Executive Summary

During the advance on Baghdad senior Marine and Army field commanders had many significant interdependent variables to contemplate, in addition to the basic capability and intent of the Iraqi forces before them. In order to maintain both the velocity and operational tempo of their highly mobile forces located across a wide battle space the subject of fuel was an ever present consideration. Much time, energy and continuous analysis was put into determining when, or if, a culminating point would be reached due to this vital resource. The challenge "Unleash us from the tether of fuel," came from Lieutenant General James Mattis, Commanding General (CG) of the Marine Corps Combat Development Command (MCCDC), and his Operation Iraqi Freedom (OIF) experience as CG of First Marine Division. Mattis' challenge was taken on by John Young, then the Assistant Secretary of the Navy (ASN) (Research, Development and Acquisition [RD&A]) who directed that the Naval Research Advisory Committee (NRAC) identify, review, and assess technologies for reducing fuel consumption and for producing militarily useful alternative fuels, with a focus on tactical ground mobility. Technical maturity, current forecasts of "market" introduction, possible operational impact and Science & Technology (S&T) investment strategy were considered. The principal findings of this study fall in two main time-frames.

As a near-term response to Gen Mattis' challenge, the Panel determined that the fuel tether remains, but found a way to lengthen it (Hybrid Electric Vehicle technology) and untangle it (dynamic fuel management). During (PR07/POM-08), the Marine Corps must commit to the development of the hybrid electric architecture for tactical wheeled vehicles and the development of sensor and communications systems to enable operational commanders to manage fuel allocation and re-supply in real-time during combat operations. These two near-term responses are described as:

1. Hybrid electric drive vehicles offer the most effective and efficient way to meet LtGen Mattis challenge. Improved fuel economy, as much as 20% or more, can significantly reduce the existing Marine Expeditionary Force (MEF) shortfall in fuel as well as reduce the expeditionary footprint. Hybrid electric drive vehicles enable highly maneuverable and agile vehicle traction control both on and off-road, in covert or overt operations, and can provide mobile electric power. This vehicle architecture also offers additional trade-offs in reach and mobility as related to a systems capability. To achieve improved reach and mobility, a hybrid electric strategy must be developed leveraging commercial sector and Army investments.

2. Presently the Marine Corps and the Army do not have the ability to effectively and efficiently manage fuel during combat operations. As operational reach is extended, accurate planning tools, real time vehicle level fuel status, and location data indicators are critical to enabling dynamic retasking of fuel assets on the battlefield, and to providing the ability to conserve fuel, sustain op tempo and reduce fuel train vulnerability.

In the farther time-frame, numerous alternative fuels are being evaluated across the spectrum of power and energy density to satisfy tomorrow's fuel needs for the U.S.;

only liquid hydrocarbons can provide the Department of Defense (DOD) with the properties needed for its transportation fuels in the foreseeable future. Currently, these fuels are obtained from refining petroleum, but these resources are dwindling and must be replaced with a suitable substitute. Fortunately, the U.S. has large deposits of coal and shale oil, and Canada has large tar sand deposits. DOD should play an active role in catalyzing the development of this US infrastructure and ensure that it will be able to make use of manufactured fuels for its vehicles. The Panel finds that DOD needs to commit now to procuring manufactured liquid hydrocarbons for the long term at lower than current market price to encourage commercial financing, push technology and help motivate the building of the necessary manufacturing and distribution infrastructure.