When Will Support Planning Finally Escape Its "Mass-Logistics" Past?

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***Author Note:** This column initiates a series that will discuss possibilities for improved support planning through an alternative approach—termed "patterns-of-operations" research—to data collection and its quantitative treatment. This column also initiates a column-title change—from "Numbers from Combat" to "Numbers from Operations"—in light of the greater applicability of the latter to today's and the foreseeable spectrum of operations as it generates data of interest.*

Modern support planning ought to achieve "variable resolution" to properly address how support requirements change with variations in forces (multi-corps, single divisions within one corps, dispersed single brigades, etc.), time (duration of requirement), and of course operational settings themselves. The analytics underlying support planning must distinguish how requirements alter as such basic variables alter, if we are to achieve higher-resolution support planning. Virtually unseen in such considerations are the character and impact of "logistics planning factors."

Like DNA codes, such factors shape and compose critical support requirements for forces—the 'bodies' for which the 'codes' define needed support. Unlike real DNA codes, which program different shapes and compositions as appropriate, logistics planning factors are generally relatively blunt, unchanging numbers, which fail to distinguish among variable forces—one factor 'size' is taken to fit many situations, with projected support basically toting up tonnage differences keyed mainly on force sizes and planning time lines. When we purport to operate modular forces, have we really progressed in our support analytics much beyond the quick "slices" of yore?

Logistics planning factors are part of the fabric of both operations planning and deliberations on force structure development, among other uses. Yet they are typically paid little heed, being turned to only when needed, briefly, as bridges to the real object of planning interest: how much is needed? They appear so simple in concept— usually, point-value rates applied to a projected force over spans of planning time, thus easily used in spreadsheets—that they are readily overlooked, effectively dismissed as needing little analytic attention.

Many of these factor-foundations to logistics planning remain today—as they have long been—dangerously out-of-synch with the operations they are intended to describe. Where commanders need to project modular forces (in overall forces of varying size and composition) conducting robust maneuver operations with precision strikes, too many logistics planning factors remain mired in a "mass logistics" mentality. To be sure, this is not intentional. Just as surely, it results when measures of support (and supporting data and methods) key more on net-averages and unvarying item lists—which fit nicely into spreadsheets, and other tools that work similarly (such as data matrices in simulations, serving as internal call-lists)—than on describing how support reflects the dynamics of varied forces and operations.

Nearly 30 years ago major attention in ground operations doctrine began to shift to a vision of modern maneuver operations, while a parallel effort perfected a vision of precision strikes (in those days, mainly against multi-depth conventional, as well as certain critical deeper, Soviet/Warsaw Pact targets) using various integrated technologies. About the time the doctrinal visions began to merge and take root, the Warsaw Pact collapsed, the Soviet Union broke apart, and the threat of war by massed forces receded from view. But a remnant of those massed forces was moved to Southwest Asia in 1990 and conducted the Desert Storm campaign's evidently spectacular success. Both maneuver and precision-strike were reinforced, and subsequent developments have sought to anchor them in our structures and practices. One important next step was to alter structure, from a massed-forces approach, to focus on force elements better suited to the new doctrine. What are now termed "modular forces" are the operational forces' structural imprint of the new vision's promise.

Logistics thinkers, never far behind, also began—with their own fanfare

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What is an effective casualty estimate?

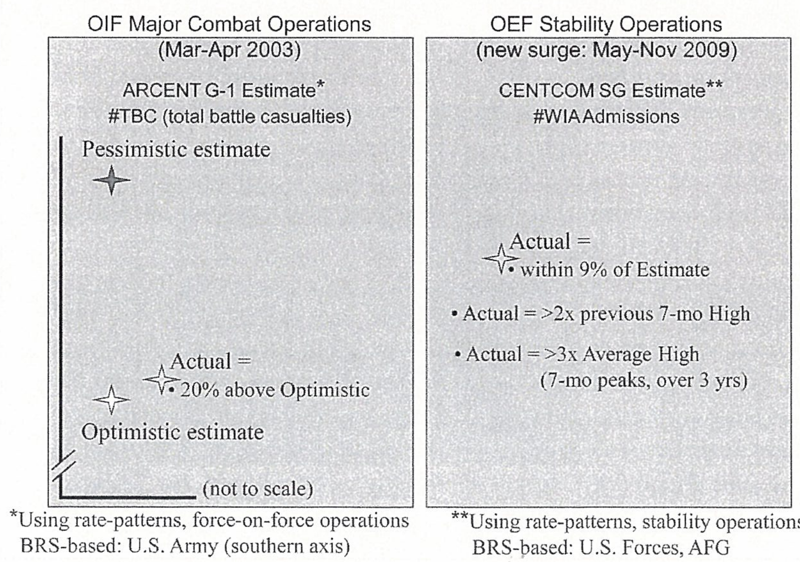

Figure 1. Battle Casualty Estimate Results for OIF (MCO, 2003) and OEF (2009)

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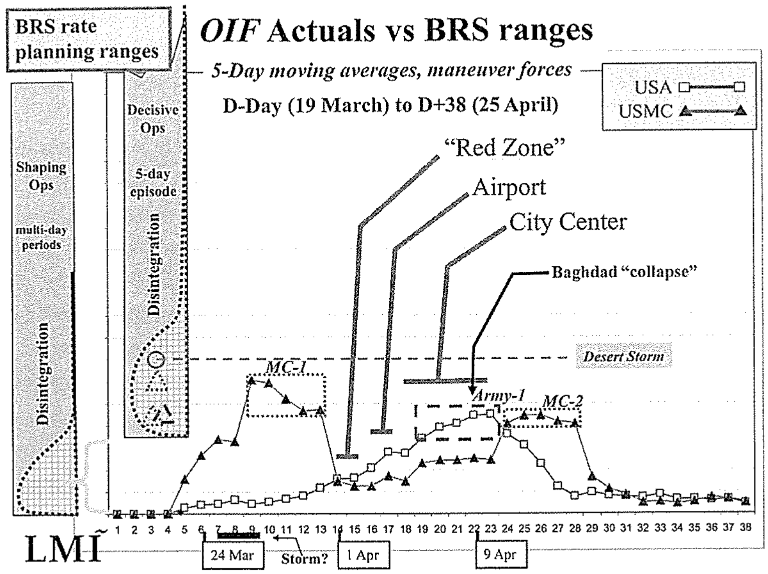

Figure 2. Comparison of 5-day actual rates (peaks noted) to BRS 5-day planning rates: OIF MCO

about 20 years ago—to aim at structures and practices better suited to supporting maneuver and precision strike capabilities. They first considered "focused logistics" for pared-down larger tactical formations with subsequent evolutions for emerging modular forces. All aimed at considerably reduced support footprints through more robust, flexible logistics practices. The term "just-in-time" support—adequate to an array of particular forces at varied points in time and space through high-resolution forecasts for "push" support and also, if less well known, for "pull" support—still rings in the mind. The era of mass-logistics—the fabled "iron mountains" of World War II, Korea, Vietnam, and the Cold War—was to fade away.

But the fact is that throughout this 30 years of operations doctrinal and structural change, the approach to most logistics planning factors—those quiet numbers used deep within the system, like DNA codes, to define supply requirements—has not changed, *in methodological concept*, by even a whit. Claims have been advanced of effectively changed planning factors, based on shifts from large-scale (e.g., theater) factor averages to smaller-scale (e.g., by unit, phase, and posture) averages. But, such averages offer no new concept if they reflect only unit-size chunks of larger-scale views or the equivalent. Without achieving genuine variable resolution—ability to focus on particular force elements support needs and on varying larger-force perspectives that include these nested elements but are more than simple aggregations of them—the fundamental mass-logistics view is not overcome.

Right-sizing support depends on ensuring an alternative approach that projects how support needs reflect fundamental operations dynamics—from accurate particular-unit views to accurate larger-force views—and how they vary as key operations parameters vary. In fact, extensive research has identified just such an alternative approach. Perhaps not surprisingly—given that it keys on operations dynamics and how to relate support-related behaviors to those fundamental dynamics—it has been termed, "patterns-of-operations" research. What may surprise some is that this research began—it has been conducted in several separate, concentrated efforts—during the same period, in the 1980s, as our forces were shifting their foundations for operations. The research has established—so far, in two disparate support arenas whose premier shared characteristics are, first, dramatic variability of occurrence, but in each arena a variability that, second, exhibits distinctive patterns associated with operations dynamics—how support planning may be laid on far more reliable and suitable grounds, to "right-size" support by matching operations dynamics.

The two examples: personnel battle casualties (which are a leading-edge driver of support planning for personnel, medical care, transportation and associated supply) and aircraft Class IX spare parts (the consumption of which, in maintenance, drives a large part of system readiness). In each case, the focus of research thus far has been ground forces. In each case, extensive empirical data have been assessed for patterns of occurrence in accord with operations patterns—of casualties (by broad types: killed, captured/missing, wounded) and of part demands (actual consumption, in physical replacements on individual aircraft: by part number/NSN and by quantity per part, for both reparables and consumables). In each case, an approach has been identified which supports projecting, with variable resolution, the respective types and quantities of casualties and spare parts.

Subsequent discussion in this space will address more detail on the overall "patterns-of-operations" research effort—concept, data, methods—for both casualty estimation and spare parts consumption demands forecasting. For this first brief note, some evidence showing results in each area is introduced.

Estimating Battle Casualties

In the case of casualties, the patterns have not only been identified and tested for validity, they have been used to support major operations planning, with subsequent actual experience in the operations showing projections to have been remarkably more accurate than traditional (point-value) estimating approaches.

Major Combat Operations: OIF, 2003

Months prior to the March-April 2003 conduct of major combat operations into Iraq, planners at Third US Army—using the Joint Staff/J4-released and Army-approved approach to rate-patterns planning, the BRS

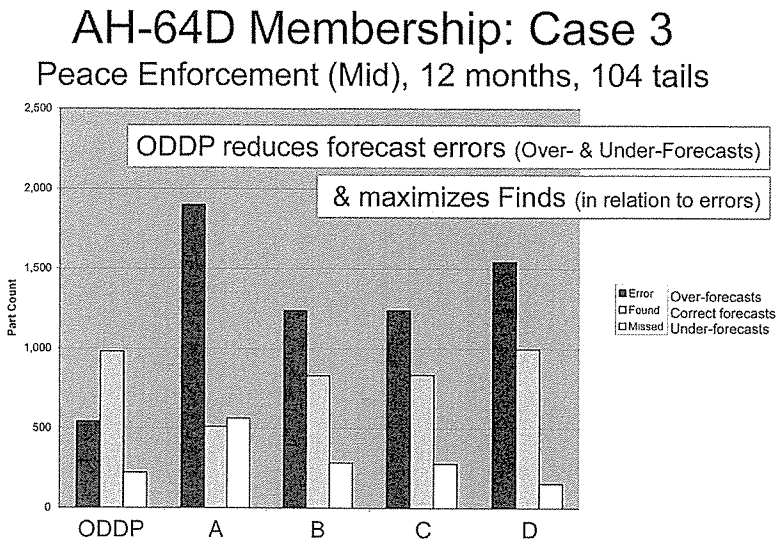

Figure 3. Comparison of Apache Class IX spare parts forecasts: Membership

(Benchmark Rate Structure, in its early manual version)—projected Army battle casualty possibilities for the so-called southern axis (decisive effort) of advance. Both optimistic and pessimistic projections were made. Rate patterns for a corps-size force-on-force offensive, featuring "disintegration" force effects, were used. Figure 1's left panel shows how the eventual actual number of battle casualties compared. This stood in sharp contrast to the Army's prior estimate—using the traditional method of fixed point-values—for Desert Storm, a dozen years earlier. That estimate had projected a number of battle casualties (speaking only of conventional casualties, before considering any from WMD threats) that turned out to be some 40 times larger than the number of conventional casualties the Army actually experienced.

Stability Operations: OEF, 2009

An entirely different set of casualty rate patterns—for stability operations, first observed in Somalia in the early 1990s, with increased insights from Iraq's post-MCO experience, and with Afghanistan's own distinctive traits also considered—was used early in 2009 to estimate casualties for all U.S. forces in the new surge operations in Afghanistan. Figure 1's right panel describes results using these BRS stability operations rate patterns for medical planning by the CENTCOM Surgeon's office, to project wounded-in-action admissions. The figure's right panel compares the actual count to the estimated count of WIA admissions for the estimate's first seven months: May through November, which in Afghanistan is typically a peak period. The actual count was within 10% of the estimate's projected number. This despite the fact that the actual count more than doubled from the count seen in the highest comparable 7-month period previously and more than tripled the average count in such 7-month peaks seen over the three previous years. The estimate had gauged the character of past and projected operations and the growing size and changing force composition and projected an entirely new casualty count at a level at the time unprecedented there. (The actual monthly counts for this period also describe a curve—a distribution—quite similar to the estimate's projection.)

The casualty research has defined numerous rate ranges and distributions for varied forces, times and operational settings. Figure 2 is one example—showing 5-day corps maneuver forces rates appropriate to OIF compared to the actual 5-day moving averages seen in OIF's MCO for both Army and Marine Corps ground maneuver forces.

Forecasting Aircraft (Army helicopter) Class IX Spare Parts

The research into patterns of aircraft spare parts consumption is more recent and less advanced. Still, here as well, a new forecast method has already shown, in extensive testing, that it achieves significantly improved part consumption demand forecasts, at unit level, over current methods. The improvements owe largely to significantly reduced over-forecast errors (i.e., parts forecasted as needed but which are, in fact, not needed); there are also significantly re-

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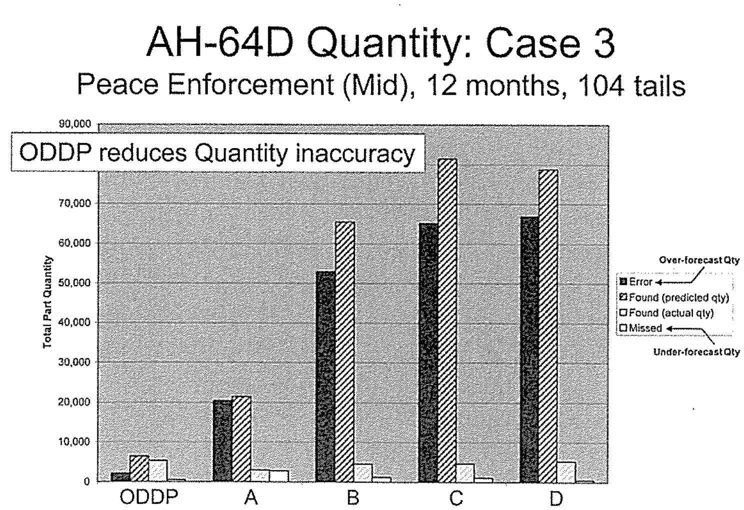

Figure 4. Comparison of Apache Class IX spare parts forecasts: Quantity

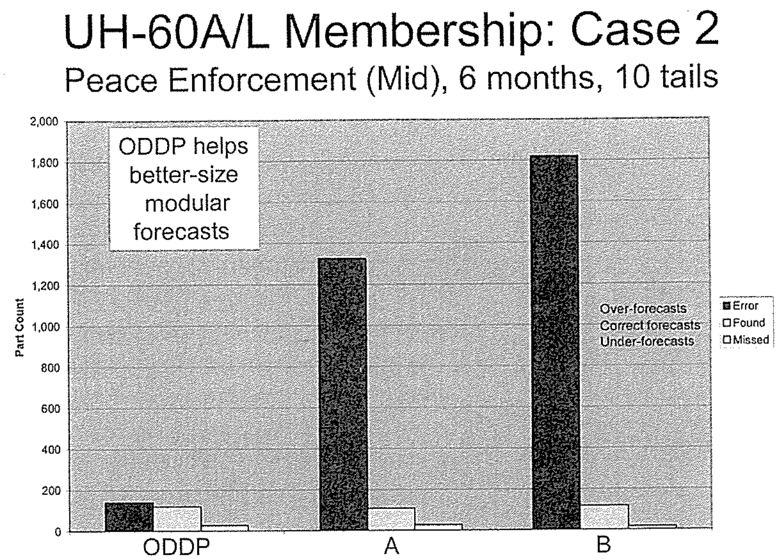

Figure 5. Comparison of Blackhawk Class IX spare parts forecasts: Membership

duced under-forecasts (i.e., failure by the forecast to include parts that turn out to be needed) of expensive reparable parts.

The research has focused on both part "breadth" and part "depth" concerns. Breadth (sometimes called "lines") refers to, "What parts?" These are individual parts (by NSN, or part number) which are forecasted as needed which tests then compare to how many of them turn out actually to be needed (used in physical replacements). This aspect of part identification addresses part "membership": which parts are 'members' of the set of parts forecasted, and of the set of parts actually used? Depth refers to the quantity ("How many?") of the individual parts. Quantity can be the aggregate quantity of all the parts, but begins with the quantity of each part (as forecasted and as actually needed).

The part forecast method grew out of the same underlying analytic approach as the battle casualty research. The patterns of ground forces operations that had been identified in the original casualty research were found helpful in describing unit-level aircraft usage and maintenance patterns and their part consumption demands—when viewed in higher resolution than by current methods, demand patterns distinctive to varied operational settings were detected. Then a method was devised to capture and use those patterns.

Result, for membership: typically, the majority (even large majority) of the parts identified in the new forecasts are now "finds"—in contrast to the older methods, where the reverse is true: the majority, even large majority, of the parts forecasted are "errors" ("over-forecasts"). Likewise for quantity: the new forecasts' quantities are far closer to the mark (e.g., consumed quantities) than the traditional forecasts.

Figures 4 and 5 compare forecast results from the new patterns-of-operations forecast method—achieved in a recent phase of the overall research and titled "Operations Driven Demand Patterns" (ODDP)[2]—to four current methods useable to forecasting part demands at unit level. Figure 4 addresses the breadth issue, in terms of part memberships in the set forecasted and in the set actually used. When one compares the parts as forecasted to those actually consumed in maintenance—tested in a series of Cases which varied the size of the force, the time (duration), and the operational setting—the parts fell into three categories with reference to the forecast:

- those parts forecasted as needed and also actually needed (the "finds");
- those parts forecasted as needed but not in fact used even once (the "errors"— more commonly termed "over-forecasts"); and
- those parts the forecast failed to identify at all but which in fact were needed in maintenance (the "missed"—more commonly termed "under-forecasts").

Figure 5 addresses the quantity issue. Each of the membership categories of individual parts in the forecast (Figure 4) is now addressed with respect to quantities. Where Figure 4 shows the three membership categories (errors, finds, misses), Figure 4 shows four quantity-count columns—this, because "Finds" divide into two sub-cases (the quantity *predicted* for the forecasted parts "found" among parts actually used, and the *actual* quantity used in maintenance for those same "found" parts). Thus, four quantity columns are shown for each method:

- Quantity of those parts forecasted but not needed: the 'errors' ('over-forecasts');
- Quantity of those parts correctly forecasted: the 'finds'—shown in two columns:
  - as they were *predicted* in the forecast, and
  - as they were *actually* used in maintenance; and
- Quantity of those parts the forecast failed to identify but which were needed in maintenance: the 'missed' ("under-forecasts").

The research-to-date also includes a second Army aircraft system, the UH-60 Blackhawk. Taking both the Apache and Blackhawk, the new higher-resolution method can better describe unit-level part demands in maintenance consumption for some 75% of the Army's helicopter inventory.

Figures 5 and 6 compare results for the new method to two of the current methods, using an alternative planning situation—this time, for a company-size force of Blackhawks, for six-months of mid-level (peace enforcement) stability operations. Again, Fig. 5 addresses part membership (What parts?), while Fig. 6 addresses quantity (How many?).

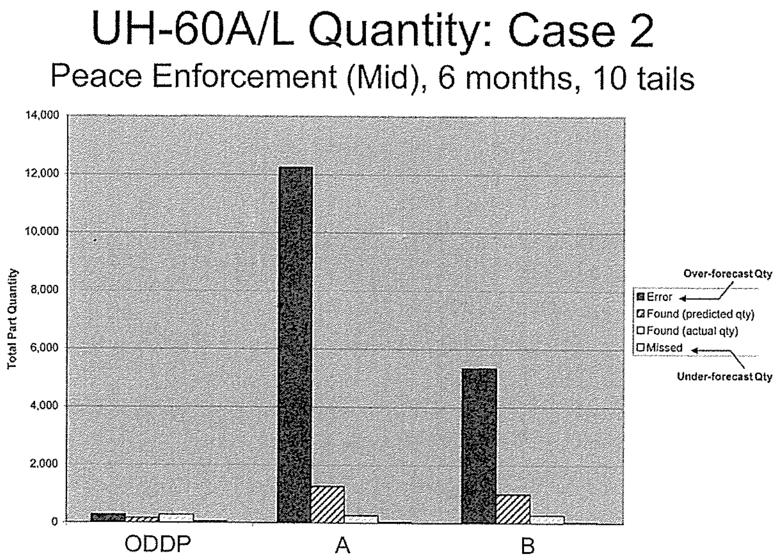

Figure 6. Comparison of Blackhawk Class IX spare parts forecasts: Quantity

Future columns will discuss how this alternative, higher-resolution "patterns-of-operations" research has achieved such dramatically improved results. Considerations include intense, rigorous data collection, and equally rigorous insistence that both the data collected and the analytic approach ensure that fundamental operational force dynamics remain the focal point and link all efforts.

Of course, putting such improved results to active planning use raises still further challenges—both technical ones[3], and perhaps the most difficult of all: introducing higher-resolution variable-pattern, bottom-up perspectives to ways of thinking and associated practices and systems long fashioned in terms of low-resolution aggregate, top-down perspectives[4]. Rate-patterns casualty estimation has been used effectively in actual planning, yet institutionalizing it is still in-process; and the spare parts research remains in the exploratory phase.

But the first-order reason for hope is that, contrary to long experience where aggregate data and methods revealed few or only weak patterns, the new results demonstrate that operations in fact exhibit the kinds of patterns that, seen in appropriate resolution, promise the ability to define support requirements that vary as actually needed for modern forces planning. The discussion will attest to how 'numbers from operations' do offer actionable patterns when properly approached—if the data are allowed to present themselves as they actually occur operationally, rather than covered over or re-presented through the lenses of otherwise-derived (often, "off-the-shelf" or other ready-to-use) approaches to analysis relating to military operations.

[1]The debate began in the 1970s and saw the Army take the route of its FM 100-5 series on Operations (e.g., the 1982 and 1986 versions, addressing AirLand operations), while the Marine Corps revamped its own doctrine in its FMFM 1 series (beginning with Warfighting (1989), Campaigning (1990), and their extensions).

[2]The term "mission based forecasting" has also been used to describe this general approach. A difficulty with this descriptor is its potential for ambiguity and misunderstanding. Part demand patterns in this research are not traceable to particular "missions" in the sense of particular aircraft flights or particular assignments such as a single attack pulse, etc. The more apt sense of 'mission' would reference the kind of operational setting at issue (force-on-force operations, stability operations, garrison operations, etc).

[3]For example, the spare parts research—not yet as advanced as the casualty research—needs to ensure that its coverage of unit-level consumption demands is maximized (to include 'backshop' maintenance). Also, a way needs to be devised to best use the new patterns-approach in defining variable-resolution part sets (to support varied forces, times, and operational settings) to better feed readiness based sparing practices.

[4]A top-down perspective might look, for example, for a single all-encompassing 'solution set' and resist improvement by stages (such as improved projections by system, building to groups of systems, or by first focusing at the unit level before moving upward to higher echelons). Yet the critical patterns are forces- and system-related—ground forces, aircraft, etc. Whatever traits the patterns among forces and systems may share, each force and system "behaves" in its own characteristic ways across the spectrum of operations. Mapping such behaviors must be by "the eaches"—the analytic approach is one, but its application is necessarily discrete: patterns showing, for ground operations of this kind versus of that kind, how proportions of wounded-to-killed differ, or how part patterns for this system differ from those for that system. Of course, discrete needn't mean serial only; sifting out multiple systems' patterns can be pursued laterally, once the analytic 'beachhead' is established. In all cases true variable-resolution will reveal how identified discrete behaviors are nested (and differently nested) as force sizes-compositions, times, and operational settings alter across the spectrum of operations dynamics.