

# SECTION 6: EXPEDITIONARY ENERGY





## INTRODUCTION

“The current and future operating environment requires an expeditionary mindset geared toward increased efficiency and reduced consumption, which will make our forces lighter and faster.”

*Gen James F. Amos  
Commandant, U.S. Marine Corps*

In 2011 the Commandant called on the Marine Corps to change the way we think about energy as we man, train, and equip our expeditionary force. As a Corps, we recognize that over the last ten years of combat, we have become more lethal, but have become critically dependent on fuel and batteries, putting our expeditionary capabilities and Marines at risk. Yet, the current and future security environment demands a “middle weight force,” flexible to respond to a host of threats at a moment’s notice, and able to sustain itself for significant periods, at a time and place of its choosing. *Modernizing our capabilities in expeditionary energy is critical to maintaining operational capabilities and readiness of the Force, for today’s fight and tomorrow’s conflicts.*

In March 2011 the Commandant issued the *Marine Corps Expeditionary Energy Strategy and Implementation Plan (Strategy)* with the goal of increasing our combat effectiveness through ethos, efficiency and renewable energy—from “Bases to Battlefield.” The goal of the Strategy is simple: a lighter, faster and more lethal force, which goes farther and stays longer on every gallon of fuel, every kilowatt of energy it requires. Specifically, the Strategy directs the Marine Corps, by 2025, to create a Marine Air Ground Task Force (MAGTF) capable of maneuvering from the sea, and only requiring liquid fuel for mobility systems once ashore. This means C4I and life support systems will be powered by alternative and renewable energy and our vehicles will power larger ground systems when required. Recognizing that to achieve this bold vision would require institutional change, the Marine Corps put in place a framework to guide our efforts: the *Strategy, the Expeditionary Energy, Water, and Waste Capabilities Based Assessment and Initial Capabilities Document (E2W2 CBA/ICD)*, together with the 2012 Marine Corps Science and Technology Strategic Plan provide an investment plan to drive modernization in expeditionary energy.

## EXPEDITIONARY ENERGY: FROM BASES TO BATTLEFIELD



### THE FUTURE FORCE

One of the Commandant's six critical pillars of modernization for the Corps, Marine Corps investments in energy efficient equipment and renewable energy are essential to building a lighter, more capable MAGTF. Translating into greater military capability, these investments mean increased tactical and operational tempo, and reduced vulnerabilities during resupply. In short, they can mean the difference between reaching "Baghdad" or waiting for resupply. They save Marines time, with more focus on the enemy and less time spent planning and executing sustainment missions. Most importantly, by investing in training Marines we are reinforcing our expeditionary mindset, teaching Marines that resource efficiency is a force multiplier that increases combat effectiveness.

### REQUIREMENTS

In September 2011, the Assistant Commandant of the Marine Corps signed a comprehensive requirements document to guide our investments in our equipment and our people: the E2W2 CBA/ICD. This document provides the analytical framework for developing the solutions to build the future force. The E2W2 CBA/ICD identifies 152 gaps, including materiel and non-materiel gaps, and together with the Strategy, provides a prioritized roadmap that the Marine Corps

is using to systematically focus investments and drive combat development.

Catalyzing the next generation of capabilities, the Marine Corps 2012 Science and Technology Strategic Plan is the third element of our framework. It identifies six priority areas to lead turn the S&T enterprise: (1) expeditionary energy harvesting; (2) temperature-independent electronics; (3) expeditionary water harvesting; (4) energy-efficient, combat-effective mobility; (5) optimized personnel performance; and (6) energy storage other than liquid.

### EXPERIMENTAL FORWARD OPERATING BASE

In November 2009, the Deputy Commandant for Combat Development and Integration established the Experimental Forward Operating Base (ExFOB) to identify, evaluate, and accelerate the Marine Corps materiel solutions to achieve the mission of the Strategy. ExFOB brings together stakeholders from across the Marine Corps requirements, acquisitions, and science and technology-development communities to systematically focus on capability gaps identified in the E2W2 CBA/ICD. A semi-annual event, ExFOB invites industry to demonstrate off-the-shelf technologies with potential to address Marine Corps needs. Promising technologies are put into the hands of Marines for extended user evaluation under combat and training conditions. Qualitative and quantitative data collected during ExFOB inform requirements, reduce investment risk, and build Marines' confidence in new capabilities.

ExFOB has taken new capabilities "from concept to combat" in less than a year—twice. In 2010 ExFOB sourced commercial and Marine Corps technologies, trained an infantry company with renewable energy systems, and deployed them to Afghanistan in winter 2010. Marines learned that these capabilities could reduce risk and increase effectiveness at the forward operating edge, such as enabling a foot patrol to operate for three weeks without battery resupply, operating

patrol bases entirely on renewable energy, and dramatically reducing fuel demand at a company outpost. In summer 2011, Marines evaluated ExFOB's hybrid power solutions and efficient air conditioners at Patrol Base Boldak in Afghanistan. This effort tackled our largest ground power user — command and control operations — and enabled a leap forward in our understanding of the military requirement for hybrid power. In 2012, the Marine Corps put this knowledge to work in preparing the Analysis of Alternatives for hybrid energy systems, a critical benchmark in accelerating the acquisition of an entirely new means of powering the force.

Since 2010 ExFOB has:

- Reviewed over 280 technologies
- Evaluated over 75 technologies at ExFOB demonstrations
- Purchased and deployed 11 different technologies to combat in Afghanistan
- Transitioned 4 Technologies to Programs of Record
- Led the requirements development of battlefield hybrid power
- Collaborated with industry to develop high efficiency flexible solar
- Collaborated with industry to develop small unit water purification systems
- Integrated and evaluated fuel saving auxiliary power units for combat logistics vehicles
- Informed \$352M in USMC investment and interests within HQMC processes and within the Expeditionary Force Development System.

### BASES TO BATTLEFIELD

The Strategy recognized that because Marines live, train, and fight as an expeditionary force, it is essential to foster energy efficient habits at our bases that Marines will translate to the battlefield. At installations, the Marine Corps has made real progress in harness-

ing renewable energy resources and building more efficient buildings and systems to drive down energy costs. To achieve the Commandant's vision of an energy-efficient, combat effective Marine Corps, every unit and every Marine at our bases and stations, including our civilian Marines and our family members, must make energy a priority. A culture that values resources and increases energy efficiency at our installations will strengthen the readiness and capability of our force.

### THE EXPEDITIONARY ENERGY OFFICE (E<sup>2</sup>O)

Established in October 2009, the USMC Expeditionary Energy Office (E2O) is responsible for analyzing, developing, and directing Marine Corps energy strategy “in order to optimize expeditionary capabilities across all warfighting functions.” E2O, a Director-level office within Headquarters Marine Corps (HQMC) reporting to the Assistant Commandant, works closely with the combat and technology development communities. E2O serves as the Proponent for Expeditionary Energy in the force development process. Additionally, E2O is tasked with advising the Marine Requirements Oversight Council (MROC) on all energy and resource-related requirements, acquisitions, and programmatic decisions. And, in accordance with the National Defense Authorization Act for Fiscal Year 2009, the Secretary of the Navy assigned the E2O responsibilities as the Marine Corps Senior Official for Operational Energy.

### PROGRAM INVESTMENTS

Our investments are focused on supporting Marines in combat today, but also on increasing the combat effectiveness of the future force. We are driving energy performance considerations into the acquisition and requirements processes, improving new and legacy systems as well as future upgrades.

We calculate our “Return on Investment” in terms of military capability gained through dramatic savings



in weight and fuel transported. For example, within the FYDP, we expect our investments to improve the energy effectiveness of our Marine Expeditionary Brigades (MEB) by about 9 percent. We estimate that the future MEB, over a 365 day operation, will be able to operate one month longer on the same amount of fuel that it demands today. It will need 208 fewer fuel trucks, thereby saving seven million pounds of fuel per year.

Initial investments in current programs and new areas put us on track to achieve the mission of the Strategy by 2025. They include:

- Accelerating expeditionary energy systems — Solar Portable Alternative Communications Energy System (SPACES) and Ground Renewable Expeditionary Energy Network Systems (GREENS) — to Afghanistan (complete in March 2012), and the Fleet Forces
- Implementing mobile electric power sources to achieve ~22 percent fuel efficiency across the fleet of systems (Army funded development and USMC funded procurement)
- Fielding Enhanced Efficiency Environmental Control Units (E3CU) to achieve ~15-25 percent improved fuel efficiency beginning in 2012, with the next-generation family of ECUs entering service in 2014
- Developing fuel economy improvements for Medium Tactical Vehicle Replacement (MTVR) vehicles, anticipating 15 percent increased efficiency
- Executing ExFOB demonstrations twice a year
- Exercising and training renewable energy systems at events including Steel Knight 2012, Weapons Tactics Instructors Course, and Enhanced Mohave Viper
- Improving expeditionary energy modeling and simulation capability to guide future program investments across the MAGTF

- Training in expeditionary energy ethos for entry-level Marines; developing improved training and education that includes ethos, energy planning, management, production, distribution and storage concepts and practices
- Supporting a Naval Postgraduate School multi-disciplinary student research program in expeditionary energy, beginning fall of 2012

These and future efforts are guided by formal requirements, which include:

- *USMC E2W2 CBA/ICD*
- *Urgent Statement of Needs for Energy-Efficient Lighting for Expeditionary Shelter System*
- *Urgent Statement of Needs for Expeditionary Shelter System Energy-Efficient Insulating Liner*
- *Urgent Statement of Needs for the Solar Portable Alternative Communications Energy System and Ground Renewable Expeditionary Energy Network Systems*
- Energy Efficiency Key Performance Parameter included in Ground-Based Optical Surveillance System (Expeditionary) Capability Development Document
- *MAGTF Expeditionary Hybrid Power System (MEHPS) Analysis of Alternatives*

“Transforming the way we use energy is essential to rebalance our Corps and prepare it for the future.”

*Gen James F. Amos  
Commandant, U.S. Marine Corps*