

Electric Vehicle Preparedness: Task 2, Identification of Vehicles for Installation of Data Loggers for Naval Air Station Whidbey Island

Stephen Schey
Jim Francfort

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Electric Vehicle Preparedness: Task 2, Identification of Vehicles for Installation of Data Loggers for Naval Air Station Whidbey Island

**Stephen Schey
Jim Francfort²**

¹Stephen Schey, Project Manager, Infrastructure Planning and Analysis, Intertek Testing Services,
North America, Phoenix, AZ

²Jim Francfort, Vehicle Systems Principal Investigator, Idaho National Laboratory operated by
Battelle Energy Alliance, Idaho Falls, ID

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**Idaho National Laboratory
Idaho Falls, Idaho 83415**

<http://avt.inl.gov>

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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).

A survey of the inventory of non-tactical fleet vehicles at Naval Air Station Whidbey Island (NASWI) was completed in Task 1. This information and characterization were 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 NASWI and Intertek for further monitoring. This fulfills the Task 2 requirements.

Intertek acknowledges the support of Idaho National Laboratory, Naval Facilities Engineering Command Northwest, and the NASWI fleet managers and personnel for participation in this study.

Intertek is pleased to provide this report and is encouraged by enthusiasm and support from Naval Facilities Engineering Command 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 Naval Air Station Whidbey Island (NASWI) could convert part or all of their fleet of vehicles from petroleum-fueled vehicles to PEVs.

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

The NASWI non-tactical fleet contains 175 vehicles for which counterpart PEVs are currently available or which are expected to be available in the near future. Of the 175 vehicles, this report identifies a 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
NASWI	Naval Air Station Whidbey Island
PEV	plug-in electric vehicle (includes BEVs and PHEVs, but not hybrid electric vehicles)
PHEV	plug-in hybrid electric vehicle
SUV	sports utility vehicle

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1. INTRODUCTION

The U.S. Department of Energy and the U.S. Department of Defense signed a memorandum of understanding 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 memorandum of understanding 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 memorandum of understanding, the 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-base studies to identify potential transportation systems that are strong candidates for introduction or expansion of plug-in electric vehicles (PEVs). Intertek previously had 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 Naval Air Station Whidbey Island (NASWI) fleet vehicles with PEVs starts with characterization of the fleet vehicles' missions and vehicle characteristics. The assessment was presented in the Task 1 report titled, *Assessment of Fleet Inventory for Naval Air Station Whidbey Island*.

PEVs generally are classified into two vehicle types: battery electric vehicles (BEVs) and 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 also another motive power source (such as a gasoline engine). In general, PHEVs have two modes: (1) charge-depleting mode, where the battery provides all or most (depending on the PHEV design) of the motive power and the battery is being depleted, and (2) charge-sustaining mode, where the non-battery power source provides the majority of the motive power while being supplemented by the battery power. For charge-sustaining mode, the battery state of charge is maintained within a designed range. A BEV can be considered to operate solely in a 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 and vehicle identification number or 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, typically take less than 5 minutes and is completed by the fleet managers or designees. The data loggers transmit vehicle information by cellular means to a data center from which 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

3.1 All Vehicles

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

Table 1. Monitored vehicles at NASWI.

Fleet Vehicle Id	Year	Make	Model	EPA Class	Odometer	Estimated Annual Miles
G10-0984N	2008	Dodge	Avenger	Sedan - Compact	29,008	4,015
G10-1137M	2012	Chevrolet	Malibu	Sedan - Midsize	11,215	3,434
G10-1138M	2012	Chevrolet	Malibu	Sedan - Midsize	17,215	5,024

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

Fleet						Estimated
Vehicle Id	Year	Make	Model	EPA Class	Odometer	Annual Miles
G10-1139M	2012	Chevrolet	Malibu	Sedan - Midsize	16,019	5,200
G10-1140M	2012	Chevrolet	Malibu	Sedan - Midsize	9,185	2,756
G10-1141M	2011	Chevrolet	Malibu	Sedan - Midsize	24,026	7,061
G10-2844L	2011	Chevrolet	Malibu	Sedan - Midsize	53,998	12,943
G103590P	2015	Chevrolet	Malibu	Sedan - Midsize	1,215	9,708
G10-2848L	2011	Chevrolet	Malibu	Sedan - Midsize	50,134	12,118
G10-2850L	2011	Chevrolet	Malibu	Sedan - Midsize	51,272	12,371
G10-2968L	2011	Chevrolet	Malibu	Sedan - Midsize	48,057	11,509
G10-3576P	2015	Chevrolet	Malibu	Sedan - Midsize	1,720	9,000
G10-5286H	2009	Pontiac	G6	Sedan - Compact	31,548	5,103
G42-1940N	2014	Chevrolet	G1300	Van - Pass	7,464	7,464
G10-7547F	2008	Dodge	Avenger	Sedan - Compact	17,566	2,464
G61-0245G	2008	Ford	Escape	SUV	8,655	8,655
G11-0472L	2014	Chevrolet	Impala	Sedan - Large	84,620	1,712
G11-1424L	2012	Chevrolet	Impala	Sedan - Large	72,580	20,109
G11-2898K	2011	Chevrolet	Impala	Sedan - Large	170	20,230
G41-1136K	2010	Dodge	Grd Caravan SE	Minivan	68,516	13,004
G41-1137K	2010	Dodge	Grd Caravan SE	Minivan	9,309	1,783
G41-1139K	2010	Dodge	Grd Caravan SE	Minivan	54,551	10,781
G41-1140K	2010	Dodge	Grd Caravan SE	Minivan	9,773	1,635
G41-1142K	2010	Dodge	Grd Caravan SE	Minivan	36,101	7,011
G41-1155K	2010	Dodge	Grd Caravan SE	Minivan	23,361	4,995
G41-1349G	2008	Dodge	Dakota	Pickup	16,956	2,337
G41-1350G	2008	Dodge	Dakota	Pickup	7,238	926
G41-1351G	2008	Dodge	Dakota	Pickup	26,112	3,634
G41-1536L	2011	Dodge	Grd Caravan SE	Minivan	6,901	1,364
G41-1597L	2011	Dodge	Dakota	Pickup	16,980	4,065
G41-1763H	2009	Ford	Ranger	Pickup	13,857	2,246
G41-1765H	2009	Ford	Ranger	Pickup	19,085	3,073
G41-1767H	2009	Ford	Ranger	Pickup	19,354	3,072
G41-1768H	2009	Ford	Ranger	Pickup	11,571	1,896
G41-2911M	2012	Chevrolet	Colorado	Pickup	4,925	1,184
G41-3153P	2014	Dodge	Grd Caravan SE	Minivan	683	744
G41-3159P	2014	Dodge	Grd Caravan SE	Minivan	2,245	1,921
G41-4334M	2012	Chevrolet	Colorado	Pickup	11,782	672
G42-0334G	2008	Chevrolet	G1300	Van - Pass	51,997	7,170
G42-0335G	2008	Chevrolet	G1300	Van - Pass	44,318	5,759
G42-0587K	2010	Chevrolet	Silverado	Pickup	14,415	2,798
G42-0590K	2010	Chevrolet	Silverado	Pickup	21,557	4,206
G42-0656K	2010	Chevrolet	Silverado	Pickup	10,695	2,074
G42-0766L	2011	Chevrolet	Silverado	Pickup	11,582	2,766
G42-0881H	2009	Ford	F150	Pickup	50,830	8,243
G42-1222M	2012	Chevrolet	G1300 Express	Van - Pass	10,894	3,215
G42-1223M	2012	Chevrolet	G1300 Express	Van - Pass	3,179	988
G42-1232M	2012	Ford	F150	Pickup	4,892	1,479

Fleet						Estimated
Vehicle Id	Year	Make	Model	EPA Class	Odometer	Annual Miles
G42-1281M	2013	Ford	E-350	Van - Pass	28,079	12,725
G42-2035L	2012	Chevrolet	Tahoe	SUV	11,320	3,680
G43-0895K	2010	Ford	E-350	Van - Pass	24,610	4,842
G43-0896K	2010	Ford	E-350	Van - Pass	7,212	1,401
G43-0936K	2011	Chevrolet	C2500HD	Van - Cargo	9,996	2,307
G43-2287M	2012	Chevrolet	G2300	Van - Pass	4,896	1,441
G43-2288M	2012	Chevrolet	G2300 Express	Van - Pass	3,797	977
G43-3437B	2006	Ford	E-350	Van - Cargo	9,095	986
G61-0513K	2010	Ford	Explorer	SUV	38,881	7,229
G62-0203H	2009	Ford	F150	Van - Cargo	69,473	11,252
G62-0871K	2010	Ford	Expedition	SUV	101,291	18,874
G62-2420P	2014	Ford	FI50 SSV	Van - Cargo	15,980	4,752

Figure 2 shows the distribution of vehicle types monitored. It also compares the percent of vehicles monitored against the entire inventory of vehicles. This distribution is approximately representative of the fleet except for the cargo vans and minivans. The selection shifted the monitored vehicles toward a larger percentage of smaller vans, which are the more likely candidates for replacement by PEVs in the near future.

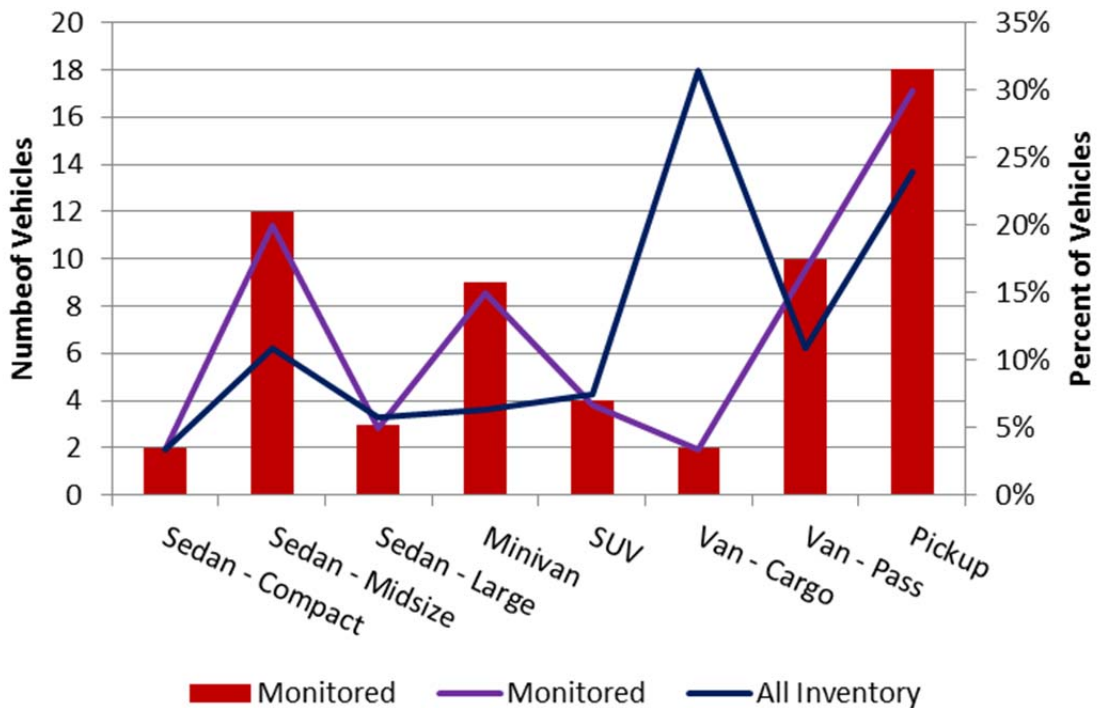


Figure 2. Vehicle type distribution for vehicles with data loggers.

Figure 3 provides distributions for model year and compares them to the full inventory of vehicles. The selected vehicles do not include many of the oldest vehicles, which are cargo vans and pickups, whose performances are better represented by newer models.

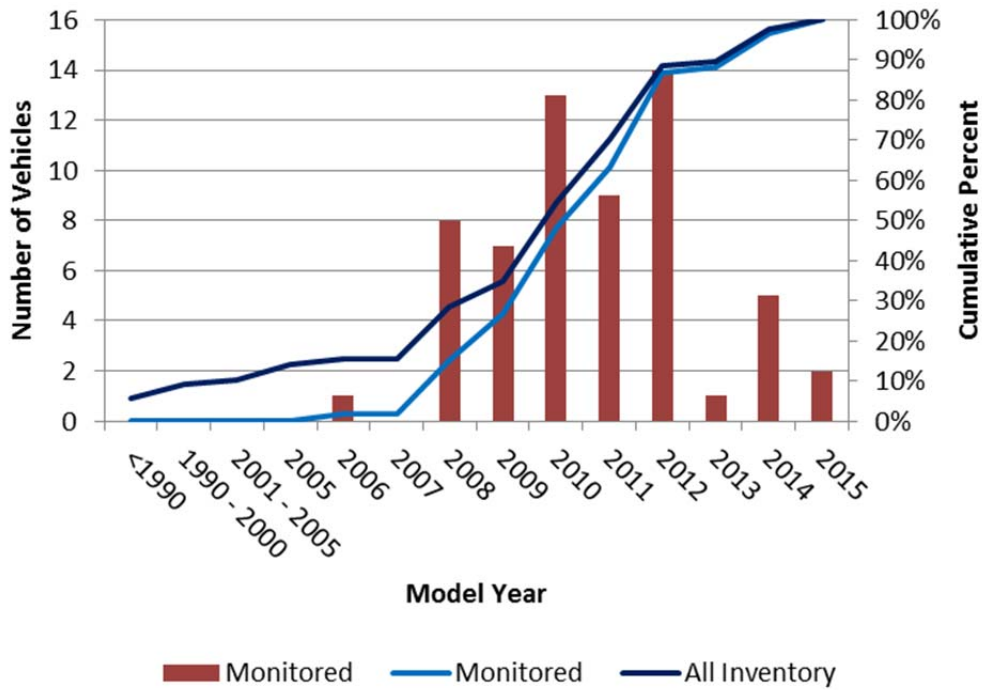


Figure 3. Model year distribution for vehicles with data loggers.

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

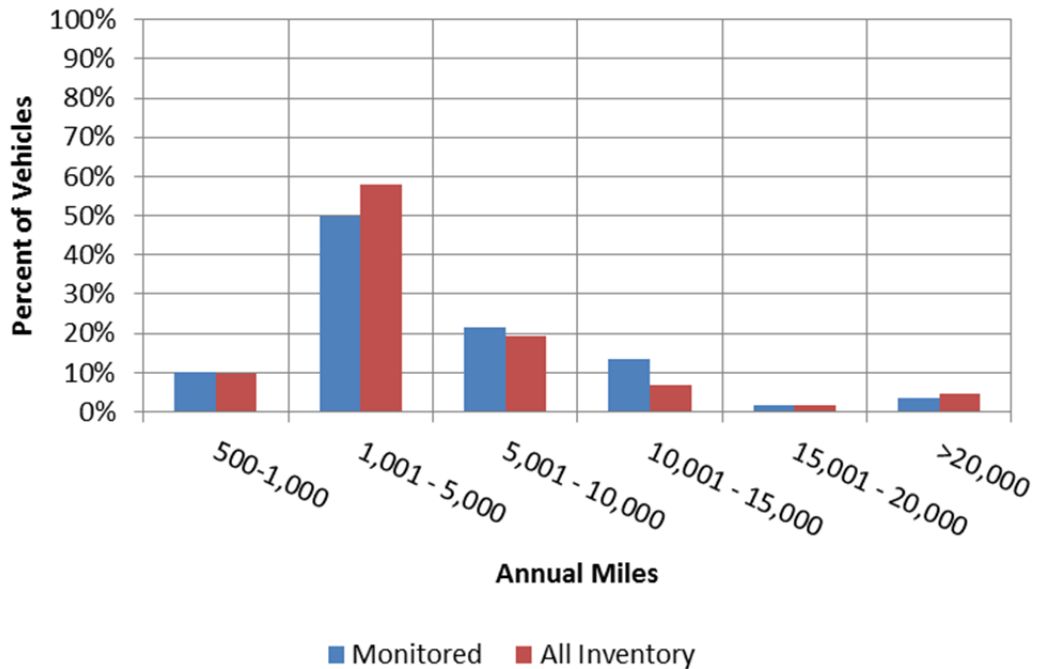


Figure 4. Annual mileage of monitored vehicles.

Figure 5 identifies the mission of the selected vehicles compared to the mission of the full inventory. The “transport” mission is typically used for heavier-duty vehicles, while cargo vans and pickups are more typically used in a “support” mission.

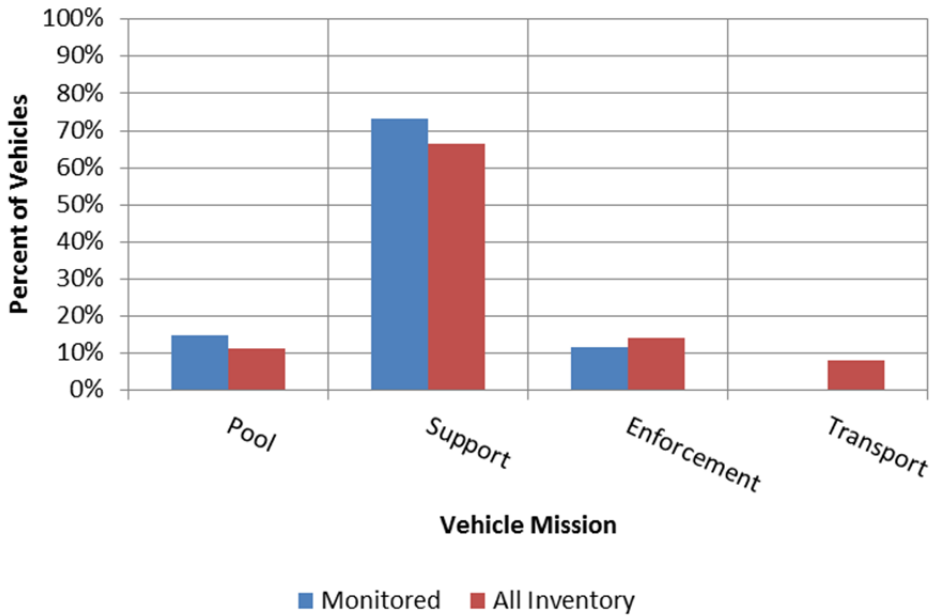


Figure 5. Vehicle mission.

Figure 6 presents the monthly mileage distribution of 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 batter capacity. Fully 95% of the monitored vehicles average less than 1,500 miles per month in travel. This is the same percentage as the entire fleet inventory. Therefore, barring charging constraints associated with the timing of daily mission activities, payload requirements, and the range issues associated with off-base trips, a significant number of vehicles should be eligible for replacement by BEVs.

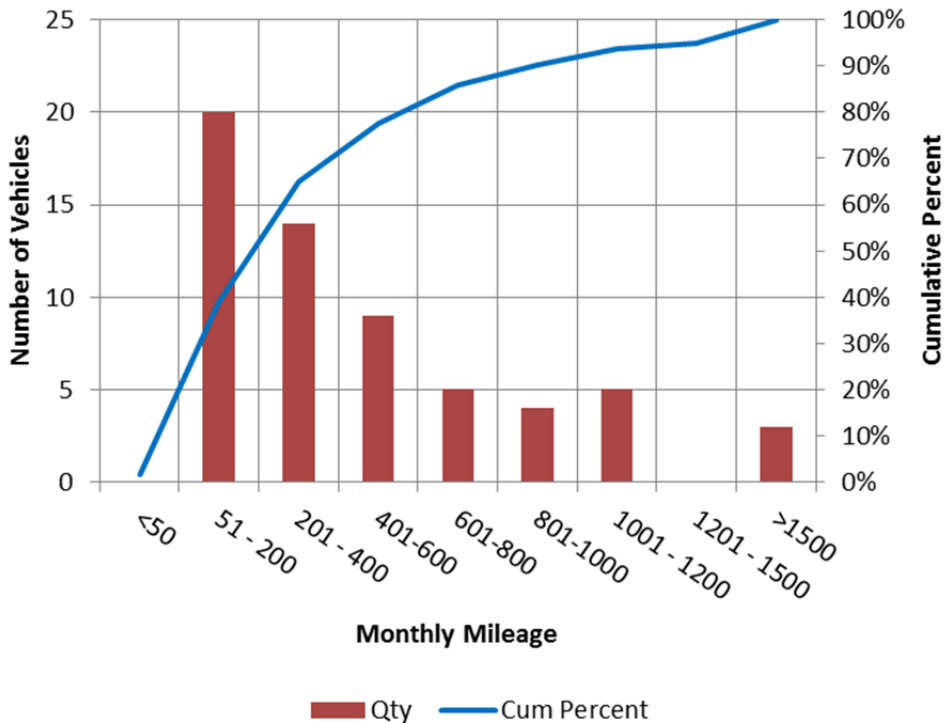


Figure 6. Monthly mileage distribution for monitored vehicles.

Finally, the Task 1 report identified the 25 tenant commands (i.e., commands) and Naval Air Station departments and divisions (i.e., departments) to which the vehicles are assigned. The monitored vehicles also represent a cross section of these commands and departments (Table 2). For sedans, 68% of the monitored vehicles are assigned to departments compared to 61% of all vehicles.

Table 2. Monitored vehicles by assignment.

	Sedan - Compact	Sedan - Midsize	Sedan - Large	Minivan	SUV	Van Cargo	Van Pass	Pickup	Total
Commands	–	4	–	6	1	1	1	5	18
Departments	2	8	3	3	3	1	9	13	42
Total	2	12	3	9	4	2	10	18	60

3.2 Sedans Only

The list of vehicles for monitoring contains 17 sedans. As identified in the Task 1 report, these sedans are reviewed separately because, at the time of this writing, only sedan-type vehicles populate the General Services Administration list for PEVs.

Figure 2 shows the comparison of sedan types between those selected for monitoring and the whole sedan fleet. The model year comparison of selected sedans to the full sedan inventory is shown in Figure 7. Figure 8 shows the comparison of monthly mileage and Figure 9 shows the comparison of mission.

The vehicles selected for monitoring are slightly older than the full inventory of sedans. This will support replacement of vehicles in the near future as part of the implementation approach to be presented in Task 4.

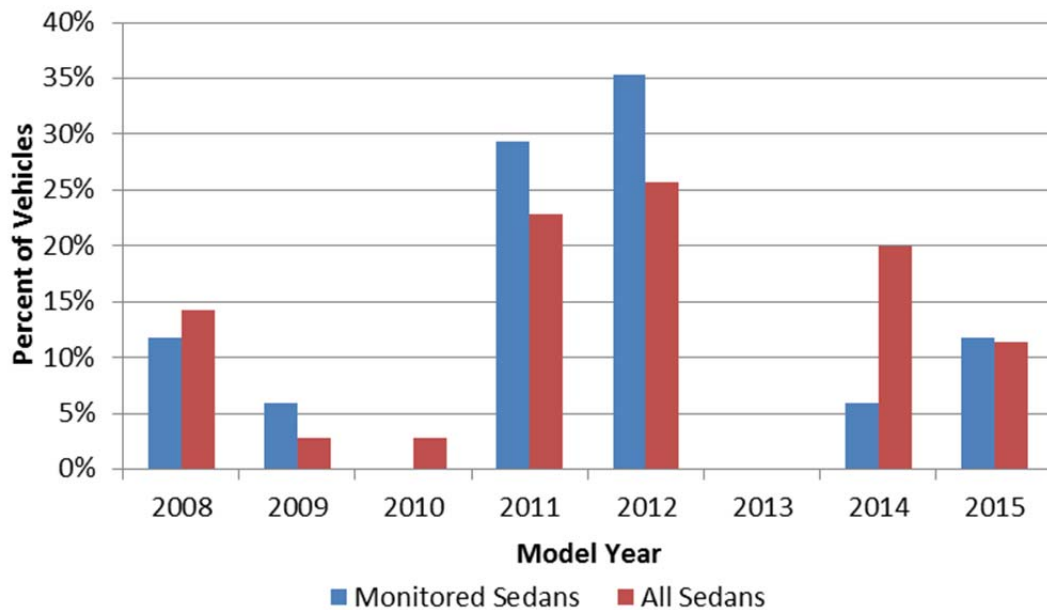


Figure 7. Model year of monitored sedans.

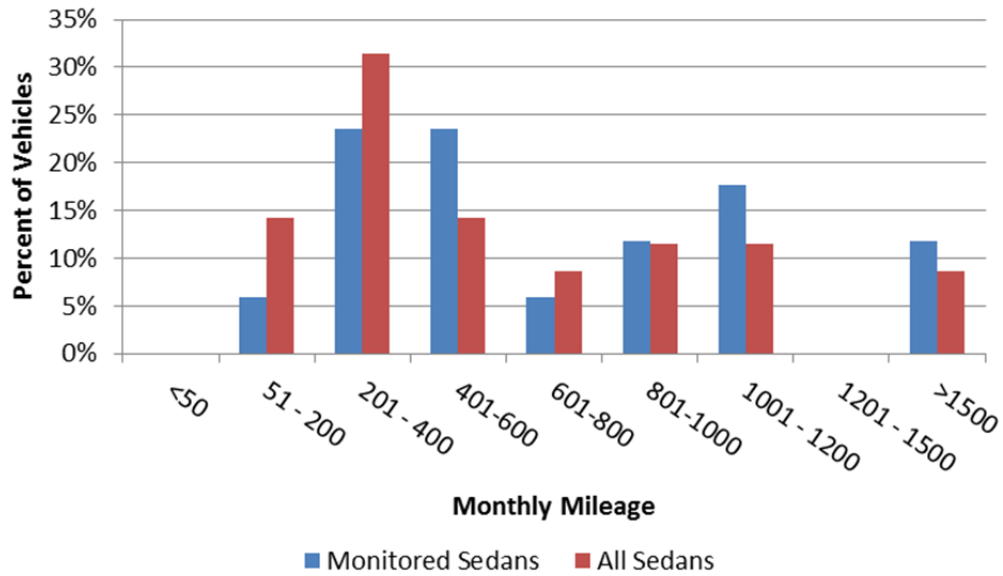


Figure 8. Monthly mileage of monitored sedans.

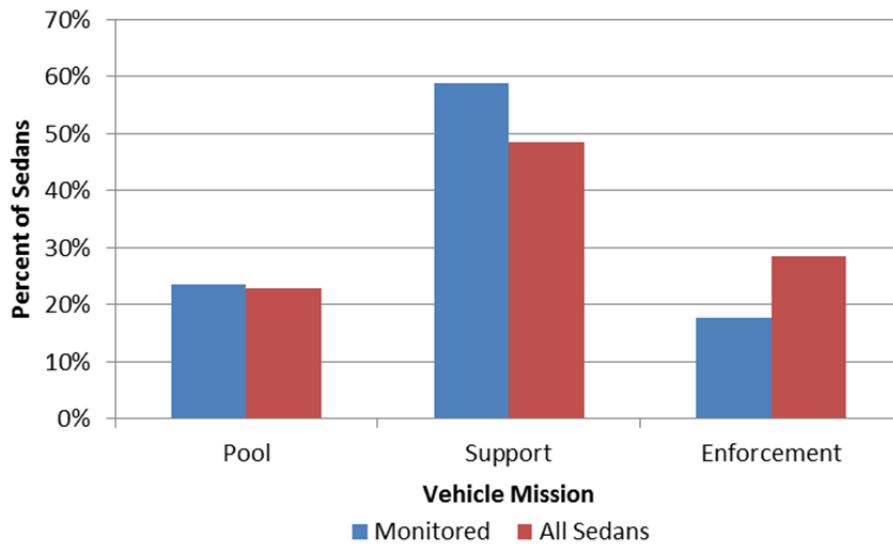


Figure 9. Mission assignment of monitored sedans.

Selection of the sedans to be monitored closely matches that of the full sedan fleet in both the monthly mileage and in mission assignments.

4. OBSERVATIONS

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