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Targeted Use of Theater Inventory to Effectively Sustain Overseas Forces While Minimizing Supply Chain Costs

During Operation Iraqi Freedom (OIF), the high costs of air shipments have garnered attention. There have been calls to send fewer items by airlift and instead to transport the items to units by low-cost but slow sealift. In some cases, these calls have led to such a shift, resulting in lower cost but worse support, as expected. However, this choice between cost and performance need not be made.

With an effective overall distribution network design that is continually monitored and updated, rapid response can be delivered at low total cost, with different items shipped via the ideal mode for each type of item, i.e., the method that meets customer response needs at the lowest total distribution cost possible. A key component of an effective distribution network to support overseas units is the targeted use of centralized theater inventory—for example in Kuwait to support units in U.S. Central Command (CENTCOM)—with replenishment of stocks via sealift. Selected use of theater inventory in conjunction with a targeted mix of airlift and sealift enables optimal support.

RAND Arroyo Center, in conjunction with the RAND National Defense Research Institute, has laid out a construct and developed a detailed methodology for designing a distribution network that minimizes total costs while ensuring effective distribution support through integration of transportation planning and theater inventory planning. Implementation of this construct has reduced costs and improved support of operations in CENTCOM.

The Key Is to Focus on Reducing Total Distribution System Costs

There are three costs to trade off—transportation, inventory, and materiel handling—in distribution network design. By considering all three costs, the ideal distribution network design option can be determined for each item. The

Key Findings

- To provide effective overseas support at minimal total cost, the distribution network must integrate theater inventory, airlift, and sealift planning.
- Theater inventory should include items with high recurring demand and low price-to-weight ratios (e.g., track, cans of oil, and construction materiel).
- Optimal implementation of theater inventory would save over \$200 million per year, with about three-quarters of a billion in savings already achieved since 2004 through improvements in theater inventory.

ideal option varies among items, because the relative value of the three costs varies based upon item physical characteristics, demand profiles, and cost:

- For a small, expensive item, inventory cost dominates, so the best option would be stockage in the continental United States (CONUS) with strategic airlift upon demand.
- For a heavy, inexpensive, high-demand item, transportation cost dominates, so the best option is theater inventory with surface replenishment and delivery upon demand by intratheater airlift or truck.
- If slower delivery is acceptable, sealift direct to units from CONUS can be the best option.

The Theater Inventory Value Proposition

The choice between CONUS stockage with strategic airlift and theater inventory can be illustrated with examples of shipments for CENTCOM, as shown in Tables 1 and 2.

A common vehicle battery weighs 89 pounds and has a price of \$113. From January 2006 to January 2007, the cost to fly the battery via military-managed strategic air averaged \$328. Every time a battery was flown, almost three more could have been purchased instead for the amount of the airlift bill. Additionally, because inventory turns over, each battery purchased for theater inventory enables multiple airlift bills to be avoided. However, while the battery is relatively inexpensive to buy compared to its transportation costs, the engine costs \$962 per pound to buy compared to about \$5 per pound to ship by air.

Table 2 shows a comparison of total theater inventory costs for the battery and engine, with the key costs shaded. For the battery, the optimal investment in theater inventory saves \$9.6 million per year. For this type of item, a cost-

Table 1
Comparison of Item Characteristics: Vehicle Battery and Apache/Black Hawk Engine, January 2006 to January 2007

	Vehicle Battery	Apache and Black Hawk Engine
Number shipped/yr.	60,309	314
Weight (each/total)	89 lb. each/ 2,700 tons	722 lb. each/ 113 tons
Unit price	\$113	\$694,615
Unit price/lb.	\$1.27/lb.	\$962/lb.
Airlift cost	\$328	\$3,550
Airlift cost/lb.	\$3.68/lb.	\$4.92/lb.

Table 2
Comparison of Theater Inventory Costs: Vehicle Battery and Apache/Black Hawk Engine, January 2006 to January 2007

	Vehicle Battery	Apache and Black Hawk Engine
Transportation savings/cost	– \$10.1M	– \$0.6M
Inventory savings/cost	+ \$0.3M	+ \$10.7M
Materiel handling	+ \$0.2M	+ \$5K
Total annual savings/cost from theater inventory cost	– \$9.6M savings	+ \$10.1M increase

minimizing inventory level can be determined. In contrast, if most engines were delivered from theater inventory, net costs would increase by about \$10.1 million annually, due to increased inventory-holding costs of about \$10.7 million annually that overwhelm the potential airlift savings.

Researchers computed these tradeoffs for all items shipped to determine which should be in theater inventory and at what inventory level. Reviewing the results produces logical “classes” for theater inventory:

- Greatest return on investment from theater inventory: items with high recurring demand and low price-to-weight ratios (e.g., track, cans of oil, and construction materiel).
- Also appropriate for theater inventory, but with a lower return on investment: high-volume, moderately priced, and heavy items (e.g., engineered automotive parts).
- Not appropriate for theater inventory: low-volume or expensive items (e.g., aircraft engine, electronics).

Reducing Costs and Improving Distribution Performance in OIF

Arroyo has been working with Department of Defense supply chain organizations to apply this methodology in CENTCOM in stages since early 2004, with about three-quarters of a billion dollars in savings to date. Additional potential for improvement remains. In many cases, inventory levels have not been set high enough or maintained at needed levels—either for theater inventory or for U.S.-based stocks, which are used to replenish theater inventory.

Recommendations

Arroyo researchers also made the following recommendations:

- Establish a standard process for determining theater inventory and run it periodically.
- Establish a joint theater inventory policy that is aligned with theater inventory benefits and apply it to all theaters of operation.
- Establish metrics and goals oriented to total distribution costs.
- Transportation costs should be borne by suppliers so they will position stocks to minimize the use of strategic airlift. ■

This research brief describes work done by the RAND Arroyo Center and the RAND National Defense Research Institute and documented in *Effectively Sustaining Forces Overseas While Minimizing Supply Chain Costs: Targeted Theater Inventory*, by Eric Peltz et al., DB-524-A/DLA, 2008 (available at http://www.rand.org/pubs/documented_briefings/DB524.html) and *Leveraging Complementary Distribution Channels for an Effective, Efficient Global Supply Chain*, by Eric Peltz and Marc L. Robbins, DB-515-A, 2007 (available at http://www.rand.org/pubs/documented_briefings/DB515.html). This research brief was written by Kristin J. Leuschner. The RAND Corporation is a nonprofit institution that helps improve policy and decisionmaking through research and analysis. RAND’s publications do not necessarily reflect the opinions of its research clients and sponsors. RAND® is a registered trademark.

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