Transition Challenges and Alternative Fuels

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presented at
The NDIA ARPA-E/DoD Workshop

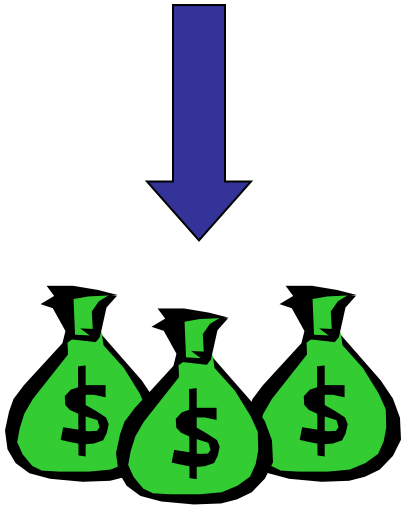
September 12, 2011

Challenges in Transitioning Technology

How can we increase the likelihood that research and technology will transition?

Transition Challenge

Typical Venture Capital Fund



Make Money

ARPA-E/DoD Performers

Make Money

Transition Technology to the Warfighter

Major Transition Issue

- **A promising technology will not be available to the DoD if the business side of the company is not robust enough to support the transition and the supply of it in quantity**

Challenges

- Mature research/IP to a set of concepts
- Mature the concepts to a number of possible “bread board” prototypes
- Mature the most promising “bread board” prototypes
- Demonstrate a prototype that looks promising in terms of application

Overcome the “Valley of Death”

Challenges (Continued)

- Pick a technology prototype that has a chance to succeed in the marketplace
- Pick a viable company that has the ambition, marketing plan, management and resources to succeed
- Capture requirements and translate into technical specifications that companies can design to that will fulfill the need
- Identify and work with a customer and user
- Get a small company to pay attention to a small player

Overcome the "Darwinian Sea"

A Contrast of Cultures

- **University**
  - Publish papers
  - Produce students
  - Get tenure
  - Create intellectual property for an entity to walk the "Valley of Death"
- **Small Business**
  - Resource limited
    - Money
    - People (time)
  - Short time scale for success
  - Immature technology and business
  - Lack of knowledge and patience to do business with government, which is a small customer
- **DoD**
  - Position rotation
  - Those in charge not experienced in technology development and small business
  - Onerous and time consuming decision cycle

Needs

- Need to manage expectations, since timescales for success are very different
- System engineering approach is needed to assess application potential of an innovative technology
- Need to address all the "ilities" like affordability, scalability, manufacturability, maintainability, sustainability and reliability
- Need to focus on cost reduction and business plan development for commercialization
- Typically, small innovative companies need resources beyond what they have or have access to, like building a viable business

Alternative Fuels and DoD Energy Mandates

Mandate/Law/Order	Provision
National Defense Auth. Act 2010	• Produce or procure 25% of the total energy from renewable energy sources beginning 2025. • Explore expeditionary use of solar and wind to provide electricity
E.O. 13423	• Increase total motor vehicle fleet non-petroleum based consumption by 10% annually
E.O. 13514	• Reduce the fleet's total consumption of petroleum 2% annually through 2020
SECNAV Goal	• Consume 50% renewable energy by 2020

Consumption within DoD
Oil accounts for more than three-fourths of DoD's total site delivered energy consumption. In terms of fuel types, jet fuel (JP-8) accounts for more than 50% of total DoD energy consumption and nearly 60% of its mobility fuel.

DoD must reduce energy use through improved efficiency; but alternative fuels are required to meet these mandates.

Alternative Fuels for Operational Energy

- **Logistics burden of fuel and water at forward locations is large (~80% of total weight of delivered materiel)**
- **Higher efficiency systems will reduce logistics burden for any liquid fuel**
- **Energy harvesting with liquid fuels generation holds the potential for logistics burden reduction**
  - ARPA-E Electrofuels Program
    - Separate energy harvesting & liquid fuels generation
    - Liquid fuel generation must offset burden of transporting the system

Delivering fuels to forward locations is a high risk and high cost operation, need to reduce total weight delivered to forward locations

Factors Affecting Commercialization of Photosynthetic Algal Oil Production

- **Available land, water, sunlight, CO_2 and nutrients**
  - Land can be arable and non-arable
  - Quality and type of water is flexible - recycling is important
  - Sunlight availability is limited to 14 MJ/m^2/day annual average
  - CO_2 can be generated through a variety of sources, but costs can be prohibitive
  - Nutrients can be costly
- **Process optimization and cost reduction**
  - Full Monte Carlo cost model analysis
- **Financial model**
  - Co-product market penetration

The goal is energy security for remote sites without indigenous resources