navy ASM Bombers



This figure shows the number of ASM bombers projected for the Soviet naval air arm in DIPP-71, DIPP-72, DIPP-73, DIPP-75, and DIPP-77. Once again, successive projections have tended to increase the number projected for any given year. However, in this case, the actual totals indicate a strongly increasing trend.

Soviet Principal Surface Combatants



This figure shows the number of Soviet principal surface combatants projected in DIPP-71, DIPP-72, DIPP-73, DIPP-75, and DIPP-77. In DIPP-72, there was a major change in the estimate, to a rapidly decreasing force size. DIPP-73, DIPP-75, and DIPP-77 continue to project a rapid decline, but delay the start. It is interesting to observe that the actual totals have been in fairly good agreement with the original DIPP-71 projections.

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in contract studies for DoD, subsequently pointed out that division/manpower counts failed, *inter alia*, to identify modernizing Soviet combat service support systems. Moreover, Karber and his colleagues, in a study published in February 1978 entitled *Trends in the Central European Military Balance*,¹³ noted that over the dozen years from 1965 to 1977 intelligence estimates had perceived relatively little change in the commonly used measures of the NATO/Warsaw Pact balance.

But significant change there had been. To inquire into both qualitative and quantitative differences among weapon systems and units on both sides, Karber assigned to each numerical indices of effectiveness—weighted effectiveness indices, or WEI, and weighted unit values, or WUV (which shall be explained in detail in the following pages)—which are widely used to assess land force balances in DoD analyses, particularly those of the U.S. Army. Thus measured, important new Warsaw Treaty Organization (WTO) capabilities, the product of burgeoning Soviet military technology, became evident:

In the last 12 years both alliances have greatly increased their theater equipment inventories and significantly upgraded the quality of their deployed weapon technologies without altering the personnel and division balances to any great extent . . . Although there is evidence of substantial growth for both alliances, the Warsaw Pact quantitative increases exceed those of NATO in every category except light tanks and armored personnel carriers. The Pact has particularly widened its quantitative advantage in tanks, anti-tank guns, artillery, and multiple rocket launchers and has decisively overcome a NATO advantage in anti-tank guided missiles (ATGMs) held in 1965. If quantitative and qualitative trends are combined (using WEI/WUV), the growth of Warsaw Pact forces relative to NATO is more dramatically apparent. The weapons systems ratio for 1977 reflects a Warsaw Pact lead in all weapon categories. . . . While NATO technology was generally superior to that of the Warsaw Pact in 1965, today the Soviets have generally achieved qualitative parity in deployed system technologies and in some cases have technology superior to that currently deployed by NATO. . . .¹⁴

Reproduced on page 11 is the summary table from the Karber study (Classified SECRET).

This past spring, a study conducted by the Office of the Assistant Secretary of Defense for Program Analysis and Evaluation used a similar WEI/WUV methodology to compare future programs of NATO force modernization with projected Soviet/Warsaw Pact modernization, and reached conclusions that in the mid-80s the capability gap between conventional forces of the two coalitions facing each other in Central Europe will narrow, but that at least some NATO allies will lose ground vis-à-vis threat forces.¹⁵ In Table III on page 11, the Warsaw Treaty Organization's improvement in firepower is measured in "armored division equivalents" (ADE), a WUV score of weighting which uses the U.S. Armored Division as standard. (The WTO forces include Soviet divisions stationed in East Europe or available in West Russia, and non-Soviet Warsaw Pact—NSWP—divisions of Poland, Czechoslovakia, and East Germany.)

¹³ Karber, P. A., Whitley, G. A., and Komer, D. R., *Trends in the Central European Military Balance: Quantitative and Qualitative Change in the Ground Forces of NATO and the Warsaw Pact Alliance*, The BDM Corporation, McLean, Virginia, February 1978. Classified SECRET. Also, Karber, et al., *Net Assessment of the Maturing Soviet Threat in Ground Forces (U)*, 12 October 1976 (Net Assessment Project 186-Phase III), (BDM Corporation), SECRET.

¹⁴ *Ibid.*

¹⁵ OASD/PA&E, *NATO Center Region Military Balance Study, 1978-1984*, July 13, 1979, Classified SECRET, pp. 6-7.

Table II
Change in Major Theater Weapon Inventories
(Active Units 1965-1977)

Type of System	WTO Percentage Change		NATO Percentage Change		WTO/NATO Ratio (Quantity + Quality)	
	Quantity	WEI Quantity/Quality	Quantity	WEI Quantity/Quality	1965	1977
Tanks	30	45	12	26	2.2 to 1	2.5 to 1
Light Tanks	—	-2	44	73	0.9 to 1	0.5 to 1
Armored Personnel Carriers	42	90	44	63	1.1 to 1	1.3 to 1
Antitank Guided Missiles	625	908	300	587	1.1 to 1	1.6 to 1
Antitank Guns	70	39	-33	32	1.5 to 1	1.6 to 1
Light Antitank Weapons	28	131	26	2	0.6 to 1	1.3 to 1
Artillery	58	78	32	49	1.4 to 1	1.7 to 1
Multiple Rocket Launchers	50	145	*	**	—	7.2 to 1
Mortars	8	50	4	5	0.5 to 1	0.8 to 1

* Quantity increased from 0-to-176 between 1970-1977.

** Quantity/Quality increased from 0-to-12,403 between 1970-1977.

Table III
Trends in Warsaw Pact Force Modernization

	ADEs		
	1978	1984	% Increase
Soviet	50.5	60.1	19%
NSWP	20.4	23.8	17%

"The Pact's modernization effort is expected to include all major types of weapons in Soviet and East European ground forces. As a result, the Pact forces in the mid-1980s will have increased capability for combined arms operations against NATO." "The study then goes on to point out that projected modernization of NATO forces in the same time frame will be asymmetric, with wide differences in effectiveness developing among the allies:

Table IV
NATO Force Modernization (ADEs)¹⁷
(1978-1984)

	1978	1984	Increase	% Increase
U.S.	6.5	8.6	2.1	33%
FRG	10.7	12.8	2.1	20%
UK	3.4	4.1	.7	18%
France	3.0	3.5	.5	17%
Netherlands	2.7	3.1	.4	15%
Belgium	1.94	1.96	.2	1%
Canada209	.276	.067	32%
Denmark	2.03	1.99	-.04	-2%

These differences are the more striking when WEI for specific weapon systems are compared: (Table V, next page).

¹⁶ *Ibid.*, p. 1-7. Classified SECRET.

¹⁷ *Ibid.*, p. 1-13. Classified SECRET. Negative values in this and the following table mean that modernization has cost so much that less firepower is afield, a better quality of arms notwithstanding.

Table V
 Modernization of Major Firepower ¹⁴
 (In-Place Forces)

	U.S.	FRC	UK	France	Neth.	Belgium	Denmark
Armor							
1978	2.56	4.37	.96	.98	.94	.48	.45
1984	3.14	5.45	.93	1.29	1.1	.43	.43
% Increase	23%	25%	-3%	31%	17%	-11%	-4%
Artillery							
1978	.53	1.93	.44	.52	.62	.26	.54
1984	.93	2.3	.49	.59	.62	.26	.52
% Increase	75%	10%	11%	13%	0	0	-2%
Anti-Armor							
1978	1.60	1.59	.41	.27	.28	.37	.09
1984	2.73	1.69	.76	.68	.41	.43	.17
% Increase	70%	7%	85%	152%	46%	16%	89%
Total Increase	2.1	1.8	.4	.8	.3	.07	.03
% Increase	45%	17%	23%	46%	15%	6%	3%

The purpose of the OASD/PA&E study was to inquire into the need for revised NATO programs, particularly those calling for earlier arrival of more U.S. reinforcements. Based on the WEI/WUV comparisons, the study concluded that NATO requires both substantial force modernization by all members and full funding of the U.S. program to preposition stocks of unit equipment in Europe and otherwise provide for swift deployment of reinforcements (Figure 3, opposite).¹⁵

Note that the difference between Curve B and Curve C is another portrayal of a potential "gap" in capabilities—still another measure of a shifting balance—which might develop if either (1) the U.S. Congress failed to appropriate funds for DoD NATO programs, or (2) our NATO allies failed to live up to their modernization commitments implicit in the newly adopted Long-Range Defense Plan, or (3) both shortfalls materialize.

So "balance of forces" is a most serious intelligence problem, one for which our traditional analytical frame of reference and usual technique has been largely irrelevant. There seem to be three principal questions or issues involved:

1. Whether the intelligence community should assess the military balance in Central Europe.
2. If so, how to weigh the military forces involved.
3. Most important, how to present the assessment to the policy maker.

ISSUE I: Assess the Military Balance?

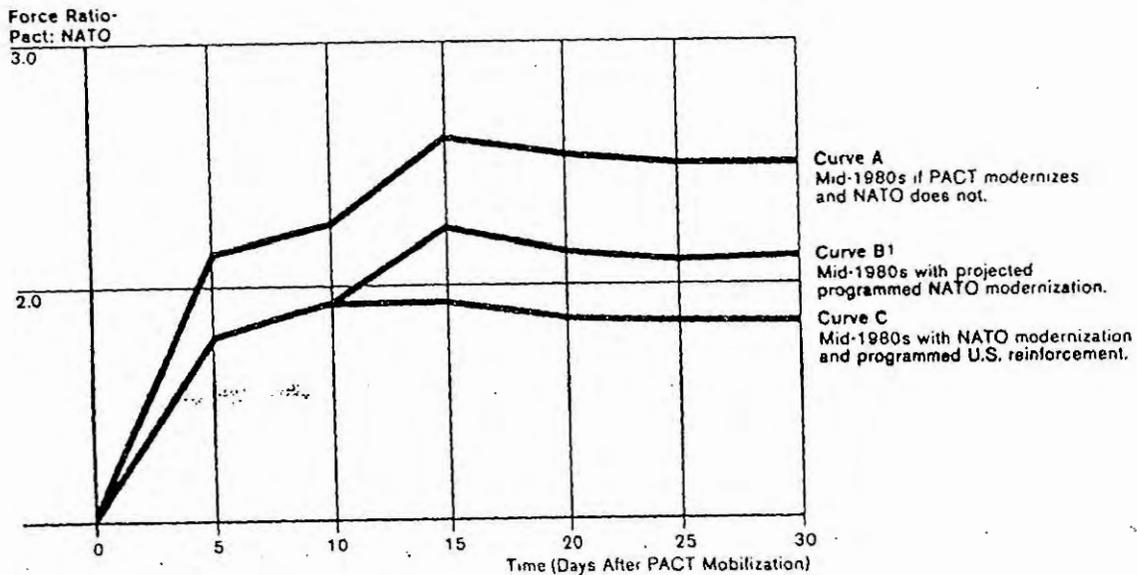
It is important to understand the depth of resistance in DIA and the military services to launching on any course which might lead U.S. intelligence to render judgments on U.S. forces, which is plainly the prerogative of the commanders concerned. While military intelligence feels free to participate in National Intelligence Estimates which assess wholly foreign military balances—even when, as in the Arab/Israeli balance, substantial amounts of U.S. arms figure—they have steadfastly

¹⁴ Ibid., p. I-15. Classified SECRET.

¹⁵ Ibid., p. I-20. Classified SECRET.

Pact-to-NATO Force Ratios
(Based on ADEs) 1984

Figure 3



¹ Curve B for 1984 is nearly equivalent to the curve for 1978. The difference between Curve B and Curve C thus represents NATO's net gain in 1978-84.

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refused to join in any comparable assessment in which U.S. forces are significant. But surely military intelligence carries its aversion to "net assessment" too far. I recently asked a DIA office to update a chart plotting, over time, thickness of frontal armor on Soviet tanks against penetrating power of U.S. antitank weapons, but was told that the office had no access to "blue data" and that such "net assessment" was beyond its charter. I find it difficult to believe that anyone trying to analyze Soviet tank design can do so competently without data on the U.S. weapons which the Soviet tanks are built to confront—preferably Soviet data, but in its absence, our own. I find it similarly hard to credit estimates of Soviet theater capabilities from analysts uninformed of those of NATO. Having helped write over the years numerous policy papers for which intelligence provided "input," usually "red" data of stipulated kinds and amounts, I suggest that commanders, operators, and planners can as readily input "blue" data for purposes of National Intelligence Estimates. Noting that they have already been doing so for NIE 11-3/8, the strategic estimate, I urge that it is now time to extend the practice to NIE 11-14, given these policy issues, each of which requires assessing the balance:

- Nuclear parity, and concomitant renewed importance for "conventional" strategies.
- U.S. commitment to the NATO Long Term Defense Plan.
- Needs for modernizing NATO conventional forces, despite foreseen economic and demographic strains.

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- Requirements for modernizing NATO's Long Range Theater Nuclear Force.
- Extension of U.S.-Soviet bilateral arms limitation talks to Theater Nuclear Forces.
- Multilateral arms limitation negotiations, notably MBFR (Mutual Balanced Force Reductions)
- U.S. objective of limiting arms transfers to the Third World.

ISSUE II: How to Weigh?

Selection of measurements for assessment of the military balance in Europe is not easy. Gross measures like ratios of manpower, Gross National Product, or even numbers of divisions on each side conceal as much as they reveal, given contrasts in the social systems and military structures. For example, expressing force ratios in terms of raw numbers of divisions is hazardous, so elusive is the term "division." James Carson of OSR, recognizing that "beancounting" involves accounting for "beans" of different shapes and sizes, used this table (Table VI, page 15).¹⁹

To illustrate the analysts' risk in the absence of reliable "blue" data I point out that I took command of one of the two U.S. mechanized divisions in Germany in July 1977, one month before Carson's paper appeared. The numbers for the division should have included:

8th Infantry Division (Mech)	
Medium Tanks	392
Cobra-Tow	42
Major AT Weapons	574

The significance of the corrected numbers is that they might have affected one of Carson's key measures of the balance, ADE (armored division equivalent), which is computed "by combining the unit's total number of ground combat weapons and the quality of each weapon in terms of firepower, mobility, and survivability." As Carson notes, thus counted, the overall NATO position looks better, more "optimistic:"

The resulting application of ADE scores to major NATO and Pact combat units . . . yields the Pact a 1.7 to 1 numerical advantage in ADEs over NATO as opposed to a 2.3/1 advantage in numbers of divisions.²¹

There is no reason worth considering why an OSR analyst struggling with such a calculus should not have access to the latest and best count of "blue beans."

On the face of it, ADE, or other WEI/WUV scoring, seems to promise a straightforward way of counting those "beans," and thus assessing the balance. But there are major limitations to this method.

WEI (weapon effectiveness indices) are lineal descendants of the firepower scores the U.S. Army has used for tactical force comparison since at least the 1941 Louisiana maneuvers. Each WEI is essentially a weighted sum of the dominant characteristics

¹⁹ SR 77-10100, p. 7.

²¹ *Ibid.*, p. 7-8. Generally speaking, application of weighting techniques has the effect of presenting a lower force ratio—but not necessarily so.

Table VI
Soviet, West German, and US Divisions¹

	Soviet Tank Division	West German Armored Division	US Armored Division	Soviet Motorized Rifle Division	West German Mechanized Division	US Mechanized Division
Personnel	9,500	24,000	15,400	12,200	24,600	15,600
Medium Tanks	325	315	324	266	278	270
Other Armored Vehicles ²	249	715	968	460	777	1,029
Artillery ³	78	88	66	90	88	66
AAA Weapons ⁴	173	121	120	206	121	120
Major Antitank Weapons ⁵	15	50	225	63	61	270

¹ Personnel and equipment strengths are estimated model wartime strengths; actual wartime strengths vary from division to division.

² All tracked, armored vehicles, including light tanks and excluding engineer vehicles.

³ Includes guns and multiple rocket launchers.

⁴ Guns and missiles, including Redeye and SA-7 Grail.

⁵ Guns and missiles with a range of 1,000 meters or more, excluding missiles mounted on personnel carriers.

for a particular weapon²² WEI express relative value or prowess within nine categories, or families, of weapons.²³ For any particular category, e.g., tanks:

$$WEI = c_f F + c_m M + c_s S$$

where

F is firepower, M mobility, and S survivability and C_f , C_m , and C_s are judgmentally assigned coefficients (constants) expressing relative weighting.

For example, one formulation of WEI_{tank} , arrived at by Delphi techniques polling military professionals (U.S. soldiers tend to emphasize firepower over other capabilities) produced these values for C_f , C_m , and C_s :

$$WEI_{\text{tank}} = .60F + .15M + .25S.$$

In turn, F_{tank} is calculated by arbitrarily designating a value of a standard tank (e.g., M60A1 or T-55) and then judgmentally quantifying on a scale of 0-1 seven factors comparing the standard with any other tank; for example its:

- lethality (Pk)
- ammunition type available (A)
- basic load (BL)
- auxiliary weapons (W)
- time to fire (FM)
- night capability (NF)
- stabilization (P)

Then F_{tank_n} , any given tank, is a function of the sum of the ratios of the characteristics of that tank and the standard tank. Tank_s , computed for example, per this formula:

$$F = .59 \frac{P_{k_n}}{P_{k_s}} + .13 \frac{FM_n}{FM_s} + .10 \frac{BL_n}{BL_s} + .07 \frac{W_n}{W_s} + .06 \frac{A_n}{A_s} + .03 \frac{NF_n}{NF_s} + .02 \frac{P_n}{P_s}$$

Similarly complicated formulae are used to compute M and S, the mobility and survivability indices.

Here are some actual WEI for various tanks, normalized to the U.S. M60A1:

U.S. M60A1	1.00	USSR T62	1.17
U.S. M60A3	1.14	USSR T72	1.37
FRG Leopard II	1.34	USSR T80	1.46
UK Chieftain	1.28		

The WUV (weighted unit value) aggregates WEI for the arms within given units, weighting the contribution of each weapon to the unit's overall combat worth. Again, judgmentally derived weighting figures heavily. Here are some typical weightings assigned to category or weapon family; note that these differ by mission, and by theater (reflecting differing utility of armament in the several environments):

Table VII

Category	Europe			Asia	Middle East
	Offense	Defense	Average	Average	Average
I. Small Arms	1	1.2	1.1	1.3	1
III. Tanks	64	55	60	46	24

²² This discussion draws on an unpublished paper of 1973, "Review of Index Measures of Combat Effectiveness," by D. M. Lester, Office of Secretary of the Army, and R. F. Robinson, of the Air Staff, and on material provided by the U.S. Army Concept Analysis Agency, Bethesda, Maryland.

²³ U.S. Army WEI compare these families (1) small arms; (2) armored personnel carriers; (3) tanks; (4) armored reconnaissance vehicles; (5) anti-tank weapons; (6) cannon/rockets; (7) mortars, and (8) armed helicopters; (9) air defense artillery.

The WUV is computed for a given unit thus.

$$WEI \times \text{Category Weight (W)} \times \text{Quantity (Q)} = WUV$$

Hence:

$$\begin{aligned} WUV = & WEI_{\text{small arms}} \times CW_{\text{small arms}} \times Q_{\text{small arms}} \\ & + WEI_{\text{tanks}} \times CW_{\text{tanks}} \times Q_{\text{tanks}} \\ & + WEI_{\text{other}^{(1)}} \times CW_{\text{other}^{(1)}} \times Q_{\text{other}^{(1)}} \end{aligned}$$

Sample WUV computed in 1978 showed these differences among divisions:

	Offense	Defense
US Armored Division	50,816	53,651
USSR Tank Division	37,889	38,127
US Mechanized Division	45,025	48,877
USSR Motorized Rifle Division	40,664	40,714

In practice, these are compared to a defending U.S. Armored Division and expressed as a ratio, an Armored Division Equivalent (ADE):

	Offense	Defense
US Armored Division	0.95	1.00
USSR Tank Division	0.71	0.71
US Mechanized Division	0.84	0.91
USSR Motorized Rifle Division	0.76	0.76

Generally, the more one aggregates using this technique, the more the input judgments—however carefully drawn from knowledgeable professionals—dominate results, and therefore the less reliable are the quantifications.

WEI suffer from:

- Linearity (20 bullets are not necessarily 20 times effective as 1 bullet).
- Lack of comparability (if $WEI_{\text{tank}}=100$ and $WEI_{\text{rifle}}=1$, 100 rifles \neq 1 tank).
- Dependence on judgmental inputs *vice* reliable combat or test data.
- Ignoring synergistic effects of weaponry (tank plus scout-afoot is some multiple of WEI_{tank} plus WEI_{rifle}).
- Category limitations (no radar, C²I).*

WUV suffer from:

- Sensitivity to judgments on category weights.
- Cascading uncertainty, stemming from summed WEI.
- Slighting terrain, weather, morale, doctrine, training, and relative finesse or efficiency. Military history is replete with examples which support Napoleon's view that in war "mind and opinion make up more than half of reality," and which confound Voltaire: "Dieu est toujours pour les gros batallions."

WEI/WUV analysis is better for small-scale military balance comparisons which attempt no more than to describe potential, or resources on both sides, e.g.:

- Weapon system trend comparisons.
- Tactical force balances in local situations.

* Command, Control, Communications, Intelligence.

WEI/WUV analysis is weak for large-scale net assessments, such as portrayal of the theater force balance, and weakest when it purports to predict a campaign outcome, precisely since it perforce deals with static comparisons, and cannot take into account such dynamics as force concentration, and superior tactics.

To illustrate these points, let me cite two examples from the work of Karber, et. al., of the BDM Corporation. In their *Trends in the Central European Military Balance*, they used a series of charts which plotted the cumulative WEI of the Warsaw Pact weapon systems vis-a-vis those of NATO. For example, this series on tanks, which showed first inventories, then types, and finally WEI trends (Figures 4,5,6).²⁴

I regard this application of WEI as meaningful, better than saying only that the Pact has a 3:1 superiority in numbers of tanks, because the WEI take armor protection into account, and portray the differing firepower of older and newer types in the inventories on both sides. The graphs portray a large and growing gap in capabilities, both in quality and quantity, which might inform policy makers contemplating amelioration via better NATO tank or antitank systems.

Portraying trends is helpful. Carson of OSR, cited *supra*, noted that in 1977 overall the Pact enjoyed a land forces advantage of 1.7:1 over NATO, as measured by WUV (ADE); he did not say what this means (although his is clearly a more helpful statement than simply a ratio of numbers of divisions on either side). Karber, writing about the same time, computed the WUV ratio at 1.85:1, and noted usefully that NATO had improved its WUV only 42% since 1965, as contrasted to a 69% plus-up for the Warsaw Pact.

But Karber, et. al. have also provided an excellent example of the perils of using and interpreting gross WEI/WUV ratios.²⁵ Applying WEI/WUV analysis to the German and Allied opposing forces in 1940 (before the German offensive), they found overall a fairly even balance. An intelligence analyst then might have used WEI/WUV to show that the Allies were offensively postured, with a clear edge in tanks, and some advantage in artillery. The Germans seemed better postured for defense, with superiority in antitank systems, anti-aircraft systems, and aircraft. WEI ratios are shown in figure 7.

Obviously, such analysis, limited to theater gross comparisons, could not have led to a warning of the German cover and deception which led to a concentration of forces in the center. The Germans threw 29 divisions through Holland in a swift, shocking campaign which drew 57 Allied divisions into Flanders. Meanwhile, 19 German divisions pinned 44 Allied divisions behind the Maginot Line, while 45 divisions massed for a crushing assault through the Ardennes against the 15 Allied divisions defending there. In short, the Germans accepted the risk of inferior force ratios on two fronts (albeit assuring themselves of offsetting advantages of surprise and initiative) in order to generate a clear superiority of force for breakthrough in the center (Map, Figure 8).²⁶

While the division-to-division ratio was 3:1 at the Ardennes *schwerpunkt*, the WEI/WUV ratio was 4:1, reflecting, among other measures, German non-divisional firepower massed there (Figure 9).²⁷

²⁴ Karber, et. al., *op. cit.*, pp. 21, 23, and 25. Classified ~~SECRET~~.

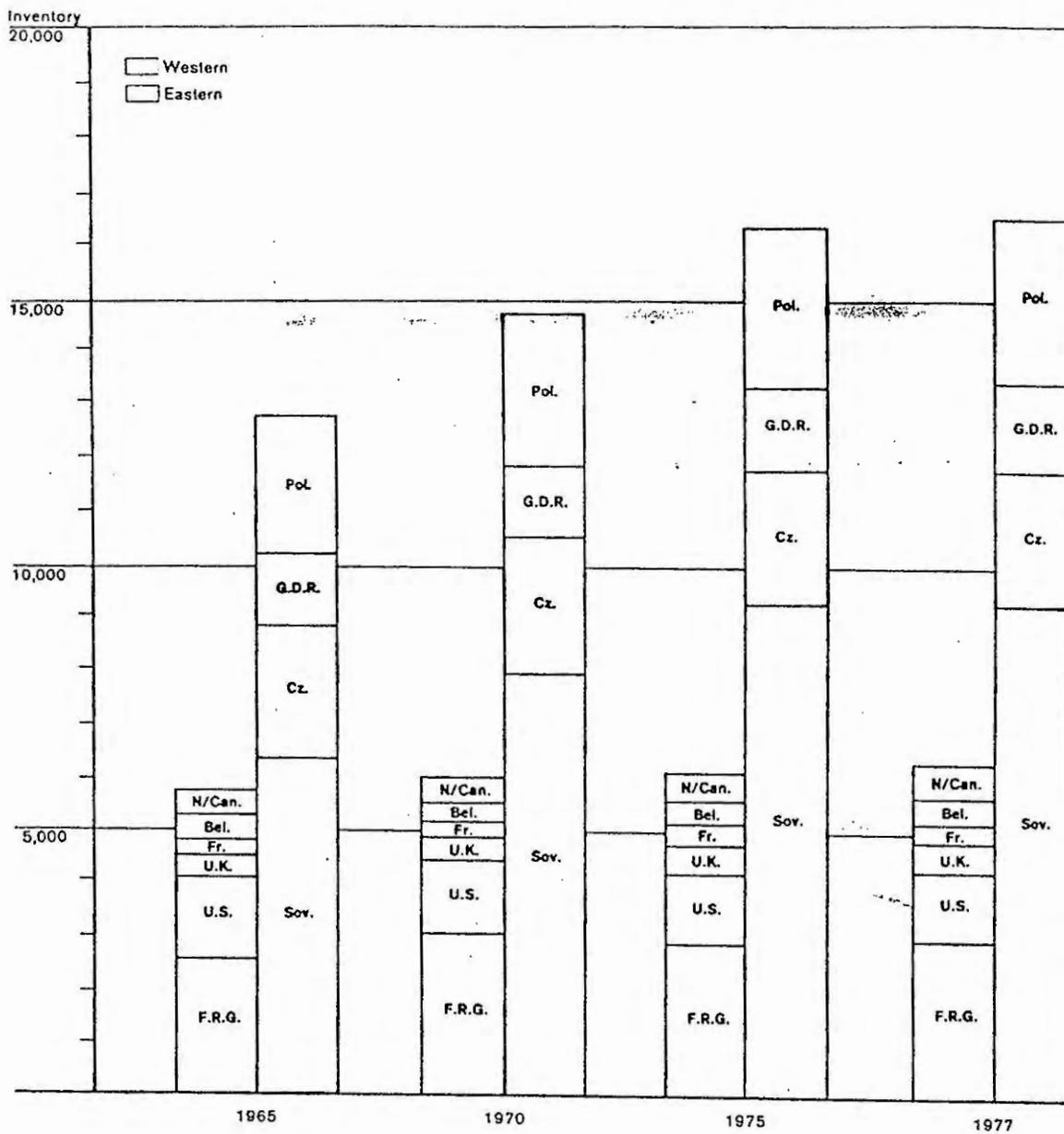
²⁵ Karber, P. A., Whitley, G., Herman, M. and Komer, D., "Assessing the Balance of Forces: France 1940." BDM, McLean, Virginia, June 1979

²⁶ *Ibid.*, p. 3-3.

²⁷ *Ibid.*, p. 4-4.

Center Region Comparisons
Medium and Heavy Tanks

Figure 4



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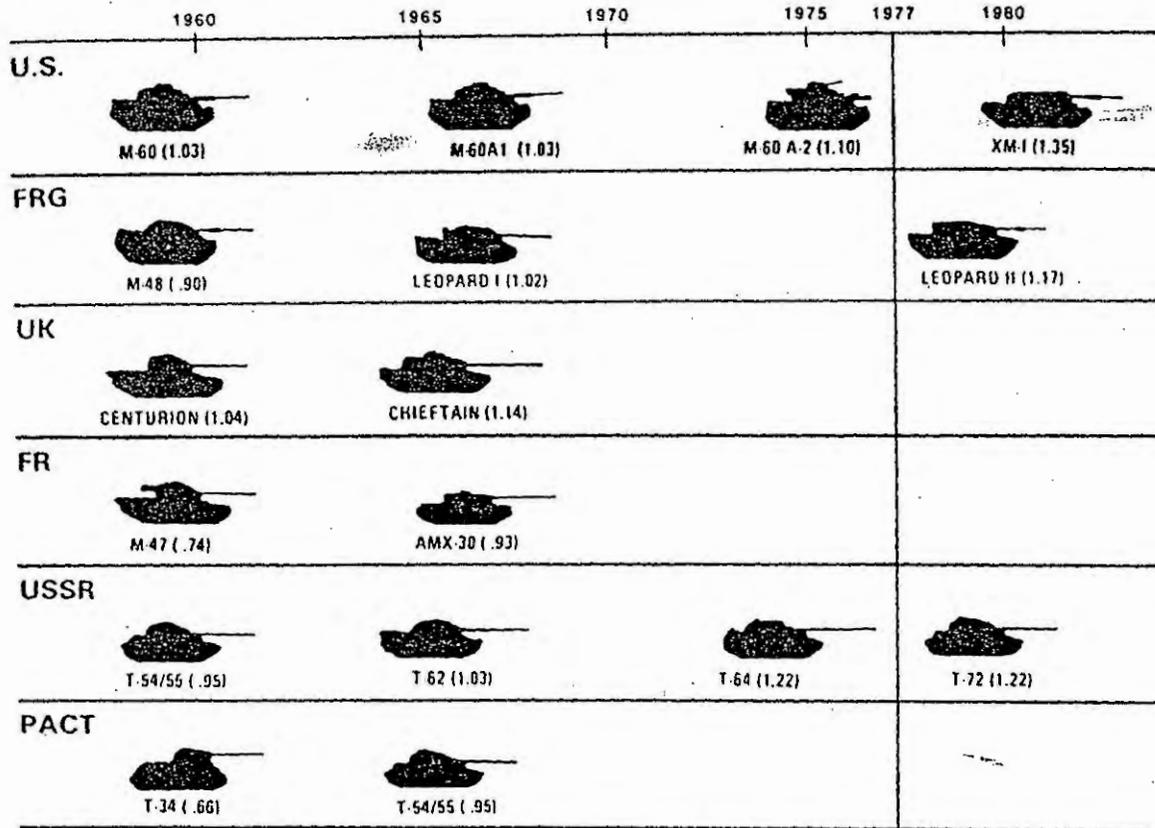
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Deployment of New Generation Technology Tanks

Figure 5

(WEI Standard-M-60A1)



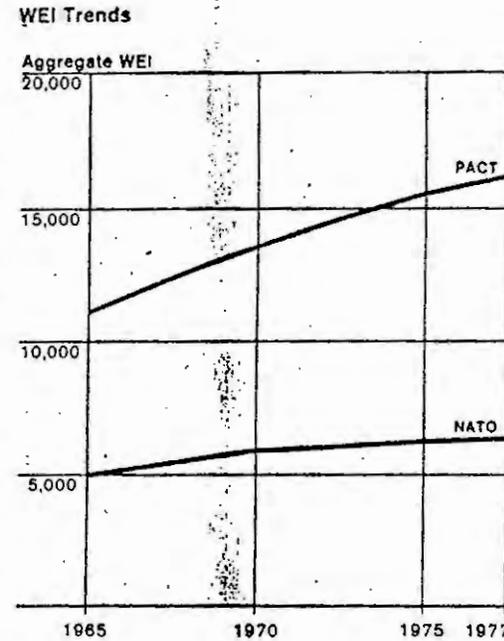
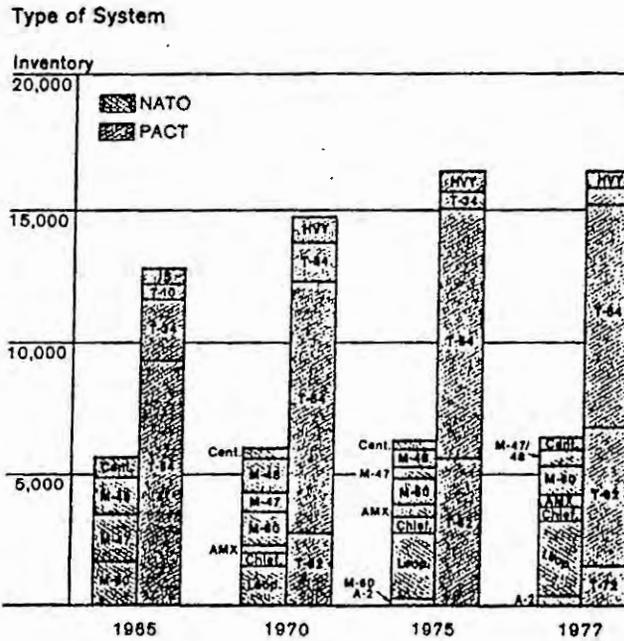
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Medium and Heavy Tanks (Active Units)

Figure 6



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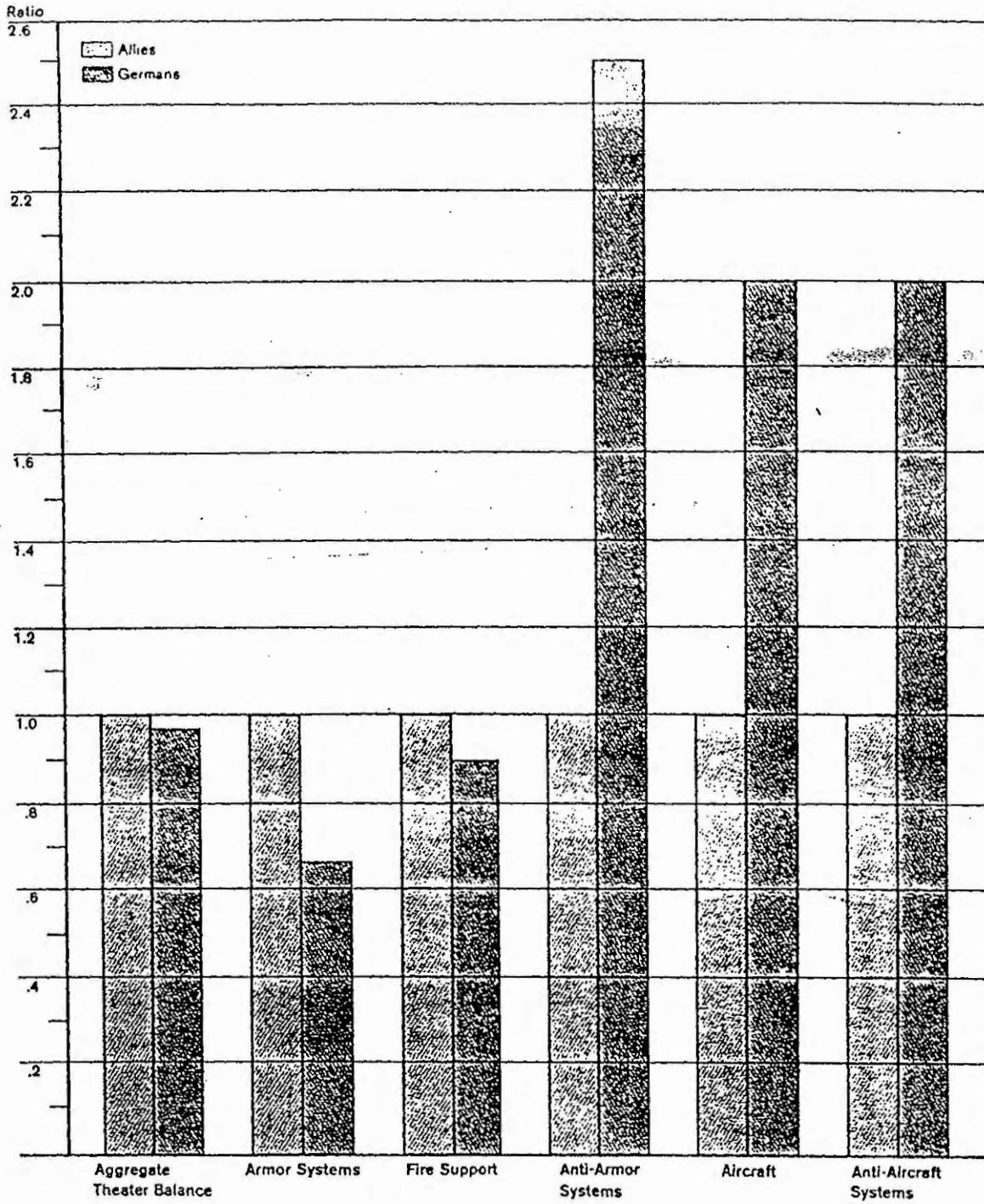
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The Military Balance

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Force Ratio Comparisons

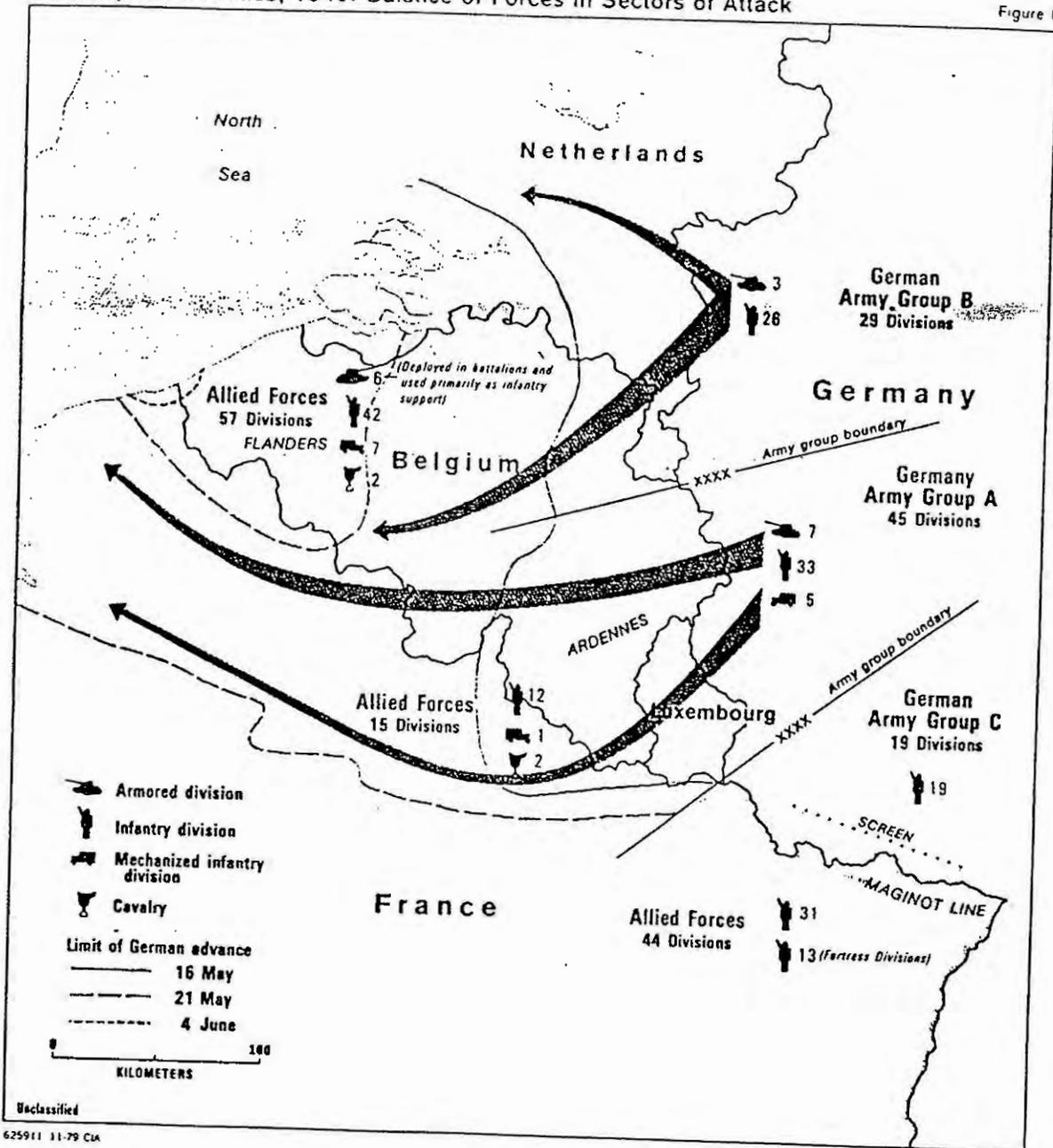
Figure 7



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Germany vs. the Allies, 1940: Balance of Forces in Sectors of Attack

Figure 8

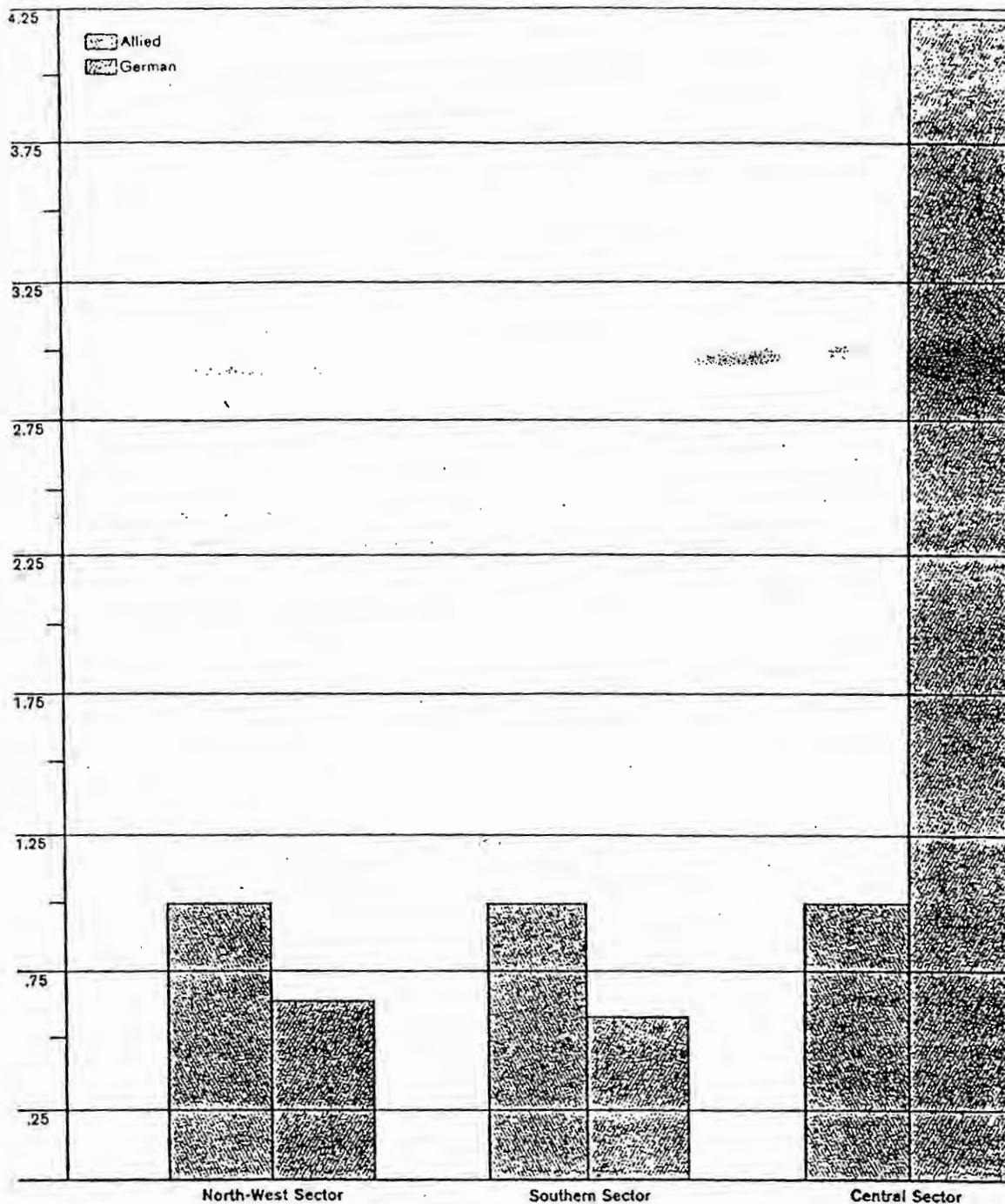


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Comparison Ratio by Sector

Figure 9



To illustrate a contemporary application of this sort of force balance assessment, here is an example (see Table VIII) from the OASD/PA&E paper cited above. The analysts used WEI/WUV to portray how the Warsaw Pact, taking advantage of its growing ground force capabilities and its advantages of initiative, could, in 1984, create Ardennes-like force ratios opposite the German I Corps and British I Corps in NATO's Northern Army Group. Postulated is a Pact attack on M plus 5, (NATO M plus 10) with five Fronts and 89 divisions (consistent with NIEs 4-1-78 and 11-14-79). The "base case" is a Soviet strategy of superiority everywhere, in which event force ratios of 6:1 at the *schwerpunkt* become possible. The "option" accepts parity everywhere except there, in which case ratios of 8.3:1 at the breakthrough sector become possible.

Table VIII

Pact Force Advantages in Alternative Force Allocation Tactics ²⁸

Pact/NATO Ratios by Corps	NEI	GEI	UKI	BEI	GEIII	USV	USVII	GEII
Base	1.5	6.1	6.1	1.5	1.5	3.0	1.5	1.5
Option	1.0	8.3	8.3	1.0	1.0	1.0	1.0	1.0

These data point up the danger that SACEUR, General Rogers, may have the modern Russian equivalents of Halder, Guderian and Rommel facing him, and they illustrate for intelligence the criticality of our warning and indications estimates. I agree with Karber that WEI/WUV analysis has its place "as a reasonably short hand method for establishing military force relationships which require further analysis to have any real significance . . ." ²⁹ And I reiterate that its best applications are found at Army Group (Front) or lower echelon.

Of course, WEI/WUV numbers are not the only numerical methods available for assessing force balances. Two other techniques of static analysis should be described, both purporting to account for intangibles omitted from WEI/WUV. One might be termed a macro-analysis, in that it deals with the larger aspects of the power relationship, assigning weights to each. Ray S. Cline, former Deputy Director for Intelligence, CIA, and former Director of the Bureau of Intelligence and Research, Department of State, proposes an overall formula as follows: ³⁰

$$P_p = (C + E + M) \times (S + W)$$

where P_p is perceived power

- C = critical mass = population + territory
- E = economic capabilities
- M = military capabilities
- S = strategic purpose
- W = will to pursue national strategy

Within this paradigm, Cline calculates M, military capabilities, by judgmentally awarding weights for (1) quality of manpower, (2) weapon effectiveness, (3) infrastructure and logistics, and (4) organizational quality, averaging, and multiplying by manpower. He produces a number for every nation, which enables tabular displays of force balances as shown in Table IX.

²⁸ OASD/PA&E, *op. cit.*, Table I-20, p. I-34. N.B.: This paper cautions (p. I-28) that the WEI/WUV-derived tables do not purport to predict outcome, "apply only to corps-level engagements and should not be used to evaluate adequacy of NATO's theater posture."

²⁹ Karber, "Assessing the Balance of Forces," *op. cit.*, p. 5-1.

³⁰ Cline, Ray S., *World Power Assessment: A Calculus of Strategic Drift*, Boulder, Colorado, 1977.

Table IX

Non-Nuclear Military Forces: Estimates of Equivalent Combat Capabilities²¹

United States and NATO	Total Manpower (thousands)	Manpower Quality	Weapon Effectiveness	Infrastructure & Logistics	Organizational Quality	Average	Equivalent Units of Combat Capability
United States	2,086	1	1	0.9	0.8	0.9	1,877
West Germany (FRG)	515	1	0.9	0.9	0.7	0.9	464
France	513	0.8	0.7	0.8	0.6	0.7	359
Turkey	490	0.7	0.5	0.4	0.5	0.5	245
Italy	362	0.6	0.5	0.5	0.4	0.5	181
United Kingdom	344	1	0.8	0.8	0.7	0.8	275
Greece	200	0.7	0.5	0.4	0.5	0.5	100
Netherlands	112	0.9	0.8	0.8	0.6	0.8	90
Belgium	88	0.9	0.8	0.6	0.6	0.8	70
Canada	78	0.9	0.6	0.6	0.6	0.7	55
Portugal	60	0.7	0.2	0.2	0.6	0.4	24
Norway	39	0.9	0.8	0.6	0.6	0.7	27
Denmark	35	0.8	0.6	0.6	0.4	0.6	21
Total, gross manpower: 4,922,000		Total, equivalent units of combat capability: 3,788					

Warsaw Pact

USSR	4,400	0.7	0.9	0.7	0.5	0.7	3,080
Poland	300	0.6	0.7	0.6	0.5	0.6	180
East Germany (GDR)	204	0.9	0.8	0.6	0.7	0.8	163
Rumania	191	0.5	0.6	0.6	0.4	0.5	96
Czechoslovakia	190	0.8	0.8	0.6	0.4	0.7	133
Bulgaria	177	0.6	0.7	0.6	0.5	0.6	106
Hungary	120	0.8	0.7	0.6	0.5	0.7	84
Total, gross manpower: 5,582,000		Total, equivalent units of combat capability: 3,842					

Cline modifies these totals further by factors which take into account "strategic reach" (the distance from homeland) and "scale of effort" (Israel and the USSR get a bonus for perceived seriousness about matters military). He is then able to draw up a "final assessment." The following table is an extract to illustrate the outcome:²²

Table X
Final Assessment

Country	Concrete Elements Perceived Power	National Strategy	Will	Total Coefficient	Total
United States	468	0.4	0.5	0.9	421
FRG	112	0.7	0.8	1.5	168
UK	99	0.6	0.4	1.0	99
USSR	402	0.8	0.5	1.3	523
GDR	22	0.8	0.2	1.0	22
Poland	48	0.5	0.2	0.7	34

²¹ Ibid., pp. 114-130²² Ibid., p. 173

In contrast with Cline's "macro" technique, which weights only the grossest characteristics of national military potential, are such methods of microanalysis exemplified by Trevor N. Dupuy's "Quantified Judgment Model," a method of comparing the relative combat effectiveness of two opposing forces in historical combat by determining the influence of environmental and operational variables upon the force strength of the two opponents.²² Dupuy assigns numbers to fifty or more variables in a series of complex equations describing a real (or hypothetical) battle, and undertakes comparison following this construct, as shown in Figure 10.

Illustrative is his computation of Force Strength (S), a concept resembling WEI/WUV:

$$S = (W_s + W_{mg} + W_{hw}) \times r_n + W_{gi} \times r_n + (W_g + W_{gy})(r_{wg} \times h_{wg} \times z_{wg} \times w_{wg}) + (W_i \times r_{wi} \times h_{wi}) + (W_y \times r_{wy} \times h_{wy} \times z_{wy} \times w_{yy})$$

The symbols represent the following:

- S — Force Strength (overall weapons inventory value of a combat force, as modified by environmental variables)
- W — Weapons Effectiveness or firepower inventories of a force, a summation of the OLI values of all small arms (W_s), machine guns (W_{mg}), heavy weapons (W_{hw}), antitank weapons (W_{gi}), artillery (W_g), air defense weapons (W_{gy}), armor (W_i), or close air support (W_y)
- r_n — Terrain factor, related to infantry weapons
- r_{wg} — Terrain factor, related to artillery
- h_{wg} — Weather factor, related to artillery
- z_{wg} — Season factor, related to artillery
- w_{wg} — Air superiority factor, related to artillery
- r_{wi} — Terrain factor, related to armor
- h_{wi} — Weather factor, related to armor
- r_{wy} — Terrain factor, related to air support
- h_{wy} — Weather factor, related to air support
- z_{wy} — Season factor, related to air support
- w_{yy} — Air superiority factor, related to air support

But he goes on to compute Combat Power Potential—which sweeps in much more than the U.S. Army's Weighted Unit Value:

$$P = S \times m \times l_e \times t \times o \times b \times u_s \times r_u \times h_u \times z_u \times v$$

The symbols represent the following:

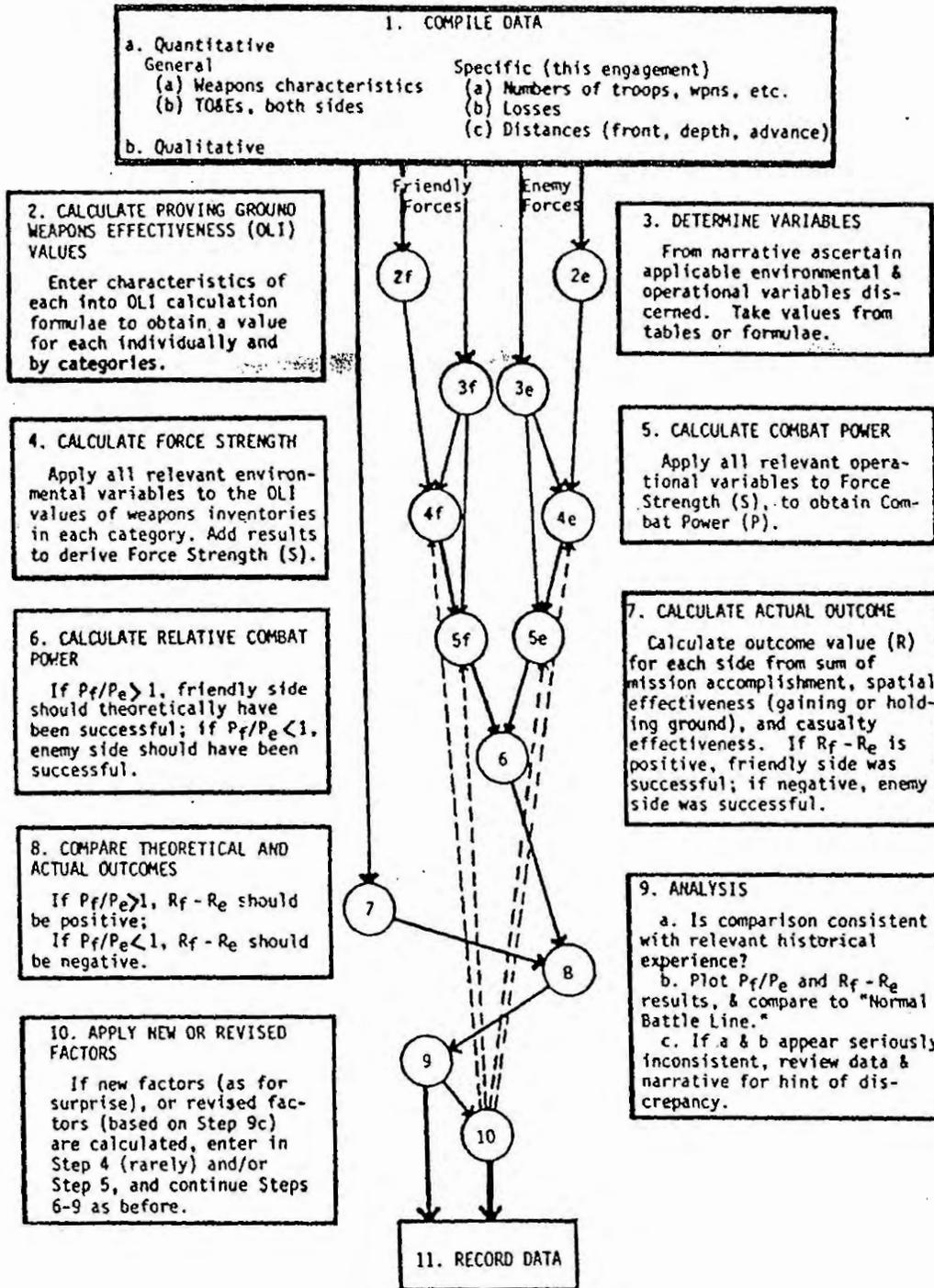
- P — Combat Potential (Force Strength as modified by operational variables)
- m — Mobility factor (as calculated in Equations (6) and (7); m for a defender is always unity)
- l_e — Leadership factor (when data permits an assessment)*
- t — Training and/or Experience factor (when data permits an assessment)*
- o — Morale factor (when data permits an assessment)*
- b — Logistics factor (when data permits calculation or assessment)*
- u_s — Posture factor, related to Force Strength
- r_u — Terrain factor, related to Posture
- h_u — Weather factor, related to Posture
- z_u — Season factor, related to Posture
- v — Vulnerability value

²² Dupuy, T. N., *Numbers, Predictions, and War*, MacDonald's and Jane's, London, 1979, pp. 50ff.

* This is incorporated in a relative combat effectiveness value (CEV) or factor, when it has been calculated.

Quantified Judgment Model
(After T.N. Dupuy)

Figure 10



With Combat Potential (P) in hand the QJM analysts can proceed to ascertain the theoretical outcome of an engagement between two forces, by means of comparing the ratio of the opposing combat power potentials.

The QJM promises to analyze much more than WEI/WUV comparisons: it purports to predict outcome of battle. For example, QJM could assess the force balance in Central Europe by arraying expected forces on both sides along the German interzonal border, and running sector-by-sector through the model enough times to generate a prediction of outcome: which side would advance or retreat and what the losses would be on each side.

All the analytical techniques described above may generally be classified as "static" in that they do not purport to account for maneuver or other interactions between opposing forces. To examine a force balance thoroughly, concentration of force, tactical finesse, reinforcement, feint, delay and other battle dynamics should figure in the calculus. The QJM borders on being "dynamic," that is, if pursued through enough iterations, on a large enough scale, the dynamics of a whole war could be analyzed, the results of each battle (or time period of operations) establishing a new force balance as start points for succeeding "engagements." But it would be laborious, and in the end, unconvincing.

More or less elaborate, truly dynamic models, war simulations, or games, computerized to speed the enormous numbers of calculations involved, exist in profusion throughout the government—one recent GAO survey identified over 400, of which the U.S. Army (understandably) owned the most models capable of resolving, or predicting, the outcome of battles, campaigns and wars. Most such models can be traced back to the seminal ideas of the English mathematician, Frederick W. Lanchester, who in *Aircraft in Warfare* (1916) proposed that the rate of loss or attrition in any battle is a function of the size of the opposing force multiplied by a coefficient (constant) measuring relative combat effectiveness. From this seemingly simple statement one can develop equations representing strength on either side at any time during a battle, and the probability for either side's winning. Lanchester's mathematics dictate that, ultimately, victory is a function of the *square* of force strength. In short, any force balance can be measured by comparing the coefficient of effectiveness and the square of the size of the forces on each side—all other things being equal.

But as one recent book on the subject of mathematical assessment of warfare notes:

Unfortunately, all other things are rarely equal in warfare.

In applying mathematics to human affairs, including warfare, the ability to solve models must not be confused with the ability to formulate the correct or appropriate model. Lanchester's equations were an intellectual breakthrough in the analysis of warfare insofar as they provided a deep insight into the possibilities inherent in simple models of combat. This is not the same as providing operational information or explicit guidance in setting policy for complicated situations in actual warfare.³¹

One study of Lanchestrian models compared with historical experience concluded that the mathematical equations were not valid in large-scale situations and lacked predictive power.³²

³¹ Brewer, G. D. and Shubik, M., *The War Game*, Cambridge, M.A., 1979, page 78.

³² Willard, D. W., *Lanchester as a Force in History: An Analysis of Land Battles of the Years 1615-1905*, Research Analysis Corporation, RAC-TP, Washington, D. C., 1962.

Few of us who have worked with mathematical models of that complex process, land combat, have confidence that we can thereby examine any aspect of battle, for any purpose, without hedging the results of our analysis with careful and extensive reservations. As one expert put it:

All mathematical models must simplify; that is their strength. They may, in oversimplifying, distort; that is their danger.³⁶

For the past two decades most studies within the Department of Defense have relied heavily on mathematical and statistical techniques which have the advantage of presenting for busy policy makers much information in a highly compact form. But any policy maker who is thus served is vulnerable in at least two respects: (1) the input data are usually not evident, sources are often questionable, and their relevance undetermined; (2) the models, which purport to describe behavior, are seldom validated, and are frequently simply unreliable. A recent magazine article noted that: "Many analyses conceal spurious content behind protective layers of mathematics and statistics."³⁷ The same article quotes the then Secretary of the Navy, Graham Claytor, in a recent speech at the Naval War College:

One of the most frustrating things I have encountered in this job has been the tendency on the part of some staff people to use systems analysis as a cover for what is really subjective judgment.

But perhaps the most incisive inquiry into the extent to which mathematical techniques can assist understanding of force balance was provided in a report prepared for the U.S. Air Force project RAND by J. A. Stockfisch. In the conclusion of *Models, Data, and War: A Critique of the Study of Conventional Forces*, Stockfisch stated:

No satisfactory simple metric exists for aggregating the diverse fighting elements that comprise modern conventional forces. The question may be raised, therefore, whether and in what way it is meaningful to try to model confrontations of such forces. Almost any attempt to develop an aggregate metric of the diverse elements must involve assigning a set of value weights to the diverse specialities. The firepower index, as an example of such an endeavor, drew upon an admixture of physical measurements and implicit assessments regarding the tactical worth of different combat specialities . . . A case can be made that many of these assessments corresponded to the valuations imbedded in ongoing weapon procurement decisions that provided, through time, more costly weapons and force-structure elements. But, apart from superficially rationalizing the idea that more costly and technically superior systems might provide combat capability commensurate with cost, has any useful knowledge followed from the intellectual effort of deriving firepower indices? Further, has any useful knowledge followed from aggregative campaign models that have used these indices as input data? My answer to both of these questions is "NO." A less harsh answer is that these efforts may have generated some insights insofar as they were an aspect of broader question-raising regarding the role and structure of general purpose forces. But any positive product obtained may have been more than offset by the point that both the firepower scores and the findings of models that used them were highly susceptible to abuse. Their aggregative quality

³⁶ Hammerton, M., "A Case of an Inappropriate Model," *Nature*, July 1964, pages 63-64.

³⁷ Brewer, G. D., and Blair, B. G., "Wargames and National Security With a Grain of SALT," *The Bulletin of Atomic Scientists*, Vol. 35 No. 6, June 1979, page 18.

concealed much subjective thinking. They distracted attention and effort* to understand combat operations."²⁸

By now the informed reader is no doubt chafing at the lack of consideration for the Soviet perspective. Unfortunately, we do not have any considerable insights into the methods used by the Soviet leadership to assess the overall force balance in Central Europe. We can certainly infer that their notions of "how much is enough" are significantly different from those prevalent in the American leadership. As in intercontinental weaponry, their approach to sizing and equipping general purpose forces appears, by our criteria, to be governed by safe-siding towards overkill, extensive redundancy, and a determined drive for qualitative *and* quantitative superiority over potential adversaries, the armed forces of NATO.

We do have some information on how they view balance of forces at the Front (Army group) echelon or below.²⁹ Interestingly, the notion of "balance of forces" figures prominently in their thinking and they appear to rely on mathematical techniques of analysis. Throughout the extensive, relevant literature available to us, the notion of "correlation of forces" is to be found. In its general sense, this term connotes comparison of the totality of the means available for waging war—economic and natural resources, societal will and cohesion, logistic and technological capability, as well as armed forces. But there is a comprehensive body of writings, much of it classified by the Soviets, in which the term "correlation of forces" is used in a more particular sense to apply to an assessment of force balance in a local, specific, tactical sense. These latter writings appear to be aimed at providing a field commander a way of ascertaining whether a given operations plan adequately provides that force superiority which would insure success in battle. There are three basic numerical concepts or factors which seem to figure in most of this Soviet combat calculus.

- The first is "equivalency factor," or "coefficient of commensurability," a number reflecting a ratio comparing a stated weapon to a standard. One particular weapon of a type is designated as the standard, and the coefficient for any other weapon computes the number of those weapons required to offset the combat effectiveness of the first in a given battle. In other words, the analyst models a battle involving standard weapon A on both sides. He then replaces weapon A with that number of weapons B on one side which will leave unchanged the outcome of the battle (or model). The ratio of number of B required to offset A is then the "equivalency factor" or "coefficient of commensurability."
- A second concept is that of "combat capabilities." This is a number used for force comparisons derived from a Lanchester-like computation: $CC = R \times N \times P$ (where R=rate of fire, N=number of elements, and P=probability of success for one shot). Proponents of this measure admit its inadequacies, but justify its use on the grounds of rapidity and simplicity of computation. (It is germane to note that a similar formula is used for tactical force comparisons in the U.S. Army, with the same caveats).

* Words missing in original text—Editor.

²⁸ Stockfish, J. A., *Models, Data, and War: A Critique of the Study of Conventional Forces*, Rand, R-1526-PR, Santa Monica, California, 1975, page 128.

²⁹ In this discussion I am indebted to Allan Rehm of OSR, and his colleagues who have read and analyzed the Soviet sources. Cf., Rehm, A., "Soviet Operations Research Books and Related Books by Military Authors—A Bibliography," April 1979; also, DIA "USSR: Methodology for Net Assessment of Military Capabilities—Introductory Survey," DDI=2610-7-76, November 1976.

- A third type number, "combat potential," appears to be equivalent to the U.S. WEI/WUV. "Combat potential" for particular weapons can be aggregated into a weighted unit value. Weighting also considers the mission of the unit, its firepower, and mobility. The process involves designating a standard item of armament or a standard military unit, and "combat potential" is expressed relative to that standard. Once again, computations are based upon the notion that each "combat potential" represents how many of the units or weapons being measured are required to offset the standard weapon or unit in a battle between balanced forces, so that the outcome is the same.

There is a recent Soviet military text entitled *Fundamentals of Troop Control in Combat*¹⁰ which is designed for use by battalion commanders and their staffs. They are urged to use as measures of effectiveness expected enemy losses, own losses, consumption of materiel, and time of mission execution. Among the analytical methods recommended to the commander for his planning are linear and dynamic programming, probability theory, differential equations, systems analysis, operations research, game theory and PERT charting. The text recommends that the commander calculate the "combat capability," the quantitative and qualitative relationships among the forces and materiel in terms of density per kilometer of front, asserting that: "as practice shows, the greatest accuracy can be achieved . . . by coefficients of commensurability of the combat possibilities (firepower, strike force, maneuverability and so on) of various types . . . and the combat potentials of the subunits as a whole."

We would be led to believe by other available literature on the military planning process in the Soviet Union that similar forms of quantification are used to assess the "correlation of forces" by higher commanders and staffs up to the national level, and that they figure in assessments of the theater force balance, or weapon systems procurement decisions. However, we have no examples of such usage, or any other certain information of how quantification figures in high-level decisions, if at all. Nonetheless, it is very much the business of intelligence to look further, and should we be so fortunate as to come upon balance assessment formulae in use in the General Staff, or in the Kremlin, we would be in a much better position to assess the European force balance from the Soviet perspective for the benefit of our own policy makers.

ISSUE III: How to Present the Assessment

Most policy makers face a hundred conceptual and semantic hurdles daily. While we in the intelligence business should regret our having to set up additional impediments, the fact is that only by mastering an understanding of techniques of force balance assessment can policy makers understand intelligence judgments. Onerous though it may be, they are going to have to delve into WEI/WUV or comparable concepts, if they are to do their job. On reflection, this appears to be no more unreasonable than requiring them to comprehend notions like "gross national product," "consumer price indices," or "balance of payments." Anthony Cordesman laid out the problem well. To compress and present effectively the complicated data inherent in analyzing force balances, we must use some quantitative shorthand, some metric of force effectiveness which reduces disparate elements on both sides to a common denominator. Policy makers should understand that it is not now possible to model on a computer the clash of all forces in the European theater, since "even the most complex computerized wargame is still an endless series of compromises with reality. Without exception models of large scale combat or combined arms must

¹⁰ Ivanov, Savelyev and Shemanskiy, *Fundamentals of Troop Control in Combat*, Voenisdat, September, 1977.

grossly abstract or ignore critical factors shaping the balance of the forces compared. . . . No war game to date can begin to adequately simulate large-scale armored maneuvers even if air forces are not played."

"Most of the advanced war games used in the Pentagon cannot realistically simulate a large-scale armored breakthrough, simultaneous land and air warfare, or the major differences in tactics and force structure between individual and Warsaw Pact forces." 41

And so for the foreseeable future we will have to use a more "static" technique for comparing forces. It is incumbent upon intelligence analysts to explain to the policy maker, and upon the latter to understand that even "static" force comparisons have major limitations:

1. They cannot accurately reflect differences in training, readiness, morale, and many other critical aspects of military capability.
2. They do not reflect many of the qualitative differences between the equipment compared. This can disguise major differences in performance capability which are significantly more important than equipment numbers.
3. They are not fully explicit. Almost all aspects of force strength can be counted using very different categories and definitions. A count that includes all artillery, for example, disguises critical differences in range, mobility, and crew protection.
4. If the count of weapons or unit strength is not modified by some measure of effectiveness (MOE), it does not indicate the capability of what is compared in war. If the count is modified by such a measure such as firepower score or kill probability, it then becomes judgmental and ceases to be explicit.
5. Most static force comparisons are made of similar types of equipment. Yet, antitank weapons do not fight antitank weapons, bombers do not fight bombers, and ballistic missile submarines do not fight ballistic missile submarines.
6. Comparisons of total national force strengths are often unrealistic in the sense they involve forces which can never engage each other in wars. Wars will inevitably be fought by only a portion of available forces.
7. War is a dynamic and complex process. Units are constantly lost in combat, they maneuver, they reinforce, or they alter in force strength and weapons mix. Even the most sophisticated static force comparison is a "snapshot." It artificially freezes the balance in a given moment, when the real balance shifts over time. No matter how well the analyst chooses his comparison, it is the dynamic process of war which may actually determine comparative military capability.
8. No comparison can count everything. Almost inevitably, the broader the comparison, the more that must be omitted.42

While the foregoing is certainly useful for charting shoals and reefs in analytical waters, it scarcely serves for laying a course for the National Foreign Assessment

41 Cardesman, *op. cit.*, p. xviii-xix

42 *Ibid.*

Center towards an estimate of the force balance in Central Europe. I would like to propose seven markers, or guidelines, useful for that purpose:

- Measure output rather than input
- Treat trends vice status quo
- Go graphic
- Compare opposites
- Be selective
- Think Soviet
- Deal with perceptions

Measure output rather than input. The first consideration to bring to an assessment of any force balance is concern for answering that ultimate question "What does it mean?" We should be searching for ways to show the *implications* of the forces on either side. As we have seen, WEI/WUV, for all their drawbacks, have the advantage of serving as a qualitative common denominator, and allow some degree of commensuration. But there are less judgmental, less arcane measures of effectiveness than WEI/WUV if our imagination will search them out. To illustrate, NIE 11-14-79 noted that the Warsaw Pact had assigned about 18,200 artillery pieces of 122mm or larger to its ground forces opposite NATO, and that the Soviets are continuing to replace towed howitzers with self-propelled howitzers. Included in the NIE is a bar chart showing growth in the number of artillery pieces from 1969 to 1979. These are "input" data, crucial for analysis, but scarcely numbers easy to weigh in the balance, or to inform the policy maker what he needs to know about relative artillery capability. Recently OSR developed a chart (see figure 11), using the same Warsaw Pact basic data, which focuses on output—firepower useful for attack preparation or defensive barrage—and shows trends from 1979 to 1984. Looking thus at the capability of either side to lay down tons of projectiles in a concentrated three minutes of preparatory or defensive fires, the meaning of NATO's growing quantitative and/or qualitative inferiority becomes evident.

Treat trends. The generation of modern general purpose forces is a lengthy and expensive process. Forces which are in the field today eventuated from decisions taken by governments five to ten years ago. Most weapons are evolutionary, predictable improvements on predecessors. National establishments for research, development, and testing which produced today's weapons can reasonably be assumed—in the absence of information to the contrary—to be working on tomorrow's weapons systems. What weapons and units are afield in the forces on either side of a force balance at any given point in time, then, is information less interesting than the pace, kind, and amounts of changes which have been occurring in the recent past, from which may be inferred what is likely to happen, quantitatively and qualitatively, to those forces in the future, and when. The OSR chart above has the virtue of showing not only the state of affairs in 1979, but the relationship likely to obtain in 1984, given what we know about development of artillery on both sides.

Since WEI/WUV are, in effect, output measures, trends measured thereby are similarly useful. Certain developmental trends deserve portrayal, such as the gun-armor race now in dead heat (referring to new techniques for protecting tanks, and new capabilities to penetrate armor).

Go graphic. While prose is indispensable for presentation of analysis, we should neglect no opportunity to visualize principal aspects of a force balance for the busy policy maker. Not only will he understand our estimate better, but he is likely to remember it longer, and use it more effectively.

Compare opposites. The DCI, in a *Foreign Affairs* article entitled "The Naval Balance: Not Just a Numbers Game" wrote that "a first step is to recognize that only the forces which oppose each other directly can be compared directly." Force balance assessments which aggregate, for example, anti-aircraft weapons on both sides violate this principle. In most recent OSR portrayals of force balances, attack helicopters, because they are in Soviet usage an air force element, have been displayed as an element of the air balance, and analyzed accordingly. Actually, an attack helicopter is designed for killing tanks, or participating in ground combat: it is a specialized ground-support aircraft. As a matter of fact, given the centrality of the tank to Warsaw Pact doctrine and force structure, we probably should compare all tank-killing systems on NATO's side against the tanks on the Warsaw Pact side, and vice versa. This sort of tank vs. anti-tank analysis will become the more important as either or both sides deploy advanced tank-killing systems, such as the U.S. A-10 aircraft, the all-weather attack helicopter, the HELLFIRE ATGM, the COPPER-HEAD cannon-launched guided missile, and other tank-disabling/killing artillery munitions.

Be selective. It is impossible, as Mr. Cordesman observed above, to measure everything. In fact, to the degree one confuses the policy maker with a profusion of data, to that degree one renders his estimate useless. The tank/anti-tank balance, artillery firepower available to both sides, ground attack air versus air defense capabilities on both sides—these are all examples of sub-balances which probably belong in a national intelligence assessment. In my opinion, however, comparisons of small arms, machine guns and even mortars are less critical, and may legitimately be excluded. These choices, however, should not be taken lightly. Were one assessing a force balance in the Middle East, one might assign a greater importance to small arms and anti-aircraft guns, given the usefulness of these weapons for fighting in cities like Beirut, than one would accord similar weapons in an assessment of the force balance in Bavaria, where city fighting may be somewhat less important to outcomes.

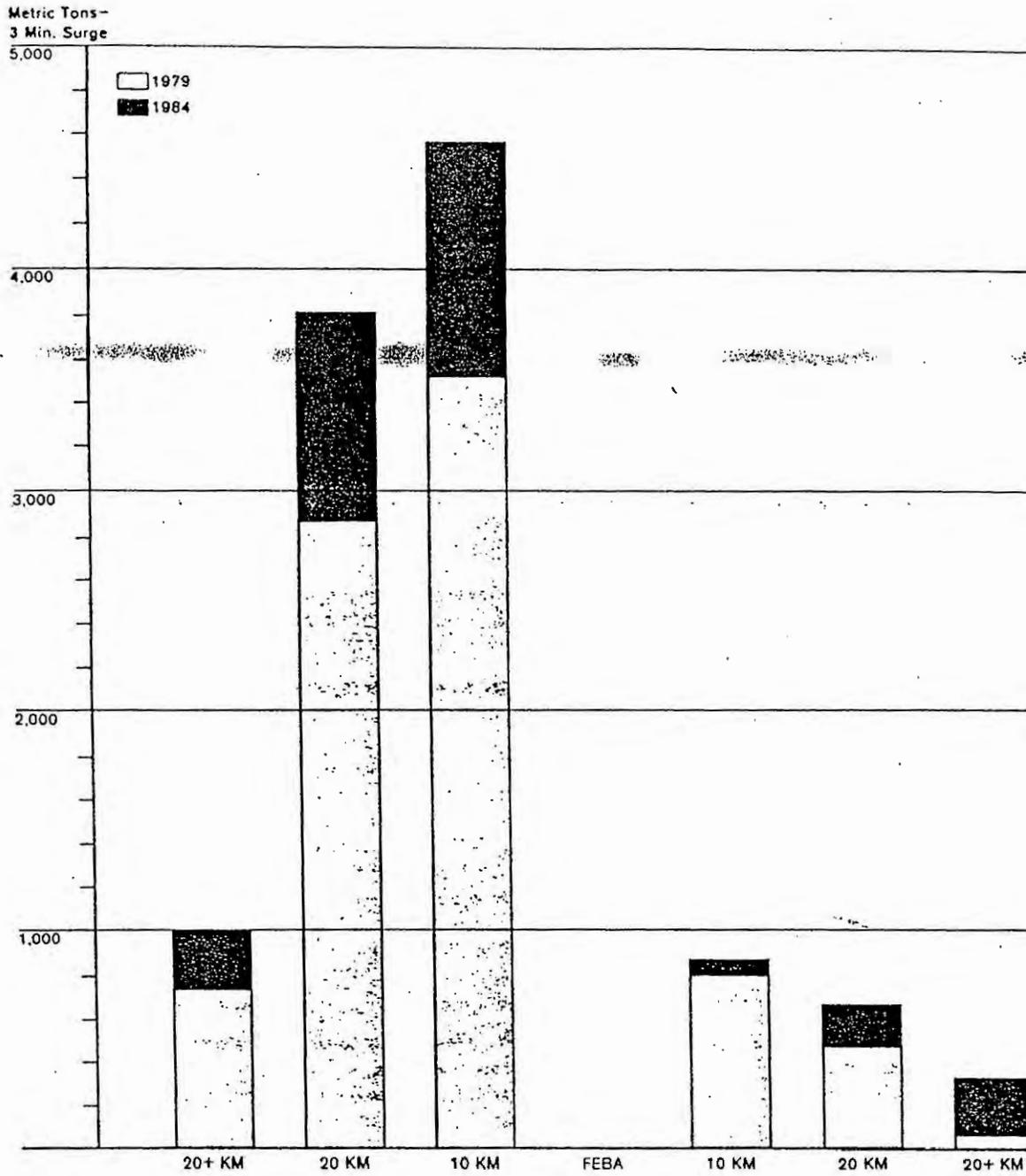
Think Soviet. To the degree that our information permits, we should determine criticality, and otherwise tailor our estimates, using *Soviet criteria*. Our job should be to present to the policy maker the Soviet perspective on the force balance, using Soviet measures of effectiveness, to the extent these are available to us or can be reasonably deduced. We must be alert to point out to the policy maker in our estimate anomalies in data to which he must bring a Soviet viewpoint for understanding. For example, the absence of an air superiority fighter like the F-15 in the current Warsaw Pact air armada should not be regarded as tilting the air balance in favor of NATO unless it can be shown that the Soviet objective of gaining air superiority by attacking NATO airfields is unobtainable. Similarly, an apparent shortage of Soviet means to attack NATO's sea lines of communication across the North Atlantic should be weighed together with their potential for attacking harbors with land-based missiles, laying mines on harbor approaches, and otherwise operating on SLOC termini.

Deal with Perceptions. In the last analysis, a balance of forces is less a matter of men and materiel than mind (*touché*, Napoleon). Certainly, any count of the forces arrayed against Israel for the past 20 years would have suggested imbalance, and I believe it is factual that most computerized war games or mathematical models would have predicted Israeli defeat in the event of war. Fortunately for the stability of the Middle East, the Israelis have had a great deal of confidence in their own superior morale and efficiency: their perception was of balanced forces, or even of a balance tilted in their favor. To be sure, the early events of the October 1973 War jarred that

¹¹ Turner, S., "The Naval Balance: Not Just a Numbers Game," *Foreign Affairs*, Vol. 55, No. 2, January 1977, page 344.

Comparative Artillery Surge Throw Weights, Central Europe 1979 and 1984

Figure 11



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confidence, but their perception of restored superiority remains a critical factor in any intelligence assessment of that region. Michael Howard in his recent article on "*The Forgotten Dimensions of Strategy*" underscores the importance of perception in strategic appreciations. These perceptions figure in what he calls the "societal dimension" of war:

If we do take account of the social dimension of strategy in the nuclear age, we are likely to conclude that Western leaders might find it much more difficult to initiate nuclear war than would their Soviet counterparts—and, more important, would be perceived by their adversaries as finding it more difficult. If this is the case, and if on their side the conventional strength of the Soviet armed forces makes it unnecessary for their leaders to take such initiative, the operational effectiveness of the armed forces of the West once more becomes a matter of major strategic importance, both in deterrence and defense."

Howard argues that, for a full appreciation of modern strategy, an intelligence assessment must consider not only strategies which rest on such *technological* means as ICBM and intercontinental bombers, but on capabilities to support the *logistical* sinews of war, and abilities to use adroitly armed forces for *operational* purposes. Hence, to assess properly a force balance in Central Europe, the analyst must weigh assets and liabilities in all four dimensions. I would argue that U.S. policy makers deserve nothing less of the intelligence community.

It is probably fitting to close with a prediction: in the decade ahead, intelligence estimates of the balance of "conventional forces" in Central Europe will become much more important for U.S. policy makers. For it seems ever more evident that the risks of war there are heightening, and that such a dread event, in Howard's words:

... would be likely to arise out of political crisis—over the rights and wrongs of which Western public opinion would be deeply and perhaps justifiably divided. Soviet military objectives would probably extend no farther than the Rhine, if indeed that far. Under such conditions, the political will of the West to initiate nuclear war might have to be discounted entirely, and the defense of West Germany would depend not on our nuclear arsenals but on the operational capabilities of our armed forces, fighting as best they could and for as long as they could without recourse to nuclear weapons of any kind ... the prospect of nuclear war is so appalling that we no less than our adversaries are likely, if war comes, to rely on "conventional" operational skills and the logistical capacity to support them for as long as possible, no less than we have in the past.

(All of the foregoing article is classified ~~SECRET No Foreign Dissem~~)

"Op. cit.