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VEHICLE TECHNOLOGIES PROGRAM

Electric Vehicle Preparedness

Task 1: Assessment of Data and Survey Results for NAS Jacksonville and NS Mayport

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Prepared for:

NAS Jacksonville and NS Mayport

Prepared by:

Idaho National Laboratory and ECOtality North America

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Electric Vehicle Preparedness
Task 1: Assessment of Data and Survey Results for NAS Jacksonville and NS Mayport

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ACRONYMS

BEV	battery electric vehicle
E85	ethanol fuel blend of up to 85% denatured ethanol fuel and gasoline or other hydrocarbon by volume
GVW	gross vehicle weight
LSV	low speed vehicle
NAS	Naval Air Station
NS	Naval Station
PEV	plug-in electric vehicle
PHEV	plug-in hybrid electric 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 the purpose of strengthening the coordination of efforts to enhance national energy security and to demonstrate federal government leadership in transitioning America 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 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 ECOtality North America to conduct several U.S. Department of Defense base studies to identify potential U.S. Department of Defense transportation systems that are strong candidates for introduction or expansion of electric drive vehicles. ECOtality previously has conducted similar fleet, city, state, and country-wide studies using their Micro-climate assessment process, which consists of the following four main tasks:

- Task 1: Conduct a fleet and infrastructure assessment
- Task 2: Develop target electrification vehicles
- Task 3: Perform a detailed assessment of target electrification vehicles and charging infrastructure
- Task 4: Perform economic analysis of target electrification.

This report details the potential for replacing fleet vehicles at Naval Air Station (NAS) Jacksonville and Naval Station (NS) Mayport (Florida) with plug-in electric vehicles (PEV), and starts with assessment of the current fleet vehicles' missions and vehicle characteristics. This assessment was conducted by combining previous survey data with General Service Administration data. This Task 1 report provides a summary and assessment of General Service Administration data and survey results.

Fleet vehicles were inventoried according to mission characteristics such as daily miles travelled, payload, and number of personnel transported per day. In addition, an assessment was made of the facility infrastructure, including the location of distribution feeders and proximity to fleet parking areas. While the facility infrastructure assessment will be provided as part of Task 3, the balance of the Task 1 effort is reported here. The recommendations of this Task 1 report will result in development of target electrification vehicles for Task 2 and installation of data loggers to confirm their selection as part of Task 3.

PEVs are generally classified into two vehicle types: (1) battery electric vehicles (BEVs), which have all motive power provided by an onboard battery, and (2) plug-in hybrid electric vehicles (PHEVs), which provide some of the motive power by an onboard battery that is supplemented by another power source (such as a gasoline engine or generator). Collectively, BEVs and PHEVs are known as PEVs. Hybrid electric vehicles are similar to PHEVs, except they cannot be powered by an external electrical power source.

Section 1.1 lists PEVs that currently are or planned to be made available by manufacturers and can be incorporated into base fleets in the future. Section 1.2 provides a summary of Sections 2 and 3.Section 2 provides a detailed summary of fleet characteristics. Section 3 presents a detailed analysis of vehicle

operational characteristics. These characteristics provide general information on which types of vehicles at the bases will be likely candidates for replacement by PEVs.

1.1 Available Vehicles

Vehicles that potentially can be utilized for replacing current base vehicles are shown in Tables 1 through 4. Tables 1 and 2 present lists of cars that are either PHEVs or BEVs currently available or announced by manufacturers to be available in the near future.

Tables 3 and 4 present analogous lists for trucks and vans. We note that sport utility vehicles will be grouped with and referred to as 'trucks" in this report. As can be seen in the tables, a variety of PEV cars of various types will be available in the next few years. Although PEV trucks and vans have been slower to reach commercialization, the number of these types of PEVs is growing fairly rapidly.

Table 1. Plug-in hybrid electric vehicle cars currently available or planned to be available.

Make	Model	Estimated Date for Commercialization
Audi	A3 eTron PHEV	2014
BMW	ActiveHybrid 5	2013
BMW	3 series Hybrid	2013
BMW	i8	2014
BYD	F3DM	
Cadillac	ELR	2014
Chevrolet	Cruze PHEV	2014
Chevrolet	Volt	2011
Daimler	BlueZero PHEV	
Fisker	Karma	2011
Fisker	Surf	2013
Fisker	Atlantic	2015
Ford	C-Max Energi	2012
Ford	Fusion Energi	2013
Honda	Accord PHEV	2013
Hyundai	Sonata PHEV	2013
Jaguar	XJ	2013
Mercedes	B-Class PHEV	2014
Mercedes	S-Class Plug-in Hybrid	2012
Toyota	Prius PHEV	2012
Volkswagen	Golf	2012
Volkswagen	XL1	2013
Volvo	V60 Plug-in	2012

Table 2. Battery electric vehicle cars currently available or planned to be available.

Make	Model	Estimated Date for Commercialization
Audi	e-tron	2012
BMW	i3 (Megacity)	2013

Make	Model	Estimated Date for Commercialization
BMW	I3	2013
Chevrolet	Spark	2013
Coda	Automotive Sedan	2012
Ford	Focus electric	2012
Honda	Fit EV	2013
Infiniti	ZEV	2014
Kia	Soul EV	2015
Mazda	2 (US)	2018
Mercedes	SLS E-Cell AMG	2013
Mercedes	B-Class E-Cell	2014
Mitsubishi	i	2012
Nissan	LEAF	2011
Nissan	ESFLOW	2013
PG	Elektrus	2012
Scion	IQ EV	2013
smart	ED	
Tesla	Model S	2012
Tesla	Model X	2014
Tesla	EV	2016
Toyota	FT-EV (Scion iQ)	2012
Volkswagen	E-up	2012
Volkswagen	Golf Blue-e-Motion	2014
Volvo	C30 Electric	2012

Table 3. Plug-in hybrid electric vehicle trucks and vans currently available or planned to be available.

Make	Model	Estimated Date for Commercialization
Bright Automotive	IDEA Plug-in Hybrid	2012
Ford	Escape Plug-in Hybrid	2012
Land Rover	Range Rover Sport	2014
Mitsubishi	Outlander PHEV	2013
Via	VR300	2013

Table 4. Battery electric vehicle trucks and vans currently available or planned to be available.

Make	Model	Estimated Date for Commercialization
Ford	Transit Connect	
Mitsubishi	Outlander EV	2013
Nissan	eNV200	2013
Toyota	RAV4 EV	2012

1.2 Summary of Sections 2 and 3

A variety of different types of data are presented in Sections 2 and 3. This section summarizes Sections 2 and 3 to give an overview of the implications for replacement of vehicles by PEVs. The following summarizes the major points:

- Pickup trucks make up about 35% of vehicles at both bases; therefore, they are very important in large-scale replacement of base vehicles with PEVs considerations.
- Vans and sedans make up over 30% of vehicles at each base; therefore, they also comprise a significant percentage of vehicles.
- Gasoline, diesel, and E85-powered vehicles comprise around 80 to 85% of vehicles at the bases; therefore, a large percentage of the vehicles potentially can be replaced by PEVs.
- Around 50% of the vehicles at the bases have a model year earlier than 2007; therefore, there are many older vehicles that potentially could be replaced in the near future at the bases.
- Around 90% of the vehicles travel less than 10,000 miles per year; therefore, based on average driving distance, battery range generally should not be a concern for most vehicles at the bases.
- Larger vans used in passenger transportation generally support a large number of personnel. Having sufficient time for charging may be an issue for these vehicles.
- Smaller pickup trucks at NAS Jacksonville and medium-sized pickup trucks at NS Mayport transport a surprisingly high number of personnel each day, which correlates with the large number of daily trips made by these vehicles. Having sufficient time for charging may be an issue for these vehicles.
- Large pickup trucks at NAS Jacksonville also make a high number of trips per day, which again raises the issue of having sufficient time for charging.
- The majority of vehicles at both bases make trips off-base and after hours, which may raise the percentage of PHEV versus BEVs in the final evaluation.

Next, we summarize the data that is disaggregated by mission type and vehicle size (Table 5). This categorization scheme is defined in detail in Section 2. The data are simply presented in this section and can be used as a reference with the bullet points; however, that data is described in greater detail in Sections 2 and 3.

Table 5. Categorization of vehicles for presentation of survey results.

Mission Type	Vehicle Type	Category ID	Color
Pool	Sedans, vans, and trucks (GVW ≤6,000 lb)	P1	
	Trucks and vans (GVW >6,000 lb)	P2	
Support	Sedans, vans, and Trucks (GVW ≤6,000 lb)	S1	
	Trucks and vans (GVW >6,000 but ≤8,600 lb)	S2	
	Trucks and vans (GVW >8,600 lb)	S3	
Transport	All sedans, vans, and trucks	T	

Figure 1 presents the summary of data for NAS Jacksonville. The colors of the outlines for each bar correspond to the categories in Table 5. The vertical blank spaces within each bar represent specific percentiles (0, 0.2, 0.4, 0.6, 0.8, and 1) for the distribution of vehicles for each data type. Note that the lines for S2 for Annual Distance Driven for 0.4 and 0.6 overlap and are represented by a single line. This is due to the high number of vehicles that have an Annual Distance Driven of 3,000 miles. The bars for the Number of Personnel also are cut off, because there are some very high outliers in the data.

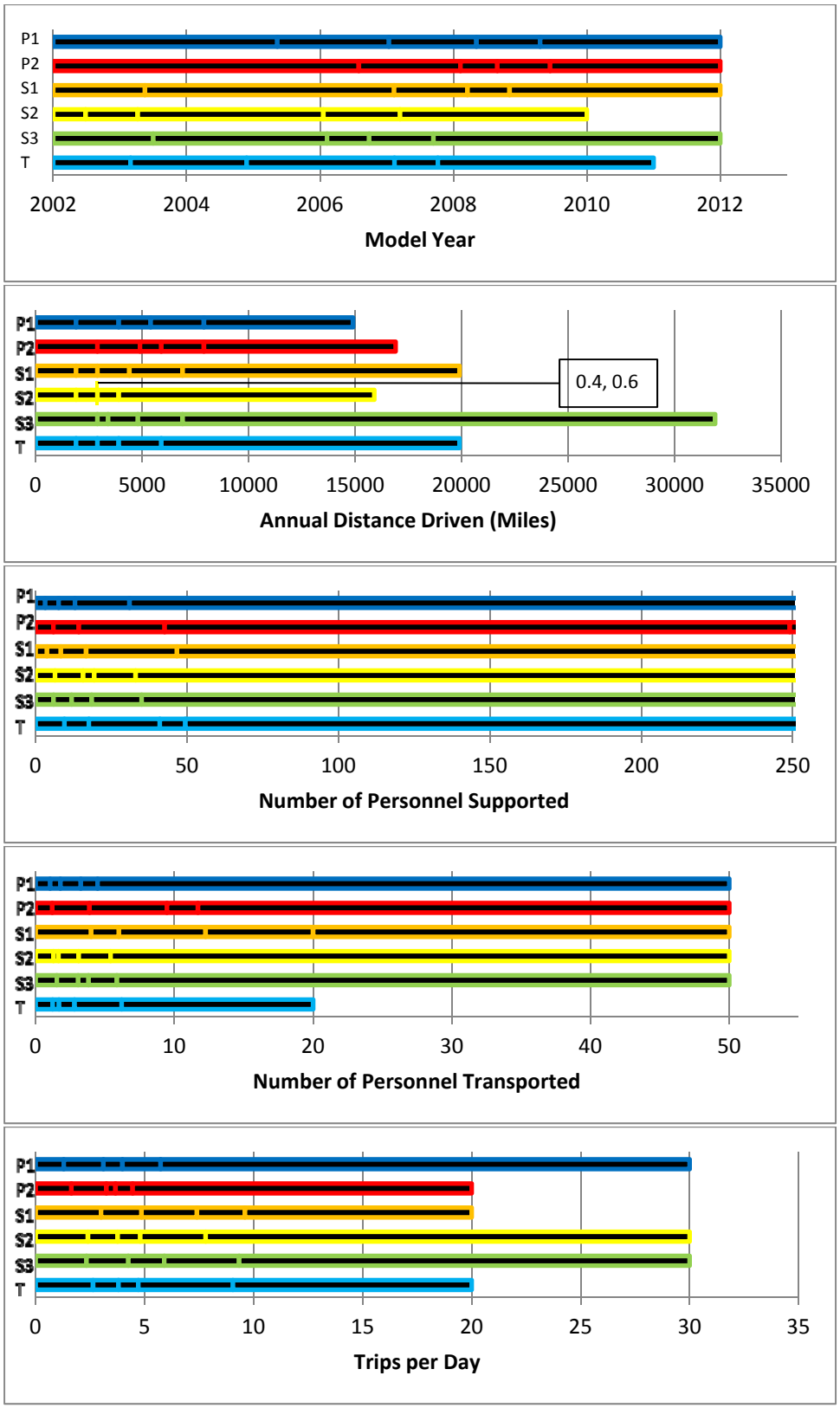

Figure 1. Summary of disaggregated data (NAS Jacksonville).

Figure 2 presents the summary of data for NS Mayport. Note that some lines for Annual Distance Driven and Number of Personnel Supported have overlaps. The bars for the Number of Personnel also are cutoff, because there are some very high outliers in the data.

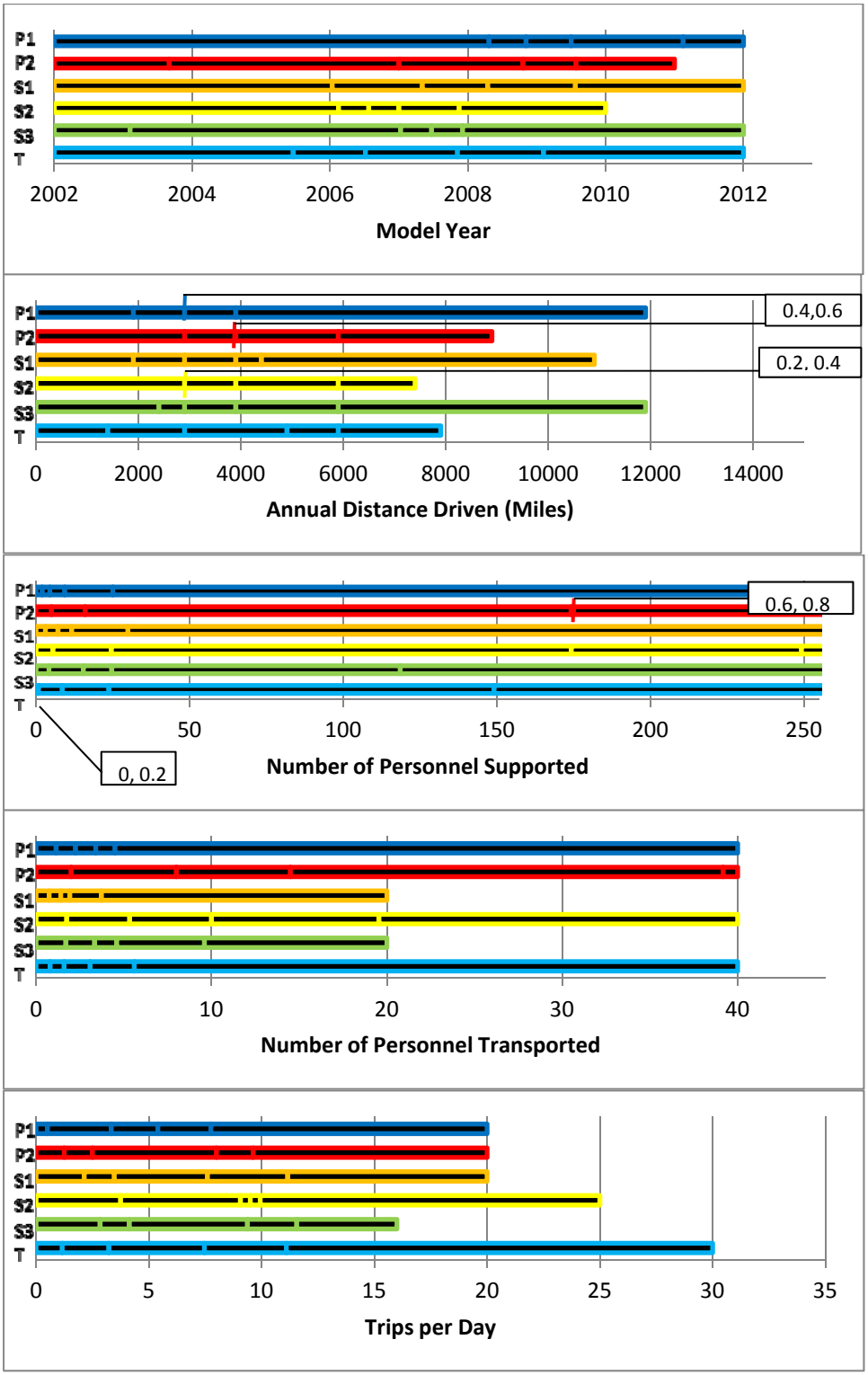

Figure 2. Summary of disaggregated data (NS Mayport).

2. FLEET CHARACTERISTICS

2.1 Vehicle and Fuel Type

Various vehicle types are included in the base fleets. Table 6 provides examples of makes and models included in the base fleets as a reference for these vehicle types. Low-speed vehicles (LSV) generally travel at maximum speeds of 45 mph or less. Stake trucks have stake beds, whereas pickup trucks have fixed sidewalls and a tailgate. Other trucks generally are medium and heavy-duty trucks, which do not qualify as being part of another category.

Table 6. Examples of vehicle types.

Vehicle Type	Make and Model	Example Photo
Bus	Bluebird SBCV	
LSV	Vantage EVR1000	
Sedan	Dodge Stratus	
Pickup truck	Chevrolet Colorado	
Stake truck	Ford F550	
Van	Chevrolet Express	
Sport utility vehicle	Chevrolet Blazer	
Other truck	Freightliner M2112	

The fleet under consideration in this report at NAS Jacksonville consists of 439 vehicles, with a vehicle type distribution as shown in Figure 3. The fleet at NS Mayport consists of 355 vehicles, with a vehicle type distribution as shown in Figure 4. The vehicle distribution data are based directly on General Services Administration vehicle information. There are a fair number of sedans at the bases as well; therefore, there should be immediate potential for replacing some of the fleet with PEVs. As larger PEVs (such as pickup trucks and vans) become increasingly available in the coming years, the majority of the fleet will become replaceable by PEVs. It should be noted that LSVs are predominantly electric; therefore, they would not need PEV replacements.

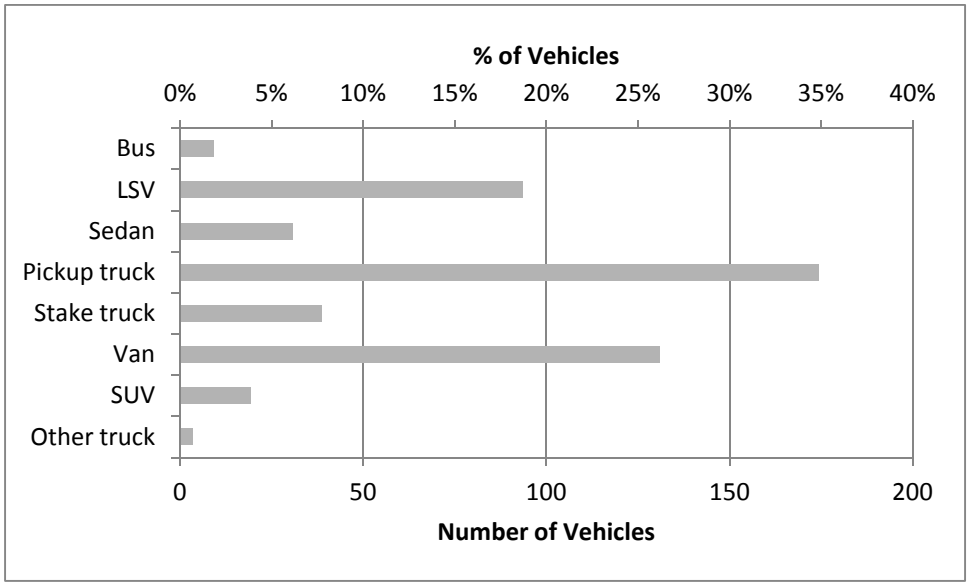

Figure 3. Vehicle-type distribution for all vehicles (NAS Jacksonville).

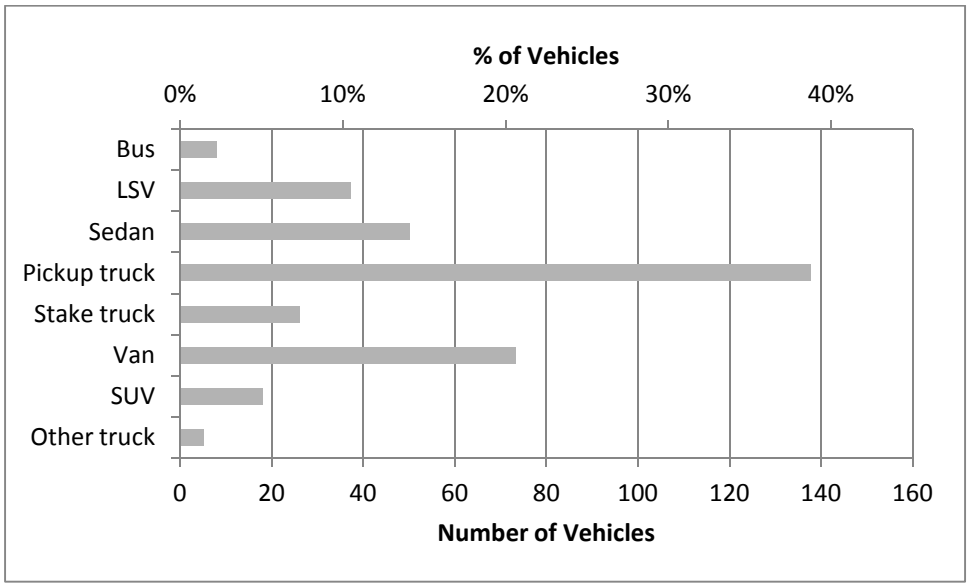

Figure 4. Vehicle-type distribution for all vehicles (NS Mayport).

As can be seen in the fuel-type distributions in Figures 5 and 6, gasoline-powered vehicles (including a significant number of E85 vehicles) comprise the majority of vehicles. In particular, cars and smaller trucks predominantly are powered by gasoline. These vehicle types make up the majority of the fleet and

are likely candidates for replacement by PEVs, because auto manufacturers have focused on providing PEVs of these sizes to date. Diesel-powered vehicles also make up a sizeable fraction of the fleet, because diesel is the predominant fuel used in large vehicles. Medium-duty trucks are rapidly becoming more likely candidates for replacement by PEVs, because manufacturers plan to provide more vehicles of this size in the coming years. This will be important to reducing fuel consumption, because larger vehicles generally have lower fuel economy. Electric-drive, medium-duty trucks also are being piloted at military installations as part of test programs for storage of energy that can be transmitted back to the electric grid. These vehicle-to-grid projects favor medium-duty trucks because the battery size is typically larger and provides more energy transfer capabilities. As previously mentioned, LSVs are predominantly electric, causing a significant percentage of the current fleets to be powered by electricity.

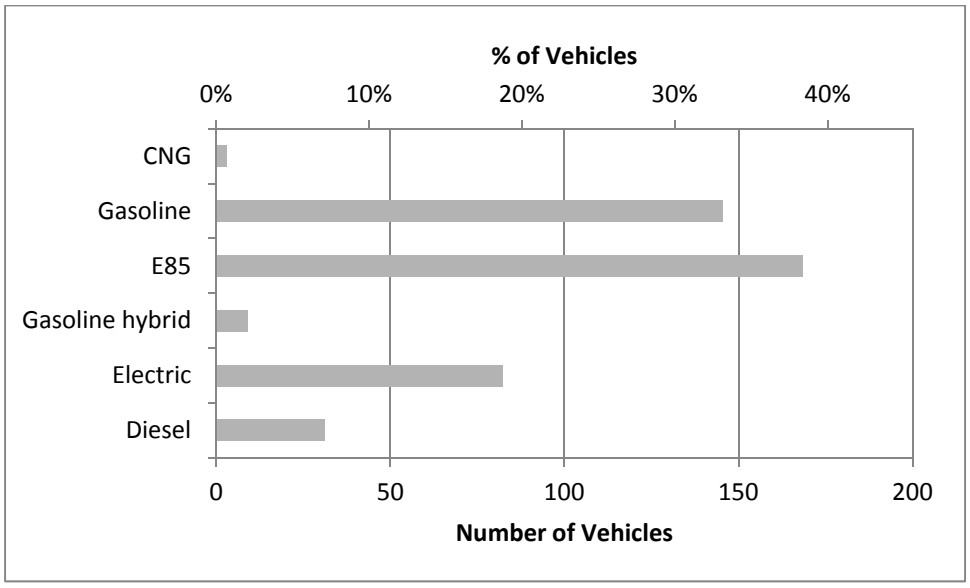

Figure 5. Fuel-type distribution for all vehicles (NAS Jacksonville).

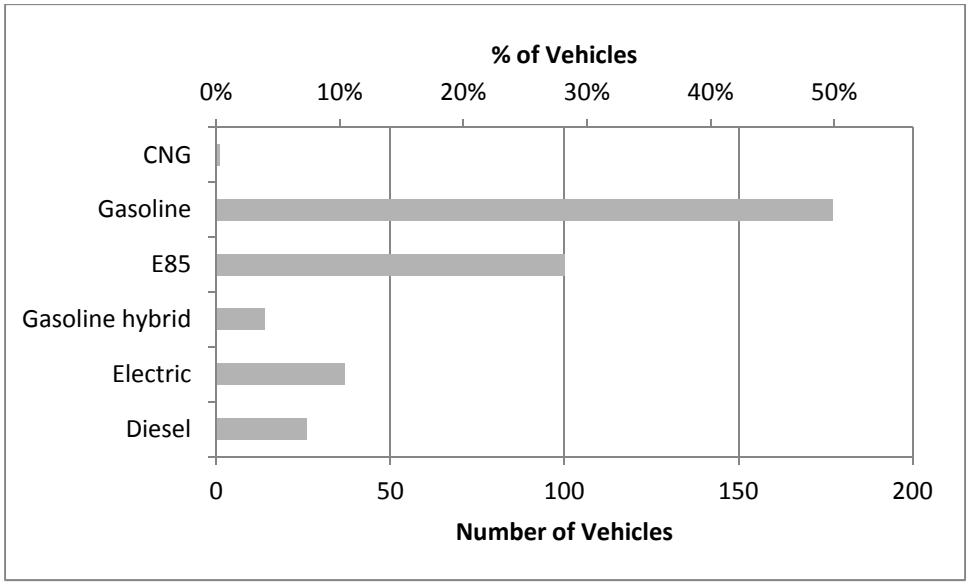

Figure 6. Fuel-type distribution for all vehicles (NS Mayport).

2.2 Vehicle Mission and Size

Survey information is available for 374 vehicles at NAS Jacksonville and 324 vehicles at NS Mayport. In order to conduct an assessment of the survey results, the vehicles have been categorized by mission type and size. Vehicles are categorized by seven mission types (Table 7) based on survey responses regarding vehicle usage.

Table 7. Mission type definitions.

Mission Type	Distribution
Shuttle/Buses	These vehicles are designed to carry large numbers of passengers, typically have an assigned driver, and follow a planned route.
Enforcement Vehicles	These light-duty motor vehicles are specifically approved in an agency's appropriation act for use in apprehension, surveillance, police, or other law enforcement work. This also includes site security vehicles.
LSV	These vehicles are legally limited to roads with posted speed limits up to 45 miles per hour and have a limited load carrying capability.
Pool Vehicles	These are vehicles that are general purpose in nature and available for many potential users. Vehicles are generally passenger cars, passenger vans, or light-duty pickup vehicles and typically carry 10 passengers or less.
Specialty Vehicles	These vehicles are designed to accommodate a specific purpose or mission (such as ambulances, mobile cranes, or handicap controls).
Support Vehicles	These vehicles are assigned to a specific work functional group to support the mission of that group. Vehicles generally are passenger or light-duty pickup vehicles and may contain after-market modifications to support the mission.
Transport Vehicles	These are light to medium or heavy-duty trucks used to transport an operator and tools or equipment of a non-specific design or nature. The vehicles frequently are used for repair, maintenance, or delivery.

The mission-type distributions are shown in Figures 7 and 8. As can be seen in the figures, support vehicles comprise the largest fraction of vehicles, followed by pool vehicles. LSVs and transport vehicles also comprise significant percentages of vehicles. LSV, pool, and transport vehicles tend to be the most easily replaced by PEVs, because they have fewer mission-specific requirements. However, most LSV vehicles on base are already PEVs. The remainder of this report will focus on pool, transport, and support vehicles, because vehicles with other missions (e.g., enforcement and specialty vehicles that deal with emergency situations) are less likely to be replaced by PEVs.

After determination of vehicle mission, vehicles are categorized by size in accordance with the categories shown in Table 8. Gross vehicle weight (GVW) is used to represent vehicles size. In subsequent sections of this report, the categories in Table 8 are used in several figures to present survey results. This categorization scheme was selected, because it splits the vehicles to allow for a disaggregated assessment, while maintaining a fairly consistent number of vehicles per category. As can be seen, pool vehicles are divided between two sizes, support vehicles into three sizes, and transport vehicles are represented by a single category.

The GVW distributions are shown for trucks and vans in Figures 9 and 10 to provide a summary of the vehicle sizes. These figures show that approximately 37% of the trucks and vans at NAS Jacksonville and 40% at NS Mayport are less than 6,000 lb. Approximately 19% of the trucks and vans at NAS

Jacksonville and 33% at NS Mayport are between 6,000 and 8,600 lb. This would indicate that, based on size, many trucks and vans should be eligible for replacement by PEVs. Around 36% of trucks and vans at NAS Jacksonville and 28% at NS Mayport have a GVW of between 8,600 and 10,000 lb; therefore, there also are many medium-duty trucks and vans. Trucks and vans in this weight range are more difficult to replace with PEVs due to their size requirements; however, increasing numbers of PEVs of this size are coming to the marketplace (see Section 1). In general, the GVW distribution does not indicate that vehicle size should be a significant hindrance to utilizing PEVs for trucks and vans in the future.

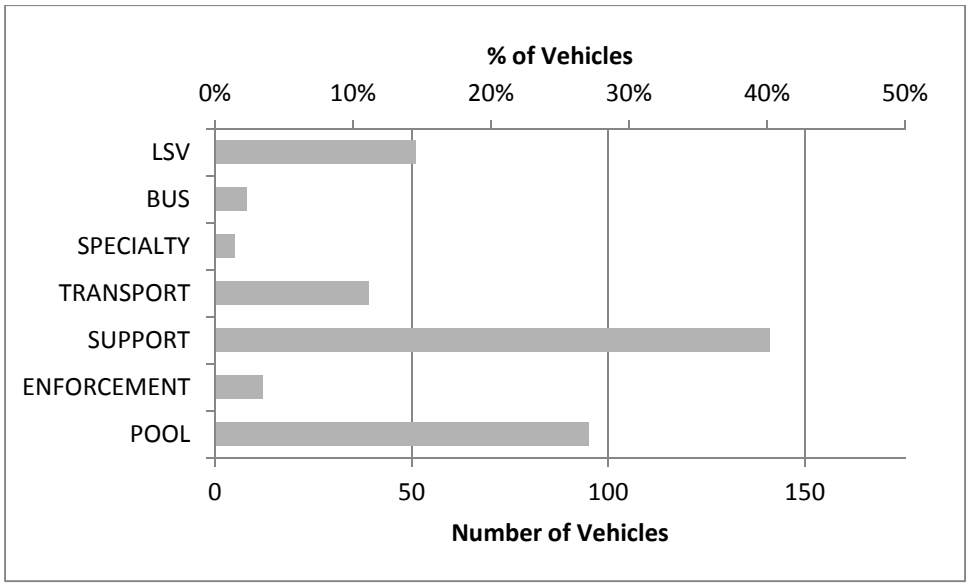

Figure 7. Mission type for all vehicles (NAS Jacksonville).

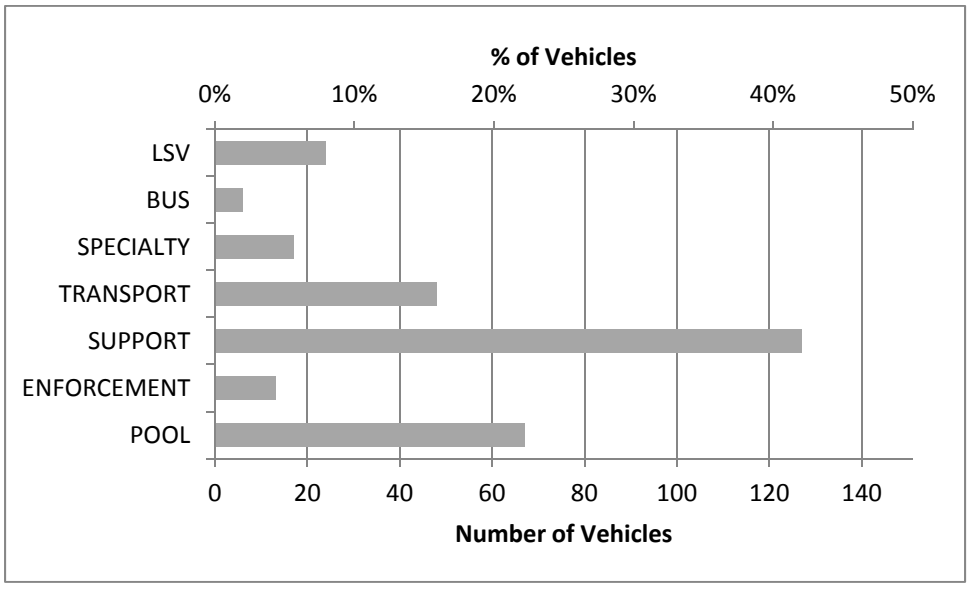

Figure 8. Mission type for all vehicles (NS Mayport).

Table 8. Categorization of vehicles for presentation of survey results.

Mission Type	Vehicle Type	Category ID	Color
Pool	Sedans, vans, and trucks (GVW ≤6,000 lb)	P1	
	Trucks and vans (GVW >6,000 lb)	P2	
Support	Sedans, vans, and trucks (GVW ≤6,000 lb)	S1	
	Trucks and vans (GVW >6,000 but ≤8,600 lb)	S2	
	Trucks and vans (GVW >8,600 lb)	S3	
Transport	All sedans, vans, and trucks	T	

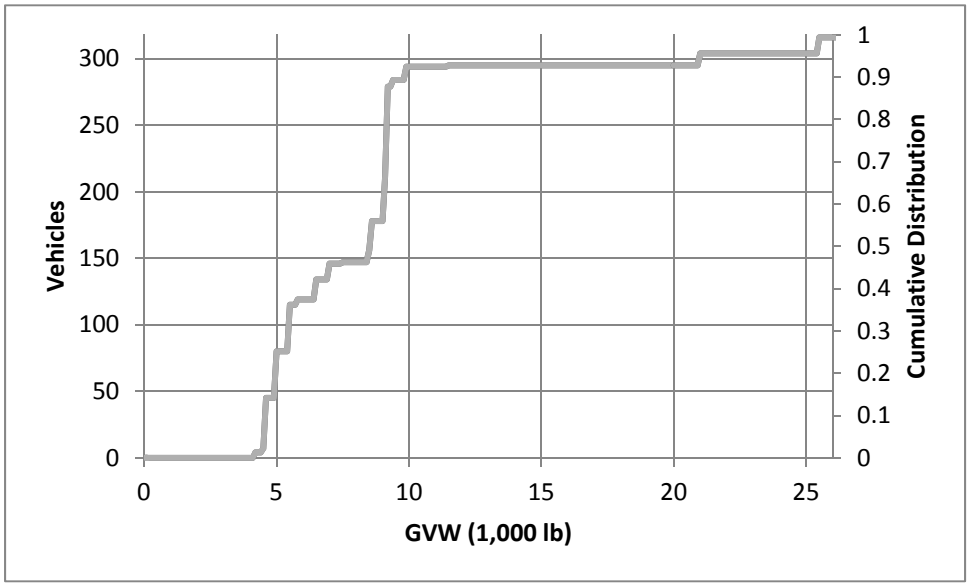

Figure 9. Gross vehicle weight distribution for trucks and vans (NAS Jacksonville).

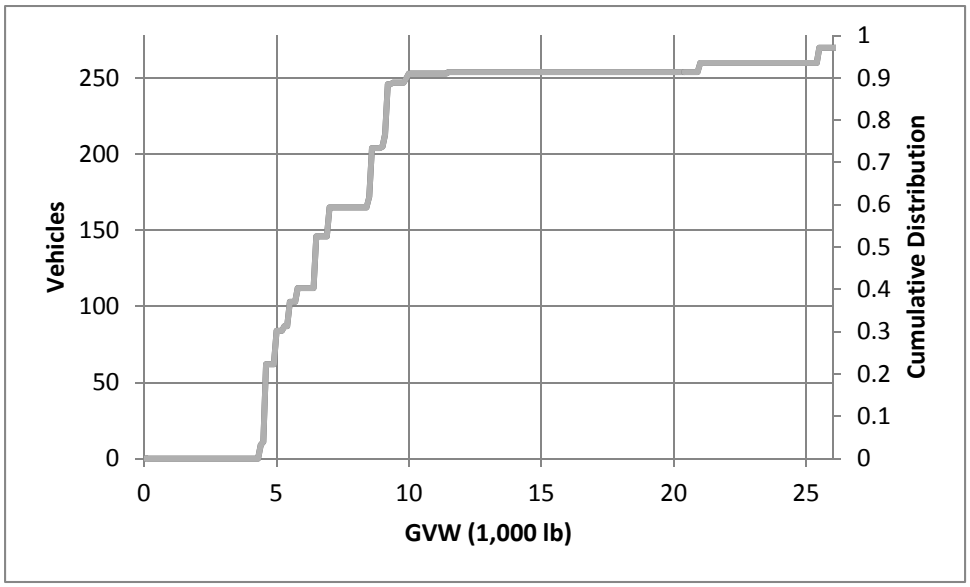

Figure 10. Gross vehicle weight distribution for trucks and vans (NS Mayport).

Distributions of vehicles by category for each base (Table 8) are shown in Figures 11 and 12. As can be seen in the figures, there is a relatively consistent number of vehicles in each category, although there are fewer mid-size support vehicles (S2) at NAS Jacksonville.

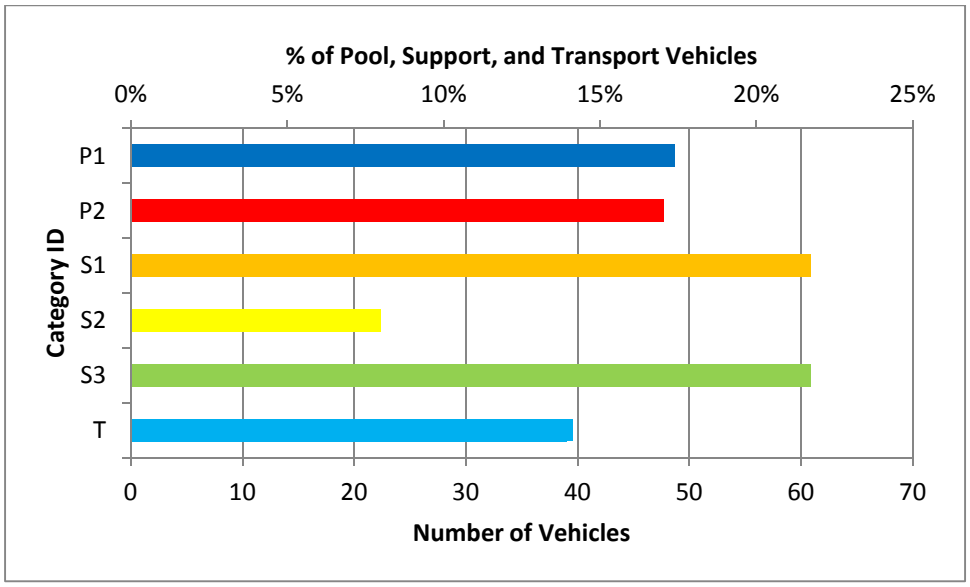

Figure 11. Vehicles by category ID (NAS Jacksonville).

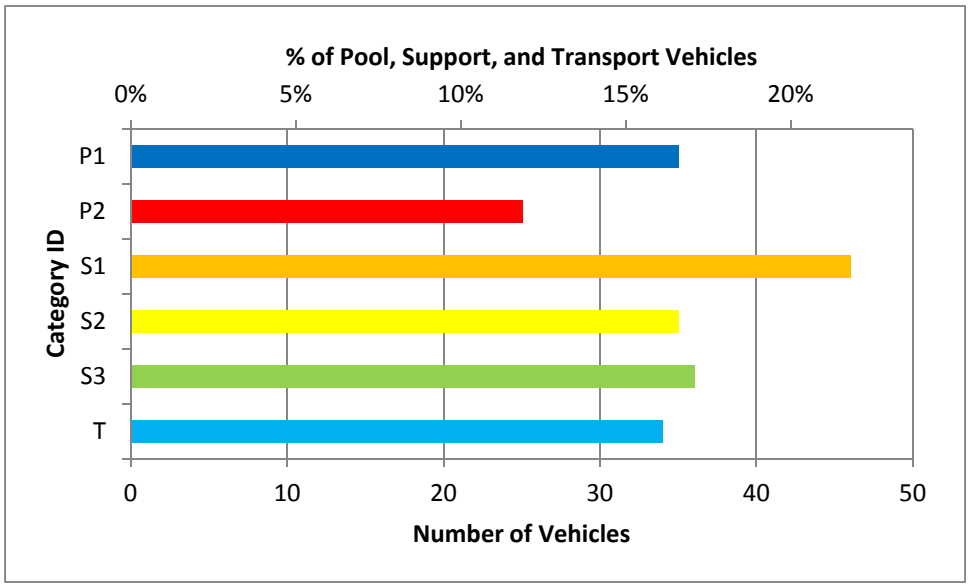

Figure 12. Vehicles by category ID (NS Mayport).

Figures 13 and 14 present the distributions of vehicle sizes within each mission type, using the color legend in the two figures. These figures are presented to give a more disaggregated view of the types of vehicles that are included in each mission type and category ID. For each mission type (e.g., pool, support, and transport), there are seven vehicle types and sizes that are listed in the order, from top to bottom, that the bars display. The seven vehicle types are listed in the legend, to the right, in the same top-to-bottom order as the bars within each mission. An empty location for a bar (e.g., lower end of the POOL mission on the vertical axis) would indicate that no vehicles of this vehicle type (e.g., truck with GVW >8,600 lb) are used in that mission. As can be seen in the figures, pool vehicles mainly are made up of

sedans, vans, and smaller trucks. Support vehicles mainly are made of vans and trucks of various sizes and transport vehicles mostly are larger trucks. Note that sport utility vehicles are included as trucks.

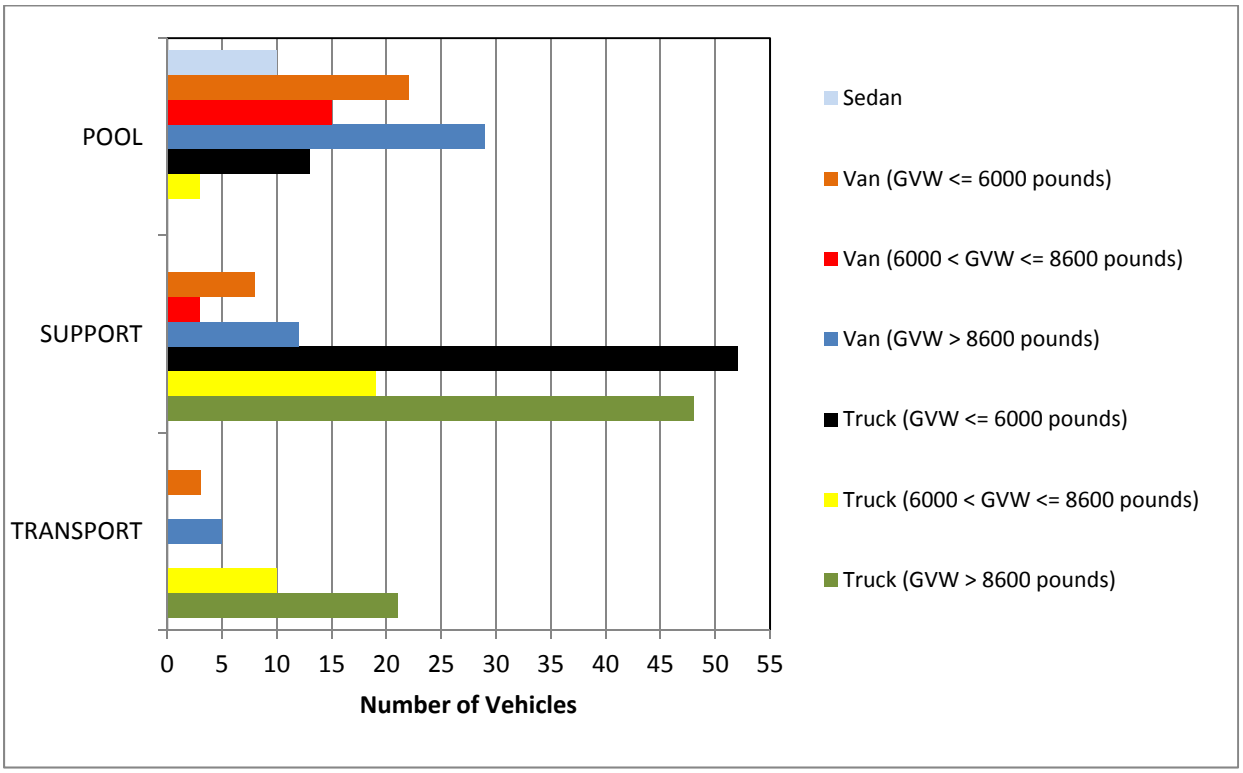

Figure 13. Mission type by vehicle type (NAS Jacksonville).

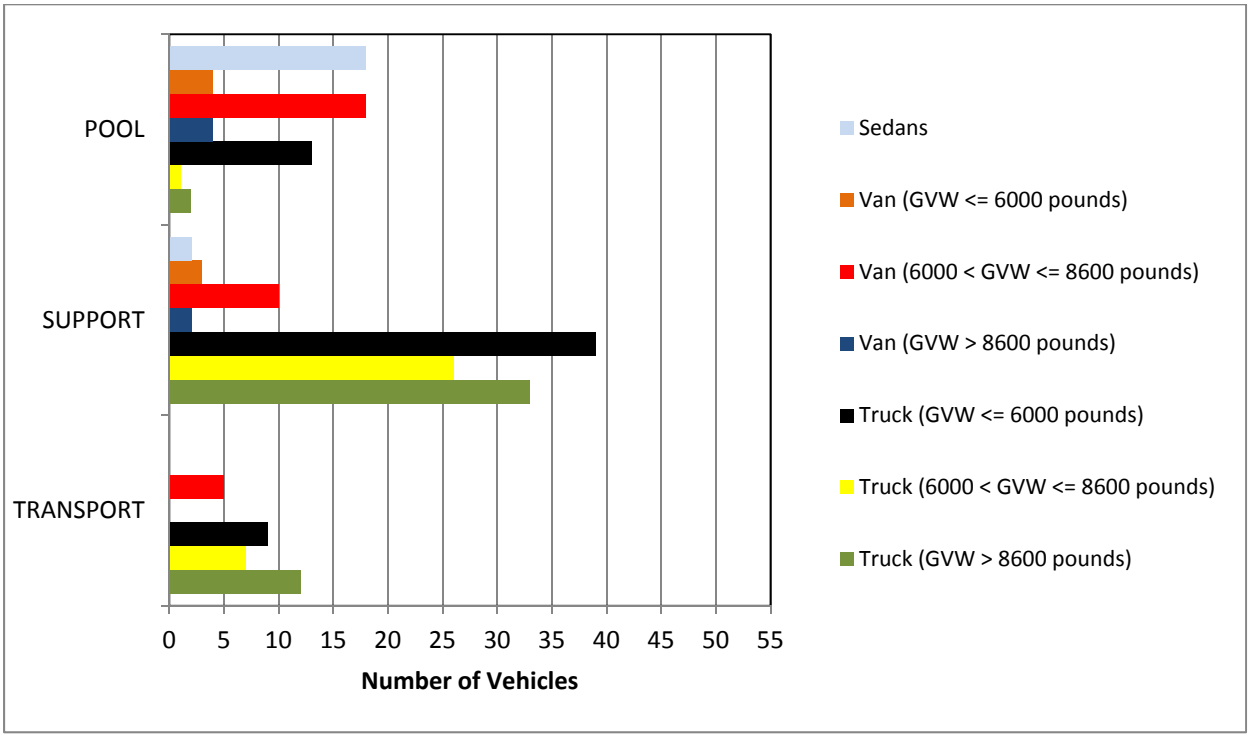

Figure 14. Mission type by vehicle type (NS Mayport).

2.3 Model Year

Figures 15 through 18 show the model year distributions for the vehicles. As can be seen in the figures, the pool vehicles (P1, P2) generally are newer vehicles, whereas larger vehicles tend to be older (S2, S3, T). Although a variety of factors affect fleet replacement decisions, the model year distribution indicates the potential for replacing many older vehicles, especially larger ones, with electric vehicles. For example, around 50% of category S2 vehicles at NAS Jacksonville have a model year of 2004 or earlier, and around 50% of category S3 vehicles at NS Mayport have a model year of 2007 or earlier.

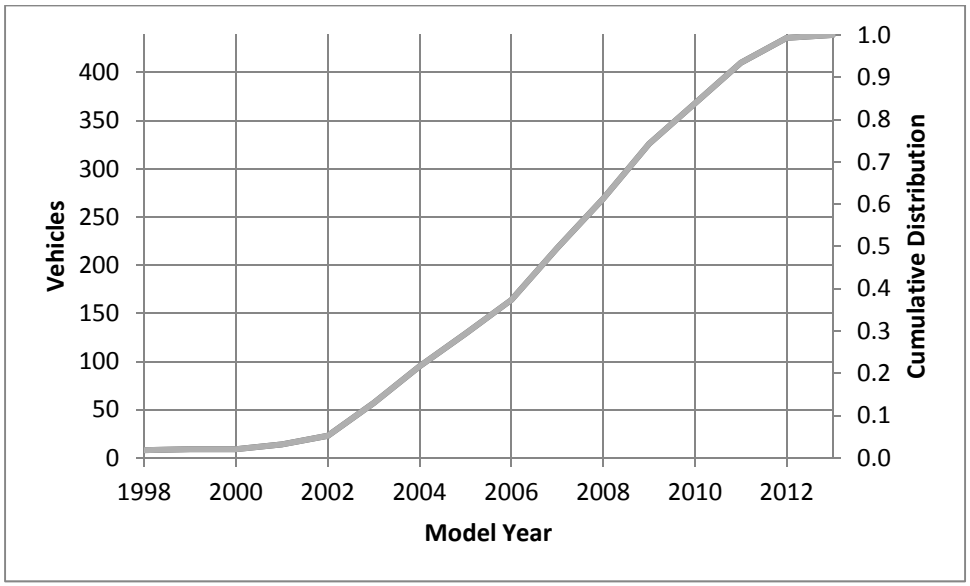

Figure 15. Model year distribution for all vehicles (NAS Jacksonville)

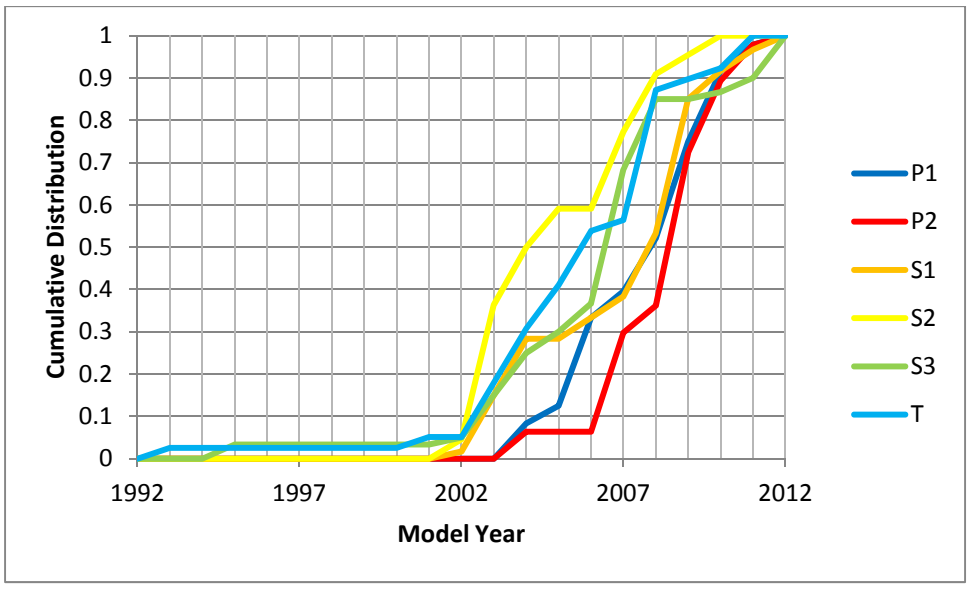

Figure 16. Model year distribution by vehicle type (NAS Jacksonville).

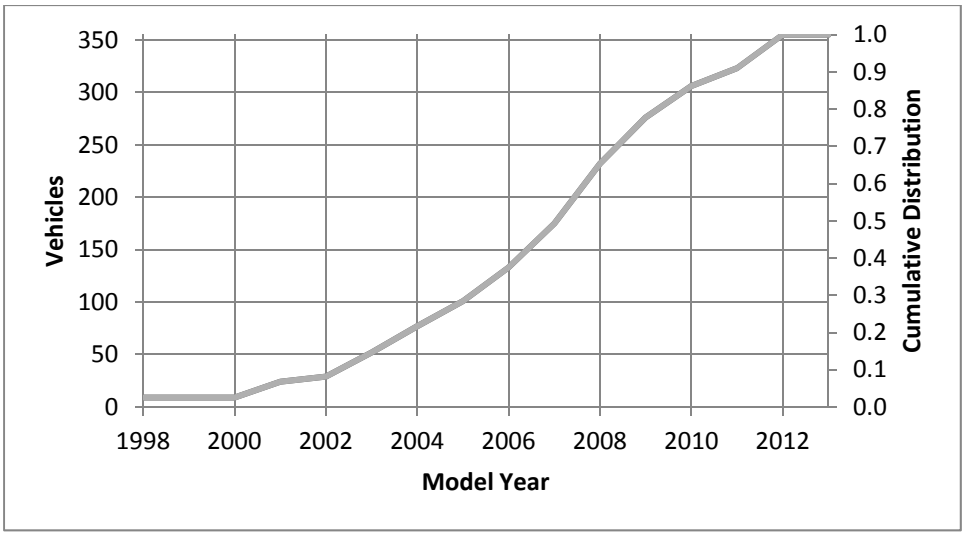

Figure 17. Model year distribution for all vehicles (NS Mayport).

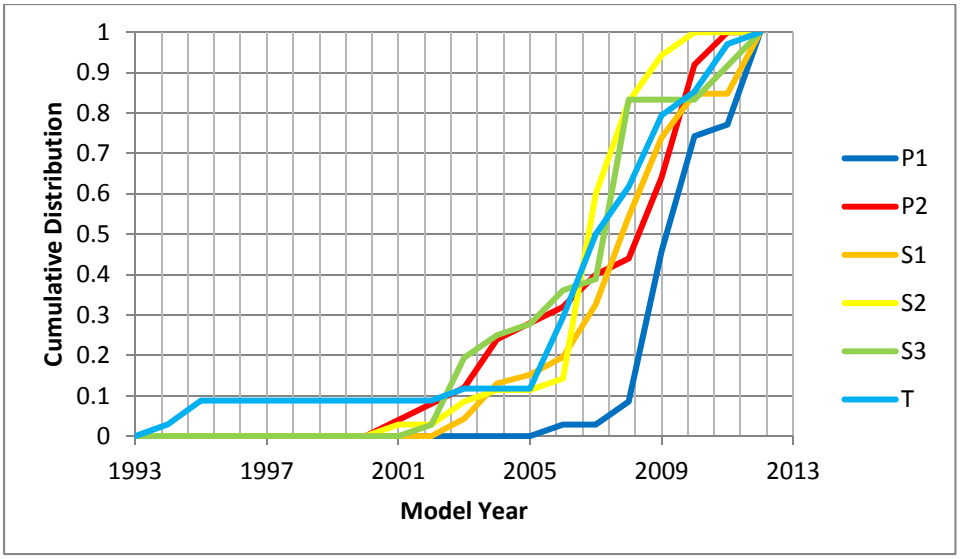

Figure 18. Model year distribution by vehicle type (NS Mayport).

3. OPERATIONAL CHARACTERISTCS

Several types of data collected through surveys regarding operational characteristics are presented for base vehicles. The data types presented include the following seven elements:

- Distance driven
- Personnel supported daily
- Personnel transported daily
- Daily trips
- After-hours usage
- Off-base usage
- Payload.

3.1 Distance Driven

Figures 19 and 20 show the distribution of annual distance driven by all vehicles at the bases. Around 90% of the vehicles at NAS Jacksonville drive less than 9,000 miles per year and around 90% of the vehicles at NS Mayport drive less than 7,000 miles per year. A conservative estimate for the annual distance limitation for a PEV that drives the same distance each day on a single charge is 48 weeks × 5 days × 75 miles = 18,000 miles. This assumes a 75-mile range per day for each vehicle. These data indicate that the mission requirements for nearly all vehicles at the base do not hinder their replacement by BEVs, based on the average driving distance. An annual estimate of the all-electric distance limitation for a PHEV with a range of 35 miles is 48 weeks x 5 days x 35 miles = 8,400 miles. The data indicate that most vehicles' driving distance falls within the range of a PHEV battery.

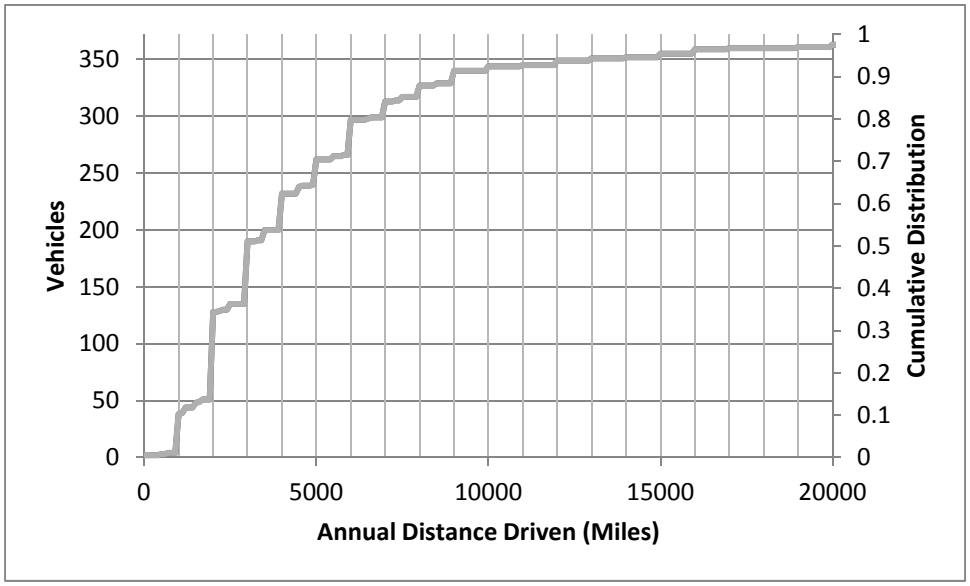

Figure 19. Distribution of the annual distance driven by all vehicles (NAS Jacksonville).

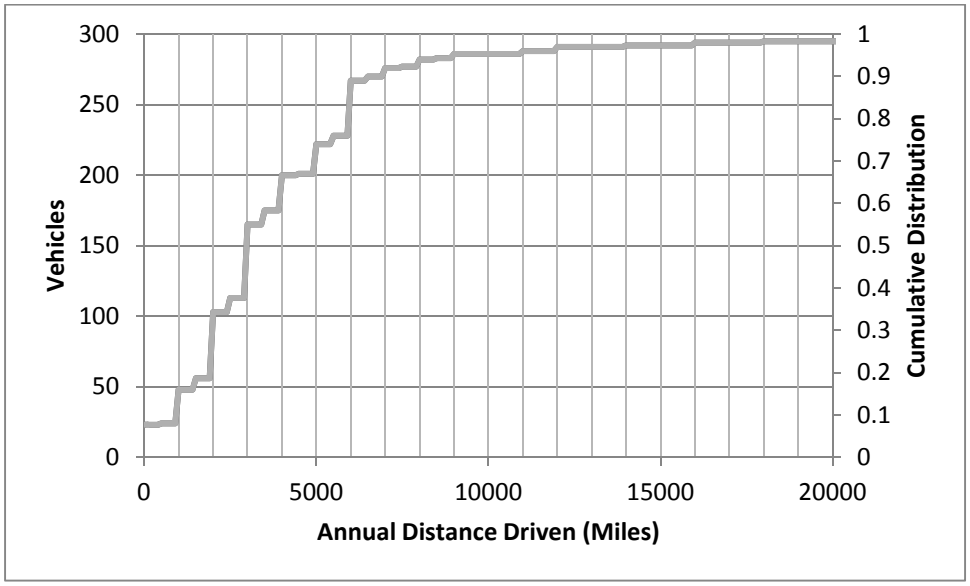

Figure 20. Distribution of the annual distance driven by all vehicles (NS Mayport).

At NAS Jacksonville, sedans and smaller vans (P1, P2) generally accrue the highest annual distance driven (Figure 21). At the same time, larger support and transport vehicles (S2, S3, T) at this base tend to accrue less annual mileage. This indicates that trucks and vans at NAS Jacksonville may make excellent candidates for replacement by BEVs. On the other hand, sedans and smaller vans may be making many off-base trips, potentially necessitating PHEVs.

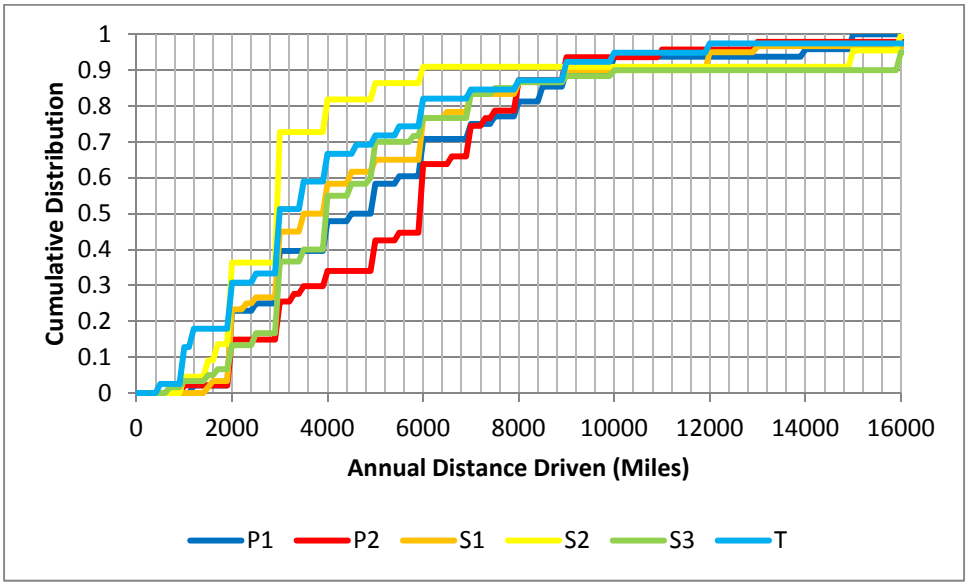

Figure 21. Distribution of annual distance driven by vehicle type (NAS Jacksonville).

At NS Mayport, larger pool vans (P2) tend to accrue the highest annual distance driven, and many smaller pool vehicles (P1) generally accrue a lower annual distance driven than other vehicles (Figure 22). This indicates that many sedans, minivans, and smaller pickup trucks (P1) at NS Mayport may be good candidates for replacement by BEVs.

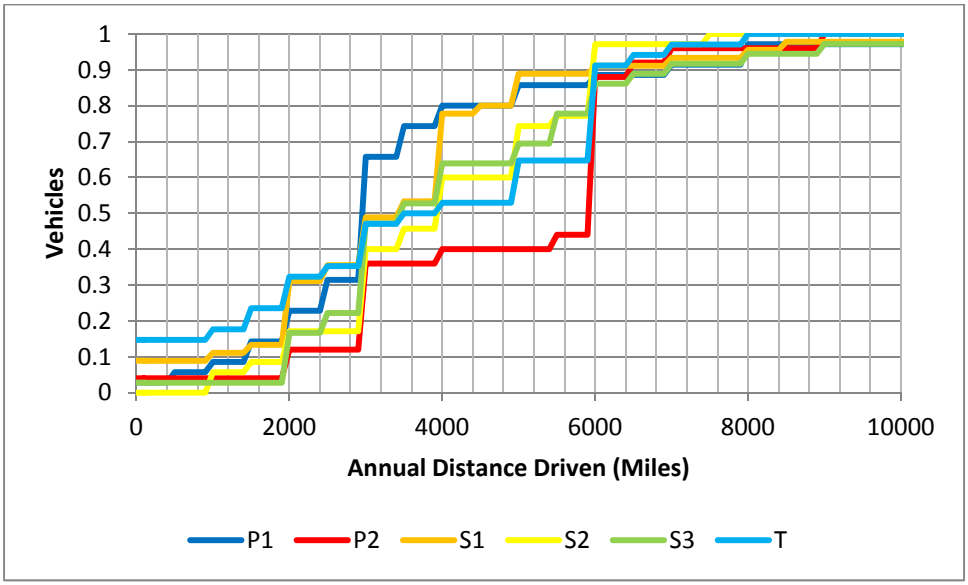

Figure 22. Distribution of annual distance driven by vehicle type (NS Mayport).

3.2 Personnel Supported

The distributions of the number of personnel supported by all vehicles are shown in Figures 23 and 24. The distributions of the number of personnel supported by vehicle type are shown in Figures 25 and 26.

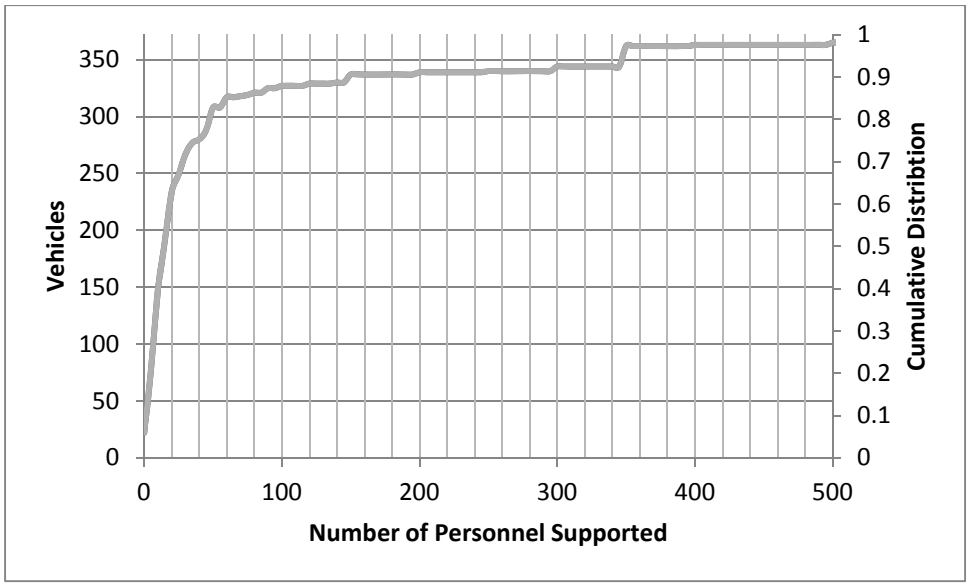

Figure 23. Distribution of the number of personnel supported per vehicle by all vehicles (NAS Jacksonville).

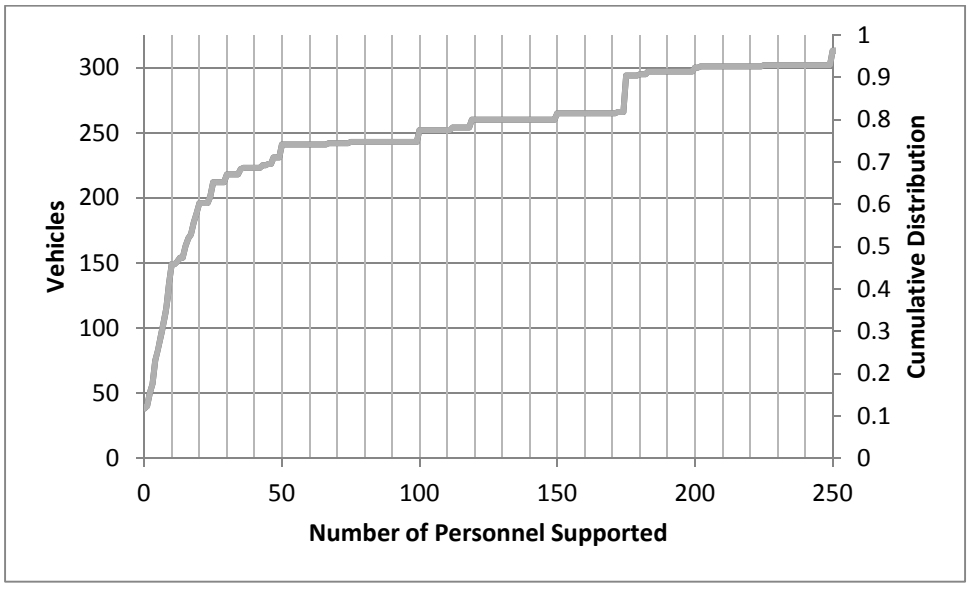

Figure 24. Distribution of the number of personnel supported per vehicle by all vehicles (NS Mayport).

At both bases, larger pool vehicles (P2) generally support more personnel than other types of vehicles (Figures 25 and 26). This can hinder replacement of larger pool vehicles by PEVs, because supporting larger numbers of personnel can cause greater variation in the frequency of vehicle usage.

The distributions of the number of personnel supported at NS Mayport are especially interesting, because they are split between three distinct regimes (Figure 26): smaller vehicles (P1, S1) generally

support fewer personnel, middle-sized vehicles generally support the most personnel (P2, S2); and larger vehicles (S3, T) comprise the intermediate regime.

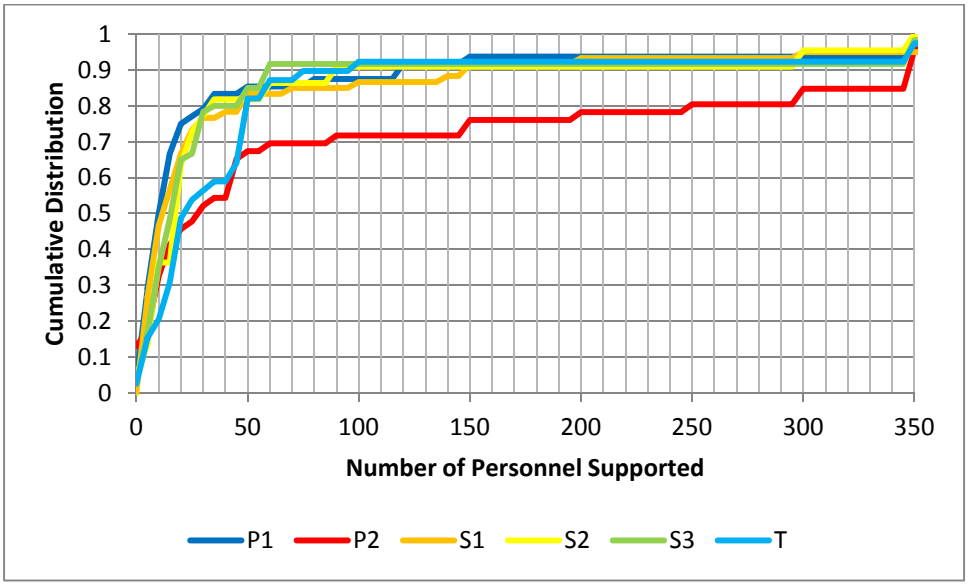

Figure 25. Distribution of the number of personnel supported by vehicle type (NAS Jacksonville).

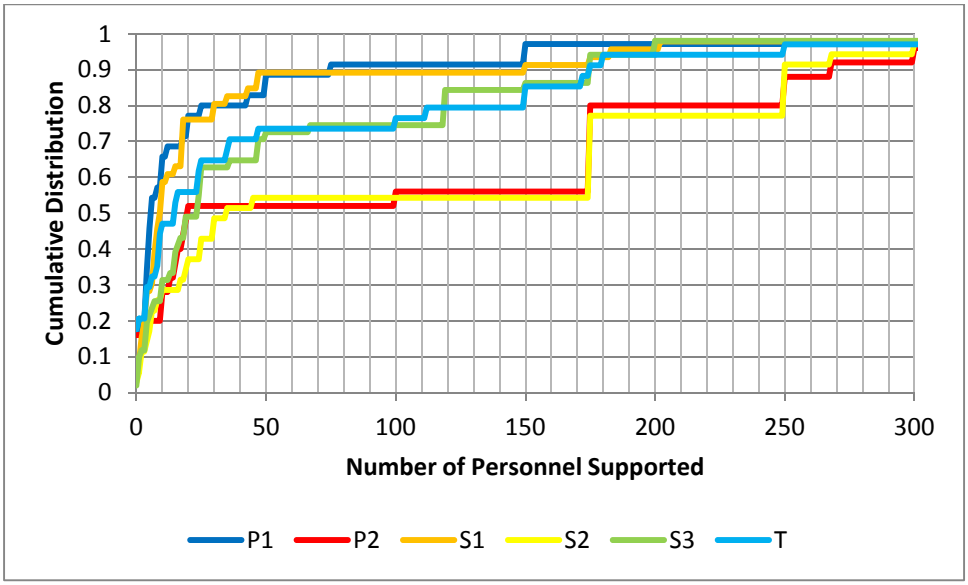

Figure 26. Distribution of the number of personnel supported by vehicle type (NS Mayport).

3.3 Personnel Transported Daily

Figures 27 and 28 display distributions for the number of personnel transported daily per vehicle by all vehicles. Figures 29 and 30 display distributions for the number of personnel transported daily per vehicle by vehicle type. Figure 30 for NS Mayport indicates similar results to Figure 26 in that the distributions are split into three distinct regimes. The number of personnel transported at NAS Jacksonville (Figure 29) is higher for smaller support and larger pool vehicles. This makes sense for pool vehicles, which are typically utilized for passenger transportation. On the other hand, smaller support vehicles seem to be getting used for more trips by different personnel each day, which is the subject of

Section 3.4. This indicates that smaller support vehicles generally may not have enough time to charge in between trips.

Figure 27. Distribution of the number of personnel transported daily per vehicle by all vehicles (NAS Jacksonville).

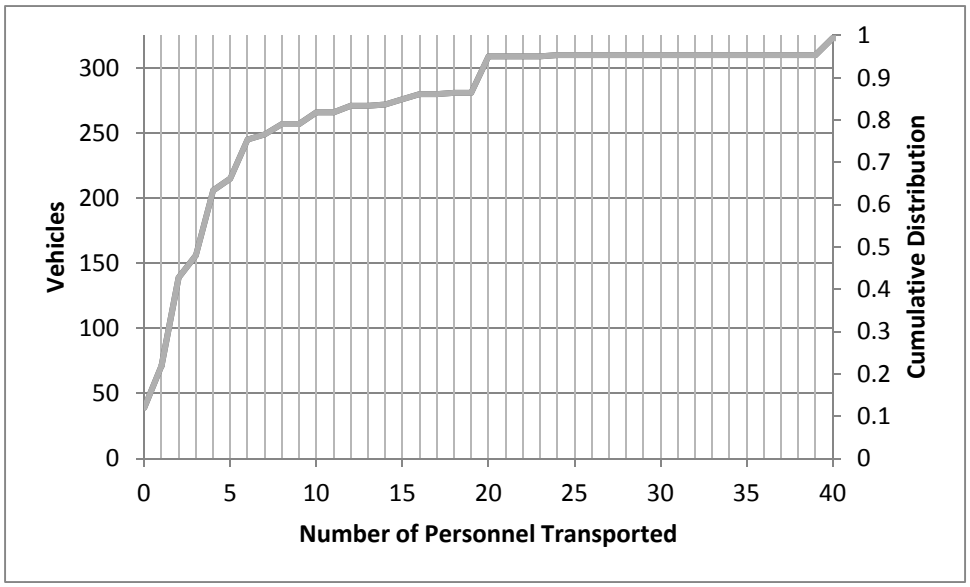

Figure 28. Distribution of the number of personnel transported daily per vehicle by all vehicles (NS Mayport).

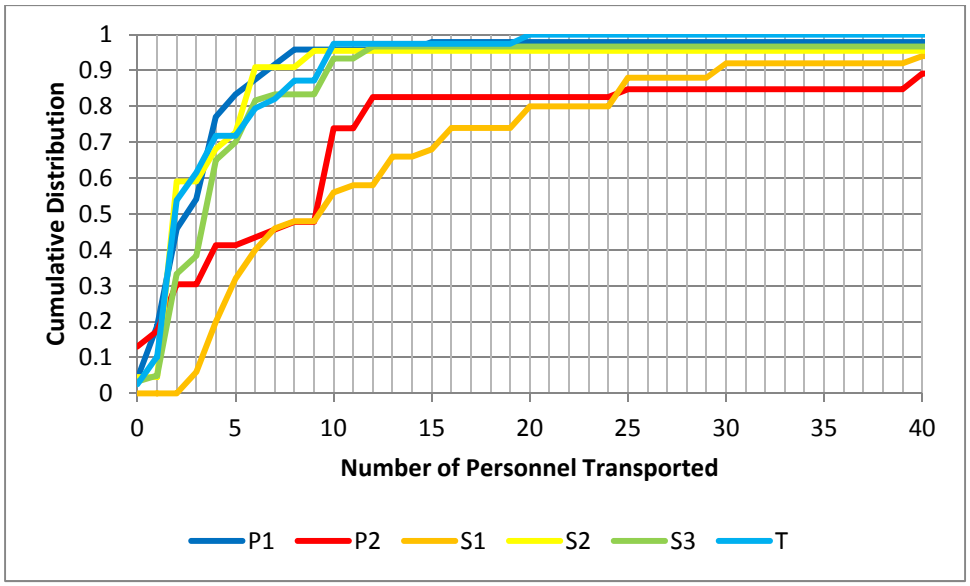

Figure 29. Distribution of the number of personnel transported daily per vehicle by vehicle type (NAS Jacksonville).

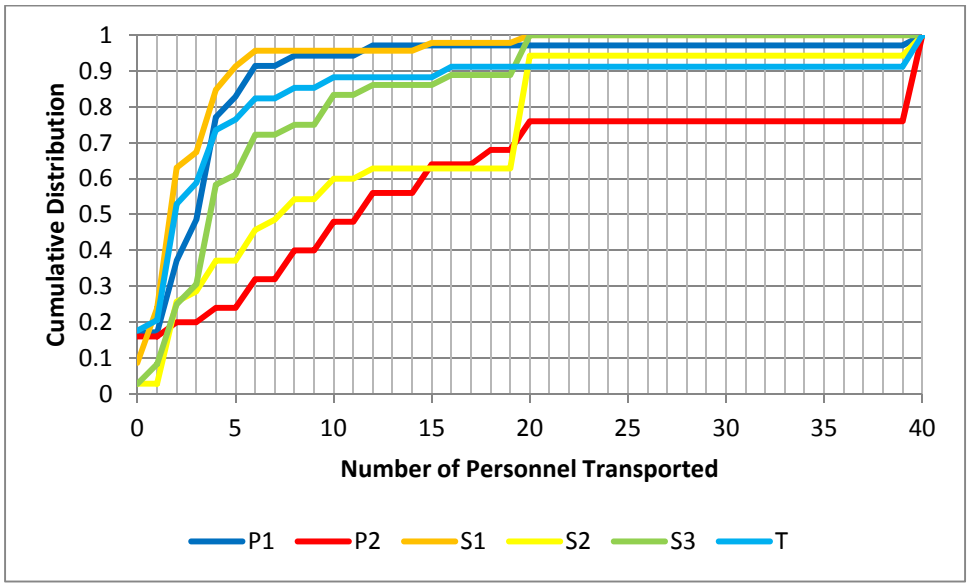

Figure 30. Distribution of the number of personnel transported daily per vehicle by vehicle type (NS Mayport).

3.4 Daily Trips

Figures 31 and 32 display distributions for the daily number of trips made per vehicle for all vehicles. Figures 33 and 34 display distributions for the daily number of trips made per vehicle by vehicle type. This can be an important factor in determining whether vehicles can be replaced by PEVs, because a high trip frequency reduces the opportunity for conducting a long charging event. About 55% of vehicles at NAS Jacksonville make less than 5 trips per day, and about 45% of vehicles at NS Mayport make less than 5 trips per day (Figures 31 and 32).

At both bases, various types of support vehicles (S1, S2, S3) generally are making the highest number of trips per day (Figures 33 and 34). Therefore, the number of trips per day may hinder the potential for support vehicles to be replaced by BEVs. On the other hand, pool vehicles generally make the lowest number of trips per day. However, these may be longer trips off-base; Section 3.1 also shows that these vehicles can have a higher mileage accrual. Transport vehicles generally make an intermediate number of trips.

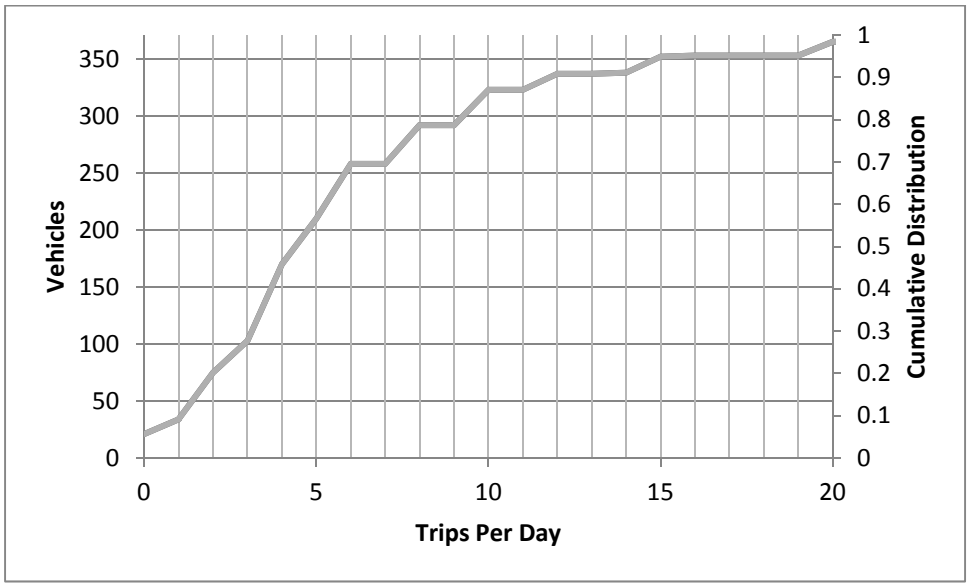

Figure 31. Distribution of the trips per day per vehicle for all vehicles (NAS Jacksonville).

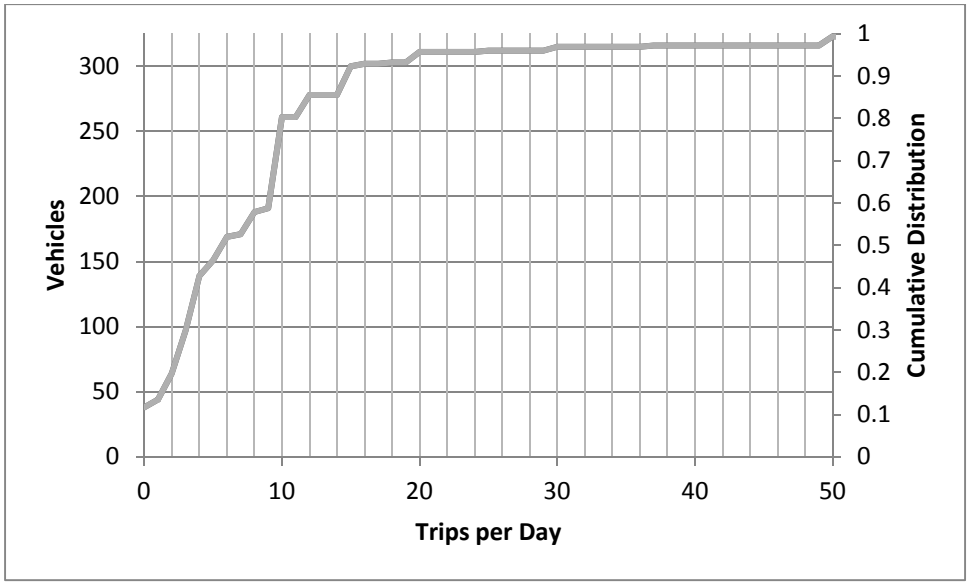

Figure 32. Distribution of the trips per day per vehicle for all vehicles (NS Mayport).

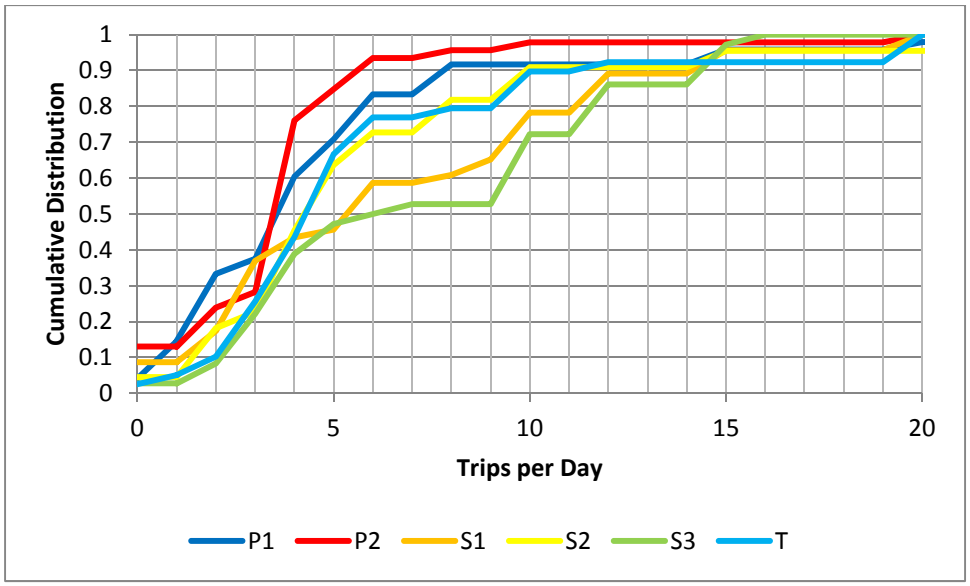

Figure 33. Distribution of the trips per day per vehicle by vehicle type (NAS Jacksonville).

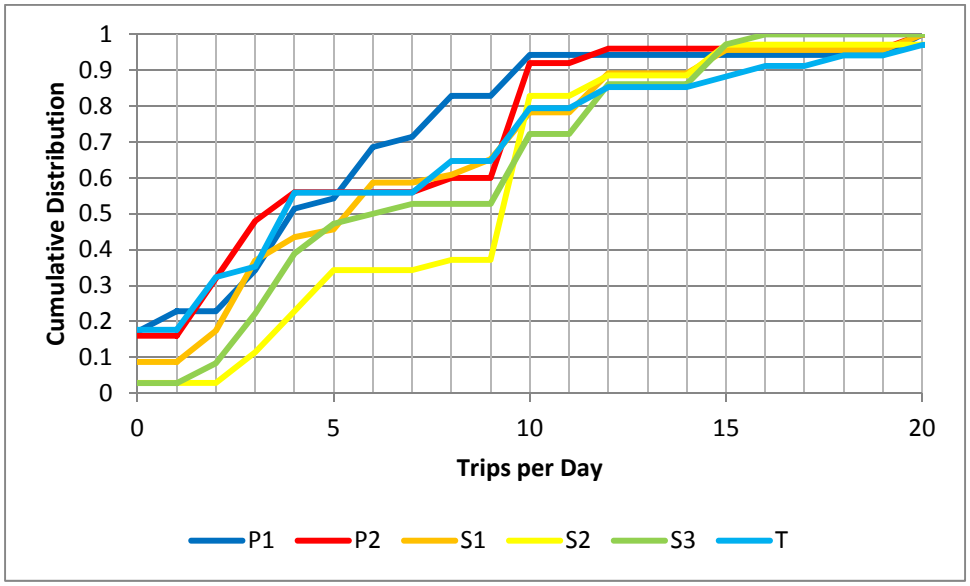

Figure 34. Distribution of the trips per day per vehicle by vehicle type (NS Mayport).

3.5 After Hours

The majority of vehicles at both bases are used after-hours (Figures 35 and 36), and this generally is the case across all vehicle types at NAS Jacksonville (Figure 37) and NS Mayport (Figure 38). Small support vehicles (S2) at NAS Jacksonville and small pool vehicles (P1) at NS Mayport have the highest fraction of vehicles, which do not operate after-hours; however, this is not significnalty different from other vehicles.

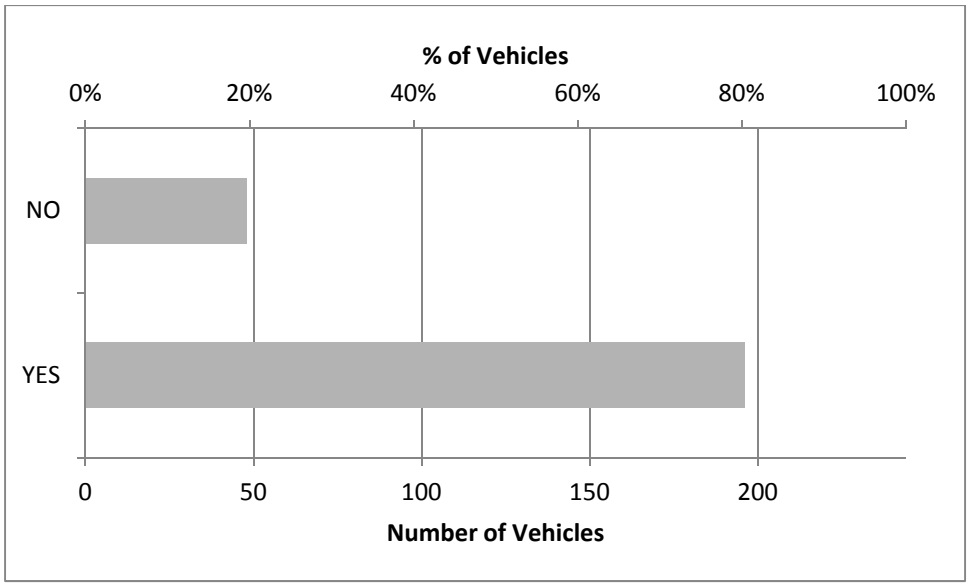

Figure 35. All vehicles: Is the vehicle used after hours? (NAS Jacksonville).

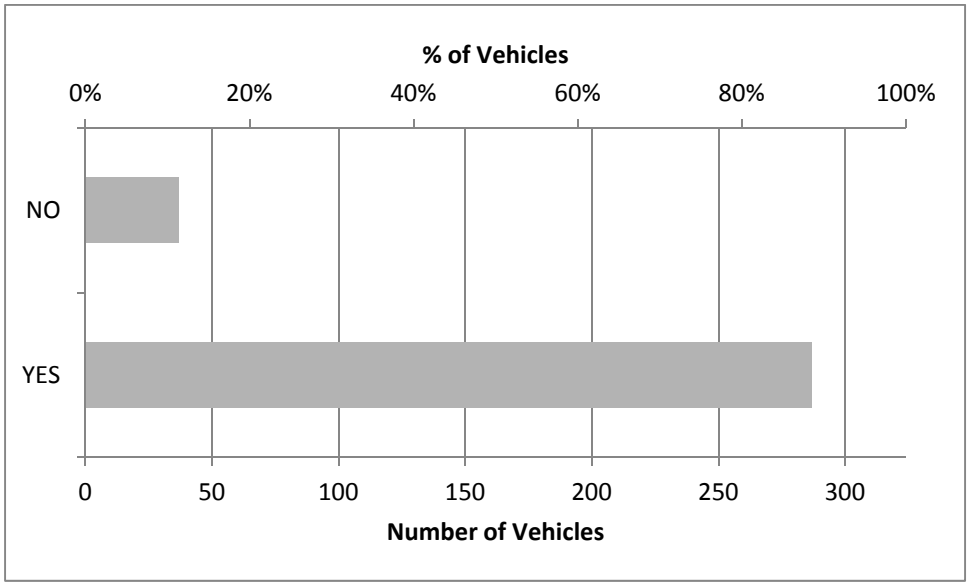

Figure 36. All vehicles: Is the vehicle used after hours? (NS Mayport).

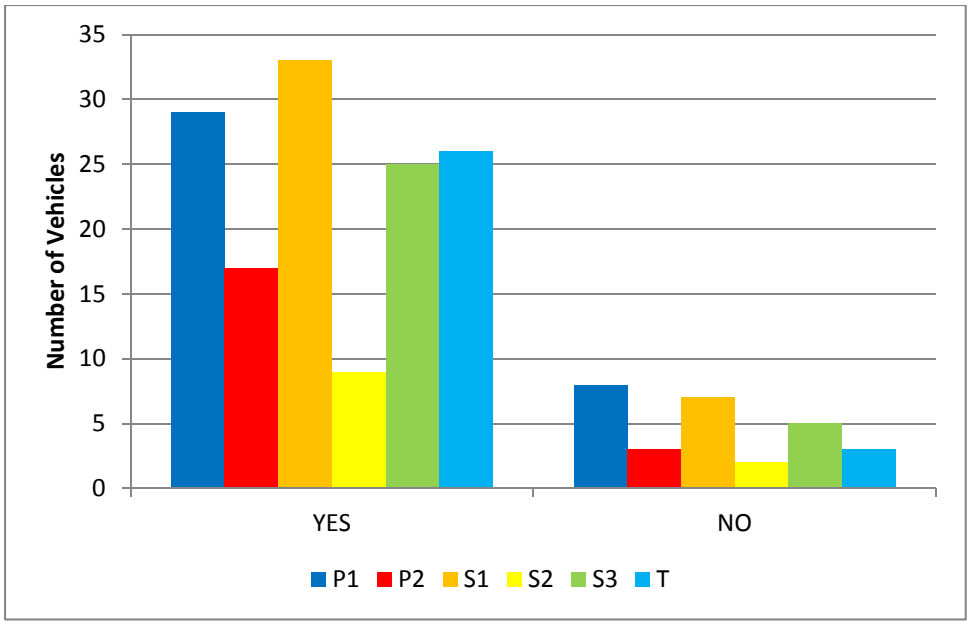

Figure 37. By vehicle type: Is the vehicle used after hours? (NAS Jacksonville).

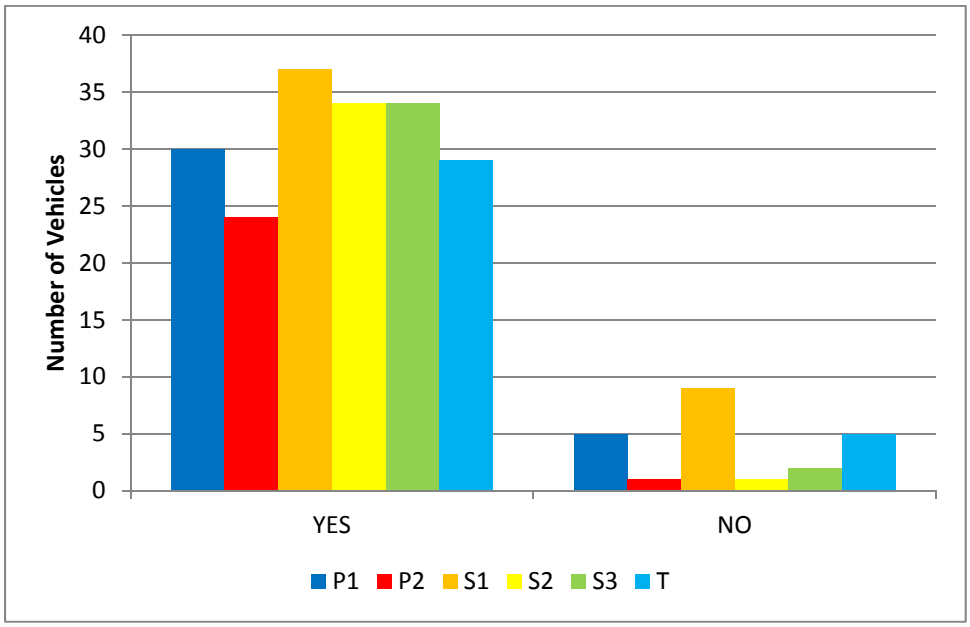

Figure 38. By vehicle type: Is the vehicle used after hours? (NS Mayport).

3.6 Off-Base Usage

The majority of respondents at both bases indicate that they use vehicles off-base (Figures 39 through 42); however, a higher fraction of vehicles are not used off-base at NAS Jacksonville. It seems likely that this is because of the larger size of the base, because the mileage accrual is somewhat higher at NAS Jacksonville (Section 3.1). In turn, this indicates that generally more vehicles at Jacksonville may be better suited to being replaced by BEVs, because charging stations can be accessed on base.

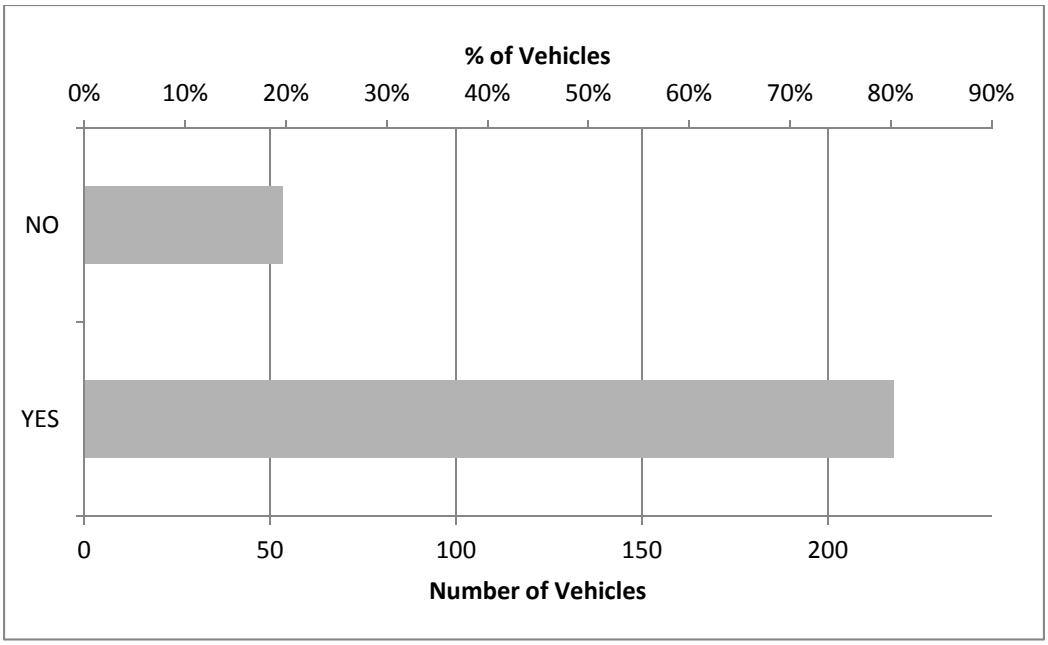

Figure 39. All vehicles: Is the vehicle used off-base? (NAS Jacksonville).

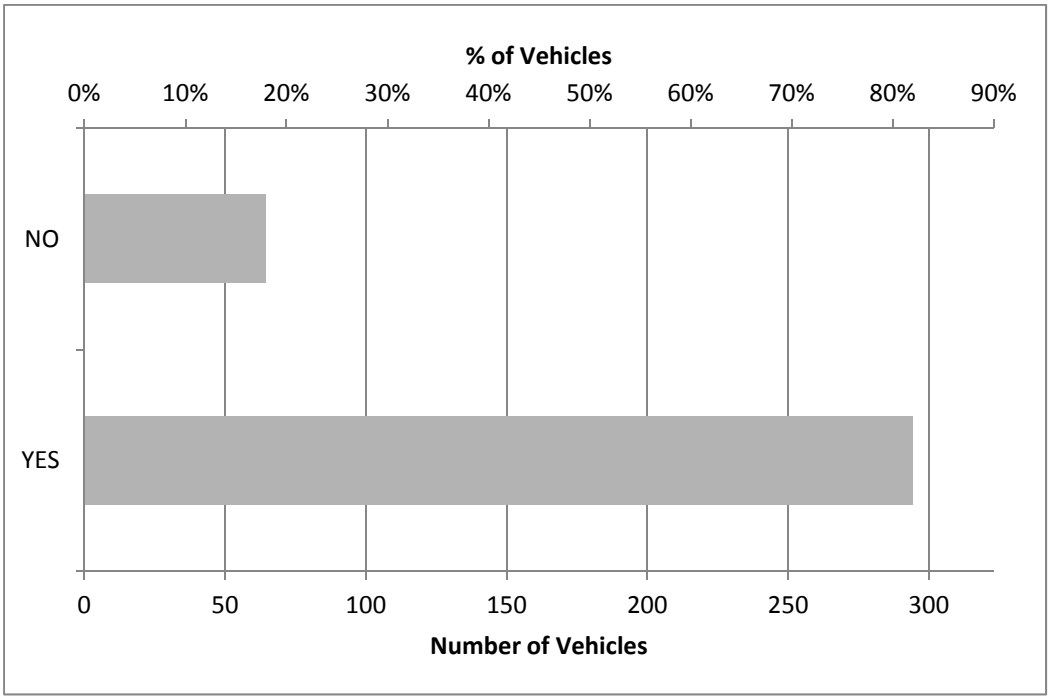

Figure 40. All vehicles: Is the vehicle used off-base? (NS Mayport).

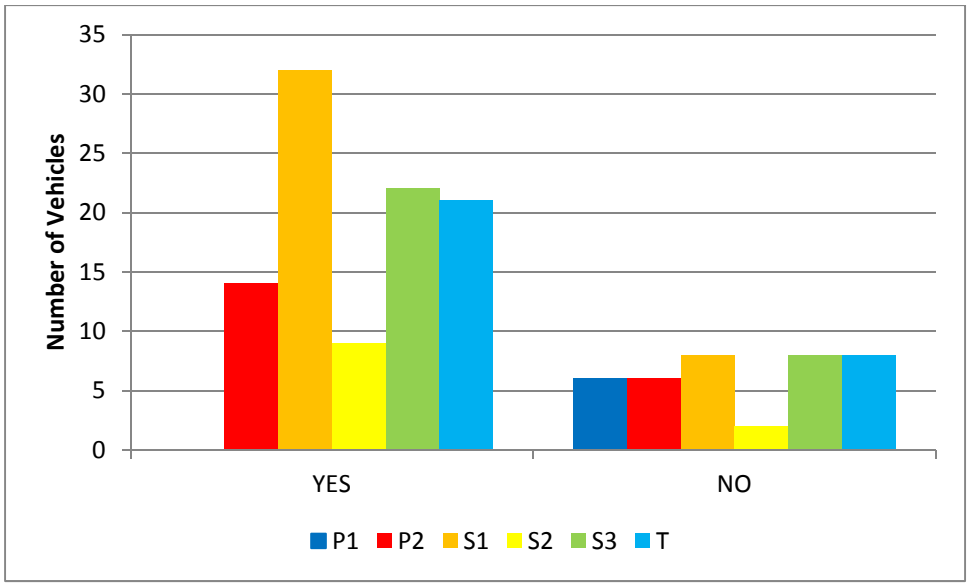

Figure 41. By vehicle type: Is the vehicle used off-base? (NAS Jacksonville).

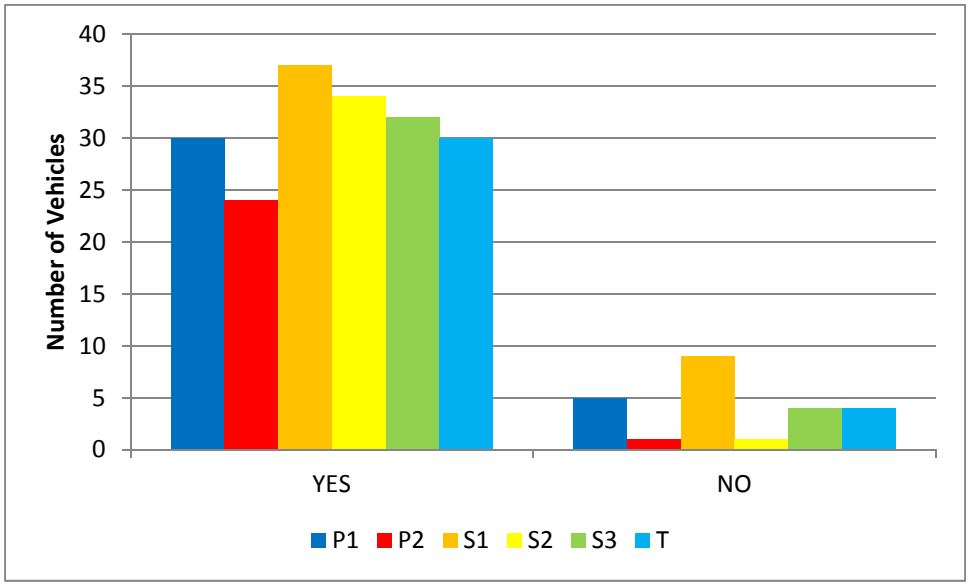

Figure 42. By vehicle type: Is the vehicle used off-base? (NS Mayport).

3.7 Payload

Responses regarding payload weight are only available for NAS Jacksonville and are presented in Figures 43 and 44. As expected, larger pool vehicles (P2) generally are carrying higher payloads than other vehicles. However, it was unexpected that smaller support vehicles (S1) also have survey responses with high payloads. This is likely due to the fact that, despite their size, these vehicles are often used to haul additional loads on trailers. In addition, responses were left blank for many vehicles and payload can vary greatly across days for a given vehicle. Therefore, the payload data may not be an accurate representation of vehicle operation at a disaggregated level. Nevertheless, Figure shows that around 55% of vehicles carry loads of less than 500 lb; therefore, payload should not be a hindrance for many vehicles on base.

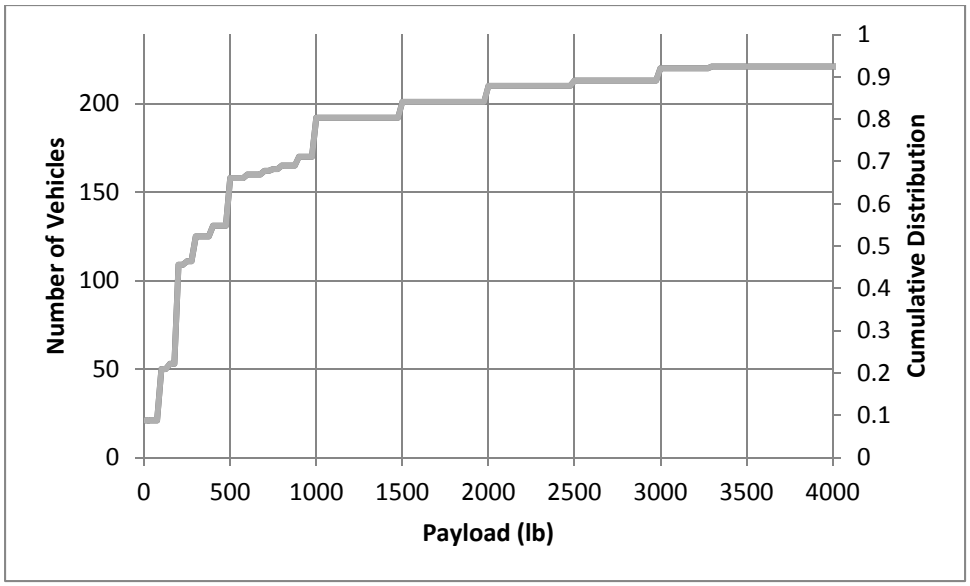

Figure 43. Payload distribution for all vehicles (NAS Jacksonville).

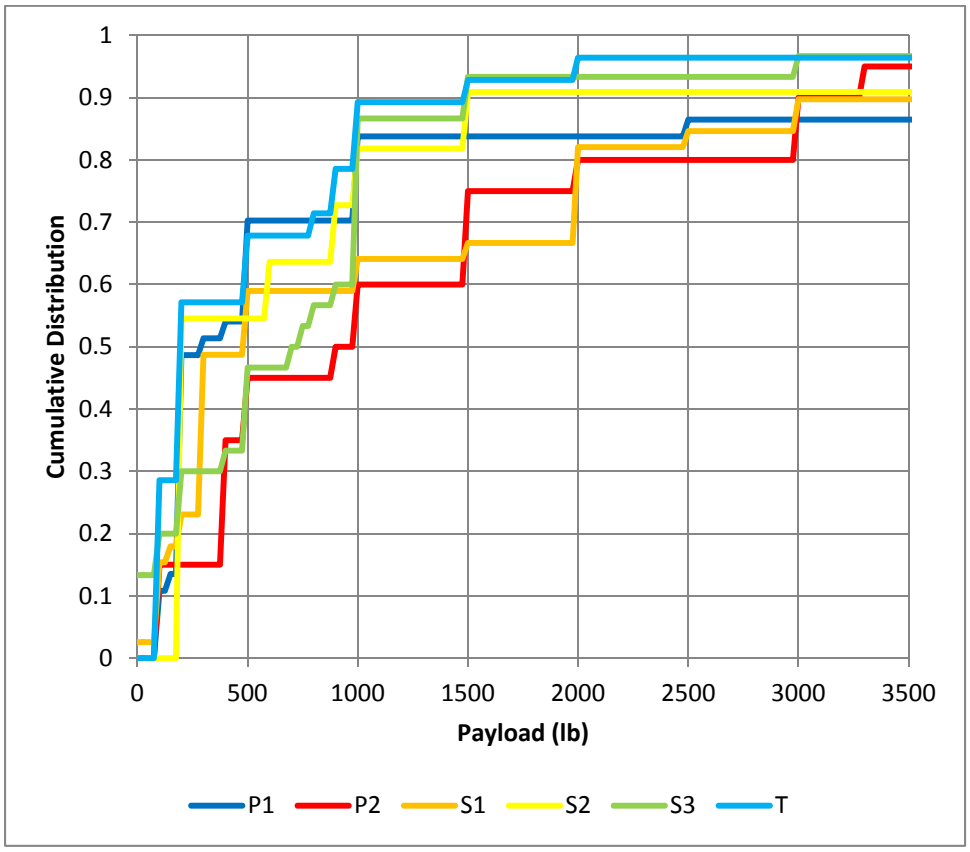

Figure 44. Payload distribution by vehicle type (NAS Jacksonville).

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