

**REQUEST FOR INFORMATION (RFI)**  
**Experimental Forward Operating Base (ExFOB) 2013-1 – Hybrid Power Systems**

**INTRODUCTION:**

This announcement constitutes an RFI notice for planning purposes.

The next Experimental Forward Operating Base demonstration (ExFOB 2013-1) will be held at Marine Corps Air Ground Combat Center (MCAGCC) Twentynine Palms, California, from 6 through 10 May 2013. The focus of ExFOB 2013-1 is **hybrid power systems** that could enhance combat effectiveness and reduce logistics support of Patrol Bases (PBs) and Forward Operating Bases (FOBs). The due date for responses to this RFI is midnight on **1 March 2013**.

**GENERAL ExFOB BACKGROUND:**

Created by the Commandant in 2009, the ExFOB brings together stakeholders from across the Marine Corps requirements, acquisition, and technology development communities in a dynamic process to quickly evaluate and deploy technologies that reduce our need for "liquid logistics" today, and to establish requirements for tomorrow.

Industry is invited to ExFOB to demonstrate off-the-shelf technologies with potential to address current Marine Corps capability gaps. Promising technologies are then put into the hands of Marines for extended user evaluation under combat and/or training conditions. User evaluation results inform requirements development and may ultimately lead to procurement and fielding of systems that close these gaps, resulting in a more combat-effective fighting force.

Over the last three years, the ExFOB Team has:

- Conducted 5 demonstrations at Marine Corps bases across the country
- Reviewed 280+ RFI submissions and evaluated 75+ technologies at ExFOB
- Purchased and deployed 11 different technologies to Afghanistan
- Transitioned 4 Technologies to Programs of Record

**HYBRID POWER SYSTEMS:**

The focus of ExFOB 2013-1 is **hybrid power systems**. The Marine Corps' hybrid power needs can be divided into four categories, each with different power demands, attributes, and transport requirements: MEHPS Lightweight, MEHPS Medium, MEHPS Micro-Grid Medium, and MEHPS Micro-Grid Heavy. The power demands, attributes, and transport requirements of each of the four categories of systems are listed below:

	<b>Peak Power</b>	<b>Attributes</b>	<b>Transport Requirements<sup>1</sup></b>
<b>MEHPS Lightweight</b>	3 kW	-Auto-control of single generator -Energy storage -Solar	Each component does not exceed four man lift
<b>MEHPS Medium</b>	10 kW	-Auto-control of single generator -Energy storage -Solar	All components on LTT
<b>MEHPS Micro-Grid Medium</b>	60 kW	-Auto-control of multiple generators -Energy storage	Controls and energy storage on LTT
<b>MEPHS Micro-Grid Heavy</b>	300 kW	-Auto-control of multiple generators	Forklift-able

The objective of ExFOB 2013-1 is to increase the Marine Corps' knowledge of the state of current commercial hybrid systems and the technological challenges that may be associated with moving these commercial technologies to viable military capabilities i.e. size, weight, durability, etc., within each of these four categories. ExFOB 2013-1 follows the recently completed Analysis of Alternatives (AoA) for Mobile Electric Hybrid Power Source (MEHPS). The AoA provides preliminary analysis concerning the power demands, attributes, and transport requirements of each of the four categories of systems. As part of this analysis, USMC utilized a micropower optimization modeling tool to measure the performance and fuel reduction capability of simulated systems within these categories versus USMC program of record gear at specific power demand profiles. The results of the AoA were presented at the MEHPS Brief to Industry held on 31 January 2013 at Marine Corps Base Quantico. The presentation from that event is available at [www.fbo.gov](http://www.fbo.gov) and [www.hqmc.marines.mil/e2o](http://www.hqmc.marines.mil/e2o).

At ExFOB 2013-1, the USMC will move beyond modeling to look at actual system performance in an austere environment. During the week-long event, ExFOB personnel will meter and monitor the performance of each hybrid system operating in USMC-specific power demand profiles developed during the AoA. Please refer to the proposed Evaluation Concept (included below) for additional information. In addition to quantitative data collection, active duty Marines will provide qualitative feedback on each system.

#### **SPECIFIC SYSTEMS OF INTEREST FOR ExFOB 2013-1:**

MEHPS Lightweight—A modular system for meeting power demand up to 3kW. The system should auto-control a single generator, utilize energy storage, and harvest solar energy. Each component should have a transport burden no greater than “four man lift”.

<sup>1</sup> See MIL-STD-1472G, DEPARTMENT OF DEFENSE DESIGN CRITERIA STANDARD: HUMAN ENGINEERING (11-JAN-2012) for definitions.

MEHPS Medium—A mobile system well suited to meet peak power demands between 3 and 10 kW. The system should auto-control a single generator, utilize energy storage, and harvest solar energy. It is not mandatory that the system be on a trailer, however, the collective components should not drastically exceed the weight and cube of a typical LTT payload.

MEHPS Micro-Grid Medium—A mobile system well suited to meet peak power demands up to and including 60 kW. The system should auto-control multiple generators and utilize energy storage. It is not mandatory that the system be on a trailer, however, the collective components should not drastically exceed the weight and cube of a typical LTT payload.

MEHPS Micro-Grid Heavy—Due to space and equipment constraints, systems of this scale **will not be considered** for participation in ExFOB 2013-1. A future ExFOB may focus on this category.

**\*\*NOTE:** The ExFOB Team will not provide USMC generators for use by participants. **Participants must bring their own generators** to ExFOB 2013-1. Civilian (commercial) generators are acceptable.

#### **SUBMISSION PROCESS AND DUE DATE:**

The ExFOB Team has partnered with the U.S. Army's joint ground systems Enterprise Market Investigation Process (EMIP) to manage the ExFOB 2013-1 RFI process. To respond to this RFI, please visit <http://www.peocscs.army.mil/EMIP.html>, complete an EMIP Technology Application Idea Submission Form (a "Sample" form is included below) and send via e-mail to: [usarmy.detroit.peo-cs-css.mbx.truck-tech@mail.mil](mailto:usarmy.detroit.peo-cs-css.mbx.truck-tech@mail.mil) with cc to [energy@usmc.mil](mailto:energy@usmc.mil). Please do not attach marketing brochures, test reports, or other extraneous materials to your Submission Form as they will not be reviewed. The due date for responses to this RFI is midnight on **1 March 2013**.

If your technology is of interest, the ExFOB Team will contact you with an invitation to participate in ExFOB 2013-1 at MCAGCC Twentynine Palms, California, from 6 through 10 May 2013.

**NOTE: This RFI is issued for the purpose of determining market capability of sources and does not constitute an Invitation for Bid (IFB), a Request for Proposal (RFP), a Request for Quote (RFQ) or an indication that the Government will contract for any of the items and/or services contained in this notice. No solicitation document exists at this time. All information received in response to this notice that is marked Proprietary will be handled accordingly. Responses may not include Classified material. Responses to this notice will not be returned. No reimbursement will be made for any costs to provide information in response to this announcement or any follow-up information requests. Information contained herein is based on the best information available at the time for publication, is subject to revision, and is not binding upon the Government.**

## ExFOB 2013-1 Hybrid Power Systems Evaluation Concept

### Overview

Using the three Hybrid Power Systems categories defined in the RFI (MEHPS Lightweight and MEHPS Medium and MEHPS Micro-Grid Medium), the ExFOB technical team will evaluate each system's performance and fuel reduction capability against its corresponding Program of Record (PoR) power generation equipment using USMC-specific load profiles. Given the wide power ranges, and the current PoR gear utilized in those ranges, there may be multiple load profiles in each category (i.e. 30kW and 60kW TQGs are both used in the MEHPS Micro-Grid Medium category). Evaluation over the four days will provide a level of endurance and fuel consumption data for each system. All load profiles are defined in the corresponding category sections below.

Vendors are expected to arrive early enough to allow time for the government evaluation team to outfit the systems with data collection equipment. Vendors must also have the system fully integrated and operational prior to the "data collection dry run" Sunday afternoon May 5th. The official evaluation event kicks off the following morning, Monday May 6th. It is anticipated that all system evaluations will be conducted during normal business hours, although the possibility of 24-hour evaluation remains. Please see Table 1 for the notional ExFOB 2013-1 event timeline. Note that Thursday May 9th is an "Open Day" which vendors can use to demonstrate additional capabilities, or to repeat evaluations if necessary.

**Table 1. Notional Daily ExFOB 2013-1 Schedule**

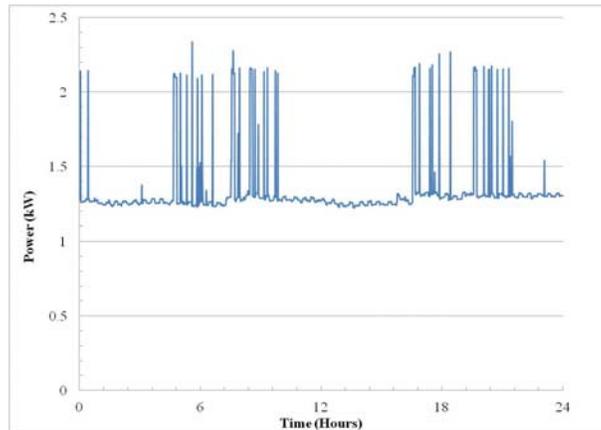
<b>Friday May 3rd</b>	Vendor Setup
<b>Saturday May 4th</b>	Vendor Setup
<b>Sunday May 5th</b>	Vendor Setup 3PM: A data collection dry run will verify the data collection equipment and connections. All vendors must have worked with the evaluation team to integrate data collection gear and completed setup.
<b>Monday May 6th</b>	Profile defined by category (i.e. constant or seasonal)
<b>Tuesday May 7th</b>	Profile defined by category (i.e. constant or seasonal)
<b>Wednesday May 8th</b>	Profile defined by category (i.e. constant or seasonal)
<b>Thursday May 9th</b>	Open Day. Useful for vendor requested demonstrations or to repeat evaluations if necessary.
<b>Friday May 10th</b>	12 noon: Retrograde

### ***MEHPS Lightweight (3kW Peak)***

#### *3kW Evaluation Concept*

Hybrid systems with peak power levels of 3kW will be evaluated based on the actual 24 hour profile found in Figure 1. During the event the load will be simplified to a constant power of

1.2kW with intermittent 2.3kW pulses (minutes in length) to simulate transient loads such as coffee pots and microwaves.

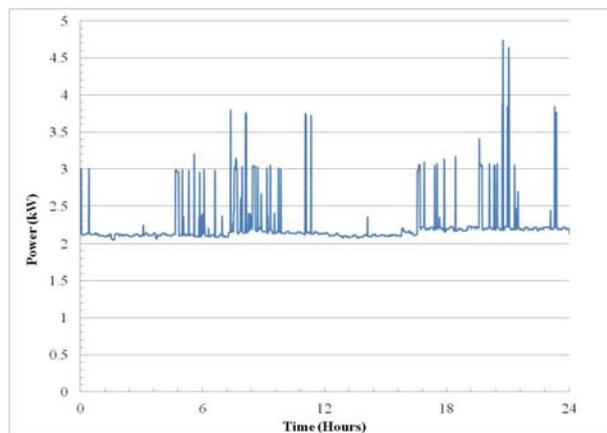


**Figure 1. 3kW ExFOB 2013-1 load profiles**

### ***MEHPS Medium (10kW Peak)***

#### *5kW Evaluation Concept*

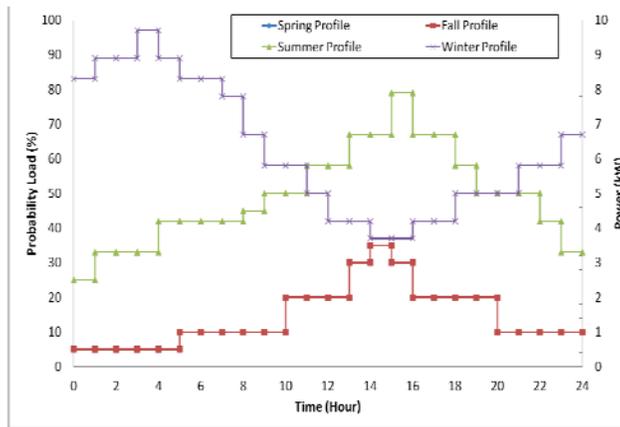
Hybrid systems with peak power levels of 5kW will be evaluated based on the actual 24 hour profile found in Figure 2. This profile will also be simplified to a constant power baseline of 2.2kW with intermittent 4.5kW pulses (minutes in length) over the course of the day.



**Figure 2. 5kW ExFOB 2013-1 load profiles**

#### *10kW Evaluation Concept*

At peak power levels 10kW and above environmental control units (ECUs) constitute a large portion of the energy requirement and overall demand is largely dependent on season. Figure 3 displays the three seasonal demand profiles that will be utilized; summer, winter and a combined spring/fall profile. Each seasonal curve is divided into 24 one-hour steps. During the event each one-hour time step may be compressed into 20 or 30 minute increments to simulate the 24 hour profile in an 8 or 12 hour evaluation day. Please note that Table 2 specifies which seasonal profile will be evaluated each day.



**Figure 3. 10 kW ExFOB 2013-1 seasonal load profile**

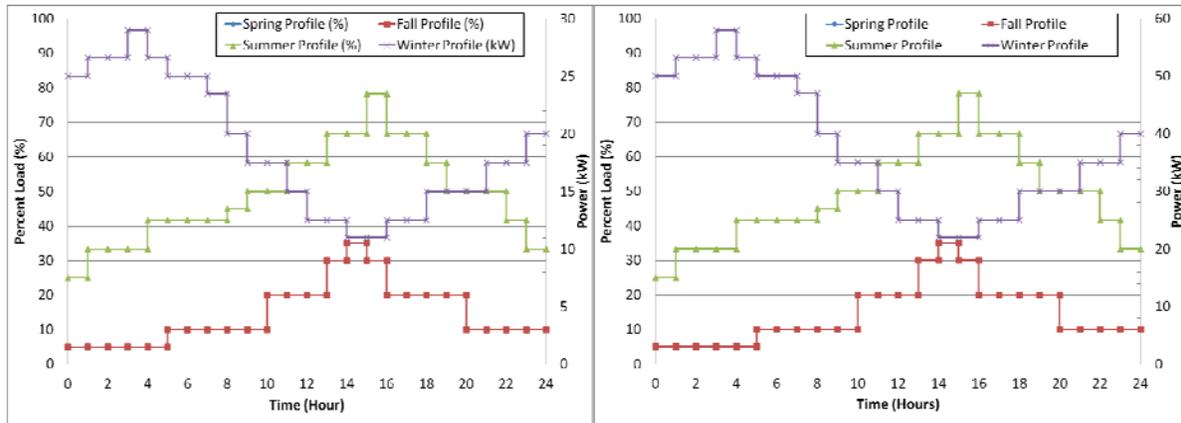
**Table 2. MEHPS Micro-Grid Medium Demonstration Schedule**

Monday May 6th	Spring/Fall Profile
Tuesday May 7th	Summer Profile
Wednesday May 8th	Winter Profile
Thursday May 9th	Open Day. Useful for vendor requested demonstrations or to repeat evaluations if necessary.

***MEHPS Micro-Grid Medium (60kW Peak)***

***30kW and 60kW Evaluation Concept***

Hybrid systems with peak power levels of 30kW and 60kW will power one of the load profiles found below, in Figure 4, based on the 30kW and 60kW PoR TQGs. At these higher power levels ECUs drive a large portion of the energy demand and therefore, three seasonal demand profiles will be used; summer, winter and a combined spring/fall profile. The shape of the seasonal curves is the same for both power levels and each is divided into 24 one-hour steps. Each load profile one-hour time step may be compressed into 20 or 30 minute increments to simulate the 24 hour profile in an 8 or 12 hour evaluation day. Please see Table 2, above, for specifics on which profile will be evaluated on which day.



**Figure 4. 30kW (left) and 60kW (right) ExFOB 2013-1 seasonal load profiles**

### *Data Collection Concept*

#### *Targeted Quantitative Data*

Data collection equipment will be provided by the government evaluation team and individual plans will be developed with each vendor to determine the best way to integrate data collection equipment. Data gathered by the government evaluation team for each system will be available for review by the respective vendors to ensure each system is operating as expected. Data gathered throughout the event for each vendor will be available to ONLY that vendor.

The evaluation team will use a data collection system to continuously monitor and log (at a slow data rate) overall function as well as spot-check measurements for confirmation. Data to be measured includes, but is not limited to:

- AC current via clamp-on meters (continuously monitored)
- AC voltages (spot checked, not monitored continuously)
- Power factor (spot checked, not monitored continuously)
- DC currents via in-line shunts (will require cutting cables, continuously monitored)
- DC voltages (continuously monitored)
- Generator runtimes and fuel consumption (logged daily)

In addition to the system mentioned above, a secondary data collection system will be used to more accurately characterize the three phase power behavior of up to eight (8) generators at a time. These eight measurements may be used for different systems on different days. Each of the eight generators or outputs will have high speed AC current, AC voltage, and power factor measurements logged.

#### *Targeted Qualitative Data*

Marines from the utilities, engineering, and logistics communities will interview each vendor and evaluate the state of each system as it pertains to areas such as training requirements, maintenance, reliability, supportability, transportability, etc.

***Vendor Responsibilities***

Vendors responding to the RFI will be responsible for providing an entire system, including commercial generators (must be permitted in CA) and load banks or loading concepts capable of simulating the provided load profiles.

Vendors selected for the event must also have their systems fully operational and integrated with the government evaluation team prior to the start of the data collection dry run on Sunday May 5<sup>th</sup>.

## Enterprise Market Investigation Process (EMIP) Technology Application Idea (TAI) Submission Form

### Instructions for submission

Please fill out both part A (technology description) and part B (demonstration plan) of this form and send to [usarmy.detroit.peo-css.mbx.truck-tech@mail.mil](mailto:usarmy.detroit.peo-css.mbx.truck-tech@mail.mil) in MS Word format with "EMIP Submission Form [your company name]" in the subject line. If you wish to submit additional information related to this form, please reference the relevant question number and submit along with the form.

### **Part A: Technology description**

Name of Technology Application Idea: <a href="#">GEN-HYB (RFI Category: MEHPS Lightweight)</a>	
Company: <a href="#">Hybrid Company A</a>	Primary contact: <a href="#">Bob the Builder</a>
Address: <a href="#">1 Hybrid Street</a>	E-mail: <a href="mailto:bob@hybrid.com">bob@hybrid.com</a>
City: <a href="#">Hybrid Town</a> State: <a href="#">VA</a> Zip:      Phone: <a href="tel:555-555-5555">555-555-5555</a> <a href="#">22222</a>	
Website: <a href="http://hybridcompany.com">hybridcompany.com</a>	
Commercial and Government Entity (CAGE)* code, if assigned: <a href="#">N/A</a>	
* A CAGE code is a five position unique identifier that provides the Government a standardized method of identifying a given facility at a specific location.	
<p>1) Capability addressed by the technology. (Choose the one most relevant category; examples are not exhaustive.)</p> <p><input type="checkbox"/> Soldier safety (collision avoidance, rollover protection, seat / restraint technology, occupant protection).</p> <p><input type="checkbox"/> Platform survivability (armor protection, force protection / self-defense / lethality, fire suppression).</p> <p><input type="checkbox"/> Reliability, maintainability and sustainability (improved reliability / maintainability: rarely breaks, easy to fix, simple to support; improved supportability: reduced number of tools and / or maintenance tasks).</p> <p><input type="checkbox"/> Mission enhancements (increased payload and / or range; improved transportability, distribution and handling; improved information management; improved training).</p>	<p><input type="checkbox"/> Mobility (improved soft soil traversing characteristics, improved ride dynamics [shock and vibration], improved stability and handling characteristics).</p> <p><input checked="" type="checkbox"/> Power (power management, auxiliary power for platforms, alternative energy sources, flexible liquid fuel systems, high voltage bus, higher power, lighter batteries, more efficient electronics, more capacitor storage, software-controlled circuit breakers).</p> <p><input type="checkbox"/> Unmanned operations (increased control of unmanned systems, UGV autonomous movement, UGV autonomous tactical behavior, robotic capabilities).</p> <p><input type="checkbox"/> Other</p>
<p>2) Provide a brief description of the technology to include weight and dimension characteristics. (If this TAI is a resubmission, please indicate what significant changes have been made to your technology.) [<b>**NOTE: Identify the RFI category (MEHPS Lightweight or MEHPS Medium or MEHPS Micro-Grid Medium) and describe the peak power, attributes, and transport requirements of your system</b>]</p> <p><a href="#">GEN-HYB fits in the MEHPS Lightweight category of hybrid systems. GEN-HYB is a 3kW peak output hybrid system with 4 kWh lithium iron phosphate batteries and 4kW of flexible solar panels. Each individual component of GEN-HYB can be transported via 4-man lift.</a></p>	
<p>3) What are the potential benefits of this technology over the technology currently in use? <a href="#">GEN-HYB requires 20% less fuel than a standard generator and offers silent watch capability.</a></p>	

4) Is your technology a model or a prototype or is it in its final configuration? Model / prototype  Final configuration   
 Please discuss. **\*\*NOTE: Respondents MUST check the "final configuration" box above. Prototypes WILL NOT be accepted.]**

5) Have you operated your technology in an environment that simulates key aspects of its intended operational environment? Yes  No  If yes, please discuss to include if anyone from the military was involved. **GEN-HYB was tested by U.S. Army CERDEC at Ft. Bliss in May 2012.**

6) Have you operated your technology in its intended operational environment? Yes  No  If yes, please discuss to include if anyone from the military was involved.

7) Is your technology currently being used by the military? Yes  No

a) If yes, please provide National Stock Number, if applicable, and identify what platform(s) your technology is on. **N/A**

b) If no, what issues do you foresee integrating your technology into military platforms and into a military environment (extreme temperatures, sand, fording, etc.)? **Interface with military generators and distribution systems may be an issue.**

8) Have you shown / discussed / been in contact with government personnel regarding your technology? Yes  No   
 If yes, please discuss to include providing government contact information.

Name: **POC 1  
CERDEC**

Date: **May 2012**

Email: **POC1@usarmy.com**

Organization: **U.S. Army**

Name:

Email:

Organization:

Date:

Name:

Email:

Organization:

Date:

9) Is your technology currently being applied in the private sector? Yes  No  If yes, how is it being applied? GEN-HYB is currently being used to power remote antennae systems in Alaska.

10) Have you been in contact with Original Equipment Manufacturers (OEMs) of military equipment about your technology? Yes  No  If yes, what was their response to your technology?

11) Please provide a summary of any relevant testing data for your technology. **[\*\*NOTE: Describe test results but DO NOT attach a copy of test report(s). If necessary, USMC will contact you for the report.]**

During a demonstration at Ft. Bliss in May 2012, GEN-HYB reduced fuel demand by 20% over a stand-alone generator.

12) Please attach a .jpg photo of your technology when submitting this form. **[\*\*NOTE: CAD drawings and computer simulations WILL NOT be accepted.]**

**Part B: Demonstration plan**

1) Demonstrators are allotted 10 minutes for conference room setup, 15 minutes for conference room teardown, and a maximum of 80 minutes for briefing presentation and physical demonstration. How much of the 80-minute allotment will you require? **[\*\*NOTE: This question is N/A. ExFOB DOES NOT include a conference room demonstration. All demonstrations must be DYNAMIC. See the Evaluation Plan accompanying the RFI for additional details.]**

2) Will your demonstration be a static display, a dynamic display, a conference room briefing?

Static  Dynamic  Conference room

3) What are the details of your demonstration plan? **[\*\*NOTE: A dynamic demonstration is required. See the Evaluation Plan accompanying the RFI for additional details.]**

4) Is a test track or other special facilities required? Yes  No  If yes, please list any requirements.

5) Will you need government equipment / vehicle(s) for your demonstration? Yes  No

If yes, please provide details. **[\*\*NOTE: Participants must bring their own generators to ExFOB. Government generators WILL NOT be provided.]**

Forklift required.

6) What is your estimate of how much time you need to install and uninstall any equipment to government vehicles?

Not applicable  30 minutes or less  30-60 minutes  60-90 minutes  Greater than 90 minutes

7) Will you need government technicians available to assist in your demonstration? Yes  No

If yes, please provide details. [**\*\*NOTE: The ExFOB test team will assist participants with connecting their hybrid systems to load banks for the demonstration.**]