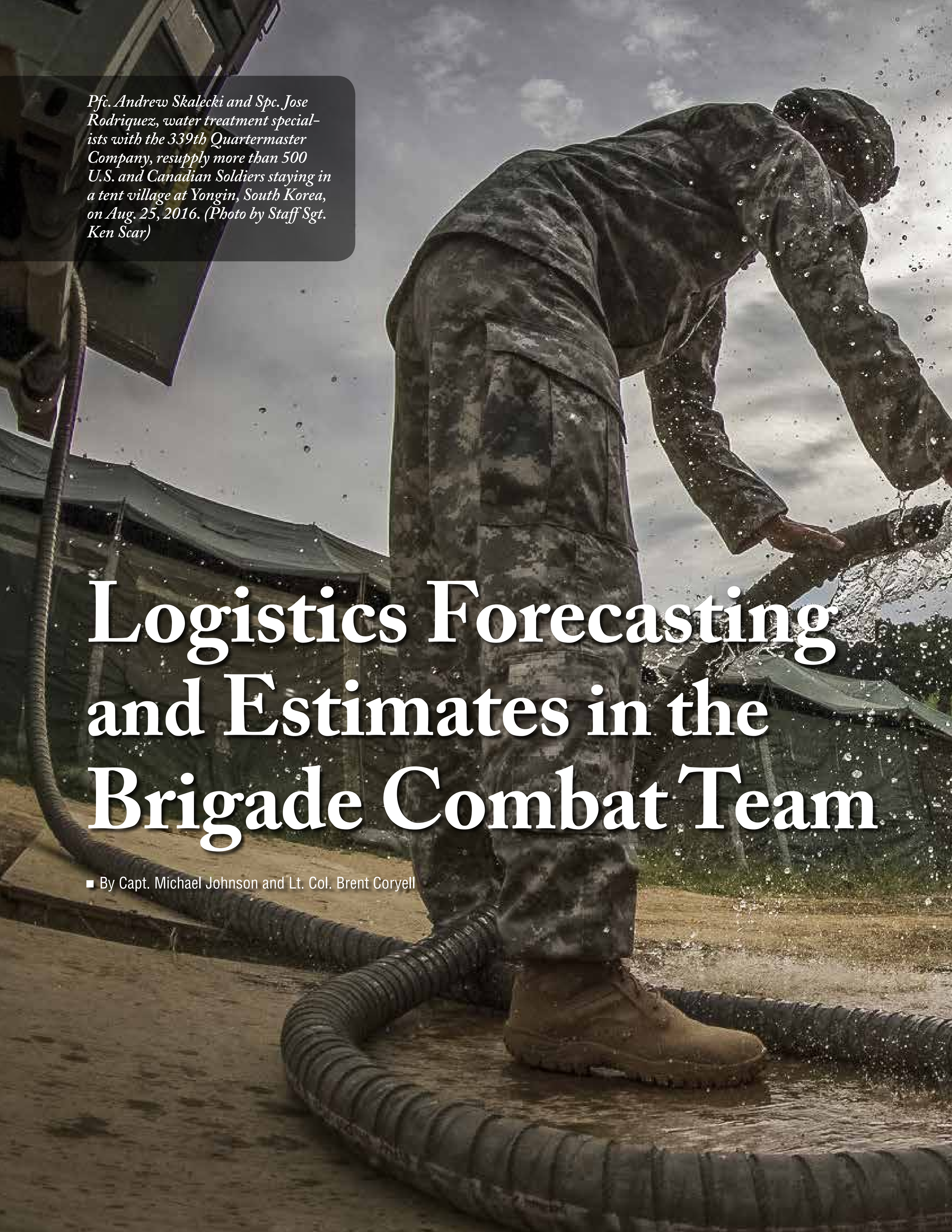

Pfc. Andrew Skalecki and Spc. Jose Rodriquez, water treatment specialists with the 339th Quartermaster Company, resupply more than 500 U.S. and Canadian Soldiers staying in a tent village at Yongin, South Korea, on Aug. 25, 2016. (Photo by Staff Sgt. Ken Scar)

Logistics Forecasting and Estimates in the Brigade Combat Team

■ By Capt. Michael Johnson and Lt. Col. Brent Coryell

Accurately forecasting logistics requirements is crucial to the mission analysis phase of the military decisionmaking process, yet it is often overlooked by brigade combat team (BCT) logistics planners. BCT logistics planners tend to submit the same daily requests instead of requesting supplies based on the future mission and factors such as requirements, consumption rates, time, and distance.

Observer-coach trainers at the National Training Center (NTC) at Fort Irwin, California, have observed that many BCTs submit automated requirements with no analysis and depend on default pushes of supplies from higher echelons to satisfy requirements. This failure to forecast commits distribution assets unnecessarily and often results in backhauls of large quantities of supplies that waste man-hours and pose increased risk to Soldiers.

Not analyzing requirement submissions also results in failure to anticipate requirements for changing missions, such as when units transi-

Observer-coach trainers from the National Training Center provide methods for accurate, detailed logistics estimates.

tion from defensive to offensive operations. While occasionally effective in sustaining units for a short time, the method is very inefficient and is not sustainable.

This article provides demonstrated methods of forecasting logistics to create maximum operational reach, flexibility, and logistics synchronization. It is intended to assist junior logistics planners in making better estimation decisions.

Mission Analysis

Forecasting requirements begins during mission analysis and is the most important mental process for logistics planners. Mission analysis should be a focused effort in which planners define the current operational environment in terms of capabilities, requirements, assessments, and mitigation plans. Logistics planners should ask, "What do I have, what don't I have, what do I need, and how do I get what I need?"

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) in order to provide calculated consumption rates for task-organized equipment. This produces a logistics estimate that mitigates shortfalls and eliminates unnecessary backhaul.

Historical data is a good starting point, but it should not be the primary forecasting method when estimating for a new operation. Historical data is valuable only when an operation has matured enough for the data to be applicable to the situation. For example, consumption rates for an attack in a forested, temperate environment will differ drastically from one in an arid desert.

Here are procedural estimates and examples for each class of supply except for classes VI (personal demand items) and VII (major end items). The examples are based on published consumption rates.

Class I (Subsistence)

Forecasting meals and water is crucial for sustainment planning. Since it is based primarily on population, class I is not as influenced by maneuver operations as most other supply classes are.

Meals. There are three categories of meals: meals ready-to-eat (MREs), unitized group rations (UGR)–A option, and UGR–heat and serve. Logistics planners forecast meals needed to sustain the force based on the head count (the number of Soldiers) multiplied by the ration cycle (the type of meal) multiplied by the issue cycle (how often bulk rations are delivered).

For example, if 100 Soldiers on an M-M-M (three MRE) ration cycle were on a "2" issue cycle (where they receive two days of supply at a time), the total MREs needed would be calculated like this:

Head count × Ration cycle × Issue cycle = x meals

100 Soldiers × 3 meals × 2 days = 600 meals

When multiple ration types are used, planners account for each type individually, with the forecasted rations being the final sum.

Because meals are transported by cases or modules on pallets, the value would be converted using the information shown in figure 1. Using the example, 600 meals would equate to 50 cases or one pallet of MREs plus two additional cases.

If conducting phased operations, the issue cycle could cover each phase, so a four-day phase would be an issue of four, pending unit-haul and storage capabilities. Planners should always adjust their total values by 10 percent to account for unforeseen changes, such as an unexpected attachment of a unit. Additional meals may be required for humanitarian aid and the holding of personnel, such as detainees and enemy prisoners of war.

There are two primary considerations when transporting meals: storing perishable items and transporting cooked UGRs. Units must consider the use of ice and multitemperature refrigerated container systems when incorporating perishable items into the ration cycle. Heat-and-serve UGRs are issued in a set of three modules. Module 3 heat-and-serve UGRs are the only meals that need cold storage in order to remain safe to consume.

Time must be considered when cooking UGRs. Once the UGR is at the correct temperature, it must be consumed within four hours. Planners must be cognizant of where a unit's assault or containerized kitchen is located in relation to the forward line of troops. Planners should add 40 to 70 minutes to the actual travel time to account for the loading and unloading of meals.

Water. Water forecasting can be categorized into bulk water, ice, and decontamination planning. During fiscal year 2015, a total of 59,800 gallons of bulk water were backhauled between forward support companies (FSCs) and brigade support battalion (BSB) units at the NTC, which resulted in the unnecessary use of personnel and equipment.

Bulk water planning consists of identifying capabilities, requirements, and shortfalls. The brigade support operations section and brigade and battalion S-4s can calculate available water capabilities based on asset availability to understand the maximum water capability of each unit. (See figure 2.)

Like meals, bulk water planning is calculated on a per-person, per-day cycle. Figure 3 on page 31 highlights planning factors for this method that are based on the climate. Planners should use this in their initial analysis for forecasting proper requirements and adjust requirements as the operation progresses.

Mortuary affairs operations are an additional planning factor to be considered at the BSB level. Processing each set of remains requires four gallons of water.

Ice. Ice is forecasted per person, per day based on the operational environment. The pounds per bag per person vary with each climate. Arid climates require 6 pounds per person; tropic, 5 pounds; temperate, 4 pounds; and arctic, 3 pounds. The bag size will determine how many bags will be on each pallet. For example, 103 20-pound bags fit on one standard pallet, and 14 pallets can fit inside one multitemperature refrigerated container system.

Decontamination. Decontamination operations require substantial water for each Soldier and vehicle. The unit decontamination crew washes off gross contamination using 100 to 150 gallons of hot, soapy water on each vehicle. Each armored combat vehicles may require 200 or more gallons of water for decontamination.

One hundred gallons of water will provide one vehicle with a two- to three-minute wash. Detailed equipment decontamination requires more water. (See figure 4 on page 31.) For troop decontamination beyond the exchange of mission-oriented protective posture equipment, water requirements are 25 gallons per person.

Class II

Successful class II (clothing and individual equipment) forecasting resides at the unit supply level, where inventories are conducted regularly to avoid shortage of critical equipment, clothing, and office supplies. Soldiers deploy with an initial load of class II and receive theater-specific equipment during the unit's reception, staging, onward movement, and integration process into theater.

Class II is difficult to forecast in relation to phases of the maneuver operation because each echelon will consume supplies at different rates. Planners should be cognizant of the need for class II and work in close coordination with the BSB supply support activity (SSA) to determine the transportation requirements for requests.

Class III

Class III (petroleum, oils, and lubricants) can affect the success or failure of any unit conducting combat operations. Class III is categorized into

Meals Ready-To-Eat	
Meals per case	12
Cases per pallet	48
Weight per case	22.7 lbs.
Weight per pallet	1,089 lbs.
Unitized Group Rations	
Servings/module	50
Modules/pallet	8 (400 servings)
Weight/module	128 lbs.
Weight/pallet	1,020 lbs.
Pallet size	40 x 48 x 40 in.

Figure 1. Transportation planning factors. (Adapted from Command and General Staff College Student Text (CGSC ST) 4-2, Theater Sustainment Battle Book)

Bulk Water Storage	
Storage Type	**Capacity in Gallons**
Buffalo	400
Blivet	500
Hippo	2,000
Camel	900
3K Semi-trailer mounted fabric tank (SMFT)	3,000
5K SMFT	5,000
Onion skin	500
20K Storage Distribution System	20,000
50K Storage Distribution System	50,000

Figure 2. Bulk water storage capacity. (Adapted from CGSC ST 4-2)

bulk fuel (class IIIB), which includes gasoline, diesel, and aviation fuel, and packaged class III (class IIIP).

Class IIIB. Forecasting class IIIB is complex because of the large variety of vehicle types, consumption rates, terrain, and hours of use. The formula used to determine bulk water carrying capacity can also be used to determine bulk fuel carrying capability. Planners should multiply available assets by their capacity. (See figure 5.) To avoid expansion and associated damage to personnel and equipment, storage assets should never be filled to their maximum capacities.

Determining class III requirements requires detailed analysis of the maneuver concept for the operation. Forecasters determine estimated fuel usage for each vehicle using the following formula: the number of vehicles multiplied by the consumption rate stated in gallons per hour (GPH), multiplied by the number of hours that the equipment is operated. (See figure 6 on page 32 for consumption rates.)

For example, an armor company comprising 14 M2 Bradley fighting vehicles is conducting a one-day operation on rugged terrain. In a 24-hour period, the Bradleys are expected to be at a tactical idle for 16 hours and traverse conditions for eight hours. Expected fuel consumption at idle would be calculated in the following way:

$$14 \times 1.4 \text{ GPH} \times 16 = \sim 314 \text{ gallons}$$

Expected fuel consumption during operations on rugged terrain is calculated like this:

$$14 \times 18 \text{ GPH} \times 8 = 2{,}016 \text{ gallons}$$

Next, we add the products to find the total amount of fuel required.

$$\sim 314 \text{ gallons} + 2{,}016 \text{ gallons} = \sim 2{,}330 \text{ gallons}$$

This process will be used for each vehicle type within a unit. While detailed, it provides an accurate estimate of class IIIB consumption that will help identify and mitigate shortfalls and 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. (See figure 7 on page 32.) Using the number of aircraft multiplied by the number of gallons per hour and air hours allows planners to compute the estimated fuel needed.

Class IIIP. There is no single manual describing class IIIP requirements by vehicle type. Unit standard operating procedures usually do not address the class IIIP basic loads required by vehicle platform. Additionally, class IIIP forecasting requires coordination with supporting maintenance elements.

Poor planning for packaged lubricants has detrimental effects. Commonly seen problems at the NTC are engines low on oil and tracks that cannot be adjusted due to lack of grease. Most units deploy with 15 to 30 days' worth of packaged lubricants as part of their stockage listing.

Environmental considerations such as dust, snow, and rain affect the consumption rate of class IIIP. Sustainers must analyze transportation trends and find out how long it takes items to arrive at the SSA and use this information to ensure timely replenishment.

Class IV

Class IV (construction and barrier materials) planning is conducted when planning for a phased defensive operation and for sustained unit defense. Every echelon is involved in materials planning and resourcing. Division-level echelons are responsible for determining 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 Annex

A 10th Brigade Engineer Battalion Soldier removes fabric from concertina wire while conducting a defensive obstacle placement mission during exercise Combined Resolve VII at the Joint Multinational Readiness Center in Hohenfels Germany, Sept. 08, 2016. (Photo by Pfc. Randy Wren)

G (Engineering), Appendix 3 (General Engineering), Tab C (Engineer Specific Combat Configured Loads).

Logistics planners must coordinate closely with the brigade engineer planner in order to forecast class IV at the brigade level and below. The brigade engineer planner is responsible for determining the CCLs needed based on the brigade's defensive operation. The engineer planner tasks how many modules are resourced for each battalion and where the CCLs are initially placed in the brigade's area of operations.

CCLs are built on container roll-in/roll-out platforms or flatracks using a brigade-tasked detail supervised by the brigade engineer battalion. CCLs can be built by the supporting echelon-above-brigade units if multiple brigades are operating in the same area.

The BSB support operations section coordinates transportation of CCLs to supported units based on the brigade engineer planner's tasking. Each CCL should be delivered to the supporting FSC at least 48 hours before the defensive operation starts. This will give maneuver units' time to establish and improve their defensive positions.

Class IV is also used in sustained unit defense for force protection. Units training at the NTC consistently fail to plan for adequate class IV when building triple strand concertina wire defense. This happens because they do not understand how class IV is resourced for defense.

Planning for a sustained unit defense is a collaborative effort between the battalion executive officer and S-4 that integrates three primary defensive methods. The first is the use of engineer assets to construct berms and hasty fighting positions. This is the preferred method because it increases protection and decreases the use of unit resources and transportation assets. The second is by setting up triple-strand concertina wire around the unit's perimeter.

The final method is a combination of the previous two that integrates

Use	Temperate	Tropical	Arid	Arctic
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

Figure 3. Daily water consumption factors in gallons per person. (Adapted from CGSC ST 4-2)

	M12A1 PDDA Rinse		M17 LDS Rinse	
Equipment	Gallons	Minutes	Gallons	Minutes
M1 Abrams	325	12	57	14
M2 Bradley	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

Figure 4. Detailed Equipment Decontamination Planning Factors. The rinse is done with the spray wand for an M17 LDS. (Adapted from Field Manual 3-11.5, CBRN Decontamination Multiservice Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Decontamination)

	Bulk Tanks	M1062	M969	M978	Blivet	TPU Pod	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			
Flow per nozzle (gpm)	50		60	50		25	
Nozzles	2		2	2	1	2	

Figure 5. Bulk fuel storage capability and planning factors in gallons. (Adapted from CGSC ST 4-2)

Legend

APC = Armored personnel carrier
GPM = Gallons per minute
HEMTT = Heavy expanded-mobility tactical truck
LDS = Lightweight decontamination system
MFS = Modular fuel system
PDDA = Power-driven decontamination apparatus
TPU = Tank and pump unit

their strengths. Planners should reference Technical Manual 3-34.85, Construction Surveying, to ensure adequate amounts of material are requested to sustain the unit's defense.

Class V (Ammunition)

Ammunition is forecasted through the Total Ammunition Management Information System operated by the brigade ammunition office. Weapon density, the number of personnel, and specific mission requirements will determine the ammunition requirements. Unit basic loads (UBLs) will vary with each operation. There is no "one size fits all" UBL.

Each combat phase may require unique ammunition. For example, high-explosive grenades are used for an attack, while the family of scatterable mines is used for a defense. Controlled supply rates are also considered by referencing the brigade operations order, Annex F, Paragraph 4, Section 3 (Supply).

Once UBLs are determined by the brigade ammunition office, the brigade master gunner, and the brigade S-4 and are validated through the Total Ammunition Management Information System, the BSB receives them from the ammunition supply point in mission configured loads. These loads must be reconfigured into CCLs for each subordinate unit.

Ammunition planners reference the Conventional Ammunition Packaging and Unit Load Data Index to determine transportation requirements for issuing ammunition to units and analyze the compatibility, weight, and cube dimensions of each set of ammunition with available transportation. This determines how many CCLs are built for each subordinate unit.

The planning factor for UBLs is three basic loads for a brigade-sized element: one with the unit with the weapon system (company level), one at the combat trains command post with the FSC (battalion level), and one stored at the ammunition transfer and holding point (brigade level). Planning for these UBLs enables smooth issuing of ammunition as phases progress.

According to section 2-19 of Army Regulation 710-2, Supply Policy Below the National Level, sustainers need to account for the basic loads and should be able to transport all CCLs with organic assets.

Planners must also consider how additional ammunition will be replenished. Unit replenishment from the ammunition transfer and holding point to each battalion's units is accomplished through expenditure reports. While the exact process is determined by unit standard operating procedures, expenditure reporting is the only method that brings a UBL 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 ensure that logistics status reports capture what was expended. The expenditure report provides the brigade ammunition office with the information needed

Vehicle	Idle	Cross-Country	Road
M1 Abrams	17.3	56.6	44.6
M2/3 Bradley	1.4	18.0	8.6
M113 APC	1.0	10.5	8.9
M88 Hercules	2.0	42	31
M9 ACE	1.4	12.6	9.3
M109A6 Paladin	2.2	16.0	11.8
MLRS	1.3	15.0	8.6

Figure 6. Fuel consumption rates in gallons per hour. (Adapted from CGSC ST 4-2)

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)	260	260	180	345	300
Passenger seats			1	33	11
Litter capacity				24	6
Ambulatory capacity				31	7

Figure 7. Aviation planning factors. (Adapted from CGSC ST 4-2)

Legend

ACE = Armored combat earthmover
APC = Armored personnel carrier
CGSC ST = Command and General Staff College Student Text
MLRS = Multiple launch rocket system

to request additional ammunition before subordinate units request it. The expenditure report itself is not an ammunition request; unit S-4s are still responsible for requesting replenishment on a Department of the Army Form 581, Request for Issue and Turn-In of Ammunition.

Class VIII (Medical Materiel)

Medical elements typically deploy with a three-day supply of class VIII to support a battalion. When forecasting class VIII requirements for medical operations, 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 and the timeliness of their delivery. Additionally, understanding projected casualty rates is crucial for forecasting unit requirements. Other considerations such as disease and accidents should also be included in estimates.

Class IX (Repair Parts)

Class IX is extremely difficult to forecast during an operation because of the unknowns involved with equipment wear and tear. Planners work in coordination with the SSA and maintenance support elements to best predict what and how much class IX is needed for an operation.

The time of year and operational environment will impact class IX requirements. For example, winter requires additional batteries and mountainous terrain requires additional tires. Units deploy with the SSA's authorized stockage list, which contains common-use items. Coordination with the SSA technician will help determine what assets are needed to transport class IX to subordinate units.

Transportation

Transportation requirements are interconnected with every class of supply. Transportation capabilities and requirements must be properly planned to support units. Having too few vehicles increases the number of trips needed to distribute supplies. Having too many increases class III and IX requirements and results in a backhaul of large quantities of supply, wasted man-hours, and the commitment of unneeded logistics assets.

Transportation is forecasted based on three things: the number of pallets needed per class of supply, the time needed to deliver supplies to subordinate units, and fighter management (ensuring Soldiers have the sleep, food, and equipment needed to cover the mission).

Pallets. In order to properly forecast transportation, planners must understand how many assets will fit onto a vehicle. Warehouse pallets are the common transportation planning factor for all classes of supply because equipment is attached to pallets, and the end state for most requirements is stated in the number of pallets needed for transport. For personnel transportation, planners need to know how many passenger seats and litter and ambulatory spots are needed and available. (This information is available in the Command and General Staff College Student Text 4-2, Theater Sustainment Battle Book.)

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

Time and distance. Transportation time and distance factors are important to forecast because they allow synchronization of efforts 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.

Leaders must also account for time on station, the time needed to upload and download equipment. This analysis will help leaders plan the total time needed for a convoy and help subordinate units synchronize their efforts for maneuver units.

Fighter management. The final transportation planning factor is fighter management. The BSB's distribution company and FSC's distribution platoon are responsible for managing transportation assets to ensure vehicles and personnel are available for convoy operations.

Units that use all of their assets at once increase risk and do not have resources to allocate for emergencies. If missions allow, units should strive to place one-third of their equipment and personnel in a stand-down status at all times in order to conduct maintenance, administrative, and rest operations.

Accurately forecasting logistics requirements is a crucial yet often overlooked process. Relying on default pushes of supplies results in wasted man-hours, increased risk to Soldiers, and the unnecessary use of logistics assets.

Forecasting and mission analysis conducted at each phase of the operation provide planners with the ability to give their commanders logistics estimates that sustain the force through any operation. Defining unit capabilities, shortfalls, and mitigations through detailed analysis and forecasting ultimately shapes the sustainment battlefield, expanding the combatant commander's operational reach, freedom of action, and operational endurance.

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