

What Do AOE's Do When They Are Deployed?

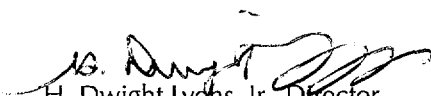
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What Do AOEs Do When They Are Deployed?

The Navy has twelve aircraft carriers and eight fast combat support ships (AOEs) that were built to act as carrier battle group (CVBG) station ships. The multi-product AOE serves as a “warehouse” for fuel, ammunition, spare parts, provisions, and stores to other CVBG ships, especially the carrier. Currently, an AOE deploys with about four out of every five CVBGs on peacetime forward deployments. Prior to 1996, when there were only four AOEs, only two of every five CVBGs deployed with an AOE. That frequency could resume in the latter part of this decade when AOE-1 class ships are retired at the end of their 35-year service life.

The combat logistics force (CLF) that supports forward deployed combatant ships consists of CVBG station ships and shuttle ships (oilers, ammunition ships, and combat stores ships) that resupply the station ships and the combatants as well. Ammunition ships are not routinely forward deployed, except as CVBG station ships, because of the low demand for ordnance during peacetime.

To better understand the utility of AOEs in peacetime, we wanted to learn how much business they do as CVBG station ships and who their customers are during forward deployment. To that end, in 1996 we asked the Navy to have deploying AOEs record their underway replenishment (UNREP) data and send them to the Center for Naval Analyses (CNA). We supplemented those data with similar AOE and substitute CVBG station ship data we had received from the fleet for 1994. This report documents the UNREP activity of the AOEs (and substitute CVBG station ships) when they are deployed. It does NOT reflect the total logistics support Navy combatants receive from all sources during their forward deployments.

AOE UNREPs

During an Average Deployment:

- FAS (fueling at sea)
 - DFM: 101 ± 35 FASs, 13 ± 6 million gallons
 - JP-5: 71 ± 21 FASs, 8 ± 2 million gallons
- RAS (replenishment at sea)
 - 56 ± 32 RASs and 1485 ± 954 pallets of dry goods
 - 24 ± 7 RASs and 914 ± 587 pallets of ammunition

Note: Numbers listed as average \pm one standard deviation

Before we present the analysis of individual AOE and how they delivered fuel and goods to customers, we show aggregated data that give a “feel” for how much business AOE did with their customers.

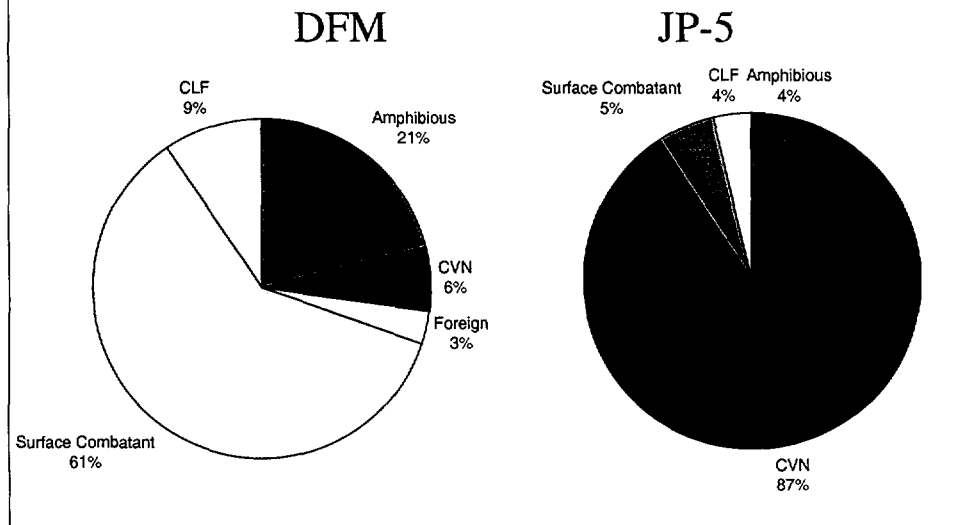
We decided to aggregate AOE UNREP data from nuclear aircraft carrier (CVN) battle groups. Most aircraft carriers are nuclear powered, thus these data (pages 2 – 4) give a good estimation for who the AOE’s customers currently are. The Navy’s four fossil fuel powered aircraft carriers (CVs) will be decommissioned in the foreseeable future, thus we felt that the data from these battle groups have less significance. Nevertheless, we included data from AOE deployed with CV battle groups in this study for completeness (pages 39 and 40).

On average, AOE delivered about 13 million gallons of diesel fuel marine (DFM) and 8 million gallons of aviation fuel (JP-5) to their customers during a typical 6-month deployment. They refueled about 116 ships, with the majority of the refuelings for DFM.

During peacetime, AOE replenish their customers with dry goods (frozen food, vegetables, consumables, aircraft engines, etc.) and limited amounts of ammunition. The average AOE delivered 1,485 pallets of dry cargo and 914 pallets of ammunition during its deployment.

It’s important to note the significant range of the average values. In most cases, the range represents 25 to 75 percent of the average value. These large deviations are due to the variability of the AOE’s business. For example, AOE 7 transferred 30 million gallons of DFM fuel while AOE 2 delivered only 16 million gallons. When numbers of these magnitudes are averaged, large variances are generated. The average quantities should be interpreted as “order of magnitude” numbers, not exact numbers.

Who Were the AOE's Customers for DFM and JP-5?

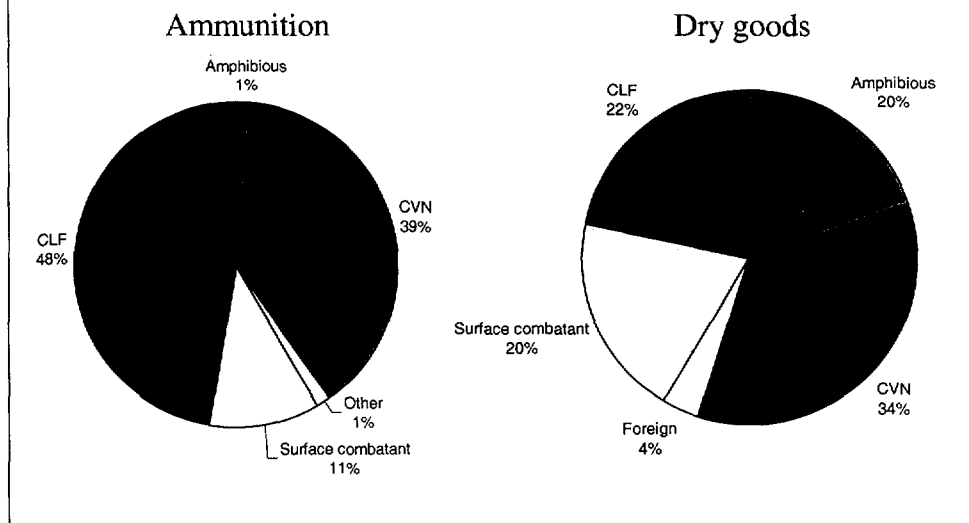


In this and the next graph, we show what percentage of fuel, dry goods, and ammunition AOE's deployed with CVN battle groups delivered to each category of their customers. We calculated percentages by adding all items (either fuel, dry goods, or ammunition) within a ship type and dividing this number by the total number of items transferred by the AOE's.

AOE's transferred over 60 percent of their DFM to surface combatants and CVNs.

The majority of the AOE's JP-5 deliveries were to aircraft carriers.

Who Were the AOE's Customers for Dry Cargo?



We used the same procedure described on page 3 for calculating the percentage of dry cargo, which is composed of dry goods and ammunition, that was transferred to the AOE's customers.

The AOE delivered the bulk of its ammunition transfers to CVNs and to other CLF ships. In calculating the percentage of ammunition transferred to customers, we removed the effect of ammunition offloaded by AOE's to CLF ships at the end of their deployment. These ammunition offloads are discussed later in this paper.

AOE's transferred over 50 percent of their dry goods to surface combatants and CVNs. Amphibious and other CLF ships received roughly the same number of dry goods pallets.

Summary of Results

Deployed AOE:

- UNREP mostly surface combatants
- Carriers are next most frequent customers
- Conduct many FASs, some RASs
- Use VERTREPs for most cargo transfers
- Seldom conduct night UNREPS

Question: Is peacetime practice consistent with wartime intentions?

This slide summarizes what we learned from our analysis of AOE data.

Most forward deployed USN ships are surface combatants. Hence, we weren't surprised that most of the ships that AOE's refueled and replenished underway were surface combatants. The next most frequent customer was aircraft carriers, followed by CLF shuttle ships and amphibious ships.

Fueling at sea (FAS) was the most common AOE UNREP event. The dominant customer in frequency and quantity for JP-5 was the carrier, whereas the surface combatant was the principal customer for DFM, with amphibious ships close behind.

FAS events are connected replenishments (CONREPs). Although AOE's conducted replenishment at sea (RAS) to deliver some dry cargo (e.g., dry goods and ammunition) by CONREP, that mostly happened in conjunction with a FAS. Otherwise, dry cargo was usually transferred to the customer by helicopters in vertical replenishment (VERTREP).

Forward deployed ships conduct very few UNREPs at night during peacetime. In fact, of the UNREP events for which the time of day was reported, less than 12 percent of them were at night (which we defined between 2000 and 0400).

Because the Navy espouses training as it intends to fight, we recommend that the fleet affirm to its own satisfaction that it plans to conduct UNREPs during wartime as it is presently practicing in peacetime: during daylight and using VERTREP almost exclusively for deliveries of dry cargo.

Outline

- Introduction
- Fuel analysis
- Dry cargo analysis
- Conclusions
- Recommendations

The first few pages of this report provide an introduction on carrier battle group composition, the battle group station ships whose data we used, and how ships are refueled and resupplied at sea.

That is followed by highlights of the fuel and dry cargo transfers they performed.

Then, we present the conclusions and recommendations that we derived from our analysis.

In an appendix, we include some additional details on the analyses. We've also included a couple of pages commenting on the UNREP data we had to work with, which limited the extent of our analysis to a degree.

Deployed CVBGs Consist of:

- One CV or CVN
- Four to seven surface combatants (CG, DDG, DD, FFG)
- One AOE (or substitute station ships)
- Two direct support SSNs

This slide shows the composition of the typical carrier battle group that forward deployed from the continental U.S. (CONUS) in 1994 and 1996–1997, the periods for which UNREP data were provided to us by the fleet.

Atlantic Fleet (“LANT”) CVBGs deployed with six surface combatants (and once with seven surface combatants), while Pacific Fleet (“PAC”) battle groups included only four surface combatants.

All four AOE-1 class and the first three AOE-6 class fast combat support ships deployed as CVBG station ships during the periods for which we have data. Three LANT CVBGs conducted forward deployment with substitute station ships, as did one PAC CVBG. The CVBG station ships for which we have data are shown on the next slide.

Each deploying CVBG included two direct support nuclear submarines. However, they didn’t receive resupply from the station ship underway and are not included as customers during the rest of this document.

The traditional overseas areas where carrier battle groups continually deploy are the Western Pacific (WestPac), SouthWest Asia (the Central Command (CentCom) area of responsibility), and the Mediterranean. CentCom is the only common area for both LANT and PAC CVBGs, but LANT CVBGs spend much less of their 6-month deployments there than do their PAC counterparts.

The UNREP Database

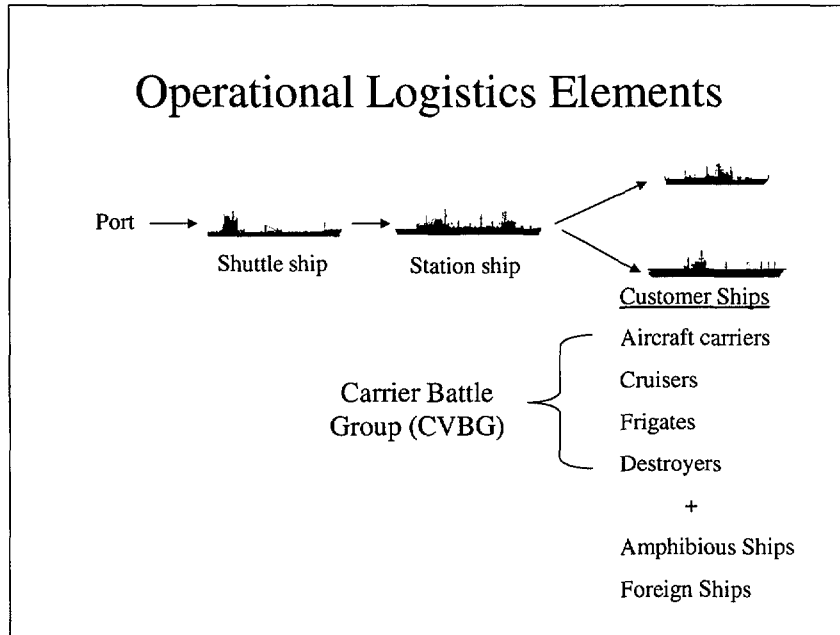
- 1994 deployed CVBG station ship data
 - LANT: AO 178/AE 34; AOR 6/AE 28; AOE 4
 - PAC: AOE 2; AOR 7/AE 32
- 1996-97 deployed CVBG station ship data
 - LANT: AO 179/AE 34; AOE 3; AOE 4; AOE 6; AOE 8
 - PAC: AOE 1; AOE 2; AOE 7

In 1994 CNA acquired UNREP data from a number of CLF ships (including a number of CVBG station ships) in connection with another project. In 1996 we asked the AOE's unit commanders, Commander Combat Logistics Group Two (COMLOGGRU TWO) and Commander, Naval Surface Group Pacific Northwest (COMNAVSURFGRU PAC NW), to have their ships record UNREP data during their forward deployments and to send that data to CNA.

This slide shows the CVBG station ships for which UNREP data was sent to CNA. However, the 1994 data, while quite complete for refueling events, was incomplete in that dry cargo delivered was not identified by type (ammunition, provisions, stores). Consequently, we included the 1994 data in our analysis of fuel deliveries but could not use it in analyzing dry cargo deliveries.

The Navy's principal CVBG station ship is the fast combat support ship (AOE), but an oiler and an ammunition ship can provide a logistics capacity that is roughly equivalent to an AOE. Periodically, such a pair deploys as a substitute station ship. For simplicity, throughout the remainder of the report, we apply the term "AOE" also to substitute CVBG station ships, when they are operating as CVBG station ships.

The composition of the 1994, 1996 and 1997 CVBGs with which AOE's deployed is shown in the appendix on page 34.



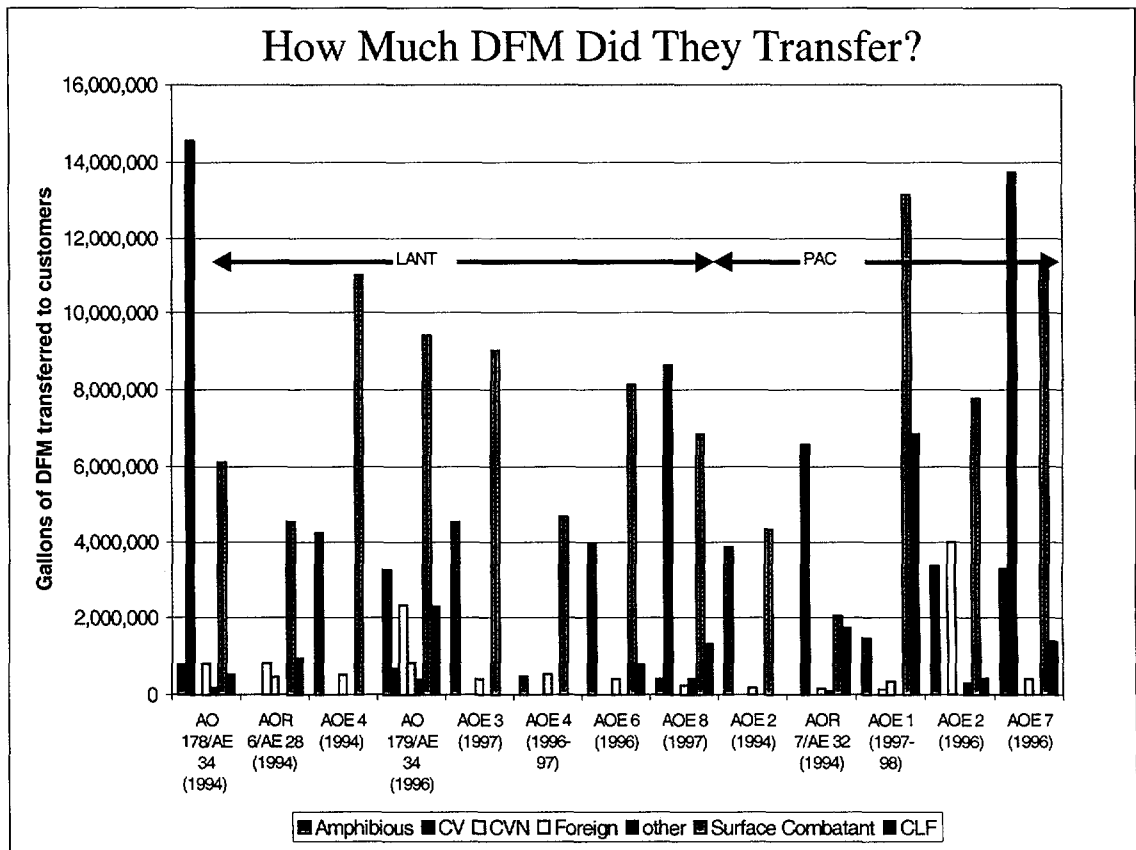
This chart shows elements of the Navy’s operational logistics system.

Initially, commercial merchant ships transport supplies from CONUS ports to forward bases in the overseas theaters where the Navy operates. Within the theater, the above picture shows the traditional operational logistics concept of operations (CONOPS), by which fuel and provisions reach the customers.

Though the picture depicts the CLF shuttle ship delivering its products only to the AOE, in actuality it also makes deliveries directly to combatants. When the CLF shuttle ship depletes its resupply material, it returns to a forward base where the cycle is repeated.

In this study, we focused on the role of the AOE during forward deployment in peacetime.

The UNREP data that follow show that the amount of product the AOE delivered to its customer varied from deployment to deployment. There are a number of possible reasons for this fluctuation in demand on the AOE. As noted above, CLF shuttle ships deliver resupply products directly to combatant ships as well as to the CVBG station ships; extensive use of shuttle ships to refuel and replenish combatants will reduce their dependence on the station ships. Combatants’ demand for fuel and provisions depends in part on the operational tempo; if the combatants are not required to conduct strenuous operations at sea while deployed, or have frequent or extended port visits, they may not require as many refuelings and replenishments.



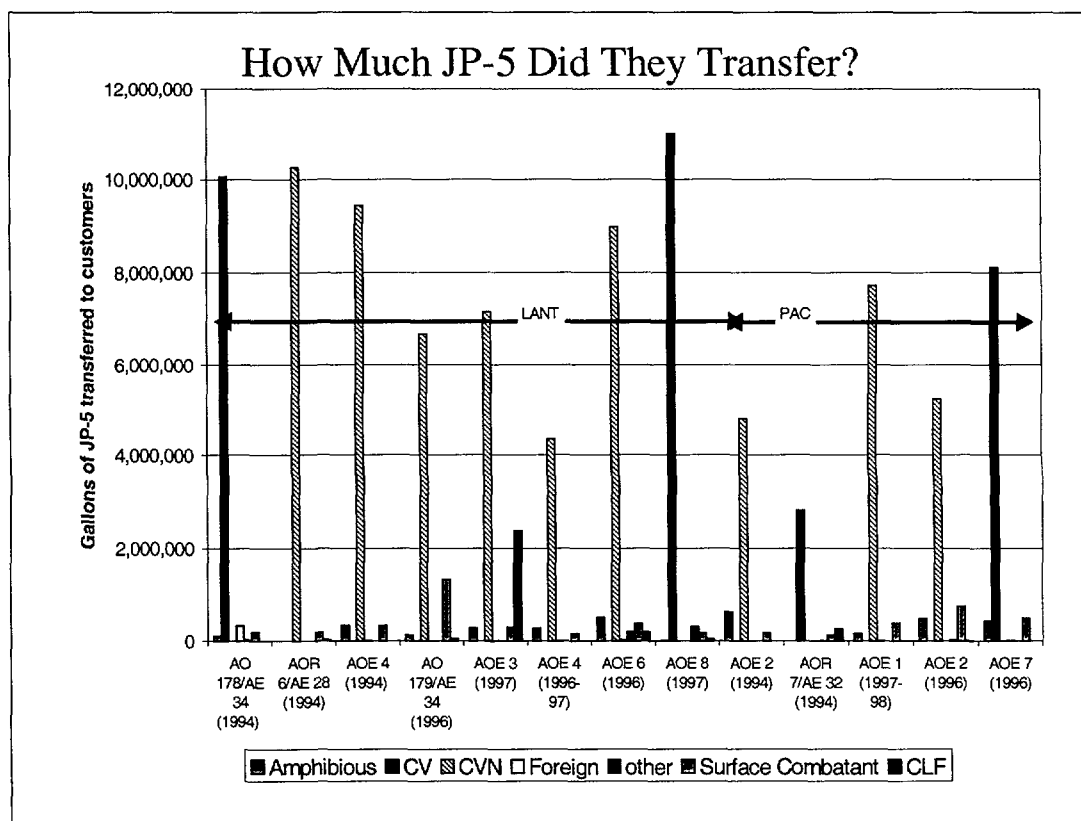
In the next several pages, we show the analysis of the AOEs distribution of DFM and JP-5 fuel to its customers. One of the most important commodities of non-nuclear naval vessels is DFM. This type of fuel is burned in ships' propulsion plants and generators to provide propulsion and electrical power. Likewise, the equivalent fuel for aircraft is JP-5.

This chart shows how much DFM each deployed CVBG AOE transferred to other ships, by type. AOEs were grouped into either Atlantic (LANT) or Pacific (PAC) depending on their parent fleet.

AOEs in non-nuclear CVBGs transferred more DFM to carriers than to surface combatants. In nuclear carrier battle groups, the AOE's main customers for DFM were surface combatants (in six such deployments no DFM was transferred to the CVN). However, you will see DFM transfers by AO 179/AE 34 and by AOE 2 to CVNs. This is unusual because CVNs' nuclear reactors provide their electrical power and propulsion. One possible reason for these DFM transfers is that the CVNs depleted their DFM cargo fuel by refueling their CVBG's surface combatants.

Another CLF customer that requires DFM is the amphibious ship. Several AOEs transferred up to 4 million gallons of DFM to amphibious ships (mainly LPDs and LSDs) during their deployments.

Note: In data sets that had less than 6 months' worth of data, we multiplied the amount of fuel or dry goods by a correction factor to produce an amount "equivalent" to a 6-month deployment. These correction factors are listed in the appendix on page 38.

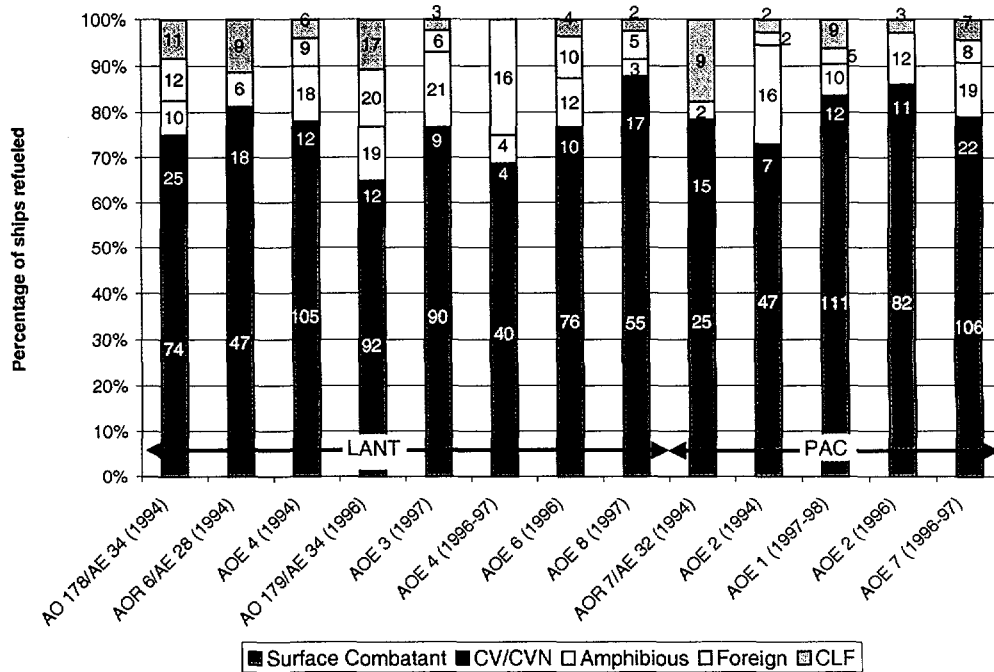


Aircraft carriers are the principal capital ships the United States uses to project its military power throughout the world. Carriers carry as many as 80 aircraft. They enable the U.S. to conduct air operations overseas without the need for shore bases. To maintain this freedom of action and to conduct a high tempo of operations during peacetime and combat operations, they must be able to refuel their aircraft whenever required.

The CVBG AOE resupplies the carrier with aviation fuel, JP-5. Deployed AOEs transferred several million gallons of JP-5 fuel to CVs and CVNs mainly, but not exclusively, to their parent carrier. Secondary customers for JP-5 were surface combatants and amphibious ships, which operate and refuel helicopters and vertical takeoff aircraft.

The above chart depicts the amount of JP-5 each AOE delivered to its customers during the course of its deployment. (We have used the same correction factor approach, as described on the previous page, to account for incomplete data.)

How Many Ships Did AOE's Refuel?



This graph depicts the number of FAS events each AOE conducted while deployed and the percentages of the total FASs for each ship type or category.

Each AOE refueled different types of customer ships during its 6-month deployment. Its primary customer for fuel was the surface combatant. This isn't surprising because each carrier battle group contains from four to six surface combatants, and other surface combatants are deployed to forward theaters; therefore, there are more surface combatants as potential customer ships than any other type of ship.

One interesting feature in the above graph is the number of foreign ships (shown in light blue) that AOE's refueled at sea. It's not commonly known that the U.S. Navy has international agreements with other navies to enable NATO and other friendly ships to refuel from oilers of another allied nation. The least number of foreign ships that an AOE refueled was 0 (AOE 2 in 1996) and the most was 20 (AO 179/AE 34). They were almost exclusively surface combatants.

When Did AOE's Refuel Their Customers?

Station Ship	Number of FAS events between 2000 and 0400 hours	Total time events	Percentage of events at night
AO 179/AE 34 (1996)	6	153	3.9
AOE 1 (1997-98)	N/A	N/A	N/A
AOE 2 (1996)	N/A	N/A	N/A
AOE 3 (1997)	4	42	9.5
AOE 4 (1996-97)	0	32	0.0
AOE 6 (1996)	7	117	6.0
AOE 7 (1996-97)	15	162	9.3
AOE 8 (1997)	7	86	8.1

Notes: N/A = no time data provided for analysis

No time data was reported by 1994 station ships

How many ships did the AOE's refuel at night, which we defined as between the hours of 2000 and 0400? This table shows the results.

Several AOE's that provided UNREP data reported the time they started and the time they completed each UNREP, which we used in constructing the above table of refuelings. All of the ships that reported start-stop times conducted less than 10 percent of their FAS's at night.

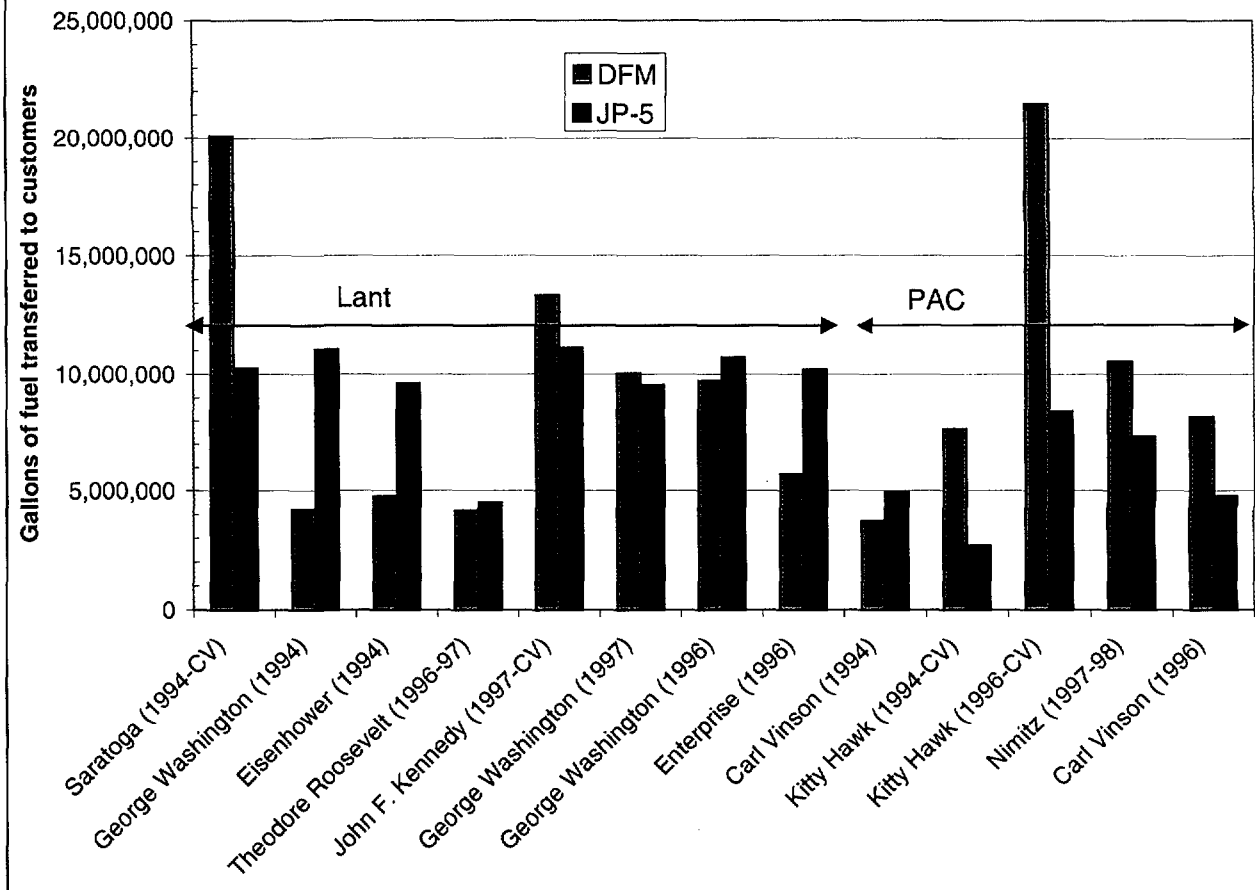
We also looked at UNREP events that either:

- began before 2000 and ended after 2000
- began before 0400 and ended after 0400.

When we added all these events, we found the percentage of night time FAS events increased by no more than 5 percent. In the case of AOE 7, the percentage of night time FAS's increased from 9 percent to 17 percent.

AOE's 1 and 2 didn't report start and stop times of their UNREPs, so we weren't able to determine what proportion of their FAS's were conducted at night.

How Much Fuel Did AOE's Deliver to Their CVBGs?



We wanted to learn how much of the AOE's business was to the ships of its own battle group, since its primary mission is to refuel and replenish ships within a carrier battle group.

To calculate the amount of fuel the AOE's transferred to their battle group ships, we added all the fuel each AOE delivered to ships of its own battle group. The sum of all DFM and JP-5 fuel transferred to the CVBG's ships was used to produce the above bar graph.

The 1996 *Kitty Hawk* and *Saratoga* CVBGs received more DFM than any other battle group. The amount of JP-5 that battle group ships received ranged from 5 to 10 million gallons. A few battle groups, such as the 1996 *Carl Vinson*, 1994 *Kitty Hawk*, and the *Theodore Roosevelt* CVBGs, received less than the average amount of JP-5 per deployment.

Note: Fossil-fuel powered carrier battle groups in the above chart are denoted with a "CV" extension of the battle group name. All other battle groups contain CVNs.

What Percentage of the FAS Events Were to Their Own CVBG Ships?

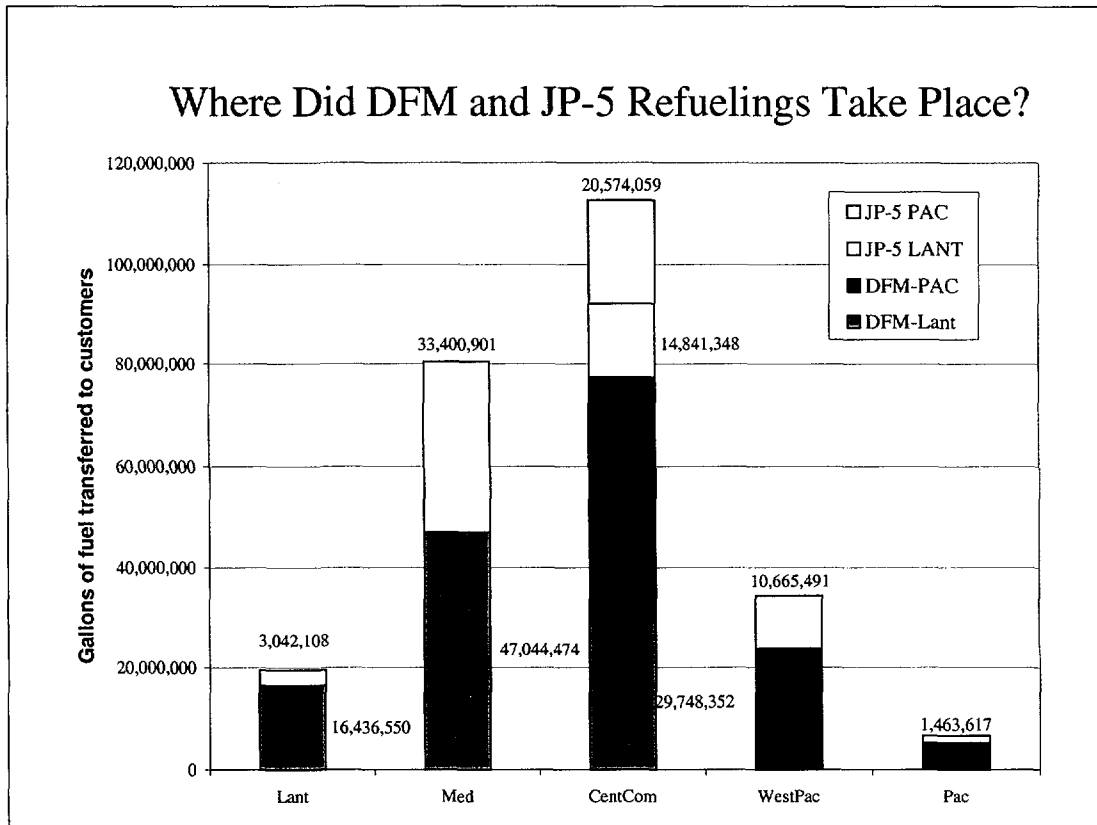
		Station	Number of CV/CVN	Percentage of CV/CVN
		Ships	FAS within own CVBG	FAS within own CVBG
LANT	↑	AO 178/AE 34 (1994)	20	100
		AOR 6/AE 28 (1994)	12	100
		AOE 4 (1994)	3	100
		AO 179/AE 34 (1996)	11	92
		AOE 3 (1997)	3	100
		AOE 4 (1996-97)	2	100
		AOE 6 (1996)	9	90
		AOE 8 (1997)	17	100
PAC	↑	AOR 7/AE 32 (1994)	15	100
		AOE 2 (1994)	6	100
		AOE 1 (1997-98)	12	83
		AOE 2 (1996)	9	82
	↓	AOE 7 (1996-97)	22	96
		Station	Number of Surface Combatants	Percent of Surface Combatants
		Ships	FAS within own CVBG	FAS within own CVBG
LANT	↑	AO 178/AE 34 (1994)	45	90
		AOR 6/AE 28 (1994)	19	70
		AOE 4 (1994)	22	65
		AO 179/AE 34 (1996)	70	76
		AOE 3 (1997)	28	93
		AOE 4 (1996-97)	17	85
		AOE 6 (1996)	52	68
		AOE 8 (1997)	47	85
PAC	↑	AOR 7/AE 32 (1994)	10	42
		AOE 2 (1994)	32	91
		AOE 1 (1997-98)	87	78
		AOE 2 (1996)	42	51
	↓	AOE 7 (1996-97)	74	69

How many of each AOE's FAS events were for ships of its own battle group? This table displays the number of such events and the percentage of all FASs the AOE conducted during the deployment.

Over 90 percent of the aircraft carriers that an AOE refueled were from its own CVBG. AOE 2 was the one exception, having refueled two carriers from another CVBG during its deployment.

There was a much wider variation in refueling surface combatants. As few as 42 percent and as high as 93 percent of the surface combatants the AOE refueled were from its own battle group.

Where Did DFM and JP-5 Refuelings Take Place?



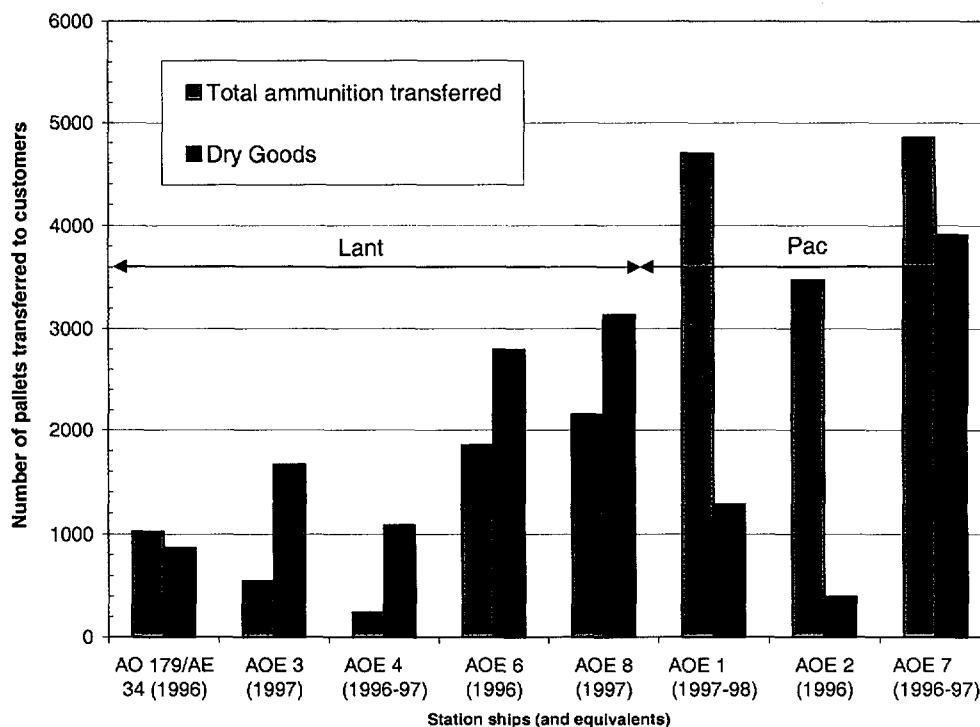
During the course of an AOE's deployment, it distributes fuel and materials to customers en route to, from, and in its forward deployed region. This graph shows where the AOE's transferred fuel, ammunition, and dry cargo. We aggregated all the data from the AOE's, similar to the way described earlier in this paper.

We omitted data from AOE 4 (1994), AOE 3 (1996), AOE 4 (1996-97) because of the limited amount of UNREP data we have from these ships. For AOE's with 4 to 5 months of data (AOR6/AE 28, AO 178/AE34 and AOE 2), we multiplied the regional total by a correction factor (see page 36 in the appendix) to generate a sum of an "equivalent" 6-month deployment.

The above graph shows the quantity of DFM and JP-5 LANT and PAC AOE's transferred in each region. They distributed most of their DFM and JP-5 in their respective forward deployed regions: the Med (for LANT) and CentCom (for PAC).

Secondary distribution of DFM and JP-5 fuel for PAC AOE's took place in WestPac, while LANT AOE's distributed fuel in CentCom. Even though LANT AOE's don't deploy to CentCom for extended periods, they transferred large quantities of both DFM and JP-5 to customers in that region.

How Much Dry Goods and Ammunition Did AOEs Transfer?



We have now shown how AOEs distribute DFM and JP-5 to their customers. We have shown who their customers were and where the fuel was distributed. In the next part of the analysis, we describe how AOEs distribute dry cargo.

AOEs transfer a variety of dry goods and ammunition to customers. For example, AOEs have the capability of transporting soda pallets, frozen foods, and ammunition because of their multi-product transport capability. For the sake of simplicity, we aggregated all non-ammunition-based cargo into a single category called dry goods. Ammunition is kept as a separate category.

How much dry cargo did the AOE transfer to its customers? This graph shows the number of dry goods and ammunition pallets each AOE transferred to its customers.

An interesting feature of this graph is the amount of ammunition PAC AOEs transferred during their deployments. They transferred almost three times as

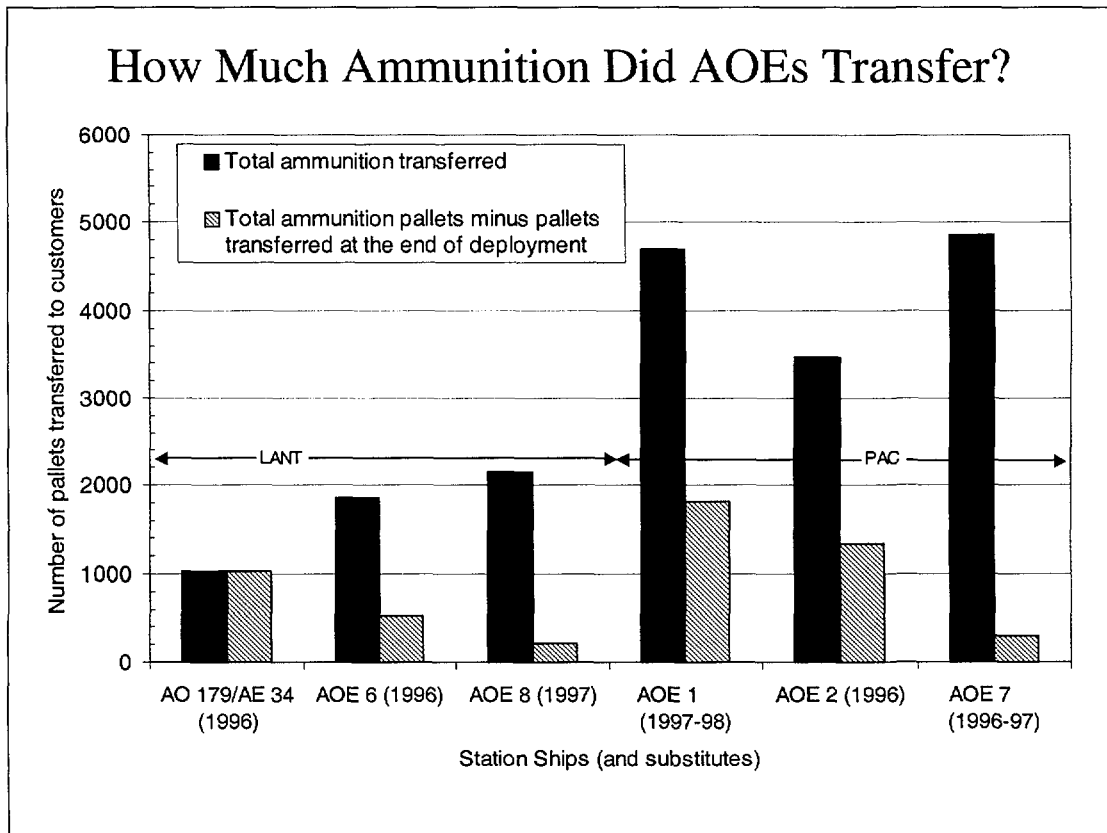
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How Much Dry Goods and Ammunition Did AOEs Transfer? (continued)

much ammunition as their LANT counterparts. Why so much during peacetime? Closer examination showed that some AOEs sent most of their ammunition transfers to other ammunition ships, not to combatants, and did so towards the end of their deployment. We think that this was cross-decking ammunition to an incoming CVBG AOE and/or offloading ordnance before returning to homeport. The table below lists the number of ammunition pallets AOEs transferred to ammunition ships, along with the transfer dates and the date the CVBG returned to CONUS.

AOE	Total pallets transferred	Pallets transferred to ammo ships	Ammunition ship	Transfer dates	CONUS return date
(P) AOE 2	3474	2137	TAE 26	10/24/96,10/25/96 11/4/96	11/14/96
(L) AOE 6	1851	1320	AE 28	12/15/96-12/16/96	12/23/96
(P) AOE 7	4854	4560	AE 32/AE33	4/3/97-4/7/97	4/11/97
(L) AOE 8	2155	1939	AE 28, AOE 6	10/20/97-10/24/97	11/28/97
(P) AOE 1	4690	2884	AE 32	2/22/98	3/1/98

How Much Ammunition Did AOE's Transfer?



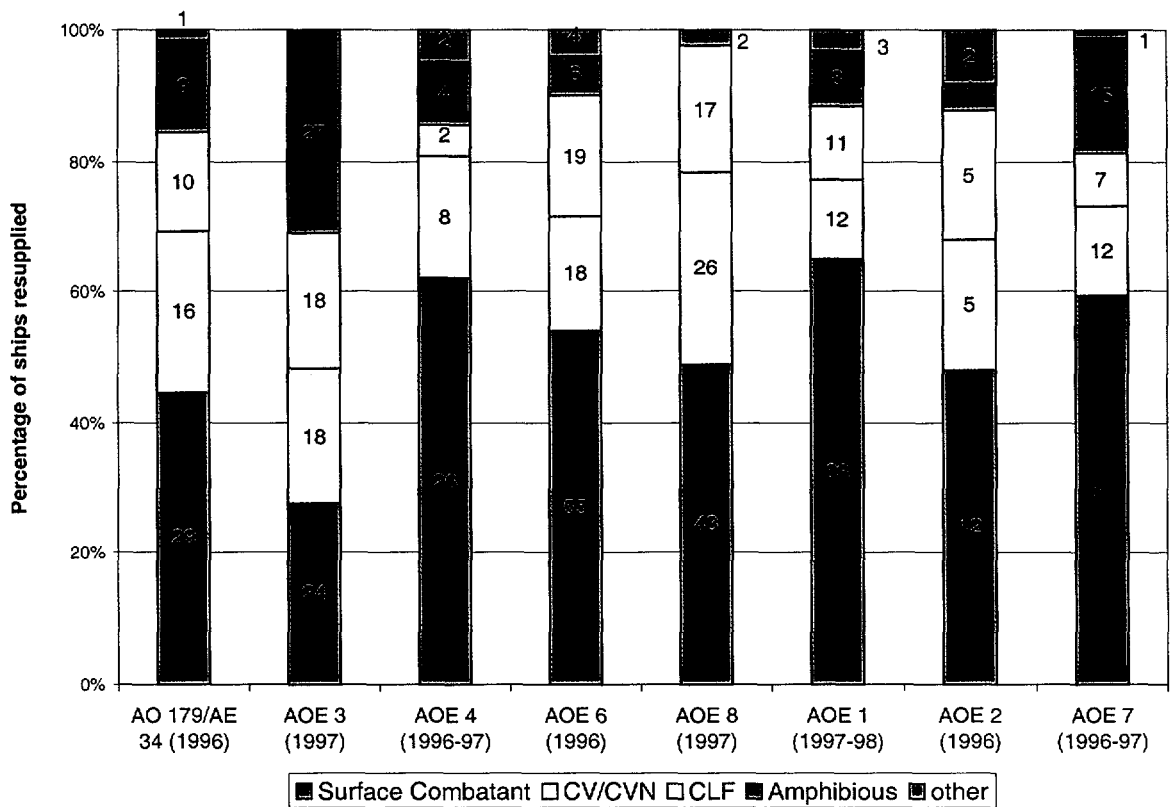
As shown on the previous page, most of the ammunition delivered by AOE's went to other CLF ships towards the end of their deployments.

In this graph, we compare the total number of ammunition pallets transferred by AOE's to the number of pallets transferred by AOE's *minus* the number of pallets offloaded at the end of their deployments.

We noticed that several PAC AOE's delivered ordnance to TAE 26 while they were deployed. We surmise that this was redistributing PAC ammunition within the Pacific area of responsibility because TAE 26 is used periodically for that task.

Note: We did not include AOE 3 and AOE 4 in this part of the analysis because we had data only from the middle of their deployments.

How Many Ships Did They Replenish?

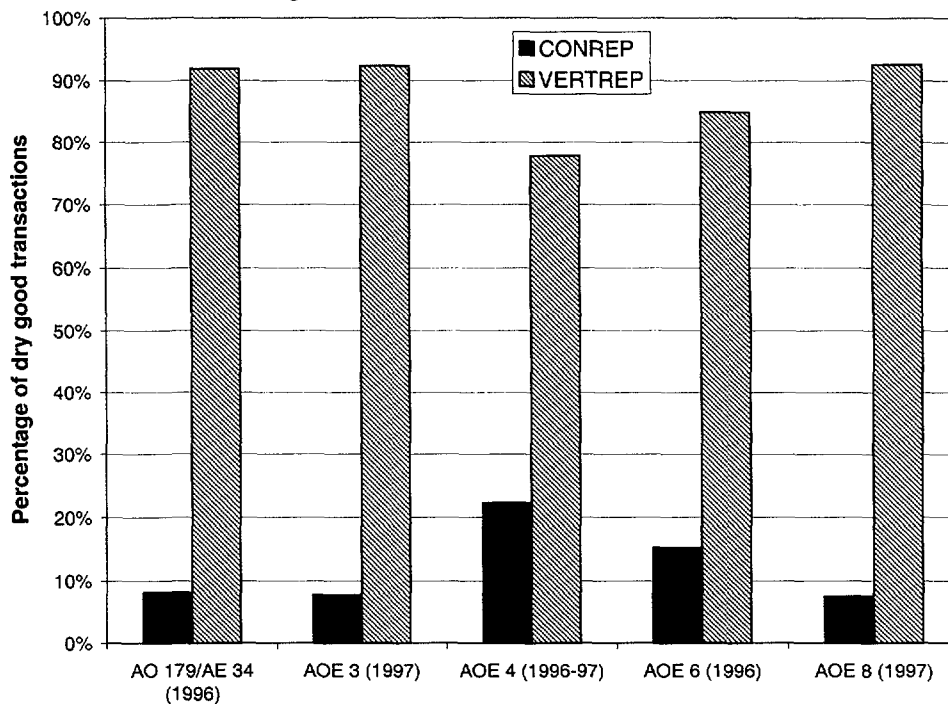


We analyzed the number of RAS events each AOE performed with its combatant customers and with other CLF ships. AOEs replenish surface combatants more often than any other type of ship. We expected this because surface combatants are the most common type of ship found in forward theaters.

In most cases, aircraft carriers are the next most frequently replenished ships.

Interestingly, AOEs analyzed in this study did not replenish many foreign ships during their 6-month deployments. Only two events were recorded in which AOEs gave supplies for foreign ships. Even though the U.S. Navy has international agreements with other countries to refuel foreign ships, the AOEs analyzed in this study transferred very few pallets of dry cargo to foreign ships.

How Were Dry Goods Transferred to Ships?



One critical issue pertaining to UNREP operations is how AOEs transfer dry cargo (provisions/stores and ammunition) to customers. There are two methods for transferring material between ships:

- Connected replenishment (CONREP): Cargo rigs strung between two ships moving at slow and equal speeds. Used to transfer heavy loads. This method is always used to transfer fuel.
- Vertical replenishment (VERTREP): Uses helicopters to transfer light, bulky loads between two ships.

We analyzed CONREP and VERTREP data from AO 179/AE 34, AOE 3, AOE 4, AOE 6, and AOE 8 because they listed which mode they used for both cargo and fuel transactions. Other AOEs didn't report how they transferred dry cargo to their customers, so they were excluded from this portion of the analysis.

In this graph, we show the percentage of CONREP and VERTREP used to transfer cargo. When AOEs transfer only cargo, VERTREP is the preferred method. When fuel and cargo are both transferred at about the same time, we got the opposite answer; in all cases (100 percent), if ships were already connected for refueling, the AOE used CONREP to transfer cargo to the customer.

When Did They Replenish Their Customers?

AOE	Number of RAS events at night	Total RAS	Percentage of night RAS
AO 179/AE 34 (1996)	2	51	4
AOE 1 (1997-98)	N/A	N/A	N/A
AOE 2 (1996)	N/A	N/A	N/A
AOE 3 (1997)	0	29	0
AOE 4 (1996-97)	0	21	0
AOE 6 (1996)	2	102	2
AOE 7 (1996-97)	10	82	12
AOE 8 (1997)	7	88	8

We looked at each RAS event to determine what time of the day it took place. This table shows the results.

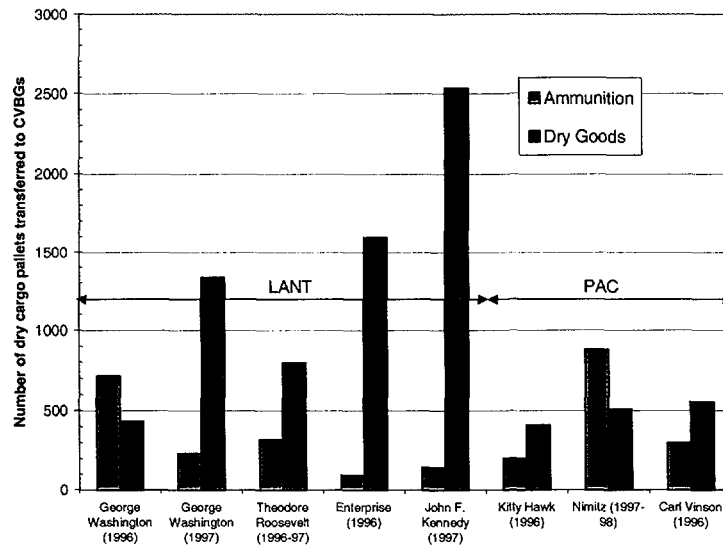
Most RASs occurred during daylight hours (between 0400 and 2000). Two AOE (AOEs 1 and 2) did not record the times of the RASs they conducted. Of the remainder, five of them conducted less than 10 percent of their RASs at night. One, AOE 7, performed 12 percent of its RASs at night. These results are similar to the FAS results shown earlier in the paper.

As described in the FAS results, we also looked at RAS events that either:

- began in daytime and ended at night
- began at night and ended in daytime.

When we add these events to the number of night time RAS events, we found the percentage of night time RAS events increased by no more than 6 percent. In the case of AOE 7, the percentage of night time RASs increased from 12 percent to 28 percent.

How Many Pallets of Dry Cargo Did AOEs Deliver to Their CVBGs?



In general, most AOEs transferred less than 1,000 pallets of provisions and stores to their battle group ships. Exceptions were the 1997 *George Washington*, the *Enterprise*, and the *John F. Kennedy* CVBGs that received more than 1,000 pallets from their AOEs.

Most of the battle groups received small numbers of ammunition pallets, except for the 1996 *George Washington* and *Nimitz* battle groups that received 700 to 900 pallets.

Percentage of AOE RASs to Own CVBG Combatants

AOEs	Number of own CV RASs	Percent of all CV RASs	Number of own CVN RASs	Percent of all CVN RASs	RASs of own Surface Combatants	RAS Percent of all Surface Combatants
AO 179/AE 34 (1996)	-	-	16	100	19	66
AOE 1 (1997-98)	-	-	10	83	44	70
AOE 2 (1996)	-	-	5	100	5	42
AOE 3 (1997)	-	-	6	100	8	88
AOE 4 (1996-97)	-	-	4	100	10	77
AOE 6 (1996)	-	-	15	83	35	64
AOE 7 (1996-97)	12	100	-	-	28	53
AOE 8 (1997)	26	100	-	-	34	79

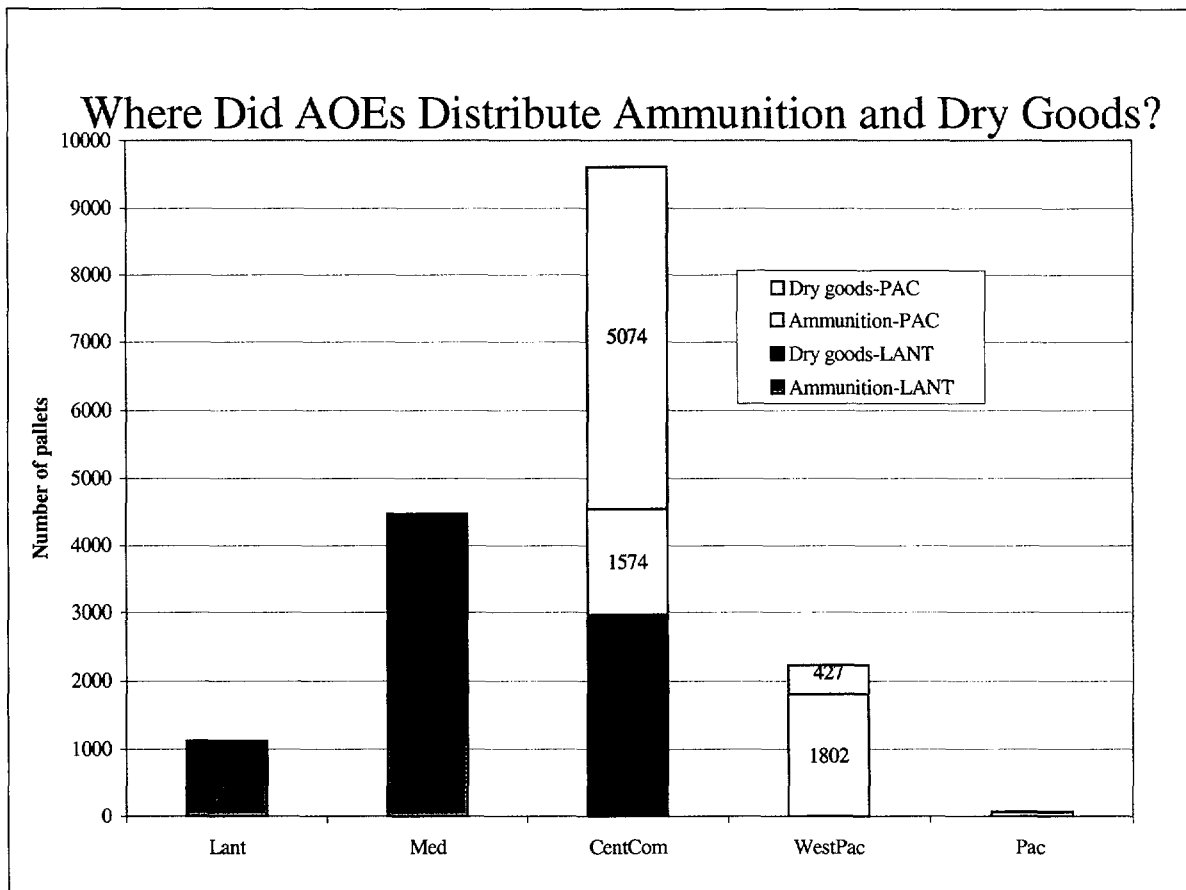
Parent Fleet

Atlantic Fleet = AO 179/AE 34, and AOE 3, 4, 6, and 8

Pacific Fleet = AOE 1, 2, and 7

In this table, we calculated the number and percentage of RASs that AOE 3 performed to their battle group's carrier and surface combatants. When the AOE replenished aircraft carriers, over 80 percent of these RASs were to its own carrier.

In the case of surface combatants, 40 to 90 percent of all the AOE 3's RASs were to ships of their CVBGs. This range is very different when compared to the aircraft carrier. The lower percentages were due to the AOE 3 having replenished surface combatants assigned either to a surface action group operating in the region or to another CVBG.



Where did the AOEs distribute dry cargo? This chart shows the number of dry cargo pallets distributed by AOEs, as a function of region, for both LANT and PAC AOEs.

LANT AOEs distributed most of their dry goods and ammunition in the Med.

PAC AOEs distributed the majority of their dry cargo in CentCom. One major difference between LANT and PAC fleet AOEs is in ammunition distribution. PAC AOEs distributed more ammunition in WestPac than in the CentCom.

Note: In generating the ammunition data for this plot, we removed the ammunition offloaded to CLF ships from the regional data. This gives a true sense of where the customers receive their ammunition during peacetime deployments. The data from three PAC (AOE 1, AOE 2, and AOE 7) and three LANT AOEs (AE 34/AO 179, AOE 6, AOE 7) were used to generate this graph.

Who Did the AOE's UNREP From Their Own Battle Group?

Lant	AOEs	% own CVs UNREPed	% own CVNs UNREPed	% own Surface Combnt. UNREPed
	AO 179/AE 34 (1996)	N/A	100	73
	AOE 3 (1997)	N/A	100	90
	AOE 4 (1996-97)	N/A	100	82
	AOE 6 (1996)	N/A	84	62
	AOE 8 (1997)	100	N/A	82
	AOE 1 (1997-98)	N/A	76	72
	AOE 2 (1996)	N/A	81	58
	AOE 7 (1996-97)	100	N/A	69
Pac				

This slide is a composite of data shown on pages 15 and 24, showing what percentage of the AOE's UNREPs was to ships of its own battle group.

More than three quarters of carrier UNREPs were to its own carrier.

There is a much wider variation in the UNREP percentage for surface combatants. Sixty to ninety percent of the surface combatants an AOE replenished were ships of its own CVBG.

UNREP Totals

	AOEs	Number of FAS	Number of RAS	Total number of UNREPS
Lant	AO 178/AE 34 (1994)	132	N/A	132
	AOR 6/AE 28 (1994)	80	N/A	80
	AOE 4 (1994)	150	N/A	150
	AO 179/AE 34 (1996)	160	65	225
	AOE 3 (1997)	129	87	216
	AOE 4 (1996-97)	64	42	106
	AOE 6 (1996)	109	102	211
	AOE 8 (1997)	84	88	172
Pac	AOR 7/AE 32 (1994)	51	N/A	51
	AOE 2 (1994)	74	N/A	74
	AOE 1 (1997-98)	142	98	240
	AOE 2 (1996)	113	25	138
	AOE 7 (1996-97)	117	87	204

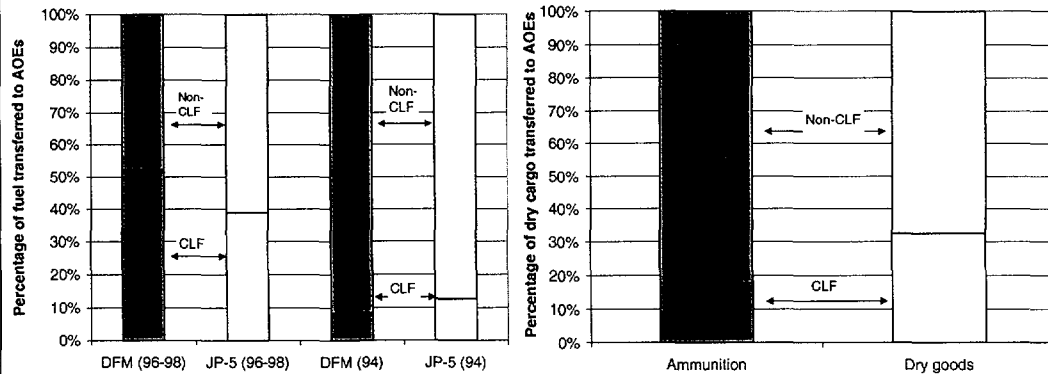
N/A = No RAS data available for ships deployed in 1994.

This table gives the total number of UNREPs conducted by AOE's deployed in 1994 and in 1996 to 1998. The FASs and RASs are added to get the total number of UNREPS.

The total number of UNREPs ranges from 106 (AOE 4) to 240 (AOE 1). AOE 1 performed 240 UNREPS, the most of any AOE analyzed in this study.

We did not have any 1994 RAS data, so these totals were not included in the UNREP totals.

Who Resupplied the AOEs?



All the foregoing discussion has been about the resupply support AOEs provided their customers. But the “rest of the story” is about how AOEs replenished their resupply products, so that they could continue to carry out their mission. In the bar graphs above, we show where AOEs obtained cargo fuel and dry cargo. We grouped the sources of resupply products into two categories:

- CLF – These were oilers (AO and TAO), combat stores ships (TAFS), and ammunition ships (AE and TAE) that resupplied the AOEs at sea.
- Non-CLF – These were overseas ports such as Jebel Ali, Bahrain, Fujairah, and Yokosuka, where the AOEs reloaded in port.¹

The AOEs that were deployed in 1994 received most of their DFM and JP-5 from non-CLF sources. Those deployed in 1996-98 received approximately the same amount of DFM from both sources and 60 percent of JP-5 from non-CLF sources. Similarly, AOEs received the majority of their dry cargo in 1996-98 from non-CLF sources. (We didn’t have dry cargo data on the 1994 AOE deployments.)

¹We also included in this category aircraft carriers, which transferred some ammunition (ordnance) to the AOEs early in their deployments, and several surface combatants that transferred single pallets of ammunition to AOEs. These transfers from carriers and other combatants were not really resupply events in the true sense.

Receipts Aren't Equal to Deliveries

AOEs	DFM			JP-5		
	Deliveries (gallons)	Receipts (gallons)	Percent Difference	Deliveries (gallons)	Receipts (gallons)	Percent Difference
AE 34/AO 179	19,191,826	340,000	-98	8,204,202	0	-100
AOE 1	21,979,257	14,610,589	-34	8,300,552	6,408,939	-23
AOE 2	15,915,375	8,040,724	-49	6,534,057	5,526,551	-15
AOE 3	13,973,703	0	-100	3,376,728	0	-100
AOE 4	5,708,000	8,102,000	42	2,403,000	4,670,000	94
AOE 6	13,299,100	1,295,100	-90	10,302,700	1,208,000	-88
AOE 7	30,171,657	13,453,969	-55	9,044,778	3,331,338	-63
AOE 8	17,863,000	13,953,000	-22	11,566,400	9,478,000	-18

Another issue we explored was the flow of commodities to and from the AOE. In an ideal world, the AOE receives as much product as it distributes. When we examined the data closely, we found that the amount of product the AOE distributed did not at all equal the amount it received from all sources during its deployment. This is shown for fuel in the above chart. The disparity between receipts and deliveries of dry cargo was even greater. We are confident that our data concerning deliveries the AOE made during their deployments are complete, except where previously noted. Hence, we believe the discrepancy between receipts and transfers is due to the AOE's having failed to include, in the data we received, one or more receipts during its deployment.¹

While we didn't know how much product the AOE had when it began and ended its deployment, the disparity between total deliveries and total receipts was far greater than could be explained by having the start and ending inventory.

¹We experienced a similar lack of receipts data in the operations of combat stores ships that is documented in CNA Annotated Briefing D0000670.A1 that will be published shortly.

Conclusions

AOEs mainly:

- Refuel and replenish surface combatants
- Conduct FAS as compared to RAS
- Use VERTREP for dry goods and ammunition
- Perform UNREP during the daytime (0400-2000)

We learned several things about AOEs from this analysis.

Most of the AOEs' customers are surface combatants. This is really not surprising because most of the ships in a battle group are surface combatants. Other frequent AOE customers are the aircraft carrier, CLF shuttle ships, and amphibious ships.

AOEs refuel customers more often than they replenish them. The dominant customer for DFM and JP-5 are the surface combatant and aircraft carrier, respectively.

When AOEs replenish their customers with dry cargo (dry goods and ammunition), they deliver it by CONREP or VERTREP, depending on the circumstances. When no fuel is being transferred, AOEs use VERTREP to deliver the dry cargo. On the contrary, when AOEs conduct FAS they usually use the CONREP method.

Most UNREPs take place in the daytime. Less than 12 percent of the UNREPs occur between the hours of 2000 to 0400. Even if we define nighttime more broadly as 1800 to 0600, less than 21 percent of the UNREPs are at night.

Recommendations

- That the Fleet answer two questions:
 - During wartime in a combat theater, does the Navy intend to conduct UNREPs mostly during daylight hours?
 - Is it going to use VERTREP almost exclusively to transfer ammunition and stores in wartime?
- and
- Standardize the format for reporting UNREP transactions
- Standardize units (i.e., pallets, lifts, etc.) for reporting dry cargo products transferred
- Develop method(s) for station ships to report UNREP data, on a regular basis, to appropriate agencies for analysis (e.g., CNA).

We were surprised that almost all UNREPs are conducted during daylight hours and that dry cargo deliveries are conducted almost exclusively by use of VERTREP. In view that the Navy espouses training as it intends to fight, we recommend that the fleet affirm to its own satisfaction that it plans to conduct UNREPs during wartime as it is presently practicing in peacetime.

In conducting this study into the operations of Navy-manned AOE's, we encountered some difficulties because of the quality and quantity of UNREP data. We anticipate that there will be times in the future when the Navy will want to analyze its CLF operations. If so, we have some suggestions, which we list here as recommendations, on measures that would improve the completeness of UNREP data, and thus, the accuracy of analyses.

Currently, there is no central agency that collects CLF UNREP data. For example, Navy CLF ships record some of their UNREP data in Quartermasters' log, ship Deck Logs, UNREP station logs, and other local records. The data are maintained for the duration of the deployment, aggregated for inclusion in the end of the deployment report, and then discarded.

Also, there is no single Navy entity charged with compiling, managing, and analyzing an operational logistics database. Assuming the Navy wants to be able to conduct analyses similar to what we have done in this document, it should formalize the continuing responsibility for doing so. Assigning this to a Navy activity or to CNA would preserve the capability to provide such analyses in the future.

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Appendix

In this appendix, we have provided information on the following:

- Composition of the carrier battle groups with whom the AOE's deployed
- Questions we sought to answer in this study
- Description of how AOE's reported cargo and fuel data, and the variability of those data
- Correction factors used for adjusting AOE data sets
- Tables with aggregated fuel and dry cargo data
- Tables showing the periodicity of FASs and RASs that the AOE conducted.

Deploying CVBGs

LANTFLT CVBGs

1994

PACFLT CVBGs

<i>Saratoga</i>	1/12/94-6/24/94			
CV 60	DD 968	FFG 50		
CG 58	DD 974	FFG 52	SSN 703	
CG 69	AE 34	AO 178	SSN 693	

<i>George Washington</i>	5/20/94-11/17/94			
CVN 73	CG 56	DDG 52	SSN 709	
CG 25	DD 979	FFG 39	SSN 750	
CG 51	DD 989	AOR 6	AE 28	

<i>Dwight D. Eisenhower</i>	10/20/94-4/19/95			
CVN 69	DD 969	FFG 49	SSN 761	
CG 68	DD 993			SSN 764
CG 71	FFG 42	AOE 4		

<i>Carl Vinson</i>	2/17/94-8/17/94			
CVN 70	CGN 41	CG 54	FFG 57	
AOE 2				

<i>Kitty Hawk</i>	6/24/94-12/22/94			
CV 63	CG 63	CG 49	CGN 36	
FFG 37	AOR 7		AE 32	

LANTFLT CVBGs

1996-1997

PACFLT CVBGs

<i>George Washington</i>	1/28/96-7/25/96			
CVN 73	DDG 55	FFG 58	SSN 756	
CG 56	DD 968			SSN 704
DDG 52	DD 979	AO 179	AE 34	

<i>Enterprise</i>	6/28/96-12/23/96			
CVN 65	DDG 57	FFG 42	SSN 720	
CG 58	DD 977			SSN 714
CG 64	FFG 49	AOE 6		

<i>Theodore Roosevelt</i>	11/26/96-5/25/97			
CVN 71	DDG 61	FFG 52	SSN 765	
CG 55	DD 997			SSN 712
CG 72	FFG 53	AOE 4		

<i>John F. Kennedy</i>	4/29/97-10/28/97			
CV 67	CG 69	FFG 50	SSN ____	
CG 51	DD 963			SSN ____
CG 66	DD 981	AOE 8		

<i>George Washington</i>	10/3/97-4/3/98			
CVN 73	DD 983	FFG 36	SSN 760	
CGN 37	DDG 64			SSN 769
CG 60	FFG 28	AOE 3		

<i>Carl Vinson</i>	5/16/96-11/14/96			
CVN 70	CGN 36	CG 67	CGN 41	
FFG 37	AOE 2			

<i>Kitty Hawk</i>	10/11/96-4/11/97			
CV 63	CG 63	CG 54	DD 985	
FFG 30	AOE 7		SSN 716	

<i>Nimitz</i>	9/1/97-3/1/98			
CVN 68	CG 73	CG 57	DD 965	
FFG 54	AOE 1			

Analysis Methodology

- Build AOE UNREP database from Fleet data
- Analyze refueling and replenishment data
 - How many and who were the AOE's customers?
 - How much product did they deliver to them?
 - How often did they conduct UNREPs?
 - What percentage of the UNREPs were at night?
 - What portion of the dry cargo UNREPs were VERTREP?

In this study, we consolidated the data sent to us by COMLOGGRU TWO and COMNAVSURFGRU PAC NW into a single Excel database for analysis. We sought to answer the following questions about CVBG station ship operations during recent forward deployments:

Refueling at Sea (FAS)

- How many ships did they refuel, and how much DFM and JP-5 did they deliver?
- How many of their FASs were to ships of their own CVBG?
- How many other ships were refueled?
- How many FASs did they average per week? (See page 40)
- How many FASs were done during nighttime hours between 2000 and 0400?

Replenishment at Sea (RAS)

- How many ships did they replenish, and how many pallets did they transfer to them?
- How many RASs did they conduct to ships of their CVBG?
- How many other ships did they replenish?
- What was their average number of RASs per week? (See page 41)
- How many of their RASs were at night?
- What percentage of dry goods was transferred by VERTREP and by CONREP?

Typical UNREP Entries From Two AOE's

Station ship AOE A

Vertrep (pallets)	Conrep	Date	Ship	DFM	JP-5	Vertrep (Lifts)	Ammo/Cargo
2		14June	CAL			26	
	16	15Jun	CVIN		661,254		37/0
3	17	15Jun	SHI	203,059	5,026	9	

Station ship AOE B

Date	Region	Customer	Mode	Start	Stop	Item	Quantity
0708	Clant	CVN 65	Conrep	0803N	1142N	DFM/JP-5	0K/907.7K
		FPG 49	Conrep	0915N	1033N	FF	4 Plts
			Conrep	0915N	1033N	DFM/JP-5	56K/0K
			Conrep	0915N	1033N	Potwater	4K
			Vertrep	0730N	0920N	Deck	1 Plt
			Vertrep	0730N	0920N	Dry	3 Plts
			Vertrep	0730N	0920N	Soda	3 Plts
			Vertrep	0730N	0920N	FF	2 Plts
			Vertrep	0730N	0920N	FRZ	2 Plts

One problem we had is that the quality and quantity of the data reported to us was uneven and often incomplete, from ship to ship and between LANT and PAC. The above table shows actual UNREP entries we received.

The data AOE A provided make it difficult to analyze how it distributed provisions and stores. Does cargo include soda pallets? How about fresh frozen vegetables? Without start and stop times, we couldn't tell how long each evolution took.

AOE B used a more complete format. The UNREP data was precisely categorized into discrete item classes. Also, the ship clearly identified the transfer mode (CONREP or VERTREP) for each item.

On the next page, we assess the quality of UNREP data each AOE provided. The descriptions of the categories are:

Ship - AOE by hull number

Time data - Did the AOE provide start and stop times of each UNREP?

Fuel data - How much fuel did it transfer (or receive)?

Provisions data - Were provisions data reported in a format similar to AOE B?

CONREP or VERTREP - Was mode of transfer given for UNREP transaction?

We've included the actual data we used in this analysis [at the back of the report]. The data was compiled from the data sheets sent from COMLOGGRU TWO and COMNAVSURFGRU PAC NW.

Quality of AOE's Provisions Data

Ship	Time Data	Fuel Data	Provisions Data	Conrep or Vertrep (Provisions only)
AOE 1	No	Yes	Yes	No
AOE 2	No	Yes	Yes/No [1]	Yes
AOE 3	Yes	Yes	Yes	Yes
AOE 4	Yes	Yes	Yes	Yes
AOE 6	Yes	Yes	Yes	Yes
AOE 7	Yes	Yes	Yes/No [2]	Yes
AOE 8	Yes	Yes	Yes	Yes
AE 34	No	Yes	Yes/No [3]	Yes
AO 179	Yes	Yes	Yes/No [4]	Yes

1. Very limited provisions data. Non-fuel data divided into cargo and ammo.
2. Listed dry goods as stores, food, mail and ammunition. Transfer mode of each transaction not listed for AOE 7.
3. Provisions data similar to AOE 2 format
4. Grouped some provisions data into broad groups. Instead of separate entries for FFV and Dry, entries listed as FFV/DRY.

AOEs reported similar items differently from one another. For example, AOE 3 grouped HULL and Deck products into a single HULL/Deck category. AOE 6 separated these items into two individual categories. AOE 3 also grouped fleet freight, Q Cog, and FILL into a single category while AOE 6 listed these items separately.

In part because of the unevenness of data we received, we grouped the data into three major categories for purposes of this analysis:

- Fuel - includes DFM and JP-5
- Dry goods
- Ammunition

“Dry goods” is the combination of all dry cargo such as FILL, HULL, fresh frozen vegetables, Q Cog, aircraft engines, chill, soda, dry, dairy, deck, and fleet freight. Items not included in this category are mail, personnel (pax), retrograde, and potable water (potwater). AOE's listed ammunition as one category, but did not list what specific kind of ammunition was delivered or received.

In most cases, the AOE's used the pallet as the unit of measure for dry goods and ammunition, but some AOE's used “loads” and “lifts.” We converted loads and lifts to pallets with the following assumed conversion:

$$1 \text{ lift (or load)} = 2 \text{ pallets}$$

That conversion allowed us to compare items transferred from all AOE's (except 1994 deployers) with each other on an equal basis.

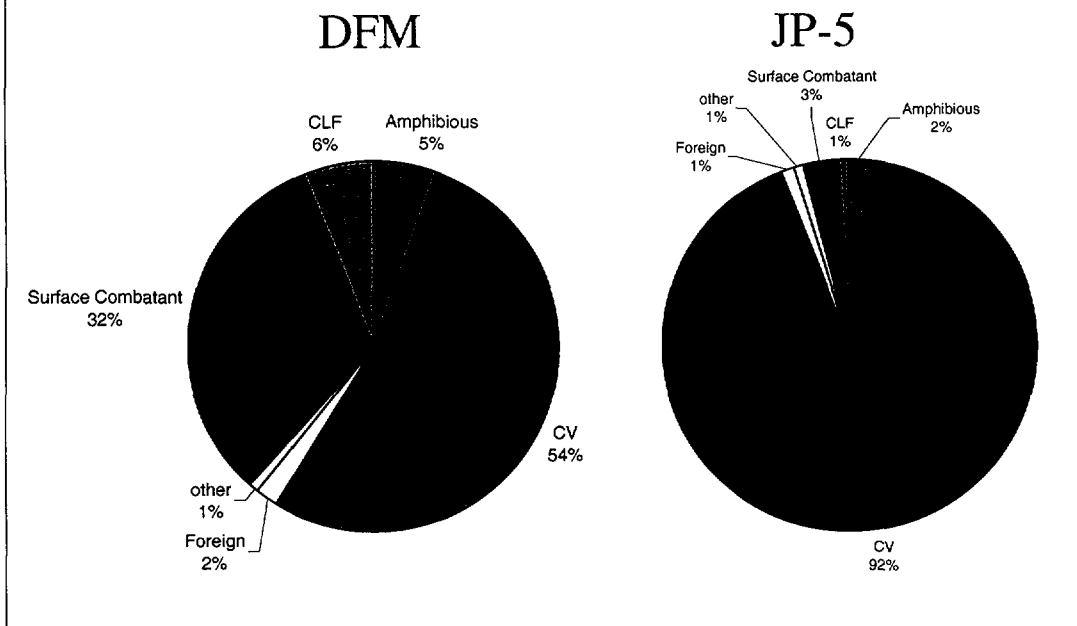
Correction Factors for AOEs with Less Than Six Months Deployment Data

AOE	Year	Correction Factor
AO 178/AE 34	1994	6/5
AOR 6/AE 28	1994	6/4
AOE 2	1994	6/5
AOE 4	1994	6/2
AOE 3	1996	6/2
AOE 4	1996	6/3

As described previously, some of the data we have from the AOEs do not contain complete 6-month deployment data. Rather than exclude these data, we decided to normalize the data over a full six months' period. The above chart shows the correction factors we used to adjust the data to generate a quantity of an "equivalent" 6-month deployment.

While we recognize that normalizing data as we have done ignores the unevenness of actual UNREP operations experienced during a full deployment, we believe the use of these correction factors generates data that approximates a full 6-month deployment.

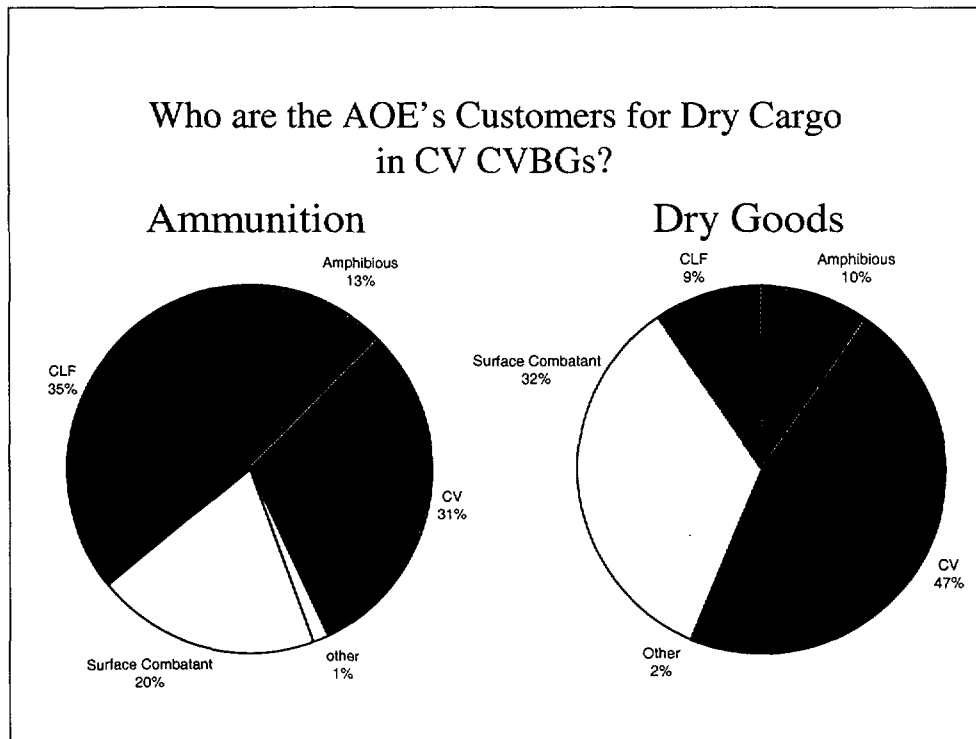
Who are the AOE's Customers for Fuel in CV CVBGs?



To whom did AOE's deployed with fossil fuel carriers in their CVBGs distribute fuel? The percentages of DFM and JP-5 that AOE's distributed to customers were calculated using the same method described on page 8.

The AOE's transferred 54 percent of their DFM to CVs, and 32 percent to surface combatants. On the other hand, AOE's deployed with nuclear CVBGs (CVNBGs) transferred 61 percent of their DFM to surface combatants and only 6 percent to CVNs (see page 3).

When we compare the amount of JP-5 transferred to customers, in both nuclear and non-nuclear carrier battle groups, AOE's transferred the majority of their JP-5 to CVs or CVNs (92 and 87 percent, respectively). This is reasonable because JP-5 is primarily used to fuel aircraft, and aircraft carriers contain large numbers of tactical aircraft.



How did AOE's deployed with conventionally-powered carrier CVBGs distribute dry cargo? We computed the percentage of ammunition and dry goods distributed by AOE 7 and AOE 8, which belonged to CVBGs with fossil fuel CVs.

These two AOE's distributed over 60 percent of their ammunition to CVs and to other CLF ships. When these data are compared to the CVNBGs' data shown on page 4, we see that the trend is basically the same. One difference we observed was the amount of ammunition distributed by AOE's to surface combatants. AOE's belonging to CVNBGs distributed 11 percent of their ammunition to surface combatants, while AOE's belonging to CVBGs distributed 20 percent of their ammunition to surface combatants.

When we look at the dry goods data, the AOE's distributed close to 80 percent of their dry goods to their own CVs and to surface combatants. In contrast, AOE's belonging to CVNBGs distributed the majority of their dry goods to their CVNs and the rest to surface combatants, CLF, and amphibious ships in near equal percentages (see page 4).

Fuel Delivered

DFM (Gal)								
AOEs	Amphibious	CV	CVN	Foreign	other	Surface Combnt.	CLF	SUM
AO 178/AE 34 (1994)	780,449	14,560,784		808,070	183,960	6,118,139	532,848	22,984,250
AOR 6/AE 28 (1994)			816,000	468,300		4,552,050	937,350	6,773,700
AOE 4 (1994)	4,247,856			520,077		11,017,275		15,785,208
AE 34/AO 179 (1996)	3,268,409	684,142	2,315,462	826,701	398,355	9,414,607	2,284,150	19,191,826
AOE 3 (1997)	4,549,200			413,370		9,011,133		13,973,703
AOE 4 (1996-97)	477,400			540,000		4,690,600		5,708,000
AOE 6 (1996)	3,961,000			413,000	6,100	8,135,700	783,300	13,299,100
AOE 8 (1997)	412,000	8,625,000		246,000	415,000	6,849,000	1,316,000	17,863,000
AE 32/AOR 7 (1994)		6,580,000		165,000	100,000	2,050,000	1,740,000	10,635,000
AOE 2 (1994)	3,871,214			192,362		4,344,196		8,407,772
AOE 1 (1997-98)	1,460,698		147,000	358,976		13,157,271	6,855,312	21,979,257
AOE 2 (1996)	3,384,864		4,004,211		315,540	7,775,311	435,449	15,915,375
AOE 7 (1996-97)	3,298,394	13,731,214		412,270		11,349,326	1,380,453	30,171,657
SUM	29,711,484	44,181,140	7,282,673	5,364,127	1,418,955	98,464,607	16,264,862	202,687,849
JP-5 (Gal)								
AOEs	Amphibious	CV	CVN	Foreign	other	Surface Combnt.	CLF	SUM
AO 178/AE 34 (1994)	90,827	8,384,758		280,014	25,410	165,620		8,946,629
AOR 6/AE 28 (1994)			6,838,000			121,300	24,100	6,983,400
AOE 4 (1994)	114,468		3,144,161	4,822		111,795		3,375,246
AE 34/AO 179 (1996)	123,470	11,861	6,669,970	2,245		1,338,148	58,508	8,204,202
AOE 3 (1997)	93,140		2,385,179	4,623		100,586	793,200	3,376,728
AOE 4 (1996-97)	137,700		2,179,300	2,600		83,400		2,403,000
AOE 6 (1996)	514,700		8,979,000	28,900	201,800	378,300	200,000	10,302,700
AOE 8 (1997)	7,000	11,017,000			319,000	175,400	48,000	11,568,400
AE 32/AOR 7 (1994)		2,810,000			10,000	125,000	265,000	3,210,000
AOE 2 (1994)	523,307		4,004,639	1,850		148,354		4,678,150
AOE 1 (1997-98)	166,911		7,730,047	5,669		392,965	4,960	8,300,552
AOE 2 (1996)	491,907		5,247,202		27,622	755,457	11,869	6,534,057
AOE 7 (1996-97)	428,223	8,109,272		12,609		494,674		9,044,778
SUM	2,691,653	30,332,891	47,177,498	343,332	583,832	4,390,999	1,405,637	86,925,842

How much fuel did AOEs give to their customers? In this table, we tabulated the amount of DFM and JP-5 transferred to customers. The amount of DFM and JP-5 are summed across fuel types, DFM and JP-5, and across AOEs. In AOEs for which we have incomplete data sets, we adjusted the data using the correction factors on page 38.

Dry Goods and Ammunition Delivered

AOE 1 (1997-98)	Ammo	Dry Goods	AOE 2 (1996)	Ammo	Dry Goods
Amphibious	14	198	Amphibious	2	
CVN	822	380	CVN	214	314
Foreign		2			
Other	4	13	Other	64	
Surface Combt	98	435	Surface Combt	113	
CLF	<u>3752</u>	<u>258</u>	CLF	<u>3081</u>	<u>62</u>
SUM	4690	1286	SUM	3474	376
AOE 7 (1996-97)	Ammo	Dry Goods	AOE 3 (1997)	Ammo	Dry Goods
Amphibious	128	832	Amphibious	9	1152
CV	152	924	CVN	225	612
Surface Combt	78	1748	Surface Combt	9	147
CLF	<u>4560</u>	<u>144</u>	CLF	<u>303</u>	<u>588</u>
SUM	4918	3648	SUM	546	2499
AOE 4 (1996-97)	Ammo	Dry Goods	AOE 6 (1996)	Ammo	Dry Goods
Amphibious	8	128	Amphibious	3	105
CVN	82	582	CVN	251	1187
Other		10	Other	1	19
Surface Combt	<u>152</u>	276	Surface Combt	45	660
CLF		88	CLF	1551	823
SUM	242	1084	SUM	1851	2794
AO 170/AE 34 (1996)	Ammo	Dry Goods	AOE 8 (1997)	Ammo	Dry Goods
Amphibious	34	162	Other	6	3
CVN	546	373	CV	123	2005
Surface Combt	194	230	Surface Combt	23	717
CLF	<u>248</u>	<u>104</u>	CLF	<u>2003</u>	<u>410</u>
SUM	1022	869	SUM	2155	3135

This table summarizes the RAS activity of deployed AOE's during the 1996–1997 period, showing the number of pallets of ammunition and dry goods each AOE delivered. Not surprisingly, they distributed the bulk of their dry goods to surface combatants and aircraft carriers, the carrier battle group ships.

Some AOE's also transferred large quantities of dry goods to amphibious ships. In fact, AOE 3 distributed more pallets of dry goods to amphibious ships than to carriers.

AOE's also distributed dry goods to other CLF ships such as TAFSs, TAOs, and other AOE's. For example, AOE 3 transferred dry goods to TAO 199, TAFS 5, TAFS 8, TAFS 9 and AOE 8 during the course of its deployment.

There is one big difference between AOE's' transfers of dry goods and ammunition during their deployments. While they transferred dry goods throughout their deployments, we saw no evidence that they offloaded large amounts of dry goods to other ships at the end of their deployments, as we observed for ammunition.

How Often Did AOE's FAS?

		AOEs	Amphibious	Deviation	CV	Deviation	CVN	Deviation
LANT	↑	AO 178/AE 34 (1994)	3	2	1	1		
		AOR 6/AE 28 (1994)					1	0
		AOE 4 (1994)	3	0			1	0
		AO 179/AE 34	3	3	1	SDP	1	0
		AOE 3 (1997)	2	2			1	0
		AOE 4 (1996-97)	2	SDP			1	0
		AOE 6 (1996)	2	1			1	0
		AOE 8 (1997)	2	1	1		0	
PAC	↑	AOR 7/AE 32 (1994)			1	1		
		AOE 1 (1997-98)	3	1			1	0
		AOE 2 (1994)	3	2			1	0
		AOE 2 (1996)	2	1			1	0
		AOE 7 (1996-97)	3	1	1	0		
		Total average	3		1		1	
		In-column deviation	1		0		0	
		AOEs	Other	Deviation	Surface combt.	Deviation	CLF	Deviation
LANT	↑	AO 178/AE 34 (1994)	2	1	3	2	2	1
		AOR 6/AE 28 (1994)			2	1	1	0
		AOE 4 (1994)			4	3	2	SDP
		AO 179/AE 34 (1996)	1	SDP	4	3	1	0
		AOE 3 (1997)			5	5	1	SDP
		AOE 4 (1996-97)			3	4		
		AOE 6 (1996)	1	0	3	2	1	0
		AOE 8 (1997)	1	0	3	2	2	SDP
PAC	↑	AOR 7/AE 32 (1994)	1	SDP	2	1	1	0
		AOE 2 (1994)	1	SDP	3	1	1	0
		AOE 1 (1997-98)			5	2	1	0
		AOE 2 (1996)	1	1	4	2	1	0
		AOE 7 (1996-97)			5	2	1	1
		Total average	1		3		1	
		In-column deviation	0		1		0	

We thought an important question to ask is “How often did the AOE refuel another ship?” Several columns in this table show the number of times per week each AOE refueled various types of customer ships.

The columns labeled “deviation” show the standard deviation of the AOE’s FASs/week data for each type of customer ship. We also calculated a total average of FASs per week for the different AOE’s within a ship type. For example, AOE’s (in this study) refueled 3 ± 1 surface combatants per week and AOE 2 in 1996 refueled 4 ± 2 surface combatants per week.

AOEs, on average, refueled surface combatants 3 times per week, more often than any other type of ship. This number is a rough average since there is a significant amount of scatter in the data shown by the high standard deviation.

Amphibious ships were AOE’s second most frequent customer. They refueled amphibious ships 2.6 times per week, on average.

AOE’s refueled other types of ships once or twice a week.

Notes: Ranges are specified as average \pm one standard deviation.

“SDP” in the above table is an abbreviation for “single datum point.”

How Often Did AOEes RAS?

	AOEs	Amphibious Average	Deviation	CV Average	Deviation	CVN Average	Deviation
LANT	AO 179/AE 34 (1996)	2	1			1	0
	AOE 3 (1997)	2	3			2	1
	AOE 4 (1996-97)	1	0			2	0
	AOE 6 (1996)	2	1			2	1
	AOE 8 (1997)			2	0		
PAC	AOE 1 (1997-98)	2	1			1	1
	AOE 2 (1996)	1	0			1	0
	AOE 7 (1996-97)	3	0	1	0		
	AOEs	Other Average	Deviation	Surface Combatant Average	Deviation	CLF Average	Deviation
LANT	AO 179/AE 34 (1996)	1	0	2	1	1	0
	AOE 3 (1997)			2	1	2	1
	AOE 4 (1996-97)	1	SDP	2	1	1	0
	AOE 6 (1996)	1	1	3	2	2	1
	AOE 8 (1997)	1	0	3	2	2	2
PAC	AOE 1 (1997-98)	2	1	4	3	1	1
	AOE 2 (1996)	1	0	2	1	1	0
	AOE 7 (1996-97)	1	SDP	4	2	2	2

In general, AOEes replenished surface combatants 2 to 4 times per week. The high standard deviation in the adjacent column indicates the AOE did not RAS surface combatants the same number of times every week throughout its deployment. For example, 1 week a AOE replenished 5 surface combatants, and 3 weeks later the same AOE replenished 8 surface combatants.

They replenished amphibious ships 1.5 to 2.5 times per week. The low standard deviation in this case shows AOE replenished almost the same number of amphibious ships each week.

The AOE replenished a CV or a CVN once to twice per week. It also replenished other CLF ships once or twice a week.

Note: Ranges are specified as average \pm one standard deviation.

Raw data

The following pages contains the database we constructed from UNREP data obtained from COMLOGGRU TWO and COMNAVSURFGRU PAC NW. We divided the data into two groups: deliveries and receipts. Deliveries consist of ammunition, dry goods, and fuel the AOE transferred to its customers. Receipts indicate fuel and dry cargo delivered to the AOE (e.g., from other CLF ships).

As discussed previously, some AOE's used different units of measure to describe identical items. In the following table, the units each AOE used is shown. All the ships reported DFM and JP-5 in gallons.

Ship	Ammunition	Dry Cargo
AE 34	Lifts	-
AO 179	-	Pallets
AOE 1	Lifts	Pallets
AOE 2	Pallets	Pallets
AOE 3	Pallets	Pallets
AOE 4	Pallets	Pallets
AOE 6	Pallets	Pallets
AOE 7	Loads	Loads
AOE 8	Pallets	Pallets

In the pages that follow, shaded cells indicate ships belonging to the AOE's own CVBG.

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Date	Location	Source/ CLF ship	Customer	Start	Finish	CONREP	VERTREP	INREP	DFM (gallons)	JP-5 Gal	Ammo Pal	Pax	Cargo Pal	Plastic Retro Pal	Flt Frt etc Pal	Plastic etc. Pal	Flt Frt Qcog/Fill Pal	Qcog Pal	SODA Pal	ITULL Pal	FFV/ Dairy Pal	Dairy Pal	Dry Pal	FFV Dry Pal	Chill Pal	Freeze Pal	Fill Pal	AO Dkld Pal	Hazmat Pal	Retro Pal	JETE Pal	Misc cargo Pal	Q-cog Pal	Mail Pounds
Receipts																																		

2/8/94	Med	Souda Bay	AE 34							38 lifts/56.5 tons																						
2/10/94	Med	TAFS 10	AE 34																												42 lifts	

2/15/94	Med	Augusta Bay	AE 34							42 lifts/19.7 tons																					
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2/23/94	Med	AO 178	AE 34							1 lift/6 tons																					
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3/20/94	Med	TAO 195	AE 34						228,090	5 tons																					
3/20/94	Med	AE 34	DD 974							/6.2 tons																					
3/23/94	Med	Sigonella	AE 34							12 lifts																					10 lifts

4/5/94	Med	NavStaRota	AE 34						198,074	57 lifts/73.17 tons																				11 lifts
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4/14/94	Med	Augusta Bay	AE 34						112,024	49 lifts																				87 lifts
4/15/94	Med	AO 178	CG 69							70.32 tons																				

Date	Location	Source/ CLF ship	Customer	Start	Finish	CONREP	VERTREP	INREP	DFM (gallons)	JP-5	Ammo	Pax	Cargo	Plastic Retro	Plt Prt etc	Plastic etc.	Plt Prt Qcog/Fill	Qcog	SODA	HULL	HFW/ Dairy	Dairy	Dry	FPV Dry	Chill	Freeze	Fill	AO Dktld	Hazmat	Retro	JETS	Misc cargo	Q-cog	Mail	
										Gal	Pal		Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pounds
Receipts																																			
4/22/94	Med	Sigonella	AE 34																															3 lifts	
5/5/94	Med	Augusta Bay	AE 34						391,800			335 lifts																						20 lifts	
5/6/94	Med	AO 178	DD 968									/89.3 tons																							
5/9/94	Med	Souda Bay	AE 34									493 lifts																						17 lifts	
5/9/94	Med	AO 178	CG 58									/398.5 tons																							
5/20/94	Med	Augusta Bay	AE 34						215,500			183 lifts																						20 lifts	
5/25/94	Med	AE 34	NSA Naples									/89.3 tons																							
6/1/94	Med	Augusta Bay	AE 34						325,516	8,126																								27 lifts	
6/4/94	Med	CV 60	AE 34									225 lifts																							
6/5/94	Med	AO 178	TAFS 8									/89 tons																							
6/7/94	Med	NavStaRota	AE 34						98,709			20 lifts																							23 lifts
6/20/94	Med	AOR 6	CVN 73																															8	
6/25/94	Med	AOR 6	CG 56																															3	
8/5/94	Med	AOR 6	CVN 73																															11	
8/16/94	Med	AOR 6	TAFS 6																															7	
9/3/94	CentCom	AOR 6	CG 51																															6	
9/18/94	CentCom	AOR 6	CVN 73																															6	

Date	Location	Source/CLF ship	Customer	Start	Finish	CONREP	VERTREP	INREP	DFM (gallons)	JP-5	Ammo	Pax	Cargo	Plastic	Flt Frt	Plastic	Hlt Frt	Qcog	SODA	HULL	FFV/	Dairy	Dry	FFV	Chill	Freeze	Bill	AO	Hazmat	Retro	JETE	Misc	Q-cog	Mail	
										Gal	Pat		Pat	Pat	Pat	Pat	Pat	Pat	Pat	Pat	Pat	Pat	Pat	Pat	Pat	Pat	Pat	Pat	Pat	Pat	Pat	Pat	Pat	Pat	Pat
← Receipts →																																			

10/6/94	Med	AOR 6	CVN 73																																8
10/8/94	Med	AO 186	AOR 6						91,000	805,000																									
10/8/94	Med	AE 28	AOR 6						50,400																										
10/13/94	CentCom	AOR 6	CG 56																																1

11/3/94	CentCom	TAO	AOR 6						1,500,000																										
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11/1/94	Med	AE 24	AOE-4																																40
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11/4/94	Med	AOR 6	AOE-4																																115
11/7/94	Med	TAFS 5	AOE-4																																11
11/8/94	Med	Souda Bay	AOE-4						2,461,620	1,451,856																									

11/25/94	CentCom	Dubai, UAE	AOE-4						841,634	904,276																									
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12/1/94	CentCom	Dubai, UAE	AOE-4						630,716	1,330,187																									
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12/7/94	CentCom	Dubai, UAE	AOE-4							1,841,421																									
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12/20/94	Med	Augusta Bay	AOE-4						1,442,397	34,734																									110
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02/27/94	WestPac	P. Harbor	AOE 2						1,352,447																										
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03/06/94	WestPac	TAO 193	AOE 2				X		816,150	714,207																									
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03/23/94	WestPac	TAO 193	AOE 2				X		434,282	1,019,834																									
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Date	Location	Source/CLF	Customer	Start	Finish	CONREP	VERTREP	INREP	DFM (gallons)	JP-5	Ammo	Pax	Cargo	Plastic	Flt Frt	Plastic	Flt Frt	Qcog	SODA	HULL	FFV/	Dairy	Dry	FFV	Chill	Freeze	Fill	AO	Hazmat	Retro	JETE	Misc	Q-cog	Mail
		ship								Gal	Pal		Pal	Retro	etc	etc.	Qcog/Fill	Pal	Pal	Pal	Dairy	Pal	Pal	Pal	Pal	Pal	Pal	Dkld	Pal	Pal	Pal	cargo	Pal	Pounds

← Receipts →

04/07/94	WestPac	FAO 197	AOE 2						686,000	682,936																										
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04/20/94	CentCom	Jebel Ali	AOE 2						632,627	593,411																										
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04/25/94	CentCom	Jebel Ali	AOE 2						894,671	639,997																										
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06/09/94	CentCom	Jebel Ali	AOE 2						1,557,527	1,458,305																										
06/13/94	CentCom	Jebel Ali	AOE 2						3,016,935																											

Date	Location	Source/ CLF ship	Customer	Start	Finish	CONREP	VERTREP	INREP	DFM (gallons)	JP-5	Ammo	Pax	Cargo	Plastic Retro	Flt Frt etc	Plastic etc.	Flt Frt Qcog/Fill	Qcog	SODA	HULL	FPV/ Dairy	Dairy	Dry	FPV Dry	Chill	Freeze	Fill	AO Dkld	Hazmat	Retro	JETE	Misc cargo	Q-cog	Mail	
									Gal	Pal		Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pounds

← Receipts →

2/10/96	Med	AE 27	AE 34				X			150																									
2/10/96	Med	TAO 195	AE 34			X			140,000																										
2/11/96	Med	CV 66	AE 34				X			150																									
2/12/96	Med	TAFS 10	AE 34				X																											30	

2/16/96	Med	TAFS 10	AO 179	06:00	08:45		X																													
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3/10/96	Med	TAFS 6	AE 34			X																													12
3/11/96	Med	TAO 195	AE 34				X																												30

Date	Location	Source/CLF ship	Customer	Start	Finish	CONREP	VERTREP	INREP	DFM (gallons)	JP-5	Ammo	Pax	Cargo	Plastic	Flt Frt	Plastic	Flt Frt	Qcog	SODA	HULL	FFV/ Dairy	Dairy	Dry	FFV	Chill	Freeze	Fill	AO	Hazmat	Retro	JETE	Misc	Q-cog	Mail	
										Gal	Pal		Pal	Pal	Pal	Pal	Qcog/Fill	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Dkld	Pal	Pal	Pal	Pal	Pal	Pal	Pounds
← Receipts →																																			
3/14/96	Med	AO 179	CVN 73	11:11	13:32	X											3																		
3/23/96	CentCom	TAFS 8	AO 179	10:05	10:45	X											38																		
3/23/96	CentCom	TAFS 8	AO 179	14:16	15:30		X										42																		
3/25/96	CentCom	AO 179	CVN 73	07:50	10:54	X											2																		
3/29/96	CentCom	AO 179	CVN 73	09:56	11:38	X											18																		
4/2/96	CentCom	AO 179	CVN 73	08:10	09:49	X																													8
4/2/96	CentCom	AO 179	CG 56	08:27	09:51	X																													3
4/2/96	CentCom	AO 179	AE 34	14:10	15:27	X																													8
4/5/96	CentCom	TAFS 8	AO 179	12:47	13:52		X																												16
4/9/96	CentCom	TAO 202	AO 179			X																													24
4/17/96	CentCom	AO 179	CVN 73	09:00	12:25	X											9																		
4/17/96	CentCom	AE 34	AO 179	20:00	21:07		X																												9
4/21/96	CentCom	TAFS 8	AO 179	13:30	15:00	X																													17
4/23/96	CentCom	TAFS 8	AO 179	14:00	17:00		X																												17
6/3/96	Med	AE 34	CVN 73			X											60																		
6/12/96	Med	AO 179	CVN 73	07:00	11:41	X																													15

Date	Location	Source/ CLF ship	Customer	Start	Finish	CONREP	VERTREP	INREP	DFM (gallons)	JP-5	Ammo	Pax	Cargo	Plastic Retro	Flt Frt etc	Plastic etc.	Flt Frt Qcog/Fill	Qcog	SODA	HULL	HFV/ Dairy	Dairy	Dry	FPV Dry	Chill	Freeze	Fill	AO Dkld	Hazmat	Retro	JETE	Misc cargo	Q-cog	Mail	
										Gal	Pal		Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal
← Receipts →																																			
6/18/96	Med	TAO 198	AE 34			X			200,000																										

7/16/96	Eastlant	AE 34	FFG 58			X				3																									
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7/22/96	Westlant	TAO 189	AO 179	13:00	17:40	X																													
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Date	Location	Source/ CLF ship	Customer	Start	Finish	CONREP	VERTREP	INREP	DFM (gallons)	JP-5	Ammo	Pax	Cargo	Plastic Retro	Flt Frt etc	Plastic etc.	Flt Frt Qcog/Fill	Qcog	SODA	HULL	FFV/ Dairy	Dairy	Dry	FFV Dry	Chill	Freeze	Fill	AO	Hazmat	Retro	JETE	Misc cargo	Q-cog	Mail	
										Gal	Pal		Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pounds
← Receipts →																																			

3/20/96	Med	TAFS 10	AOE 6	15:10	17:10	X													29	5		15		3	9		7								
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9/7/96	Med	AO 186	AOE 6	14:30	18:10	X			1,100,000	301,500					?																						
9/7/96	Med	AO 186	AOE 6	16:55	19:35		X				6				3																						

Date	Location	Source/CLF	Customer	Start	Finish	CONREP	VERTREP	INREP	DFM (gallons)	JP-5	Ammo	Pax	Cargo	Plastic	Flt Frt	Plastic	Flt Frt	Qcog	SODA	HULL	FFV/	Dairy	Dry	FFV	Chill	Freeze	Fill	AO	Hazmat	Retro	JETE	Misc	Q-cog	Mail
		ship								Gal	Pal		Pal	Retro	etc	etc.	Qcog/Fill	Pal	Pal	Pal	Dairy	Pal	Pal	Dry	Pal	Pal	Pal	Dkld	Pal	Pal	Pal	cargo	Pal	Pounds
←----- Receipts -----→																																		
9/26/96	CentCom	TAFS 3	AOE 6	22:53	23:40		X											1	9		12		6		3	7								

10/7/96	CentCom	TAFS 3	AOE 6	13:20	13:55		X																										8		1	
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11/6/96	CentCom	TAO 197	AOE 6	07:41	10:00		X			195.100	906.500																								
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11/7/96	CentCom	AOE 6	DD 978	08:50	09:10		X																													2	
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11/7/96	CentCom	AOE 6	CG 50	10:10	10:55		X																														3	
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11/14/96	CentCom	AOE 6	CG 64	07:52	09:29		X																														3	
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11/17/96	CentCom	AOE 6	CVN 65	08:00	09:36		X																														64	
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11/22/96	CentCom	AOE 6	CVN 65	07:01	08:37		X																														3	
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11/24/96	CentCom	AOE 6	CVN 65	09:30	11:24		X																													12	
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12/3/96	Med	Souda Bay	AOE 6	09:30	11:00			X			27																										
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Date	Location	Source/ CLF ship	Customer	Start	Finish	CONREP	VERTREP	INREP	DFM	JP-5	Ammo	Pax	Freeze	Food	Chill	Dry	Chill/ FFV	Dairy	FFV/ Dairy	chill FFV/ Dairy	chill/ ffv stores	Other stores	Soda	Ft Ft	Ft Ft	Ft Ft	AO	DKLD	DKLD	Hull	Hull/ DKLD	Fill	Pot- Water	JETS	Retro	Q-Cog	Nitro	Lube	A/C	Mail	NRFI/				
									Gal	Gal	Pal		Pal	Loads	Pal	Pal	Pal	Pal	Pal	Pal	Loads	Loads	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Gal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	
Deliveries																																													
12/8/96	Med	AOE 6	CG 58	15:24	16:54	X			141,800	14,900																																			
12/8/96	Med	AOE 6	CG 58	15:10	16:30		X						2		3				7																										
12/8/96	Med	AOE 6	DDG 37	16:03	17:05	X			67,500																																				
12/9/96	EastLant	AOE 6	CVN 65	06:46	08:30	X							47		2									52																					
12/9/96	EastLant	AOE 6	CVN 65	07:30	08:30		X												7							1																		40 bundles	

12/10/96	EastLant	AOE 6	AOE 4	10:00	12:05		X				92																																					
12/14/96	CentLant	AOE 6	DD 977	13:17	14:19	X		X	102,900																																							
12/14/96	CentLant	AOE 6	FFG 49	13:19	15:00	X			40,500	7,600																																						
12/15/96	CentLant	AOE 6	AE 28	08:59	15:35	X																																										
12/15/96	CentLant	AOE 6	AE 28	08:25	18:00		X																																									
12/16/96	CentLant	AOE 6	LPD 4	05:52	08:19	X			436,800																																							
12/16/96	CentLant	AOE 6	AE 28	07:11	13:27	X																																										
12/16/96	CentLant	AOE 6	AE 28	07:15	23:45		X																																									
12/16/96	CentLant	AOE 6	LSD 44	09:09	12:50	X			136,100																																							
12/16/96	CentLant	AOE 6	LHA 2	14:33	17:42	X			728,800																																							
12/16/96	CentLant	AOE 6	AE 28	15:08	22:33	X																																										
12/17/96	WestLant	AOE 6	CG 58	09:09	10:30	X			94,100																																							
12/15/96	Med	AOE 4	FFG 53	08:50	09:43	X			37,000																																							
12/15/96	Med	AOE 4	FFG 53	10:37	14:32		X				21																																					

Date	Location	Source/ CLIF ship	Customer	Start	Finish	CONREP	VERTREP	INREP	DFM (gallons)	JP-5	Ammo	Pax	Cargo	Plastic Retro	Plastic etc.	Plastic etc.	Plt Frt Qcog/Fill	Qcog	SODA	HULL	PFV/ Dairy	Dairy	Dry	FPV Dry	Chill	Freeze	Fill	AO	Hazmat	Retro	JETE 1	Misc cargo	Q-cog	Mail	
										Gal	Pal		Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pounds

← Receipts →

12/9/96	EastLant	Rota, SP	AOE 6	13:00	17:00			X																											
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12/16/96	Med	AugustaBay	AOE 4	16:15	22:45			X																													
12/16/96	Med	AugustaBay	AOE 4	18:45	01:30			X	761,000																												
12/16/96	Med	AugustaBay	AOE 4	18:20	01:35			X																													
12/17/96	Med	AugustaBay	AOE 4	08:00	20:35			X																													
12/17/96	Med	AugustaBay	AOE 4	18:37	00:20			X																													
12/18/96	Med	AugustaBay	AOE 4	07:25	11:50			X	86						16																						
12/26/96	Med	Palma de	AOE 4	09:00	09:20			X	1																												
12/26/96	Med	Palma de	AOE 4	09:50	11:45			X																													

4/22/96	Eastpac	Indian Island	AOE 2																																		
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6/1/96	WestPac	Sasebo	AOE 2					X																													
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6/5/96	WestPac	TAO 197	AOE 2				X		1,809,372	765,610																											
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6/23/96	WestPac	TAO 202	AOE 2				X		1,411,872	668,304																												
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7/12/96	CentCom	TAO 199	AOE 2				X	X	1,509,437	1,507,054			5																									
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Date	Location	Source/ CLP ship	Customer	Start	Finish	CONREP	VERTREP	INREP	DFM (gallons)	JP-5	Ammo	Pax	Cargo	Plastic Retro	Flt Frt etc	Plastic etc.	Flt Frt Qcog/Fill	Qcog	SODA	HULL	FFV/ Dairy	Dairy	Dry	FFV Dry	Chill	Freeze	Fill	AO Dkld	Hazmat	Retro	JETE	Misc cargo	Q-cog	Mail	
										Gal	Pal		Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pounds
← Receipts →																																			

9/6/96	CentCom	TAO 199	AOE 2			X			174,691	1,344,897																									
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9/20/96	CentCom	TAO 199	AOE 2			X			1,121,457	459,179																									
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9/28/96	CentCom	TAO 199	AOE 2			X			1,013,895	781,507																									
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Date	Location	Source/ CLF ship	Customer	Start	Finish	CONREP	VERTREP	INREP	DFM (gallons)	JP-5	Ammo	Pax	Cargo	Plastic Retro	Plt Frt etc	Plastic etc.	Plt Frt Qcog/Fill	Qcog	SODA	HULL	FPV/ Dairy	Dairy	Dry	FPV Dry	Chill	Freeze	Fill	AO	Hazmat	Retro	JETE	Misc cargo	Q-cog	Mail	
										Gal	Pal		Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pounds

← Receipts →

10/27/96	WestPac	Guam	AOE 2								1592																								
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10/14/96	MidPac	TAO 204	AOE 7	08:00	12:20	X	X		309,337	72,203																									100
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10/22/96	MidPac	joyrides	AOE 7	13:40	14:21		X				7																								
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10/27/96	WestPac	TAO 202	AOE 7	12:45	16:49	X	X		1,776,718	615,769	1																								2,000
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11/10/96	WestPac	TAO 199	AOE 7	10:18	16:12	X	X		2,595,650	958,856																									1,000
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11/19/96	WestPac	TAO 199	AOE 7	9:00	13:00	X	X		1,474,081	323,072																									515
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12/15/96	CentCom	ASU Bahrain	AOE 7				X				1																								2,500
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Date	Location	Source/ CLF ship	Customer	Start	Finish	CONREP	VERTREP	INREP	DFM (gallons)	JP-5	Ammo	Pax	Cargo	Plastic	Plt Prt	Plastic	Ht Prt	Qcog	SODA	HULL	FFV/ Dairy	Dairy	Dry	FFV	Chill	Freeze	Fill	AO	Hazmat	Retro	JETE	Misc cargo	Q-cog	Mail	
										Gal	Pal		Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pounds
Receipts																																			
12/16/96	CentCom	TAO 197	AOE 7	10:20	15:35	X	X		2,197,218	747,390																								50	

12/23/96	CentCom	ASU Fujarah	AOE 7					X			3																							150
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12/31/96	CentCom	TAO 197	AOE 7	5:45	9:49	X			1,037,449	310,994																								
2/4/97	Med	Augusta Bay	AOE 4	08:16	14:02			X			2			30			4		20				18				2							

2/9/97	Med	TAFS 5	AOE 4	09:50	11:16			X						11			2				17		4	20										
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2/17/97	Med	Augusta Bay	AOE 4	08:00	18:15			X						17				33			10		1	5			20			70	8 (LEFT)			
2/18/97	Med	Augusta Bay	AOE 4	08:09	13:37			X						17				98										12		10 (Pat)				
2/20/97	Med	Souda Bay	AOE 4	13:30	14:55			X						17																				
2/21/97	Med	Souda Bay	AOE 4	09:35	22:49			X	1,310,000	2,150,000																								
2/25/97	Med	Souda Bay	AOE 4	10:12	10:21			X														3												
2/26/97	Med	Souda Bay	AOE 4	13:00	13:35			X										4									1							
2/27/97	Med	Souda Bay	AOE 4	10:15	11:20			X													10													

3/8/97	Med	TAO 196	AOE 4	08:54	12:45	X			1,980,000																									M
3/8/97	Med	TAO 196	AOE 4	08:54	11:03	X				185,000																								
3/8/97	Med	TAFS 5	AOE 4	08:11	11:24			X						16			12		23		18		23	82			17		7					
3/8/97	Med	TAO 196	AOE 4	11:23	13:20			X						8				28	13		2						16		21					

3/31/97	CentCom	TAFS 7	AOE 4	14:10	15:02			X										2	3		8		3	6					2				
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Date	Location	Source/ CLF	Customer	Start	Finish	CONREP	VERTREP	INREP	DFM (gallons)	JP-5	Ammo	Pax	Cargo	Plastic	Plt Frt	Plastic	Plt Frt	Qcog	SODA	HULL	FFV	Dairy	Dry	FFV	Chill	Freeze	Fill	AO	Hazmat	Retro	JETB	Misc	Q-cog	Mail
		ship								Gal	Pal		Pal	Pal	etc	etc.	Qcog/Fill	Pal	Pal	Pal	Dairy	Pal	Pal	Dry	Pal	Pal	Pal	Dktd	Pal	Pal	Pal	cargo	Pal	Pounds

← Receipts →

5/16/97	Med	Augusta Bay	AOE 8	13:25	16:47			X							4								24	66	3									
5/16/97	Med	Augusta Bay	AOE 8	13:15	17:23			X							3				4				9	1	3	1								
5/16/97	Med	Augusta Bay	AOE 8	14:15	18:54			X	\$82,000	601,000																								
5/17/97	Med	Augusta Bay	AOE 8	09:50	12:37			X							3								10	1	3	1								

5/22/97	Med	TAFS 10	AOE 8	08:53	11:10		X								3			7		2			17	25	24	7								
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6/2/97	EastLant	Rota	AOE 8	14:25	17:07			X															16	91											
6/2/97	EastLant	Rota	AOE 8	16:03	23:43			X	1,000,000	1,300,000																									
6/5/97	EastLant	Rota	AOE 8	22:38	02:30			X	1,300,000	350,000																									

6/15/97	Med	TAFS 10	AOE 8	08:54	10:41		X								36			7		1			32	7	16	8								
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6/17/97	Med	Souda Bay	AOE 8	12:42	13:53			X		42																									
6/17/97	Med	Souda Bay	AOE 8	18:00	19:37			X							10																				
6/18/97	Med	Souda Bay	AOE 8	08:30	13:00			X							2								19	73	3										
6/18/97	Med	Souda Bay	AOE 8					X	1,000,000	625,000																									

6/30/97	Med	Augusta Bay	AOE 8	13:22	22:55			X	1,600,000	1,100,000																									
6/30/97	Med	Augusta Bay	AOE 8	10:45	15:00			X																											

7/14/97	Med	Augusta Bay	AOE 8	12:00	20:30			X							140			14	111	11			310	82	18	11						4		
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Date	Location	Source/ CLF ship	Customer	Start	Finish	CONREP	VERTREP	INREP	DFM (gallons)	JP-5 Gal	Ammo Pal	Pax	Cargo Pal	Plastic Retro Pal	Plt Prt etc Pal	Plastic etc. Pal	Plt Prt Qcog/Hill Pal	Qcog Pal	SODA Pal	HULL Pal	FFV/ Dairy Pal	Dairy Pal	Dry Pal	FFV Dry Pal	Chill Pal	Freeze Pal	Fill Pal	AO Dkld Pal	Hazmat Pal	Retro Pal	JETS Pal	Misc cargo Pal	Q-cog Pal	Mail Pounds
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Receipts

7/18/97	Med	Souda Bay	AOE S	17:30	22:50			X	1,300,000	897,000																									
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8/5/97	Med	Souda Bay	AOE S	10:29	14:02			X		642,000																									
8/5/97	Med	Souda Bay	AOE S	10:29	15:15				931,000													4		1	3										

8/13/97	Med	Souda Bay	AOE S	11:52	17:40			X	1,300,000	932,000																									
8/14/97	Med	Souda Bay	AOE S	09:30	12:06	X											18		58			190													
8/14/97	Med	Souda Bay	AOE S	06:30	07:45		X										6		33			65					15								

8/30/97	CentCom	Jebel Ali	AOE S	12:08	18:58			X	2,500,000	1,600,000																									
8/31/97	CentCom	Jebel Ali	AOE S	06:10	08:15			X																											
9/2/97	CentCom	TAFS S	AOE S	12:55	13:49	X											7		6			6		1	2										

9/10/97	CentCom	TAFS S	AOE S	09:45	11:10	X																													
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9/11/97	CentCom	Fujairah	AOE S	14:35	00:30			X	1,100,000	525,000																									
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9/27/97	Med	Souda Bay	AOE S	09:06	16:58		X			254																									
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10/2/97	Med	Augusta bay	AOE S					X									147																			
10/3/97	Med	Augusta bay	AOE S					X										32																		
10/4/97	Med	Augusta bay	AOE S					X										22																		

10/14/97	EastLant	Rota	AOE S					X									21		9		56														
10/15/97	EastLant	Rota	AOE S	19:00	01:12			X	1,040,000	906,000																									

Date	Location	Source/ CLF ship	Customer	Start	Finish	CONREP	VERTREP	INREP	DFM (gallons)	JP-5	Ammo	Pax	Cargo	Plastic	Plt Frt	Plastic	Plt Frt	Qeog	SODA	HULL	FFV/	Dairy	Dry	FFV	Chill	Freeze	Fill	AO	Hazmat	Retro	JETE	Misc	Q-cog	Mail	
										Gal	Pal		Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pal	Pounds

Receipts

3/23/97	WestPac	TAO 200	AOE 7	7:30	10:55	X	X		1,613,516	103,054																									
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4/2/97	MidPac	AO 180	AOE 7	10:30	15:15	X	X		2,450,000	300,000																										
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9/10/97	WestPac	CVN 68	AOE 1			X	X			75																										
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Date	Location	Source/CLF ship	Customer	Start	Finish	CONREP	VERTREP	INREP	DFM (gallons)	JP-5 Gal	Ammo Pal	Pax	Cargo Pal	Plastic Retro Pal	Plt Frt etc Pal	Plastic etc. Pal	Plt Frt etc. Pal	Qeog Pal	SODA Pal	HULL Pal	FFV/ Dairy Pal	Dairy Pal	Dry Pal	FFV Dry Pal	Chill Pal	Freeze Pal	Fill Pal	AO Dkld Pal	Hazmat Pal	Retro Pal	JETE Pal	Misc cargo Pal	Q-cog Pal	Mail Pounds	
← Receipts →																																			
9/11/97	WestPac	AOI 180	AOE 1			X			1,585,209	288,392																									

9/18/97	WestPac	TAFS 7	AOE 1				X												5	2	13		15													
9/18/97	WestPac	TAO 197	AOE 1			X			1,114,837	395,187																										
9/20/97	WestPac	TAE 26	AOE 1				X				265																									
9/22/98	WestPac	Yokosuka	AOE 1				X				8													15												

9/25/97	WestPac	Jebel Ali	AOE 1			X			1,145,144																											
9/26/97	WestPac	CVN 68	AOE 1				X				8																									

10/6/97	WestPac	TAO 202	AOE 1			X	X		1,471,741	782,100					2				1																	
10/8/97	WestPac	CVN 68	AOE 1				X							1																						

10/12/97	WestPac	Jebel Ali	AOE 1			X	X		1,982,999	118,031					4																					
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10/15/97	CentCom	Bahrain	AOE 1				X				2	2			2																					
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10/18/97	CentCom	CVN 68	AOE 1				X																												24	
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10/22/97	CentCom	Sir Beh Det	AOE 1				X												6	21																
10/23/97	CentCom	Jebel Ali	AOE 1			X	X		1,730,844	1,374,847					34				8					18												

10/31/97	CentCom	ETP-53 Bahrain	AOE 1				X								3																					
11/1/97	CentCom	CVN 68	AOE 1				X																												38	

11/4/98	CentCom	Bahrain	AOE 1				X								5																					7
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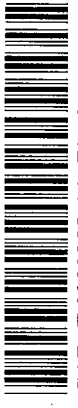
11/5/97	CentCom	Bahrain	AOE 1				X				6				2																					
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Date	Location	Source/CLF ship	Customer	Start	Finish	CONREP	VEKTRREP	INREP	DFM (gallons)	JP-5 Gal	Ammo Pal	Pax	Cargo Pal	Plastic Retro Pal	Plt Frt etc Pal	Plastic etc. Pal	Plt Frt etc. Pal	Qeog/Fill Pal	Qeog Pal	SODA Pal	HULL Pal	FPV/ Dairy Pal	Dairy Pal	Dry Pal	FPV Dry Pal	Chill Pal	Freeze Pal	Fill Pal	AO Dkld Pal	Hazmat Pal	Retro Pal	JETTE Pal	Misc cargo Pal	Q-cog Pal	Mail Pounds		
← Receipts →																																					
11/7/97	CentCom	TAFS 8	AOE 1				X								15						1			3		5	11	1			10						
11/8/97	CentCom	FFG 54	AOE 1				X																														
11/9/97	CentCom	Bahrain	AOE 1				X								38					1																	
11/11/97	CentCom	AOE 1	LHA 5																																10		
11/12/97	CentCom	Bahrain	AOE 1				X					5												9		1	1										
11/13/97	CentCom	AOE 1	DDG 965				X																													2	
11/13/97	CentCom	DD 965	AOE 1				X																													2	
11/13/97	CentCom	CVN 68	AOE 1				X																													9	
11/15/97	CentCom	Jebel Ali	AOE 1				X																													42	
11/19/97	CentCom	Bahrain	AOE 1				X					64																									
11/22/97	CentCom	DUCK	AOE 1				X					2																									
11/24/97	CentCom	TAFS 9	AOE 1				X								4						2		41		55		14	14	1								
11/24/97	CentCom	CVN 68	AOE 1				X																													27	
11/25/97	CentCom	Jebel Ali	AOE 1							1,146,460	1,025,488																										
11/26/97	CentCom	Jebel Ali	AOE 1																																		
11/28/97	CentCom	Jebel Ali	AOE 1												35																						
12/1/97	CentCom	Bahrain	AOE 1				X																														
12/3/97	CentCom	Bahrain	AOE 1				X					40																									
12/6/97	CentCom	FFG 55	AOE 1				X																														
12/9/97	CentCom	TAFS 9	AOE 1				X								3																						
12/9/97	CentCom	DD 987	AOE 1				X																														

Date	Location	Source/CLF ship	Customer	Start	Finish	CONREP	VERTREP	INREP	DFM (gallons)	JP-5 Gal	Ammo Pal	Pax	Cargo Pal	Plastic Retro Pal	Flt Frt etc Pal	Plastic etc. Pal	Flt Frt etc. Pal	Qcog/Fill Pal	Qcog Pal	SODA Pal	ITULL Pal	FFV/ Dairy Pal	Dairy Pal	Dry Pal	FFV Dry Pal	Chill Pal	Freeze Pal	Fill Pal	AO DKld Pal	Hazmat Pal	Retro Pal	JETE Pal	Misc cargo Pal	Q-cog Pal	Mail Pounds	
← Receipts →																																				
12/14/97	CentCom	TAFS 9	AOE 1				X								18			1				4		1			1									
12/18/97	CentCom	Jebel Ali	AOE 1			X			2,191,519	1,085,743																										
12/19/97	CentCom	Jebel Ali	AOE 1				X							5								5														
12/23/97	CentCom	Jebel Ali	AOE 1				X																												4	
12/26/97	CentCom	Jebel Ali	AOE 1				X							12						1		22				7									10	
12/28/97	CentCom	Bahrain	AOE 1				X				11			2																						
12/29/97	CentCom	FFG 51	AOE 1				X				1																									
1/5/98	CentCom	CVN 68	AOE 1				X				2																									3
1/7/98	CentCom	TAFS 9	AOE 1				X							23				2					9		1	15	1									
1/10/98	CentCom	Fujairah	AOE 1						2,196,836	1,338,951				2																						
1/11/98	CentCom	Fujairah	AOE 1											1								33	4													6
1/19/98	CentCom	TAE 26	AOE 1				X				306																									
1/25/98	CentCom	Perth	AOE 1				X														15	17	1													12
2/16/98	WestPac	DD 965	AOE 1				X																													2
2/21/98	WestPac	Pearl Harbor	AOE 1											10				1	8			6														8

Date	Location	Source/CLF ship	Customer	Start	Finish	CONREP	VERTREP	INREP	DFM (gallons)	JP-5	Ammo	Pax	Cargo	Plastic	Flt Frt	Plastic	Flt Frt	Qcog	SODA	HULL	FFV/	Dairy	Dry	FFV	Chill	Freeze	Fill	AO	Hazmat	Retro	JET/	Misc	Q-cog	Mail	
										Gal	Pal		Pal	Retro Pal	etc Pal	etc. Pal	Qcog/Fill Pal	Pal	Pal	Pal	Dairy Pal	Pal	Pal	Dry Pal	Pal	Pal	Pal	Dkid Pal	Pal	Pal	Pal	Pal	cargo Pal	Pal	Pounds
← Receipts →																																			

05/19/2000



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