

Battery Selection for Electronic Systems

Battery selection should be considered early during the design phase of affordable electronic systems. The important choice of an appropriate battery can reduce system acquisition costs and keep logistics support costs down for the life of the system.

Battery Selection Considerations

Operational voltage:

At what voltage will the system operate? Batteries are rated for a nominal voltage, which is the average voltage the battery produces from full charge to end of discharge. Design your system to operate properly over the full voltage range of the battery to maximize the energy capacity for your system.

Typical run time:

How long does the system need to run before replacing or recharging the battery, or shutting down the system? High power requirements, high operational voltage, and long runtimes mean larger batteries.

If small, lightweight batteries are required – such as for soldier carried communications systems – consider power management in your system design. Try to minimize power consumption when the system is on standby or running routine functions.

Operating environment:

Will the system be required to run outside in extreme cold (winter in Alaska) or extreme heat (summer in the Middle East)? If so, select a battery that can operate at extreme temperatures.

Single use (primary) battery or rechargeable (secondary) battery (Table 1):

Consumer grade, single use batteries such as AA and D alkaline cells are inexpensive. The logistics cost of supplying warfighters at long distances from a supply depot, may significantly add to the cost of a “cheap” consumer grade primary battery and therefore increase the lifetime cost of the system. When the system is used at the end of a long supply chain, a rechargeable battery may initially cost a little

more, but re-supply costs will be reduced. Consider a system design that allows either rechargeable or single use batteries to be switched in the field.

Need	Rechargeable	Non-Rechargeable
Cycling	X	
Long Life	X	
Low Cost		X
Low Weight		X
Low Maintenance		X

Table 1: Comparison of rechargeable (secondary) batteries and single-use (primary) batteries [1]

Battery compartment size:

Once the battery has been selected, dedicate enough space in the system housing for the battery. Do not block or disable battery safety devices, such as safety pressure release vents or battery safety electronics. When possible, keep batteries away from heat concentrations in the housing. Overheating rechargeable batteries could negatively impact their cycle life or cause a thermal runaway condition. When considered late in the design process, sometimes only a custom battery can provide the power needed while still fitting in the available housing space. Custom batteries drive up both the acquisition and lifetime costs of a system. Unless a special application requires a custom battery that a proven electro-chemistry cannot satisfy, avoid cutting edge battery developments because of their lack of standardization and unproven performance.

Finally, when possible, select a standard size commercial battery or a standard military battery in common use. Standard batteries are easy for the operator to obtain and the manufacturers automatically improve their capacities with the latest electro-chemistry and manufacturing technology improvements without additional costs to the system designer. Some examples are shown in Table 2.

Electro-Chemistry	Typical Application
Lead acid	Wheel chairs, emergency lighting, UPS, automobiles
Nickel-Cadmium (NiCd)	Two-way radios, biomedical equipment, video cameras, power tools
Nickel-Metal Hydride (NIMH)	Cell phones, laptop computers, electric and hybrid vehicles
Lithium Ion (Li-Ion)	Computers, cell phones
Lithium Ion Polymer (Li-Ion polymer)	Cell phones, computers
Reusable Alkaline	Toys, entertainment devices, flashlights

Table 2: Some typical applications for standard rechargeable batteries [1]

For more information, please contact the Helpline at 610.362.1320 or via email at helpline@aciusa.org.

Reference

[1.] Buchmann, Isidor. Batteries in a Portable World: A Handbook on Rechargeable Batteries for Non-Engineers. Cadex Electronics, Inc. May 2001.

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