



Fully Electrical Class A Recreational Vehicle

Team F.E.R.V.



SAN DIEGO STATE UNIVERSITY

Project Overview

The Class A RV industry is lacking innovation and quality with poor customer experiences. Recreational vehicles need a large Internal Combustion Engine (ICE) to propel the vehicle. ICE consume large amounts of fuel, they are inefficient, and pollute the environment. Our team has designed a four-wheel drive electrical drive system for a class A Recreational vehicle. Four Permanent Magnet AC electrical motors will power the vehicle. Electrical motors are more efficient than ICE, they are more reliable, cheaper to build, they are lighter and required minimal maintenance. These improvements will increase the durability and quality of the vehicle to give and overall greater customers experience.

Systems Operation

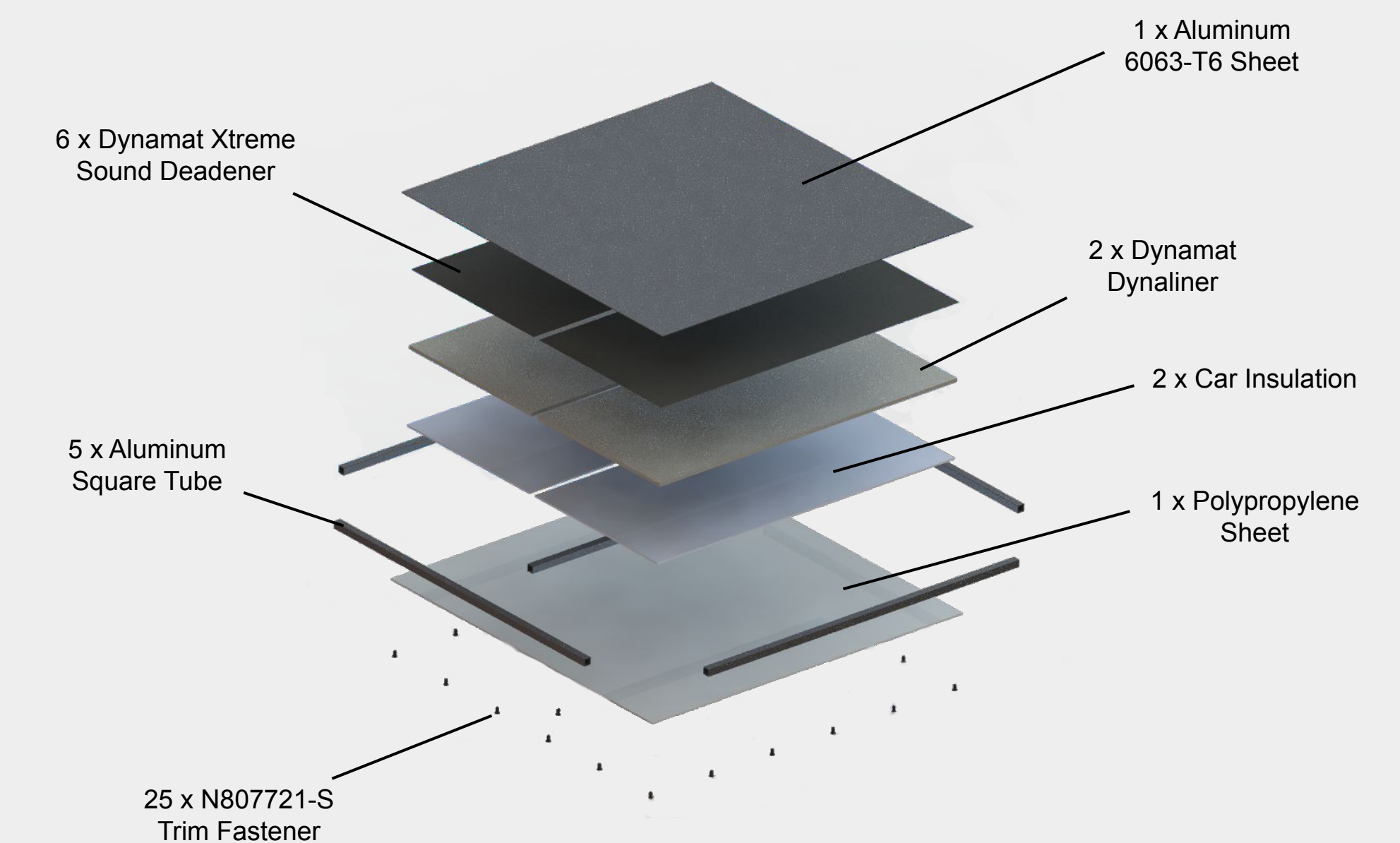


The four-wheel drive system configuration provides better vehicle stability since electric motors can accurately control individual wheel torque. The rapid dynamics of electrical motors, enables accurate control of wheel torque, thereby achieving better handling performance. This configuration also allows safety control systems such as collision avoidance, traction control, and vehicle stability control to perform faster, resulting in a safer vehicle.

The Fully Electrical RV (FERV) runs on electrical energy stored in the battery module. The battery is charge using the electrical grid via a charger by solar panels, and by regenerative braking. The controller takes power from the DC batteries and delivers it to the electrical motor. The inverter takes in the direct current from the battery pack and converts it into a maximum of 240V alternating current.



Wall Assembly



TEMPERATURE DIFFERENCE:

OUTSIDE: 100 F
INSIDE: ~74.4 F

NOISE DIFFERENCE:

OUTSIDE: 100 Db
INSIDE: ~82 Db



Team F.E.R.V.



Philip Alberti
Manufacturing Engineer



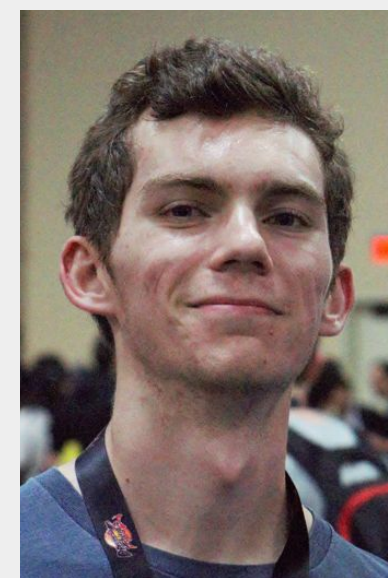
Justin Legaspi
Supply Engineer



Ramil Gapuz
RV Wall Engineer

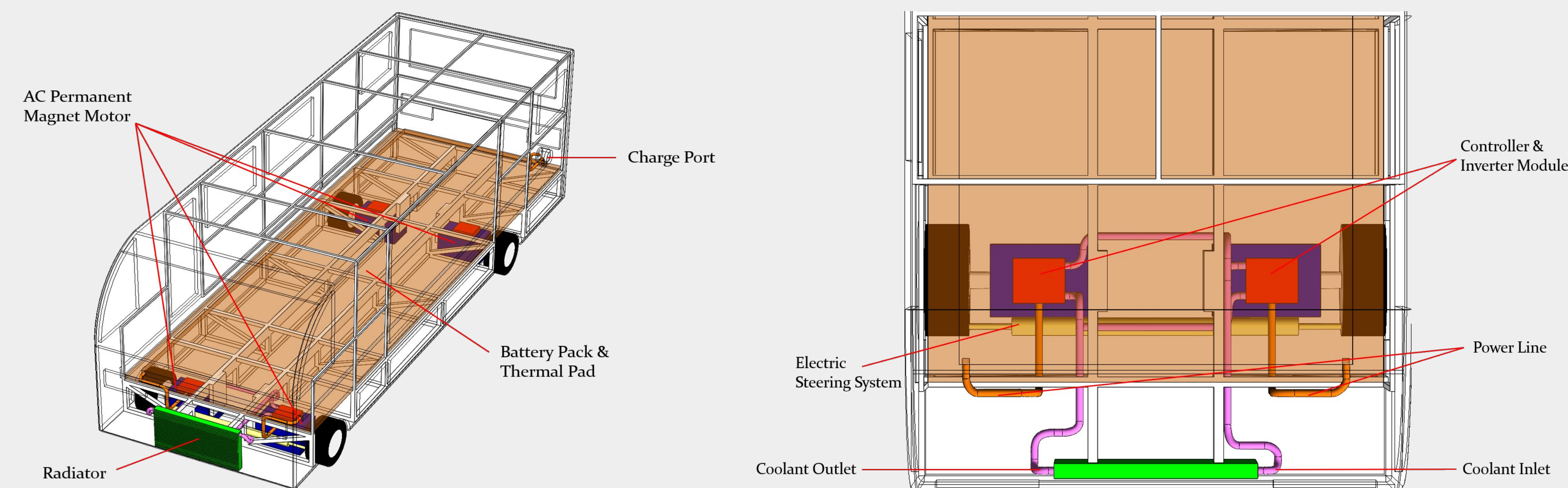


Rene Navarro
Powertrain Engineer



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Energy Engineer

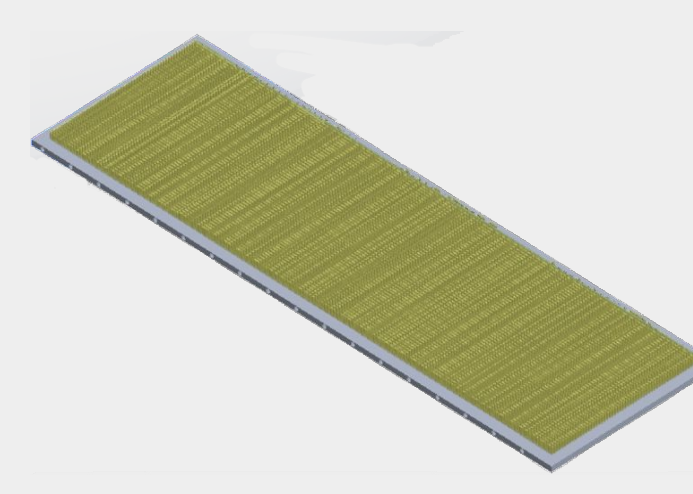
Systems Engineering



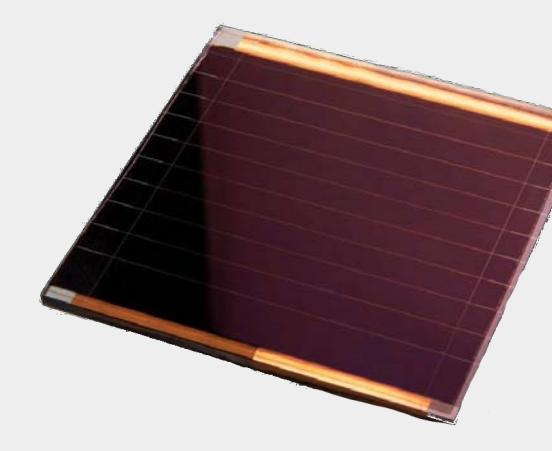
Major Components



Ford Eluminator Electric Motor
Peak Power: 210 KW
Peak Torque: 430 Nm
Gear Ratio: 9.05:1
Weight: 205 lbs



800V Battery Module
Panasonic 21700 Cells
Aluminum Heatsink
25ft: 667 kWh
+5ft: +148 kWh



Solar Panels
Perovskite Panel
Up to 29% efficiency
Addition of 90kW/day
+5ft: +20kW/day

Vehicle Specifications

RV Length	Gross Vehicle Weight	Power (kW)	Power (HP)	800V Battery Capacity	Estimated Solar Energy Generation (per 8 hrs)	Estimated Vehicle Range	Estimated Vehicle Cost
25 ft	31175lbs	204	274	667.5 kWh	90 kW	350mi	\$268000
30 ft	42400lbs	270	362	815.8 kWh	120 kW	370mi	\$394000
35 ft	47620lbs	301	404	964.2 kWh	135 kW	410mi	\$457500
40 ft	52840lbs	332	445	1112.5 kWh	155 kW	450mi	\$552400
45 ft	53180lbs	363	487	964.2 kWh	180 kW	390mi	\$524100

Shown is the estimated vehicle specification per specified length. Class A RVs range from 25-45ft, thus increments of 5ft were chosen to simplify the customer experience. With this powertrain design, each vehicle will be able to reach a minimum of 350 miles per charge, and has sufficient solar power to supplement cabin power consumption. The usage of per wheel motors ensures capable performance to counteract the significantly higher vehicle weight.