



Portable Emergency Device

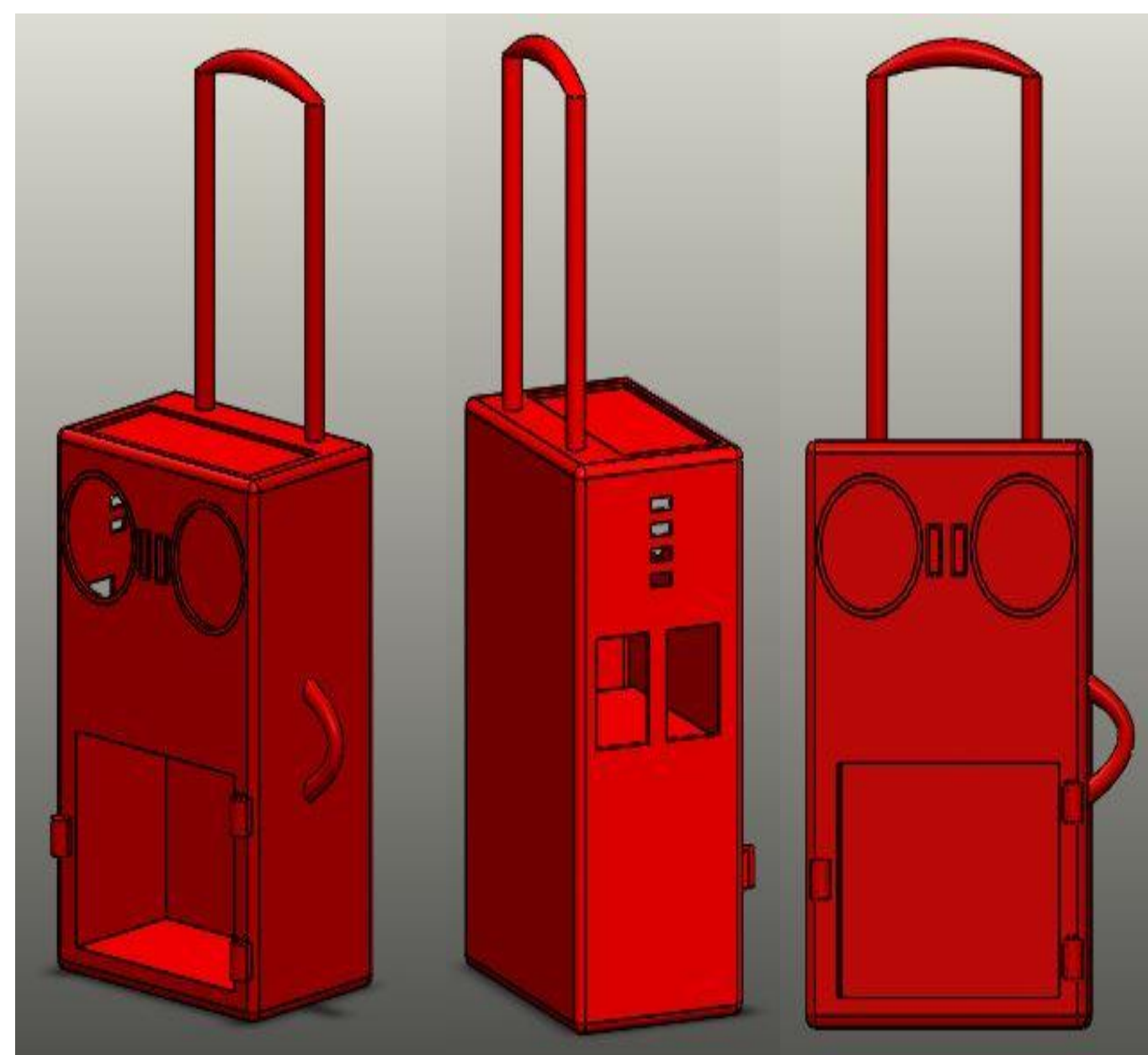
Team Members: Matthew Hopper
Austin Brown
Montgomery Thedford
Justin Reynolds
Yousif Kastiro
Faculty Advisor: Donald Ellis
Sponsor: Grand Canyon University

Project Description and Justification

The Portable Emergency Device (PED) is a project aimed at providing essential resources and peace of comfort to consumers affected by disaster situations. Since, on average each year 160 million individuals are affected by natural disasters and go without electricity, communication services, water, and other basic needs for days or weeks ("Natural Events," 2012). To counteract those major issues, the PED provides a rugged and waterproof design, solar rechargeable internal battery pack, powerful LED light, emergency siren, internal medical kit, a long-range radio, and GPS service capabilities.

Functional Requirements	Design Metrics	Engineering Standards	How it is applied
Provide Power to Small Devices	Provide power, output 5V 2A	IEC 62680-2-3	PED uses QC 3.0 USB charging port
Size	Maximum size (32" x 14" x 9"). Must be under 30lbs	N/A	N/A
Storage	Fit Red Cross Emergency Aid Kit	N/A	N/A
Impact Resistant/Water Resistant	IP65 Rated, 3ft Drop Resistant	ASTM C1521-19	The PED is trying to obtain an IP65 ingress rating
Battery Storage	Power Light for 24 hours & whole system for 5 hours.	UL 2054	Safety of battery pack needs to be tested
Communication Services	Receive radio frequencies 462.675 MHz, 27.065MHz, and 462.6125MHz	NEMA SB 50-2014	Motorola T480 is provided with the PED.
GPS Services	Gather/Display Coordinates on LCD screen	IS-GPS-200F	The GPS chip must receive the frequencies
Light Source	Be able to provide 1000 lumens 10' x 10' x 10' space	ANSI C82.16-2015	The purchased LED light needs to be tested for temperature control
Siren Alarm	80 dB and able to be heard up to 100ft.	ISO TC1 SC3 WG1	To the custom alarm on the PED
Regenerative Power	Charge PED in 10 hours	IEEE 1526	Applied by carrying out the testing procedure correctly and also tested multiple times for consistency.

Design Process



Brainstorming Phase: In the figures above outlines the original PED concept idea. This idea consisted of a much larger design that resembles more of a carry on luggage.



Design Review: A design review was conducted on the original idea and the team concluded that it was too large. So, a new design was implemented creating PED V2.

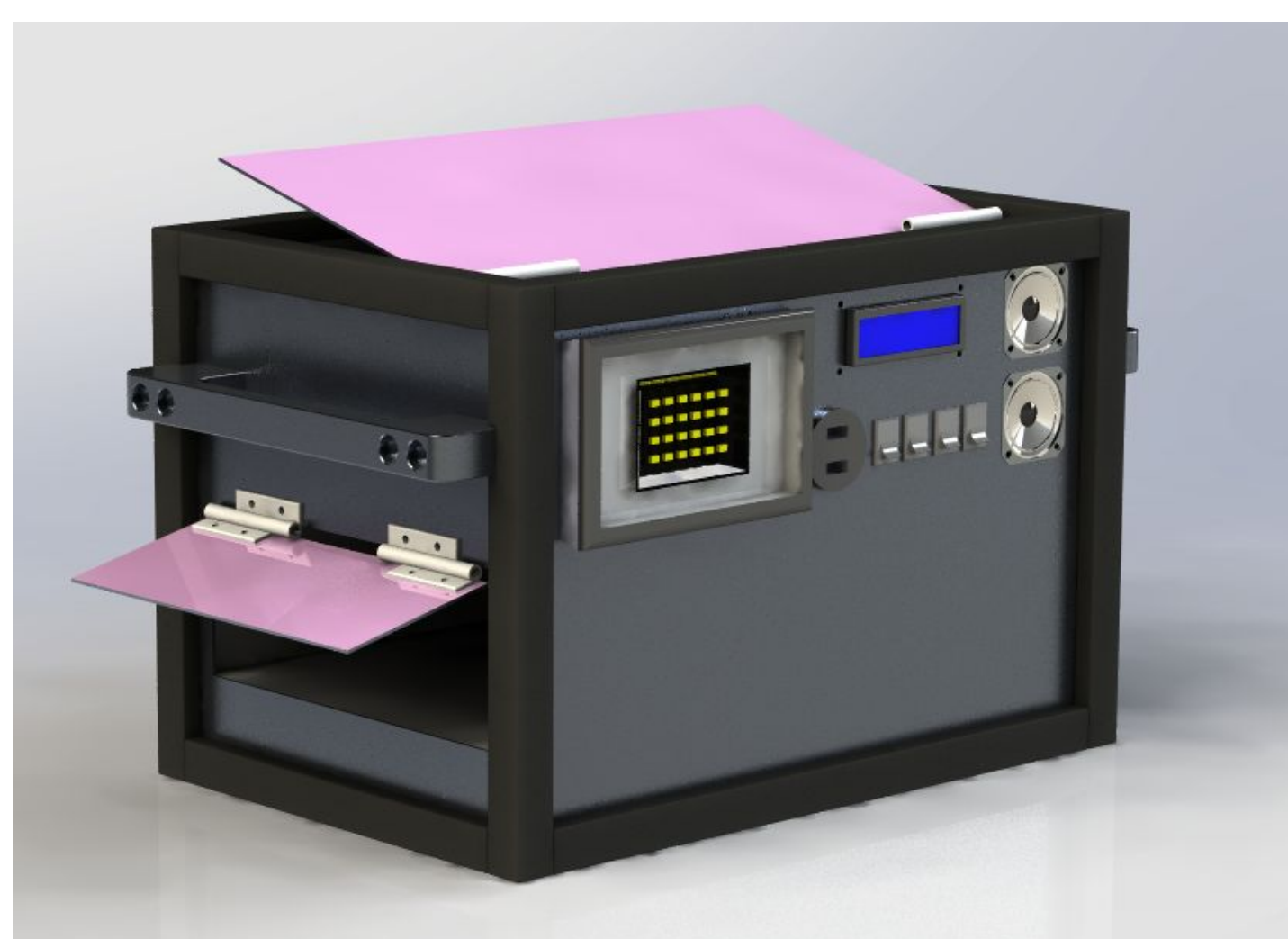


Prototype Phase: Based upon the new design, PED V2, an initial prototype was created. The prototype ensure that all the components and circuits would function and fit properly within the current dimensions. Also, it was used as a proof of concept to help identity what needs to change with the design.



Production Phase: Once the prototype was created the team moved to the Final Production of the PED.

Final Design



The final design consisted of a aluminum sheet metal frame that was created in two parts. The dimensions for the PED frame are 9" x 9" x 14" and it is estimated to weigh about 25lbs with all the components placed within the design. The PED features two carrying handles, one compartment for holding the solar panel (12.9" x 8.1" x 3.2"), one compartment for holding the medical kit (13.2" x 6.7" x 4.1"), and the handheld radio. In addition, it features two 80db speakers, on 998 lumen LED flood light, USB QC 3.0 charge port, 16x2 LCD screen, 14.8V 24,500mAh battery pack, waterproof design, and impact resistant siding.

Verification Test & Results

Functional Requirement	Verification Test	Results
GPS Services	Are the Lat. & Long. Coordinates Accurate?	Not Complete: Would of tested different locations to determine if the coordinates received by the PED are accurate to the actual location.
Battery Storage	Does the PED have a 24 hour battery life?	Not Complete: Need to fully charge the PED and activate the LED light. Time how long the light remains powered for.
Size	Are dimensions with 32"x14"x9"?	Complete: PED dimensions are 9" x 9" x 14"
Weight	Does the PED weigh under 30 lbs.?	Complete: PED weight is 25lbs
Storage	Will it fit a first-aid kit?	Complete: Storage Compartment Dimensions 13.2" x 6.7" x 4.1"
Communication Services	Will the radio receive EMRS and weather bands?	Not Complete: Use the handheld radio setting to confirm it receives the different emergency bands.
Impact Resistant	Can it withstand a 3 ft. drop	Not Complete: Drop the PED 5 times from 3ft and monitor the electrical functions to see if they fail.
Regenerative Charging	Can it charge over a 12 hour period? (Daylight)	Not Complete: Measure the average current output while laying out in the sun over a 10 hour time span.
Siren & Alarm	Will the alarm emit 80dB of volume?	Not Complete: Activate the Siren use dB meter to measure.
External Power Supply	Can it charge a smartphone?	Not Complete: Activate PED USB ports, plug in smartphone see if it charges.
Light Supply	Can it illuminate a 10'x10'x10' room?	Complete: The light was able to fully illuminate a 10' x 10' x 10' room.

References

Natural events. (2012). Retrieved from https://www.who.int/environmental_health_emergencies/natural_events/en/