



Green Ammonia to Fuel International Security

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Agenda

- My Background
- Past DoD Applications
- New Military Requirements
- New Missions
- The Threat
- A Way Ahead: Potential Solutions
- Potential Funding Sources

My Background

- RAND Corp. Analyst (Weapon Systems, C4ISR)
- Worked for DARPA (20 years) on special weapons (Area Effects, Brilliant Munitions) & Communications
- Team leader for first MMOG (Massively Multiplayer Online Game) DARPA's SIMNET, cost \$240 million
- Led teams for DOD (All 4 Services, Ofc. of SecDef, Intel Community), DHS, NATO, MODs in Middle East, MODs ASEAN, etc. for \$560+ million in projects.
- Modeling & simulation for SOCOM, NORTHCOM,, IC, JCS, DARPA.
- My license plate:



Past Ammonia military applications

- Not used as fuel due to limited range, ready availability of fossil fuel in US wars (WW2, Vietnam)
- Operation Snoopy used People Sniffer Sets (airborne and Infantry-carried manpack)
- Successfully detected enemy personnel



Military Uses of Ammonia Today

- Many DOD Laboratories' vision of Military's Mission:
 - Detect and Identify
 - Close in/Acquire Target
 - Neutralize (Destroy)
- Need: More Weapons and Vehicles
- Fossil Fuel compact, gives good MPG
- Little appreciation for green energy or pollution
- MOP (Measure of Performance): **MPG**
- Ammonia has “poor” MPG
- End of Story?

But...what does today's Military really do?

- **US Africa Command**, in concert with interagency and international partners, builds defense capabilities, responds to crisis, and deters and defeats transnational threats in order to advance U.S. national interests and promote regional security, stability, and prosperity.
- ...small teams of soldiers will conduct at least 108 missions in at least 34 countries in Africa in 2014.
- **Stability Operations** are military missions...conducted outside the United States to maintain or reestablish a safe and secure environment, provide essential governmental services, emergency infrastructure reconstruction, and humanitarian relief.
- **Bottom Line:** Small military and USAID (civilian) units helping local communities in remote areas.

AFRICOM COCOM

United States Africa Command

Interagency Update
December 14, 2007



The overall classification is UNCLASSIFIED

Partnership, Security, Stability

US CENTCOM

- Help Communities to be safe and stable
- Increase Community Resilience
- Stability Operations
- Work with Civilian Agencies
- Use COTS Equipment (not just MILSPEC)
- Help smallhold farmers increase yield (75% of population)



US SOCOM Special Operation Command



SOCOM Missions

- Provide Training
- Win Hearts and Minds
- Establish Friendly Outposts
- Help Afghanistan farmers with “non-traditional” crops



Modern Missions: Not just “Find & Kill”

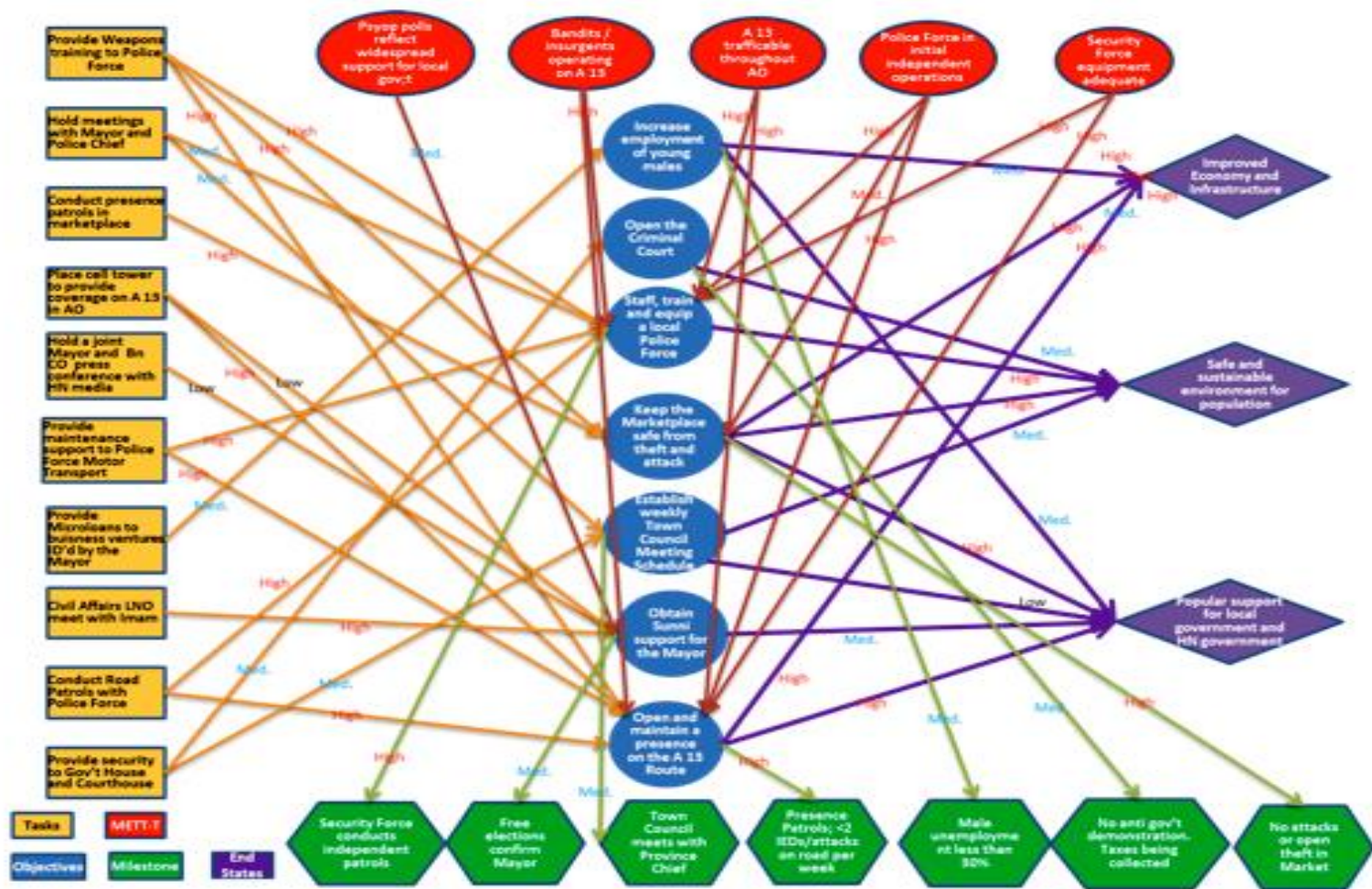


Figure C-1: The DICOP Model (Influence Diagram)

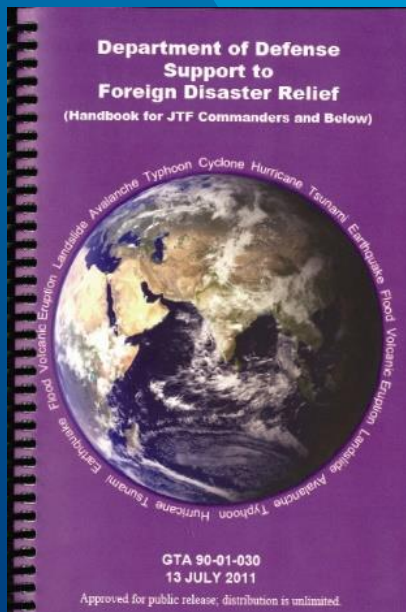
Military Mission: Teach Agriculture

- Regular Army and National Guard units training in agriculture before deploying to AFRICOM, CENTCOM, PACOM, etc.
- In-theater, teaching modern agricultural methods for increased crop yield
- Coordination with State Dept. (USAID) and Allies
- Purpose: better crops keep people on farms, reduce famine and food insecurity



HA/DR (Humanitarian Assistance/Disaster Response)

- Major mission for DoD
- Includes Army, Air Force and Navy
- Medical Support Ships with NGOs)



Stability Ops & HA/DR: Common Problems

- Lack of Reliable/Sustainable Electric Power, for:
 - Smallhold farmers/agriculture
 - US units in remote areas
 - HA/DR aid units, for medical tents, communications
- Lack of fertilizer for improved agriculture
 - Afghanistan high-value crops (e.g., fruit trees) instead of opium poppies
- Water shortages
 - For drinking water and agriculture
 - Takes up great volume of HA/DR aid
- Dangers of Logistics Support
 - Fuel for vehicles and machines

Fuel Logistics (esp. for remote areas)

- 65% of support for operational units in WW2 and Korea was for POL (Petroleum, Oil & Lubricants)
- Fuel trucks are prime target for insurgents and terrorists
- At times, half the casualties in Iraq and Afghanistan (thousands of US and Allied) resulted from roadside ambushes (including IEDs)
- Fuel transport very costly (e.g., \$400/gallon)

Difficulty of Fuel Transport



- Afghanistan fuel offloaded at Karachi
- Truck caravans over long highway & rough road routes



Fuel Truck Route Dangers

- Iraq: “Highway of Death”
- Afghanistan: vulnerable on long mountain roads
- High-explosive IEDs
- Tolls from local warlords
- Africa: interdiction (incl. theft) by insurgents



Fuel Transport Costs (cont'd)



Military Missions: Problems Overview

- Small US units in remote locations throughout global developing nations with limited infrastructure
- Difficult logistics support, esp. for fuel
- Need robust electrical power, 24/7
 - For implanted units
 - In case of disaster response operations
- Water shortage a major problem
- Need ammonia-based fertilizer to increase crop yields, earnings & sustainability of farmers

To the Rescue: Ammonia!



**Ammonia and Sunshine
offer a Global Solution!**

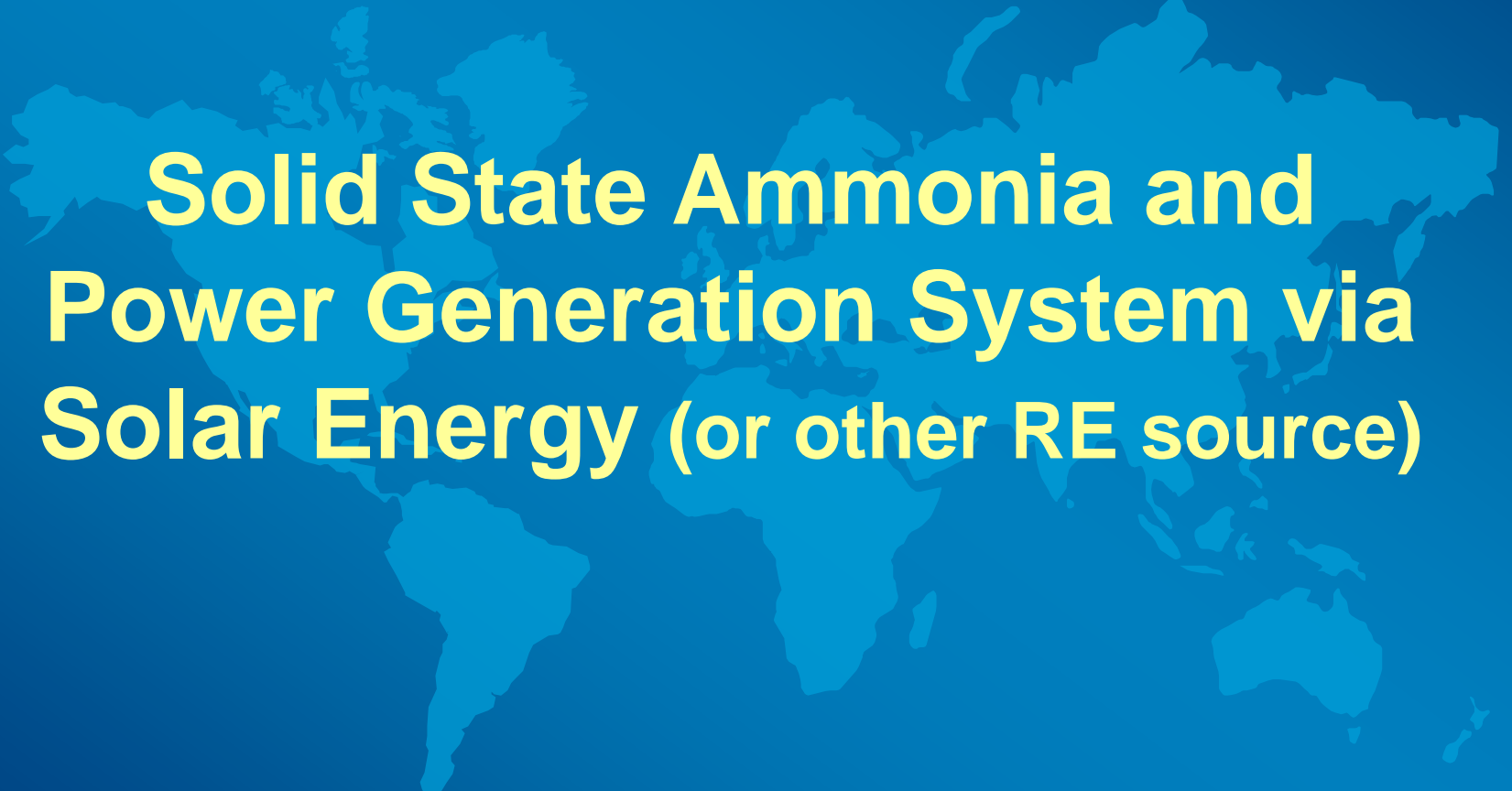
Partners: Sunshine and Ammonia

Ammonia named after
Egyptian god Amon

As Amon-Ra, God of the
Sun and
Giver of Life



Potential Solution for Military



**Solid State Ammonia and
Power Generation System via
Solar Energy (or other RE source)**

A Way Ahead: Potential Solutions

- Small and Community-Scale Renewable Energy Electric Power Generators
- Small and Community-Scale Ammonia Generation
- Ammonia for storing & releasing energy 24/7

Also:

- Provide Ammonia-based fertilizer for:
 - Farmers that cannot afford it
 - Increased crop production and increased wealth
 - Decreased soil depletion and desertification
- Ammonia as fuel for vehicles and farm machinery, to reduce need for dangerous fuel transport
- System can power compact desalination and purification units

Potential RE Power and Ammonia Generation System

- Small-Scale Renewable Energy (Solar and/or Wind) Collection
- Electric Power Generation (with possible connect to Microgrid)
- Solid State Ammonia Generation and Storage System



What's Needed

- Pilot project(s) to demonstrate proof of concept of RE power and solid-state ammonia generation sets
- Ruggedized systems capable of containerized packaging/shipping and low maintenance
- Prototype systems with sponsors and funding
- Public-Private Partnerships for “total package” of production, support and business model financing
- Improved technology for greater efficiency of compact ammonia generation and energy release
- Vehicles (tractors, motorcycles, tuktuks, trucks, cars) capable of running on ammonia blend or pure ammonia

Possible Funding Mechanisms

- Funding directed by COCOMs with urgent problems and needs
- USAID and/or World Bank Sponsorship
- Allied support (EU, ASEAN countries)
- Propose as 6.3 (Advanced Development), not 6.1 (Basic Research) or 6.2 (Applied Research)
- Create Consortium including university, hardware manufacturers, government sponsorship and test site, marketing with distribution channels, etc.
- Find low-cost partner to help display products, develop consortium, identify end-users & clients.

Potential Partner for Visibility/Contacts

STAR-TIDES (Transformative Innovation for Development and Emergency Support)

- Displays and coordinates technology for COCOM, State Dept. and Allied needs
- Part of the Center for Technology and National Security Policy (CTNSP) at the National Defense University (NDU), which is part of the Department of Defense.
- Sponsors technology demonstrations at US and Allied Military Conferences, United Nations, World Bank, etc.
- Mechanism for forming partnerships and gaining contacts with possible clients.
- Next STAR TIDES Demonstration is 6-11 October at Ft. McNair.

STAR TIDES Shows



STAR TIDES (cont'd)



SUMMARY: The Need

- Modern Military Operations require Independent and sustainable electric power generation for remote areas.
- Present situation of supporting remote US units with conventional fuel is not only expensive, but is **COSTING LIVES!**
- Need exists for local ammonia generation, for power storage, to fuel vehicles and machinery, and to increase crop productivity of US-supported farm areas.
- Pilot projects needed for proof of concept.

SUMMARY: A Possible Approach

Propose a system for ammonia generation and use as vehicle/machinery fuel for Military Operations.

Emphasize not MPG, Miles Per Gallon, but
LPG (Lives Per Gallon saved)

SUMMARY: The Need is Urgent

YOU
could help prevent
this:

And help US
military and Allies
in their mission.

The need is urgent!
Godspeed!





Thank you for your Attention!

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