Logistics Forecasting and Estimates in the Brigade Combat Team

by CPT Michael Johnson and LTC Brent Coryell

*(**Authors' note**: This article presents proven sustainment tactics, techniques, procedures, observations, insights, lessons-learned and best practices as observed by the observers, coaches and trainers (O/C/Ts) of the Operations Group's Goldminer Team. It provides demonstrated methods of forecasting logistics at different support echelons to create maximum operational reach, flexibility and logistics synchronization. The intended audience is junior logistic planners and maneuver officers / noncommissioned officers working in logistic positions at the brigade combat team (BCT) level and below. We discuss all classes of supply with the exception of Classes VI and VII. We do not discuss the Logistical Estimate Workbook and Operations Logistics Planner. This is not an authoritative source or alternative for sustainment doctrine because it is not inclusive of all the subject matter; we tied it only loosely to sustainment doctrine as outlined by Army Doctrine Publication (ADP) 4-0.)*

Accurate forecasting of logistic requirements is a crucial, yet often overlooked, process in the mission-analysis phase of BCT logistics planners' military decision-making process (MDMP). BCT logistics planners tend to submit the same requests day-to-day instead of conducting analysis based on the future mission and factors such as requirements, consumption rates, time and distance. Many BCTs rotating through National Training Center (NTC) decisive-action operations rely on a "swag" or "auto," depending on a default push of supplies from higher echelons to satisfy requirements with no analysis of what requirements actually are.

This failure to forecast commits unneeded distribution assets and often results in a backhaul of large quantities of supply, wasting manhours and increasing risk to Soldiers. It also fails to anticipate requirements for changing missions such as a transition from defensive to offensive operations. While occasionally effective in sustaining units for the short term, this methodology is very inefficient and is not sustainable over long periods.

Forecasting support requirements begins in mission analysis and is the most important mental process for the logistics planner. Mission analysis for logistics planners should be a focused means to define the current operational environment in terms of capabilities, requirements, assessment and mitigation. In short, what do I have, what don't I have, what do I need and how do I get what I need? With that understanding, the foundation for accurate forecasting is the use of standard logistics-estimation tools that analyze distances and usage hours, derived from the scheme of maneuver, with calculated consumption rates to task-organized equipment densities. This produces a logistics estimate that mitigates shortfalls and eliminates unnecessary backhaul.

Historical data is a good starting point or guide, but it should not be the primary forecasting method when conducting an estimate for a new operation. Historical data is valuable only when an operation has matured enough to be applicable to the situation. For example, consumption rates for an attack in a forested, temperate environment will differ vastly from one in an arid desert. In addition, training data, while historical, will not completely mimic deployed combat operations.

Following are procedural estimates and examples for each class of supply, based on published consumption rates. We list each class of supply by class, not necessarily in order of importance.

Class I: subsistence

Forecasting Class I (CLI) meals and water is crucial for sustainment planning. Since it is primarily population-based, CLI is not as influenced by the maneuver operation, as are most other supply classes. This provides more consistency to planners.

Meals: Logistics planners forecast meals to sustain the force based on headcount (how many Soldiers) multiplied by the ration cycle (what type of meal) multiplied by the issue cycle (how often bulk rations are delivered). There are three categories of meals: Meals Ready to Eat (MRE), Unitized Group Ration (UGR)-A Option and UGR-Heat and Serve. When multiple ration types are used, planners account for each type individually, with the forecasted rations being the final sum.

Meal example: If 100 Soldiers on an M-M-M ration cycle are issued a "2" cycle, the total MREs needed would be 600 meals (100 headcount x 3 M per day x two days). Since meals are transported by cases/modules and pallets, the value would be converted using the charts shown. In the example, 600 meals would equate to 50 cases, or one pallet of MREs plus two additional cases.

Class I transportation planning factors for MREs	
Ration package	**Weight**
Meals per case	12
Cases/pallet	48
Weight/case	22.7 pounds
Weight/pallet	1,089 pounds
Class I transportation planning factors for UGRs	
Ration package	**Weight**
Servings/module	50
Modules/pallet	8 (400 servings)
Weight/module	128 pounds
Weight/pallet	1,020 pounds
Pallet size	40 inches/48 inches/40 inches

Table 1. Class I MRE and UGR weight and pallet conversion.

If conducting phased operations, the issue cycle could cover each phase, so a four-day phase would be an issue of "4," pending unit haul and storage capabilities.

Planners should adjust their total values to account for variances and unforeseen changes – for example, planners should add 10 percent to account for an unforeseen change such as an unexpected attachment of a unit. More meals may be required for humanitarian aid, such as internally displaced personnel, and personnel holding, such as detainees and enemy prisoners of war.

There are two primary considerations when transporting CLI meals: storing perishable items and transporting cooked UGR meals. Units must consider the use of ice and Multi-Temperature Refrigerated Container Systems (MTRCSs) when incorporating perishable items into the ration cycle. Failure to do so results in supplements being spoiled and wasted. Module 3 UGRs are the only meals that need cold storage to remain safe to consume.

Time is important when cooking UGR meals. Once heated to the correct temperature, there are only four hours allotted to eat them. Therefore planners must be cognizant of where a unit's assault/containerized kitchen is located in relation to the forward troops. General planning factors are 20-35 minutes upload/download time (40-70 minutes), plus actual time traveled.

Water: Categorize it into bulk, ice and decontamination planning when forecasting requirements.

- **Bulk water.** During Fiscal Year 2015, 59,800 gallons of bulk water were backhauled between forward-support companies (FSC) and brigade-support battalions (BSB) units at NTC, resulting in unneeded use of personnel and equipment. Bulk water planning follows the same MDMP in terms of identifying capabilities, requirements and shortfalls. The brigade-support operations section and brigade/battalion S-4s can calculate available water capabilities at echelon based on on-hand asset availability to understand the maximum water capability at each unit.

Bulk water planning is similar to CLI meals in that you calculate it on a per-person, per-day cycle. Table 3 of the ***Theater Sustainment Battle Book*** highlights planning factors with this methodology based on the climate. Planners should use this in their initial analysis to forecast proper requirements. Adjust the water consumption requirements with historical data as the operation progresses.

Bulk water storage and requirements								
Modes of movement (capacity in gallons)					Bulk fixed storage (capacity in gallons)			
Buffalo	Blivots	Hippo	Camel	3K SMFT	5K SMFT	Onion skin	20K	50K
400	500	2,000	900	3,000	5,000	500	20,000	50,000

Table 2. Bulk water-storage capacity.

Use	Temperate	Tropical	Arid	Artic
Drinking water	1.5	3.0	3.0	2.0
Personal hygiene	1.7	1.7	1.7	1.7
Field feeding	2.8	2.8	2.8	2.8
Heat injury treatment	.1	.2	.2	.1
Vehicle maintenance	--	--	.2	--
Standard planning factor	6.1	7.7	7.9	6.6

Table 3. Water-consumption factors in gallons/persons/day.

Mortuary affairs operations are an additional planning factor considered at the BSB level. You need four gallons per set of remains for processing.

- **Ice.** Forecast ice on a per-person, per-day basis based on the operational environment. Recommended planning factors in pounds per bag per person are Arid-6, Tropic-5, Temperate-4 and Artic-3. The bag size determines how many bags per pallet (e.g., 103 20-pound bags fit on one wooden pallet). Use MTRCS for ice storage; 14 pallets fit into one MTRCS.
- **Decontamination.** Decontamination operations require substantial water requirements for each contaminated Soldier and vehicle. The unit decontamination crew conducts vehicle wash-down in the unit area of operations (AO). For operational decontamination, the vehicle wash-down crew may use 100 to 150 gallons of hot, soapy water on each vehicle to wash off gross contamination. For combat vehicles like the M1 series of armored fighting vehicles, 200 gallons or more of water may be required per vehicle. Each 100 gallons of water provides a two- to three-minute wash.[1]

More gallons are required (see Table 4) for detailed equipment decontamination. For troop decontamination beyond mission-oriented protective posture exchange, it takes 250 gallons of water per 10 Soldiers or 25 gallons per person.[2]

Equipment	M12A1 PDDA rinse		M17 LSD rinse	
	Gallons applied	Minutes applied	Gallons applied	Minutes applied
M1 tank	325	12	57	14
M2 BFV	325	12	57	14
M113 APC	203	9	38	10
M109A Paladin	325	12	57	14
HEMTT	180	8	30	12
5-ton truck	158	7	42	11
Humvee	90	4	23	6
Note: The rinse is done with the spray wand for the M17.				

Table 4. Detailed equipment decontamination planning factors for a rinse station.

Class II: clothing and equipment

Regular inventories conducted at unit supply level are the key to successful Class II (CLII) forecasting. This avoids a stock-out of critical office supplies, clothing and equipment. Soldiers deploy with an initial load of clothing and equipment and are fielded theater-specific equipment during the unit's reception, staging, onward movement and integration into theater. CLII is difficult to forecast in relation to phases of the maneuver operation because each echelon consumes supplies at a different rate. Planners should be aware of the need for CLII and work in close coordination with the BSB's supply-support activity (SSA) to determine transportation requirements CLII requests need.

Class III petroleum, oil and lubricants

Class III (CLIII) can affect the success or failure of any unit conducting combat operations. CLIII is categorized into bulk fuel (CLIII (B)) – including gasoline, diesel and aviation fuel – and packaged (CLIII (P)) – including greases, oils and lubricants.

- **Bulk CLIII.** Bulk CLIII is complex to forecast due to the large variety of vehicle types, consumption rates, varied terrain and hours of use. Determining bulk fuel-carrying capability is the same as bulk water: multiply available assets by their capacity amounts. Remember, though: never fill storage assets to maximum capacity; consider expansion to avoid damage to personnel and equipment. Determining CLIII requirements requires detailed analysis of the maneuver concept of the operation. Forecasters determine estimated fuel usage for each vehicle using the following formula: number of vehicles x gallons per hour consumption x time in operation.

CLIII bulk example: An armor company comprised of 14 M2 Bradley Fighting Vehicles (BFVs) is conducting a one-day operation on cross-country terrain. During a 24-hour period, the unit expects to be at a tactical idle for 16 hours and traverse cross-country for eight hours. Expected fuel consumption at idle is 14 x 1.4 x 16 = 314 gallons. Expected fuel consumption during cross-country operations is 14 x 18 x 8 = 2,016 gallons. Total estimated fuel consumption for the operation is 2,330 gallons.

Fuel planning factors							
	Bulk tanks	M1062 7.5K	M969 5K	M978 HEMTT	500-gallon blivot	TPU pods	MFS
Usable capacity		7,425	4,800	2,250	500	500	2,500
Bulk-fill rate (gpm)	600	300	600	300	125	125	
Self-load rate (gpm)	600	300	300	300			
Retail flow per nozzle	50		60	50		25	
Number of nozzles	2		2	2	1	2	

Table 5. Bulk fuel-storage capability.

Vehicle	Idle	Cross-country	Road
M1	17.3	56.6	44.6
M2/3	1.4	18.0	8.6
M113	1.0	10.5	8.9
M88	2.0	42.0	31.0
M9 ACE	1.4	12.6	9.3
M109A6	2.2	16.0	11.8
MLRS	1.3	15.0	8.6

Table 6. Vehicle consumption rates in gallons per hour.

Use this process for each vehicle type within a unit. While detailed, it provides an accurate estimate of CLIII (B) consumption that helps identify and mitigate shortfalls to ensure operational success. As with other classes of supply, adjust amounts based on historical data and actual consumption.

Calculate aviation fuel requirements the same as ground equipment. The number of aircraft multiplied by air hours allows planners to compute the estimated fuel needed.

Aircraft	AH-64A	AH-64D	OH-58D	CH-47D	UH-60L
Max speed (knots)	170	150	120	170	193
Cruise speed (knots)	120	120	90	120	120
Endurance (hours)	2.3	2.3	2.0	2.5	2.5
Range (miles/kilometers)	260/430	260/430	180/300	345/575	300/500
Passenger seats	N/A	N/A	1	33	11
Litter evacuation	N/A	N/A	N/A	24	6
Ambulatory evacuation	N/A	N/A	N/A	31	7

Table 7. Aviation planning factors.

- **Packaged CLIII.** Packaged CLIII forecasting requires coordination with supporting maintenance elements. There is currently no single source manual for CLIII (P) requirements by vehicle type. Moreover, unit standard operating procedures (SOPs) usually do not address the CLIII (P) basic loads required by vehicle platform. Unfortunately, poor planning for packaged lubricants has detrimental effects. Commonly seen problems at NTC are engines low on oil or tracks that can't be adjusted due to the lack of "grease, artillery automotive." Most units deploy with 15-30 days of packaged lubricants on hand as part of their stockage listing. Environmental considerations such as dust, snow and rain affects the consumption rate of CLIII (P). Therefore, sustainers must also analyze transportation trends, regarding how long items take to arrive at the SSA to ensure timely replenishment occurs.

Class IV: construction material

Class IV (CLIV) planning is conducted when preparing for a phased defensive operation and for sustained unit defense. Every echelon participates in materials planning and resourcing. Division echelons determine each module configuration for their subordinate units. Each module will dictate the National Stock Number, nomenclature, quantity and unit of issue for a given defensive combat-configured load (CCL). These modules are found in the division operations order's Annex G (engineering), Appendix 3 (general engineering), Tab C (engineer-specific CCLs).

Logistics planners must coordinate closely with the brigade engineer planner to forecast CLIV at the brigade-and-below level. The brigade engineer planner determines the number of CCLs based on the brigade's defensive operation. He or she tasks the number of modules needed for each battalion and where in the brigade's AO to initially place the CCLs. The CCLs are built on container roll-in/roll-out platforms or on flat racks using a brigade-tasked detail supervised by the brigade engineer battalion. Echelons-above-brigade units can build the CCLs if multiple brigades are operating within the same area.

The BSB support operations officer coordinates transportation of CCLs to supported units based on the brigade engineer planner's tasking. Each CCL should arrive at the supporting FSC no later than 48 hours before defensive operations start to give maneuver units time to establish and improve defensive positions.

Aside from planning phased defensive operations, CLIV helps sustain unit defense for force protection. Unfortunately, units training at NTC consistently fail to plan adequate CLIV resources when building a triple-strand concertina wire defense. This happens because units lack understanding of CLIV resources needed for defense.

Planning for a sustained unit defense is a collaborative effort between the battalion executive officer and the S-4 (logistics) officer when three primary defensive methods are integrated:

- The first method is the use of engineer assets to construct berms and hasty fighting positions. This is the preferred method due to the increased protection, lower use of unit resources and decreased transportation assets.
- The second method is the construction of triple-strand concertina wire around the unit's perimeter (Table 8). Planners should ensure they request adequate materials.[3]
- The third method is a combination of the previous two that integrates each strength against the terrain defended.

Entanglement type	Pickets			Reels of barbed wire[1]	Number of GPBTO	Number of concertinas	Staples	Manhours to erect[2]	Kg of materials per linear meter of entanglement[3]
	Long	Medium	Short						
Double apron, 4 and 2 pace	100		200	15-16 (19)[4]				71	4.6 (3.5)[5]
Double apron, 6 and 3 pace	66		132	15-17 (18)[4]				59	3.6 (2.6)[5]
High wire (less guy wires)	198			19-21 (24)[4]				95	5.3 (4.0)[5]
Low wires, 4 and 2 pace		100	200	11				59	3.6 (2.8)[5]
4-strand cattle fence	100		2[7]	6-7 (7)[4]				24	2.2 (1.8)[5]
Triple-standard concertina	160		4[8]	3 (4)[4]		59	317	30	8.2 (7.3)[5]
GPBTO					(8)[6]			(1)[6]	2.7

[1] The lower number of reels applies when you use U-shaped pickets; the higher number applies if you use wooden pickets. If there is only one number, use it for both pickets.

[2] Manhours are based on the use of driven pickets. Multiply these figures by 0.67 if experienced troops are being used, and by 1.5 for night work.

[3] Average weight when you use any-issue metal pickets (1 truckload = 2,268 kilograms).

[4] Number of barbed-tape carrying cases required if barbed tape is used in place of barbed wire.

[5] Kilograms of material required per linear meter of entanglement if barbed tape is used in place of barbed wire and barbed-tape concertina is used in place of standard barbed-tape wire concertina.

[6] Based on vehicular emplaced obstacles placed in triple belts.

[7] Only two required for one belt.

[8] Only four required for one belt.

Table 8. Requirements for 300-meter sections of various wire obstacles.

Class V: ammunition

Forecast ammunition requirements through the Total Ammunition Management Information System (TAMIS) operated by the brigade ammunition office (BAO). Weapon density, number of personnel and specific mission requirements determine the requirement – unit basic loads (UBL) – that can vary with each operation. There is no “one size fits all” UBL for an entire operation. Each combat phase may require unique ammunition. For example, a unit may require high-explosive grenades for an attack and need Field Artillery Scatterable Munitions for a defense. Planners should consider controlled supply rates by referencing the brigade operations order, Annex F, Paragraph 4, Section 3 (supply).

The BAO, brigade master gunner and brigade S-4 determine the UBLs and validate them through TAMIS. Then, the ammunition supply point issues the UBLs as mission-configured loads, which are reconfigured into combat loads for each subordinate unit.

Ammunition planners reference the Conventional Ammunition Packaging and Unit Load Data Index to determine transportation requirements for issuing to units; they analyze the compatibility, weight and cubic dimensions of each set of ammunition. This determines the number of CCLs for each subordinate unit. The planning factor for UBLs is three basic loads for a brigade-size element: one for the unit with the weapon system (company level), one for the combat-trains command post at the FSC (battalion level), and one stored at the ammunition-transfer holding point (ATHP) (brigade level). This enables the smooth issue of ammunition as a phase progresses. Sustainers need to account for the basic loads and should be able to transport all combat loads with organic assets.[4]

The final forecasting consideration is how to replenish ammunition beyond the first two basic loads. Unit replenishment from the ATHP to battalion units happens through expenditure reports. The exact process for these report is determined by unit SOPs. However, expenditure reports are the only method to bring unit UBLs back to 100 percent after each combat engagement. Companies should incorporate an expenditure-reporting process through their platoon sergeants to ensure accurate replenishment. Battalion S-4s must ensure each logistics-status report captures the amount of expended ammunition. The expenditure reports allow the BAO time to request more ammunition (as needed) prior to subordinate units turning in their requests. The expenditure report itself is not an ammunition request; unit S-4s must still request replenishment on a Department of the Army Form 581, “Request for Issue and Turn-In of Ammunition.”

Class VIII: medical material

Medical elements typically deploy with three days of Class VIII (CLVIII) in support of their battalion. When forecasting CLVIII requirements for medical operations, planners should consider the mission, location, projected causality rates and available medical assets. Determining multiple courses of action and methods of execution will ensure accessibility of supplies. It also ensures the frequency of their delivery. Also, understanding projected battle casualty rates is crucial when forecasting unit requirements. Other considerations, such as disease and accidents, should also be included in estimates.

Class IX: repair parts and components

Class IX (CLIX) is extremely difficult to forecast during an operation due to the unknowns involved with equipment wear and tear. Planners must work in coordination with their SSA and maintenance-support elements to predict the type and quantity of CLIX needed for an operation. The time of year and operational environment will also factor into CLIX requirements.

For example, winter operations require more batteries, whereas mountainous terrain requires more tires. Units deploy with the SSA’s authorized stockage list that contains common-use items for the unit. Coordination with the warrant-officer SSA technician will help determine the transportation assets needed to transport CLIX to subordinate units.

Transportation

Planners should interconnect transportation requirements to every class of supply they forecast because transportation capabilities and requirements must be accurate for support units. When plans forecast too few capabilities/requirements, it forces multiple trips to distribute supplies. Planning too many capabilities/requirements is just as bad: it increases CLIII and CLIX supplies required and results in a backhaul of large quantities of supply, wasted manhours and the commitment of unneeded logistics assets.

With that in mind, planners should forecast transportation based on two things: the analysis of how many pallets needed per class of supply, and the determination of time needed to deliver supplies to subordinate units.

Proper transportation forecasting relies on understanding how many assets will fit on a vehicle. For classes of supply, warehouse pallets are the common transportation-planning factor because all physical equipment is bound to pallets and the endstate for most requirements is the number of pallets needed for transportation. Planners must factor in the required passenger seats and the available litter and ambulatory spots when forecasting personnel transportation. Table 9 indicates standard planning factors.

	Number of warehouse pallets	Number of 463Ls pallets	Minutes to upload / download	Maximum personnel	Maximum litter	Maximum ambulatory
20' container	16		10			
40' container	32		10			
M872 trailer	18		10	30		
M871 trailer	12	4	8	50		
Supply van	12	3	8			
463L pallet	4					
PLS flat rack	10	2	2			
LMTV	6		4	16		
MTV	8		6	18		
HEMTT	8		6			
Bus				50		
UH-60 / HH-60 Blackhawk				12	6	1
CH-47 Chinook	12	3		33	8	19
UH-72 Lakota					2	8
CH-46 (Sea Knight)					6	15
CH-53 (Sea Stallion)					8	19
V-22 (Osprey)					12	24
Sherpa	4			30	24	30
C-130 (Hercules)		6		90	50	27
C-141 (Starlifter)		13		200	48	38
C-5 (Galaxy)		36		73		70
C-17 (Globemaster)		18		54	36	102
C-21					1	3

Table 9. Pallet and time factors per major transportation asset.

Supplies bound on pallets can sometimes be double-stacked, effectively doubling the available space. Planners should be cautious when doubling loose items, as the top stack will lose integrity in tough terrain.

Transportation time/distance factors are important to forecast because they allow synchronization of efforts at echelon by dictating movement times and the total time on the road. Convoy times can be determined by dividing the distance traveled by the speed limit (time = distance/speed). Leaders must also take into account "on-station" time, the time needed to upload and download equipment. This analysis helps leaders plan the total time needed for a convoy and helps subordinate units synchronize their efforts for maneuver units.

Fighter management is the final planning factor for transportation assets. The distribution company and FSC distribution platoon manage transportation assets to ensure vehicles and personnel are readily available for convoy operations. Units that place all assets into operation at one time assume increased risk, preventing allocation of resources for emergencies that arise. If missions allow, units should strive to place one third of their equipment and personnel in a stand-down status at any time to conduct maintenance, administrative and rest operations.

Conclusion

Accurately forecasting logistics requirements is a crucial yet often overlooked process in a sustainment planner's duties.

Unfortunately, relying on a default push of supplies results in wasted manhours, increases risk to Soldiers and commits unneeded logistic assets. However, proper forecasting and mission analysis conducted at each phase of the operation provides units the ability to provide their commanders a logistics estimate that will sustain the force through any operation. Defining unit capabilities, shortfalls and mitigations through detailed analysis and forecasting ultimately shapes the sustainment battlefield, expanding the combat commander's operational reach, freedom of action and operational endurance.

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Notes

[1] Field Manual (FM) 3-11.5, ***[Nuclear, Biological, Chemical] Decontamination***, Chapter XII, May 2006.
[2] Ibid, Chapter XII, Table XII-1.
[3] Technical Manual ™ 3-34.85, ***Engineer Field Data,*** March 2, 2015.
[4] Army Regulation 710-2, ***Supply Policy Below the National Level*** (Section 2-19), March 28, 2008.

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