Colonel David Karcher

As Colonel Robert Charette, Jr., noted, the Commandant has said go faster and gain and maintain momentum. You have seen some of the things that we have done. But, it is with your help that we are going to gain and maintain the momentum that we need

Colonel David Karcher recently retired after more than 31 years as a United States Marine. A U.S. Naval Academy graduate, he served in various command, staff, and instructor positions across the Marine Corps. Primarily a field artilleryman, with secondary specialties in acquisition and joint operations, he deployed to operations including Urgent Fury in Grenada, security operations and humanitarian evacuations in Lebanon, Sharp Edge evacuation operations in Liberia, Desert Shield/Desert Storm in Kuwait, United Nations Operation in Somalia II (UNOSOM II) with Joint Task Force Somalia, Operation Iraqi Freedom (OIF) in Iraq, and Operation Enduring Freedom (OEF) in Afghanistan. His acquisition tours included acquisition of command and control systems (Advanced Field Artillery Tactical Data System, Tactical Combat Operations system, Intelligence Operations Workstation, and Global Command and Control System) and tactical software (Command and Control Personal Computer) and serving as Director of the DoD Joint Non-Lethal Weapons Program and Chief of Staff of the Marine Corps' Acquisition Command. Colonel Karcher retired in December 2009. He returned to government service in 2010 and is currently the Director, Energy and C-IED Systems, Marine Corps Systems Command in Quantico, Virginia. Colonel Karcher graduated from the U.S. Naval Academy with a B.S. in engineering, holds a master's degree in business from Oklahoma City University, and earned a master of science degree from the Industrial College of the Armed Forces. He is a graduate of the Amphibious Warfare School, the Command and General Staff College, the Armed Forces Staff College, the Defense Systems Management College, the Defense Acquisition University, and the National Defense University. He is a Lean Six Sigma Black Belt and is Defense Acquisition Workforce Improvement Act Level III certified in program management.

to reach the goals we have set for the future. Colonel Charette did a nice job of laying out our strategy. How are we going to put this into action? How are we going to have long-term enduring solutions that the Marines and the other services can use? I will show you some of the challenges that we have; those faced by the Army are very similar.

The Marine Corps Systems Command (MCSC), where I work, provides support to both the acquisition community and the requirements community. One of the things we have done to gain and maintain momentum is to put a multifunction team together. It has worked very well. That team is addressing the capabilities that we want to have in the Marine Corps given our limited resources. While some of our challenges are the same as those for the other services, some are different. Thus, we have to get the requirements right. The bullet points below provide some background:

- MCSC provides long-term material solutions
- We meet the requirements
- We provide life cycle support
- The warfighter must be, and is, an integral part of process
- Materiel solutions must be integrated into the larger Expeditionary Energy Strategy

Earlier, Colonel Ted Smyth took a shot at defining the term "expeditionary" from the Marine Corps perspective. I want to expand that a bit by looking at "expeditionary" from the energy perspective. In my view, it is a mindset, but it is also more than that. We have to be able to go at any time to any place, and we have to win the battles that the country calls on us to fight. So, the first thing that comes to mind when I hear the word "expeditionary" is that whatever piece of gear that Marine takes with him has to work exactly as he expects it to the first time he uses it and every time thereafter.

Obviously, we have to make trades when we consider energy efficiencies. We have to be very careful when we make those trades because our material solutions still have to provide desired

capabilities. Thus, we have a bit of a challenge, particularly on the engineering side. Our systems have to be rugged, and they have to work. We have to be able to train on them and be able to do so in a way that does not add to the existing training burden. Then, we have to be able to use them. They have to work. They have to fit into our mission profiles. When necessary, we have to be able to repair them or get parts for them.

In some ways, the energy efficiency community is fairly new. While many things have been going on for years, a lot of the interesting work is still being done by small companies with great ideas. Managing the supply chain and providing long-term support are not necessarily their strong suit; so, we have to work our way through that. When we build something, we want it to be as lightweight as possible. We want it to be agile. And we have to be able to test and prove that it works, and we have to do all this preferably by this afternoon, and if not, by tomorrow morning. In short, it has to be worth taking to "every clime and place." It has to be useful to our individual Marines and to their units. It has to make them better in combat and also in secondary missions such as those providing humanitarian assistance. It also has to operate in a Marine Air-Ground Task Force organization (transportability, training, mission profile, supply chain, weight/space, testing, etc.). So, we have to be prepared to do all those things, but when it gets aboard that ship or aboard that aircraft, we have to make very tough choices. We already have too much of what we sometimes refer to as GLOP—gear left on pier—because it does not fit aboard our ships. So whatever equipment or renewable sources we use to improve energy efficiency have to be worth that prioritization.

So what are we trying to do? To meet these requirements, we want to do a couple of different things. We want to reduce our energy consumption for the equipment we already have across the board (vehicles, aircraft, radios, generators, computers, mobile command posts, night vision devices, etc.). It is always a challenge to re-buy or reset, and it is not particularly unusual to have a pilot or a truck or tank driver who is younger than the equipment he is using. In some cases, his father may have used the same equipment before him. We want our gear to last for a long time. Given

our resources, we have to be able to make it last for a long time. Unfortunately in many cases, when the original program manager made his design trades, gas was less than $1 a gallon. Fuel efficiency was not that important. Now it is. We seek to supply energy more efficiently and to supply it in part from renewable sources.

One of the first things we need is the expertise found in this room and in other rooms like it to make improvements in the gear we have. In some cases, the production lines are long closed. So, how do we insert new technology? How do we do it gracefully, smartly, inexpensively, and without taking everything we have down? We will still need to be able to use the equipment, or at least some portion of it, while we refit. We are looking at all our equipment from top to bottom and from left to right as you can see in Figure 1.

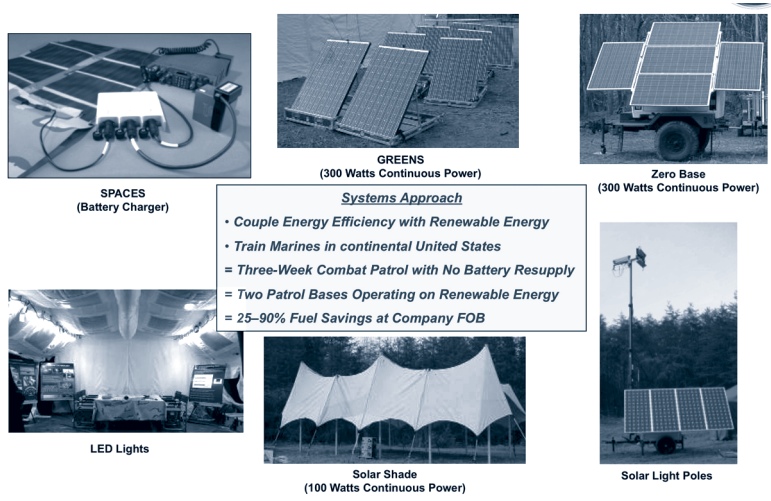

Figure 1. Recently Deployed Power and Energy Systems

We have seen dramatic proof of the increase in the number of batteries used by a rifle company. We need to make a difference not only at company level but at squad level and for the individual Marine. If we can make that company 10% more efficient, they can go that much longer without resupply, that much farther, or operate that much more efficiently. At the same time, we have to

get a good return on our investment, so we have to take both capability and cost into account.

We also have to change behavior. It is not just training; it is mindset. Something that makes us more efficient is not any good if we do not actually use it. We seek to combine efficient behavior and equipment. How are we going to do this? Well, Marines get it. Our young Marines clearly understand power consumption if only from the necessity of recharging their personal electronics. They do not always know what it costs, so we have to continue to meter up and show them the energy costs for the equipment that they are using. The Commandant has clearly said that we need to go faster. So we are getting very good acceptance. But that acceptance is based on the belief that what they get will work every time and it will make them better in combat. So far, what we have delivered in admittedly small amounts has met those requirements. Now, how do we transition that across the Marine Corps? We certainly look for your help in making reliable deliverables of the appropriate material solutions.

So far, some things seem to be doing particularly well. I will not necessarily say that solar is better than any other renewable, but for the environments in which we expect to operate, and certainly in Afghanistan and Iraq, solar is pretty reliable. We can make it reasonably rugged, and it has a fairly good return. Geothermal and hydro are not quite as dependable in all the geographical locations that Marines can expect to visit. Moreover, solar is a technology that is fairly well understood at least in some installations.

So, the question is how do we take that and have the high efficiencies and low weight that a small Marine unit can use? As a simple example, almost every Marine has a flashlight. If we just made a difference in flashlights between weight and power it would be a significant difference. Getting to the right kind of rechargeable batteries and getting to a more unified approach just on flashlights will make a big difference. There are lots of opportunities for improving technology across all our equipment, and solar has been a big help.

While industry is doing a good job making our IT equipment more energy efficient, there are some things that do not work as well. Tactical units—infantry, armor, and artillery—have to be able to pick up and move their gear on short notice, and they have to be able to operate as part of a Marine Air-Ground Task Force and more likely than not in some remote location. They may be able to connect their equipment, say a radar, to the power grid, or they may have to connect it to its own power supply. When you have to move often, and on short notice, renewable energy sources do not always enable rapid movement or provide the high energy densities that they need. Thus, in the short term, although we want to get out of the generator business, it is a technology we understand.

We want to have energy sources, preferably as dense as possible, that can come and go with our units and plug into the commercial power grid when it is available. We need to be both efficient and effective. In the case of some of our tactical units, it is a real challenge to fit energy efficiency into their environment. We want our tanks to be as lethal as possible and to be able to move their 70-ton weight as rapidly as possible. Energy efficiency was not important when we first partnered with the Army on the M-1 tank. We have since put an auxiliary power unit (APU) on it so we do not have to run the tank main engine quite as much. The weight penalty was small, and we do save some fuel, so this modification has had a good outcome. That has not been true for everything. So, we are still looking for technologies that will provide energy efficiencies for the equipment used by our tactical units.

Now let us look at what we are focused on for this coming year and what are we looking for in the long term. As Colonel Charette indicated, this is the year of the vehicle. A lot of our battlefield fuel is used by our vehicle fleet. As we have added vehicles and as they have gotten heavier in response to the improvised explosive device threat, our fuel use has increased further. My sons are 23 and 25. They are starting to learn exactly what it costs them to fill their car at the pump and that driving efficiently with a lighter foot on the pedal is a good thing. We want to put more effort into training our young Marine drivers to do the same thing. We want to provide

feedback within our tactical vehicles that shows the driver how the way they are driving is affecting the vehicle's efficiency.

To some extent, industry has led the way in efficiency improvements. However, we are not always able to use some of the advances they have made. Consider, for example, something as simple as low-rolling-resistance tires. Michelin sells them for commercial vehicles, but they are not made for the types of tires that we use on our large trucks. So, we are partnering with Michelin to see what can be done. In other cases, industry is not yet looking at the technology that we want to use. What is called on-board power generation is an example. Today's military truck has enhanced vision devices for the driver, radios, and a host of other electronics to include, in some cases, cameras and jammers. We are looking at providing a more efficient bus inside that vehicle so it can use its electricity better and can in fact produce more of it. We have actually just about reached the physical size limit of alternators to generate power on board a vehicle. So, we are asking what can we do to make our vehicles more energy efficient?

We are very interested in what is called concentrated solar. How can we obtain greater energy density? We also want to establish relationships and partnerships with the other organizations that are working on energy efficiency. We want to know what they are doing and, where possible, whether there is some sort of leveraging or trade-off that can occur. We think such collaborative efforts will help us move from the short term where we have seen success to the long term. We are interested in meeting with anyone who may have a path to success. By all means, please let us know.