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Joint Defense Manufacturing Technology Panel (JDMTP) Power Sources Technical Working Group (TWG) Fuel Cell Roadmap

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Disclaimer/Warning !!!!

- **The views expressed herein do not necessarily represent the views of management, the Department of Defense (DoD), or Defense Contract Management Agency (DCMA). They are the views, reflections and comments of the presenter only.**

- **Why Roadmap?**
- **Background**
- **Goals of the Roadmap**
- **The Process/Data Sources**
- **Roadmap Content**
- **Questions/Contact Information**

Why Roadmap?

Identify the path forward



Meet future platform needs



Allocate Resources

Support the Warfighter



Right stuff, right time

Why Roadmap? (cont'd)

Scope:

- Batteries and Fuel Cells

Purpose:

- Identify current state of technology
- Project future needs of the military
- Identify and bridge gaps between the two
- Facilitate the availability of affordable and reliable military power and energy devices essential to the Warfighter

Purpose: (cont'd)

- Identify the technology needs of DoD power source systems:
 - Near term (1-3 years) Batteries/Fuel Cells
 - Mid term (4-7 years) Batteries/Fuel Cells
 - Long term (8-12 years) Batteries
- Roadmap establishes a needed foundation for further planning of potential R&D projects

Background

- Requested by the Manufacturing Technology (ManTech) Office at OSD
- Identify the Services' Science & Technology (S&T) elements
- Needed efforts to move technology to production
 - Complimentary to Services' S&T Road Maps prepared by OSD Energy and Power Technologies Initiative (EPTI)

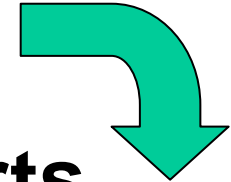
Goals of the Roadmap

- Strategic/high level overview of military power sources technology development
- Tool for comparing current and future military power source capabilities versus WarFighter requirements
- Identify a path for resolving shortfalls

Goals of the Roadmap (cont'd)

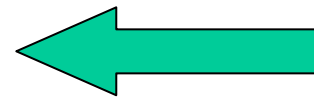
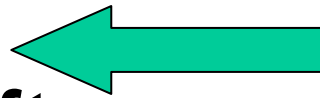
- Provide a tool for guiding future resource allocation decisions (especially within the ManTech community) – Span the Valley of Death
- A byproduct of other strategic initiatives
- Bridge from S&T to production

The Process



Govt SMEs

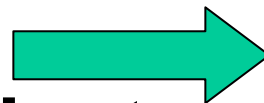
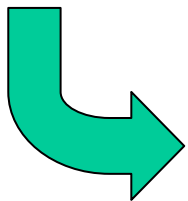
Review Data/Reports



Second Draft

Review by Govt SMEs

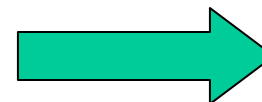
Initial Draft



Final Govt Review



We are here!



**Review by Industry
NDIA Site**



- **Government Subject Matter Experts**
- **Service S&T Roadmaps**
- **EPTI Goals Objectives Technical Challenges and Approaches “GOTChAs” Charts**
- **Peer Reviews**
- **Handbooks & Web Sources**
- **Industry Input**

Roadmap Content

- **Fuel Cell Roadmap covers 3 ranges:**
 - Soldier-carried power and sensors & Man-portable power (1W-1kW)
 - Mobile Power (1kW-100kW)
 - Stationary Systems (>100kW)



- **The Roadmap addresses various Fuel Cell types as well as Reformers:**
 - Direct Methanol Fuel Cells (DMFC)
 - Reformed Methanol Fuel Cells (RMFC)
 - Chemical Hydrides
 - Proton Exchange Membrane (PEM)
 - Solid Oxide Fuel Cells (SOFC)
 - Molten Carbonate Fuel Cells (MCFC)

- **Technology Overview**
- **Current State** - Demonstrated capability of the technology as of today. Assessment Code (AC) is based on ability of technology to meet **today's** WarFighter requirements
 - Advantages
 - Disadvantages

- **Future State (Six years out) - Two future states are considered, one with no additional funding and one with all required funding provided. AC based on the ability to meet the projected future needs of the WarFighter**
 - GOTChA Charts
 - Parameter Matrices

Assessment Codes:

Green

Meets or exceeds desired capability

Yellow

Comes close to or has potential to meet desired capability

Red

Does not come close to or can not meet desired capability

Pink

Unproven ability to meet requirement

Orange

Significant investment & research required to meet desired capability

- **Projected Applications of Army, Air Force, Navy and USMC**
 - Soldier Power, sensors, Battery Chargers, Unmanned Aerial Vehicles (UAV), Unmanned Ground Vehicles (UGV), Unmanned Underwater Vehicles (UUV), Auxiliary Power Units (APU), Forklifts, Tent Cities, Ground Support Equipment, Troop Buses, Tactical Operation Centers

Roadmap Content (cont'd)

Parameter Matrices Example

Item No	Strategic Thread	Parameter	Requirement	Current Status	Invest?	6 Year 2014
1	A	Commercial Applications	Desired		Y	
					N	
2	D	Temperature Performance - High	Perform to +55° C	+45° C	Y	+55° C
					N	+45° C
3	D	Temperature Performance - Low	Perform to -20° C	-20° C	Y	-20° C
					N	-20° C
4	C,D	TRL	TRL 9	TRL 6	Y	TRL 9
					N	TRL 6

Roadmap Content (cont'd)

Technology Maturity Horizon Example				
Technology	Now	Near	Mid	Far
Type 1	< 100W		→	
Type 2	< 100W		→	
Type 3	100W - 500W			→
Type 4	100W - 500W			→
Type 5	< 500W			→
Type 6	>100W			→
Type 7	500W - 1kW			→
Type 8	500W - 1kW			→
Type 9	1W - 1kW			→

Green – Meets or exceeds desired capability

Yellow – Comes close to or has potential to meet desired capability

Red – Does not come close to or can not meet desired capability

- **Roadmaps**
 - Funding Requirements
- **Conclusions**
- **Recommendations**
- **Definitions**
- **Appendices**

Roadmap Content (cont'd)

Funding Roadmaps Example

ID	Strategic Thread	Action/Metric	Priority	\$Cost M	\$Source
1	Performance Improvement	Increase High Temperature Performance from +50° C to +55° C	1	\$4.00	ManTech
2	Performance Improvement	Increase Power Density from 25W/kg to 100W/kg	2	\$2.00	ManTech

Timeline



2009	2010	2011
TRL 4	➔	TRL8
MRL3	➔	MRL8

Acronym List

- **AC** - Assessment Code
- **EPTI** - Energy and Power Technologies Initiative
- **GOTChA** - Goals Objectives Technical Challenges and Approaches
- **JDMTP** - Joint Defense Manufacturing Technology Panel
- **OSD** - Office of the Secretary of Defense
- **SME** - Subject Matter Expert
- **S&T** - Science and Technology
- **TWG** - Technical Working Group

Contact Information

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Questions?



Questions and Comments?

