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Electric Vehicle Preparedness: Task 2, Identification of Vehicles for Installation of Data Loggers for Marine Corps Base Camp Lejeune

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Electric Vehicle Preparedness: Task 1, Identification of Vehicles for Installation of Data Loggers for Marine Corps Base Camp Lejeune

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ABSTRACT

Battelle Energy Alliance, LLC, managing and operating contractor for the U.S. Department of Energy's Idaho National Laboratory, is the lead laboratory for the U.S. Department of Energy's advanced vehicle testing. Battelle Energy Alliance, LLC contracted with Intertek Testing Services, North America (Intertek) to conduct several U.S. Department of Defense-based studies to identify potential U.S. Department of Defense transportation systems that are strong candidates for introduction or expansion of plug-in electric vehicles (PEVs).

In Task 1, a survey was completed of the inventory of non-tactical fleet vehicles at the Marine Corps Base Camp Lejeune (MCBCL) to characterize the fleet. This information and characterization was used to select vehicles for further monitoring, which involves data logging of vehicle movements in order to identify the vehicle's mission and travel requirements. Individual observations of these selected vehicles provide the basis for recommendations related to PEV adoption. It also identifies whether a battery electric vehicle or plug-in hybrid electric vehicle (collectively referred to as PEVs) can fulfill the mission requirements and provides observations related to placement of PEV charging infrastructure.

This report provides the list of vehicles selected by MCBCL and Intertek for further monitoring and fulfills the Task 2 requirements.

Intertek acknowledges the support of Idaho National Laboratory and MCBCL fleet management and personnel for participation in this study.

Intertek is pleased to provide this report and is encouraged by the enthusiasm and support from MCBCL personnel.

EXECUTIVE SUMMARY

Federal agencies are mandated[a] to purchase alternative fuel vehicles, increase consumption of alternative fuels, and reduce petroleum consumption. Available plug-in electric vehicles (PEVs) provide an attractive option in the selection of alternative fuel vehicles. PEVs, which consist of both battery electric vehicles and plug-in hybrid electric vehicles, have significant advantages over internal combustion engine vehicles in terms of energy efficiency, reduced petroleum consumption, and reduced production of greenhouse gas emissions, and they provide performance benefits with quieter, smoother operation. This study intended to evaluate the extent to which the Marine Corps Base Camp Lejeune (MCBCL) could convert part or all of their fleet of vehicles from petroleum-fueled vehicles to PEVs.

The Task 1 report provided an assessment of the existing non-tactical fleet of vehicles at MCBCL to characterize its current components. From this characterization, the 60-vehicle subset of representative vehicles was selected for an in-depth assessment. This led to specific results for these selected vehicles and wider extrapolation to the full fleet of vehicles.

The MCBCL non-tactical fleet contains 862 vehicles for which counterpart PEVs are currently available or are expected to be available in the near future. Of the 862 vehicles, this report identifies the 60-vehicle subset that has been selected for further monitoring and evaluation.

[a] Energy Policy act of 1992, Energy Policy Act of 2005, Executive Order 13423, and Energy Independence and Security Act of 2007.

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ACRONYMS

BEV	battery electric vehicle
Intertek	Intertek Testing Services, North America
MCBCL	Marine Corps Base Camp Lejeune
MOU	memorandum of understanding
PEV	plug-in electric vehicle (includes BEVs and PHEVs, but not hybrid electric vehicles)
PHEV	plug-in hybrid electric vehicle

Electric Vehicle Preparedness: Task 1, Identification of Vehicles for Installation of Data Loggers for Marine Corps Base Camp Lejeune

1. INTRODUCTION

The U.S. Department of Energy and the U.S. Department of Defense signed a memorandum of understanding (MOU) on July 22, 2010, for strengthening the coordination of efforts to enhance national energy security and to demonstrate federal government leadership in transitioning the United States to a low-carbon economy. The MOU included efforts in the areas of energy efficiency, fossil fuels, alternative fuels, efficient transportation technologies and fueling infrastructure, grid security, smart grid, and energy storage.

In support of the MOU, Idaho National Laboratory, with funding provided by the U.S. Department of Energy's Vehicle Technologies Office and Federal Energy Management Program, directed Intertek Testing Services, North America (Intertek) to conduct several U.S. Department of Defense-based studies. These studies were conducted to identify potential transportation systems that are strong candidates for introduction or expansion of plug-in electric vehicles (PEVs). Intertek previously has conducted similar fleet, city, state, and countrywide studies using their EV Micro-Climate® assessment process, which consists of the following four main tasks:

- Task 1: Conduct a non-tactical vehicle fleet assessment
- Task 2: Identify vehicles for further mission and fleet characterizations
- Task 3: Perform detailed assessment of selected vehicles and charging infrastructure needs
- Task 4: Provide an implementation approach for adoption of electric vehicles.

An assessment of the potential for replacing the Marine Corps Base Camp Lejeune (MCBCL) fleet vehicles with PEVs starts with characterization of fleet vehicles' missions and vehicle characteristics. That assessment was presented in the Task 1 report: "Assessment of Fleet Inventory for Marine Corps Base Camp Lejeune."

PEVs generally are classified into two vehicle types: (1) battery electric vehicles (BEVs) and (2) plug-in hybrid electric vehicles (PHEVs). A BEV contains an onboard battery that provides all motive power. PHEVs also have an onboard battery that provides some motive power; however, there is another motive power source (such as a gasoline engine). Generally, PHEVs have a charge-depleting mode, where the battery provides all or most (depending on the PHEV design) of the motive power with the battery being depleted. They also have a charge-sustaining mode, where the non-battery power source provides the majority of the motive power while being supplemented by battery power and the battery state of charge is maintained within a designed range. A BEV can be considered to operate solely in charge-depleting mode. Collectively, BEVs and PHEVs are referred to as PEVs.

The Task 1 effort led to identification of fleet vehicles that appear to be good candidates for replacement by PEVs. To validate the survey results, 60 vehicles within the candidate groups are selected for further monitoring and analysis through addition of vehicle data loggers. The Task 2 results are presented in this document.

2. DATA LOGGERS

Individual privacy concerns exist when monitoring vehicle movement with data loggers. Data collection occurs by data logger number, vehicle identification number, or an agency-assigned vehicle number. Intertek receives no information related to the vehicle operator and provides no raw data to the fleet managers. In this manner, Intertek does not collect, analyze, or report on individual driving habits.

Data are collected using non-intrusive data loggers (Figure 1) that are placed into the vehicle's onboard diagnostic port. Installation of the data loggers and manual recording of information about the

vehicle that ties the logger and vehicle together in the data, typically take less than 5 minutes and is completed by the fleet managers or designees. The data loggers transmit vehicle information through cellular means to a data center where Intertek retrieves this information. Once installed and activated during vehicle use, the data loggers transmit vehicle information every minute during vehicle operation by cellular communication to the data center.

Figure 1. InTouchMVC data logger.[2]

Intertek maintains the data logger's connectivity and verifies data transmission weekly. Missing data (reported as "null" values) are frequently the result of lost global positioning system reception, logger device removal, or extended periods in regions with insufficient cellular reception. Intertek filters the vehicle and data logger information if these null values present a significant impact on the data collected and no resolution is possible.

Data consist of key-on events, key-off events, and position updates logged every minute while the vehicle is keyed-on. InTouchMVC fleet reporting converts these data points into records of trip events, stop events, and idle events.

From these data points, the following information will be available for evaluation:

- Trip start and stop time and location
- Trip distance and duration
- Idle start time, location, and duration
- Typical vehicle operating schedule.

The data loggers are retained on a vehicle for approximately 6 to 8 weeks to gather sufficient movement information on the vehicle.

3. FLEET VEHICLE SELECTION

The 60 vehicles selected by MCBCL and Intertek for further study are identified in Table 1.

Table 1. Monitored vehicles at MCBCL.

Fleet Vehicle Id	Year	Make	Model	EPA Class	Odometer	Estimated Annual Miles
290597	1997	Ford	E350	Van - Cargo	27,949	957
290910	2003	International	4200SBA	SP	69,793	3,507
291045	2006	Ford	F550	SP	41,941	3,656
291073	2007	Ford	E250	Van - Pass	45,547	2,935
294285	2009	X	Malibu	Sedan - Midsize	44,190	3,795
294293	2009	Chevrolet	HHR	SUV	53,870	4,214

[2] www.intouchmvc.com [accessed July 30, 2014]

Fleet Vehicle Id	Year	Make	Model	EPA Class	Odometer	Estimated Annual Miles
294315	2009	Chevrolet	3500	Pickup	23,997	3,208
294324	2009	Chevrolet	HHR	SUV	42,589	8,195
301321	2012	Ford	F350	Pickup	11,849	3,669
302039	2014	Ford	F250XL	Pickup	6,781	6,424
302040	2014	Ford	F250XL	Pickup	13,083	10,937
302334	2015	Ford	F350 stake	Pickup	6	1,200
G103327L	2012	Chevrolet	Malibu	Sedan - Midsize	17,359	7,085
G130325K	2012	Ford	Focus	Sedan - Compact	6,380	1,037
G137974P	2015	Ford	Focus	Sedan - Compact	6,295	12,000
G410379H	2009	Dodge	Grd Caravan	Minivan	25,874	5,614
G410391H	2009	Dodge	DAKOTA	Pickup	27,140	7,507
G410754M	2012	Dodge	Grd Caravan	Minivan	10,918	5,183
G410762M	2012	Dodge	Grd Caravan	Minivan	24,992	20,099
G410806P	2014	Dodge	Grd Caravan	Minivan	12,562	12,552
G411689L	2011	Ford	Ranger	Pickup	18,215	5,649
G411846K	2011	Dodge	Grd Caravan	Minivan	43,151	12,317
G412399K	2010	Dodge	Dakota	Pickup	32,811	10,754
G413297K	2011	Ford	Ranger	Pickup	18,013	5,368
G413300K	2011	Ford	Ranger	Pickup	39,239	15,644
G413301K	2011	Ford	Ranger	Pickup	21,645	7,306
G420216F	2008	Ford	E150	Van - Pass	16,356	2,189
G420644M	2012	Ford	E150	Van - Pass	42,887	22,209
G420667P	2014	Ford	F150	Pickup	6,576	9,600
G420671P	2014	Ford	F150	Pickup	7,688	7,678
G420883M	2012	Ford	E150	Van - Pass	42,763	16,827
G420898M	2012	Ford	E150	Van - Pass	36,465	16,246
G420911L	2012	Chevrolet	C1500	Pickup	20,898	7,978
G420915M	2012	Ford	F150	Pickup	16,287	7,072
G422985H	2010	Chevrolet	C1500	Pickup	63,594	20,146
G430310H	2009	Ford	E350	Van - Pass	55,280	7,232
G430323H	2009	Ford	E350	Van - Cargo	67,585	12,155
G430324H	2009	Ford	E350	Van - Cargo	32,035	5,969
G430326H	2009	Chevrolet	2500HD	Pickup	39,522	4,863
G431182M	2012	Chevrolet	CG3300	Van - Cargo	28,376	12,279
G431453G	2008	Chevrolet	G2300	Van - Pass	64,529	15,539
G431855P	2015	Ford	F350	Pickup	2,522	4,800
G432025K	2010	Ford	F250	Pickup	12,867	3,755
G434073F	2008	Chevrolet	G2300	Van - Pass	51,238	4,712
G434075P	2015	Ford	F250	Pickup	464	3,600
G610161H	2009	Dodge	Dakota	Pickup	46,893	14,979
G610174H	2009	Jeep	Liberty	SUV	38,149	8,683
G610594L	2011	Jeep	Patriot	SUV	26,107	10,657
G610879P	2014	Chevrolet	Equinox	SUV	4,434	4,232
G611508D	2008	Jeep	Liberty	SUV	31,152	1,051

Fleet Vehicle Id	Year	Make	Model	EPA Class	Odometer	Estimated Annual Miles
G611509D	2008	Jeep	Liberty	SUV	26,551	3,292
G612644P	2015	Jeep	Patriot	SUV	10	3,600
G620791H	2009	Ford	Expedition	SUV	45,614	9,273
G621583G	2008	Chevrolet E	K1500	Pickup	60,381	10,816
G624085L	2012	Dodge	1500	Pickup	17,386	10,608
G630163H	2009	Chevrolet	K2500HD	Pickup	57,812	9,018
G630934G	2008	Chevrolet	K3500	Pickup	49,385	7,502
G632765D	2007	Dodge	2500	Pickup	23,537	2,469
G632885L	2012	Chevrolet	K2500HD	Pickup	10,474	4,112
G632888L	2012	Chevrolet	K2500HD	Pickup	13,548	4,480

Figure 2 shows the distribution of the vehicle types monitored. It also compares the percent of vehicles monitored against the entire inventory of vehicles. As can be seen in Figure 2, this distribution is approximately representative of the full fleet.

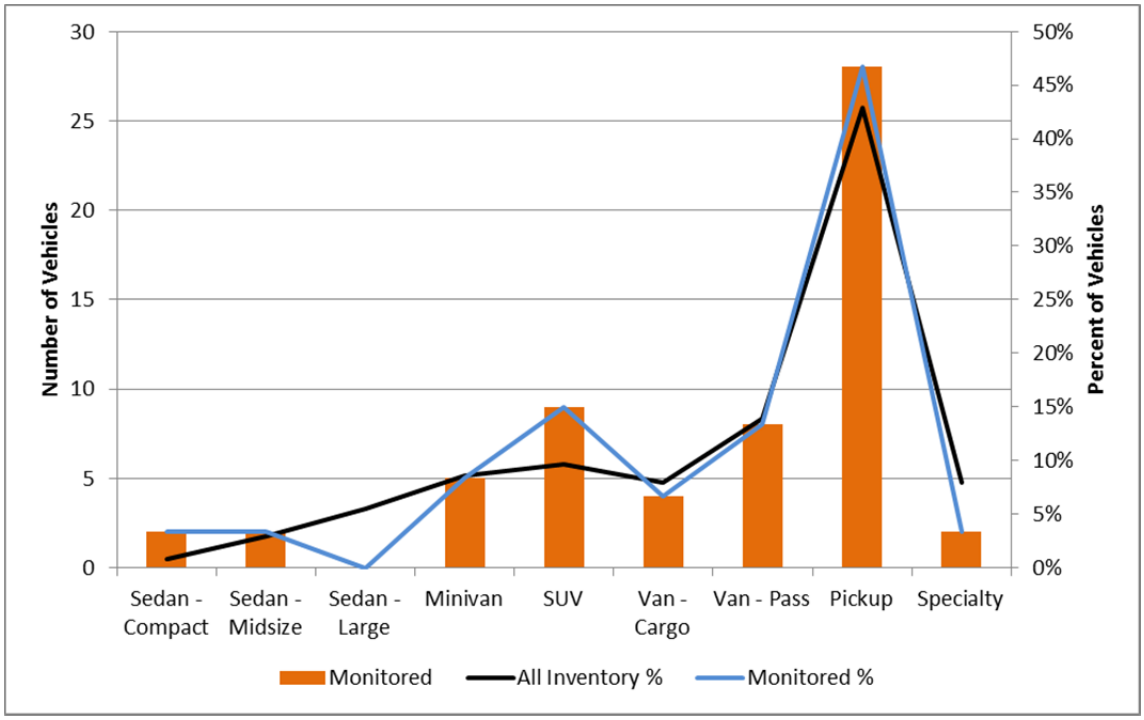

Figure 2. Vehicle type distribution for vehicles with data loggers.

Figure 3 provides the distributions for model year and compares them to the full inventory of vehicles. Again, the selected vehicles are representative of the full fleet.

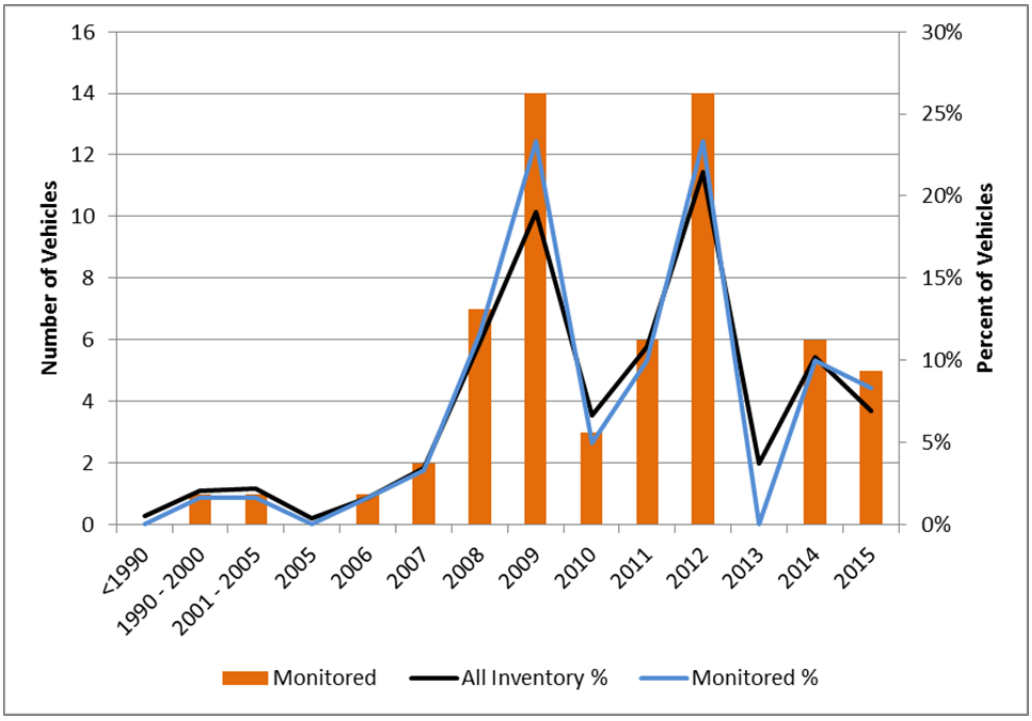

Figure 3. Model year distribution for vehicles with data loggers.

Figure 4 shows the monthly mileage of the monitored vehicles and compares it to the full inventory of vehicles. The characteristics of the monitored vehicles closely match the entire inventory.

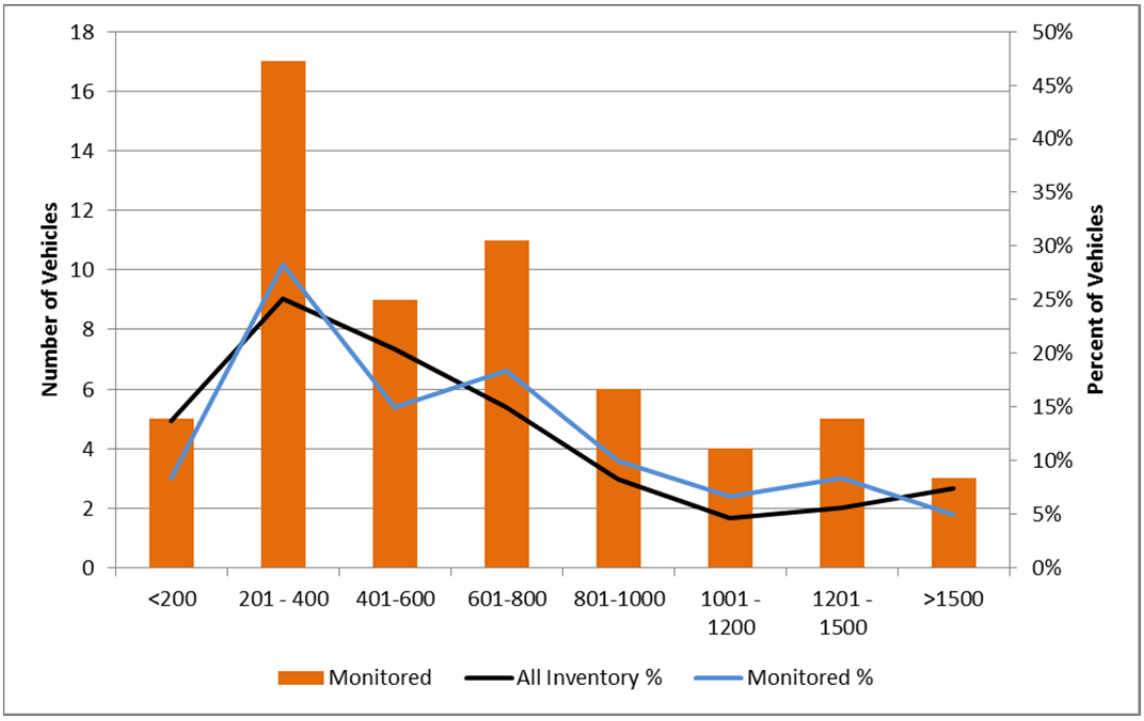

Figure 4. Monthly mileage of monitored vehicles.

Figure 5 identifies the mission of the selected vehicles compared to the mission of the full inventory.

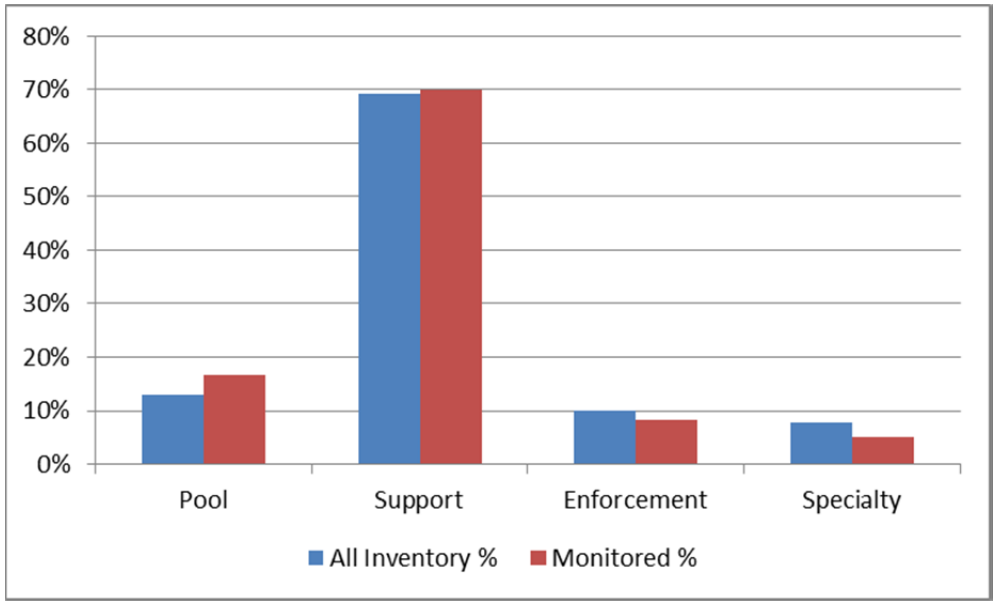

Figure 5. Vehicle mission.

Figure 6 presents the monthly mileage distribution of the vehicles selected for monitoring. If one assumes a battery range of 70 miles for a BEV and 21 working days per month, then a vehicle that consistently travels the same distance each day would have to travel greater than approximately 1,500 miles per month to exceed the battery's capacity. Fully 95% of the monitored vehicles average less than 1,500 miles per month in travel. This is nearly the same percentage as the entire fleet inventory. Therefore, barring charging constraints associated with the timing of daily mission activities, payload requirements, and range issues associated with off-base trips, a significant number of vehicles should be eligible for replacement by BEVs.

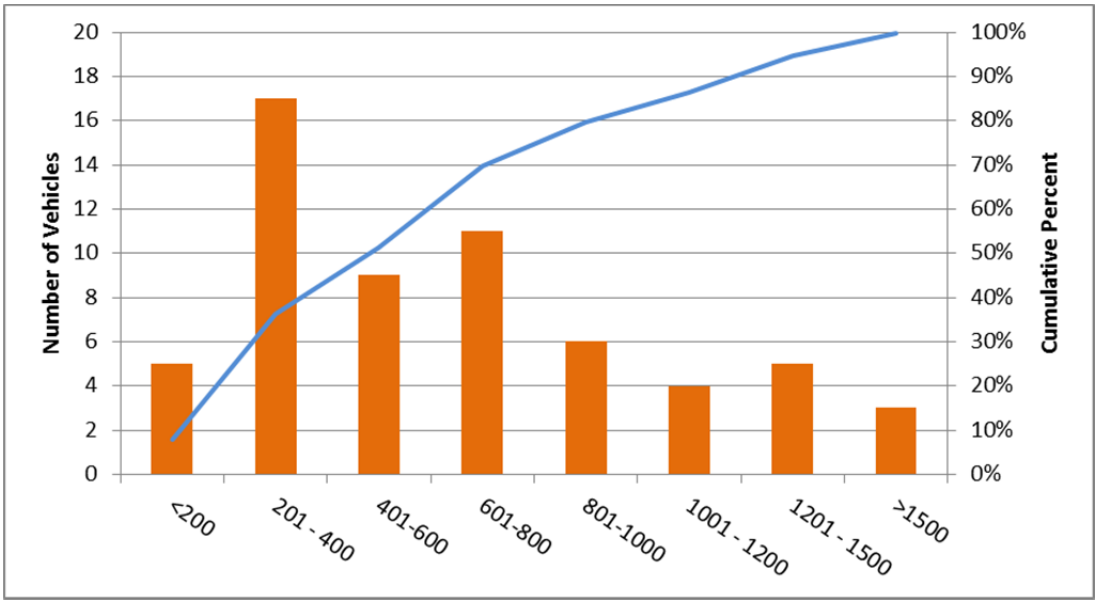

Figure 6. Monthly mileage distributions for monitored vehicles.

Finally, the Task 1 report identified the tenant commands and Marine Corps Installation East departments and divisions to which the vehicles are assigned. The monitored vehicles also represent a cross section of these tenant commands and Marine Corps Installation East departments (see Table 2).

Table 2. Monitored vehicles by assignment.

	Sedan Compact	Sedan Midsize	Sedan Large	Minivan	SUV	Van Cargo	Van Pass	Pickup	Specialty	Total
Tenant Commands	0	0	0	2	3	0	6	7	0	18
Marine Corps Installation East	2	2	0	3	6	4	2	21	2	42
Total	2	2	0	5	9	4	8	28	2	60

4. OBSERVATIONS

The 60-vehicle subset of the fleet inventory reflects the overall fleet inventory's characteristics. Data collection on these vehicles will commence and the results will be the focus of Task 3. The close match of the monitored vehicles to the full fleet allows extrapolation of data on the 60-vehicle subset to the full fleet.