2007 Joint Service Power Expo

"Power & Energy Independence for Warfighters"

24 – 26 April 2007

San Diego, CA

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- OIF 5-7 Commercial Power Generators, *GySgt G.V. Yanez*
- Doing Business with the Government, *Ms Yvonne Bova & Ms Shekela Hutchinson*
- Doing Business with the Marine Corps, *Ms. Shekela Hutchinson*
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- Power Optimizer for the Warfighter's Energy Requirements "Battery Calculator", *Mr. Don Brockel*
- Power Optimizer for the Warfighter Energy Requirements, *Mr. Don Brockel*
- Planning and Decision Support for Enhanced Power and Energy Management through Seminar Gaming and Analysis, *Mr. Gordon Steward*
- Future Trends and Thrust for Army Manportable Power Sources – CERDEC, *Mr. Michael Brundage*
- Advancements in Navy and USMC Power Systems – NSWC Carderock, *Ms. Daphne Fuentevilla*
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- Marine Corps Mobile Electric Power Distribution System Replacement , *MSgt Fred McCue*
- The Case for Smart/Safe Power Management and Distribution for the Military, *Mr. Rick Silva*

WEDNESDAY, 25 APRIL 2007

- Mobile Electric Power for Today and Tomorrow, *Mr. Paul Richard*
- Common Sense Approach to the Selection, Design/Fabrication, & Testing of Safe Operational Power Sources, *Mr. Robert Byrnes, Sr.*
- Fighter/EW/Helo/Patrol Arc Fault Circuit Breaker Development, *Ms Susan Waggoner*
- Large-sized Li-ion battery module for hybrid powered energy systems, *Mr. William A Moll*
- Communications Power Sources and Vehicle Battery Maintenance, *Mr. Mike Bissonnette*
- Power Generation Lesson Learned OIF 5-07, *MSgt Dickson*
- Case Study – Reducing Premature Failure of Parts with Interactive Virtual Training for Generator Operators, *Mr. Erik Kaas*
- Lightweight 2-kW Generator with Integrated Starter Alternator (ISA), *Mr. Gregory Cole*
- Servicing Hawker Vehicle Batteries with Standard Battery Charging and Test Equipment, *Mr. Fred Krestik*
- Testing of COTS/NDI Products, *Mr. John O'Donnell*

Lunch Speaker:
"Warfighting in a Climate Warming World – Implications for U.S. National Security Policies", *Honorable Philip Coyle*, Senior Advisor, World Security Institute

- On Board Vehicle Power, *Mr. Michael Gallagher*
- On-Board Vehicle Power Briefing & Way Forward, *Dr. Jim Cross*
- Onboard Vehicle Power: Talking Points on Emerging Requirements, *Mr. Tim Raney*
- Marine Corps On-Board Vehicle Power Systems for Legacy Military Vehicles, *Mr. Michael Gallagher*
- Tactical Generators, *MSgt Fred McCue*
- AutoDISE, *MSgt Fred McCue*
- On Board Vehicle Power, *Mr. Michael Gallagher*
- Electric Drive Approach to Mobile Power Platforms, *Mr. Nader Nasr*
- Video *NATC Proving Grounds*
- Video *MTVR BVP*
- Power-Managed HMMWV Demonstrator, *Mr. Stephen Cortese*

Workshop Battery Technical Manuals and Milspecs, *Ms Susan Waggoner*
- Solar Power Adapters and Deployable and Renewable Alternative Energy Module, *Major David Morris*
- Tactical Power Systems, *Mr. Tom Lederle*
- Self-Generated Field Power Sources, *Mr. Albert Hartman*

THURSDAY, 26 APRIL 2007

- USMC Family of Environmental Control Equipment, *Major David C. Morris*
- Integrated Trailer-ECU-Generator (ITEG), *Major David C. Morris*
- Solving power supply obsolescence, reliability, and power density issues by advances in power electronics technology, *Mr. Richard Sidley*
- Advances in Chemical Hydride Based PEM Fuel Cells for Portable Power Applications, *Shailesh Shah*
- Advances in Chemical Hydride Based PEM Fuel Cells for Portable Power Applications, *Mr. Andy Wallace*
  - Video *Customer Broadcast*
  - Video *Customer UAV*
  - Video *Customer UGV*
- Data Systems for Enhanced Power and Energy Management, *Mr. John Adams*
- Back up Slides - Data Systems for Enhanced Power and Energy Management, Part 2 *Mr. John Adams*
- Portable Power Sources: One Size Fits None – Protonex Technology Corp, *Mr. Phil Robinson*
- Solid Oxide Fuel Cell Power Systems for Small UAV's, *Mr. Timothy LaBreche*
  - Video *UAV Fuel Cell Flight with Timer*
  - Video *11.5 Hr Ground Test with Time*r
  - Video *BOP Buner UAV*
  - Video *Short Crash Loop*
- Portable, JP-8 fueled battery charger for remote operation and portable solid oxide fuel cell systems, *Ms. Christine Martin*

Monday, April 23, 2007

1:00 p.m. - 5:00 p.m.	**Exhibitor Move-in**

Tuesday, April 24, 2007

7:30 a.m. - 8:30 a.m.	**Continental Breakfast**
8:30:00 a.m. - 9:30 a.m.	**General Session** **Admin Remarks** **Color Guard** **Welcoming Address** **Keynote Speaker — Major General Stephen T. Johnson**
9:30 a.m. - 5:00 p.m.	**Exhibit Hall Open**
9:30 a.m. - 10:00 a.m.	**BREAK in Exhibit Hall**
10:00 a.m. - 11:30 a.m.	**OIF - Stories from the Field - Lessons Learned** **LtCol K. Jansen — A Few OIF Power Observations** **Ken Zemach — Battlefield Power for the Warfighter Lessons for the Development Community** **GySgt R.L. Gardner — 9th COMM BN ENGINEERS OIF LESSONS LEARNED** **GySgt G.V. Yanez — OIF 5-7 Commercial Power Generators**
11:30 a.m. - 1:30 p.m.	**LUNCH**

1:30 p.m. - 3:00 p.m.	**Session 1 - Chair: Joanne Martin joanne.martin@usmc.mil**	**Session 2 - Chair: Don Brockel Donald.Brockel@us.army.mil**
	Doing Business with the Government - Yvonne Hicks & Shekela Hutchinson	**Determining the Right Type and Quantity of a Power Source - US Army CERDEC/LRC, Don Brockel (#4931)**
	Doing Business with the Marine Corps - Shekela Hutchinson **Marine Corps Systems Command Purchasing & Evaluation of Power Items - Michael Gallagher**	**Future of US Navy Electromotive Power Logistics - NAVAIR, LCDR Davis Spurlock (#4841)** **Planning and Decision Support for Enhanced Power and Energy Management - MTS Technologies, Inc., Stephen Sullivan (#4823)**
3:00 p.m. - 3:45 p.m.	**BREAK in Exhibit Hall**	
3:45 p.m. - 5:15 p.m.	**Session 3 - Chair: Mike Brundage Michael.Brundage1@us.army.mil**	**Session 4 - Chair: Bob McKenzie robert.h.mckenzie@usmc.mil**
	Future Trends and Thrust for Army Manportable Power Sources - CERDEC, Mike Brundage (#4930)	**Marine Corps Mobile Electric Power Distribution System Replacement - USMC, MSgt Fred McCue (#4649)**
	Advancements in Navy and USMC Power Systems - NSWC Carderock, Justin Govar (#4902)	**The Case for Smart/Safe Power Management and Distribution for the Military - Custom Manufacturing & Engineering (CME), Rick Silva (#4835 & 4839)**
	DoD Battery Technical Working Group - US Army roadmaps and databases CERDEC, Marc Gietter (#4929)	**Fuel reduction solutions for deployment of mobile electric power systems - Oerlikon Contraves, Philippe Bisaillon Eng. MEM (#4805)**
6:00 p.m. - 8:00 p.m.	**Conference Reception in Exhibit Hall**	

Wednesday, April 25, 2007

7:00 a.m. - 5:30 p.m.	**Exhibit Hall Open**		
7:00 a.m. - 8:00 a.m.	**Continental Breakfast in Exhibit Hall**		
8:00 a.m. - 9:30 a.m.	**Session 5 - Chair: Maj Daniels regina.daniels@us.army.mil** **Mobile Electric Power for Today and Tomorrow - DoD Project Manager Mobile Electric Power, Paul Richard (#4829)**	**Session 6 - Chair: Julie Banner julie.banner@navy.mil** **Ultralast Chinese Li/FeS2 Cells - David Hale Associates, Inc., Robert Byrnes Sr. (#4860)** **High Voltage Systems: Do's and Don'ts - Naval Surface Warfare Center Crane, Susan Waggoner (#4918)** **Large-sized Li-ion battery module for hybrid powered energy systems - GS Yuasa Corp., Koichi Nishiyama (#4690)**	**Session 7 - Chair: Mike Bissonnette mbissonnette@mkisystems.com** **MILITARY TRAINING** **Communications power sources & vehicle battery maintenance**
9:30 a.m. - 10:15 a.m.	**BREAK in Exhibit Hall**		
10:15 a.m. - 11:45 a.m.	**Session 8 - Chair: Maj Daniels regina.daniels@us.army.mil** **Mobile Electric Power Lessons Learned in the Global War on Terror - USMC, Robert McKenzie III (#4647)** **Case Study - Reducing Premature Failure of Parts with Interactive Virtual Training for Generator Operators - NGRAIN Corp., Erik Kaas (#4840)** **Lightweight 2-kW Generator with Electric Start and Voltage Regulation - Mainstream Engineering Corp., Gregory Cole (#4884)**	**Session 9 - Chair: Don Brockel Donald.Brockel@us.army.mil** **Servicing Hawker Vehicle Batteries with Standard Battery Charging and Test Equipment - US Army, TARDEC, Fred Krestik (#4672)** **Battery Maintenance and Management - Pulsetech Products Corp., Mark Abelson (#4818)** **Hybrid Li-ion/VRLA Battery for Silent Watch - Modular Energy Devices, Stephen Eaves (#4668)**	**Session 10 - John O'Donnell john.h.odonnell@usmc.mil** **Testing of COTS/NDI products (Joint presentation) (#4882)**
11:45 a.m. - 1:45 p.m.	**LUNCH** **Speaker - Hon. Philip E. Coyle III**		
1:45 p.m. - 3:15 p.m.	**Session 11 - Chair: Mike Gallagher michael.a.gallagher@usmc.mil** **DOD Efforts in On-Board Vehicle Power (Joint presentation) (#4639)**	**Session 12 - Chair: Marc Gietter marc.d.gietter@us.army.mil** **Research and Development, GEN4 Zinc Air Battery Technology - Electric Fuel Battery Corp., Darrel Morris (#4830)** **Flexible Hybrid Power Architecture and Evaluation of Multiple Sources Under Load - US Air Force Research Labs, Lt Joshua Johnson (#4837)** **Power Surety for the Long War - US Army, Rapid Equipping Force Power Surety Branch, Daniel Nolan III (#4662)**	**Session 13 - Chair: CWO5 Good pamela.good@usmc.mil** **MILITARY TRAINING** **Generators & AUTODISE**
3;15 p.m. - 4:00 p.m.	**BREAK in Exhibit Hall**		
4:00 p.m. - 5:30 p.m.	**Session 14 - Chair: Mike Gallagher michael.a.gallagher@usmc.mil** **Oshkosh Truck's electric drive approach to mobile power platforms - Oshkosh Truck Corp., Nader Nasr (#4822)** **30 kW On-Board Vehicle Power for the HMMWV - ePower LLC, William Henrickson (#4700)**	**Session 15 - Chair: Sue Waggoner susan.waggoner@navy.mil** **Workshop - Battery Documents Navy Aircraft and Army C/E - US Navy & US Army, Susan Waggoner & Pat Lyman (#4917)**	**Session 16 - Chair: Jonathan Hernandez jhernandez@fbiacademy.edu** **Solar Power Adapters and Deployable and Renewable Energy Alternative Module - Marine Corps Systems Comand, Maj David Morris, (#4673 & 4686)** **Need for Tactical Off-Grid Solar Power System - NEST Energy Systems, Tom Lederle (#4940)**

Self-Generated Field Power Sources - High Tide, Albert Hartman (#4807)

Thursday, April 26, 2007

7:00 a.m. - 12:00 p.m. **Exhibit Hall Open**

7:00 a.m. - 8:00 a.m. **Continental Breakfast in Exhibit Hall**

8:00 a.m. - 9:30 a.m.

Session 17 - Chair: Maj Daniels regina.daniels@us.army.mil	Session 18 - Chair: Jonathan Hernandez jhernandez@fbiacademy.edu
The Family of Environmental Control Equipment - Marine Corps Systems Command, MSgt Teresa Terry (#4689)	Moving Forward with Fuel Cells: Army CERDEC Development & Demonstration Progress - US Army, CERDEC, Elizabeth Bostic (#4684)
Integrated Trailer, Environmental Control Unit, and Generator (ITEG) - Marine Corps Systems Command, Maj David Morris (#4674)	XX25 Reformed Methanol Fuel Cell for Portable Power Applications - UltraCell Corp., Ian Kaye (#4755)
Solving power supply obsolescence, reliability, and power density issues by advances in power electronics technology. - Custom Manufacturing & Engineering, Richard Sidley (#4833)	Advances in Chemical Hydride Based PEM Fuel Cells for Portable Power Applications - Millennium Cell Inc., Shailesh Shah (#4877)

9:30 a.m. - 10:15 a.m. **BREAK in Exhibit Hall**

10:15 a.m. - 12:00 p.m.

Session 19 - Chair: Sue Waggoner susan.waggoner@navy.mil	Session 20 - Chair: Jonathan Hernandez jhernandez@fbiacademy.edu
Data Systems for Enhanced Power and Energy Management - MTS Technologies, Inc., Zachary P. Hubbard (#4826)	Durability and Performance issues of PEM Fuel Cell Systems for Portable Applications - Hampton University, Dr. Amir Hoshang Chegini (#4685)
Powering the Mobile Warfighter: One Size Fits None - Protonex Technology Corp., Phil Robinson (#4832)	Solid Oxide Fuel Cell Power Systems for Small UAVs - Adaptive Materials, Inc., Brad Clawson (#4838)
The Next Level of Intelligent Power Management & Distribution - Energy Technologies, Inc., Tim Lowe (#4836)	Military 3 kW Jet-Fueled Tactical Fuel Cell Generator - IdaTech, LLC, Eric Simpkins (#4706)
	Portable, JP-8 fueled battery charger for remote operation and portable solid oxide fuel cell systems - Mesoscopic Devices, LLC, Christine Martin & Dr Jerry Martin (#4709 & 4710)

12:00 p.m. **Conference Adjourns**

12:00 p.m. - 4:00 p.m. **Exhibitor Move-out**

Baghdad
Hilla
بغداد
الحلة

NIGHT VISION GOGGLE

U.S. MARINE

2007 Joint Service
Power Expo & Conference
24-26 April 2007

Battlefield Power for the Warfighter

Lessons for the Development Community

Ken Zemach, Ph.D.
Lion Cells, Inc.
April 2007

SF soldiers in theater ripping apart dozens of MBITR boxes to run them from BA-5590s

Actual operational power supply rigged by soldiers to run $500,000 thermal sight in theater

BLUF

2 years of developing, deploying, and supporting technology in theater

- 20% of successful technology deployment is the technology… 80% is logistics (materials, repair, training, support)
- Power is a large part of the logistics nightmare for many items… avoid proprietary solutions whenever possible

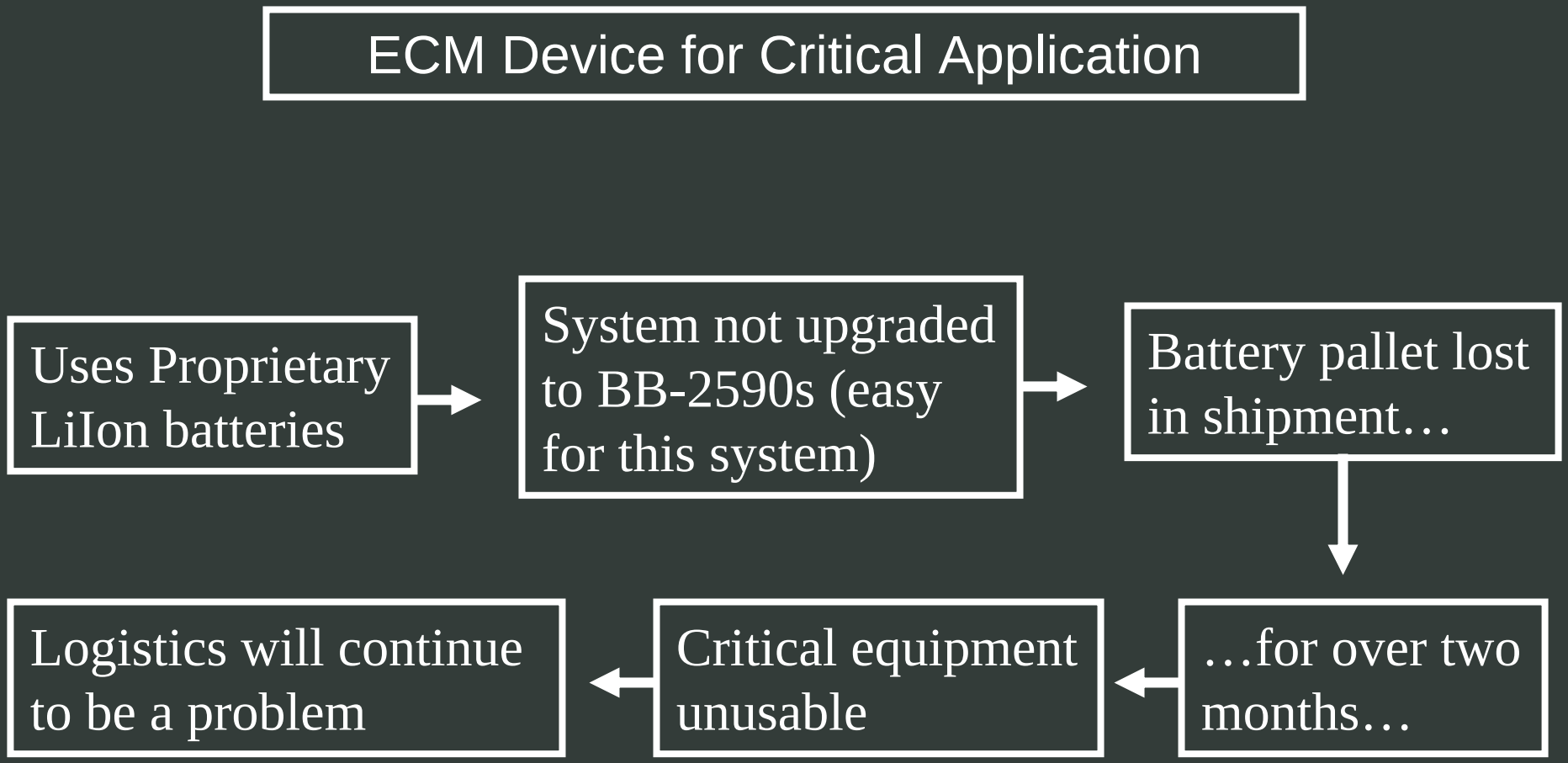
Proprietary Batteries: Resupply/Charge

Cooling Vest for Mounted Operations

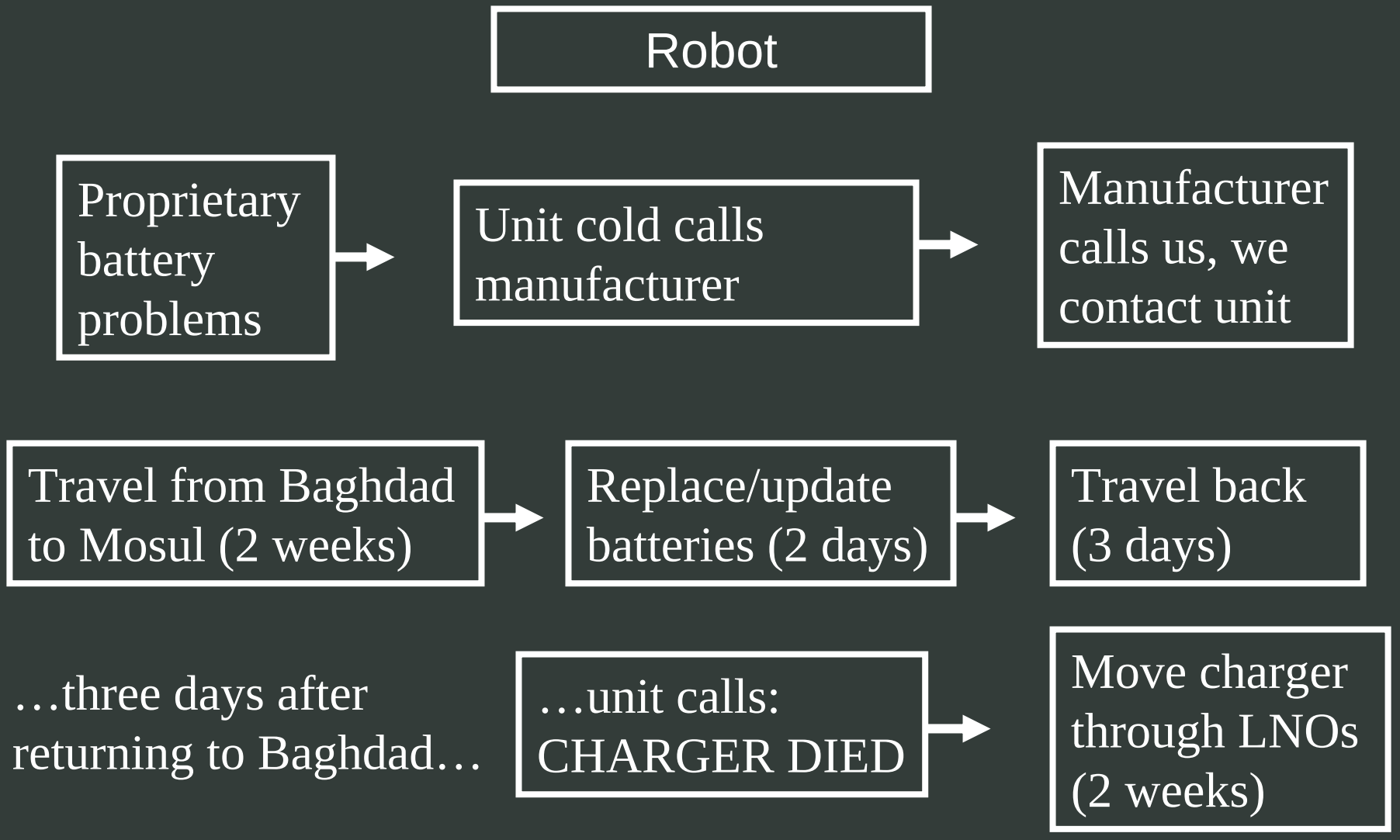
Correct battery solution but…

- Reduced utility, lower initial cost, lower long term cost, countless substitutes
- More utility, lower initial cost, lower long term cost, countless substitutes
- Reduced utility, lower initial cost, lower long term cost, countless substitutes

Proprietary Batteries: Logistics



Proprietary Batteries: Support



Good News: Use the “Standards”

Good News: Use the “Standards”

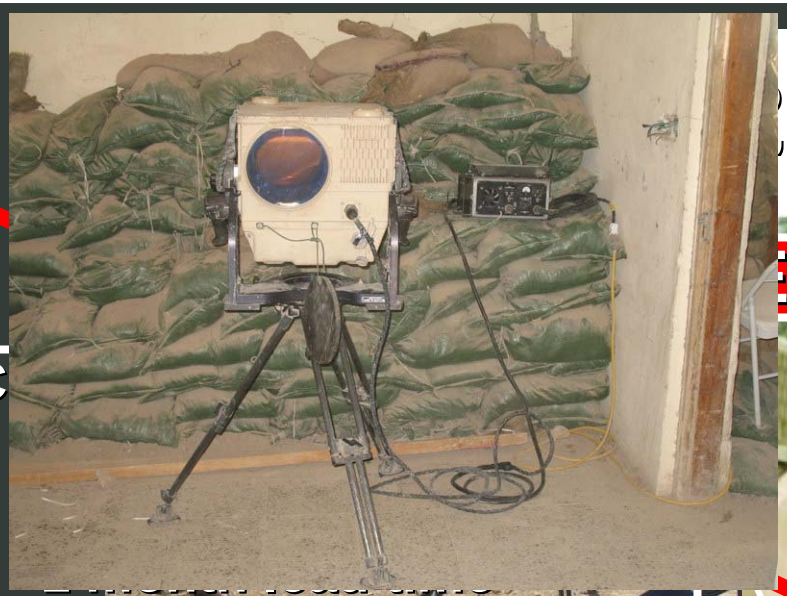
Run anything COTS from an x90

COTS:

- Cell phones
- Sat phones
- PDAs
- AA chargers
- Laptops
- Camcorders
- DVRs
- LCD monitors
- Surveillance cameras
- Loudspeakers
- Spotlights
- Dremel tool
- Etc.

Good News: Use the “Standards”

SSGA.S.W. Developed for INFREG wins with:



- 9 -12 month lead time
- $250k NRE
- $5k+ each
- Meets strict equipment specs

Moving to a “standard” 24V Power Supply:

- Saved 9+ months of R&D
- Saved over $250k in NRE for development
- Saved over $800k in power supply costs
- Avoided logistics/support issues for new custom equipment

system dismounting in fixed locations (battery box unacceptable solution)

Solar Battery Charging!

Product Design and Fielding Issues

Why manufacturers should standardize and/or have the right adapters

- **It CAN be done, and it's not that hard.**
  - **Examples: MARCbot, ODIS, Raven, LRAS3**
- **For manufacturers:**
  - **Reduces time to market, battlefield**
  - **Increases military acceptance**
  - **? Reduces product cost ?**
- **For Military:**
  - **Increases standardization (a good thing)**
  - **Reduces logistics and support issues (HUGE)**
- **Manufacturers (military and consumer) need:**
  - **Directive AND understanding why**
  - **Help with how: recommended options, dimensions, sources, connectors, DC-DC converters, suppliers, etc.**

Contact Info

Ken Zemach

Email: kzemach@alum.mit.edu

Useful Website: www.warfightersolutions.com

Naval Character Distributed Operations Seabasing

- Forward Presence
- Security Cooperation
- Counterinsurgency
- Forcible Entry
- Prolonged Operations
- Countering Irregular Threats

A Few OIF Power Observations

Joint Service Power Expo
24 Apr 2007

LtCol Jansen

HQMC, ASL-32

Spoon.wmv

Early 2003

- **Build up**
  - **Tents (RUTS AC)**
  - **Generators (relatively short period)**
  - **Haircuts/lPODs*/Chow Hall****
  - **Hard Stands (Ku)**
  - **Field Food Court/PX**
- **Crossing the LOD**
  - **Dump the Stuff***
  - **Batteries**

Early 2003

Spring 2004

- **Armoring**

  - **Add on 3/16” → 3/8”and 3/4” →**
  - **Kits/Programs →**

  - **Bullets → Bombs**
  - **Special Vehicles?**

Summer 2005

- Sustained Ops
  - Cans/Hardstands(I*)/Sea Huts/Tents
  - Generators/Power Grid (STAC)(STP)
  - Green Bean/PX/Chow Hall
- Convoys
  - Armoring/Comm/Data/EW/AC
  - More Special Vehicles
- CNN Syndrome

Summer 2005

Summer 2006 – Early 2007

- Sustained Ops
  - Cans/Hardstands/SeaHuts/Tents
  - Power Grid/Generators (MTAC)(MTP)
  - AC and Contractor Proliferation
  - Distributed Ops within Sustained Ops
- Convoys
  - Still More Stuff (turrets)
- CASEVAC – Power

Summer 2006 – Early 2007

Reflections

- Great Expectations (Home/Auto)
- Distributed Ops
- Ton of Feathers = Ton of Lead
- Power Interface
  - US to Non US = Wakeup Call
  - Plug to grid
  - Pickup and Go
- SLEEP-Y is the Answer

Questions?

9TH COMM BN ENGINEERS
OIF LESSONS LEARNED

GYSGT R.L. GARDNER
ENGINEER PLT SNCOIC

OVERVIEW

- BN EVOLUTION FROM OIF 1 THROUGH 5-7
- WHAT WE DID RIGHT
- WHAT WE DID WRONG
- SUGGESTIONS FOR IMPROVEMENT
- BRIEF SUMMARY
- QUESTIONS

OIF-I
(TACTICAL GENERATORS)
OCT 02 – OCT 03

- TACTICAL (GENERATORS) AUGMENTED WITH GENERATION 1 MMG-25

- VARIOUS LOCATIONS THROUGHOUT IRAQ

OIF-II-I & II (TACTICAL, PRIME COMMERCIAL GENERATORS, & GEN I & II MMG-25)

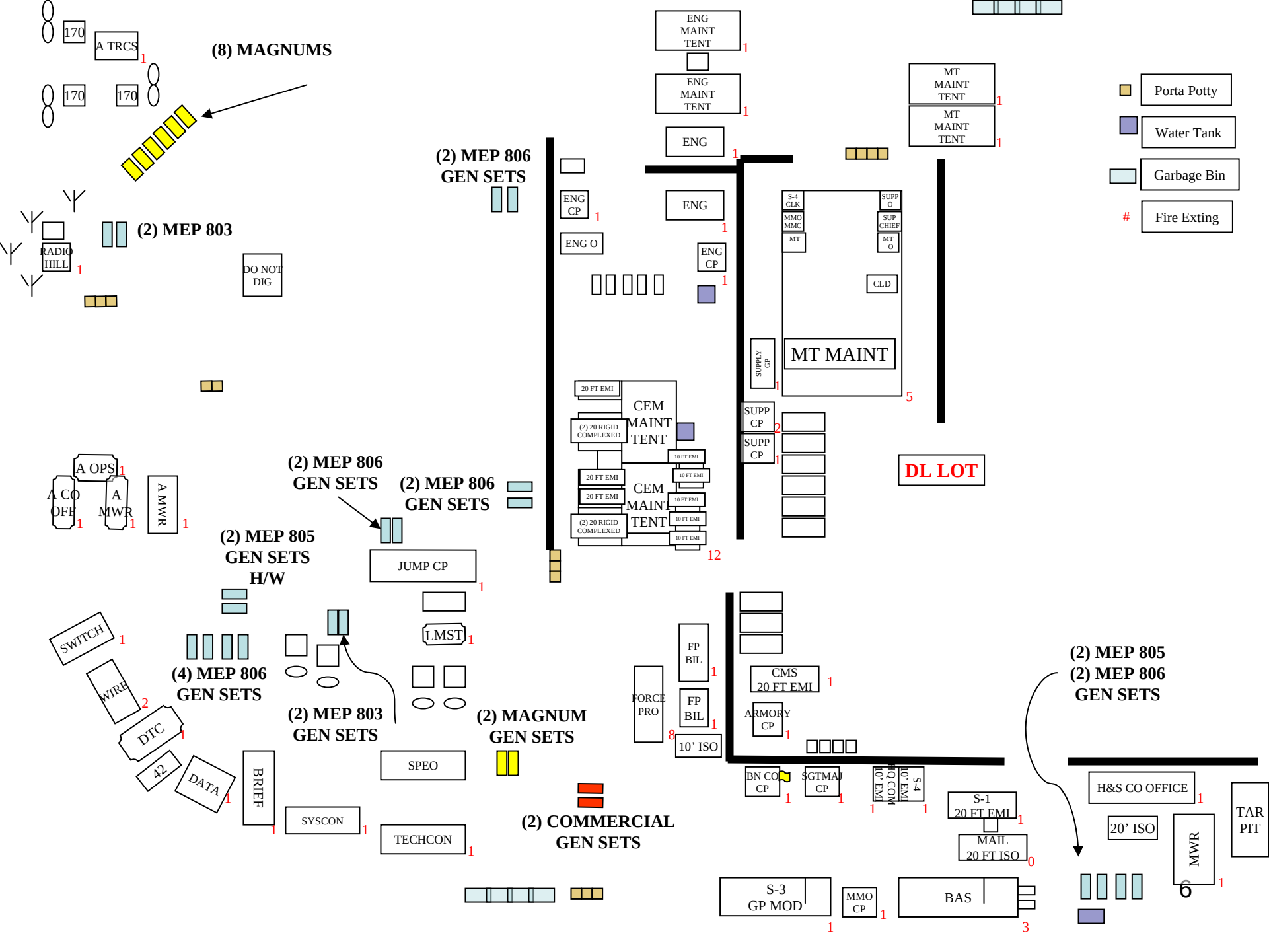
JAN 04 – APR 05

- CAMP FALLUJAH SITE- (21) GEN PITS (8) PITS ARE BACK UP/ PRIMARY DURING OVERHEATING)
- (10) OUTLYING SITES (Forward Operating Bases)
- (32) MMG-25 GENERATORS (GEN II MODIFICATIONS COMPLETE)
- (1) 120V & (4) 240V COMMERCIAL GENERATORS
- LARGER COMMERCIAL GENERATORS BEGIN TO REDUCE PRIMARY TACTICAL GENERATOR PITS

OIF-05-07 (HUGE REDUCTION IN TACTICAL, INCREASE IN PRIME AND COMMERCIAL, & GEN III MMG-25)

JAN 06 – FEB 07

- FEB 07- CAMP FALLUJAH HUB SITE- APPROXIMATELY 70% COMMERCIAL GENERATORS WITH TACTICAL GENERATORS ON STAND BY
- (5) OUTLYING SITES (FOBS)
- (40) MMG-25 GENERATORS (INCLUDES GEN 3 MMG-25 GENERATORS)
- (5) 120V (6) 240V GENERATORS
- LARGE COMMERCIAL GENERATORS PRODUCE 70 PERCENT OF PRIMARY POWER FOR THE BATTALION. PITS ON FOBS GREATLY REDUCED.


170
A TRCS
1
(8) MAGNUMS
170
170
(2) MEP 803
RADIO HILL
1
DO NOT DIG
(2) MEP 806 GEN SETS
ENG MAINT TENT
1
ENG MAINT TENT
1
ENG
1
ENG CP
1
ENG O
ENG
1
ENG CP
1
MT MAINT TENT
1
MT MAINT TENT
1
S-4 CLK
MMO MMC
MT
SUPP O
SUP CHIEF
MT O
CLD
MT MAINT
5
SUPPLY CP
1
SUPP CP
2
SUPP CP
1
DL LOT
20 FT EMI
(2) 20 RIGID COMPLEXED
CEM MAINT TENT
10 FT EMI
20 FT EMI
20 FT EMI
(2) 20 RIGID COMPLEXED
CEM MAINT TENT
12
A OPS
1
A CO OFF
1
A MWR
1
A MWR
1
(2) MEP 806 GEN SETS
(2) MEP 806 GEN SETS
(2) MEP 805 GEN SETS H/W
JUMP CP
1
LMST
1
SWITCH
1
WIRE
2
DTC
1
42
DATA
1
BRIEF
1
(4) MEP 806 GEN SETS
(2) MEP 803 GEN SETS
(2) MAGNUM GEN SETS
SPEO
SYSCON
1
TECHCON
1
(2) COMMERCIAL GEN SETS
FP BIL
1
FP BIL
1
FORCE PRO
8
10’ ISO
CMS 20 FT EMI
1
ARMORY CP
1
BN CO CP
1
SGTMAJ CP
1
BN COM CP
10’ EMI
1
S-4
10’ EMI
1
S-1 20 FT EMI
1
MAIL 20 FT ISO
0
S-3 GP MOD
1
MMO CP
1
BAS
3
(2) MEP 805
(2) MEP 806 GEN SETS
H&S CO OFFICE
1
20’ ISO
MWR
1
TAR PIT
6
Porta Potty
Water Tank
Garbage Bin
#
Fire Exting

WHAT WE DID RIGHT

AGGRESSIVE PREVENTIVE MAINTENANCE

- **PM's performed every 10 days**
- 38 tactical generators over 5000 hours/10 with 10000+
- Readiness of 95%
- Decreased time spent on maintenance
- Pressure washer and wash rack

AIR COMPRESSORS

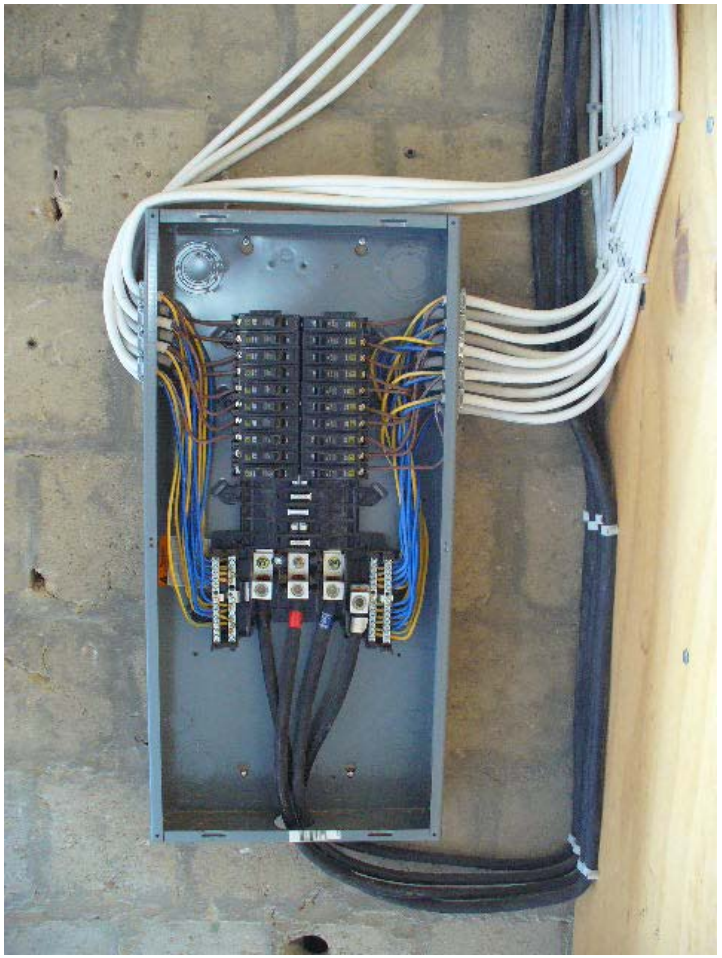
TRAINING

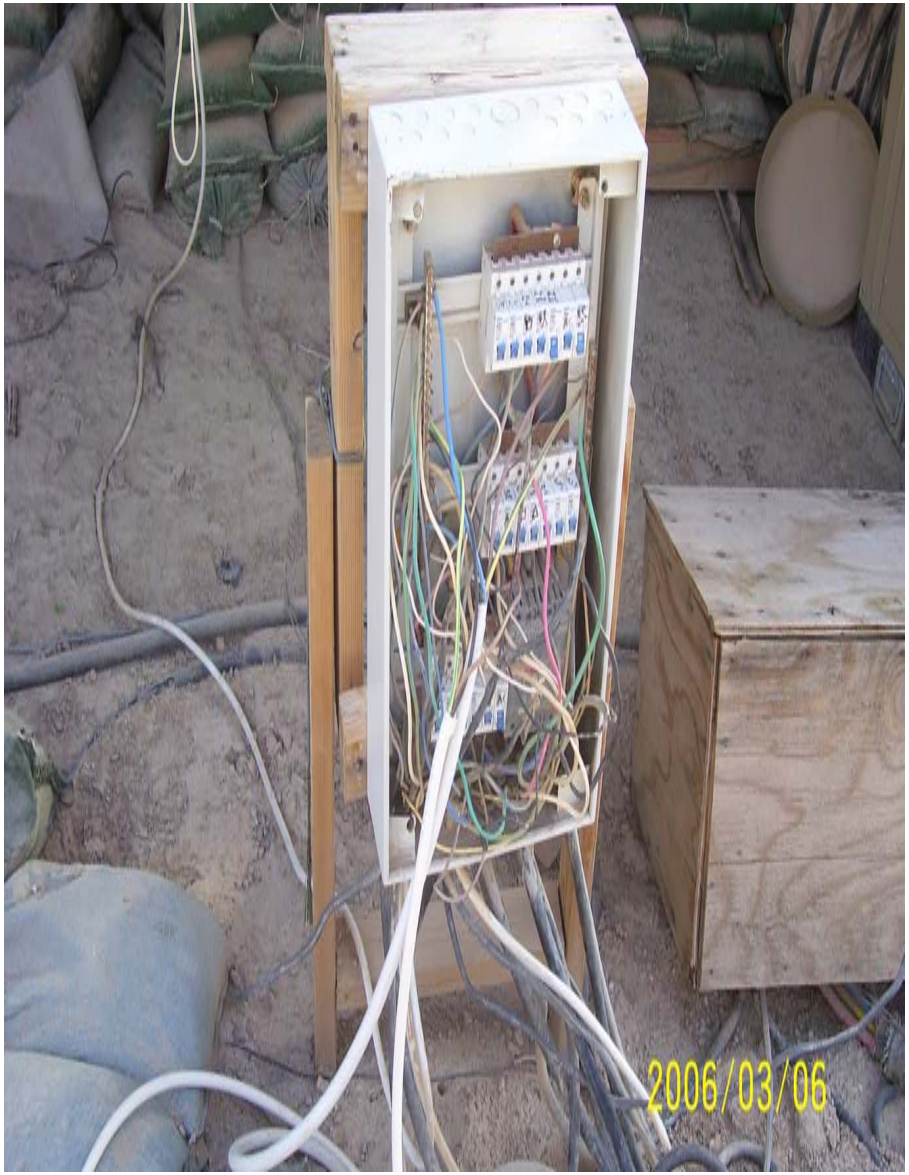
- Cross trained every Marine

  -Freed up generator techs allowing them to work outside the main base
- Companies training before deployment

WHISKEY 1

CROSS TRAINING




2006/03/06

2006/03/26

PM/REPAIR PARTS

PEB EXAMPLE

ENGINEER PEB INVENTORY						
MEP 803A						
PM PARTS						
			QTY	AUTH	AUTH	
NOMENCLATURE	**NSN**	**PRICE**	**ON HAND**	**QUANTITY**	**ROP**	**Jan**
OIL FILTER	2940-01-154-5127	$2.49	70	75	25	9
FUEL FILTER WATER SEPARATOR	2910-01-376-5666	$16.52	67	75	25	5
AIR FILTER	2940-00-934-7989	$7.12	116	100	20	5
FILTER, BODY FLUID (803,805,806)	2940-01-365-6535	$5.25	49	26	5	
FUEL FILTER	2910-00-099-5467	$2.58	127	75	25	5
MEP 805A&B/MEP 806A&B						
PM PARTS						
			QTY	AUTH	AUTH	
NOMENCLATURE	**NSN**	**PRICE**	**ON HAND**	**QUANTITY**	**ROP**	**Jan**
FUEL WATER SEPARATOR (806A/B)	2910-01-359-4971	$14.03	44	70	40	14
OIL FILTER (805A/806A)	2940-00-007-4791	$4.43	107	75	25	18
AIR FILTER ELEMENT	2940-01-378-1130	$9.77	102	105	50	27
FUEL WATER SEPARATOR (805A/805B)	2910-01-444-3758	$14.57	23	50	10	17
OIL FILTER (805B/806B)	4330-01-444-3729	$9.55	21	35	25	9

REPAIR PARTS

- BPA (Blank Purchase Agreement) with Magnum

  -Eliminated the OPR (Open Purchase Request)
- Added high usage corrective maintenance parts into the PEB (Pre-Expended Bin)

  -No wait time on parts through supply

GENERATOR WATCH

- 5 on watch for 24 hour period (4 MOS's)

  -Quick response/versatility

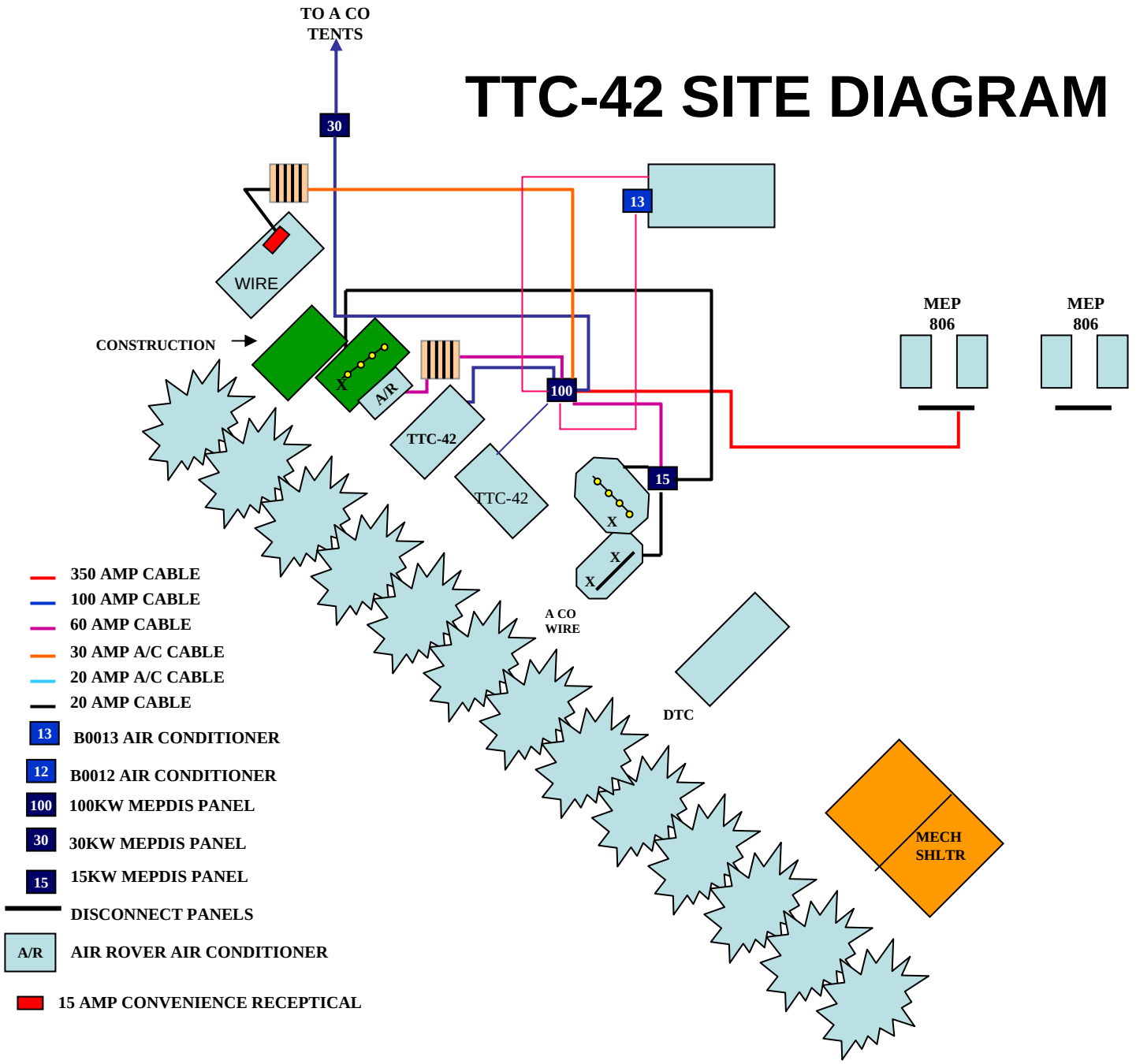
  -Always in teams of 2

  -Gator!!!/Radio!!!
- Checks performed every 3 hours (oil, water temp, hours, fuel, and power draw)

  -Able to proactively monitor potential problems

GENERATOR WATCH

TTC-42 SITE DIAGRAM



BATTERIES

BATTERIES

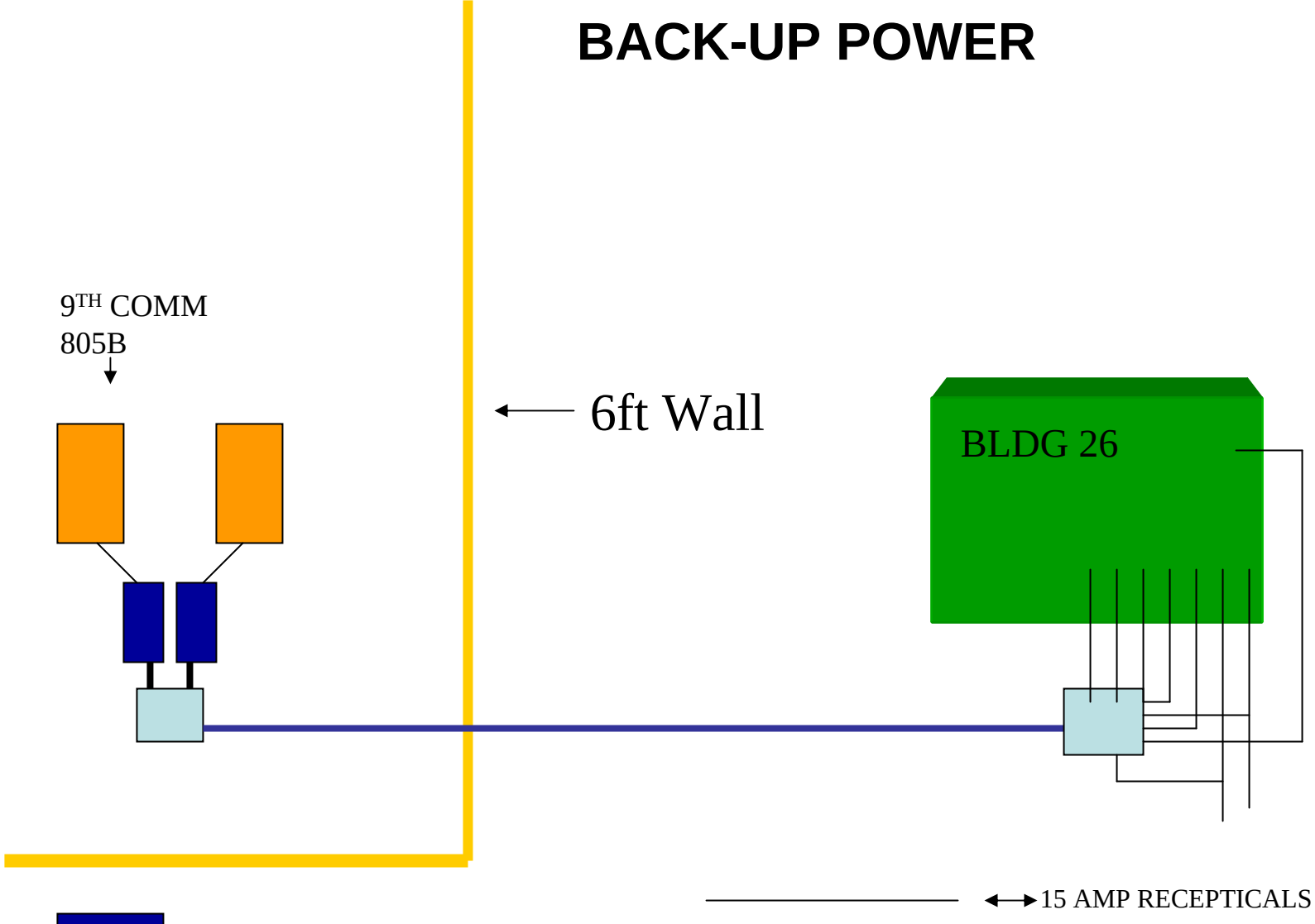
- Build battery room w/exhaust fan
- Created log book for tracking
- Center for Engineers, MT, and other units
- From electrolyte to gel-cell

COMMUNICATIONS

- Maintained contact with II MEF counterparts throughout the year

- Established liaison with warranty coordinators, adjacent units, higher units, and field rep (Gunny)

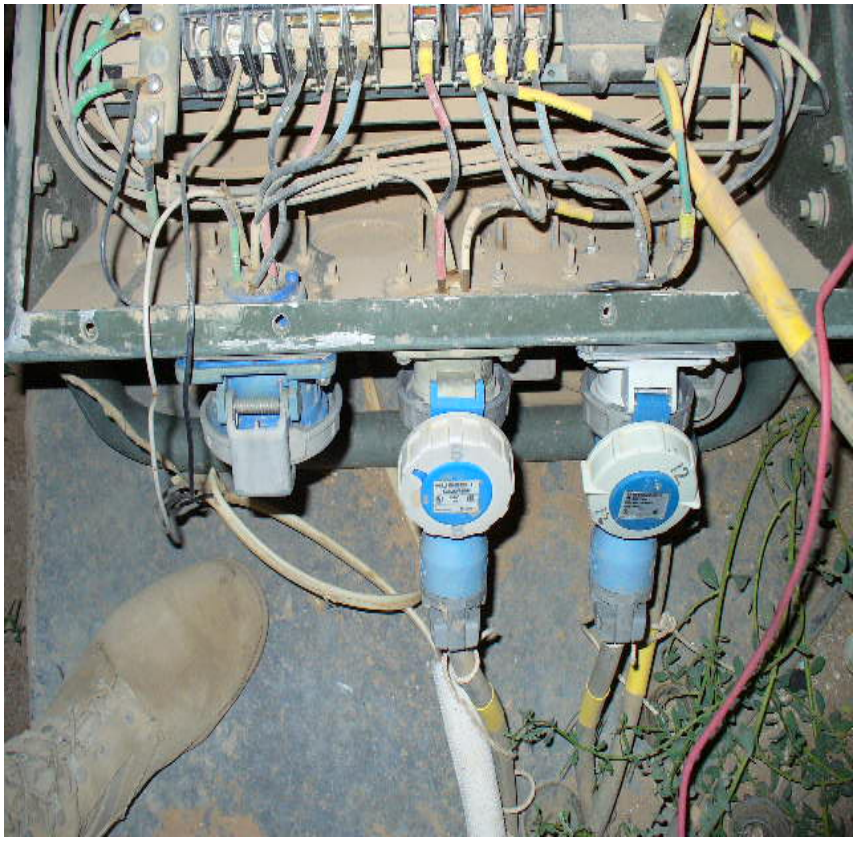
BACK-UP POWER



WHAT WE DID WRONG

LABELING POWER DISTRIBUTION BOXES

TURTLES



- Lost time to trace circuits
- Needed to purchase circuit tracers

GROUNDS

GROUNDS

- Replaced every ground

  -Insulated/solid strand copper wire

- Ground reports

  -Daily/identified potential problems

- Comm gear sensitivity

COMMERCIAL POWER

SUGGESTIONS FOR IMPROVEMENT

- Purchasing equipment from the same company

  -BPA with them

  -Training before installation

  -Same PM parts
- Syncing ability
- UPS (Uninterrupted Power Supply)
- Purchasing A/C’s from locals-color code different/no instructions

SUGGESTIONS FOR IMPROVEMENT

- Better outlets for buying 240 volt assets
- PEI (Principal End Item) Rotation

  -Tactical gear coming off line

  -Who needs it more?

DOMINANT MOTIFS

- SHIFT FROM TACTICAL DOMINANCE TO COMMERCIAL AND PRIME POWER UTILIZATION
- FREQUENT AND AGGRESSIVE MAINTENANCE ELIMINATES COMMON EVERYDAY PROBLEMS?

SUMMARY

- BN EVOLUTION FROM OIF 1 THROUGH 5-7
- WHAT WE DID RIGHT
- WHAT WE DID WRONG
- SUGGESTIONS FOR IMPROVEMENT
- BRIEF SUMMARY
- QUESTIONS

OIF 5-7 Commercial Power Generators

GySgt Yanez G.V.

I MHG Engineer Maintenance Chief

USMC I MEF Headquarters Group

OIF 5-7

Review of Prime Power

- Commercial Generators for Prime Power
- EMTA Prime Power for Camp Fallujah
- KBR Support on commercial generators

OIF 5-7 (con't)

Review of Generator Support

- In-Country Purchased Generators
- Commercial Generator Supply Issues
- Tactical Generator Support

Introduction of Prime Power

- Initial camp power support
- Facilitation of prime power at Camp Fallujah, Iraq
- Utilization of (9) 1.2 megawatt generators
- New power distribution system installed

Benefits of Prime Power

- Eliminated a large amount of generator sites used in the past
- Provided power support for **all** hard stand buildings
- Provided one power distribution center

EMTA Prime Power Support

Responsibilities included:

- Maintained Generators and distribution system
- Provided proper documentation for generator repairs
- Provided efficient and trained staff for emergency response and routine maintenance

EMTA Prime Power Support

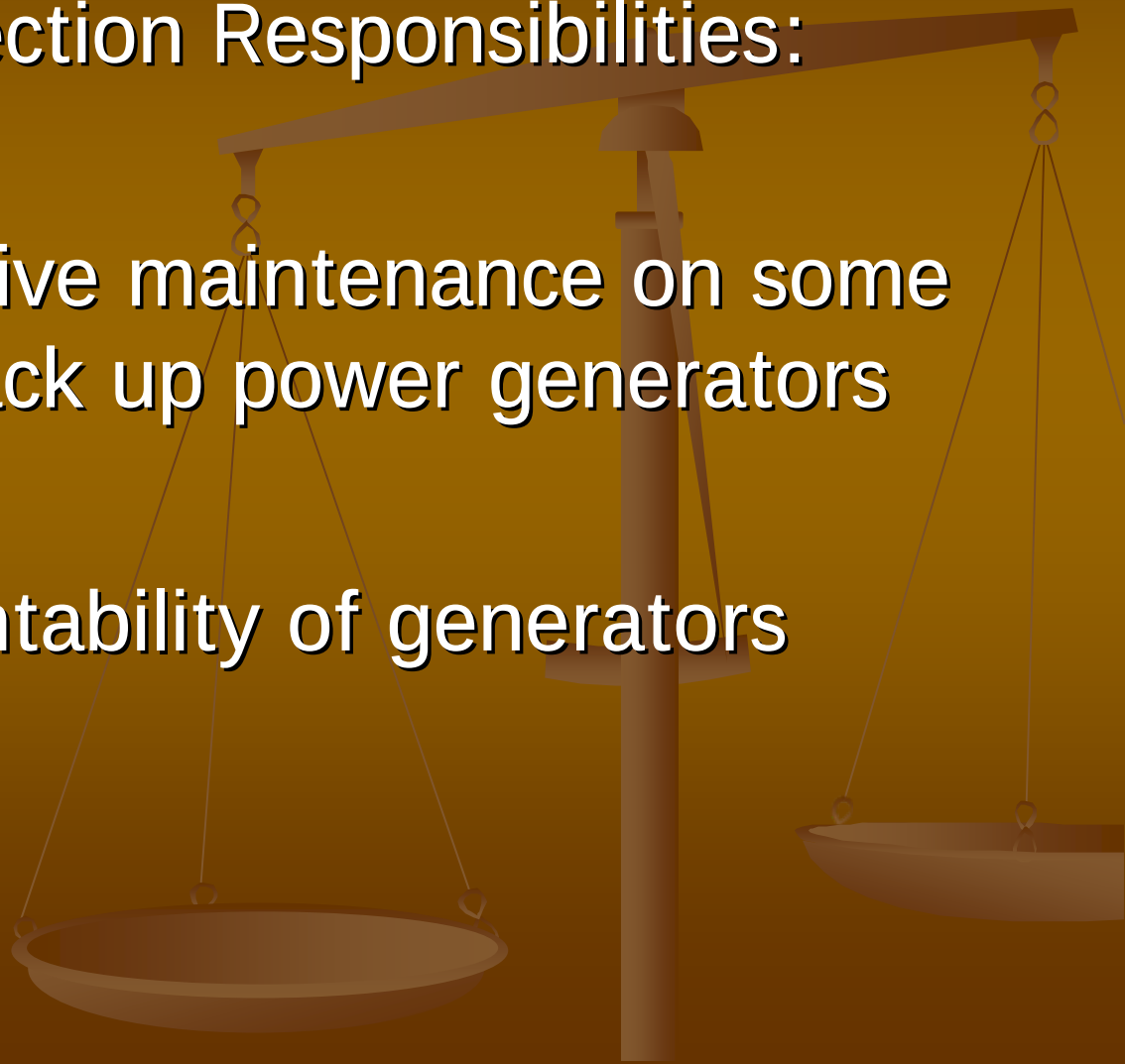
Responsibilities (con't):

- Provided all materials for high voltage distribution
- Provide all staff continued training, including electric motor repair
- EMTA was a self sustained company
- Minimum power outages

KBR Support of Commercial generators

KBR Generator Section Responsibilities:

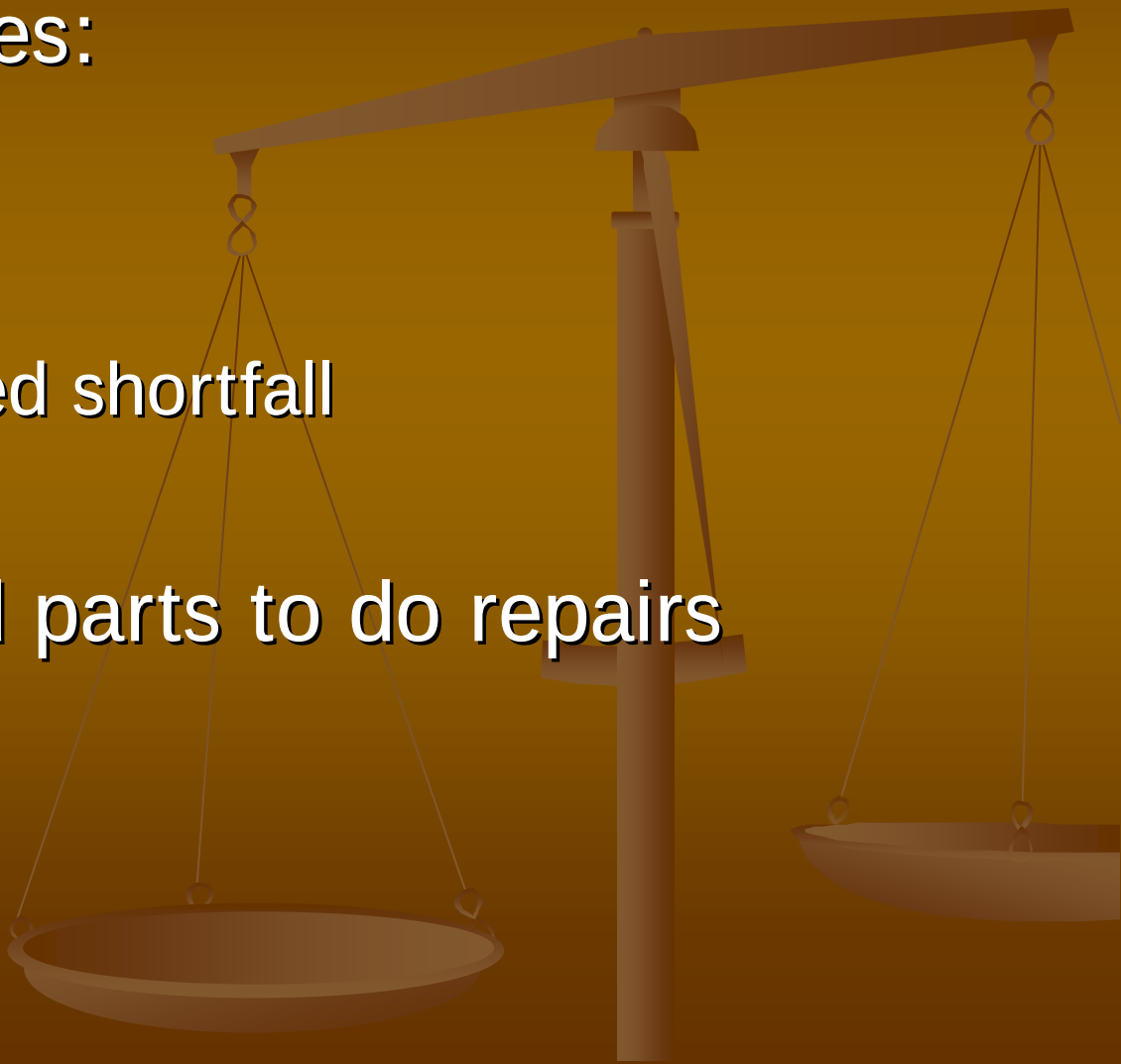
- Provide preventive maintenance on some primary & all back up power generators
- Maintain accountability of generators



KBR Support of Commercial generators

Section Deficiencies:

- Understaffed
  - Marines inherited shortfall
- Lack of required parts to do repairs



KBR Support of Commercial generators

Actions taken:

- Assigned military personnel as the power generation representative

In-Country Purchased Generators

- Units purchasing generators
- Several different types and models were purchased
- Insufficient training provided to Marine Corps
- Deficiencies in equipment compatibility

In-Country Purchased Generators

- Received rebuilt equipment instead of new
- No warranty with equipment
- Technical publications and repair manuals

In-Country Purchased Generators

Recommendations:

- Provide additional training to Marines
- Insure proper technical manuals are purchased with equipment
- Purchase same brand of generators with compatible parts

Commercial Generator Supply Issues

- Availability of repair parts in country
- Local venders
- Price gouging by some venders
- Delivery of repair parts

Tactical Generator Support

- Tactical Generator requirements
- Insufficient power
- The effect of ambient temperature
- Sand storms
- Maintenance requirements increased

Summary:

- Commercial Generators for Prime Power
- EMTA Prime Power for Camp Fallujah
- KBR Support on commercial generators
- In-Country Purchased Generators
- Commercial Generator Supply Issues
- Tactical Generator Support

Semper Fidelis

QUESTIONS

Power & Sensor Solutions

The Case for Smart Power Management and Distribution for the Military

Joint Service Power Expo 2007

Introduction

- **Rick Silva**
  - At CME 6 years in military power management
  - Previous work in power automation at TeCom, a TECO Energy company, that resulted in two patents in Environmental Controls
- **PI for Shipboard Power Management**
  - Navy Phase II STTR with ONR
  - Power management for future Electric Ships
- **PE for Advanced Power Management**
  - Army Phase II SBIR that transitioned to Phase III, and resulted in a TRL 8 power system

What is Smart Power ?

- **Basic Elements of a Power System**
  - Generation
  - Distribution
  - Consumption
- **Smart Power System**
  - Where one or more elements act on information to effect a desirable change in the system
- **Examples**
  - Self-Dispatching Generators (demand based)
  - Input-Qualifying Distribution Equipment
  - Self-Shedding / Restoring Loads

Applications

- **Tactical Operations Centers (TOC)**
  - Radios, Networking Equipment, Computers
- **Forward Operating Bases / BEAR Bases**
  - Billeting, Kitchens, Showers, Medical Facilities, Satellite Communications
- **Ships**
  - Radar, Guns, Catapults, Missiles
- **Fixed Facilities – Camps, Forts, Naval Bases**
  - Admin. Buildings, Training Facilities, Housing

Tactical Operations Center

- **A TOC is one or more shelters, tents and/or containers outfitted with equipment and power with defined operational functions and arranged for efficient interaction among them.**
- **Functions in a Brigade TOC**
  - S2 – Intelligence
  - S3 – Operations
  - ENG – Engineering
  - ADA – Air Defense Artillery
  - FSE – Fire Support Element

Tactical Operations Center

- **Power Sources**
  - APU's: 10kW AC, 5kW DC
  - MIL STD
  - Tactical Quiet Generators; 3kW to 200kW
  - Non-MEP military / commercial generators
- **Issues**
  - APU limits mission equipment
  - Generators tend to be over specified/underused
  - Safety suffers from creative generator hookups
  - Phase imbalance can reduce available power
  - The need to reduce fuel consumption
  - Lack of training

Tactical Operations Center

- **Power Distribution - PDISE**
  - M200: 200A 3ph input, 100A, 60A 3ph output
  - M100: 100A 3ph input, 100A, 60A 3ph output
  - M40: 40A 3ph input, 12-20A 1ph outputs
  - M60: 60A 1ph input, 6-20A 1ph outputs
  - M46: 20A 1ph input, 12-15A 1ph outputs, 3 drop lights
  - Universal Adapter: 60A 3ph input, lugs output
- **Issues**
  - No connector for 60A 1ph shelters
  - Bulbs in the M46 break
  - M46 load can overload M40

Tactical Operations Center

- **Loads**
  - ECU, single largest load in most shelters
  - Power Supply, paralleled with vehicle battery for trickle charging and as a UPS for radios
  - Radios, SatCom, Phones, DAGR, MTS
  - Computers, Networking Equipment, Printers
- **Issues**
  - Not all loads are in the MTOE
  - Localized overloads do occur
  - Power quality may be lacking
  - SICPS shelters aren't 3ph loads

Smart Generators for TOC's

- **Smart Power Generation System**
  - Generators that can be clustered and run based on demand
- **PSI**
  - 20kW and 35kW generators
  - Auto-shed load bank to eliminate wetstacking
  - Auto-shed ECU in GET units
- **Rolls-Royce**
  - 15kW FEPS (VSIG about to go into service)
  - Prognostics / Diagnostics / Data Logging

Smart Generator Benefits for TOC's

- **Smart Power Generation System**
  - Clustered generators provide incremental power
  - Only generators that need to run are operating
  - Fuel savings
  - Higher reliability, no power disruptions
  - Smaller HMMWV towable generators
  - Prognostics / Diagnostics / Data Logging (R-R)

Smart Distribution for TOC's

- **Smart Power Distribution System**
  - Monitors and provides input status, ensures safety, balances loading across all phases
- **IPDISE is for distribution management**
  - Single and three phase AC sources and loads
  - Per phase measurements (V, A, W, Hz)
  - Passive and active load balancing across phases
  - Components; I200, I60, I46
  - Input Qualification
  - Embedded troubleshooting guide

Smart Distribution Benefits for TOC's

- **Smart Power Distribution System**
  - Safer power distribution through input qualification
  - Less training required through guided troubleshooting
  - Load balanced across phases, more available power
  - Fewer units per TOC, an I200 can accommodate 11 direct shelter connections plus daisy-chaining
  - Direct support for 60A 1ph shelters
  - Less weight, smaller size
  - Improved generator voltage regulation

Smart Loads for TOC's

- **Smart Load Management System**
  - Loads shed and restore with no mission impact, no soldier intervention
- **Intelligent Power Management System**
  - IPMS is for shelter load management
  - Total shelter and load power measurements
  - Priority based load shedding and restoral
  - AC and DC loads
  - Programmable breaker
  - TRL 8

Smart Load Benefits for TOC's

- **Smart Load Management System**
  - No soldier intervention, focus is on the mission
  - Avert overloads, loss of power
  - Priorities can be easily changed for different mission profiles
  - Power consumption and demand can be lowered

Smarter Loads for TOC's

- **Smarter Load Management**
  - Manage loads across multiple shelters
  - More sophisticated shedding and restoral
- **Distributed Power Management System**
  - DPMS is for load management across the TOC
  - Load aware shedding and restoral, load shifting, load sharing
  - AC and DC loads
  - Web-based Application
  - Embedded or Point of Load modules

Smarter Load Benefits for TOC's

- **Smarter Load Management**
  - TOC level load management provides more options for control of consumption
  - No soldier intervention, focus is on the mission
  - Avert overloads, loss of power
  - Load aware load management allows for virtually no programming
  - Web-based access to shelter load information
  - Point of Load modules simplify installation

Issues for TOC's

- **Smart Power Systems**
  - Implementation of Smart Power crosses boundaries of responsibility
  - No one owns the whole Power System
  - Historic and philosophical practices hinder advances
- **Future Possibilities**
  - The drive to reduce fuel consumption, weight, size and logistics tail could bring change
  - The Greening of the Military could be the start

Forward Operating/BEAR Bases

- **BEAR Base**
  - Air Force Mobile Base
  - Supports 550 airman increments
  - Basic Expeditionary Airfield Resources
- **Forward Operating Base**
  - Army version of BEAR
  - Supports 3300 soldiers

FOB / BEAR Bases

- **Power Sources & Distribution**
  - MEP-12, MIL-STD 750kW
  - DPGDS, Deployable Power Generation & Distribution System, 920kW
  - Prime Power output is 2400/4160 VAC
  - Prime Power requires Primary and Secondary Distribution Centers
- **Issues**
  - MEP-12 are old
  - DPGDS is Smart Generation but may have problems

FOB / BEAR Bases

- **Loads**
  - 60kBTU ECU's are used for cooling
  - Shelters are tents of various sizes from small barracks to large hangars
  - Billeting, Kitchens, Showers, Maintenance Facilities, Communications,

- **Issues**
  - The fuel needed by the base (4000 gal/day)
  - The directive to reduce the foot print and to go green

Smart Power For Bases

- **Smart Power Sources & Distribution**
  - Exists in DPGDS, assuming it works
  - Prognostics, diagnostics and data logging with Web-based access
  - Primary and secondary distribution monitoring
- **Smart Load Management**
  - Coordinated ECU control
  - Occupancy detection or scheduled operation

Smart Power For Bases

- **Micro Grid System**
  - The use of multiple generating sources
  - The inclusion of green sources (solar, wind)
  - The inclusion of less conventional sources (fuel cells, hybrid vehicles)
  - Overall system monitoring and control system (SCADA)
- **Prior Work**
  - Tyndal Air Force Base has done work in shelter based hybrid power generation

Smart Power For Bases

- **Micro Grid System Implementation**
  - DPMS could be used for distributed measurements and Point of Load controls
  - Larger generators of the PSI and R-R variety
  - Energy storage could be considered if there was sufficient green power overcapacity.
- **Issues**
  - Impermanence
  - Mobility
  - No commercial grid

Smart Power For Bases

- **Micro Grid System Questions**
  - Can green power be effective harnessed in this environment?
  - Can “Plug-n-Play” technology overcome the need to engineer the system?
  - Can this technology deliver the reduction in fuel and air lift footprint the military wants?

  There is much work to do to answer these questions.

Ships

- **Ship Power is in transition**
  - The Navy Electric Ship is at hand
  - Crew size reduction mandates automation
  - Electric weapons push for controlled high power
  - The Integrated Power System (IPS) will rely on Smart Power technology
- **Implementations**
  - PEBB / PCM units are Smart Loads
  - Smart Distribution Systems will control power distribution to provide reconfiguration for recovery from battle damage or faults as well as direct power to systems as required

Advanced Electrical Power System, Office of Naval Research

- Phase II STTR project to develop an advanced electrical power management system for future Navy warships
- Teamed with Texas A&M University Power Center
- Developing software application for power system reconfiguration

Benefits for Ships

- **Reduced crew size**
- **Enhanced survivability and fight through**
- **Electric Weapons support**
  - Rail Gun
  - High Energy Laser
- **High Power Sensor Systems support**
  - Radar

Variations on Smart Power

- **Energy Scavenging Autonomous Surface Vehicle**
  - Green Self-Navigating Surface Vehicle
  - Wind and solar energy for locomotion
  - Solar power stored and consumed by an electric outboard motor
  - Wind power is used for long distance travel

Energy Scavenging ASV, Office of Naval Research

- Phase II STTR to develop an autonomous surface vehicle (ASV) with self-sustaining energy scavenging and energy harvesting capabilities
- Provides energy harvesting technology development to support persistent, on-station surface platform
- Project includes the development of control algorithms and storage technologies.
- FSU Center for Advanced Power Systems (CAPS) on our team

Summary

- **A variety of military applications can benefit from Smart Power Systems**
  - Smart Generators
  - Smart Distribution
  - Smart Loads
- **The technology is available**
  - The application needs to be defined
  - The goals articulated
  - The benefits understood
- **With the right combination of technologies we can have a smarter future**

About Us

- Founded by Dr. Nancy Crews in 1997
- ISO9001:2000; 36,000 square foot Development & Manufacturing Center in Tampa Bay area
- Top Secret facility
- ~120 employees with 60 in Engineering
- 40% of technical staff possess graduate degrees
- Over 15 years average technical experience
- Technically diverse capabilities and products
- Proven electronics fab and assembly operation
- Leading SBIR/STTR transition company: 13 Phase I, 9 Phase II, and 5 Phase III projects
- Multiple Awards & Recognition
- Customers: Government and prime contractors

Power & Sensor Solutions

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Sr. Systems Engineer

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BOOTH 314

Custom Manufacturing & Engineering, Inc.

2904 44th Avenue North

St. Petersburg, FL 33714

Marine Corps Systems Command Purchasing & Evaluation of Power Items

Mr. Michael Gallagher
Program Manager

AGENDA

- Requirements
- Business Strategy
- Market Research
- Acquisition Strategy
- Contracting Strategy
- Statements of Work / Specifications
- Product Sample Evaluation
- Test & Evaluation Strategy
- Procurement Phase Issues
- Fielding Issues
- Questions

Requirements

- **Nothing happens without a validated requirement**
  - **Marine Corps Combat Development Command**
  - **For Power & ECUs: Logistics Integration Division**
  - **Most power items are covered under “Family of” programs**
    - **Mobile Electric Power**
    - **Advanced Power Sources**
    - **Environmental Control Equipment**
- **JUONS are outside the regular validation process**
- **Science and Technology does not require a validated requirement (but should be linked to one)**
  - **Office of Naval Research**
  - **Marine Corps Warfighting Laboratory**
  - **Office of Comparative Testing / International Programs**

Business Strategy

- How fast are items needed
- How defined, understood and available is the end item
  - May require Market Research
- How often are items needed
  - One-time-buy,
  - Life-of-item buy,
  - Life-cycle sustainment management
  - Interim solution
- Who is the customer
  - Defined / manageable
  - Varied / predictable
  - Unpredictable
- Joint Service interests
  - Other service lead / USMC follow
  - USMC lead / other service as paying customer

Market Research

- Prescribed by Acquisition Regulations
- Done right, can truly help a program
- Done wrong – wastes everyone's time & money
- Multiple methods
  - In-house (formal or informal)
  - External data call (Sources Sought / RFI)
  - Site visits (pre-solicitation, allows interchange)
- Regardless of method – should be formally documented
- Best research / intention only achieves 75% of intended purpose
  - Like in a movie audition – a call-back is good
- If contacted, then Gov't really is looking for your input
- Don't be scared away by support contractor contacting you on behalf of a Gov't Program Office
  - Support contractors are key members of Gov't Program Offices

Acquisition Strategy

- **Market Research should define / focus the strategy**
- **Research and Development Strategy**
  - **Defined scope / defined product**
  - **Defined scope / undefined product**
  - **Follow-on procurement effort planned?**
- **Procurement & Fielding Strategy**
  - **Commercial Item procurement (FAR part 12)**
  - **Developmental phase with follow-on procurement**
- **Operations and Support Strategy**
  - **Full and Open procurement**
  - **Sole Source Procurement (commonality with current item)**
  - **Federal Supply Schedule procurement**
  - **Military Interdepartmental Procurement Request (MIPR)**

Contracting Strategy

Where the magic happens

- **3-way collaboration**
  - **Program Management shop**
  - **Contracting Officer**
  - **Lawyer**
- **Risk vs the "RUBBER TRIANGLE"**
  - **Cost**
  - **Performance**
  - **Schedule**
- **USMC uses FAR PART 12 to fullest extent possible**
  - **Nature of our business**
    - **COMMERCIAL ITEM PROCURMENT**
    - **Modification of Commercial Item**
  - **Urgency of situation**
  - **Minimal R&D dollars to develop a solution**

Specifications and Statements of Work

- **Specification Types**
  - **Standard Performance Specification (MIL-PRF)**
  - **Program Unique Specification**
  - **Military Standard (MIL-STD)**

  } You build to our spec

  - **Purchase Description**
  - **Commercial Item Descriptions (CIDs)**

  } You tell us what you will build

- **Work Statement Types**
  - **Guidance in Military Handbook MIL-HDBK-245D**
  - **Statement of Work** **- Do as I say**
  - **Statement of Objectives** **- You tell me**
  - **Combined Solicitation / Synopsis** **- Short & sweet**

Specifications

- **With a Mil-SPEC of Mil-PRF, you are required to meet all requirements**
- **Failure to do so requires contractual modification / waiver**
- **With Purchase Description or Statement of Objectives, we list top level requirements**
  - **These are called CRITICAL PERFORMANCE PARAMETERS**
  - **These MUST BE MET, or Technically Unsatisfactory**
- **All other requirements are Objectives / Desires**
- **With Commercial Item, the offeror proposes his Product Specification for what is possible / being offered**
- **Best Analogy is Buying a Car**
- **Selection is made using Best Value**
- **Best Value does not always mean lowest price**

Selection Criteria

FACTOR 1 Operational Effectiveness	FACTOR 2 Supportability	FACTOR 3 Past Performance
(a) Technical Approach (b) Pre-existing Test data and certifications (c) Value Added (d) Management of Configuration and Quality of Products (e) Product Sample Evaluation	(a) Publications and Data (b) Warranty provision (c) Training capability and experience	No Sub-factors

Descending order of priority

Product Sample Evaluation

- Entails / requires / assumes Commercial Item
- Strategy has proven very productive
- If your item is a Commercial Item.....
  - It should be readily available
- If available.....
  - Lets evaluate it during source selection
  - Test results factored into selection process
- Everyone benefits all around
  - We get your article (temp loan, no cost to us)
  - You get our 3rd party independent test report

Product Sample Evaluation

- But comes with conditions on all parties
  - Test results can make you sink or swim
  - Formal evaluation is costly and timely
  - All parties treated equally
  - You only see your results
  - Contractors normally excluded from test sites
  - Test result are Competition sensitive
  - Test results are not releasable via FOIA requests
- We usually test Critical Parameters first
- Sample may be damaged / destroyed during test
- Can not claim testing as USMC endorsement

Product Sample Evaluation

- **Program Success Stories with Product Samples:**
  - **Marine Corps Bayonet**
  - **Integrated Trailer – ECU- Generator**
  - **9,000 BTU/hr Environmental Control Unit**
  - **Ruggedized Power Supply (version 2.0)**
  - **Vehicle Power System**

Test & Evaluation Strategy

- **Product Sample Evaluation**
  - Top level
  - PASS-FAIL criteria
  - Critical Performance Parameters
  - Value Added Features
- **Production Verification Testing**
  - To support Full Rate Decision
  - To measure Performance, Reliability, Interfaces
  - Critical data elements
- **Random Production Verification (configuration)**
- **User Evaluations**
  - Field User Evaluations
  - Validation / Verification of Technical Publications

Procurement Phase Issues

- **Our contracts must provide maximum flexibility to respond to changes:**
  - **Money changes**
  - **Requirements changes**
  - **Customer demands**
- **Multi-year contracts are the norm**
- **Indefinite Delivery Indefinite Quantity (ID-IQ) contracts**
- **Regulatory issues must be factored into strategy**
  - **EPA changes**
  - **Doctrinal changes**
  - **Urgent requirements**

Fielding Issues

- **Publications**
  - **Organizational / Intermediate**
  - **Depot / rebuild**
- **Training**
  - **Curriculum development**
  - **Initial / New Equipment Training**
  - **Train-the-trainer**
- **Copyright release for data**
  - **Government purpose use**

Questions ?

Doing Business With The Marine Corps

Marine Corps Systems Command

Presenter: Shekela Hutchinson

MARCORSYSCOM CONTRACTS

Marine Corps Systems Command Mission:

- **To serve as the Commandant's principle agent for acquisition and sustainment of systems and equipment used by the Operating Forces to accomplish their war-fighting mission.**

"Doing Things RIGHT…
Doing RIGHT things!"
Mr. William C. Randolph
Assistant Commander of Contracts
Marine Corps Systems Command

MARCORSYSCOM CONTRACTS

Contracts Directorate Mission

To contribute to the war fighting mission of the United States Marine Corps by providing quality, timely, cost-effective and value-added procurement solutions to our Marine Corps customers; all while being diligent and faithful stewards of the taxpayers dollars and trust.

How To Market Your Business

- Identify Your Customer
- Determine Customer Needs
- Determine Buying Policies And Practices
- Make Capabilities Known
- Follow Up

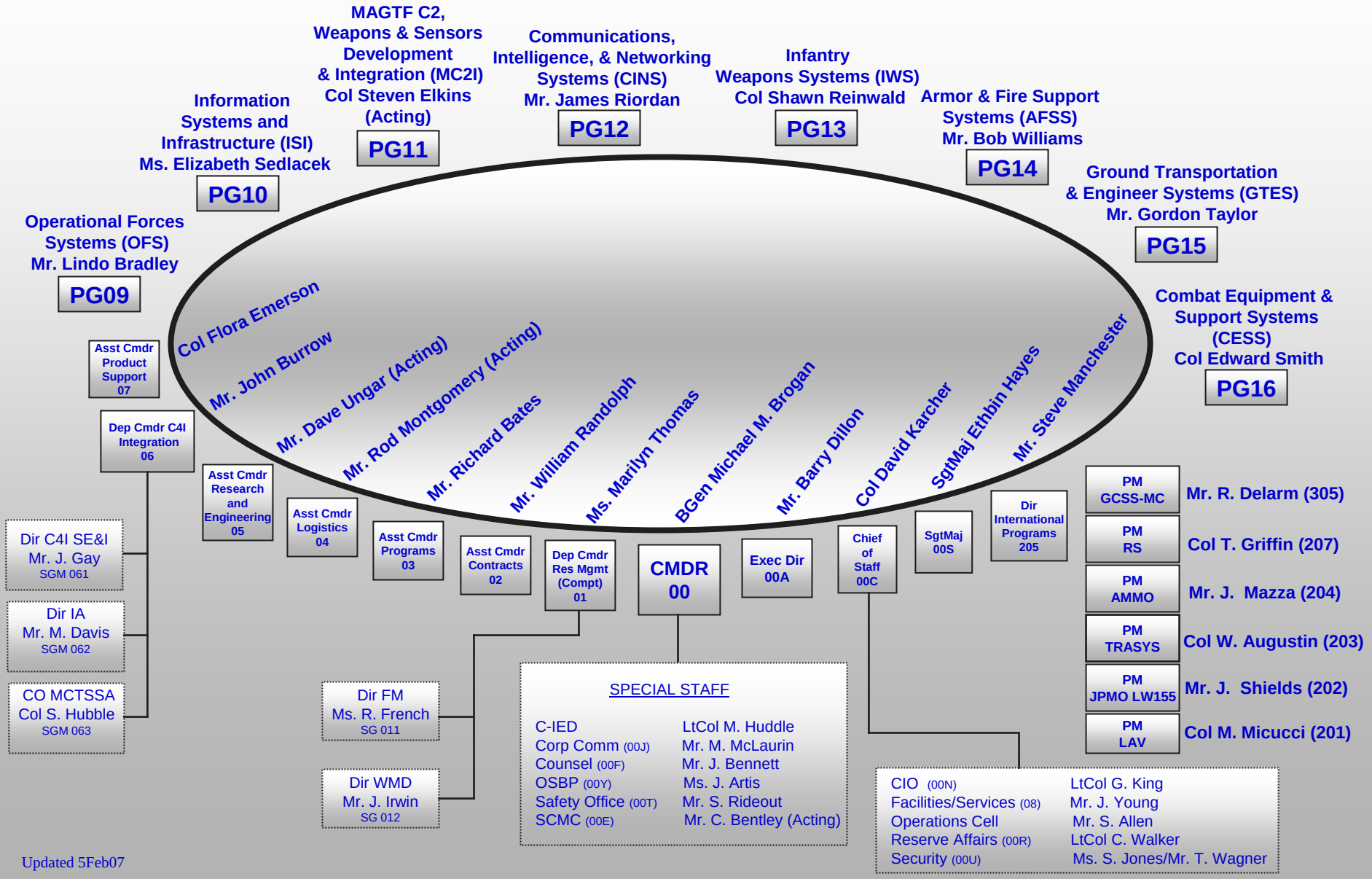
How To Market Your Business

- Identify Your Customer

Doing Business With The Marine Corps

- Marine Corps Base Quantico (MARCORSYSCOM), VA
  - Our primary location
  - Composed of ten purchasing branches
    - provide support to the Commanding General
    - 8 Product Group Directors, 1 Program Executive Officer
  - confirm the location of your party before visiting
- Woodbridge, VA –
  - Program Manager for the Expeditionary Fighting Vehicle
  - Contracting Officer, Program Manager, and Contractor are all co-located
- Orlando, FL - Program Manager for Training Systems (PMTRASYS).
- Camp Pendleton, CA - Marine Corps Tactical Systems Support Activity (MCTSSA).

MARCORSYSCOM ORGANIZATION



Updated 5Feb07

How To Market Your Business

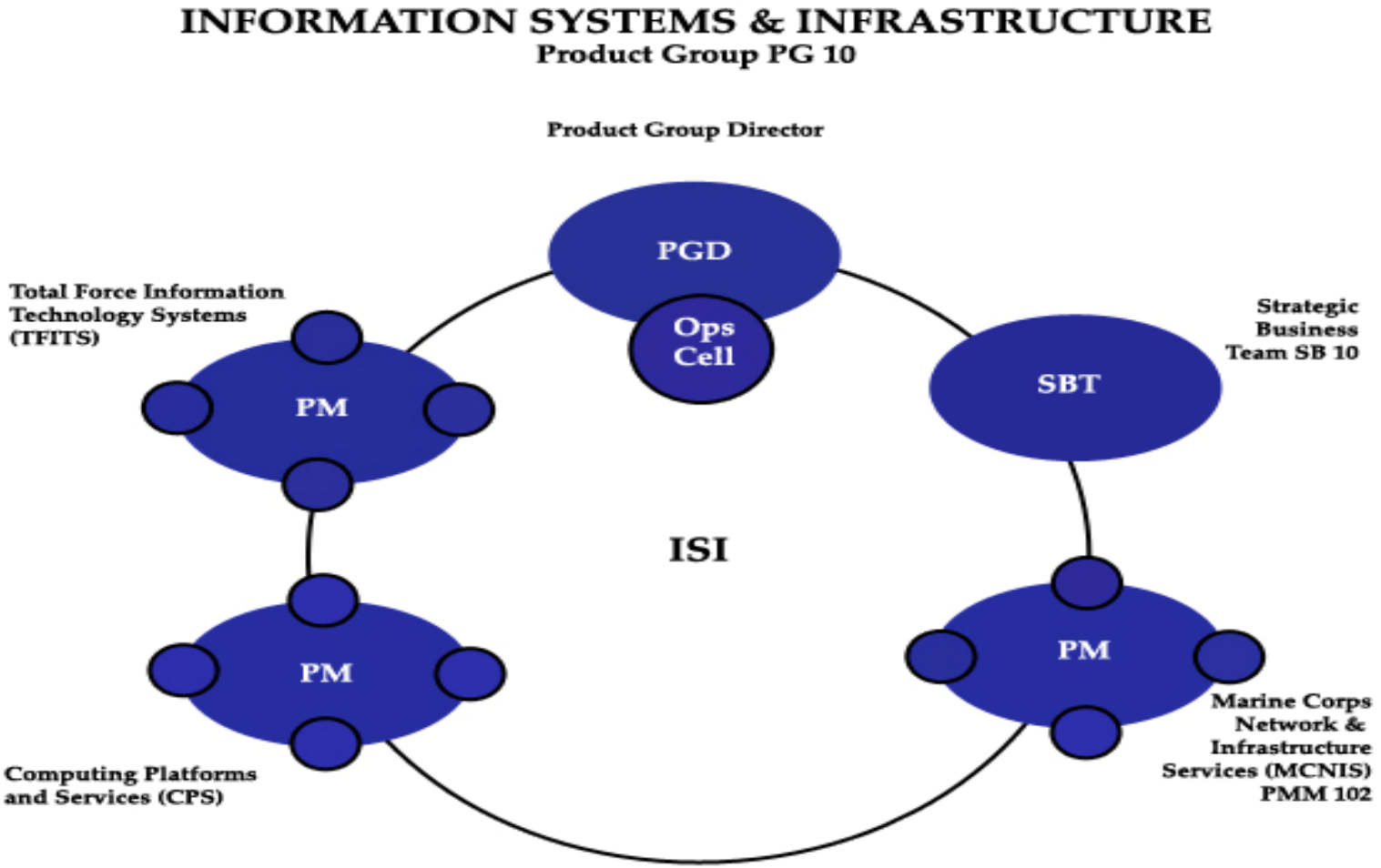
- Determine Customer Needs

Identify Marine Corps Systems Command Program Office that Purchase your Products or Services

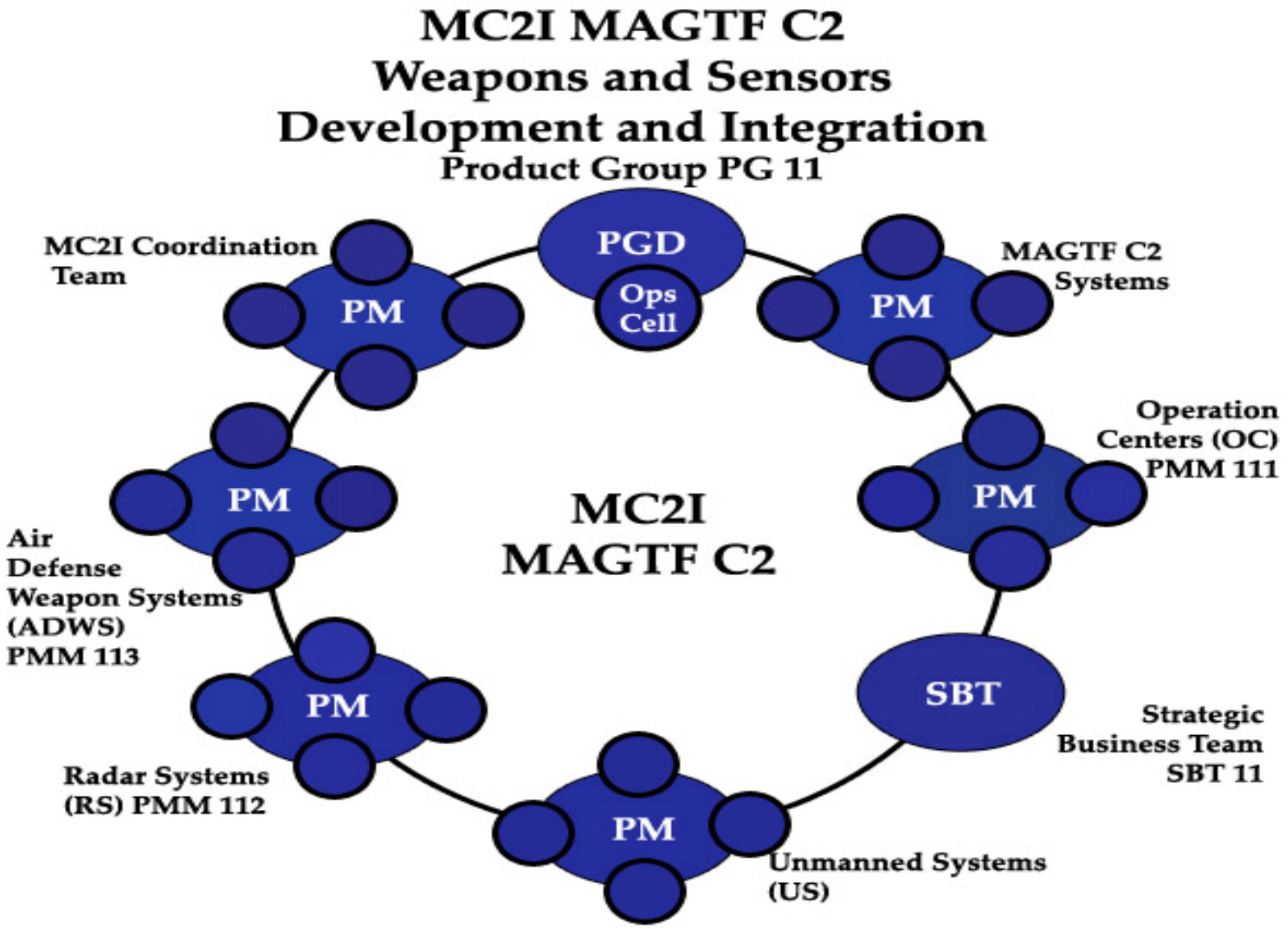
PG09 – Operational Forces Systems (OFS)

a. Newly organized Product Group
b. Updates will be added to the website as they come available

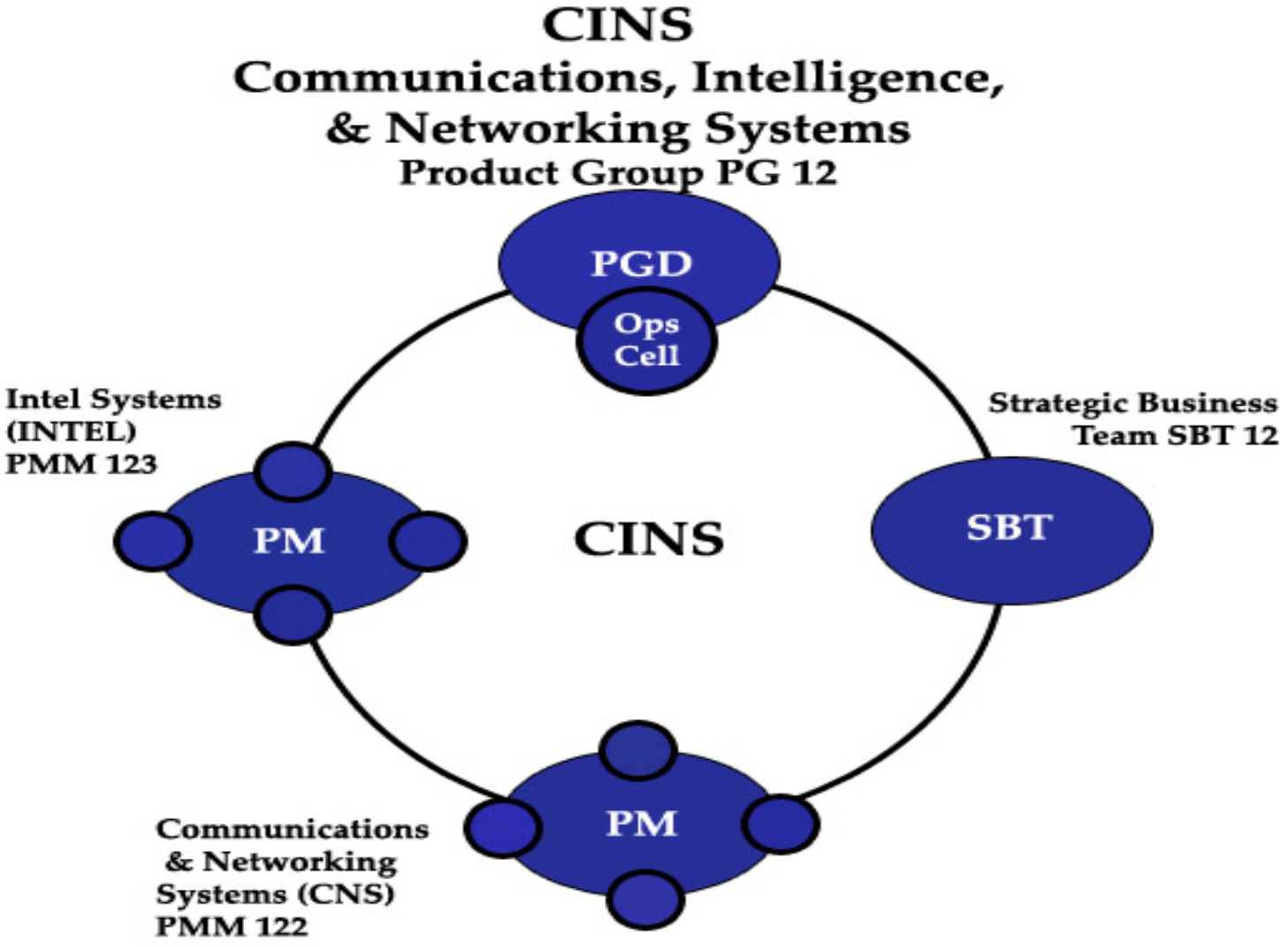
Identify Marine Corps Systems Command Program Office that Purchase your Products or Services



Identify Marine Corps Systems Command Program Office that Purchase your Products or Services

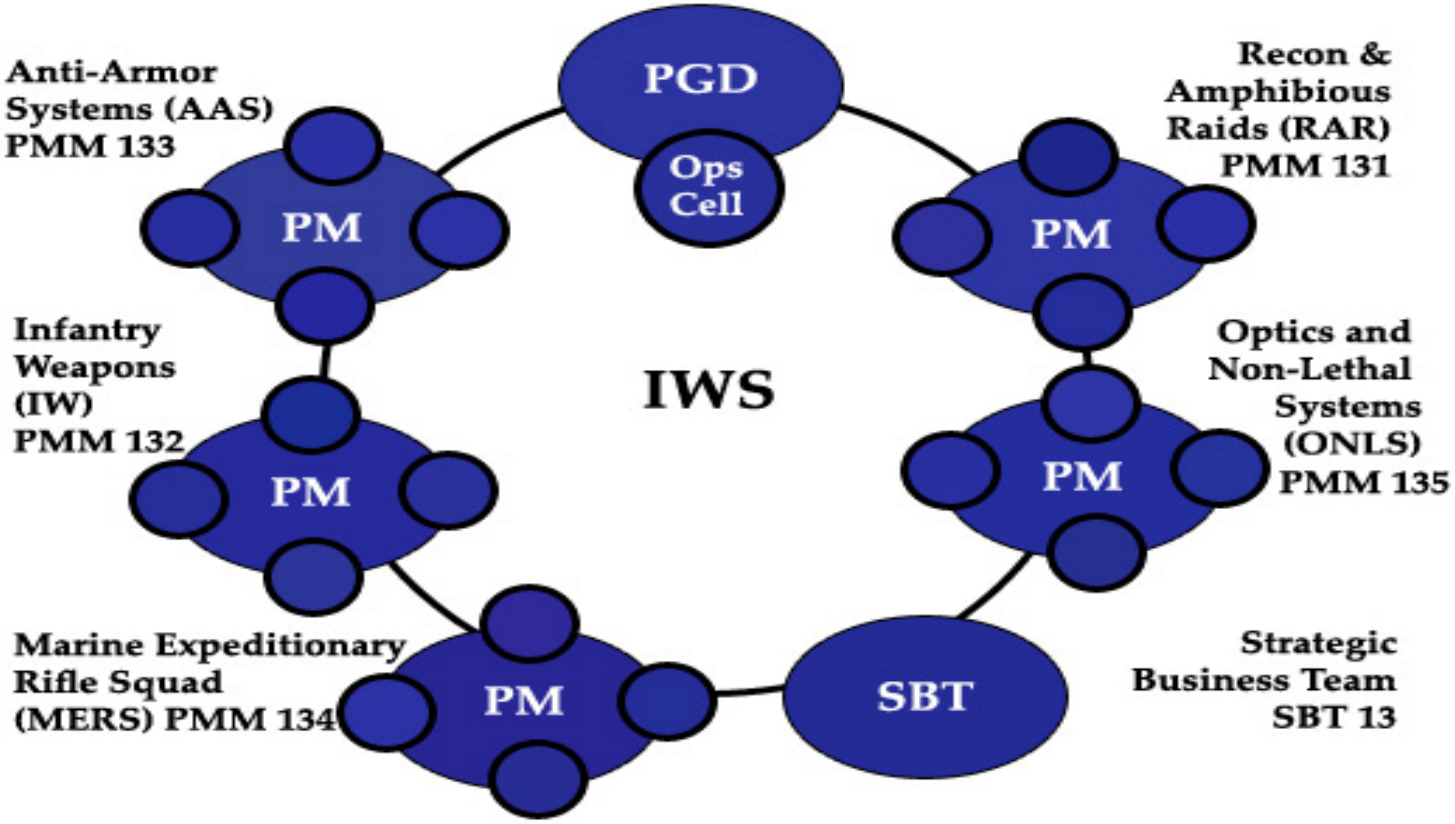


Identify Marine Corps Systems Command Program Office that Purchase your Products or Services



Identify Marine Corps Systems Command Program Office that Purchase your Products or Services

Infantry Weapons Systems
Product Group PG 13



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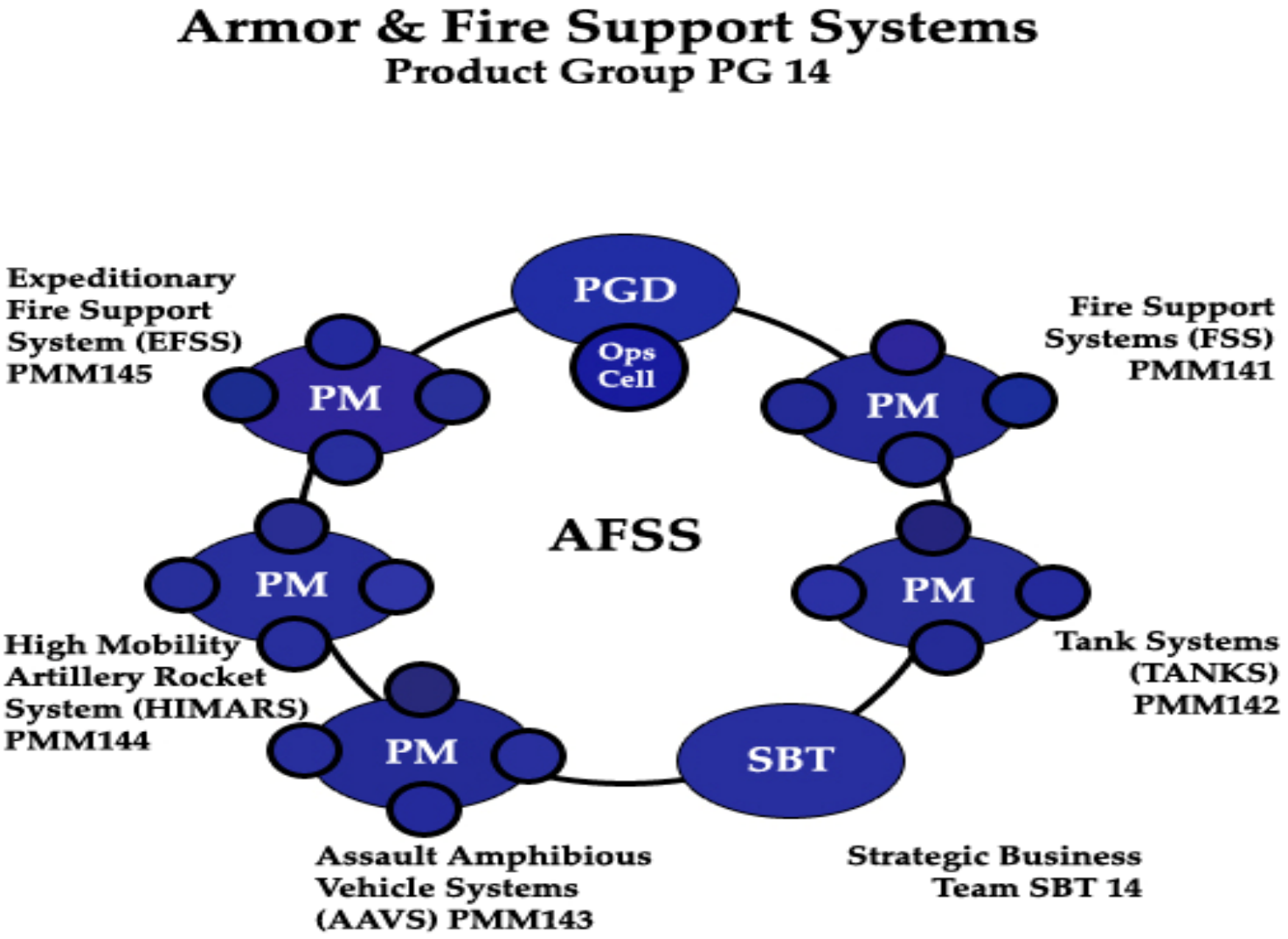
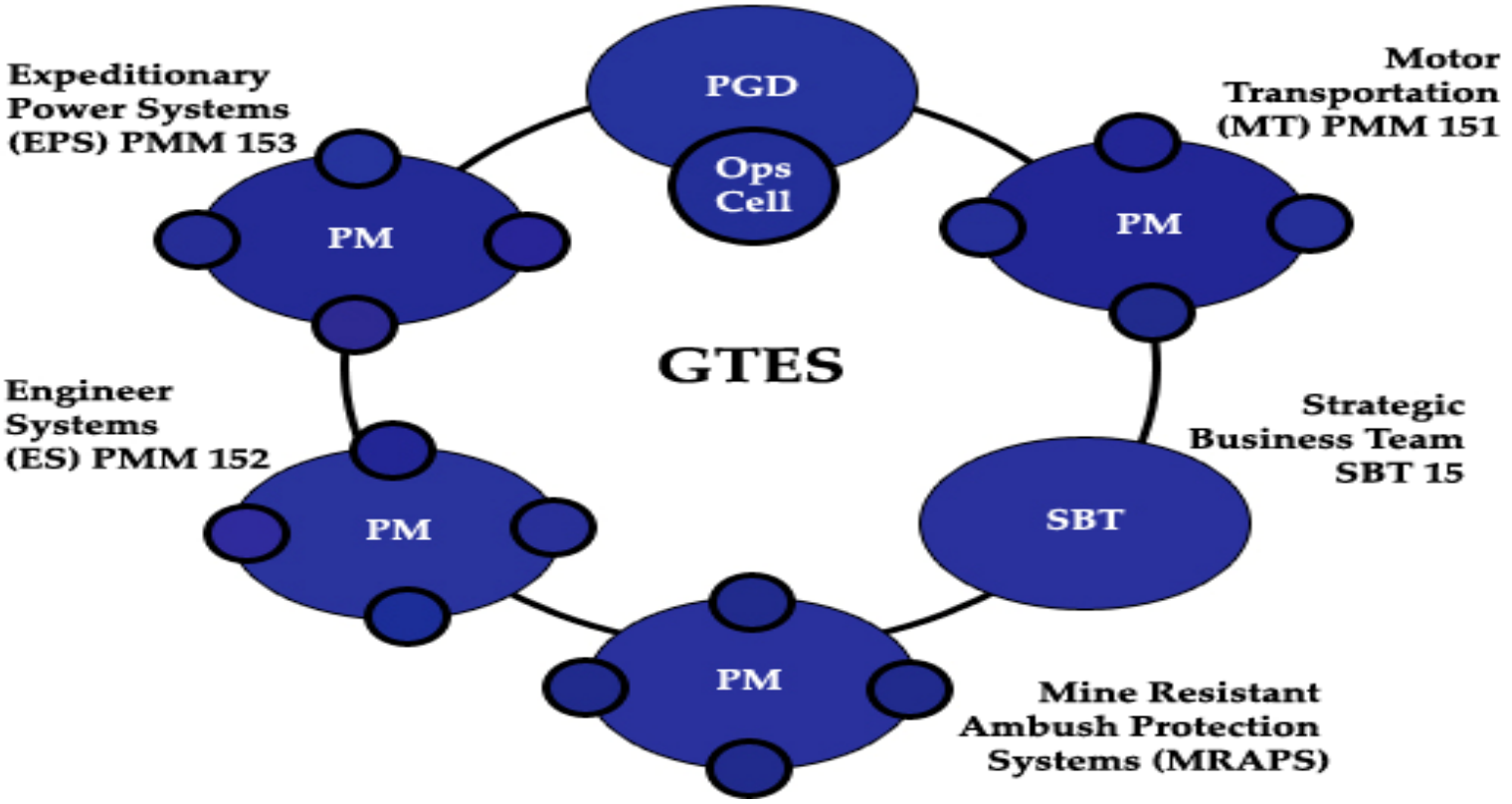


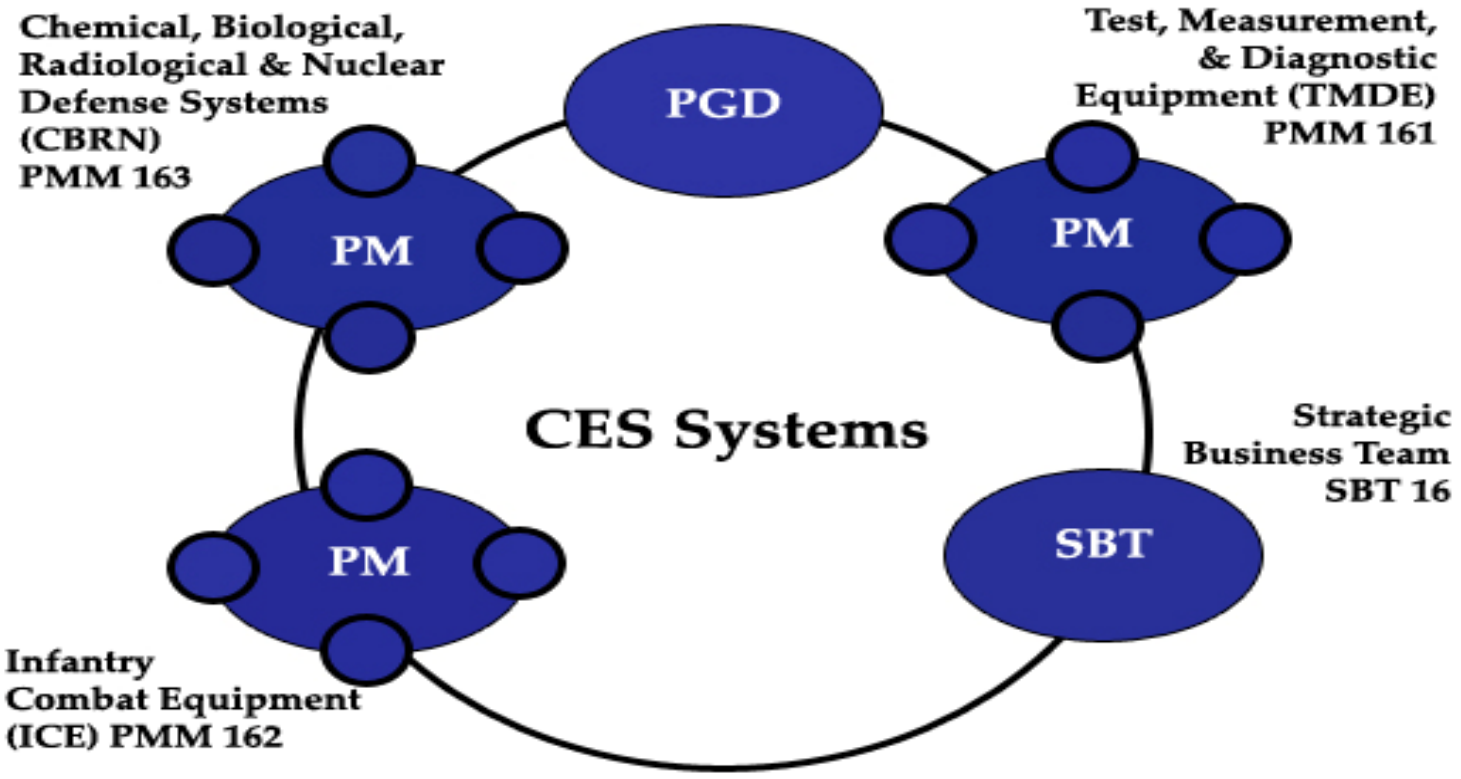
Identify Marine Corps Systems Command Program Office that Purchase your Products or Services

Ground Transportation & Engineer Systems
Product Group PG 15



Identify Marine Corps Systems Command Program Office that Purchase your Products or Services

Combat Equipment & Support Systems
Product Group PG 16



Doing Business With The Marine Corps

PG15 - PM Power:

a. Use many items with the Federal Supply Code Series “61 – Electric Wire, Power and Distribution Equipment”

http://www.marcorsyscom.usmc.mil/sites/pmeps/

Identify Current & Future Marine Corps Procurement Opportunities

MARCORSYSCOM Opportunities

Information on current and upcoming Marine Corps programs and requirements are at http://www.marcorsyscom.usmc.mil/Vendor/.

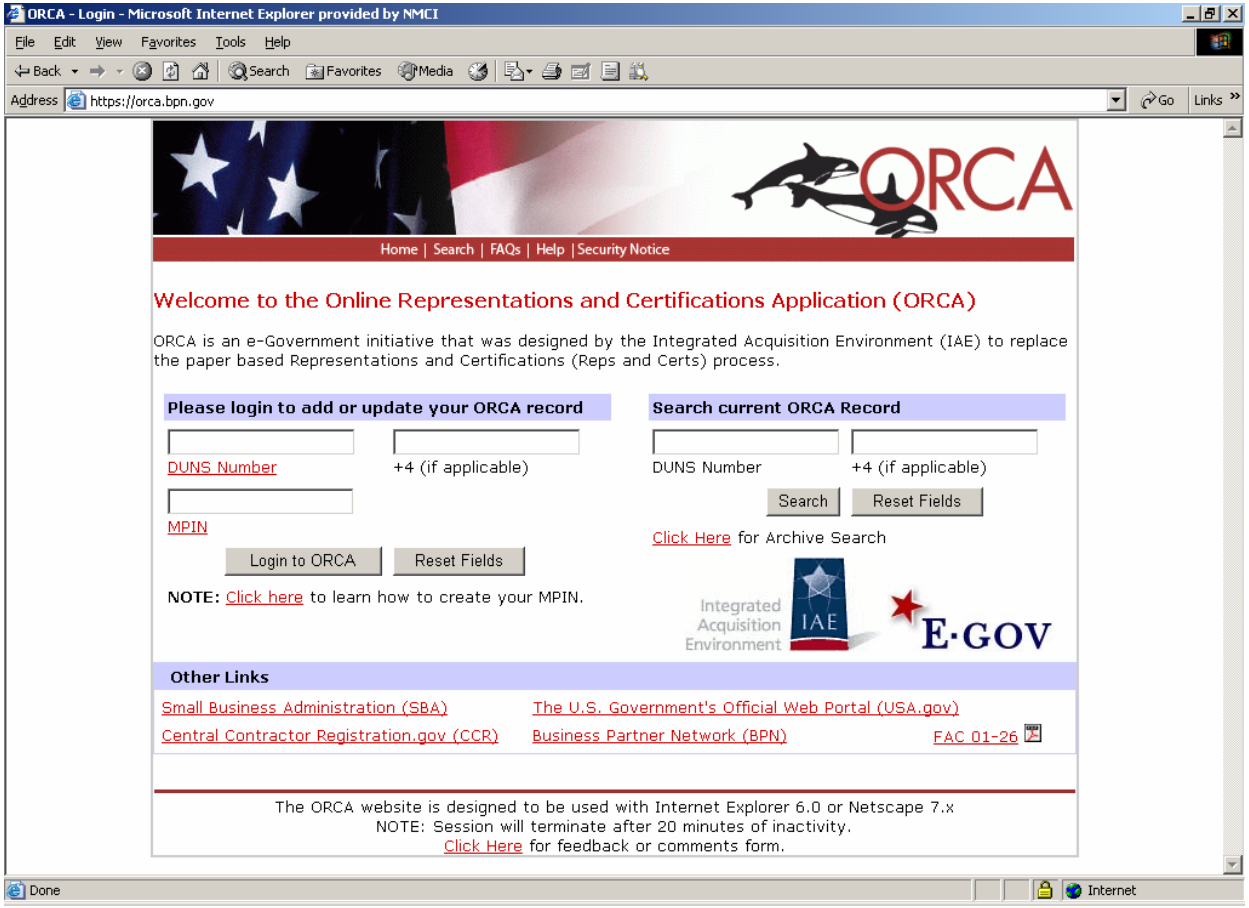
Competitive solicitations are available electronically on the Navy Electronic Commerce Online (NECO) website at www.neco.navy.mil.

The NECO Vendor User Guide is available at http://www.marcorsyscom.usmc.mil/sites/ctq/Links/NECO%20Guide.pdf

Doing Business With The Marine Corps

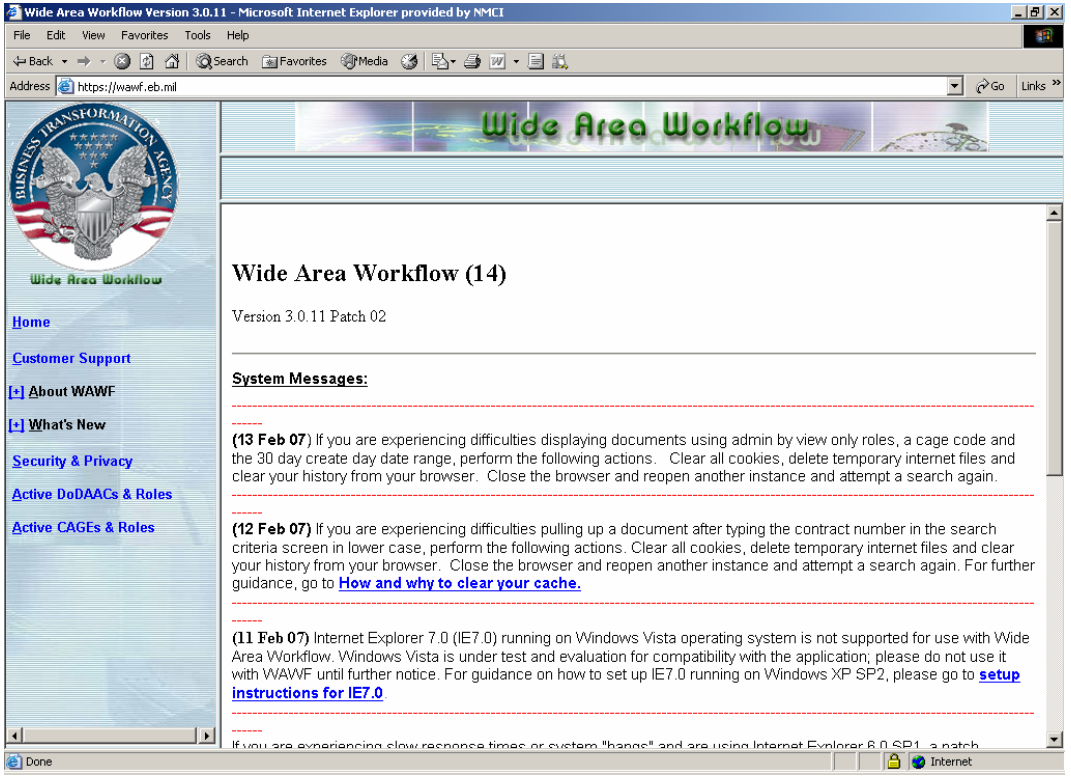
Register with ORCA

– https://orca.bpn.gov



Doing Business With The Marine Corps

- Register with Wide Area Workflow
  - **https://wawf.eb.mil**



  - *****Remember You Must Obtain a Taxpayer Identification**
  - **Number (TIN) http://www.irs.ustreas.gov**

Doing Business With The Marine Corps

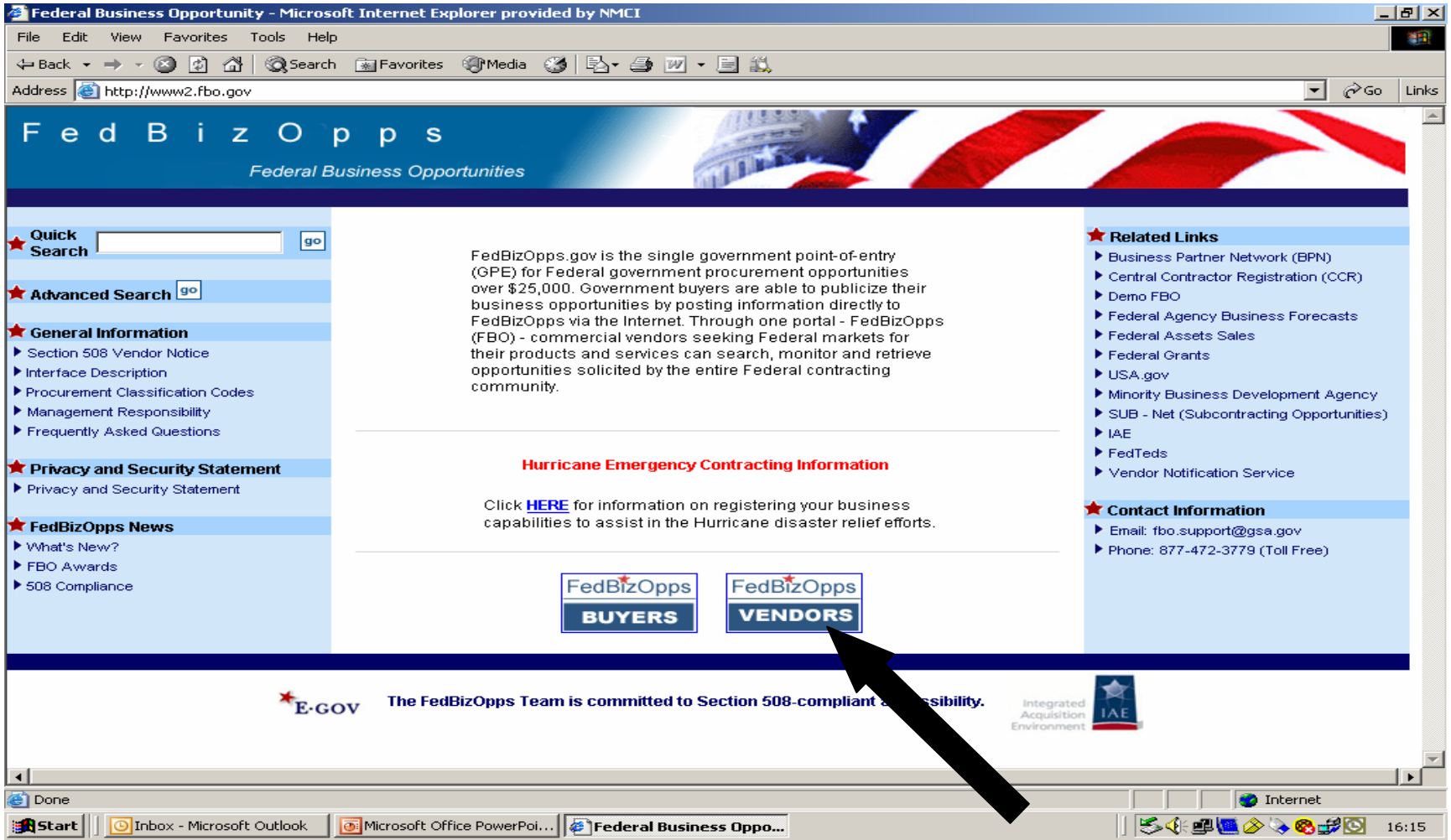
Navy Electronic Commerce Online (NECO)

– https://www.neco.navy.mil

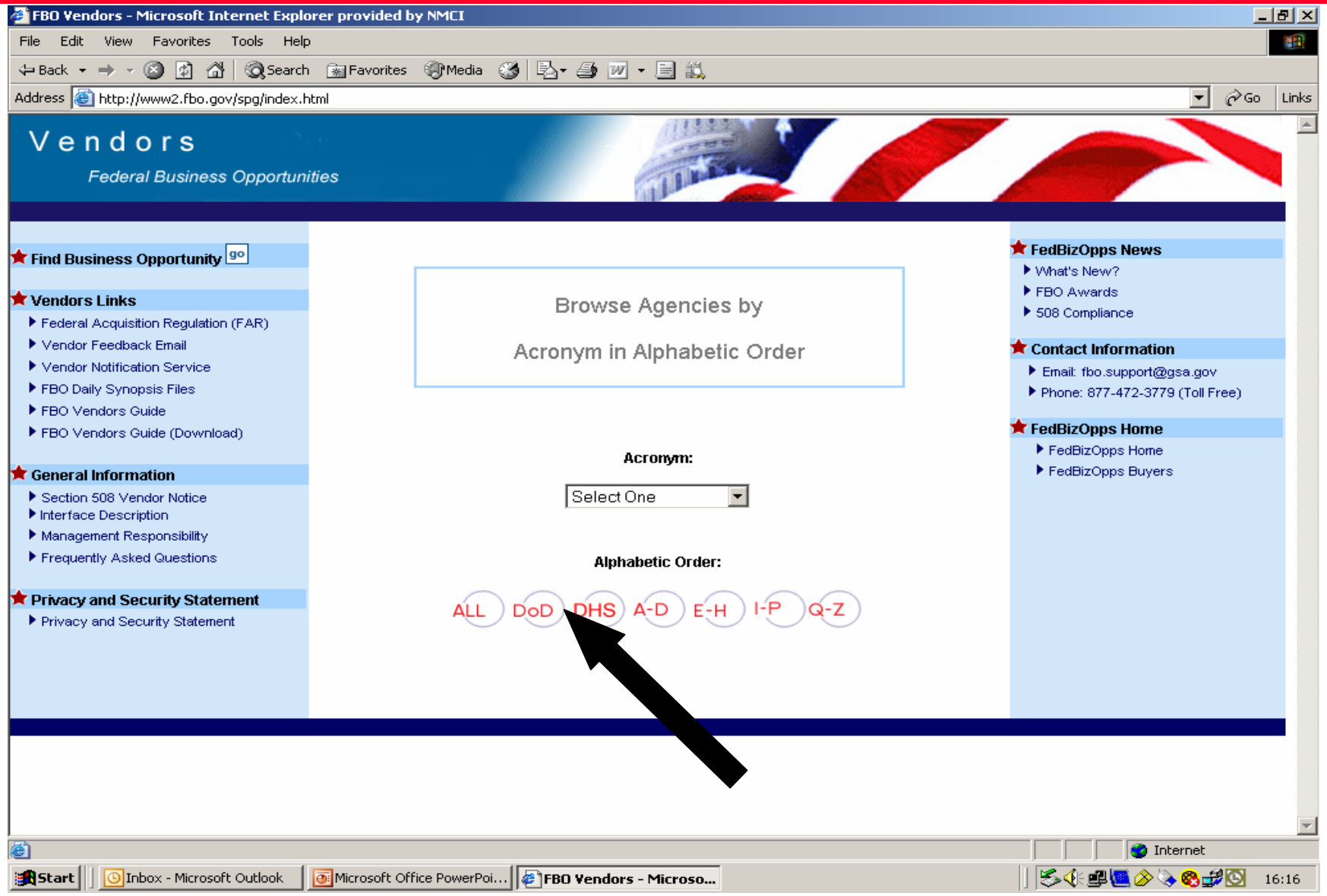
Doing Business With The Marine Corps

Federal Business Opportunities

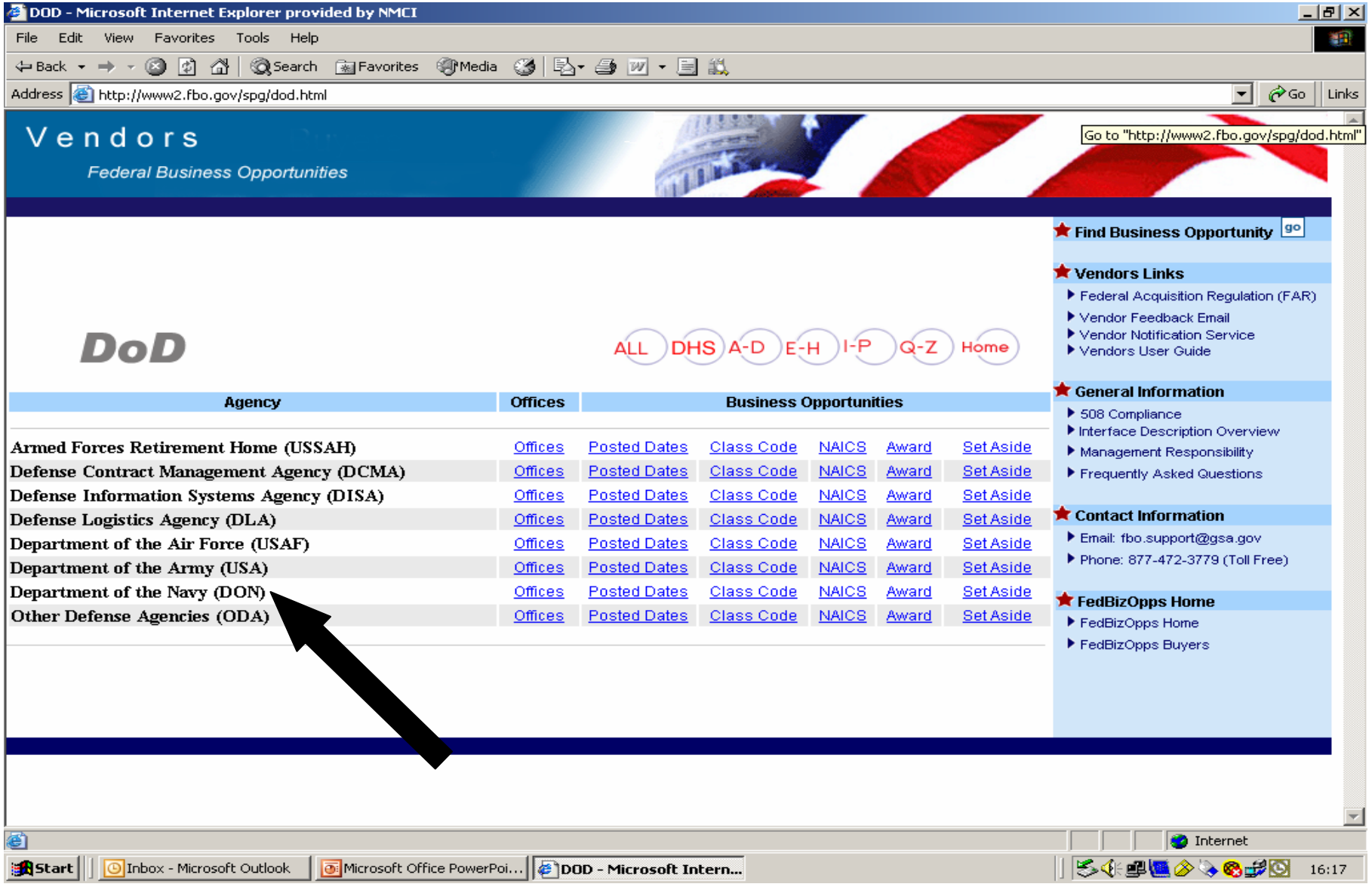
– www.fedbizopps.gov



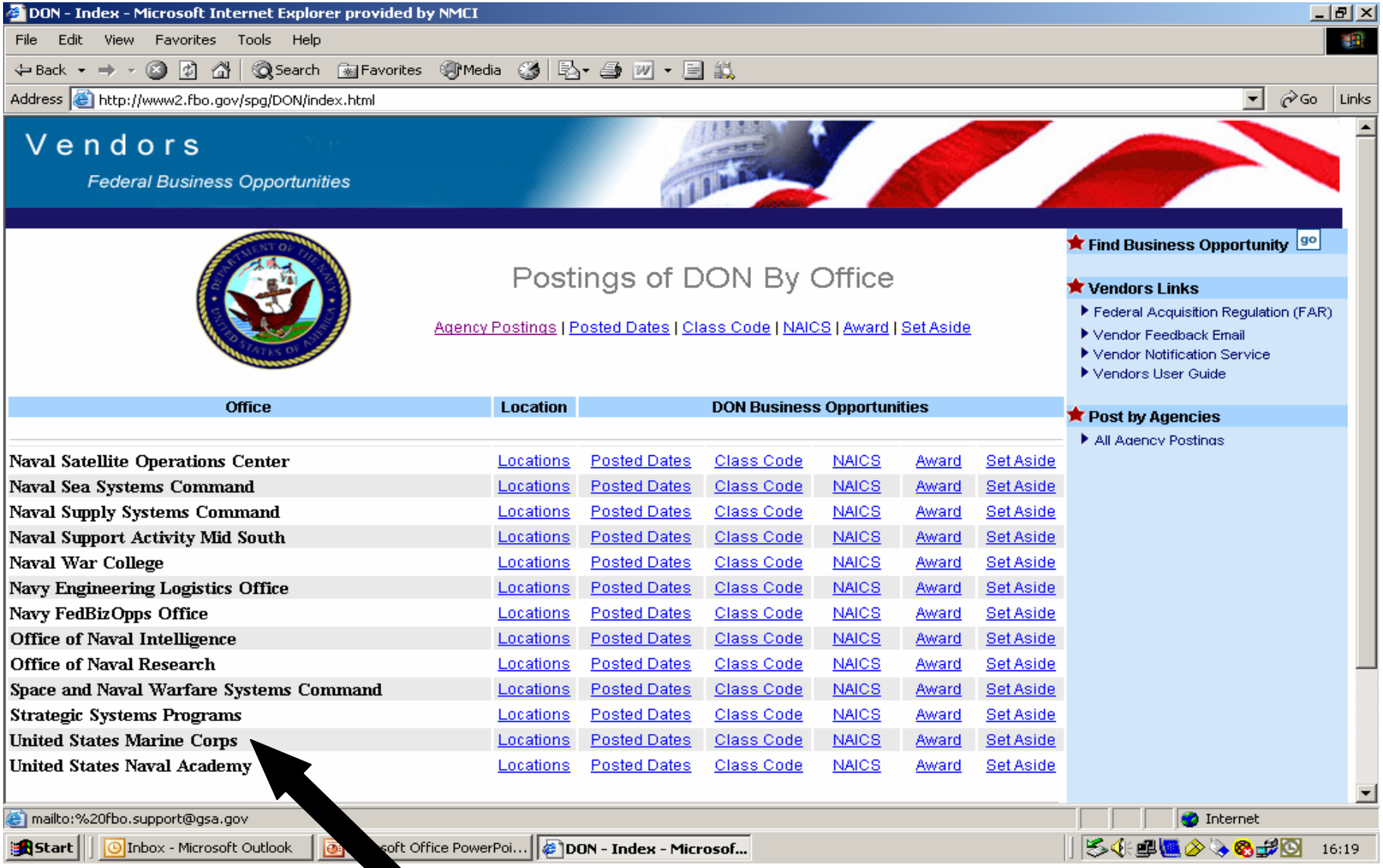
Doing Business With The Marine Corps



Doing Business With The Marine Corps



Doing Business With The Marine Corps



Doing Business With The Marine Corps

How To Market Your Business

- Determine Buying Policies And Practices

Doing Business With The Marine Corps

- **Familiarize Yourself with Federal, DoD, and Marine Contracting Procedures**

- Navy Marine Corps Acquisition Regulation Supplement (NMCARS)
  - www.abm.rda.hq.navy.mil

- Federal Acquisition Regulation (FAR)
  - www.arnet.gov/far or http://farsite.hill.af.mil/

- Defense Federal Acquisition Regulation Supplement (DFARS)
  - www.acq.osd.mil/dp/dars or http://farsite.hill.af.mil/VFDFARA.HTM

How To Market Your Business

- Make Capabilities Known

Small and Disadvantaged Business Utilization Program

Department of the Marine Corps SADBU Policy –

- Promote Maximum Utilization of Small Business Concerns in Marine Corps Contracts
- Provide Small Business Concerns Maximum, Practicable Opportunity to Participate as Subcontractors in Prime Contracts Awarded to Major Prime Contractors

Contact the Small & Disadvantaged Business Specialist

Jeraline S. Artis
Assoc. Director for Small Business
Marine Corps Systems Command
Ph: 703-432-3946 / DSN 378-3946
jeraline.artis@usmc.mil

Doing Business With The Marine Corps

Questions and Comments

Presenter:
Shekela L. Hutchinson
Ph: 703-432-4982 Fax: 703-432-5029
shekela.hutchinson.ctr@usmc.mil

Jeraline S. Artis
Assoc. Director for Small Business
Marine Corps Systems Command
Ph: 703-432-3946 / DSN 378-3946
jeraline.artis@usmc.mil

Doing Business With The Government

Presenters: Yvonne Bova / Shekela Hutchinson

How To Market Your Business

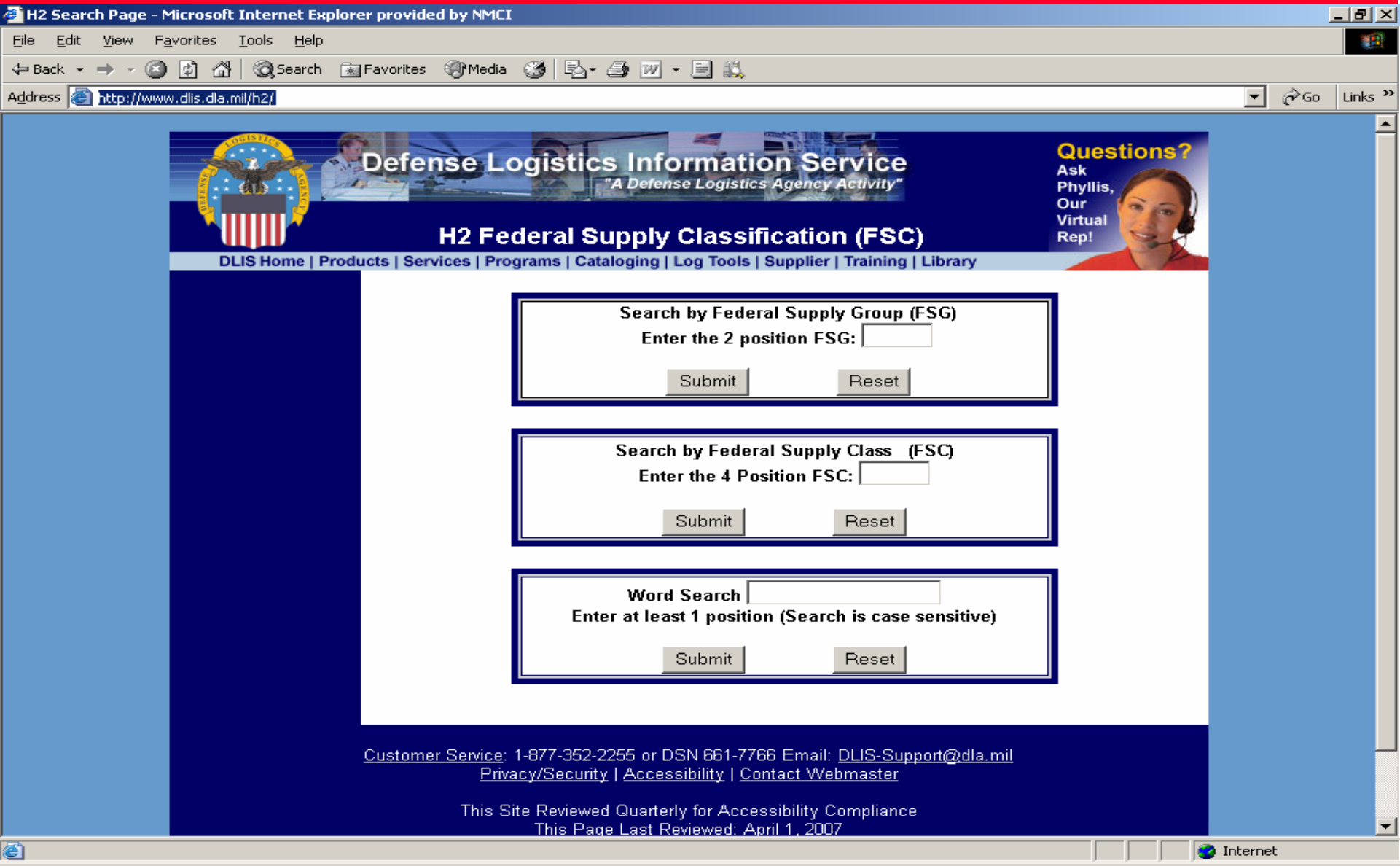
- Identify Your Product or Service
- Register Your Business
- Identify Current Procurement Opportunities
- Familiarize Yourself with Contracting Procedures
- Investigate Federal Supply Schedule (FSS) Contracts
- Seek Additional Assistance as Needed
- Explore Sub-contracting Opportunities
- Investigate Small- Business Programs
- Market Your Firm Well

Identify Your Product or Service

- Federal Supply Classification Code (FSC) & Product Service Code (PSC)
  - **http://www.dlis.dla.mil/h2/**

- North American Industry Classification System (NAICS)
  - **www.census.gov/naics**

Identify Your Product or Service



Identify Your Product or Service

NAICS -- North American Industry Classification System - Microsoft Internet Explorer provided by NMCI

File Edit View Favorites Tools Help

Back Search Favorites Media

Address http://www.census.gov/epcd/www/naics.html Go Links

NAICS to SIC
SIC to NAICS

Enter keyword
NAICS Search

Implementation
Census Bureau
BEA
BLS
Other agencies

Product Classification
Service Sector
Manufacturing

Questions?
Ask Dr. NAICS

International
Concordances

Development of NAICS
Introduction
Federal Register
Issues & concepts
Papers & speeches

U.S. Census Bureau

North American Industry Classification System (NAICS)

The North American Industry Classification System (NAICS) has replaced the U.S. Standard Industrial Classification (SIC) system. NAICS will reshape the way we view our changing economy.

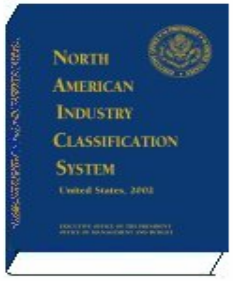
NAICS was developed jointly by the U.S., Canada, and Mexico to provide new comparability in statistics about business activity across North America.

NAICS 2002 included substantial revisions from NAICS 1997 within the Construction and Wholesale Trade sectors, and a number of revisions for the Retail and Information sectors. NAICS 2002 was implemented in the 2002 Economic Census.

A new North American Product Classification System (NAPCS) is presently under development, with initial focus on products of service industries. (NAPCS will focus on manufacturing products at a later date; for existing census codes, see the Numerical List.)

Federal Register notice describes changes adopted for NAICS 2007. Full code lists and correspondence tables are available.

The official **2002 US NAICS Manual** *North American Industry Classification System--United States, 2002* includes definitions for each industry, tables showing correspondence between 2002 NAICS and 1997 NAICS for codes that changed, and a comprehensive index--features also available on this web site. To order the 1400-page *2002 Manual*, in print, call NTIS at (800) 553-6847 or (703) 605-6000, or check the NTIS web site. The 1250-page *1997 Manual*, showing correspondence between 1997 NAICS and 1987 SIC, is also available. The 2002 and 1997 versions of NAICS are available on CD-ROMs, which can be ordered at NTIS.



Also available at this site are lists of 2002 NAICS codes (with links to definitions), 1997 NAICS codes, tables showing correspondence between NAICS 97 and SIC, tables showing correspondence between NAICS 97 and NAICS 02, and other files for downloading.

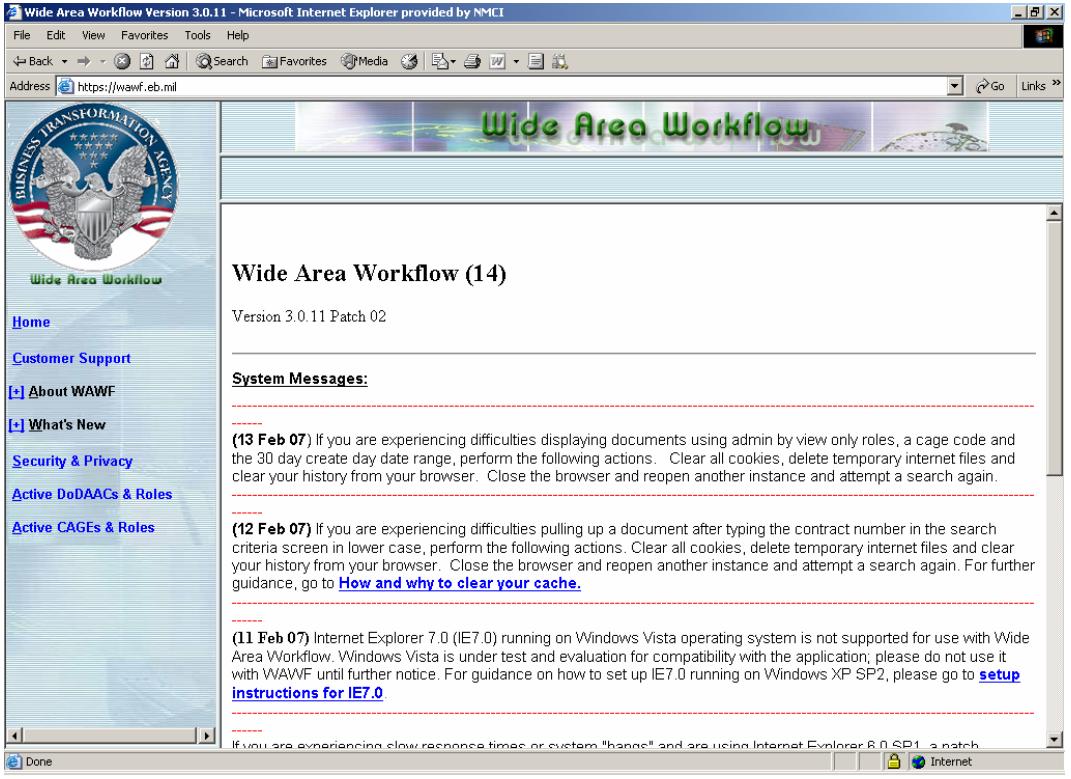
http://www.census.gov/epcd/naics02/ Internet

Register Your Business

- Obtain Data Universal Numbering Systems (DUNS)
  - –**www.dnb.com/us**
- Obtain Commercial and Government Entity (CAGE) Code
  - –**www.dlis.dla.mil/CAGESearch**
- Register in the DoD Central Contractor Registration (CCR) System
  - –**www.ccr.gov**

Register Your Business

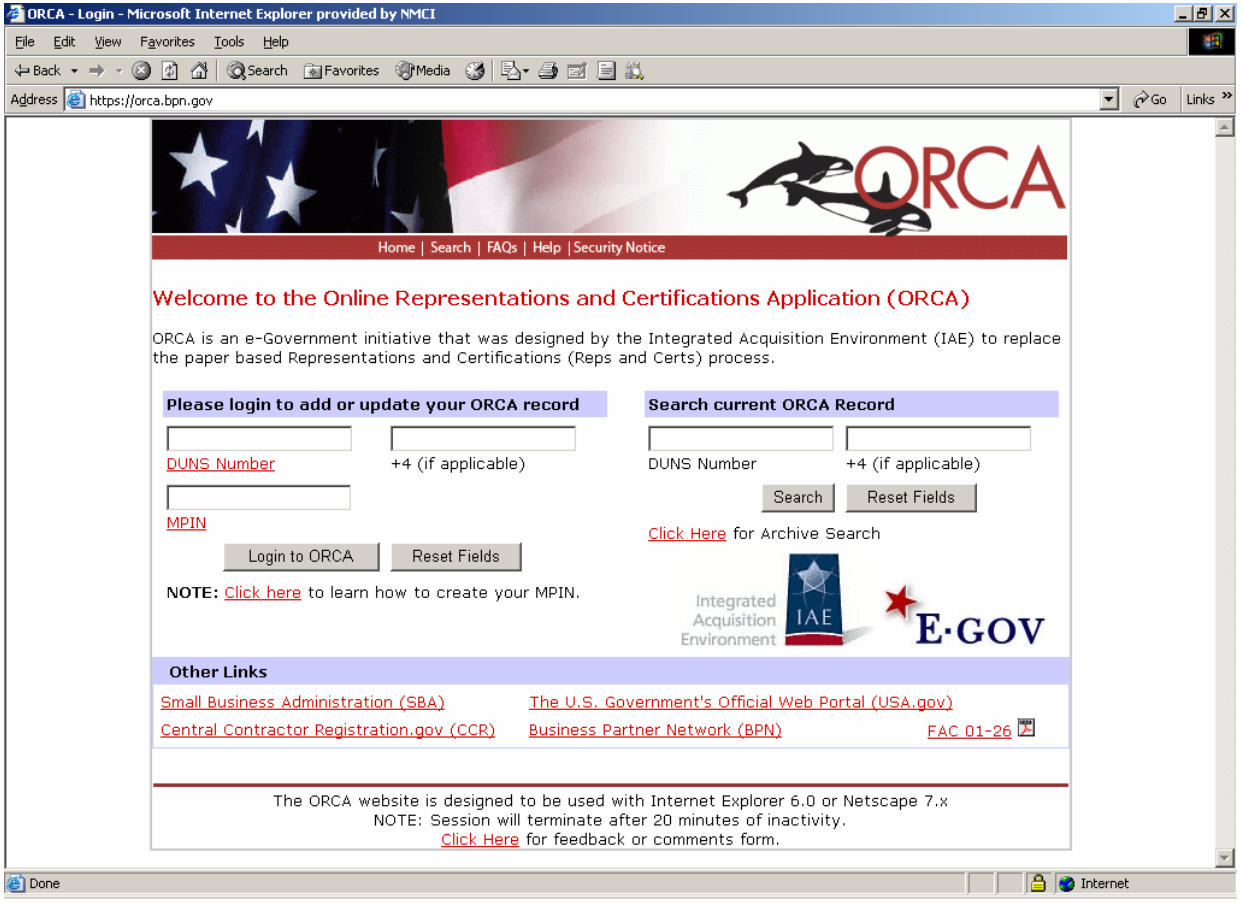
- Register with Wide Area Workflow
  - https://wawf.eb.mil



  - ***Remember You Must Obtain a Taxpayer Identification
  - Number (TIN) http://www.irs.ustreas.gov

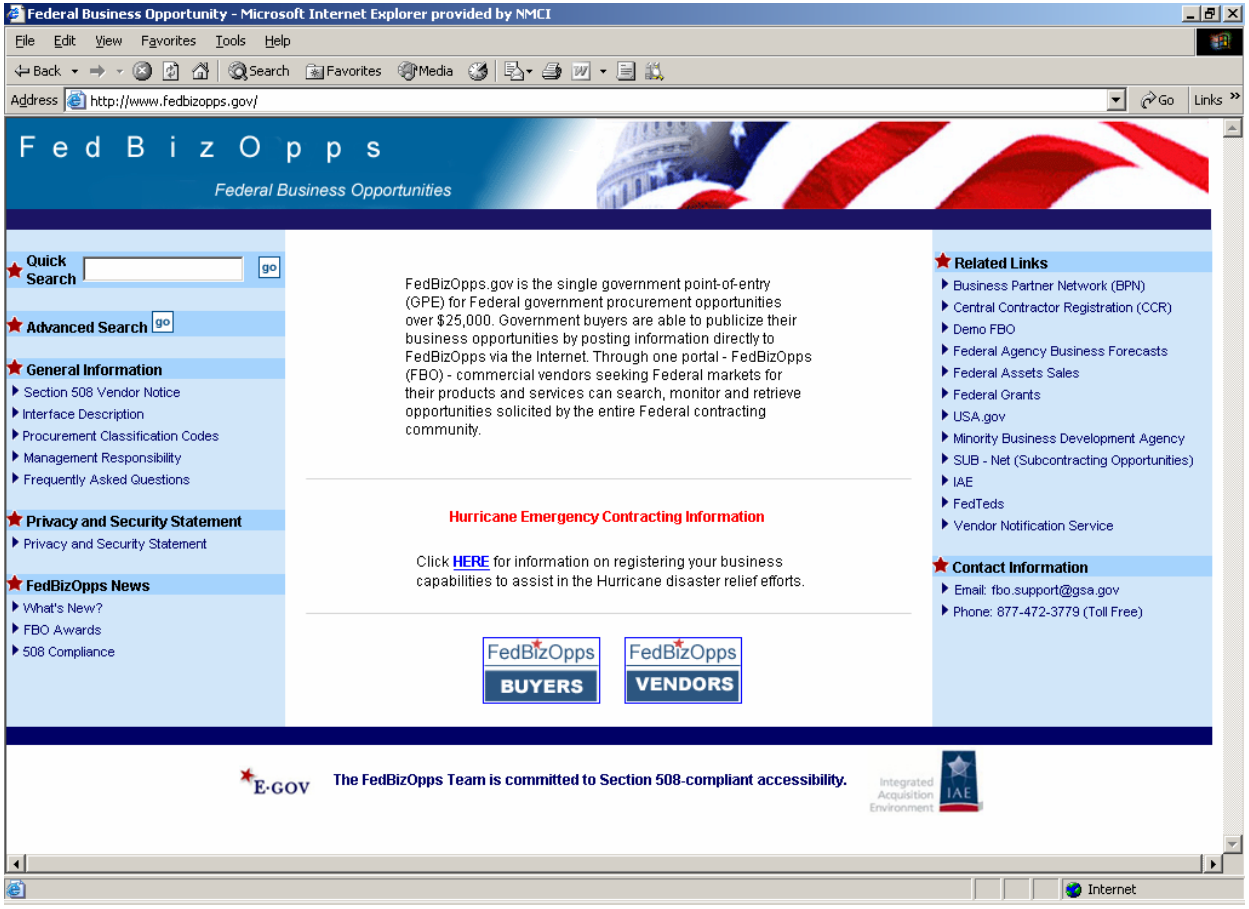
Identify Current & Future Procurement Opportunities

- Register with ORCA
  - https://orca.bpn.gov



Identify Current & Future Procurement Opportunities

- Federal Business Opportunities
  - www.fedbizopps.gov



Familiarize Yourself with Federal and DoD Contracting Procedures

Familiarize Yourself With SBA Resources

- Register in SBA Procurement Marketing and Access Network
- Investigate Other SBA Resources & Small Business Programs
  - www.sba.gov
- Federal Acquisition Regulation (FAR)
  - www.arnet.gov/far or http://farsite.hill.af.mil/
- Defense Federal Acquisition Regulation Supplement (DFARS)
  - www.acq.osd.mil/dp/dars or http://farsite.hill.af.mil/VFDFARA.HTM

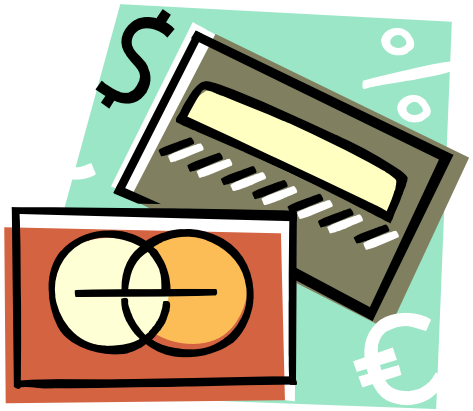
  And Agency Specific Supplement Guide

  http://www.regulations.gov

Investigate Federal Supply Schedules (FSS)

- Federal Supply Schedules (FSS)
  - **https://www.gsaadvantage.gov/advgsa/advantage/main/start_page.do**

- Government-wide Commercial Purchase Card (GCPC)
  - www.fss.gsa.gov/services/gsa-smartpay



Seek Additional Assistance as needed in the Marketplace

- Federal/DOD Business Opportunities
  - www.dodbusopps.com
  - www.fedbizopps.gov
  - www.womenbiz.com
- Procurement Technical Assistance Centers
  - www.sellingtothegovernment.net/ptac_map.asp

Explore Sub-contracting Opportunities

Subcontracting Resources

- www.acq.osd.mil/sadbu/csp/index.html
- http://web.sba.gov/subnet
- www.sba.gov/GC/sbsd.html

Investigate Other DoD Small Business Programs

- Small Business Innovation Research (SBIR)
- Women-owned Small Business Program
- Historically Black Colleges and Universities/Minority Institutions Program
- Native American Incentives
  - www.acq.osd.mil/sadbu

MARKET YOUR FIRM WELL

- **Identified the Customer**
- **Researched the requirement**
- **Became familiarized with procurement strategies**
- **Seek the Small Business Representative**
- **NOW, Present the Company's Capabilities!!!**

Doing Business With The Government

QUESTIONS
OR
COMMENTS

Presenter: Shekela Hutchinson

Gordon Stewart
23 April 2007

MTS Technologies, Inc.

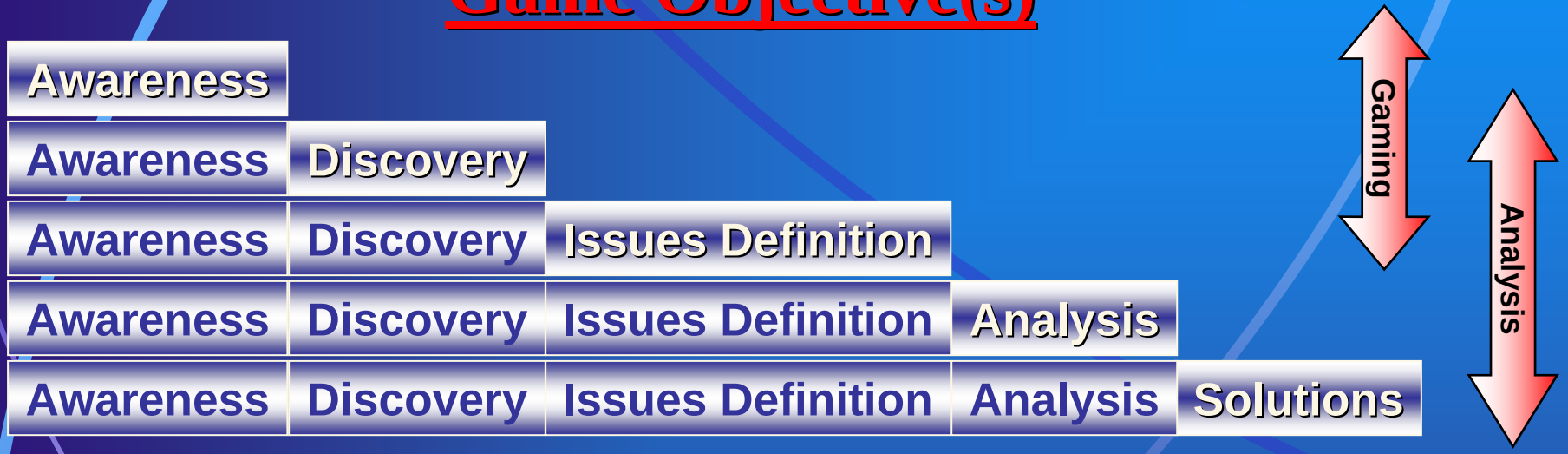
Management and Technical Services

2007 Joint Service Power Expo

Planning and Decision Support
for
Enhanced Power & Energy Management
through
Seminar Gaming and Analysis

MTS Seminar Games

Game Objective(s)



- Games are specifically designed to focus on client's needs and concerns
- Games require pre- and post-game analysis
- Games can be combined with facilitated workshop to enhance:
  - –Analysis
  - –Issue resolution

Tailored to Client needs

How can the Game best deal with client concerns?

Concerns

- Power & Energy Independence for the warfighter at the
  - Tactical level
  - Operational level
  - Strategic level

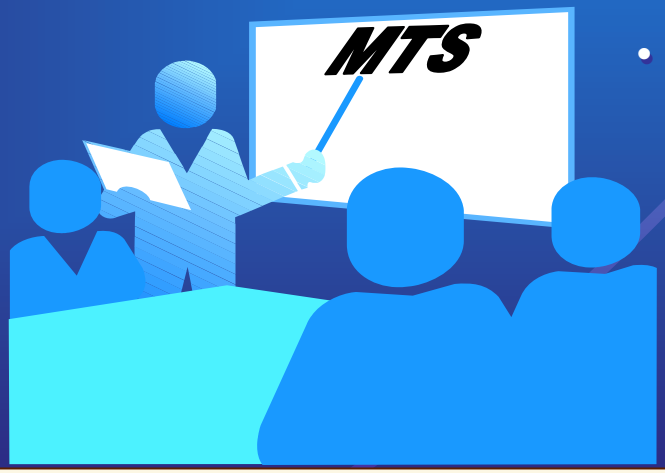
Pre-game Identified Issues

- Laws/ Regulations/ Doctrine/ Policy/ Habits
- Invalid Assumptions
- HD/LD Items
- Energy independence required to exploit technological advantages

MTS Seminar Games

Classic seminar game

- Loosely structured
- Players fulfill most, or all, game input requirements:
  - Role players
  - Discussants
  - Threats
  - Controllers
  - Assessors



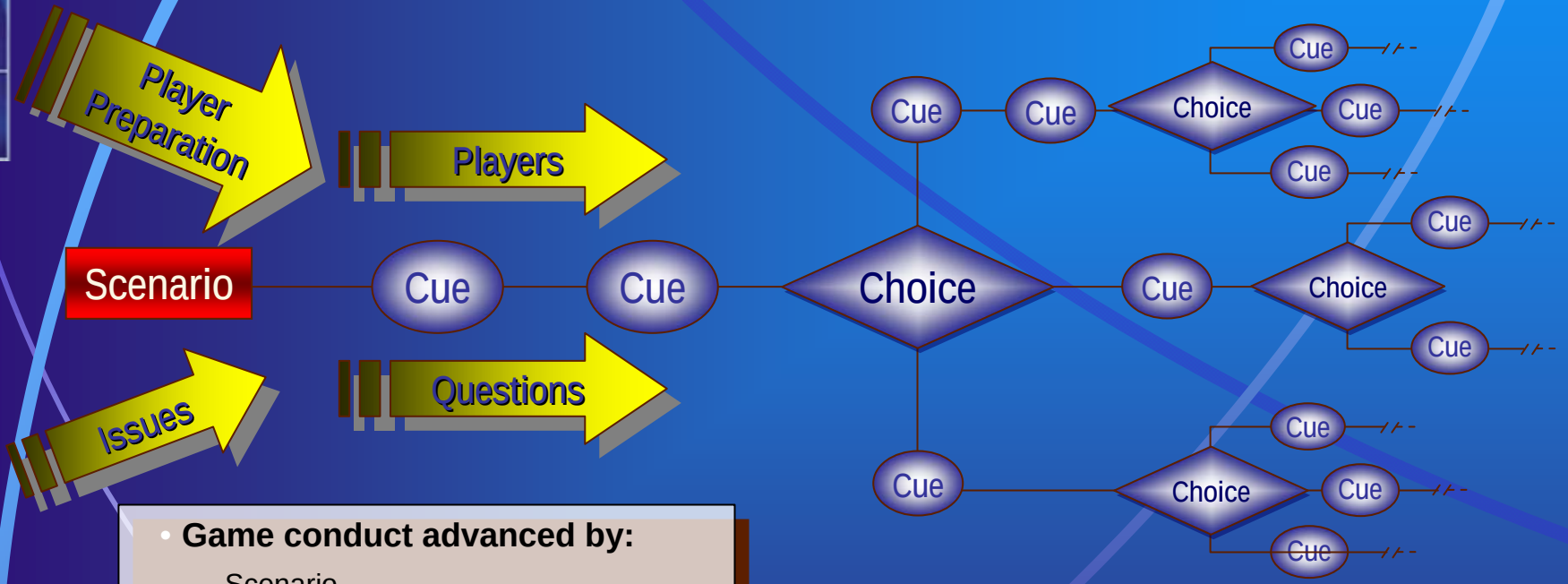
MTS seminar game

- **Systematic issue introduction**
- **Participants play themselves or their parent organizations**
- **Non-attribution policy**
- **Facilitators:**
  - Provide external inputs
  - Control game tempo & direction

Designed to ensure key issues come into play

MTS Game Design & Execution

Issue-based, modified, branching seminar game



- **Game conduct advanced by:**
  - Scenario
  - Player Preparation
  - Cues (issues)
  - Player inputs
  - Focused enabling questions
- **Players perform actual roles as members of a staff, interagency working group, advisory board, etc**
- **Relies upon player intellectual curiosity and participation in discussion**

Attributes of Successful Gaming

- **Early identification of game objectives**
- **Frequent client / *MTS* interaction during game development**
  - Game design
  - Game validation
- **Participant pre-game preparation**
  - Players' Seminar Guide
  - Reference Manual
  - One-on-one briefs

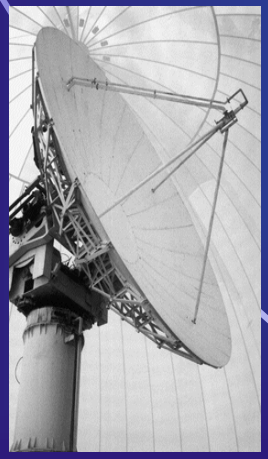
Attributes of Successful Gaming

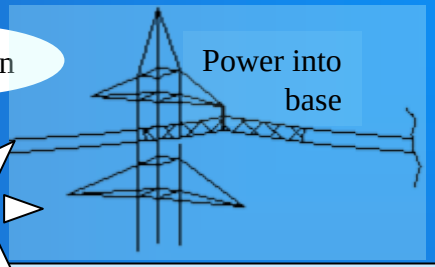
- **Participant interaction**
  - Moderator (normally senior player) is assisted by *MTS* gamers
  - Focused enabling questions
  - Off-line discussions
- **Post-game analysis and reporting**
  - Captures the game
  - Documents results, finding, insights and observations for follow-up and future action
  - Always the property of the client

Scenario Gaming Results

- **What can Scenario Planning & Gaming do for Power & Energy Management?**
  - At minimal cost, enhance organizational preparedness to deal with a variety of events
  - Identify problems for which existing policy, processes or funding levels are inadequate
  - Exercise plans, processes, and interactions before an event actually occurs
  - Assist in the resolution of problems through analysis and remediation
  - Support team building by bringing together stakeholders in a collegial, non-stressful environment

Military Energy Distribution Issues



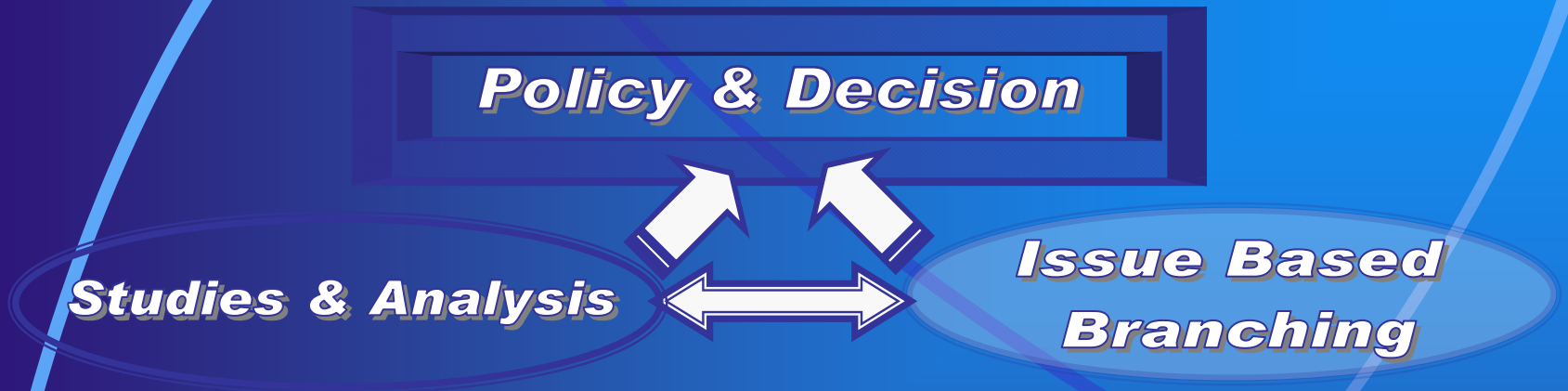


- Suitability of existing plans
  - Validity of assumptions
  - Points of vulnerability
  - Critical areas of interactions
- Feasibility of workarounds
  - Conflicting priorities
  - Competition for resources
    - Logistics
    - Personnel
    - Time
- Acceptability of risks
  - Level of assumed risk
  - Cascading failures

Questions?

Back-up Slides

Executive Level Support



Range of Support

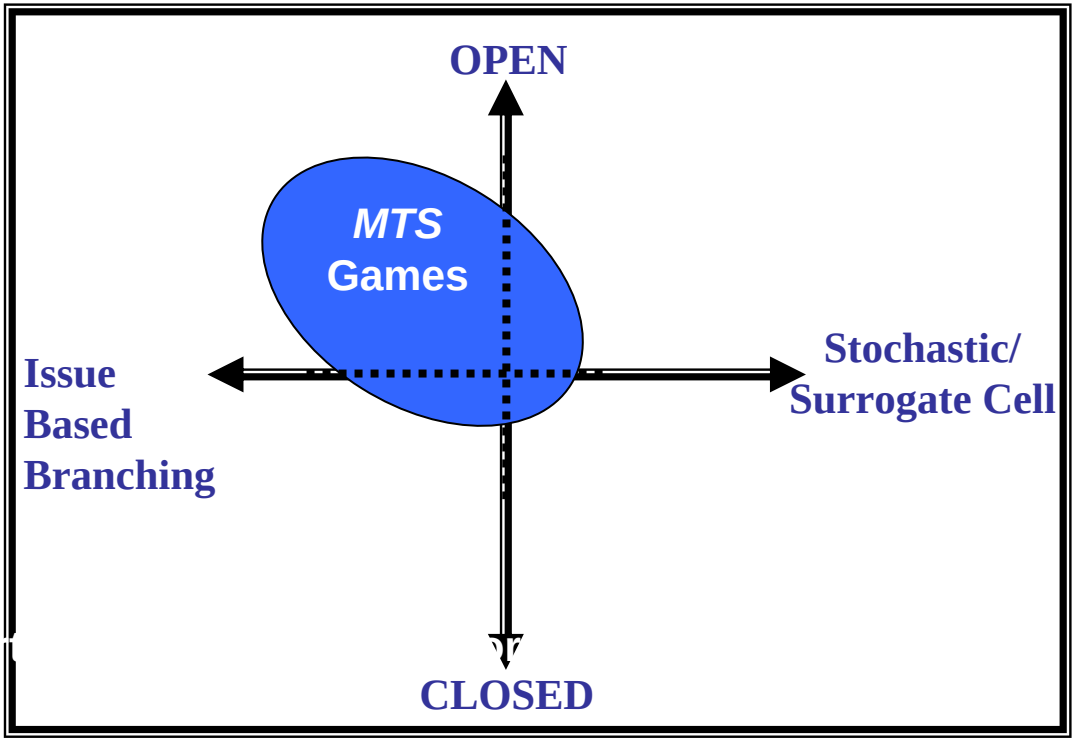
- Policy
- Strategy
- Implementation

- *MTS* offers studies, analysis, and issue based gaming to support Executive-level policy & decision making
- A full range of support is available for all executive needs
- *MTS'* focus is generally high-level

MTS Seminar Games

Game Characteristics

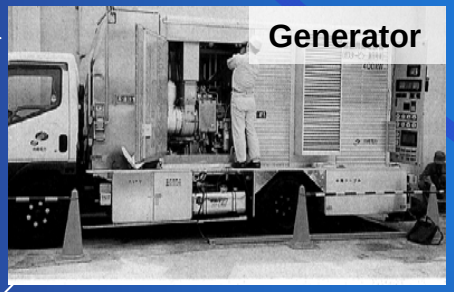
- **Open, issue based seminar game**
- **One sided**
- **Lead by senior player**
- **Assisted by *MTS* Facilitator**



MTS Products

MTS Studies & Analysis Products

Deployed Troop Installation



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  - Critical areas of interactions
- Feasibility of workarounds
  - Conflicting priorities
  - Competition for resources
    - Logistics
    - Personnel
    - Time
- Acceptability of risks
  - Level of assumed risk
  - Cascading failures

Battery Charger Alternatives

- Suitability of existing plans
  - Validity of assumptions
  - Points of vulnerability
  - Critical areas of interactions
- Feasibility of workarounds
  - Conflicting priorities
  - Competition for resources
    - Logistics
    - Personnel
    - Time
- Acceptability of risks
  - Level of assumed risk
  - Cascading failures

POWER OPTIMIZER FOR THE WARFIGHTER'S ENERGY REQUIREMENTS

Created by USA CE-LCMC, Power Sources Team, Ft. Monmouth, NJ

Click for User's Guide

Distribution authorized to U.S. Government agencies and their contractors for official use or for administrative or operational purposes only.

White Areas require user input

1) Select an End Item

Choose Item by: NOUN

Item List

- AN/PRC-138
- AN/PRC-148(V)(C)
- AN/PRC-150(C)
- AN/PRC-25
- AN/PRC-343
- AN/PRC-68

POC: USA CE-LCMC, Ft. Monmouth, NJ
Ari Herman
email: ari.herman@us.army.mil
Phone: (732) 532-6763 DSN: 992-6763

Please Reference: POWER 1.2, Released 4/18/07

The selected item is the AN/PRC-148(V)(C), Multiband Radio, MBITR, NSN: TBD

2) Select the temperature conditions in which the end item will be used Normal Temperature (32F to 130F)

Battery option(s)*	Qty	Run Time	Units	Note:	Total Batt. Weight	Units
BA5590	1	2	days	Use Adapter J-6686/U	2.3	lbs
BA8140	1	3	days	Use Adapter J-6686/U	3.0	lbs
BB MBITR Batt	1	8	hrs		1.0	lbs
BA5390	1	3	days	Use Adapter J-6686/U	3.0	lbs
BB2590	1	2	days	Use Adapter J-6686/U	3.2	lbs
BB390	1	1	days	Use Adapter J-6686/U	3.9	lbs
BA8180	1	10	days	Use Adapter J-6686/U	6.0	lbs

**Note: Batteries listed here may listed in the TM of some older dev which batteries have become ob replacements, please see the 'Replaced'*

3) Given the above options, which battery do you wish to use BB MBITR Ba

Battery	NSN	# per Package	Description	Specific Information
1600515-7	6140-01-487-1153	1	Battery, Rechargeable, Lithium Ion	

4) *Choose which version you wish to use* 1600515-7

5) **The BB MBITR Batt is estimated to last 8 hrs in the AN/PRC-148(V)(C), Multiband Radio, MBITR at Normal Temperature (32F to 130F)**

The battery will be swapped out after…. _____ **hrs of use**

You must enter how often the battery will be changed

6) **Input the number of AN/PRC-148(V)(C) to be powered** 1 **devices**

7) **Input the number of hours per day the end item will be in operation** 24 **hrs**

Steps 8 and 9 are for rechargeable batteries only.
For more information on rechargeable batteries and chargers see the tab labeled 'Rechargeable Info'

8) **How frequently will the warfighter be resupplied with charged batteries? Every…..** 8 hrs

Enter a value in step 5

9)

Enter a value in step 5 #DIV

Battery	Battery NSN	Batt. per package	# of devices	Device
1600515-7	6140-01-487-1153	1	1	AN/PRC-148(V)(C)

Minimum Requirements			
	# of Batteries	# Pkgs to order	Total Weight (lbs)
1 day mission	*Step 5 = value?*		
3 day mission	*Step 5 = value?*		
30 day mission	*Step 5 = value?*		

differ than those
vices. For a list of
solete, and their
e tab labeled

POWER

Version 1.2

POWER ***O***PTIMIZER FOR THE ***W***ARFIGHTER'S ***E***NERGY ***R***EQUIREMENTS

"Battery Calculator"

Created by: US ARMY CE-LCMC, Power Sources Team, Fort Monmouth, NJ

2007 Joint Service Power Expo

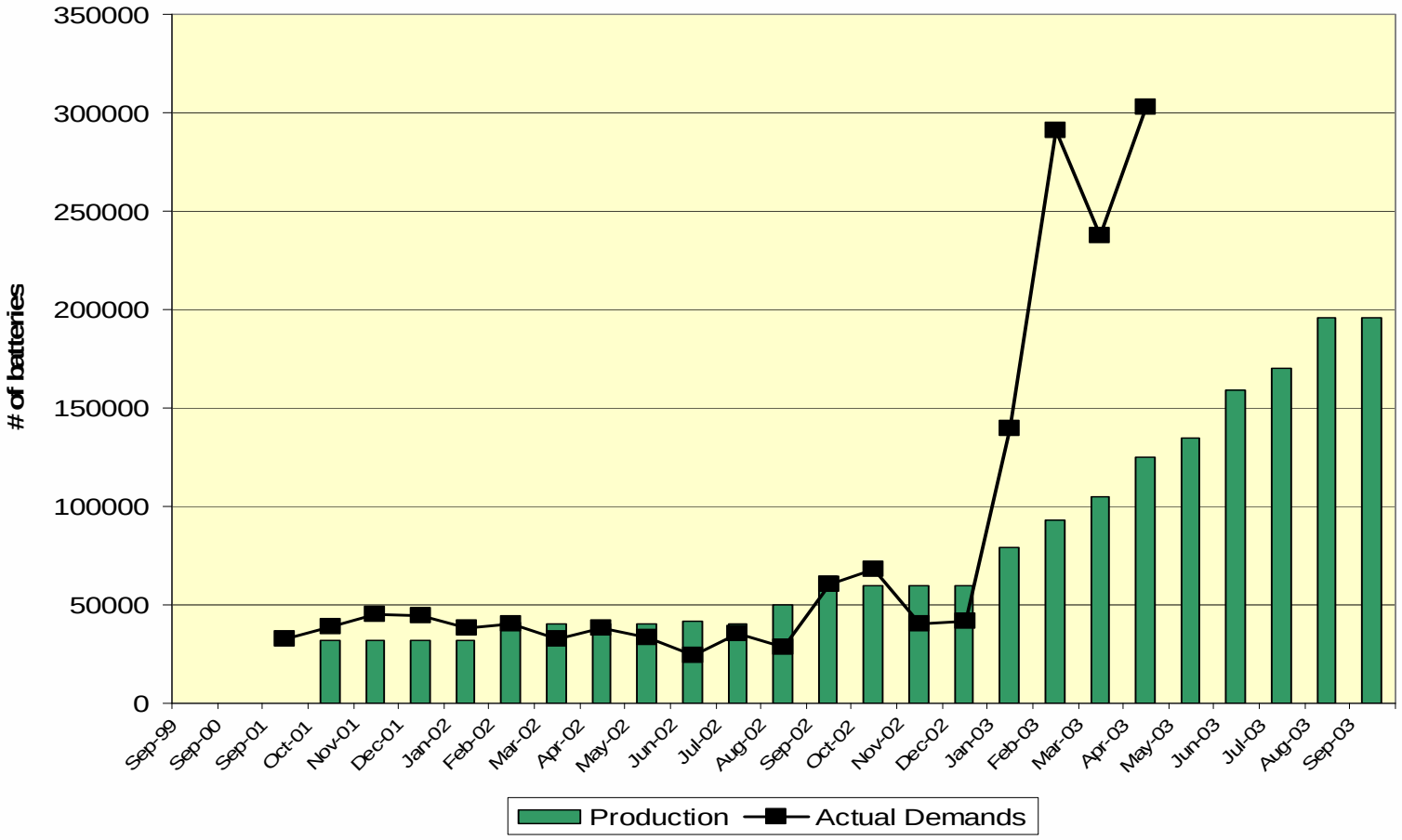
Presented by Don Brockel,

Rechargeable Project Leader US Army

No Batteries: No Commo

Army Capt. Chad Foster.
Photo by Petty Officer 1st Class Michael Larson, U.S. Navy.

Supply vs. Demand



POWER

POWER **O**PTIMIZER FOR THE **W**ARFIGHTER'S **E**NERGY **R**EQUIREMENTS

- POWER is a battery requirement calculator
- Designed with the Warfighter in mind
  - Accessibility:
    - Can be downloaded from the internet
    - Stored on a secure server (AKO access required for download or can be emailed to ".mil addresses")
    - Microsoft Excel based
  - Usability:
    - Full user instructions included
    - Simple step-by-step process
    - Data is saved in spreadsheet format

Large Database

- Built around the data in SB 11-6
  (Supply Bulletin 11-6: Communications-electronics Batteries Supply And Management Data; 1 June 2001)
- Battery options for most portable devices in the DoD inventory
- Runtimes for many devices
- Temperature corrections

Live Demonstration

Sample Use: Comparing different battery options

- Example: AN/PRC-119F
  - Device always on
  - Battery swap times in 24 hour* intervals
  - 24 hour re-supply time
  - Comparing battery options using FY07 pricing
  - Normal Temperature

*20 Hours for the BB-390

Comparing Battery Options

Summary of Minimum Battery Requirements (ASIP)- Normal Temp

	Minimum for 1 day mission				Minimum for 3 day mission				Minimum for 30 day mission			
	Batts (day)	Pkgs to order (day)	Weight (day)	Cost (day)	Batts (3dy)	Pkgs to order (3dy)	Weight (3dy)	Cost (3dy)	Batts (mo)	Pkgs to order (mo)	Weight (mo)	Cost (mo)
BA-5590B/U	1	0.3	**2.25**	**$88**	3	0.8	6.75	**$235**	30	7.5	67.5	$2,199
BB-390B/U	5	5	21	$1,213	5	5	21	$1,213	5	5	21	$1,213
BA-5390A/U	1	0.3	3	$144	2	0.5	**6**	$240	15	3.8	45	$1,825
BB-2590/U	4	4	12.8	$1,181	4	4	12.8	$1,181	4	4	**12.8**	**$1,181**
BA-8180/U	1	1	6	$356	1	1	**6**	$356	5	5	30	$1,778

Lowest Weight

Lowest Cost

Commo Equipment Batteries...

POWER for the Warfighter

ESTIMATING YOUR UNIT'S BATTERY NEEDS HAS JUST GOTTEN *EASIER.*

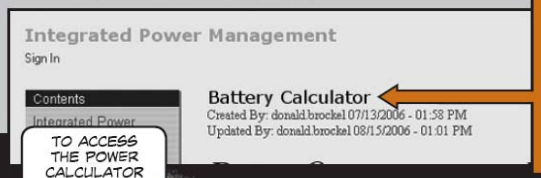
A MICROSOFT EXCEL-BASED APPLICATION, POWER OPTIMIZER FOR THE WARFIGHTER'S ENERGY REQUIREMENTS (POWER), IS AVAILABLE FOR YOU TO DOWN-LOAD ON THE INTERNET.

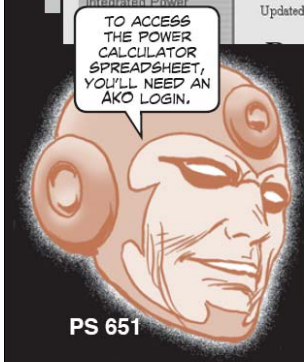
HERE'S HOW TO GET TO IT.

First, go to:
http://www.monmouth.army.mil/cecom/lrc/lrc.html
At that site, click on Battery Support under the Logistics Support heading.

At the next site, click on Rechargeable Battery Program.

At this site, click on Battery Calculator. You will get instructions on how to use the spreadsheet from a step-by-step guide listed in the Table of Contents. This is the only place on the web the guide is shown





The POWER spreadsheet is a step-by-step process in which you are asked a series of questions about device usage. After each step, information is given to assist you in making the right choices regarding battery type and frequency of changing the battery, plus other valuable information.

You can save your work and add to it later, too!

If you run into problems or have questions about POWER, email: @us.army.mil

Or call: DSN 992-6763 or (732) 532-6763.

PS 651 43 FEB 07

POWER: Battery Management

Army Capt. Chad Foster.
Photo by Petty Officer 1st Class Michael Larson, U.S. Navy.

Summary

- POWER helps the Warfighter estimate battery needs
  - Eliminates waste
  - Helps avoid needless battery shortages
- POWER allows the Warfighter to figure out which options work best for the mission profile
  - Weight
  - Runtime
  - Cost

Questions & Contact Information

Don Brockel

donald.brockel@us.army.mil

732-532-4948

Software POC:

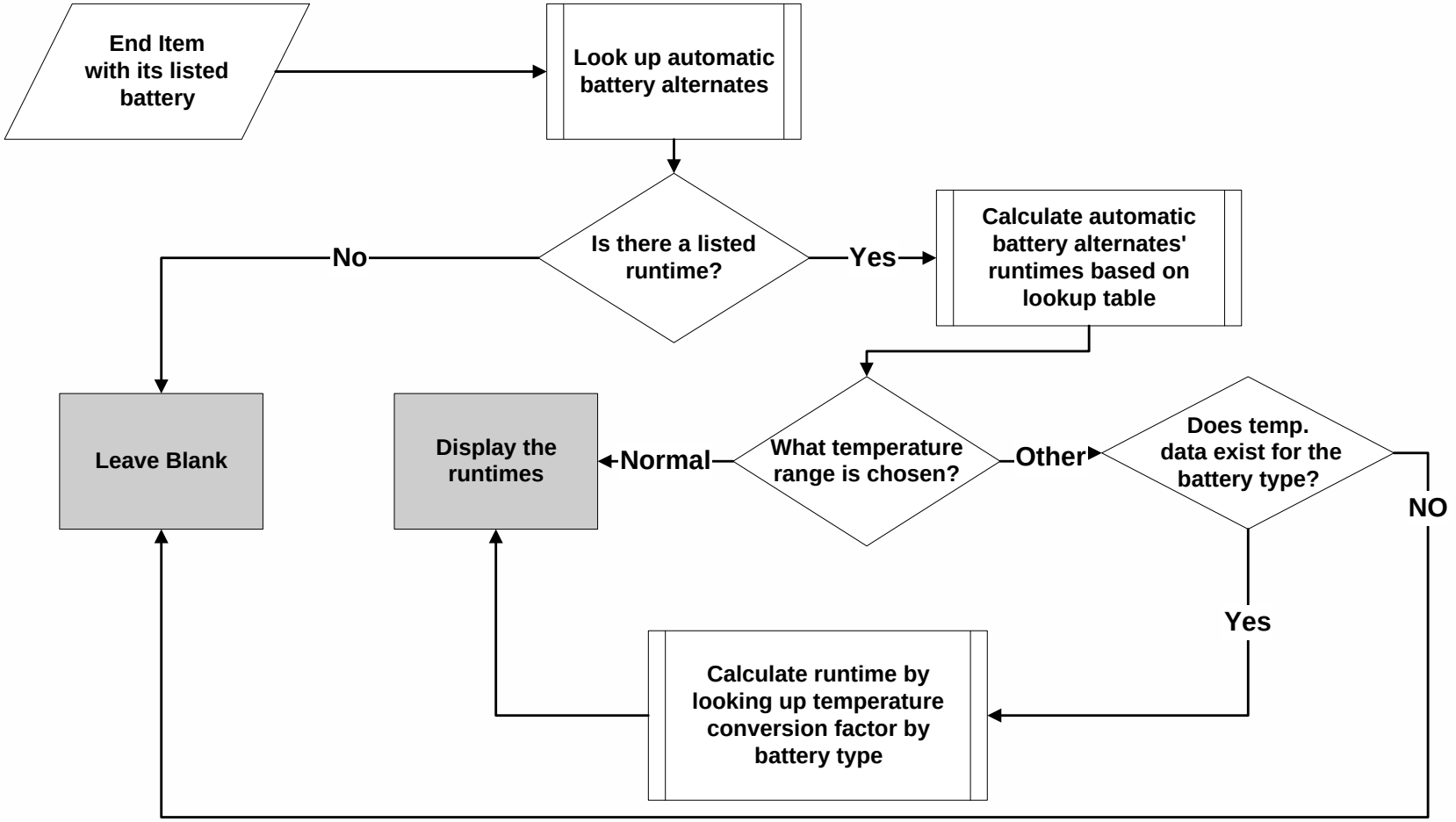
Ari Herman

ari.herman@us.army.mil

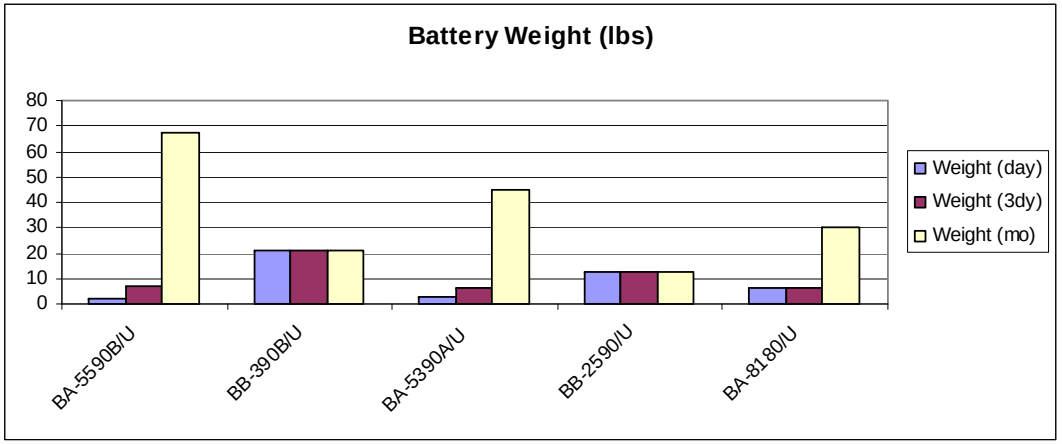
732-532-6763

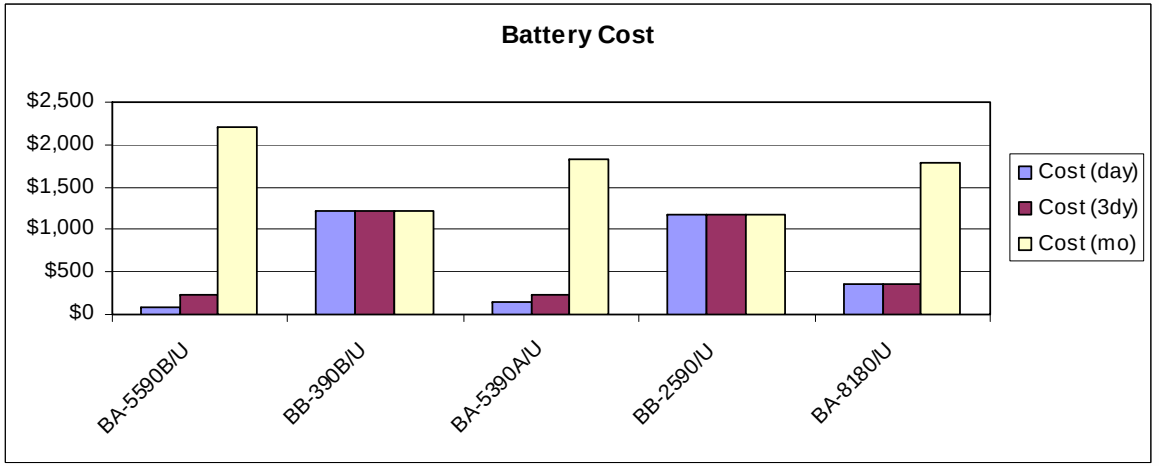
Supplemental Slides

Runtime Calculations



Comparing Battery Options





Battery Technical Working Group

Marc D. Gietter

Co-Chairperson

Army Power Division

AGENDA

- Who we are
- What we do
- Where you fit in

Who We Are

OSD
Deputy Assistant Secretary (Advanced Systems and Concepts)

Joint Defense Manufacturing Technology Panel

Electronics Processing and Fabrication Sub-Panel

Battery Technical Working Group

Primary Members

- **UNITED STATES ARMY (Current Chair)**
- **UNITED STATES NAVY**
- **DEFENSE LOGISTICS AGENCY**
- **UNITED STATES AIR FORCE**
- **MISSILE DEFENSE AGENCY**

Associate Members

- UNITED STATES MARINE CORPS
- DEFENSE CONTRACT MANAGEMENT AGENCY

Who we are (in detail)

- Battery Technical Working Group
  - USMC SYSTEMS CMD
  - DCMC INDUSTRIAL ANALYSIS CTR,
  - US ARMY (Current Chair)
    - CERDEC
    - TARDEC
    - ARL
    - AMRRCOM
  - US NAVY
    - CRANE
    - CARDEROCK
  - DLA
  - USAF
    - WRIGHT LABS
  - MDA

Our Areas of Interest

COTS Items (alkaline/ Lithium Ion

Vehicles (Lead Acid)

Aviation (Lead Acid/ NiCd)

C/E (Li/SO2 / Li/MnO2)

Missiles (Thermal)

Fuze

POWER APPLICATION CONTINUIM

Commercial Applications

Military Unique Applications

What is our "Big Picture" Mission?

MANTECH Investment Strategy

Subject Matter Experts

Domestic Production Base

Gov't/ Industry Interface

MANTECH Investment Strategy

- Coordinate Service Programs
- Established “Purple PE”
- Recommend/nominate projects

BATTMAN REPORT

Domestic Production Base

Lean Battery Initiatives

Army GFF

Company Investments

DLA WarStoppers

IMPROVED SURGE PRODUCTION BASE CAPACITY

The Key to Success –
An Integrated Approach

Subject Matter Experts

Funded by OSD

Ideal Power Source

- Purple in nature
-Decision making tool
- Prioritization
-Leveraging of funds

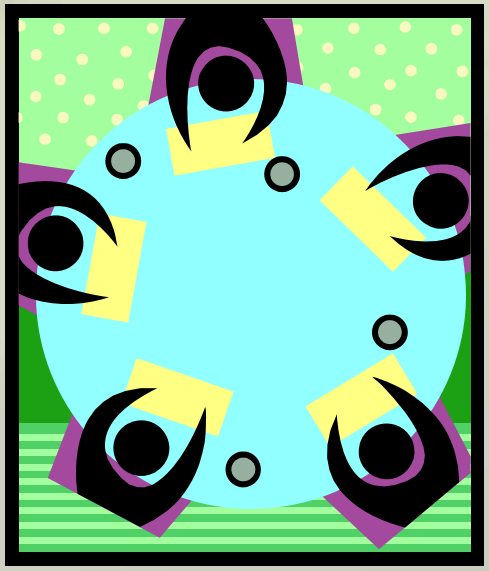
NATIBO Fuel Cell Study

Battery Coherent View

Draft Shown At Industry Roundtable

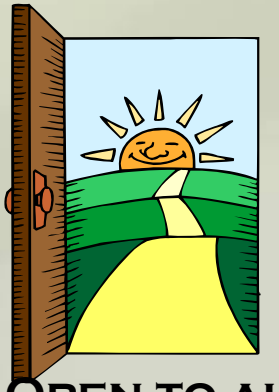
JDMTP Power Roadmap

Gov't/
Industry
Interface



Goals

-Open line of communication
-Socialize issues
-ID Industry Concerns
-Get industry Feedback



Open to all

Industry roundtable

Where do you fit in?

Together we hold the key to success

By working together

- Better technologies
- Coherent View
- Round Table
- Road MAP

Contact us!

- Michael Brundage (Co-Chair)
  - (732) 427-3560
  - Michael.brundage1@us.army.mil
- Marc Gietter (Co-Chair)
  - (732) 532-6764
  - Marc.d.gietter@us.army.mil
- Jim Gucinski (Tiburon – Secretariat)
  - (812) 825-435
  - jag@tiburonassociates.com

Advancements in Navy and USMC Power Systems

Joint Service Power Expo 2007
C. Justin Govar, Daphne A. Fuentevilla, Julie A. Banner,
and Clinton S. Winchester
Naval Surface Warfare Center, Carderock
Systems & Materials for Power & Protection Branch
9500 MacArthur Blvd, Bethesda, MD
301-227-5394, Clint.Govar@navy.mil

Presentation Goals

NAVSEA
WARFARE CENTERS
Carderock Division

- Provide an overview of portable power technologies for current and near-term transition into Naval and USMC applications
- Support user selection of power sources through review of selected technology characteristics, including performance and safety

USMC Battery Applications

- State-of-Charge Indicators
- APU/UPS Applications
- Zn/Air Hybrid Battery System
- Magnesium Air Batteries
- Aerial Vehicle Batteries

State of Charge Indicator For Zn/Air Batteries

- Goal
  - To develop a state of charge (SOC) indicator for the BA8180 and future Marine Corps Zn/Air batteries.
- Key Parameters
  - Size and weight
  - Efficiency and power consumption
  - Cost
  - Accuracy
  - Environmental factors
- Companies
  - Yardney Technical Products
  - Global Technology Connection

SOC Indicators for Primary batteries

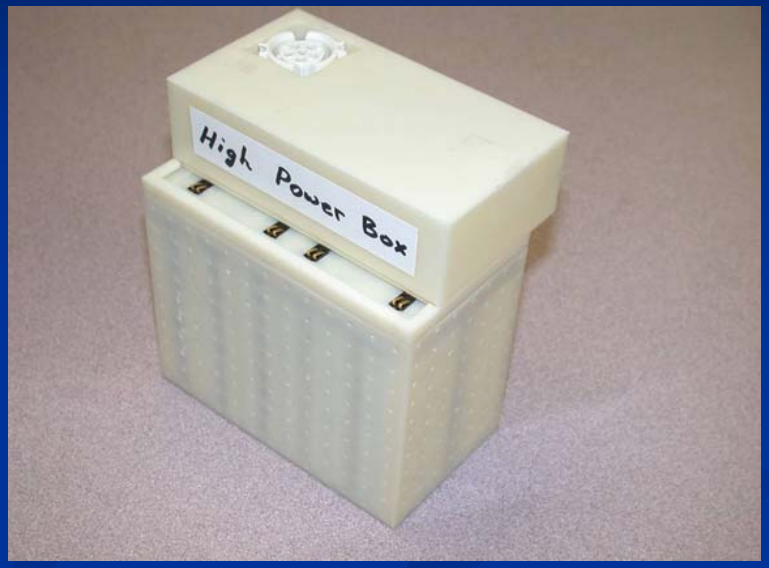
- Evaluating the SOC Indicators for BA5390A/U and the BA5590A/U
- Evaluation is done
- Currently in the approval process for the various Marine Corps Equipments
- Conclusions:
  - SOC does not effect the safety of the BA5390A/U
  - The BA5390A/U is susceptible to hard reversal conditions that can overcome its safety devices
  - SOC does not effect the safety of the BA5590A/U

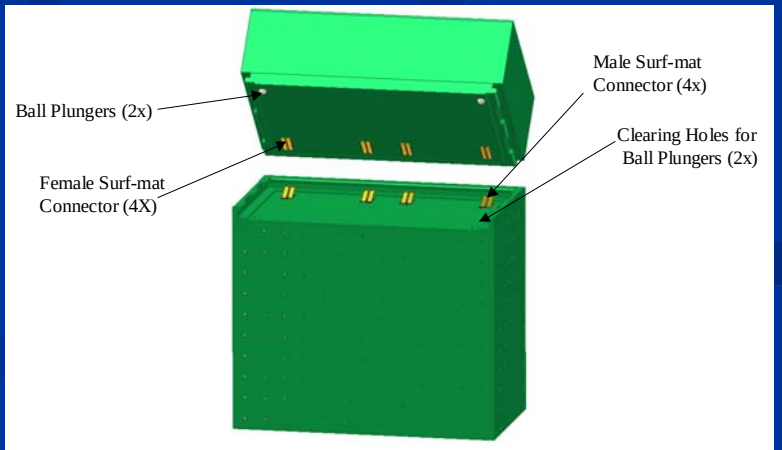
Marine Portable Power Unit

- Goal
  - To develop a APU/UPS system that utilizes the BB2590 as the energy storage device and can double as a battery charging station
- Key Parameters
  - 50lbs, single man portable
  - Uses and recharges the BB2590
  - Battery are hot-swappable while in use
  - 12VDC, 24VDC, 120VAC input and output
  - 1kW power output capability for 1 hour
- Companies
  - Space Hardware Optimization Technology
  - Acumentrics
  - AeroVironment

Zn/Air Hybrid Battery System

- 45% weight reduction (over 2 BA5590)
- 50% volume reduction (over 2 BA5590)
- Same size as BA5590
- 1.26kg
- 15Ah, 440Wh
- 350Wh/kg
- 100+Watt Capable
- Duel voltage 15V, 30V
- 62 hour run time on SINCGARS profile





Mechanical and Electrical Interface View

Emergency Battery System

- Magnesium/Air battery
- Three Different Systems
  - Basic – Soft rubber pack
  - Standard – Basic with hard case and fan cooled
  - Disposable – One time use
- 50Ah plates, 570g (dry)
- 400Wh/kg (dry), 228Wh/kg (wet)
- Takes ~ 500ml of salt water
- 20Watts, 6V
- 12V/24V DC/DC converter (88% Efficiency)
- BB2590 Charger adaptor

Metal Cell Batteries
(Still under evaluation)

Large Backup Power System

- Voltage = 12V
- Energy Density
  - 280Wh/kg (dry over 4 plates)
- Energy = 2200 Wh
- Power = 50W-100W
- Hydrogen inhibitor
- Size = 7”x10”x16”
- 35 pounds (Dry with salt)

InfraTech Battery
(Still under evaluation)

UAV Battery Designs

- Dragon Eye (2004 version): AeroVironment P/N 55616
  - 21 Saehan-Enertech li-ion polymer cells (1.9 Ah)
  - Nominal 25.9V, 5.7 Ah
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Navy Power System Advancements

- Focus on TRL Level 6-9
- Advancements in Fieldable Systems
- Examples

Technology Readiness Level (TRL)

9	**"Flight Proven" OT&E**
8	**"Flight Qualified" DT&E**
7	**System Prototype Demo in Operational Environment**
6	**System Demo in Relevant Environment**
5	'High Fidelity' Benchtop Integration
4	'Low Fidelity' Benchtop Integration
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2	Paper Study/Basic Principle
1	Concept

Current Navy Power Systems

NAVSEA
WARFARE CENTERS
Carderock Division

- Hit on a few of the recent Navy battery systems
  - Unmanned Ground Vehicles
  - Unmanned Underwater Vehicles
  - Manned Vehicles

Unmanned Ground Vehicles

NAVSEA
WARFARE CENTERS
Carderock Division

- Talon
  - EOD/IED disposal reconnaissance
  - Weight <150 lbs
  - Payload 100 lb
  - Water resistance to 90ft
  - Li-Ion Battery Pack
    - 70Whr
    - 42 Volts, 17.8 Amp-hours
    - 4.5 hour operation/charge
    - S9310 Approved

Unmanned Ground Vehicles

NAVSEA
WARFARE CENTERS
Carderock Division

- Toughbot
  - Remote Video and Audio Reconnaissance
  - 2.2 lbs
  - 100-300ft range
  - Li-polymer Battery Pack
    - 7.4V, 0.65 Ahr
    - ~1hr operating time
- Throwbot
  - Earlier version of Toughbot
  - Remote Video and Audio Reconnaissance
  - Tossable: Soda-can size, <1 kg
  - 100ft range
  - Li-polymer Battery Pack
    - 11V, 0.25Ahr

- Limited S9310 Approval

Unmanned Underwater Vehicles

NAVSEA
WARFARE CENTERS
Carderock Division

- 12 ¾” UUV
- SAMS
- “Tunnel”
- REMUS/SARV

REMUS 100 Power System

NAVSEA
WARFARE CENTERS
Carderock Division

- SAFT MP176065 based Li-Ion battery
  - Fully S9310 Approved & Tested
- Moli 18650 based Li-Ion battery
  - Preliminary S9310 Evaluation
  - Cell Capacity 2.2Ahr ⟶ 2.4Ahr

Battlespace Preparation Autonomous Underwater Vehicle (BPAUV)

NAVSEA
WARFARE CENTERS
Carderock Division

- Maps Ocean Floor, Hunts Mines
- Up to 2 x 3.6kWhr battery packs
- 120Ahr at 30V in 8S24P configuration

Solar Autonomous Underwater Vehicle (SAUV)

NAVSEA
WARFARE CENTERS
Carderock Division

- Autonomous UUV, Technology Testbed
  - Moli 18650 based Li-Ion 2kWhr Battery Pack
  - Solar panels recharge Li-Ion Battery while deployed
  - S9310 Limited Approval

Manned Vehicles

NAVSEA
WARFARE CENTERS
Carderock Division

- ProMare/MarlinSubs S201 2-Man Submarine
  - Technology Testbed
  - Currently Contractor Owned and Operated
  - Li-Ion Battery
    - Phosphate Cathode
    - Uses 18650 size cell
    - 150 kWatt-hour
  - S9310 evaluation in progress

Manned Vehicles

NAVSEA
WARFARE CENTERS
Carderock Division

- Joint Strike Fighter, F-35
  - Li-ion Power Supply
    - Start-up Power, Back-up Flight control
    - 270 V

Conclusions: Trends in Battery Development

NAVSEA
WARFARE CENTERS
Carderock Division

- Modularity
- Commercial off the shelf
- Specialty packages with COTS cells
  - Still have batteries that have odd shape factors or special locations
- Metal air chemistries
- Rechargeable batteries
- Larger battery systems
- Higher energy density
- Higher power density

NAVSEA
WARFARE CENTERS
Carderock Division

Questions ?

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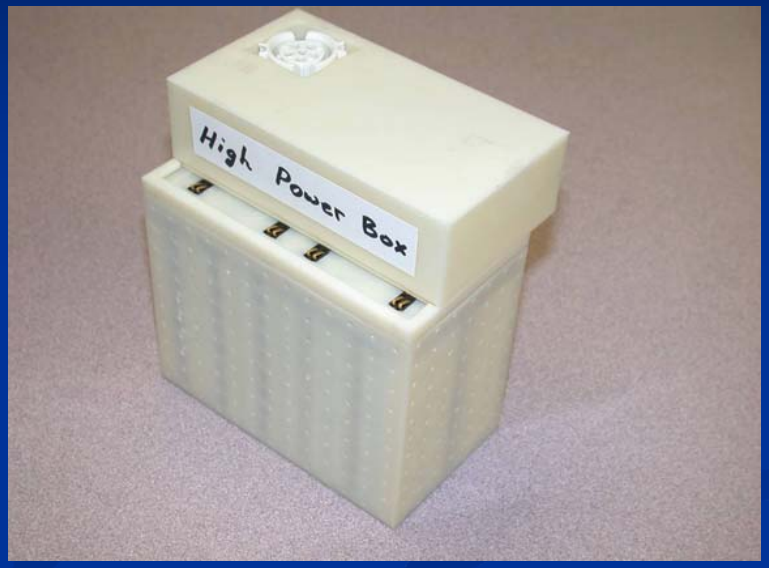

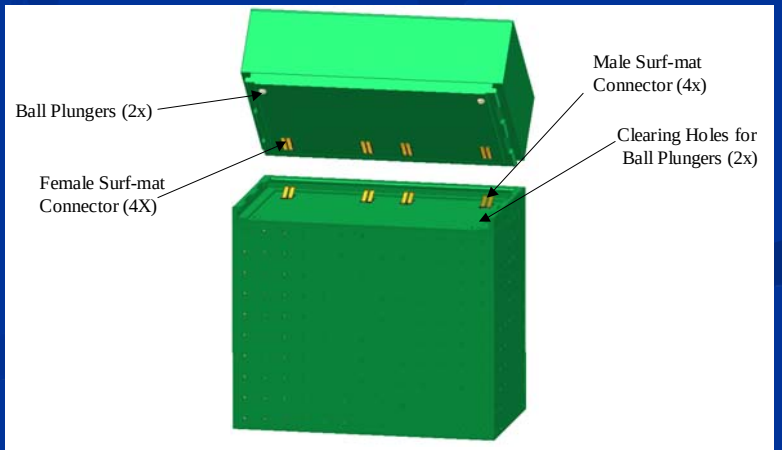

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NAVSEA
WARFARE CENTERS
Carderock Division

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NAVSEA
WARFARE CENTERS
Carderock Division

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  - Li-Ion Battery Pack
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    - ~1hr operating time
- Throwbot
  - Earlier version of Toughbot
  - Remote Video and Audio Reconnaissance
  - Tossable: Soda-can size, <1 kg
  - 100ft range
  - Li-polymer Battery Pack
    - 11V, 0.25Ahr

- Limited S9310 Approval

Unmanned Underwater Vehicles

NAVSEA
WARFARE CENTERS
Carderock Division

- 12 ¾” UUV
- SAMS
- “Tunnel”
- REMUS/SARV

REMUS 100 Power System

NAVSEA
WARFARE CENTERS
Carderock Division

- SAFT MP176065 based Li-Ion battery
  - Fully S9310 Approved & Tested
- Moli 18650 based Li-Ion battery
  - Preliminary S9310 Evaluation
  - Cell Capacity 2.2Ahr ⟶ 2.4Ahr

Battlespace Preparation Autonomous Underwater Vehicle (BPAUV)

NAVSEA
WARFARE CENTERS
Carderock Division

- Maps Ocean Floor, Hunts Mines
- Up to 2 x 3.6kWhr battery packs
- 120Ahr at 30V in 8S24P configuration

Solar Autonomous Underwater Vehicle (SAUV)

NAVSEA
WARFARE CENTERS
Carderock Division

- Autonomous UUV, Technology Testbed
  - Moli 18650 based Li-Ion 2kWhr Battery Pack
  - Solar panels recharge Li-Ion Battery while deployed
  - S9310 Limited Approval

Manned Vehicles

NAVSEA
WARFARE CENTERS
Carderock Division

- ProMare/MarlinSubs S201 2-Man Submarine
  - Technology Testbed
  - Currently Contractor Owned and Operated
  - Li-Ion Battery
    - Phosphate Cathode
    - Uses 18650 size cell
    - 150 kWatt-hour
  - S9310 evaluation in progress

Manned Vehicles

NAVSEA
WARFARE CENTERS
Carderock Division

- Joint Strike Fighter, F-35
  - Li-ion Power Supply
    - Start-up Power, Back-up Flight control
    - 270 V

Conclusions: Trends in Battery Development

NAVSEA
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Carderock Division

- Modularity
- Commercial off the shelf
- Specialty packages with COTS cells
  - Still have batteries that have odd shape factors or special locations
- Metal air chemistries
- Rechargeable batteries
- Larger battery systems
- Higher energy density
- Higher power density

NAVSEA
WARFARE CENTERS
Carderock Division

Questions ?

Battery Technical Working Group

Marc D. Gietter

Co-Chairperson

Army Power Division

AGENDA

- Who we are
- What we do
- Where you fit in

Who We Are

OSD
Deputy Assistant Secretary (Advanced Systems and Concepts)

Joint Defense Manufacturing Technology Panel

Electronics Processing and Fabrication Sub-Panel

Battery Technical Working Group

UNITED STATES MARINE CORPS

DEFENSE CONTRACT MANAGEMENT AGENCY

Associate Members

UNITED STATES ARMY (Current Chair)

Primary Members

UNITED STATES NAVY

DEFENSE LOGISTICS AGENCY

UNITED STATES AIR FORCE

MISSILE DEFENSE AGENCY

Who we are (in detail)

- Battery Technical Working Group
  - USMC SYSTEMS CMD
  - DCMC INDUSTRIAL ANALYSIS CTR,
  - **US ARMY (Current Chair)**
    - CERDEC
    - TARDEC
    - ARL
    - AMRRCOM
  - **US NAVY**
    - CRANE
    - CARDEROCK
  - **DLA**
  - **USAF**
    - WRIGHT LABS
  - **MDA**

Our Areas of Interest

COTS Items (alkaline/ Lithium Ion)

Vehicles (Lead Acid)

Aviation (Lead Acid/ NiCd)

C/E (Li/SO2 / Li/MnO2)

Missiles (Thermal)

Fuze

Commercial Applications

Military Unique Applications

What is our "Big Picture" Mission?

MANTECH Investment Strategy

Subject Matter Experts

Support Production Base

Gov't/ Industry Interface

MANTECH Investment Strategy

- Coordinate Service Programs
- Established “Purple PE”
- Recommend/nominate projects

BATTMAN REPORT

Support Production Base

Lean Battery Initiatives

Army GFF

Company Investments

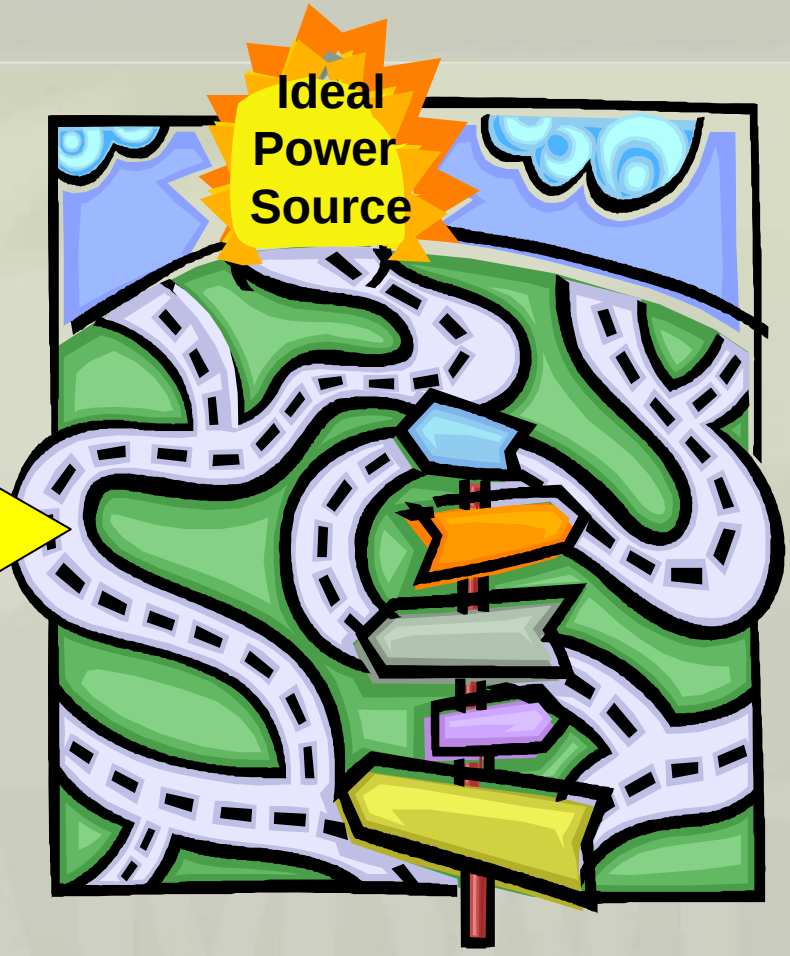
DLA WarStoppers

IMPROVED PRODUCTION BASE CAPACITY

The Key to Success –
An Integrated Approach

Funded by OSD

Subject Matter Experts



- Purple in nature
-Decision making tool
- Prioritization
-Leveraging of funds

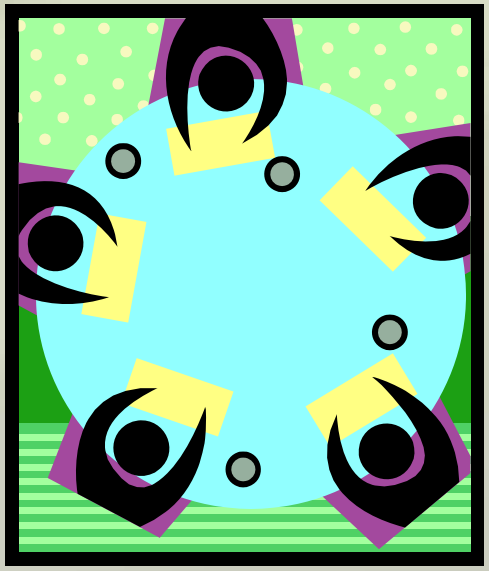
NATIBO Fuel Cell Study

Battery Coherent View

Draft Shown At Industry Roundtable

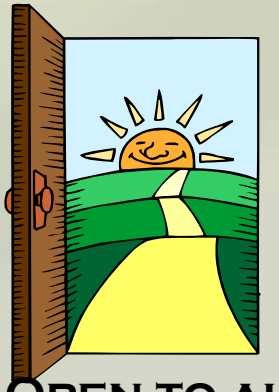
JDMTP Power Roadmap

Gov't/
Industry
Interface



Goals

-Open line of communication
-Socialize issues
-ID Industry Concerns
-Get industry Feedback



Open to all

Industry roundtable

Where do you fit in?

Together we hold the key to success

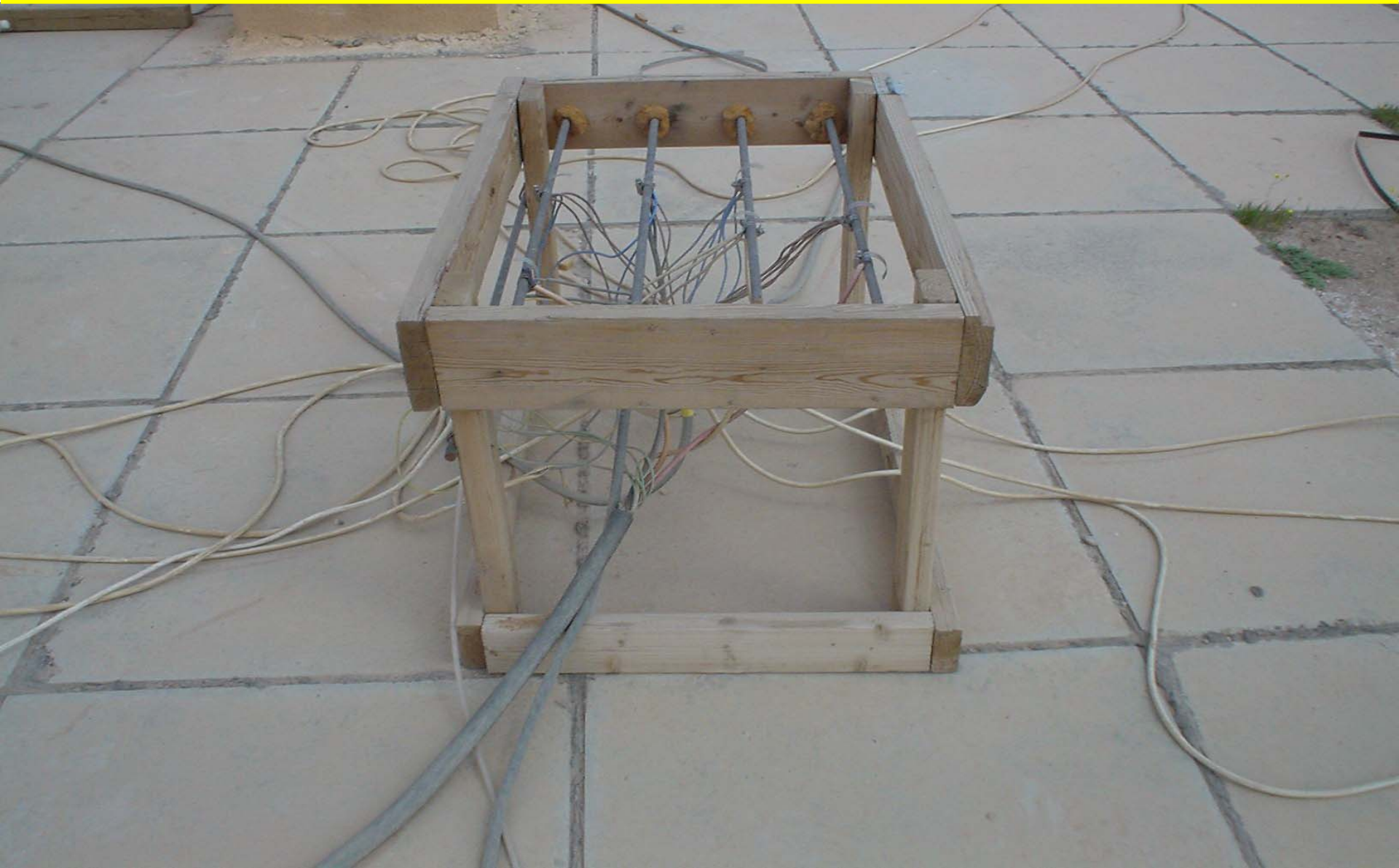
By working together

- Better technologies
- Coherent View
- Round Table
- Road MAP

Mobile Electric Power Distribution – Replacement (MEPDIS-R) and Related Systems

MSgt Fred McCue
Project Officer - Mobile Power Team
fred.mccue@usmc.mil

Somewhere in Iraq….



Agenda

- **Overview of projects**
  - **MEPDIS-R**
  - **Field Wiring Harness**
  - **Tent Lights**
  - **Field Food Service Buss Duct**
- **Future roadmap**
- **Questions**

Current USMC MEPDIS

- **Fielded in early 1980's / Fabricated by FPI**
- **3 size panels**
  - **15 kW – TAMCN B595**
  - **30 kW – TAMCN B600**
  - **100 KW – TAMCN B605**
- **Single power inputs**
- **60 & 400 Hz compatible**
- **10 wire sets issued with system**
- **Amphenol© military connectors**

Field Wiring Harness

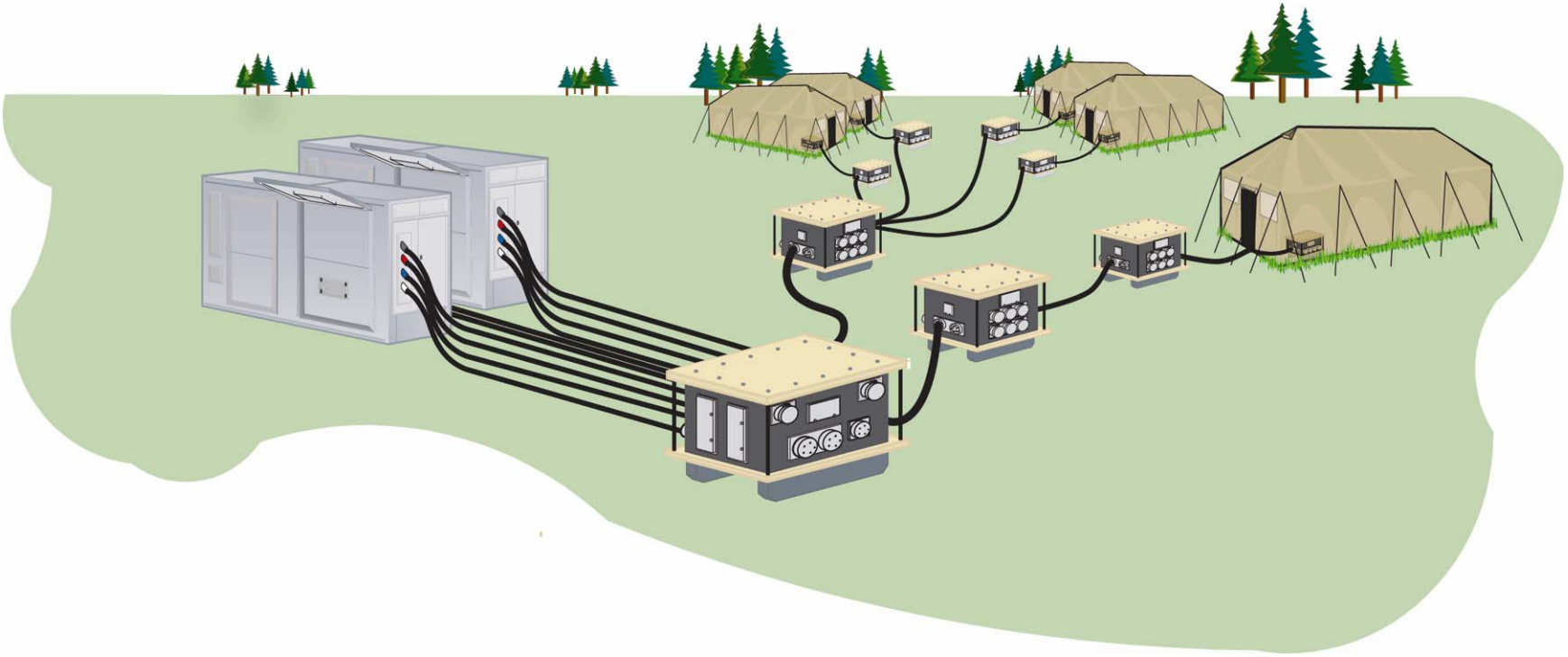
Used for Tent lighting and general electrical hook-ups

12 different wire assemblies + light bulbs

Weight: 764 lbs. / Cube: 32 ft^3

TAMCN: B0608

MEPDIS-R

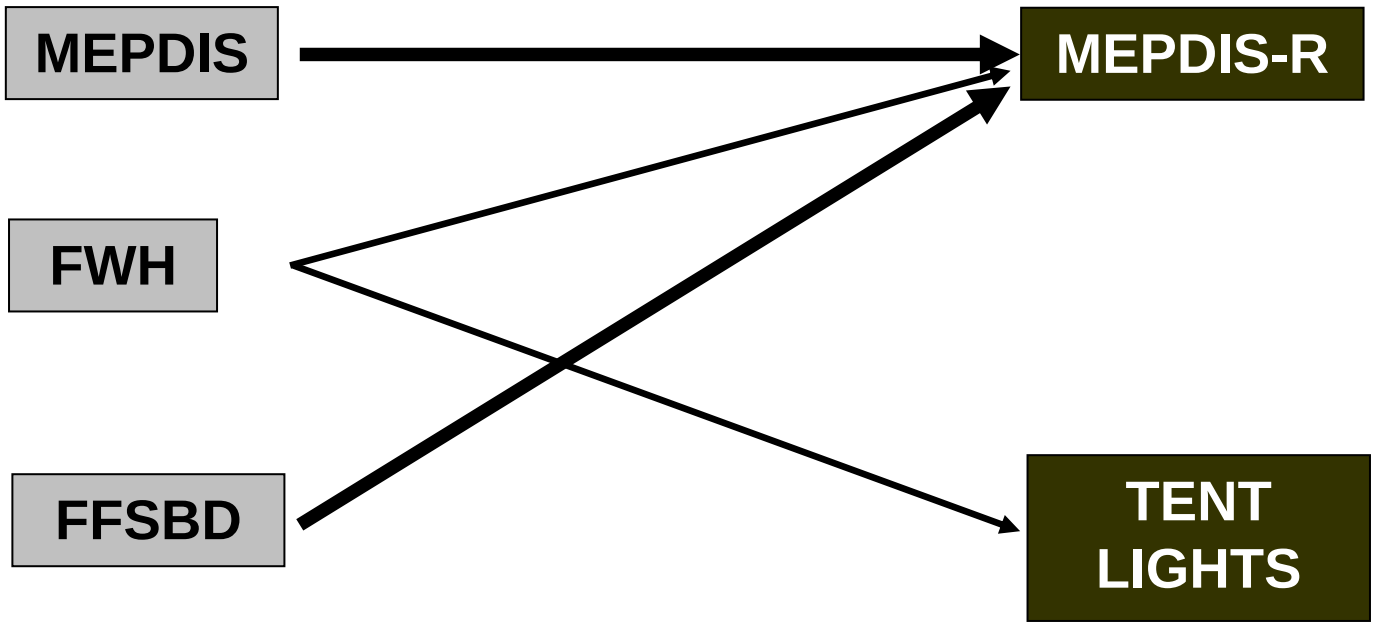


MEPDIS-R will replace current MEPDIS (B0595, B0600, B0605) and Field Wiring Harness (B0608)

MEPDIS-R

- **Replaces functionality of MEPDIS and the Field Wiring Harness (FWH) when used with new tent lights.**
- **System composed of six different types of power distribution panels, each with associated cables and accessories.**
- **Compatible with MEPDIS and existing equipment**
- **Based on commercial components and technology**

System Roadmap

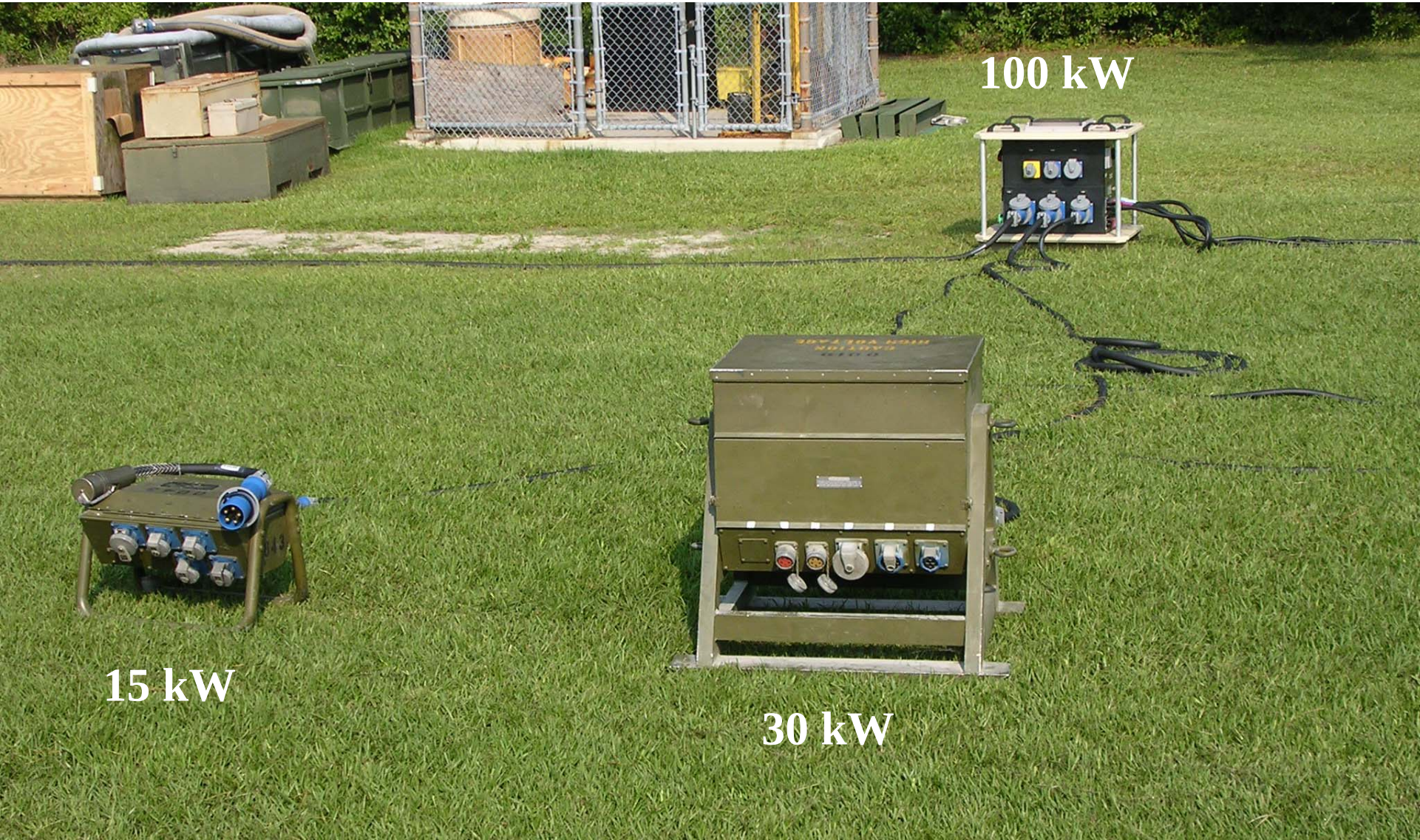


Note that MEPDIS, FWH, and FFSBD are interoperable with MEPDIS-R and will remain in service for the near future.

MEPDIS-R Evaluation

- **Competed to industry based on performance specifications and established interfaces – 2005**
- **Lex Products selected – 2005**
- **System extensively tested – 2005/06**
  - **Environmental testing (Aberdeen)**
  - **Electrical performance testing (Aberdeen, MET)**
  - **Durability testing (Aberdeen)**
  - **Field user evaluation (CLNC)**

MEPDIS-R Compatibility (LUE)



MEPDIS-R Power Panels

5 Kilowatt Power Panels

5 Kilowatt Outdoor Non-GFCI Protected Power Panel

- **Input:**
  - **5 wire, 3-phase, 30 amp IEC 309 Pin & Sleeve**
- **Output:**
  - **6 each: 3 wire, 1-phase, 20 amps IEC 309**
  - **3 each: 3 wire, 1-phase, 30 amps IEC 309**
- **Cords:**
  - **6 each: cord sets, 50 ft. each in length with 4 each, 5-15R receptacles**
- **Connectors:**
  - **(3) HBL330P4W 30A 1ø 2P 3W 120 VAC IEC309 Pin & Sleeve Plugs**

5 Kilowatt Indoor GFCI Protected Power Panel

- **Input:**
  - **5 wire, 3-phase, 30 amp IEC 309 Pin & Sleeve**
- **Output:**
  - **9 each: 3 wire, 1-phase, 120 VAC 20A GFCI Duplex Receptacles**
- **Cords:**
  - **6 each: cord sets, 50 ft. each in length with 4 each, 15R receptacles**

15/30 Kilowatt Power Panels

15 Kilowatt Power Panel

- Input:
  - Circuit Breaker Protection
  - 2 each: 5 wire, 3-phase, 60 amp IEC 309 Pin & Sleeve
- Output:
  - 4 each: 5 wire, 3-phase, 30 amp IEC 309 Pin & Sleeve
  - 4 each: 3 wire, 1-phase, 20 amp IEC 309 Pin & Sleeve
  - 1 each: 3 wire, 1-phase, 120 VAC 20A GFCI Duplex Receptacle

30 Kilowatt Power Panel

- Input:
  - Circuit Breaker Protection
  - 2 each: 5 wire, 3-phase, 100 amp IEC 309 Pin & Sleeve
- Output:
  - 4 each: 5 wire, 3-phase, 60 amp IEC 309 Pin & Sleeve
  - 2 each: 5 wire, 3-phase, 30 amp IEC 309 Pin & Sleeve
  - 2 each: 5 wire, 3-phase, 20 amp IEC 309 Pin & Sleeve
  - 2 each: 3 wire, 1-phase, 20 amp IEC 309 Pin & Sleeve
  - 1 each: 3 wire, 1-phase, 120 VAC 20A GFCI Duplex Receptacle

100 Kilowatt Power Panel

- **Input:**
  - **400 Amp Switch Protection, 2 each,**
  - **Cam Style, 5 wire**
- **Output:**
  - **1 each: Cam Type, 200 Amp, 5 wire connection**
  - **4 each: 5 wire, 3-phase, 100 amp IEC 309 Pin & Sleeve**
  - **2 each: 5 wire, 3-phase, 60 amp IEC 309 Pin & Sleeve**
  - **2 each: 5 wire, 3-phase, 30 amp IEC 309 Pin & Sleeve**
  - **2 each: 5 wire, 3-phase, 20 amp IEC 309 Pin & Sleeve**
  - **2 each: 3 wire, 1-phase, 20 amp IEC 309 Pin & Sleeve**
  - **1 each: 3 wire, 1-phase, 120 VAC 20A GFCI Duplex Receptacle**

300 Kilowatt Power Panel

- **Input:**
  - **400 Switch Protection**
  - **3 each Cam Style, 5 wire**
- **Output:**
  - **2 each: Cam Style, 400 Amp, 5 wire connection**
  - **2 each: 5 wire, 3-phase, 100 amp IEC 309 Pin & Sleeve**
  - **1 each: 3 wire, 1-phase, 120 VAC 20A GFCI Duplex Receptacle**

MEPDIS-R Cabling

50' 60A INPUT CABLE PIGTAIL 15KW
NSN: 6150-01-529-7368

50' 100A INPUT CABLE PIGTAIL 30KW
NSN: 6150-01-529-8803

50' 30A CABLE JUMP 15KW-5KW
NSN: 6150-01-529-8428

50' 100A CABLE JUMP 100KW-30KW
NSN: 6150-01-529-8806

5KW OUTDOOR CORD SET ONLY
NSN: 6150-01-530-7352

5KW INDOOR CORD SET ONLY
NSN: 6150-01-530-1960

MEPDIS-R Cabling

50' 60A CABLE JUMP
30KW-15KW
NSN: 6150-01-529-7674

25' 400A (5) Wire Feeder Set
NSN: 6150-01-529-7900

Y-cable with 50 foot extension
NSN: 6150-01-540-3519

Adapter, 100A
Commercial - Mil Std
NSN: 6150-01-529-8424

Adapter, 100A Mil Std -
Commercial
NSN: 6150-01-529-7698

Adapter, 60A Mil Std -
Commercial
NSN: 6150-01-529-8063

USMC Future Direction

- **USMC is moving away from Military Style connectors:**
  - **High Cost**
  - **Long Lead time**
  - **Cables for backward compatibility are part of MEPDIS-R family**
- **Commercial Connectors:**
  - **Fully meet electrical and environmental requirements**
  - **Readily available from industrial supply stores worldwide**
  - **Much cheaper than current Mil Connectors**
  - **Rapid assembly and repair**
  - **Waterproof connection for wet locations**
  - **Separate Ground from Neutral, 3-wire 1-phase, 5-wire 3-phase**
- **Industry standards based on voltage and current**
  - **IEC 309 is standard being followed**
  - **Recently renamed to IEC 60309**

AC Connectors

- **AC connectors are of two types**
  - **Large power**
    - **Single Pole**
  - **Small power**
    - **Multi Pole (3 to 5 wire)**
    - **Less than 125 AMPS**
    - **Pin & Sleeve Connectors**

IEC “P” & “S” Features

- **Provides maximum protection from abuse and environment**
- **Heavy-wall molding resists impact, heat, flame and chemicals**
- **Superior performance in low-to-high ambient temperatures (-40^{o}C to 60^{o}C)**
- **Excellent UV stability for outdoor performance (UL 1682)**
- **V-O flammability rating**
- **Fully insulated**
- **Color coded by voltage for easy identification**

Cam Loc Connectors

Cam Loc Type 16 Connectors

- These are single conductor connectors
- Come in two sizes
  - 2-0 cables
  - 4-0 to 1-0 cables

The connector must be twisted 180 degrees upon insertion, or they can overheat

Cam Loc Benefits & Features

- **Inter-mateable and compatible with competitive cam-type products – can be retrofitted to existing locations and power distribution systems**
- **Locking and reinforcing ring won't melt, break, or crack**
- **Shatter and crack-proof – high durometer thermoplastic elastomer (TPE) or neoprene rubber**
- **Color coded insulating sleeves – fast and easy phase ID**
- **Prevents arching or burning – no movement of contact surfaces**
- **Self-compensating for wear – slit and cam in male contact provides spring action for longer usage**
- **Quick connect/disconnect – twist and pull provided by double cam male and cam-button in female**
- **High conductivity, positive, vibration proof connection**
- **Meet most NEC requirements, are UL listed, NEMA 3R rated (rainproof) for outdoor use**

Form Factors

Tent Lights

- **New tent systems will include florescent tent lights (C3409) as part of the tent. Lights are available to retrofit older tents.**
- **Power distribution systems (5 kW indoor) will power the tent lights, and will provide the power outlets inside the tent.**

Field Food Service Buss Duct

- **FFSBD (C0200) is a 300 KW power distribution panel that allows paralleling of up to three 60 kW or 100 kW generators**
- **Fielded as part of the Field Food Service Kitchen (FFSK)**
- **Will remain in service, but new purchases will be of MEPDIS-R 300 kW panel (B0032)**

Questions ?

Backup Slides

Making the Right Connection is as Easy as Matching Colors and Telling Time!

Leviton's pin and sleeve devices are easy to use. Matching amperage and voltage requirements is literally as easy as matching colors and telling time.

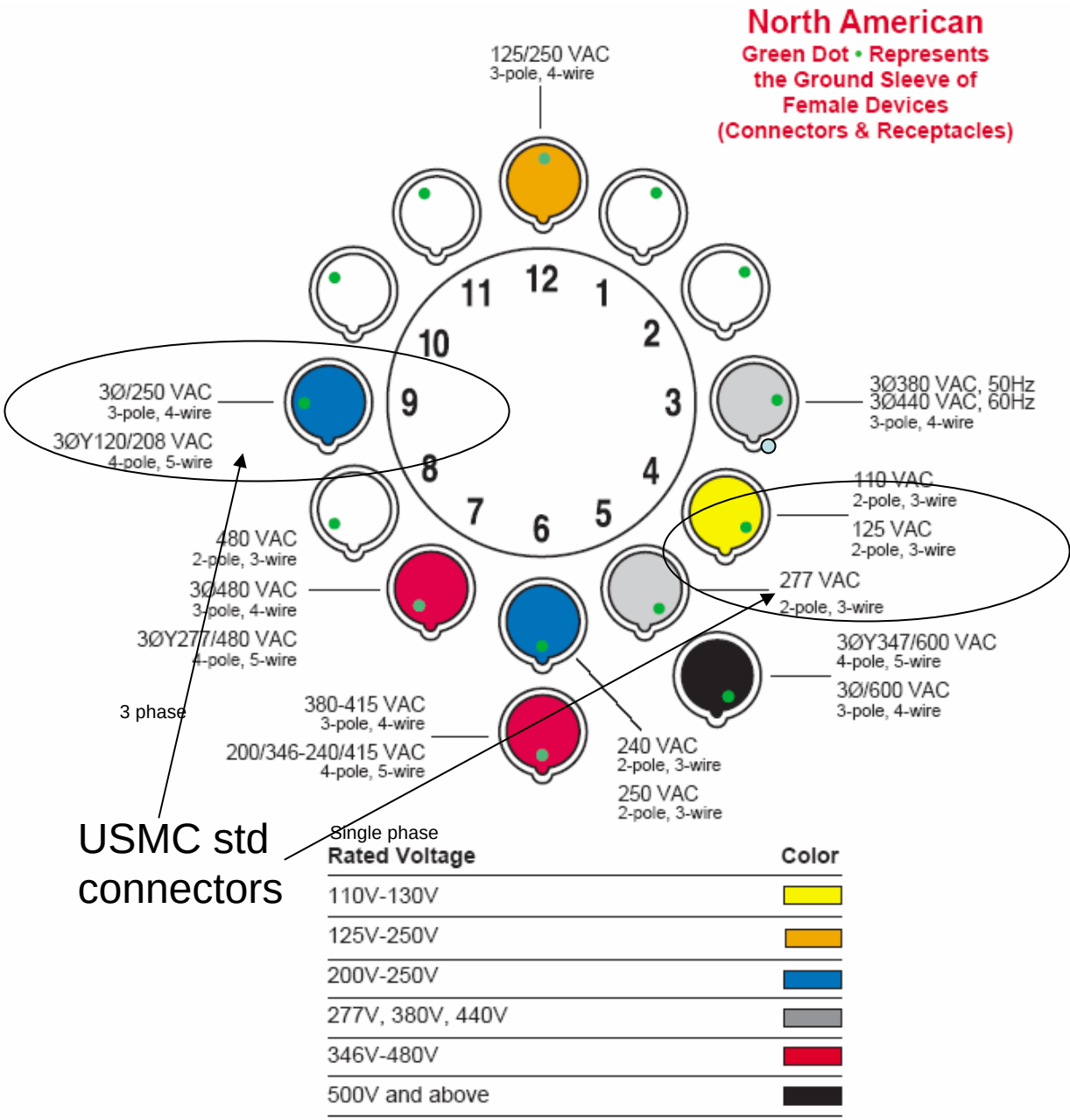
The amperage rating is related to the size of the device; devices of the same amperage are the same size.

The voltage rating is related to the location of the ground sleeve on the female device and the number of conductors. This location is based on a clock face with the key-way at the 6 o'clock position.

The ground sleeve is positioned at a specific hour location, depending on the device's voltage rating.

The clock position for plugs and inlets is a mirror image of the position for matching connectors and receptacles.

For quick visual identification, voltage ratings are also color-coded and the housings of interconnecting units are always the same color. All 125VAC devices are yellow; 250VAC are blue, etc. Matching up interconnecting devices is as easy as matching colors.



Key Design Elements

IEC 309-1 & 309-2

Pin & Contact Carrier 60 & 100 Amp

- Protects pins & contacts, holding them firmly in place
- Pin Carrier and Contact Carrier constructed of glass fiber reinforced nylon for maximum impact resistance and maximum protection of pins and contacts
- Superior arc-tracking resistance
- Excellent heat-resistance and flame-resistance
- Chamfered wire entry makes wiring easier

Gasket/Grommet

- Prevents moisture, dust, and contaminants from entering housing or pin/contact carrier
- Solid Chloroprene for positive seal and excellent chemical/corrosion-resistance
- Onion skin design on grommet provides precise watertight fit, eliminating the need to choose from multiple grommets that may not fit the cable jacket precisely

Spring Loaded Cover, Cover Arm, & Locking Rings

- Rings lock plug to connector
- Spring loaded cover closes automatically
- "Performance grade" Stainless Steel cover spring for superior corrosion-resistance and long life
- Excellent UV stability for outdoor use
- V-0 flammability rating
- Interior arm design in 60 and 100 amp helps eliminate breakage

Receptacle

Inlet

Plug

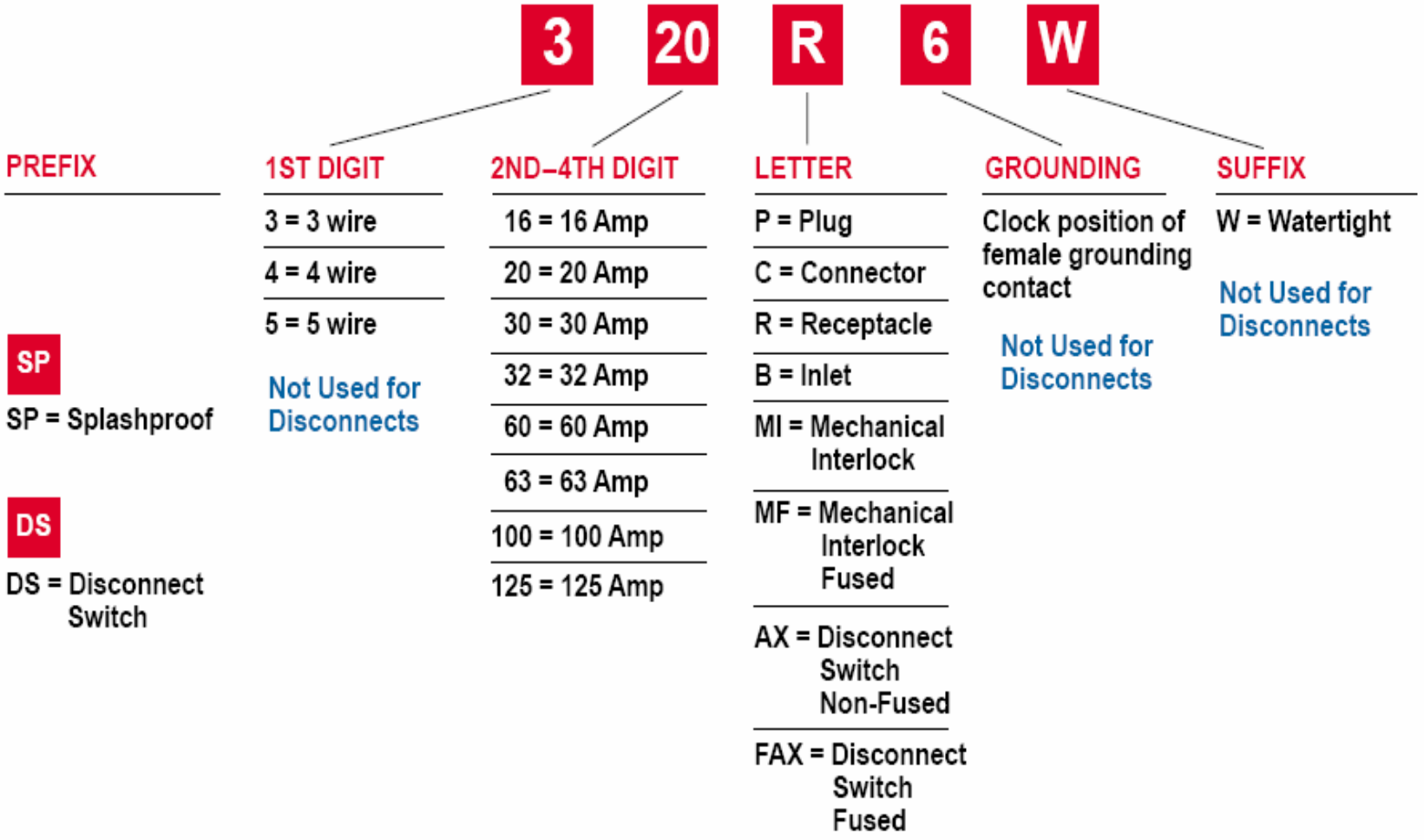
Connector

TYPE	Current Rating	Color	Receptacle Part #	Inlet Part #	Plug Part #	Connector Part #
1Phase 3 wire 100-130V						
1P 3W	15	Yellow	316R4W	316B4W	316P4W	316C4W
1P 3W	20	Yellow	320R4W	320B4W	320P4W	320C4W
1P 3W	30	Yellow	330R4W	330B4W	330P4W	330C4W
3 Phase 5 wire 120/208 V						
3P-5W	20	Blue	520R9W	520B9W	520P9W	520C9W
3P-5W	30	Blue	530R9W	530B9W	530P9W	530C9W
3P-5W	60	Blue	560R9W	560B9W	560P9W	560C9W
3P-5W	100	Blue	5100R9W	5100B9W	5100P9W	5100C9W

Catalog Numbering System

Leviton's catalog numbering system is easy to use. Each letter or number provides a description of the product. Simply follow the six-part code below, made up of letters and numbers. Each catalog number contains the number of conductors, amperage rating, device type, clock position of the ground sleeve, and environmental rating.

For example, the catalog number below refers to a 3-wire, 20 amp receptacle with a grounding sleeve located at the 6 o'clock position and an environmental classification of watertight.



Cam Type Specs

Leviton Catalog #: **16D31-R**
Description: Female, Plug, Detachable, Double Set Screw, 2-2/0 AWG, 300 Amp Max., 16 Series Taper Nose, Commercial Grade, ECT Cam-Type Connector - Red

16 SERIES - TAPER NOSE
Double Set Screw
Plug Connector

2 - 2/0 AWG **DETACHABLE**
300 AMP
600 VOLT

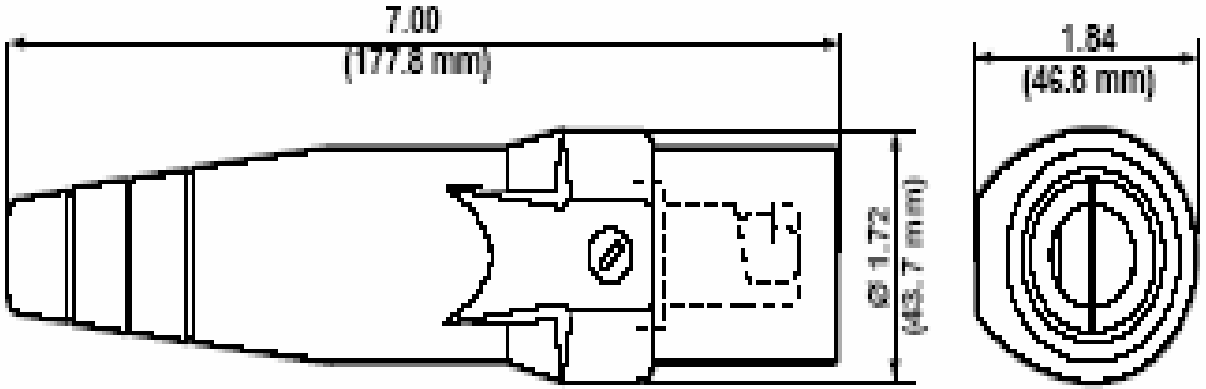
FEMALE

RED

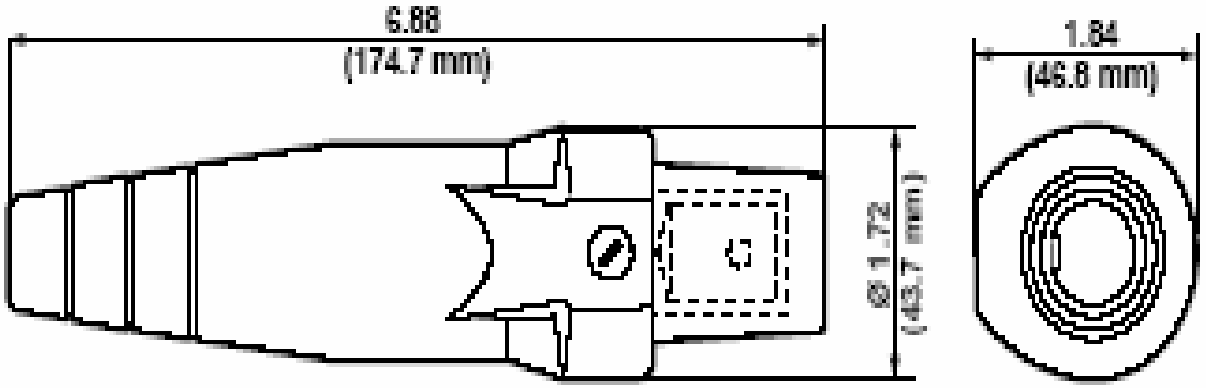
Product Features:

Gender:	Female
Style:	Detachable
Connection Type:	Double Set Screw
Cable Range:	2-2/0 AWG
Max Amperage:	300 Amp
Max Voltage:	600 Volt
Color:	Red
Standards And Certifications:	UL/CSA
Warranty:	NA
Series:	16
Component:	Complete
Contact Cat. No.:	16D31-C
Insulator Cat. No.:	16SDF-22R

Male and Female Designs



MALE DETACHABLE PLUG—CRIMPED
Cat. No. 18D28

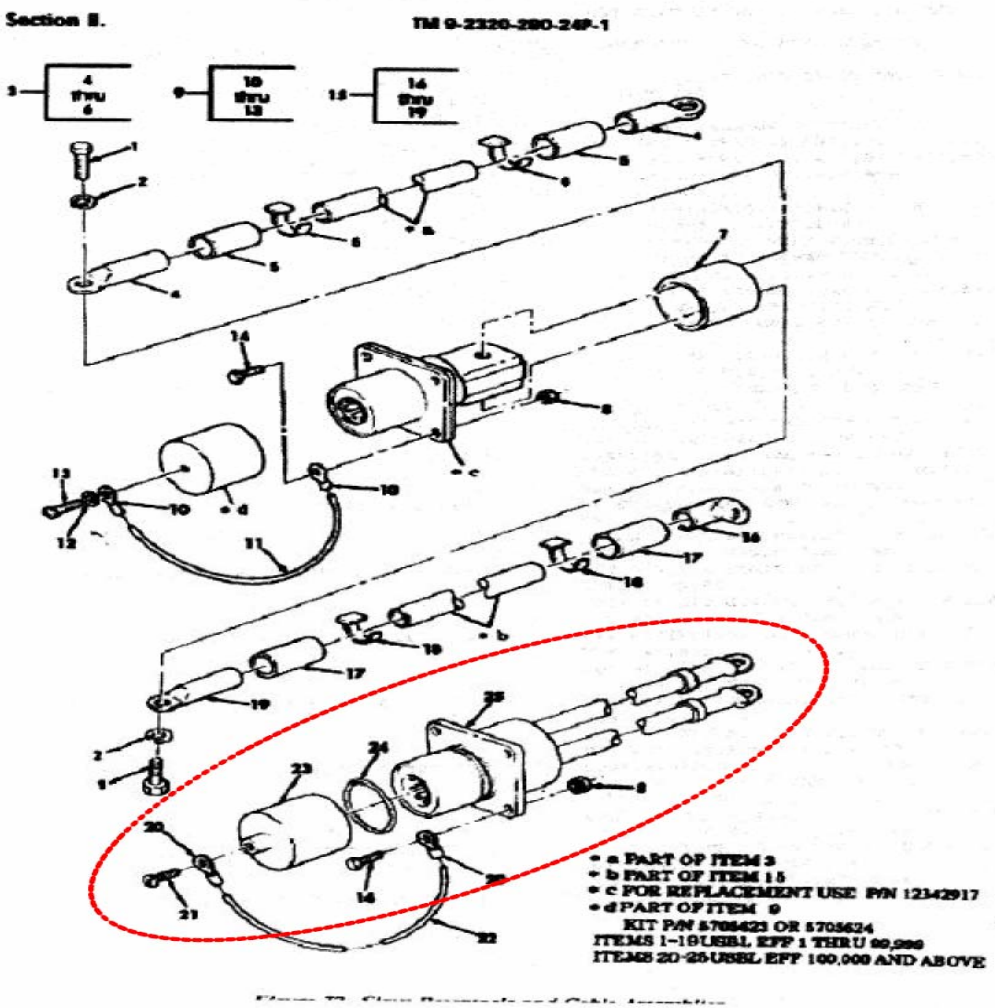


FEMALE DETACHABLE PLUG—CRIMPED
Cat. No. 18D37

DC Connectors

- **Types of DC power distribution connectors**
  - **High Power Cam Loc**
    - **Same as AC**
    - **Different Color Code**
  - **Medium power - NATO Slave**
  - **Low Power**
    - **5-40 VDC, up to 30 Amps**
    - **Efforts still in progress to continue defining models / classes**
- **PM EPS is working to standardize for commonality across future items to be fielded**

NATO Connector - Medium

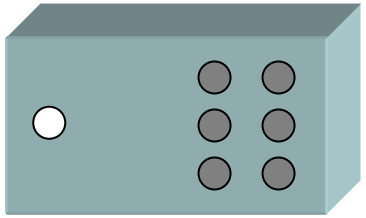


DC Power - Low

Possible Power Sources

- Vehicle Power
- Solar Power Adaptors
- Batteries
- Fuel Cells
- Power Supplies
- DC generator

Input



Output (multiple)

Possible Power Consumers

- Radios
- Sensors
- Computers
- Battery Chargers
- Personal items

Cabling

- **Moving to standardize on SEOOW Cable**
  - **S – 600 Volt Thermoset service cord**
  - **E – Elastomer compound**
  - **O – Oil resistant inner conductor insulation**
  - **O – Oil resistant outer jacket**
  - **W – Outdoor, harsh, industrial environment**
- **Balance between the weight concerns and performance needs**
- **Suitable for full spectrum environmental profile**
- **Description sheet provided on conference CD**

Sample Cabling Specification

PART NUMBER:	22329
DESCRIPTION:	10/3 STRANDED TYPE SEOOW SUBMERSIBLE FLEXIBLE POWER CABLE
CONSTRUCTION:	This cable consists of three bare copper insulated conductors cabled with fillers and an overall jacket.
APPROVALS:	UL Standard 62, CSA 22.2 No. 49, NEC Article 400.
APPLICATION:	600V Portable Oil and Water Resistant Submersible Outdoor Flexible Power Cable

Construction Parameters:

Conductor	10 AWG Bare Copper
Stranding	104/30
Insulation Material	105C TPE
Insulation Thickness	0.046" Nom.
Insulated Conductor Diameter	0.210" Nom.
Number of Conductors	3
Lay Length	3.50" Nom.
Filler Type	Polypropylene
Separator/Wrap	Paper Tissue
Jacket Material	105C TPE
Jacket Thickness	0.100" Nom.
Overall Cable Diameter	0.655" Nom.
Approximate Cable Weight	265.9 Lbs/1M' Nom.
Flame Rating	UL/CSA Horizontal Flame Test

Electrical Properties:

Temperature Rating	-50°C to 105°C
Operating Voltage	600 V RMS Max.
DC Resistance per Conductor @ 20°C	0.99 Ohms/1M' Nom.
Max Ampacity per Conductor (Per NEC Table 400-5a)	30 amps/cond (Assume two current carrying conductors) (Note: Because of 105C temperature rating, higher current can be used under engineering supervision)

MEPDIS-R Nomenclature

TAMCN	NOMENCLATURE
B0027	5 kW Indoor MEPDIS-R panel
B0028	5 kW Outdoor MEPDIS-R panel
B0029	15 kW MEPDIS-R panel
B0030	30 kW MEPDIS-R panel
B0031	100 kW MEPDIS-R panel
B0032	300 kW MEPDIS-R panel

Panels include input and output cables, cable reels, and other items.

MEPDIS-R Cable Reels

Large and Small model

Stackable (anti-slip lugs welded)

Fielding Plan

- **MEPDIS-R panels are not a one-to-one replacement for MEPDIS panels.**
- **Allowances appear by MEPDIS-R panel TAMCN.**
- **Unit allowances determined by capability.**
- **Plan is to field to individual units, vice MEF IIP.**
- **MEPDIS and Field Wiring Harness (FWH) will remain in service for near future.**

Fielding Schedule

		3RD QTR FY07 FIELDING					
MEF	**UNIT**	**5 KW O**	**5 KW I**	**15 KW**	**30 KW**	**100 KW**	**300 KW**
I MEF	7TH ESB	50	25	12	8	4	2
I MEF	9TH COMM	30	15	7	8	8	2
BIC	MPS-1	80	40	16	28	8	4
		4TH QTR FY07 FIELDING					
		5 KW O	**5 KW I**	**15 KW**	**30 KW**	**100 KW**	**300 KW**
III MEF	9TH ESB	50	25	12	8	4	2
III MEF	7TH COMM	20	10	5	8	4	2
IV MEF	6TH ESB	50	25	12	8	4	2
IV MEF	6TH COMM	30	15	7	8	8	2

Fielding Schedule

		1ST QTR FY08 FIELDING					
		5 KW O	**5 KW I**	**15 KW**	**30 KW**	**100 KW**	**300 KW**
II MEF	8TH ESB	50	25	12	8	4	2
II MEF	8TH COMM	30	15	7	8	4	2
II MEF	MWSS 271	32	16	8	6	4	2
II MEF	MWSS 272	32	16	8	6	4	2
II MEF	MWSS 273	32	16	8	6	4	2
II MEF	MWSS 274	32	16	8	6	4	2
I MEF	MWSS 371	32	16	8	6	4	2
I MEF	MWSS 372	32	16	8	6	4	2
I MEF	MWSS 373	32	16	8	6	4	2
I MEF	MWSS 374	32	16	8	6	4	2
III MEF	MWSS 171	32	16	8	6	4	2
III MEF	MWSS 172	32	16	8	6	4	2
IV MEF	MWSS 471	32	16	8	6	4	2
IV MEF	MWSS 472	32	16	8	6	4	2
IV MEF	MWSS 473	32	16	8	6	4	2

Fielding Schedule

		2ND QTR FY08 FIELDING					
		5 KW O	**5 KW I**	**15 KW**	**30 KW**	**100 KW**	**300 KW**
I MEF	1ST CEB	20	10	5	4	2	0
II MEF	2ND CEB	20	10	5	4	2	0
III MEF	3RD CAB	40	20	10	4	2	0
IV MEF	4TH CEB	20	10	5	4	2	0

Fielding Issues

- **MEPDIS-R is a significant improvement over MEPDIS and is fully compatible with it.**
- **7th ESBn & 9th CommBn will receive MEPDIS-R in June 2007**
- **MWSSs will receive MEPDIS-R ~ Oct 2007.**
- **1st CEB will receive MEPDIS-R ~ Feb 2008.**
- **All shipments will be direct to unit, not IIP,**
- **Retain MEPDIS until no longer serviceable.**
- **NET to be conducted by Talmadge Jackson, FSR.**

IF NOTHING ELSE, REMEMBER THIS:

- **MEPDIS-R will complement MEPDIS.**
- **Retain MEPDIS until no longer serviceable.**
- **Call the Project Officer or FSR if you need help.**

Testing of COTS/NDI Products

Joint Service Power Exposition

25 April 2007

Testing of COTS/NDI Products

Joint Service Power Exposition

25 April 2007

Session 10

Introduction

Mr. John O'DONNELL, USMC

Marine Corps Approaches

Mr. John O'DONNELL, USMC

Navy COTS Testing

Mr. Randy Haag, Manger, Power Systems Division NSWC Crane

COTS Testing By the ARMY

Mr. Jose Antonetti , Test Director
US Army Aberdeen Test Center

Testing of COTS/NDI Products

USMC Approach

John O'Donnell

John.h.odonnell@usmc.mil

Joint Service Power Exposition
25 April 2007

Testing For Military Use

- **Why COTS ?**
- **Cheaper**
- **Get quicker Avoid Development and Qualification**
- **Vendor handles Configuration and Tech Data Package**
- **Faster Delivery Schedule**

Why Do We Test?

- **The operating environment is more extreme**

  Greater Temperature extremes

  Sand and Dust Rain and Salt Air

  EMI interference issues

  The transportation conditions are more extreme

  The power used for power is from Generators (greater surges sags and phase anomalies)

Transportation

- **The Marine profile is based on transportation off road 80% of the time.**
- **The transportation is in the back of truck**
- **Units are dropped and transported to extreme altitudes and via watercraft.**

Testing

- **Road Course Testing**
- **Loose cargo bounce**
- **Drop Testing**
- **Lift and Tie Down**
- **Environmental**
- **EMI**

Vibration USMC way

Testing

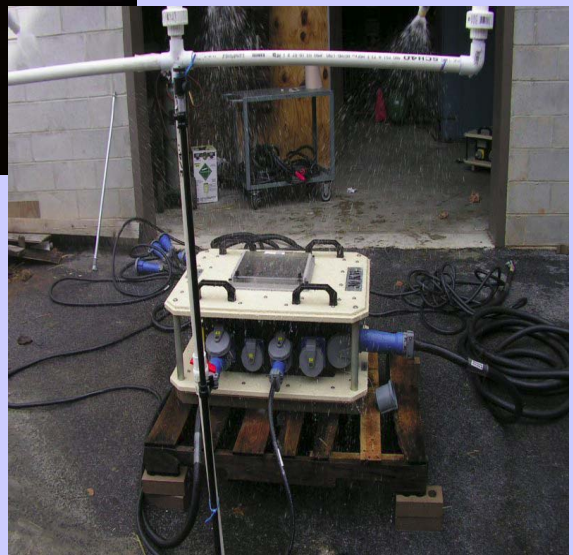
Lift and Tie Down

Drop testing

Rail Impact

Testing Transportation

Testing Environmental

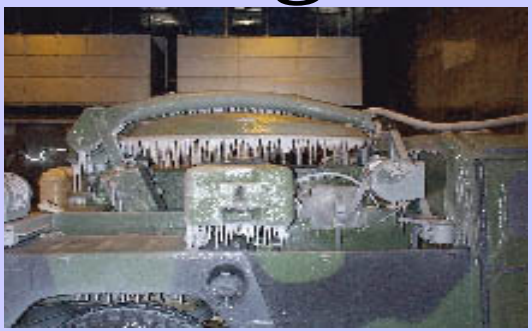


Temperature -40 to 160 F storage

-25 to 130F operating with solar

Salt Fog Rain and Humidity Dust and Sand

Testing Environmental

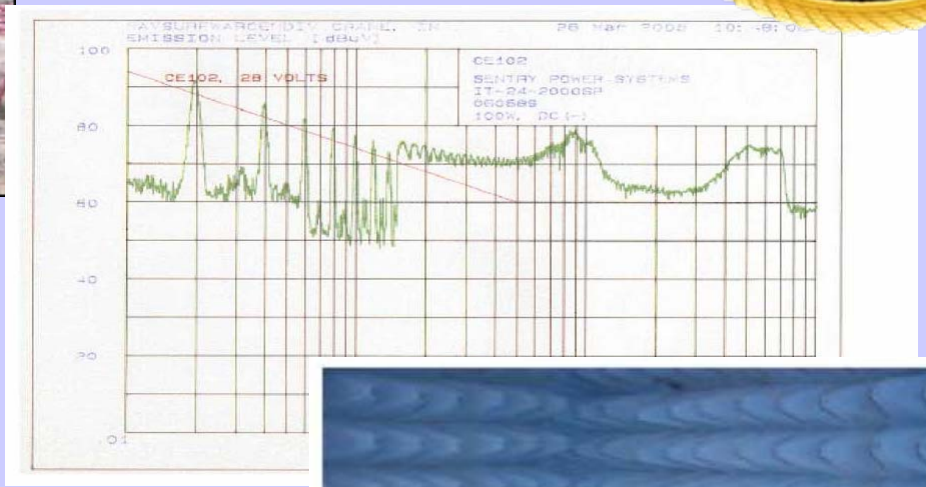


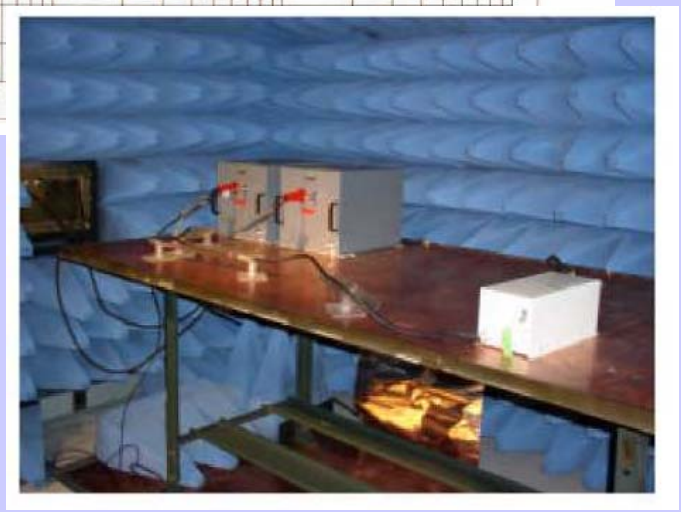
Temperature -40 to 160 F storage

-25 to 130F operating with solar

Salt Fog Rain and Humidity Dust and Sand

Testing EMI





Do I effect other equipment ?

Does other Equipment Effect Me?

Testing Performance

- **How will unit work in USMC environment does performance change?**
- **Does it perform as manufacturer claims?**
- **What are the safety issues ?**
- **Human Factors Is it Marine proof?**
- **Operational Testing with training module and manual evaluation**

Sample Power Supply Performance Test Plan

2. The following tests and examinations were performed:

M[redacted] 1[redacted]	[redacted]	[redacted]	[redacted]
Visual	Visual	Visual	Visual
*Initial Electrical	*Initial Electrical	*Initial Electrical	Initial Electrical
Drift	*Drift	Drift	Drift
*Temperature		*Temperature	*Temperature
Humidity		Humidity	
Thermal Shock		Thermal Shock	
Altitude		Altitude	
Vibration		Vibration	
Shock		Shock	
Transit Drop		Transit Drop	
Bench Handling		Bench Handling	
Dripproof		Drippoof	
*EMI		*EMI	
Salt Fog		Salt Fog	
*Post Electrical		Post Electrical	Post Electrical
Safety		Safety	
Human Factors		Human Factors	

Testing Conclusion

- **How will unit work in USMC environment?**
- **Will arrive intact?**
- **What are the limits of operation ?**
- **Is it Marine proof?**

USMC Family of Environmental Control Equipment

Major David C. Morris
Deputy Program Manager / Project Officer
david.c.morris@usmc.mil

AGENDA

- **USMC Family of Environmental Control Units (ECUs)**
- **Issues with current ECU Family**
- **Future Family of ECUs**
- **Desired Improvements**
- **Technologies of Interest**
- **Field Refrigeration System/Refrigerated Boxes**
- **HVAC Tool Kit**

FAMILY OF ECUs

- ¾ Ton (9,000 BTU/hr)
  - In production verification testing
- 1.5 Ton (18,000 BTU/hr) ECU
  - Fielding
- 3 Ton (36,000 BTU/hr) ECU
  - Fielding
- 5 Ton (60,000 BTU/hr) ECU
  - Fielding
- 8 Ton (96,000 BTU/hr)
  - Developed and tested, but not fielded

FAMILY OF ECUs

- USMC unique items
- 50/60 Hz
- R-22 Refrigerant
- Replaces multiple types of (vertical and horizontal) military standard units
- 3/4 Ton unit is single phase 120 VAC
- Larger units are three phase 208 VAC

ECU ISSUES

- **400 Hz ECUs**
  - **The family of ECUs does not replace any 400 Hz ECUs.**
  - **The problem of supporting 400 Hz systems is a known issue.**
  - **We are developing an interim solution of refurbishing the fleet of 400 Hz ECUs to extend service life until the requirement disappears.**
- **Family of ECUs interface issues**
  - **The family of ECUs does not interface with some specific systems in the same way as the older ECUs.**
  - **The interfaces are being redesigned for replacement systems.**
  - **Interim solution is to retain existing ECUs for those limited applications.**

FUTURE ECU FAMILY

- **A new family of ECUs will be developed to replace the current "family of" ECUs in the 2010-2012 time frame.**
- **New refrigerant**
  - **Will need to use a more environmentally friendly (and less regulated) refrigerant.**
  - **Next refrigerant is yet to be determined, but industry and the US Army seem to like R-410A.**
  - **For economy, we will follow industry as much as possible.**
  - **R-134A will see continued use in automotive systems and refrigeration systems.**
- **New family will probably have same ECU sizes, but largest unit may be 10 tons rather than 8 tons.**

DESIRED IMPROVEMENTS

1. Reduced power requirements
2. More ruggedization (for transport)
3. “Soft Start” to reduce startup power
4. Better energy efficiency
5. Reduced noise
6. Better heating capability
7. Multi-frequency and multi-voltage capability

TECHNOLOGIES OF INTEREST

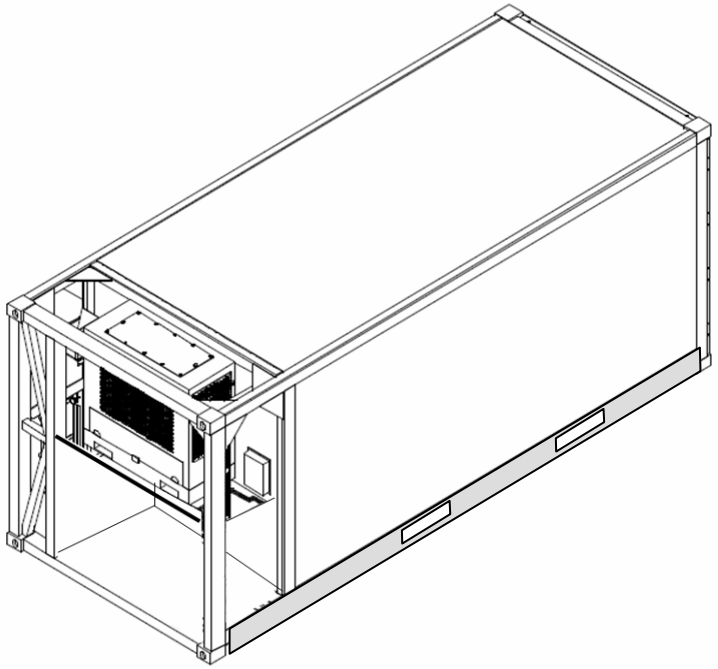
- **Variable speed drive for compressors**
- **Variable displacement compressors**
- **Multi-compressor systems**
- **Environmentally acceptable refrigerants**
- **Heat pumps**
- **Thermo-electric systems**
- **Fabric ducts**
- **Radiant spot heating**

FIELD REFRIGERATION SYSTEMS

- Large Field Refrigeration System (LFRS)
  - Based on standard 20-foot insulated ISO container
- Mortuary Affairs Refrigeration System (MARS)
  - Similar to LFRS, but with unique internal features
- Small Field Refrigeration System (SFRS)
  - Developed by Food Services
  - Based on Quadcon (quarter ISO) container
- “Legacy” 10-foot Refrigerated Boxes

LARGE FIELD REFRIGERATION SYSTEM

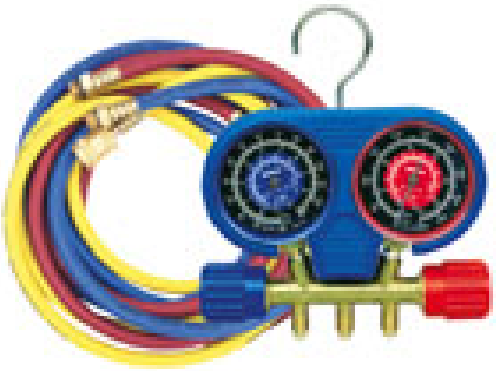
- **Large Field refrigeration System (LFRS)**
  - Based on standard 20-foot ISO container
  - Based on commercial equipment modified to meet military requirements
  - Single item for refrigeration unit and insulated box (no longer two separate items)
  - Currently awaiting responses from vendors



Food Services and Utilities support have landed !

FUTURE RECOVERY SYSTEM

- Will be included in new version of HVAC tool kit
- Replaces functionality of existing recovery machine in a more portable kit
- Advantages:
  - Portable
  - Light
  - No digital screen
  - Faster recovery
  - Oil-less compressor
  - Can be used with more refrigerant types
  - No filters to replace



Notional Solution Only

NEW HVAC TOOL KIT

Replacement for Refrigeration Tool Kit

- Replaces 2 existing items with one
- Modern refrigeration tools
- Updated hand tools
- Also replaces consumables kit that is currently a separate item
- <u>Currently awaiting responses from vendors</u>

Current System

Tool Kit, Refrigeration Service, Expendable Supplies

Recovery Machine

New HVAC Toolkit

Questions ?

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14

Integrated Trailer-ECU-Generator (ITEG)

Major David C. Morris
Deputy Program Manager / Project Officer
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WHY ARE WE HERE ?

Family of Generators
2 – 100 kW

Family of Trailers
HMMWV, MTVR, LVS

Family of ECUs
9K – 96K BTU/hr

But all three can not be mated and HMMWV towed

(with sufficient power and cooling capacity)

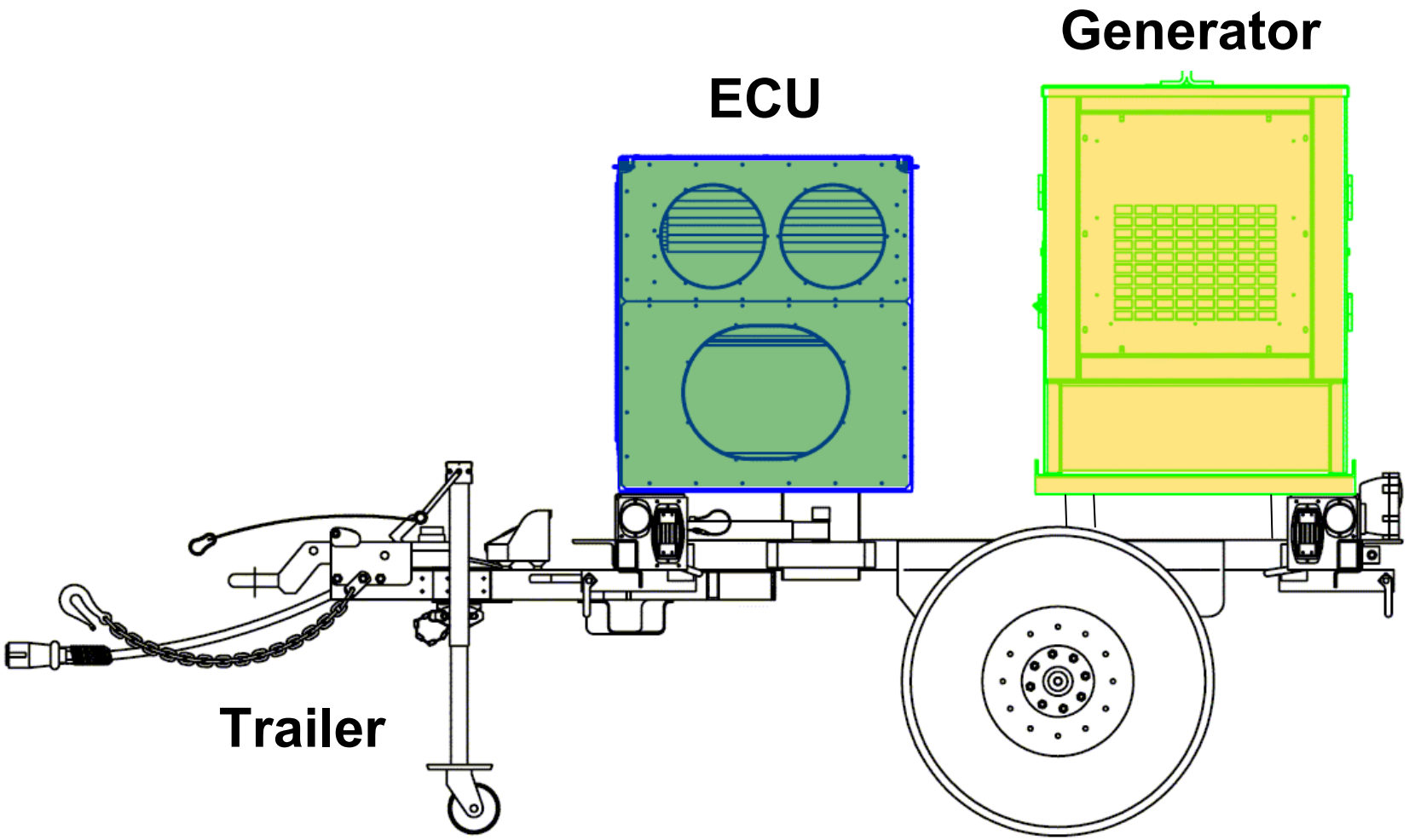
AGENDA

- ITEG Definition
- Requirement
- History of ITEG Development Efforts
- Current ITEG Effort
- ITEG Supportability
- Project Timeline
- ITEG Project Issues
- Future ITEG development
- Questions

ITEG DEFINITION

- **Integrated Trailer-ECU-Generator (ITEG), also known as Generator-ECU-Trailer (GET)**
- **System that combines a diesel electric generator and Environmental Control Unit (ECU) on a HMMWV-towable trailer**
- **Usually includes requirement for additional cargo capacity to carry a tent on the trailer**
- **General requirements**
  - **Mobility: 4200 lbs or less gross weight & HMMWV towable**
  - **Power available: 10 kW or more with max ECU demand**
  - **ECU: 8 tons/96,000 BTU per hour cooling and 40,000 BTU per hr heating**

ITEG DEFINITION



USMC ITEG REQUIREMENT

- **4 Universal Needs Statements (UNS) have come into MCCDC for ITEG systems**
  - **2 Urgent, 2 Conventional**
  - **Currently being validated via Combat Development Process**
- **An ITEG variant (General Dynamics GET Spiral 1) is currently part of the Combat Operations Center (COC) program.**
- **Various other commercial ITEGs have been purchased by Marine Corps units for other purposes.**

ITEG DEVELOPMENT EFFORTS

- **Efforts began in 2005**
  - **Model development and analysis**
  - **Identification of three primary courses of action**
    - **Commercial off-the-shelf (COTS) or Modified COTS item**
    - **Integration of existing USMC components**
    - **Developmental system**
- **Based on business case analysis and user community input, the integration approach was selected (77% user preference).**

ITEG DEVELOPMENT EFFORTS

User community ranking of ITEG attributes:

1. **Performance**
   - **Generator (export power availability)**
   - **ECU (cooling capacity)**
   - **Trailer (mobility)**
2. **Maintainability**
3. **Supportability**
4. **Transportability**
5. **System safety and human factors engineering**

ITEG COURSES OF ACTION

1. **Do nothing – status quo**
   - Disparate & varied equipment in the fleet
   - Throw-away systems
   - No organic support
2. **Integrate existing USMC / Army supported products into system**
   - All built for general purpose, not specific use
   - Individually optimized for HMMWV transport, not in unison
3. **Procure COTS / NDI**
   - Least up-front cost
   - Adequate market to select from
   - Fleet acceptance of products
4. **Modify COTS / NDI**
   - Could possibly garner another 5-10% improvement
   - Requires time and money
5. **Developmental System**
   - Requires lots of time and money
   - Some long range efforts are underway (USMC SBIR, Army R&D)

COA 2 - INTEGRATE EXISTING COMPONENTS

- **Integration effort attempted with:**
  - **M-1102 HC trailer (HMMWV)**
  - **B0980Generator (MAGNUM 22 kW)**
  - **B0014 ECU (96,000 BTU/hr)**
- **Failed safety assessment due to excessive weigh**
- **Will re-investigate in 2008 with new MTVR trailer (8000# payload)**

MTVR Trailer

CURRENT ITEG PROJECT

- **With no funding available for a research and development program,**

- **The only remaining Course of Action was to acquire a COTS/NDI system (COA #3)**

CURRENT ITEG PROJECT

- **Market research performed in 2006 for:**
  - **HMMWV towable**
  - **96K BTU/hr cooling**
  - **20-30 kW total electrical power**
  - **300-500 lbs additional payload capacity**
- **Competition of responding vendors with commercial systems was held in 2006**
- **Program funded by the Defense Acquisition Challenge Program (OSD)**

CURRENT ITEG PROJECT

- **GD C4S Generator-ECU-Trailer (GET) selected**
  - Loaded Weight ≤ 4200 lbs
  - HMMWV towable
  - Payload Available ~ 290 lbs
  - Generator Capacity 20 kW
  - Export approx. 5-7 kW (with full ECU load)
  - Cooling Capacity 96,000 BTU/Hr *
  - Meets Environmental Performance requirements
  - Fuel Capacity 8 hrs
  - Uses modified LTT chassis

Currently in production verification testing

ITEG SUPPORTABILITY

- **The General Dynamics (GD C4S) GET system is the Marine Corps standard for ITEG.**
- **ITEG will be organically supported**
  - **Parts support will be through the supply system**
  - **Maintainers will be trained to repair the ITEG**
- **ITEGs will be centrally controlled items**
- **Intent of this effort is to get the USMC to a single product**
  - **Programs / FMF units with other solutions will be on their own for support.**
  - **Even though we have a standard solution, the losers are still marketing their wares. "Caveat emptor" to the Fleet.**

PROJECT TIMELINE

• Proposals & Bid Samples Received	1 Jun 2006
• Aberdeen Testing (with User Evaluation)	Jun-Aug 2006
• Select/Award Single Winner	Sept 2006
• Deliver 5 systems for First Article Test	Dec 2006
• Conduct Production Verification Test	Dec 2006 to May 2007
• Production Articles available	late 2007

ITEG ISSUES

- **ITEG is not a direct replacement for any current equipment item.**
- **PM EPS will provide the mechanism (contract) for other programs to obtain ITEGs as components of their systems**
- **There is no plan to field to using units as a stand-alone capability unless validated by MCCDC**
- **We have a contract limit of 200 units for the current contract**

ISSUES

- **ITEGs are not the answer to every need**
  - **Standard generators and ECUs are more capable; many performance compromises were required to achieve HMMWV towability.**
  - **Not everything needs to be HMMWV towable.**

FUTURE DEVELOPMENT

- As long as the HMMWV is the tow vehicle, system weight is limited to ≤ 4200 lbs.
- Environmental regulations
  - Force change of refrigerants in ECU (2010)
  - Force change of generator engines (2008)
- More integrated generator/ECU
- Ability to manage and control ECU power requirements while preserving export power and the best possible level of cooling

Questions ?

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http://www.marcorsyscom.usmc.mil/sites/pmeps/default.asp

Joint Services Power Expo
April 24-26, 2007

“Solving power supply obsolescence, reliability, and power density issues by advances in power electronics technology”

Rich Sidley

Custom Manufacturing & Engineering

CUSTOM MANUFACTURING & ENGINEERING, INC.

A Power & Sensors Company

- **Integrated Power Supplies, Power Distribution & Management Products**
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- **Obsolescence Solutions**

Problems

- 1995 DOD policy change allows military to integrate COTS into weapon systems.
  - COTS ≠ Military requirements.
  - Peak availability and lowest pricing of a given component may last only six to 18 months.
- Higher power densities → higher switching frequencies.
  - More RFI/EMI but can be handled by smaller components.
  - Layout (resonance).

COTS ≠ Military

- Special technical requirements for military power supplies fall into three main categories:
  - Environmental:
    - High temp:
      - Semiconductor MTBF halves for every 10 °C increase in operating temperature.
    - Low temp:
      - LCDs.
      - Capacitor dielectric.
      - Crystallization of potting compounds.
    - Shock and vibration resistance.
    - Dust.
    - Moisture.

COTS ≠ Military

- The special technical requirements for military power supplies fall into three main categories:
  - Input and output voltage:
    - Military specifications are stringent for low and high line conditions and voltage spikes, surges and excessive input ripple.
    - Output voltages are often non-standard when compared with commercial products.

COTS ≠ Military

- The special technical requirements for military power supplies fall into three main categories:
  - Electro-magnetic compatibility:
    - COTS does not necessarily pass any EMI standards
    - Military limits typically 10 Hz to 1 GHz, adding a range of conducted and radiated susceptibility and emissions requirements.
    - FCC and Europe's EN55022 are lower bandwidth, etc.

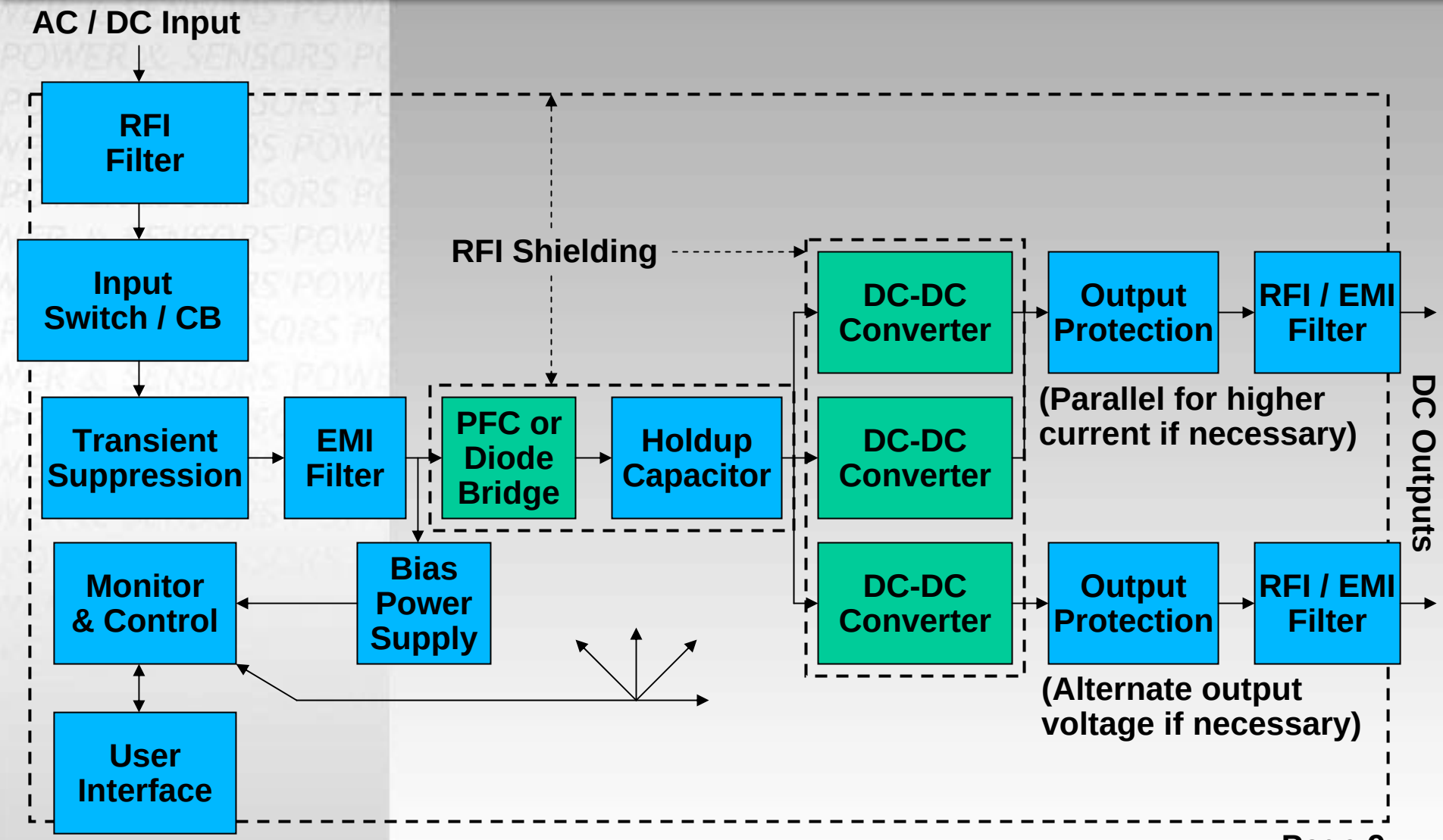
COTS ≠ Military

- Additional glue components:
  - Input and output conditioning are needed to achieve compliance.
  - Active filters remove spikes and filter both conducted emissions and conducted susceptibility such as transients or input ripple appearing at the output.
  - Radiated emissions are dealt with by complete screening of the final power supply.
- Considerable certification testing.

Military COTS

- Some components are called “Military COTS” but still are not self-sufficient to meet all military and system requirements.

CME's Generic Military Power Supply

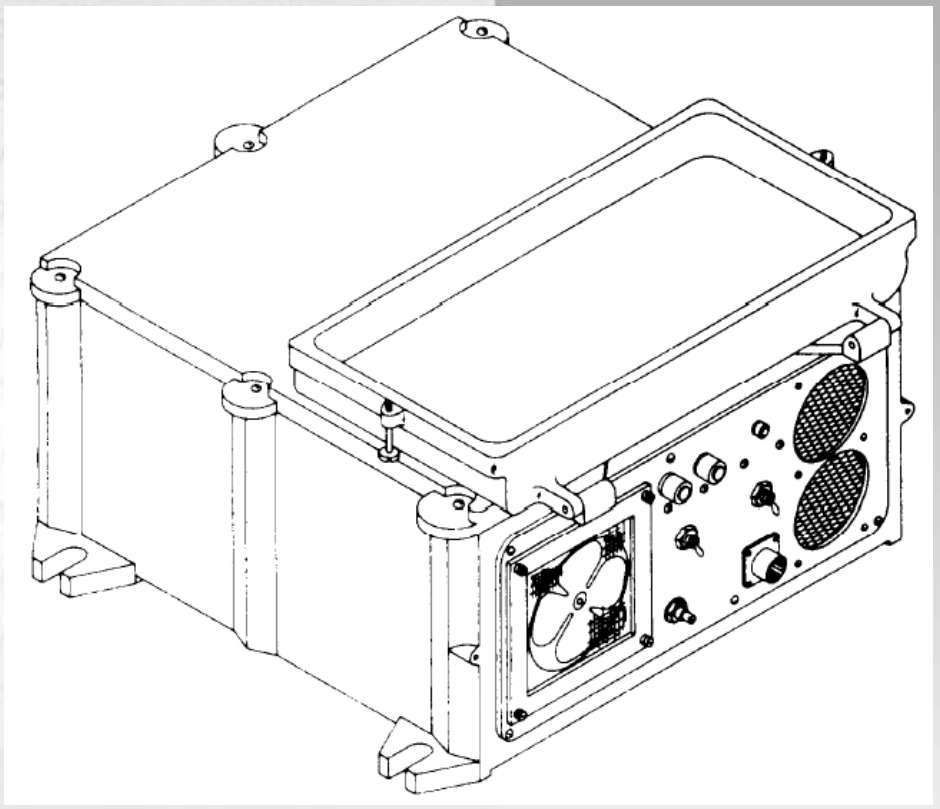


CECOM Tactical Power Supply W15P7T-04-R-C006

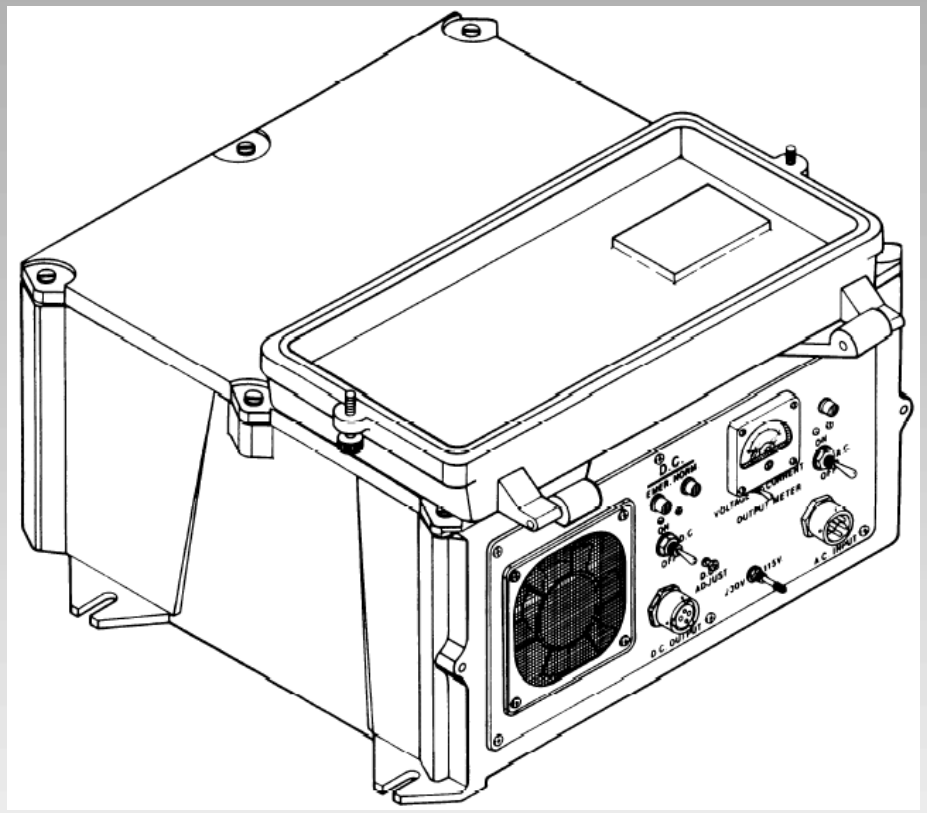
- Solicitation:
  - "The Army is seeking alternative designs for the cover used to protect the front panel assembly. Currently, the cover is attached to the housing assembly using steel spring pins and hinges. In a tactical environment, these pins break easily."
  - Combining two similar power supplies:
    - PP-2953C/U
    - PP-6224B/U

    into one via MIL-PRF-49080B (CR).

Two Obsolete Power Supplies

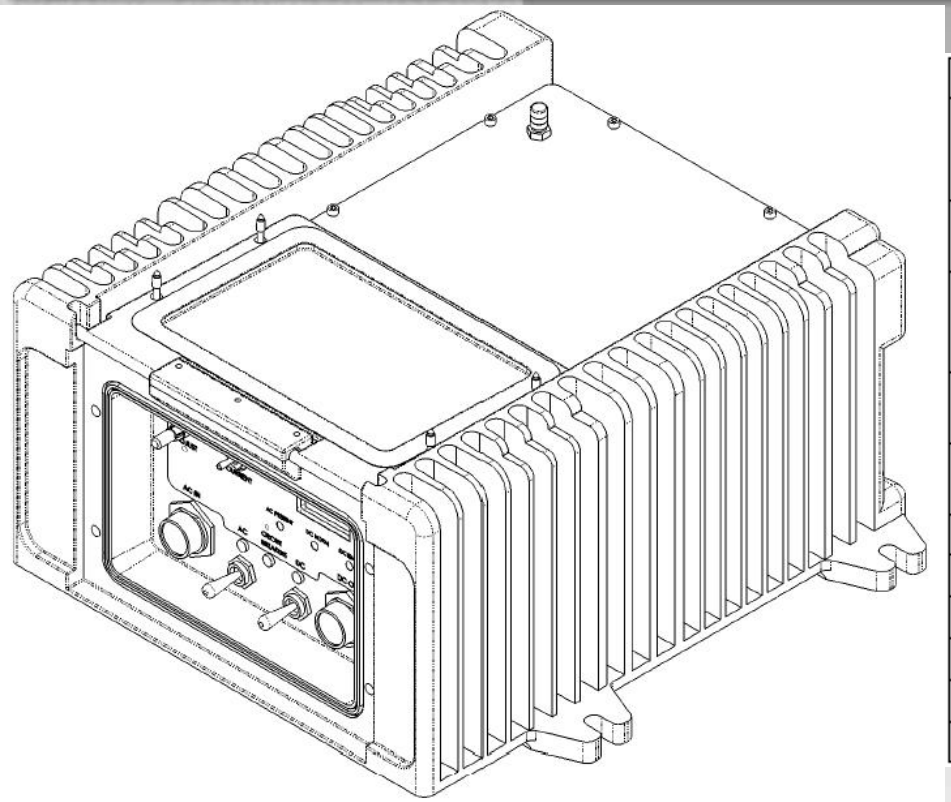


PP-2953C/U



PP-6224B/U

Combined Replacement Power Supply



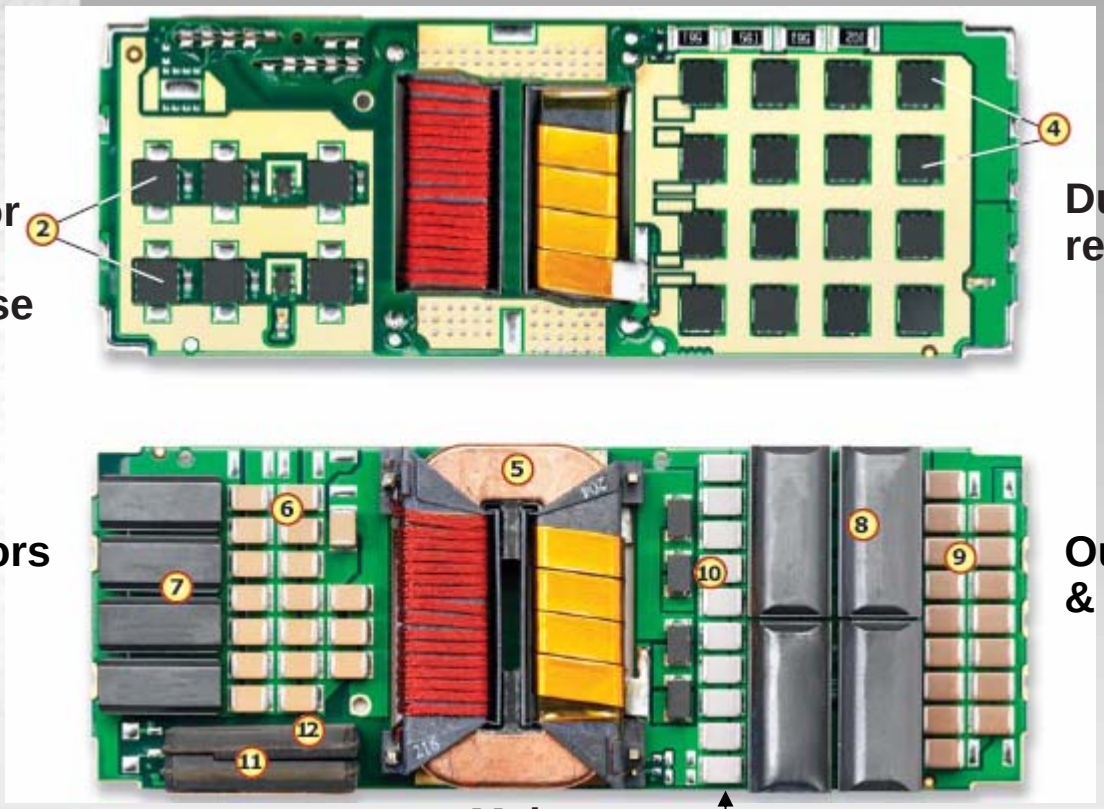
PARAMETER	CHARACTERISTIC
Power Input	115/230 VAC, 50, 60, or 400 Hz, Single Phase (Automatic input power detection)
Power Output	Adjustable 24 – 32 VDC at 0 to 25A (800W)
Standby Mode	24 VDC Battery Standby Mode (pass-through, not DC-to-DC) adjustable from external battery
Output Stability	+/- 1% peak, 0.5% RMS max ripple from 20 Hz to 10 MHz
Temperature Operating Range	Ambient temperatures in the range of 150° F (+66°C) to -40°F (-40°C)
Efficiency	Greater than 70%
Height	7.0 Inches
Width	14.25 Inches
Depth	14.5 Inches
Volume	1446 Inches^3 (0.55W per Inch^3)
Weight	36 Pounds (22W per pound)

PP-2953D/U and PP-6224C/U combined power supply.

Fully interchangeable in form, fit, and function with the previously fielded power supplies.

DC-DC Module

MOSFETs.
Main switch and common drain for low conducted and radiated noise



Dual diode rectifier

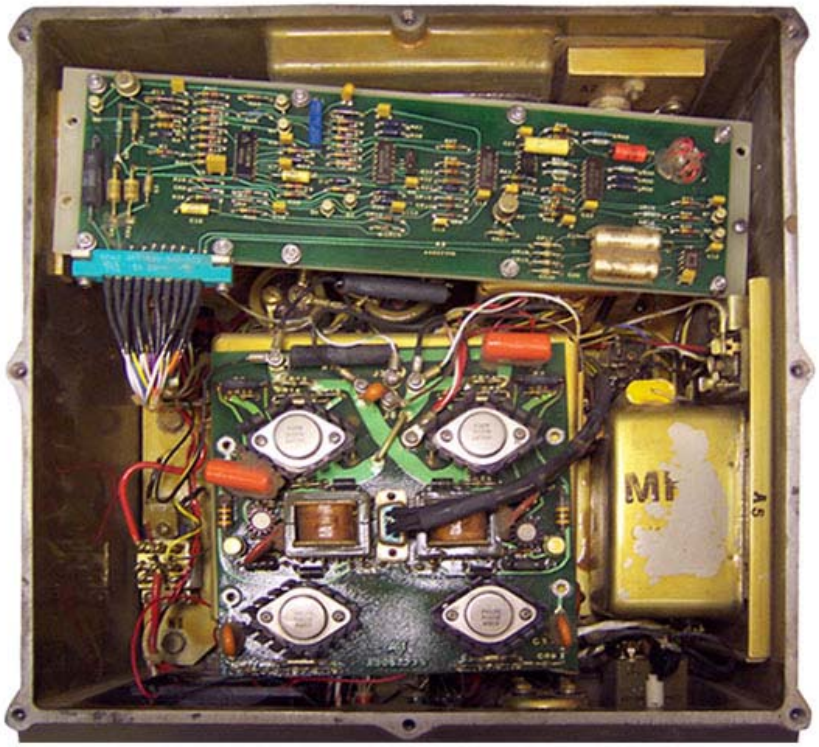
Input capacitors & inductors

Output capacitors & Inductors

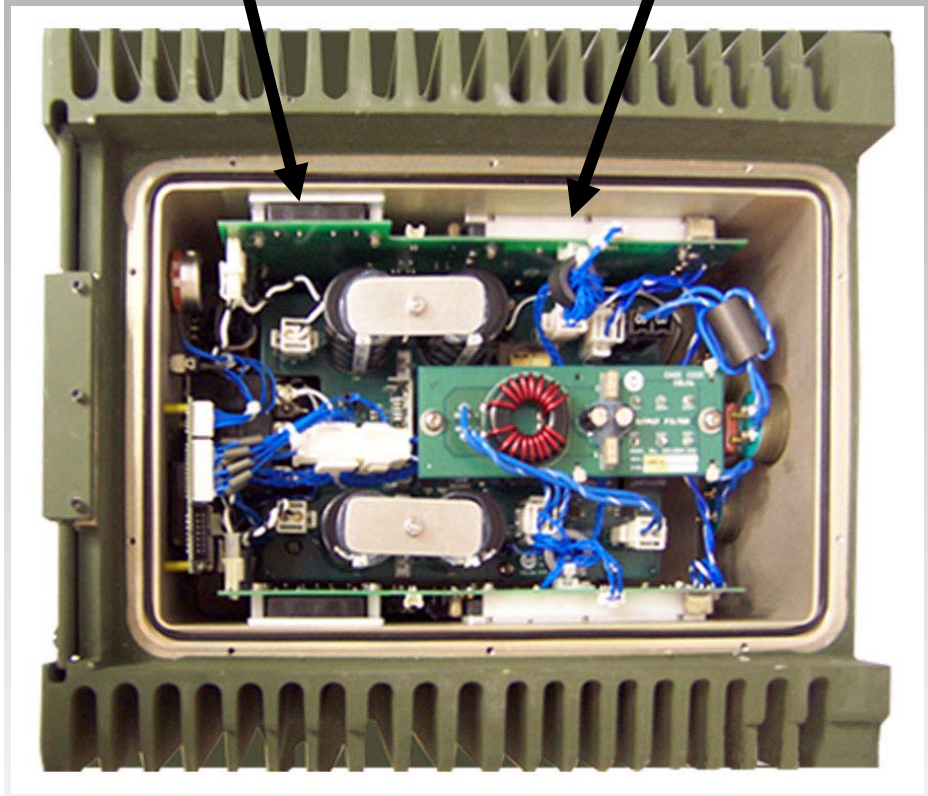
Main Transformer

“Brains”.
Primary and secondary control devices (ASIC)

Resonant capacitors.
Quasi-resonant tank for zero-current-switching converter



Old



New

Added Features

- Improved cover design:
  - Longer hinge length.
  - Hinge “pin” part of one-part lid.
  - Lid protected from shear when fully open.
- Front panel recessed so items are protected from shear.
- Environmental improvements:
  - Sealed.
  - Old supply used a fan which was another low reliability point.

Note

- Spec did not call for design without a lid, just an “improved” lid. In fact, spec says:
  - “3.3.2.1 Cover. A cover shall be installed to protect the front panel.”
- Front panel elements are mostly sealed:
  - Potentiometer chosen is not sealed due to cost but could have been.
  - LCD/LED cover is thin and sealed unless punctured.

Note

Recessed front panel
+ Totally sealed unit

No need for cover lid at all!

Note

- Lesson:
  - Step back.
  - Look at existing use, possible future use, and possible improvements.
  - Ask.

Added Features

- Auto voltage ranging:
  - 115 VAC +/- 10%
    or 230 VAC +/- 10%
  - Can really handle any voltage
    85 – 264 VAC, but by spec we had to put in an "undervoltage" changeover to battery bypass for 230 VAC nominal operation.
  - Old supply says: "Applying 230 VAC when switch is in 115 V position will damage Power Supply."
- Power factor correction
  - Old supply had no PFC.

Added Features

- Overcurrent:
  - ‘OC’ displayed.
  - Old supply had no indication.
- Battery wiring reversed:
  - ‘888’ displayed.
  - Use of battery is disabled until polarity fixed.
  - Old supply says: “Reverse polarity will cause equipment damage.”

Note

- Battery charging:
  - Old power supplies were used for battery charging (foldback current limit then constant voltage for final stage).
  - DC-DC converter technology chosen has current limiting, but does not have foldback current limit, so if the current is high, but not high enough to open the CB, our automatic current limiting circuitry turns off the output for a time and tries again a little later.

Added Features

- Improved efficiency:
  - reduction in the amount of waste heat dissipated per watt of output:
    - permits convection cooling.
- Mechanical design permits stacking 10 high.

Added Features

- Improved reliability:
  - No fan:
    - fan is high failure point.
    - reduces airborne contaminants such as dust and sand.
    - eliminates changing air filters.
  - >90% probability of 5,000 hours failure-free operation.
  - MTBF over 99,000 hours.

PP-2953D/U and PP-6224C/U

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Future Trends and Thrusts for Army Manportable Power Sources

Michael T. Brundage

US Army RDECOM CERDEC

2007 Joint Service Power Expo

24 – 26 April 2007

AGENDA

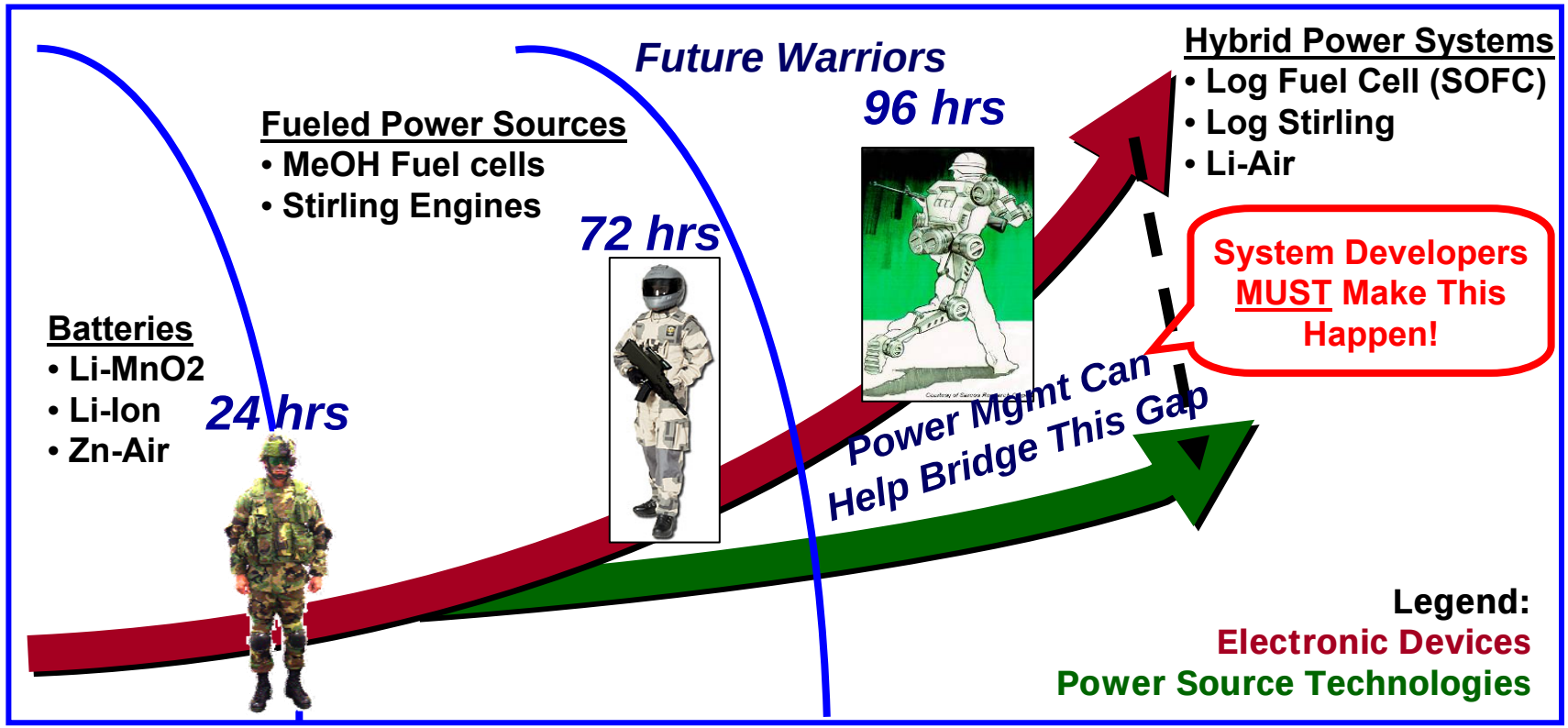
- Soldier Power Requirements
- Science & Technology Programs
- Solutions Available Today
- What's Next
  - High Energy Batteries
  - Hybrid Power Sources
  - Fuel Cells
  - Stirling Engine
- Summary

Our Challenge

…Lighten Their Load

Power Requirements

MORE POWER …… *…… LESS WEIGHT*



Science & Technology Programs

Mounted/Dismounted Soldier Power IV.LG.2006.01

FY06 – FY08

Soldier Power- Watts ⟷ *Kilowatts Tactical Power-*
Batteries/ Hybrid *Logistics Fuel*

Fuel Cell Battery Hybrid

Less weight, lower cost longer missions

Self Powered Battery Charger

Quiet Power Sources

Less fuel, smaller, quieter power sources

Purpose:

Develop component technologies for power systems for increased mission duration while decreasing logistics burden

Products:

- *Soldier*
  - *<500 Watt Man-portable field battery charger and improved rechargeable batteries*
  - *Hybrid power source (fuel cell & battery)*
  - *Li-Air battery and improved photovoltaics*

Payoff:

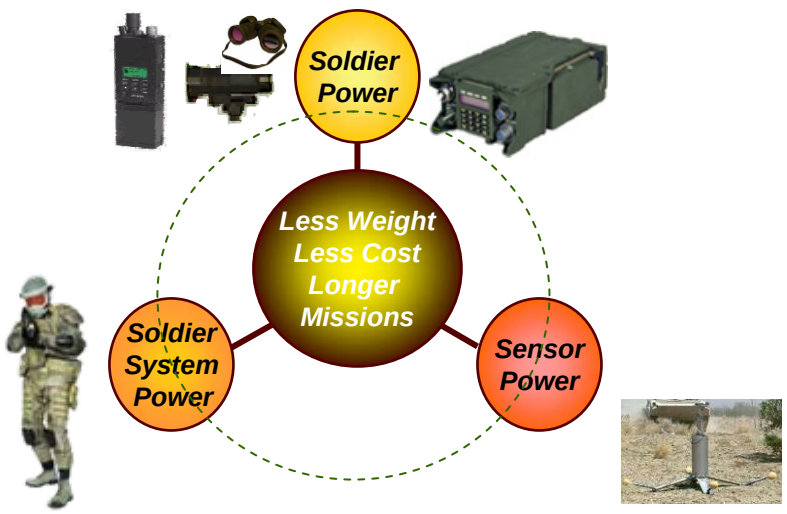
- *Provides savings by reducing number of batteries required for soldiers. Increased power/energy adds mission capability.*

- *Transitions:*
  - *Hybrid demonstrators to PM-Soldier in FY06; improved technology for Ground Soldier System in FY08*

Science & Technology Programs (cont)

D.CER.2008.08 Power for the Dismounted Soldier

FY08 – FY11



Purpose: *To provide the Warfighter with small light weight power sources that maximize specific energy for core Soldiers, integrated Soldier systems and sensors.*

Products:

- *Prototype Half-size/2X energy primary C4ISR batteries*
- *Conformal rechargeable Soldier system batteries*
- *Soldier mission extending hybrid fuel cell system*
- *Logistic fuel (JP8) powered Soldier portable power source to enable tactical battery recharging*

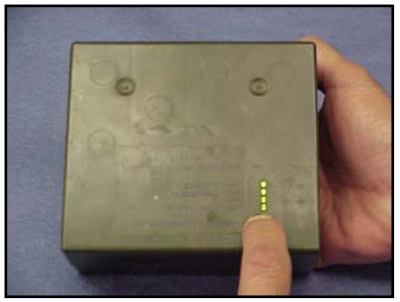
Payoffs:

- *Reduction in Soldier weight load*
- *Extended mission times in Soldier and sensor applications*
- *Battlefield energy independence; reduced logistics*
- *Increased Soldier mobility, sustainability, survivability and deployability by providing higher energy sources*
- *Power sources and charging technologies that meet Soldier-as-a-System requirements*

Solutions Available Today

Batteries With State-Of-Charge-Indicators

- Instantly Indicates Remaining Capacity in BA-5590A and BA-5390A
- Adds No Additional Weight to Battery
- BA-5590A/U (Li/SO_2)
  - All Production Converted to SOCl
- BA-5390A/U (Li/MnO_2)
  - In Stock & Available Now

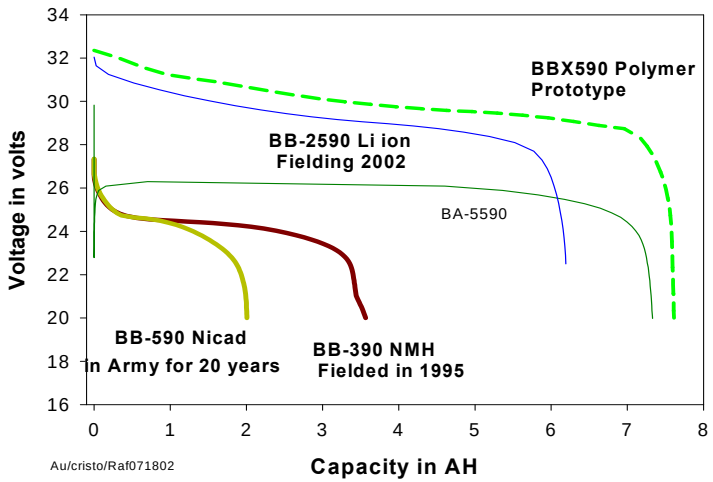


BA-5590A/U

BA-5390A/U

High Energy Rechargeable Li-Ion Batteries

BB-590 Nicad, BB-390 NMH, BB-2590, BB-X590 Batteries and Primary BA-5590 Discharge at 2A



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Solutions Available Today (cont)

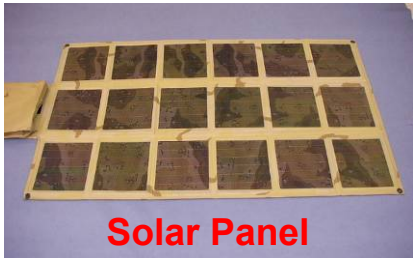
AA 8 - PACK SCAVENGER

Portable Fast Battery Charger for AA-size Cells

8 - PACK SCAVENGER

- Recharges commercial AA cells
- Charges 8 cells in 100 minutes
- Scavenges un-used energy from Military power sources
- Saves 25lbs per Platoon over 5 days

Any 12 VDC source



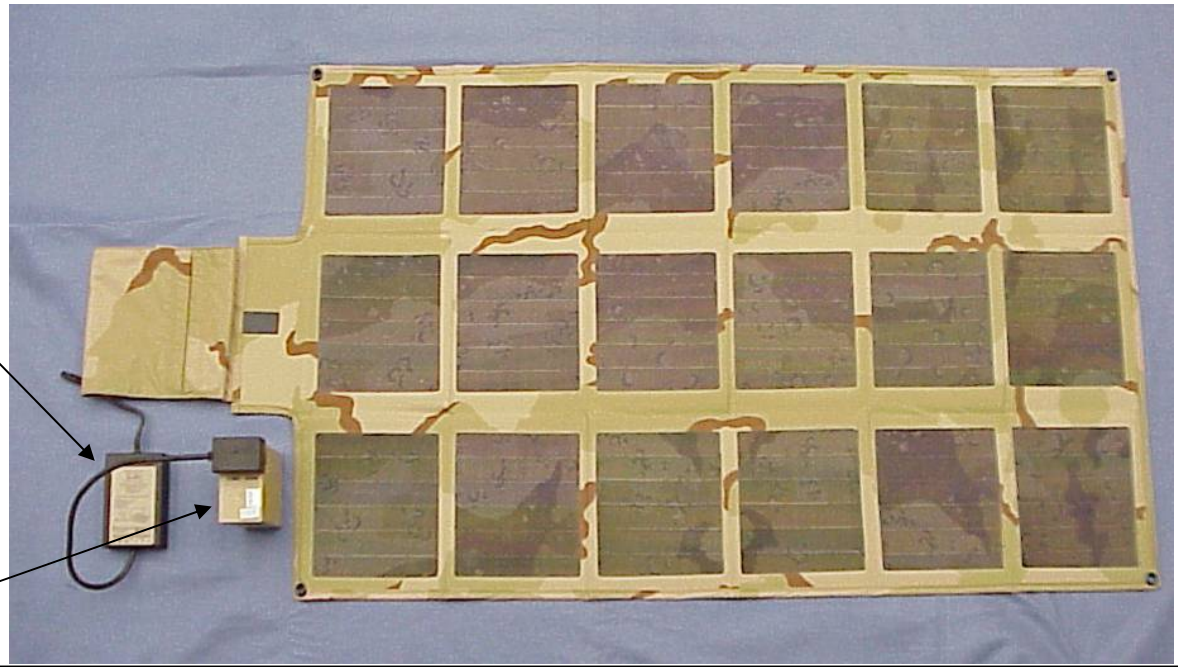
Charging Sources	# of AA-cells Charged
BA-8180	128
BA-8150	80
BA-8140	64
BA-5590	24
BA-5390	32
BB-390	20
BB-2590	24
SP4-solar panel	∞
Vehicle Adapters	∞

Solutions Available Today (cont)

55 W Solar Charger - Soldier

- Charges two 6.2Ah BB-2590 Li-Ion batteries in ~5-6 hrs
- Flexible Panel Design
- Anti-Glint, Inlaid Cammo

Maximum Power	Nominal Voltage	Maximum Current	Weight	Deployed Area	Packed Volume
(Watts)	(Volts)	(Amperes)	(lbs.)	length x width (in.)	length x width x height (in.)
55.0	16	2.8	4.4	55 x 32	11 x 9 x 1.3

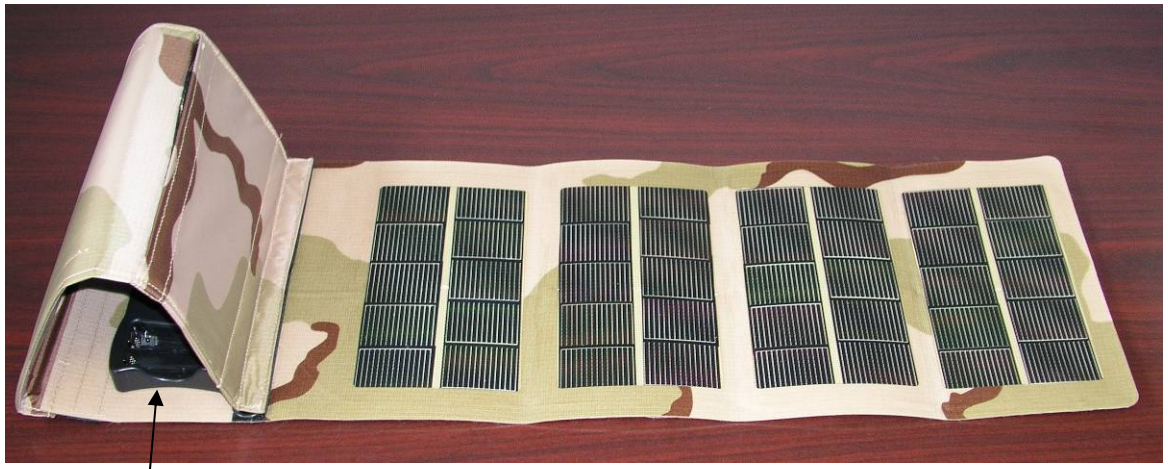


Renewable Energy – Lighten Soldier Loads, Reduce Logistics, Lower Costs

Solutions Available Today (cont)

AA-Cell Solar Charger - Soldier

- Charges four 2.3Ah AA NiMH batteries in ~4 hrs
- Flexible Panel Design
- Anti-Glint



AA-Cell Holder
& Charge Controller

- 9” x 5” x 2” folded
- 9” x 25”, deployed w/shade
- 0.87 lbs without batteries

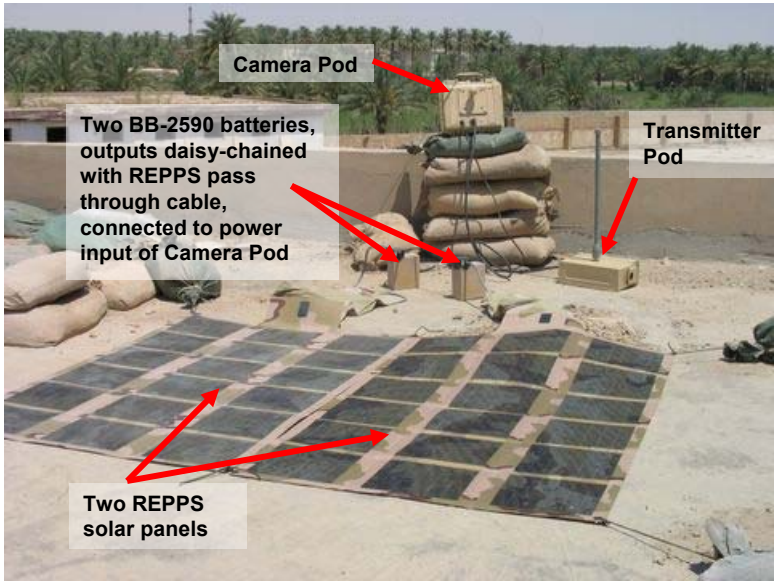
Renewable Energy – Lighten Soldier Loads, Reduce Logistics, Lower Costs

Solutions Available Today (cont)

Rucksack Portable Power System - Soldier

- **Solar Panel, Charger, Inverter, and NATO/Commercial Power Adapters.**
- **DC/AC power output and Charger for military batteries.**
- **In field use for unattended ground sensors (UGS) and surveillance systems.**

Soldier Feedback:
"I wanted to thank you again for everything. The camera system [using a REPPS system for 24 hour operation] has been a huge success thus far and I believe has saved lives by keeping our soldiers out of harms way."
SPC Fiorino, David G.



Renewable Energy – Lighten Soldier Loads, Reduce Logistics, Lower Costs

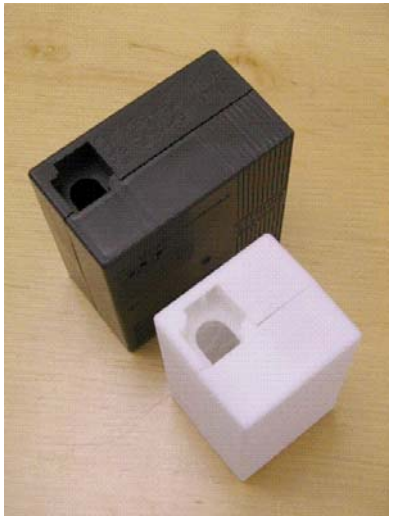
What's Next – High Energy Batteries

Extended Run-Time Lithium Carbon Monofluoride (Li/CFx) Batteries

Objective

The development of high energy density Li/CF_x batteries allow for:

- **A BA-5590 replacement with twice the run time at equivalent weight and volume**
- **A half-sized BA-5590 with equivalent run time at half the weight and volume**



Technology

Disposable Battery	Chemistry	Weight (lbs)	Energy (Wh)
BA-5590	Li/SO_2	2.16	200
BA-5390	Li/MnO_2	2.94	300
BA-XX90	Li/CF_x	**2.2**	**400**

Twice the Mission Runtime at same weight versus the BA-5590

Participants

- **Sponsor (s): U.S. Army RDECOM CERDEC**
- **Gov't Contributors: PM JTRS Ground Domain HMS, USAIC**
- **Industry: Five Known Interested Parties**

What's Next – Hybrid Power Sources

Hybrid Power Mission Extender

Case Study: For a 72hr Mission How many batteries/hybrids do we need to support the Land Warrior System?

Li-145 Lithium Ion (Baseline)

Gen 4 Zinc-Air/Li-145 Hybrid System

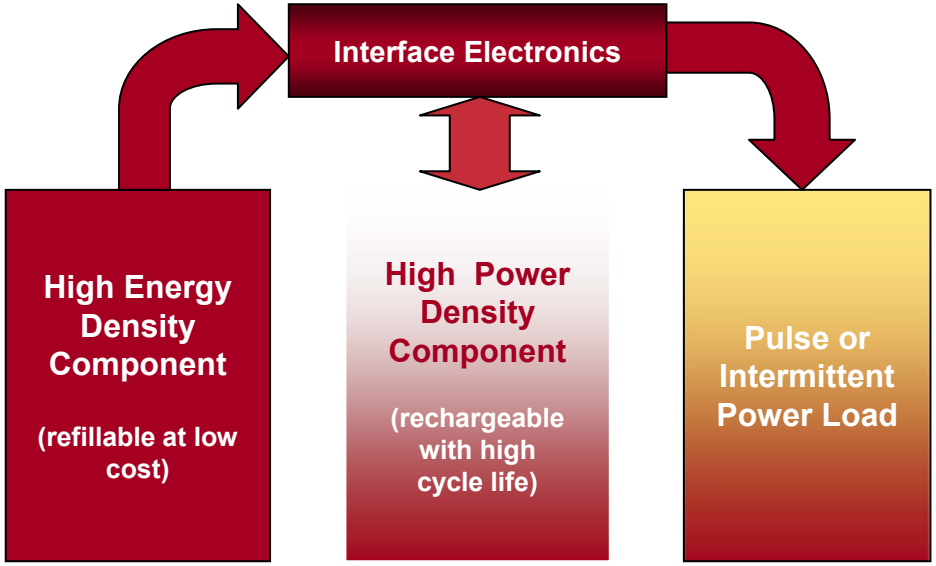
UltraCell Fuel Cell Li-145 Hybrid System

	Li-145 Lithium Ion (Baseline)	Gen 4 Zinc-Air/Li-145 Hybrid System	UltraCell Fuel Cell Li-145 Hybrid System
Weight:	13.2 lbs	9.4 lbs	6.1 lbs
Volume:	216 in^3	218 in^3	94 in^3
Energy: (available)	870 Wh	1145 Wh	895Wh

What's Next - Hybrid Power Sources

- Extends Mission Runtimes
- Reduces the Battery Weight and Volume Required for Multiple Day Operation
- Reduces Logistics Costs

Hybrid Power Sources



Lithium Ion / Zinc-Air Battery/Battery Hybrid for UGS

Lithium –ion Battery / Solar Panel Hybrid for UGS

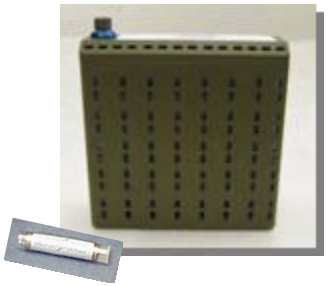
Sealed Pb-Acid / Zinc-Air Battery/Battery Hybrid for SATCOM Radios

Zinc-Air Battery / Capacitor Hybrid for Javlin

What's Next - Hybrid Power Sources

Battery Hybrid Power Source - Soldier

High Energy Component



Zinc-Air Battery

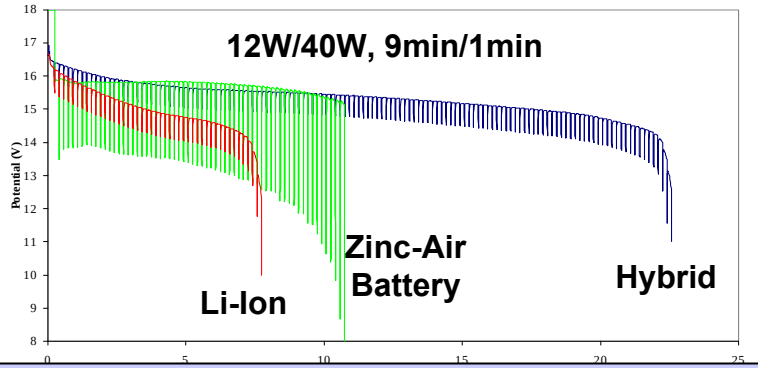
- Nominal potential: 14 V
- Nominal rating: 15 Ah
- Weight: 900 g
- 42- Cell "AA" Design:
- 14S3P cell configuration

200 Wh/kg

High Power Component

Li-Ion Battery

- Nominal potential : 15.2 V
- Nominal rating: 7.2 Ah
- Weight: 882 g (1.94 lbs)
- 16 18650G 2 Ah cells
- 4S4P cell configuration



Provides 1/3 Weight Reduction Over Rechargeable Alone for 24 Hours

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What's Next - Fuel Cells

20W DMFC - Soldier

- Dimensions: 9.75" x 2.31" x 3.06"
- System Dry weight: 1.18 kg
- Fuel cartridge: 500 ml / 0.47 kg
- 24 hr mission weight: 1.6 kg
- 72 hr mission weight: 2.6 kg
- Efficiency: 22.4%
- Fuel Cartridge Duration: 24 hours
- Fuel is 100% methanol at low temp; water/methanol mix at high temp >40ºC
- 72 hour mission energy density 554 W-hr/kg

20 Watt DMFC System

Mission Extender Power Source, Battery Charging

What's Next - Fuel Cells

25W RMFC - Soldier

CERDEC collaboration with DARPA

Dimensions: 9.3'' X 5.38'' X 1.8''

System Dry Weight: 1.2 kg

Fuel Cartridge Weight: 0.325 - 0.350 kg

24 hr mission weight : 2.25 kg
72 hr mission weight : 4.23 kg

Efficiency: 23.8% @ 20 watts
Fuel Cartridge Duration: 9 hours

72 hr mission energy density: 340 Wh/kg

25W Reformed Methanol Fuel Cells

Soldier System Hybrid

Mission Extender Power Source, Battery Charging

What's Next - Fuel Cells

20 W Solid Oxide Fuel Cell - Portable

CERDEC collaboration with DARPA and SOCOM

Power:	**20 W**
Start Up Time:	**20 minutes**
Dimensions:	**11.6'' X 3.7 '' X 5.11''**
System Weight:	**1.55kg**
Fuel Cartridge Weight:	**0.406kg (propane/butane)**
24 hr mission weight:	**1.95 kg @ 20 Watts**
72 hr mission weight:	**2.77 kg @ 20 Watts**
Fuel Cartridge Duration:	**25 hours @ 20 Watts**
Energy Density:	**520 W-hours/kg (72 hrs@ 20 watts)**

20 Watt SOFC

Platoon Level Portable Power Source, Battery Charging – JP-8 Target Fuel

What's Next - Fuel Cells

250 W Solid Oxide Fuel Cell - Portable

- **Developing a 250 W portable fuel cell system operating on de-sulfured JP-8 fuel.**
- **Current system uses Propane/Butane fuel.**
- **Partial Oxidation (POX) reformer design for JP-8.**
  Air oxidation, smaller reactor
- **<10kg target for 250 W.**

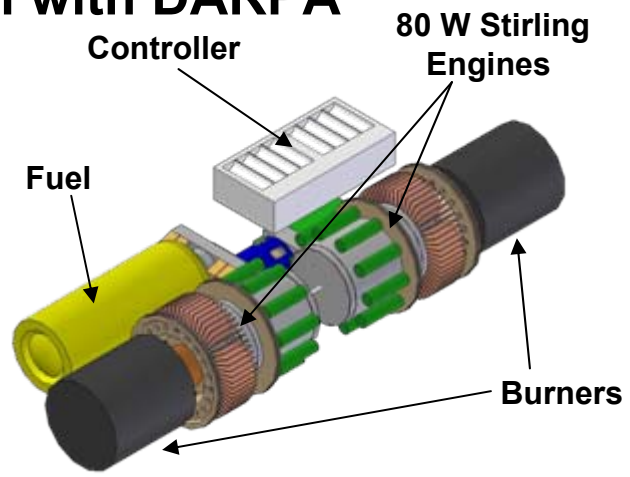
Platoon Level Portable Power Source, Battery Charging – JP-8 Target Fuel

What's Next - Stirling Engine - Portable

CERDEC collaboration with DARPA

- **Air cooled design**
- **Propane (FY06)**
- **JP-8 fuel (FY08)**

Projected JP-8 160W_e Performance	Target
Hot-end Temperature	650 ºC
Cold-end Temperature	70 ºC
Nominal Operating Frequency	102 Hz
Nominal Voltage	28 V_{DC}
Nominal Engine/ Alternator Output Power	160 W_e
Fuel	JP-8
Engine/ Alternator Efficiency	36 %
Generator System Efficiency (without parasitics)	24 %
Net System Efficiency	20 %
System Weight	<10kgs



160W_e System (Dual Opposed 80W_e Engines)

Platoon Level Portable Power Source, Battery Charging – JP-8 Target Fuel

Summary

- Power Source Technologies continue to improve.

- Power Sources will always be seen as a weight/volume/logistic burden unless taken in as part of the equipment system level designs, which must include power management.

- Power Management of the Systems to a Fixed Power Budget will reduce the weight, volume, and logistic costs for power and energy.