

The Need for a New Battery Option

Subject Area General

EWS 2006

Contemporary Issues Paper
EWS Writing Assignment
The Need for a New Battery Option
Submitted by Captain GM Marshall
to
Major R.A. Martinez, CG2
February 7, 2006

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE 2006		2. REPORT TYPE		3. DATES COVERED 00-00-2006 to 00-00-2006	
4. TITLE AND SUBTITLE The Need for a New Battery Option				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) United States Marine Corps, Command Staff College Marine Corps, University, 2076 South Street, Marine Corps Combat ,Development Command, Quantico, VA, 22134-5068				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 12	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

The Need for a New Battery Option

Any Marine during an after-action report will let you know: the grunts were great and comm stunk. This observation often results from dead batteries. The Marine Corps' dependence on the existing battery selections for radio equipment significantly limits the amount of time operations can be conducted by foot or away from vehicles. The heavy carrying weight and short power life of the current main power source for USMC manpack radios, the BA-5590/U Lithium Sulfur Dioxide (LiSO₂), presents challenges to operational planners who rely upon it as the primary battery for tactical radio systems. While the Marine Corps has made significant advances in renewable power sources supporting stationary command posts or vehicle radio systems (VRC/MRC radios), it has not increased the overall power life of the BA-5590. Replacing the BA-5590 would provide adaptability in foot-mobile operations/manpack operations planning. Prolonged reliance on the BA-5590 will continue to restrict commanders' flexibility when planning for dismounted operations.

The Marine Corps' Current Alternatives

Although commanders and operators in the field are most directly affected and could benefit from a substitution of the

BA-5590 with a more capable power source, the current push for battery alternatives is being made by the Commandant of the Marine Corps. The Commandant's initiative focuses on alleviating supply shortages rather than tackling tactical concerns. Draft Marine Corps Order 3523.XX (MCO 3523), entitled "Conservation Policy for Primary Batteries," highlights the requirement for units to seek substitute power methods for radio systems. This drive for secondary power sources is meant to address an "[i]ncreased operational tempo and unexpected production shortfalls" that have led to dwindling BA-5590 stockpiles; it is not a recognition of the tactical improvements available in a longer-lasting or light-weight battery replacement.¹

MCO 3253 additionally includes a "Power Source Selection Diagram"² ("Selection Diagram") which provides a key for planners "to determine possibilities for powering equipment"³ by means of house power (AC power), vehicle power (DC power), or rechargeable battery options. The "Selection Diagram" provides several factors a planner should consider, including availability of power resources, equipment availability, and mission duration.

¹ USMC, "Draft MCO 3253.XX" paragraph 1.b (22 October 2003).

² "MCO 3253" Enclosure 1.

³ "MCO 3253" paragraph 3.b (2).

MCO 3253 identifies the use of AC and DC adapters as the Marine Corps' preferred means of providing power to radio equipment when practical. According to the "Selection Diagram," communications planners must review the house or vehicle power sources available. Then planners should arrange to use communications equipment with uninterrupted power adapters for bench- or vehicle-mounted radios, while not depleting a unit's battery stockpiles. Though these alternatives reduce a unit's consumption of battery supplies, these solutions are designed for static positions and are too rigid for foot-mobile operations.

For these important dismounted operations where dedicated AC or DC power sources are unavailable, the "Selection Diagram" goes on to list the secondary solution for radio powering requirements as rechargeable batteries⁴ and the BB-390 Nickel Metal Hydride battery specifically.⁵ The BB-390 is the primary rechargeable battery substitute to the BA-5590, and it can support foot-mobile operations with some limitations.

Although the BB-390 operates in the same manner as the BA-5590, there are practical restrictions to its utility for

⁴ "MCO 3253" Enclosure 1

⁵ USMC, "Military Batteries 101," paragraph 3.0, 4 April 2003
<<http://www.marcorssyscom.usmc.mil/sites/pmeps/DOCUMENTS/BatteryPolicy/Battery%20Policy%20-%20Battery%20101.doc>>(30 December 2005).

supporting ground forces. For instance, the Marine Corps Systems Command (MARCORSYSCOM) classifies only a sixty to eighty percent battery life for the BB-390 in comparison to the BA-5590.⁶ Planners would have to send radio operators on foot-mobile missions with at least twenty-five percent more batteries than if they were using BA-5590s. This is why the "Selection Diagram" identifies the BB-390 as a choice only for "[s]hort duration missions..." rather than long-term ones.⁷ For longer missions, planners must to rely on the Marine Corps primary battery system, the BA-5590.

Limiting Factors of the Primary Battery System

Power, price, size, and weight have forced communicators--and MARCORSYSCOM--to reflect on the suitability of the BA-5590 to continue to serve as the primary battery system for Marine Corps radio systems. In fact, it is the limited lifespan of the BA-5590 that has depleted the stockpiles of batteries to the point where the Commandant had expressed concern about the available inventory.

To help facilitate the planner's ability to calculate power requirements, the Marine Corps has developed the "Master

⁶ "Military Batteries 101," paragraph 3.0.

⁷ "MCO 3253," Enclosure 1

Battery Requirements Model.”⁸ This Microsoft Access database program provides a planner with a quick method to compute the number of batteries needed (both rechargeable and non-rechargeable) for a specified period of use. For example, if a planner wants to utilize one manpack PRC-119 radio system (the primary VHF Single Channel Ground-Air Radio System or “SINCGARS” radio system used by the Marine Corps), twenty-four hours of continuous use will require a minimum of one BA-5590. The same operation with a PRC-113 UHF radio will need four BA-5590s, and the PSC-5 Tactical Satellite (the primary Tacsat in the Marine Corps) Radio system will involve six.⁹ Many planners would likely inflate the projected number of batteries necessary to provide redundancy and to cover any unforeseen changes in the mission.

In addition to the duration constraints associated with the BB-390 and the BA-5590, there are other restrictions associated with these power systems. For instance, the BA-5590’s weight of 2.25 lbs¹⁰ and BB-390’s 3.88 lbs¹¹ would appear innocuous. However, when reflecting on these weights

⁸ USMC, “Master Battery Requirements Model,” CD (18 February 2004).

⁹ “Master Battery Requirements Model” computation of TAMCN A2070, A2065, and 0918.

¹⁰ Saft America, Inc., “BA-5590” Data Sheet, December 2005, <http://www.saftbatteries.com/130-Catalogue/PDF/BA_5590_BU.pdf>(6 February 2006).

¹¹ Bren-Tronics, Inc., “BB-390 B/U” Data Sheet, August 2004, <<http://www.bren-tronics.com/NEWEST%20DATA%20SHEETS/BB390B-U.pdf>>(6 February 2006).

and the fact that planners add extra batteries for power redundancy for the SINCGARS when able, or that the Tacsat radios entail many more BA-5590s for the same time period, the limitation begins to become clear. For instance, in the case of twenty-four hours of operation for a PSC-5 Tacsat radio, six BA-5590s weighing 2.25 lbs each would equal 13.5 lbs. For each additional day, the radios would need another 13.5 lbs of batteries.

This weight factor, along with the size of the batteries, places a heavy burden on dismounted operators. The dimensions of the BA-5590 and BB-390 are 4.4 by 2.5 by 5 inches (two batteries would take up about the space of an MRE).¹² Where Marine Corps radio systems require one-to-six BA-5590s per day, batteries begin to take up the limited pack space instead of other essentials. An operation utilizing Tacsat planning for a forty-eight-hour period of active use would necessitate twelve BA-5590s and sixteen BB-390s.¹³ The BA-5590 batteries would weigh twenty-seven lbs and take up nearly all of the space in the pack, while the BB-390s would weigh in at a staggering sixty-two lbs and compel the use of multiple packs to carry. An operation lasting for seventy-two hours would call for eighteen BA-5590s weighing forty lbs. Needless to

¹² "BB-390 B/U" Data Sheet

¹³ "Master Battery Requirements Model" computation of 0918.

say, BB-390s in this scenario is not an option: the pack would weigh-in at ninety-three lbs for the twenty-four batteries required.

New Options on the Horizon

Since the BA-5590 poses these limitations on planners--as well as the individual necessary to carry them--the Marine Corps has begun to look at other batteries. The two main options to the BA-5590 are the BA-5390/U Lithium Manganese Dioxide (LiMnO₂) and the Zinc-Air BA-8180/U batteries. Each battery type possesses its own set of risks, but they represent a vast improvement on the BA-5590.

The first risk facing these new systems, much like any new item in the acquisition system, is the limited amount of safety review completed.¹⁴ Also, there is a format issue for both batteries. The higher voltage output of the BA-5390 compared to the BA-5590 makes it acceptable for use only with the SINCGARS radio.¹⁵ Use of this battery with Tacsat would damage the radio.¹⁶ Since the Tacsat radio is the true power hog in battery-consumption planning, this is a significant constraint on the BA-5390 as a full solution.

¹⁴ This is the case with the BA-5390 which has not yet received its official HazMat certification.

¹⁵ "Military Batteries 101," paragraph 2.1

¹⁶ "Military Batteries 101," paragraph 2.1

The format issue for the BA-8180 is the fact that it takes up more room and weight than the BA-5590 at a size of twelve by seven by two inches and a weight of six lbs.¹⁷ Additionally, the BA-8180 requires an adapter to connect the battery to radio systems. The Marine Corps is reviewing multiple adapter solutions, but so far each radio will only needs one adapter to function properly. The adapter is a one-time purchase of sixty dollars, bringing the overhead cost of communications equipment even higher for cash-strapped units.¹⁸

There are some additional price considerations for these alternatives. The BA-5390, priced at 120 dollars per battery, costs about forty-five dollars more than the BA-5590 per unit.¹⁹ The BA-8180's cost comes in at a whopping 250 dollars per battery.²⁰ But even if price was not a factor, there are no stockpiles available of these batteries.

What a planner gets for the additional cost, size, and weight is a much longer runtime than the existing BA-5590 solution. MARCORSYSCOM recognizes that the BA-5390 "has demonstrated to provide 50% more energy capacity than BA-5590"

¹⁷ USMC, "BA-8180/U" Power Documentation Pamphlet, <http://www.marcorsyscom.usmc.mil/sites/gtes/PM%20POWER/DOCUMENTS/BA-8180.pdf#search='ZincAir%20BA%208180'>>(6 February 2006).

¹⁸ "Military Batteries 101," paragraph 2.2

¹⁹ "Military Batteries 101," paragraph 2.1

²⁰ "BA-8180." Though it should be noted that one 8180 replaces two 5590's.

and the BA-8180 "has 5X to 7X the runtime of a BA 5590."²¹

Using the same number of batteries that previously would last only one day, these new batteries would enable operations to last from thirty-six hours to seven days longer than with the BA-5590.²² This factor provides for tremendous flexibility in operations planning.²³

Easing the Burden

If a communications planner can reduce the pack weight imposed by a primary battery, the radio operator will benefit. For instance, a foot-mobile operation would be able to move longer distances without putting as much strain on the individual carrying the communications gear.²⁴ Also, for operations facing limited re-supply options, a longer battery life means more room in the pack for other sustainment essentials such as water. Although the overall pack weight may not be reduced, the burden due to communications requirements will be.

²¹ "Military Batteries 101," paragraphs 2.1, 2.2

²² The 5390 weight is comparable to the 5590 at 2.8lbs according to the Ultralife Battery Incorporated BA-5390/U Technical Data sheet, therefore planning factor is the same.

²³ One benefit that is not discussed is the fact that the 8180 "contains no hazardous material and can be disposed of as normal household waste" according to the BA-8180 Power Documentation pamphlet.

²⁴ This can be seen as much the same reason that the SINCGARS was reduced in size from the original "A" model of the PRC-119 to the "D" model.

When the Marine Corps eliminates the weight and size of the BA-5590, a commander will be able to enjoy a greater flexibility in foot-mobile operations. Though the Marine Corps' focus has been on preserving the existing BA-5590 stockpiles through the utilization of rechargeable battery stocks and vehicle power solutions, replacement of the BA-5590 as the primary battery system and main power source for manpack radios will do the most to improve the tactical development in the Marine Corps. Even according to the Marine Corps' own "Military Batteries 101" guidance, "Tactics and Doctrine need to continue to be factored into consideration with battery selection and usage."²⁵ Without alternatives to the BA-5590, such as BA-8180 and its related reduction in pack weight and space, commanders will be stuck with restricted foot-mobile tactics.

Word Count: 1,697

²⁵ "Military Batteries 101," page 6, paragraph 6.0

Bibliography

- Bren-Tronics, Inc. "BB-390 B/U" Data Sheet. August 2004.
<<http://www.bren-tronics.com/NEWEST%20DATA%20SHEETS/BB390B-U.pdf>>(6 February 2006).
- Saft America, Inc. "BA-5590" Data Sheet. December 2005.
<http://www.saftbatteries.com/130-Catalogue/PDF/BA_5590_BU.pdf>(6 February 2006).
- United States Marine Corps. "BA-8180/U" Power Documentation Pamphlet,
<<http://www.marcorsyscom.usmc.mil/sites/gtes/PM%20POWER/DOCUMENTS/BA-8180.pdf#search='ZincAir%20BA%208180'>>(6 February 2006).
- United States Marine Corps. "Draft Marine Corps Order 3253.XX," 22 October 2003. Washington, D.C.
- United States Marine Corps. "Master Battery Requirements Model." CD-ROM. 18 February 2004.
- United States Marine Corps. "Military Batteries 101." 4 April 2003.
<<http://www.marcorsyscom.usmc.mil/sites/pmeps/DOCUMENTS/BatteryPolicy/Battery%20Policy%20-%20Battery%20101.doc>>(30 December 2005).