Section I

Transportation Regulatory History

Section II

DMFC
Technology, Safety & Leadership

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Presentation to ICAO DGP
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Section I

Transportation Regulatory History
-Regulatory Timeline-

- 2001 – 1st at US DOT. How to ship or allow passenger use of DMFCs?
- 2002 – General concept developed. Seek UN description, then to ICAO.
- 2003 – To the UN TDG. UN TDG accepts USA DMFC proposal.
- 2004 – UN TDG approval. UN modifies, approves new shipping description.
- 2005 – UN Modal Agencies and IEC. Identify aircraft requirements, insert into IEC

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2001- 1st at US DOT
How to Ship or Allow Passenger Use of DMFCs?

- US Fuel Cell Council study on DOT and international transportation regulations possibly affecting fuel cells;
- A DMFC developer approaches DOT for guidance on DMFC devices using 24% and 100% methanol fuels;
- USA's 24% methanol exception and methanol flammability characteristics are studied in-depth
- Letter of Clarification for DMFC using 24% methanol is formally requested from DOT.

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2002 – General Concept Developed Seek UN Description, Then to ICAO

- DOT issues Letter of Clarification that DMFC using 24% methanol is not a hazardous material under DOT, but is under ICAO and UN;
- In-depth study of transport options continues. DOT develops general regulatory concept for DMFCs using up to 100% methanol - propose to UN TDG new descriptions for DMFC devices and cartridges in Class 9 with performance requirements, like lithium batteries used for consumer electronics. If enacted, proceed to ICAO and other modal agencies with approved new descriptions;
- IEC and UL, Inc. code standards work commences.

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2003 – To the UN TDG
UN TDG Accepts USA DMFC Proposal

- DOT submits to UN TDG a proposal for 24% methanol solution exception at July meeting (discussed/tabled);
- DOT and industry develop informational paper on 100% methanol DMFCs for UN TDG July meeting. It features new UN descriptions for DMFC devices and cartridges in Class 9 and identifies likely cartridge performance tests;
- DOT revised informational paper is submitted with 5 specified performance tests and hazard Class 9. It is accepted on agenda at 12/03 UN TDG meeting;
- UL/DOE regulatory workshop with DOT, FAA, EPA, CPSC. Typical UN transport tests added to UL and IEC.

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2004 – UN TDG Approval
UN Modifies, Approves New Shipping Description

- Japan joins USA as co-sponsor. Proposal is modified to reflect cartridge may be for direct or reformed MFC technologies. Set to agenda for UN TDG in July;
- Presentation by DMFC industry from US, Japan, Europe at July UN TDG meeting. Sample DMFC fuel cartridge is available to examine. UN TDG discussion of proposal;
- Based on UN TDG comments, USA modifies proposal to "Fuel cell cartridge, containing flammable liquids", with internal pressure test, Class 3, & use UN 3363 for devices;
- USA presents informational paper on methanol fuel cell consumer electronics to ICAO DGP 10/2004 meeting;
- UN approves "Fuel cell cartridge, containing flammable liquids", UN 3473, Class 3 with packing instruction P003.

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2005 – UN Modal Agencies and IEC Identify Aircraft Requirements, Insert Into IEC

- UN 3473 proceeds to UN modal agencies for consideration and suitable cargo regulations;
- Discussions commence on passenger allowance by ICAO;
- IEC draft safety code standards are "open" to incorporate passenger aircraft requirements before finalization of 2005 Committee Draft and adoption into international standard during 2006-07.

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Section II

Direct Methanol Fuel Cells (DMFC) Technology, Safety & Leadership

- Key DMFC Merit Parameters
- DMFC System Diagrams
- Advantages of Methanol as a Fuel Source
- Industry Participants
- DMFC-Powered Commercial Product
- Future DMFC Powered Products Planned

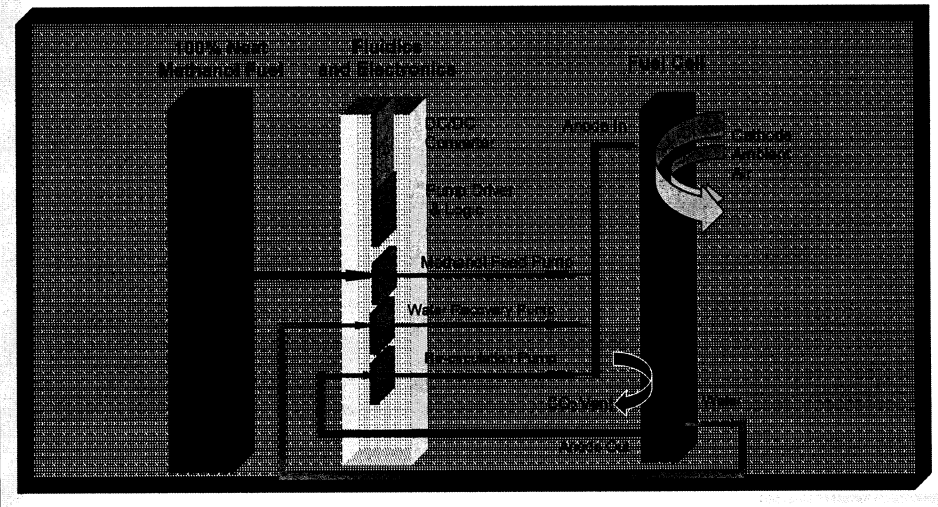
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Key DMFC Merit Parameters

- Safety in Operation and Re-Fueling
- Instantaneous recharge (refuel)
- Longer operation run times vs. batteries
- Superior fuel cartridge energy density
- Direct electrochemical reaction
  - Low Temperature operation (30 deg. C)
- Small, light-weight, simple device

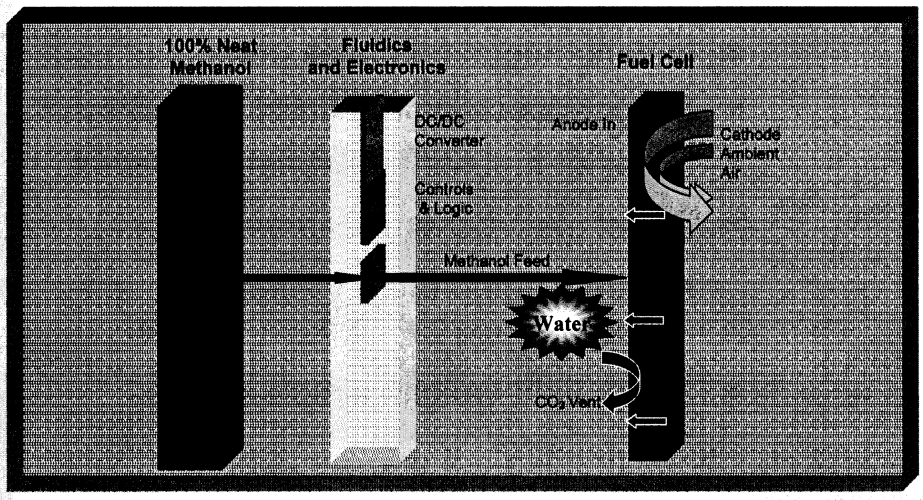
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Typical (active) DMFC



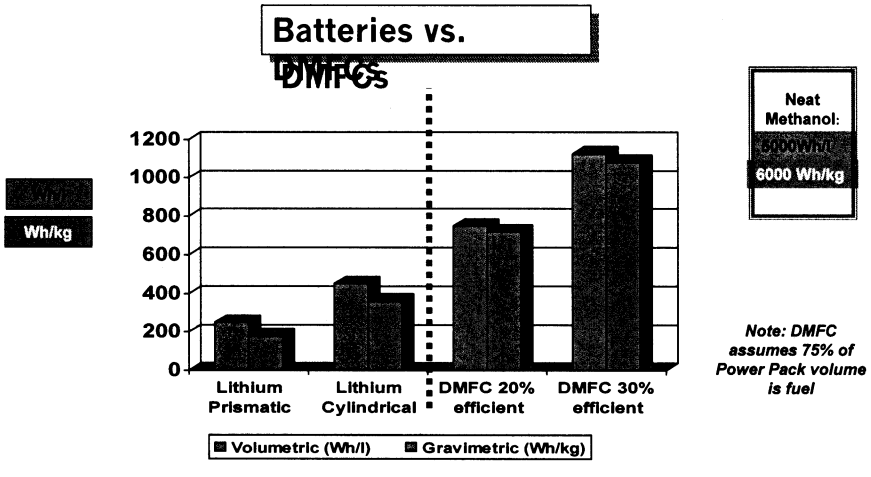
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mobion (passive) DMFC



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Comparative Performance Projection



Note: DMFC assumes 75% of Power Pack volume is fuel

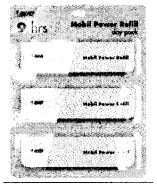
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DMFC Industry Participants*

HITACHI

FUJITSU

BIC



SAMSUNG

The Gillette Company

TOSHIBA

SMART FUEL CELL





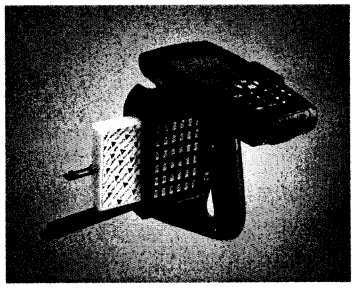
NEC

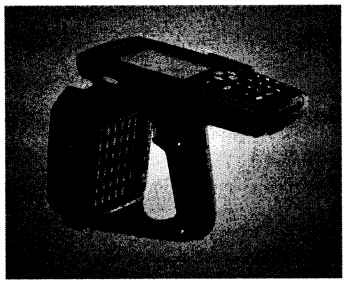
* partial listing

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First of a Kind:
DMFC & Methanol Cartridge Integrated into an RFID Reader
World's First Safety-Certified Micro Fuel Cell Product

A fuel cartridge and a thin, molded fuel cell array are integrated into the handle of Intermec Technologies' RFID reader.





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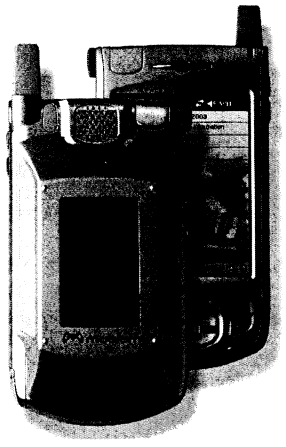
DMFC System Characteristics

Cartridge: 100% MeOH
Power out: 1W continuous, 5W peak
Energy to load in continuous discharge: 35 Wh*

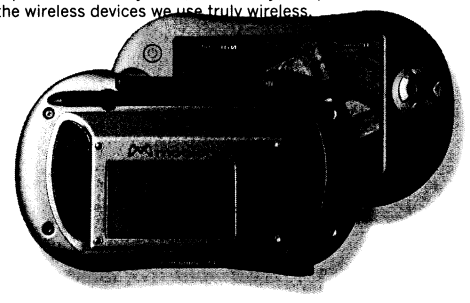
(*Present battery is 8 Wh)

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Future Product Targets



MTI Micro's Mobion™ cord-free rechargeable power packs are being developed to replace incumbent power packs used by Original Equipment Manufacturers (OEM) in many rechargeable hand held electronic devices. MTI Micro believes its Mobion™ technology will provide increasingly longer-lasting power necessary and, eventually, help to make the wireless devices we use truly wireless.



mobion™

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DMFC Technology
Executive Leadership and Safety in Fuel Cell Technology



Photo courtesy of Methanol Institute

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