

Entrée Wireless

Mobility Solutions for Demanding Applications

How to build a Warrior Portable HotSpot in a Box

Scenario – John Doe an electrical engineer works for a medium to large sized company (>100 employees) that

- a. Provides products to commercial and government organizations.
- b. or Wants to deploy portable communication equipment to several in house locations.

John's boss asks him to develop 'Make vs Buy' recommendation for the deployment of 10 or more Warrior Hot Spot like products. The recommendation is to be supported by a detailed project plan for the design and manufacture of 10 units. John's development plan is on the next page and the summary report is below. He suggested the following:

1. Assign an electrical/mechanical engineer ½ time for 3 – 4 months
2. Provide technician, purchasing and quality control support
3. Allocate a non burdened budget of \$25K - 30K including cost of materials and engineering time.
4. or just *call Entrée Wireless for a price and delivery quote* (3 weeks max) on a custom design.

How to build a Warrior Portable HotSpot - Summary Design and Development Plan

Item	Effort Days	Material Cost	Calendar Work Days	Description
1	2		5	Develop product specification including reviews and revision
2	2		5	Prepare detailed Development Plan, itemize all tasks
3	3		5	Develop preliminary design including component selection. Identify several alternates on key components, Detailed bill of materials, nuts, bolts, rivets etc. Include a design review
4	2	\$2,100	20	Procure materials (Qty 1 + spares), custom brackets and panels (Qty 12 ie. min order each bracket)
7	2	\$500	5	Design, procure and set up system test, loads, thermometer, data recorder
5	2		8	Write a test plan, Test key components under all operational scenarios and multiple full charge/discharge cycles..
6	2	\$200	5	Fabricate prototype (1), Hand build in house
8	1		5	Test and evaluate prototype, revise as required
	16	\$2,800	58	sub totals for Prototype
	\$600	\$9,600		Eng \$/day (\$75/hr)
		\$12,400		Total Engineering & Material for Prototype
9	2		5	Prepare pre-Production documentation, Solid Works drawings
10	2	\$3,000	2	Procure pre-production materials including cases, charger, batteries (Qty 12), use brackets purchased from prototype above
11	3	\$1,500	5	Fab 10 pre-production units, out source case modifications
12	1		1	Quality control inspection
13	2		2	System test
14	1		1	Packaging
15	3		2	Final report
	14	\$4,500	18	Sub totals for pre-Production run – (Qty 10)
	\$600	\$8,400		Eng \$/day (\$75/hr)
		\$12,900		Total Material and Engineering for pre-Production Run
	30	\$25,300	76	Total Project Cost – (Qty = 10 + Prototype)
			3.6	Total Calendar Months

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Detailed Project Plan. – How to Build a Warrior Portable HotSpot in a Box

1. Specification – Develop a detailed product specification
 - a. Specify features, size, weight, operating time, recharge time, operating conditions, ruggedness, weather worthiness
2. Prepare development plan
 - a. Identify development tasks
 - b. Estimate development, material and manufacturing cost
3. Design review – It is surprising what comes to light when you write it down
 - a. Revise specification and development plan per design review
4. Preliminary design – Electrical, Mechanical, Packaging
 - a. Estimate power requirements of routers and other equipment
 - b. Design and draw schematic/wiring diagram
 - c. Select battery, charger, electro/mechanical and RF components – include several alternates
 - d. Preliminary mechanical design
 - i. Select case
 - ii. Sketch preliminary placement of internal components – panels, brackets
 - iii. Design and 3D render component placement – charger, battery, router, other
 - iv. Design and sketch component mounting and brackets
 - e. Identify and select electro-mechanical components – include several alternates
 - f. Identify and select standard RF components – Antennas, cables, adaptors
 - g. Identify custom RF components
 - h. Identify and select battery and charger – include several alternates
 - i. Develop preliminary bill of materials including alternates
 - i. Don't forget appropriate hardware, nuts and bolts (stainless steel?)
 - j. Identify suppliers and part number
 - k. Price bill of materials, Define labor requirements and estimate cost.
5. Design review – revise as required
6. Create preliminary manufacturing specifications and drawings
7. Develop detailed 'Bill of Materials' (BOM) and estimate total material cost
8. Design review – revise preliminary design as required
9. Create a system test plan – review, revise and approve
10. Acquire/develop test equipment
 - a. low, medium and high loads,
 - b. temperature test at high and low loads, operating, charging, et c
 - c. Select equipment to record data during all tests
11. Test and measure power requirements of routers and other devices
12. Order and test key components (2 sets)
 - a. Battery, Charger, Electro/mechanical
13. Validate performance of battery and charger.
 - a. Test with and without devices connected and with and without AC connected.
 - b. Perform multiple discharge and charge cycles
 - c. Record and analyze results
14. Order custom and standard parts for 12 units
 - a. Allow for min quantities and long lead times on custom components
 - b. Battery, Charger
 - c. Standard electro-mechanical, RF parts
 - d. Custom sheet metal – Min order \$300 - \$500 (long lead time)
 - e. Custom RF components – Min order ??, (long lead time)
 - f. customer labels – Allow for lead time, usually a \$50 - \$100 min charge
 - g. Receive and review components, Revise and reorder as required

15. Develop a system test procedure – multiple charge/discharge cycles
 - a. Approve system test plan
16. Hand build a prototype,
 - a. Manually layout measure and drill holes, machine case as required
 - b. Install mechanical components
 - c. Install, crimp, solder, tie down electrical components
 - d. Organize and ty-wrap wiring
17. Set up test equipment – data recorder, simulated hi and low current loads
 - a. Run a subset of the system test
18. Run system test
 - a. Perform a detailed system test
 - b. Document and Report results
19. Review and revise design
 - a. Revise schematic and BOM as required
 - b. Approve
20. Revise hardware as required
21. Re-order affected components
22. Kit parts for a run of 10 units, re-order missing parts as required
23. Design review –
 - a. revise specifications as required
 - b. revise manufacturing documents as required
24. Create/update manufacturing drawings for pre-production run (10 units)
 - a. Revise and upgrade all drawing
 - b. Create procurement specifications for custom components
 - c. Design labels
25. Prepare detailed Bill of Materials
26. Create machining templates for the case,
 - a. Test machine and assemble one case
27. Order custom case machining for 10 units – allow for lead time
28. Select and order packing and shipping materials
29. Kit components for 10 units
30. Fabricate 10 units
31. Assemble mechanical components
 - a. Assemble electrical components – solder, crimp and tie down as required
 - b. Add labels
 - c. Quality control inspection
32. Final test 10 units
 - a. Run system test, Report results
33. Pack for shipping
34. Update manufacturing documentation
 - a. Revise product specifications
 - b. Summarize project expenses
 - c. Revise manufacturing cost estimate
35. Develop summary project report