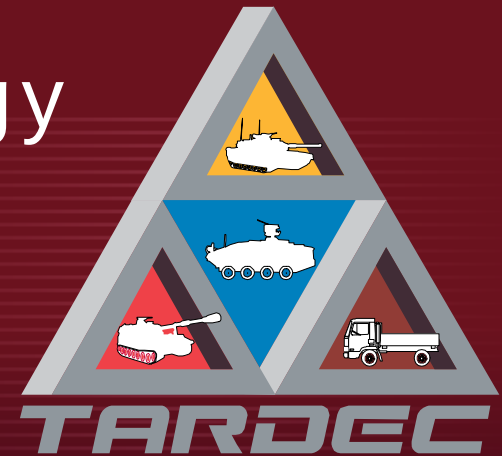




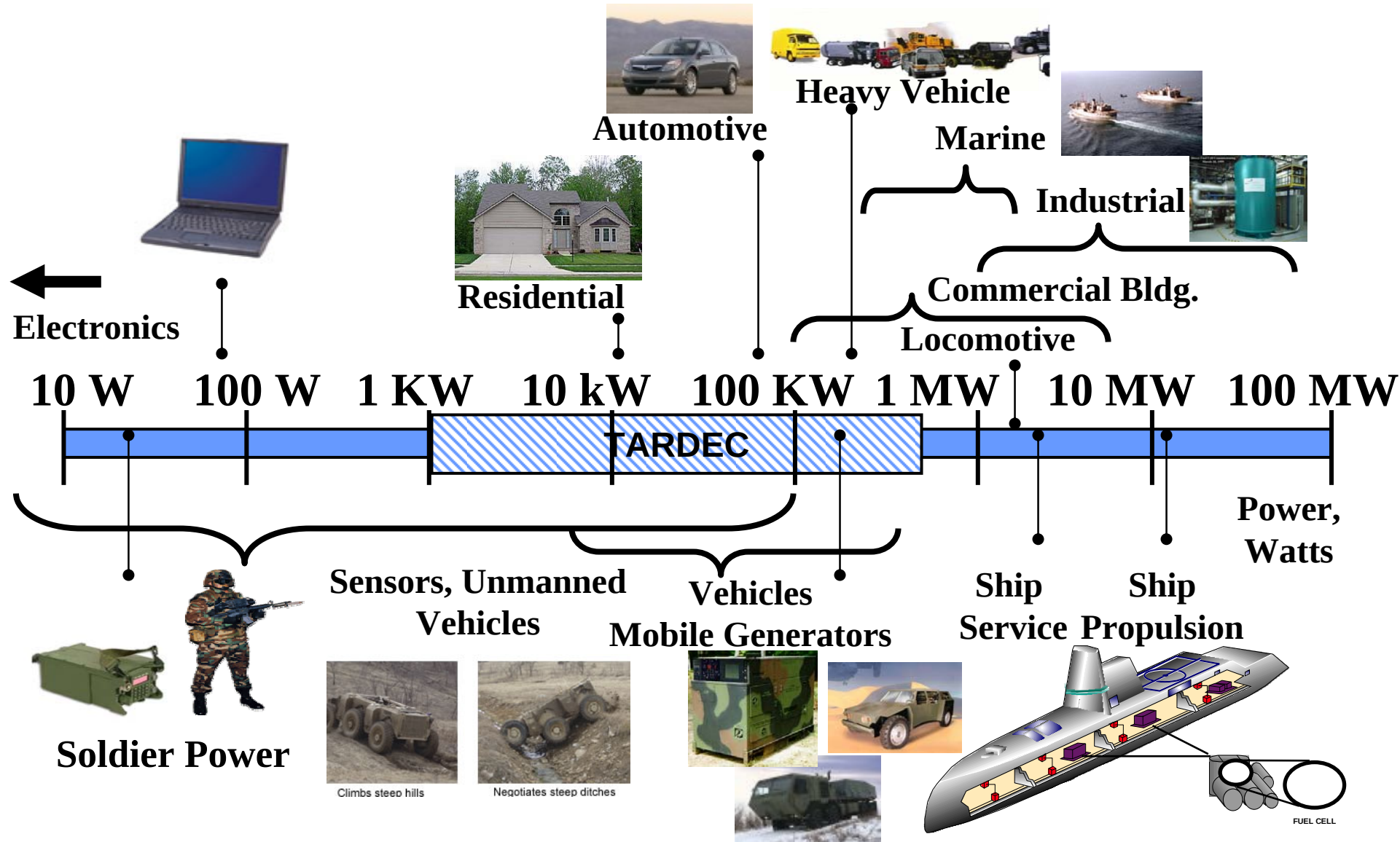
Power and Energy Strategy

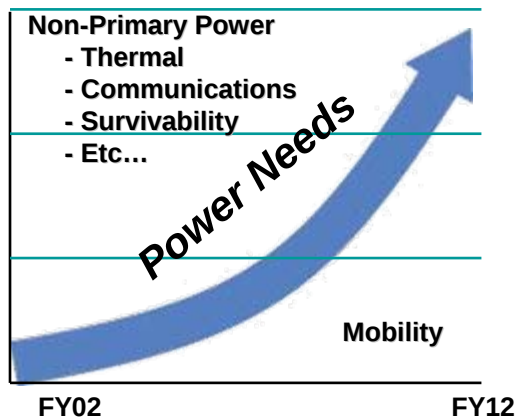


TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

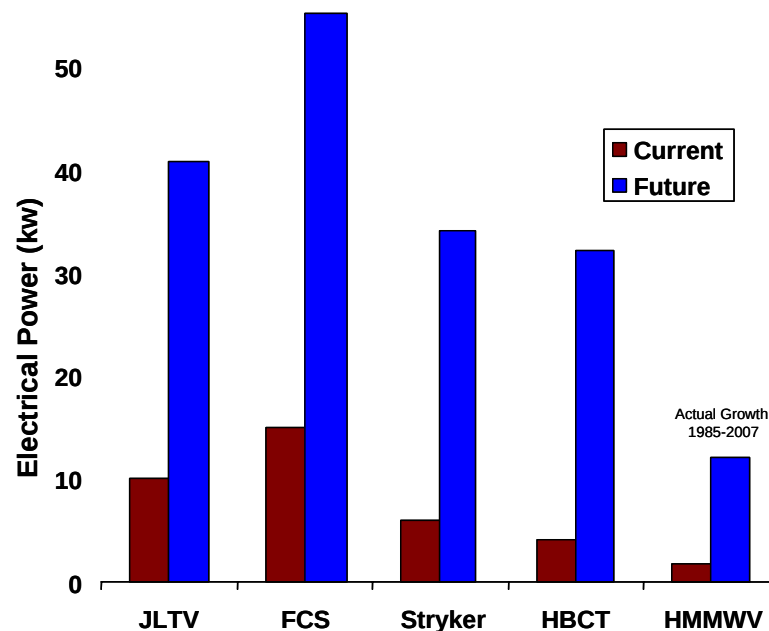
Ms. Jennifer Hitchcock
Associate Director of
Ground Vehicle Power and Mobility

Report Documentation Page				Form Approved OMB No. 0704-0188	
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**Non-Primary Power
Estimated Electrical Power Growth**



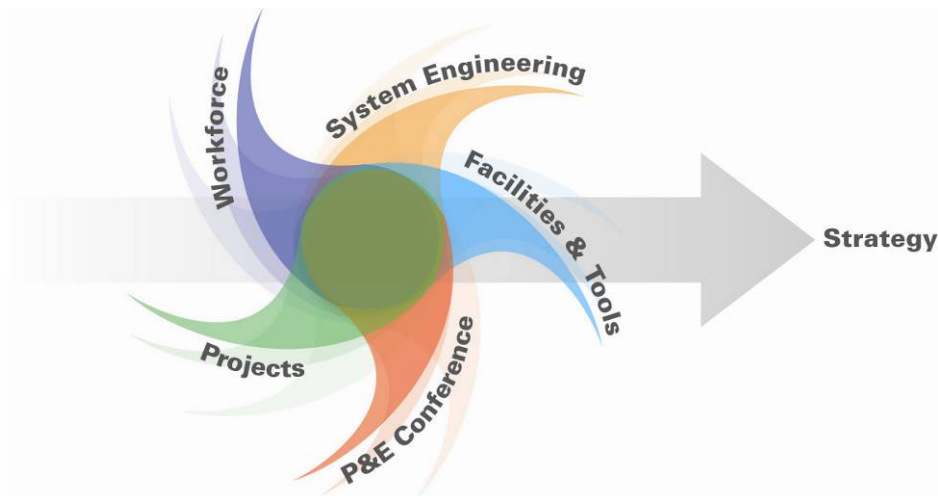
Power and Energy Strategy Objectives

Develop an integrated strategy to meet the power and energy requirements of current and future modular force.

Allows science and technology investments to be prioritized and focused on products that can transition.

Allows program managers to plan and resource for technology insertion.

Allows the development of the required people, tools and facilities.





Ground Vehicle Power and Energy Active Programs – FY 07



Prime Power

Advanced Traction Motor
Advanced Fuel Injection System and Valvetrain Technologies
Advanced Military Diesel Engine Technologies (Injection Control)
Advanced Military Hybrid Technology
All-SiC Inverter for Hybrid Electric HMMWV Power Steering
Band Track over Wheels
Bushings Test Machine
Co-Continuous Metal Matrix Composites Lightweight Diesel Engine
Cold Start for Military Vehicles
Compact Efficient Electric Propulsion Motor
Compressible Magneto-Rheological (CMR) Fluid / Damper
Cross-Flow Membrane Fuel Filter
Diagnostic Air Filter Test Machine
Elastomer Research
Electric Drive Running Gear
Electro-Mechanical Filter (Self-Cleaning)
Endurable Ceramic Thermal Barriers
Engine ILIR-Combustion
FCS High Temperature Lubrication
HAMMER (Hydraulic Hybrid_Advanced Materials_Multi-Fuel Engine Research)
HE-HMMWV Upgrade
High Temp Tribology
High Temperature Bushings
HIPER High Speed Engine Development
HIPER High Speed Engine Research Study Phase
HIPER OPOC
HIPR Turbo Engine
HMMWV Compressible Fluid Strut Suspension
Hybrid Steel Track
Improved Abrams T-158 IRB Track
Intelligently Vibrating Air Cleaner
Lightweight Blast Resistant Road Wheels
Lightweight Road Wheels
Load Range E Tire & Wheel Qualification
Long Life M1 Abrams Air Cleaner Scavenging Blower Motor
Magneto-Rheological Fluid Suspension
Matracks
Next Generation Non-Tactical Vehicle Propulsion
Power and Energy Hardware in the Loop SIL
Fastening and Joining Research Institute
Oil Filter with Integrated Condition Monitoring System
Powered Air Precleaner
Segmented Track
Sonic/Acoustic Cleaning System
Supercharger for Generator
Two – Stroke Opposed Piston Engine

Non Primary Power

Amorphous Metal Membrane H2 Separation
Defense Transportation Energy Center
Fuel Cell Ground Support Equipment Demonstration
Hydrogen PEM Ambient Pressure Fuel Cell Med/Heavy
JP8 Reformation
Liquid JP-8 Desulfurization
Liquid JP-8 Desulfurizer System
Liquid JP-8 Desulfurizing Adsorbent Development
Low Cost Tubular Solid Oxide Fuel Cells-MMP
Low-sulfur diesel Gasifier and Pre-Reformer
Plasma JP-8 Fuel Reformer
Rotary APU
Solid Oxide Fuel Cell (SOFC) Materials and Manufacturing
Turbo Fuel Cell Engine
Opposed Piston Opposed Cylinder APU



Rotary Engine APU



OPOC Diesel 2-stroke



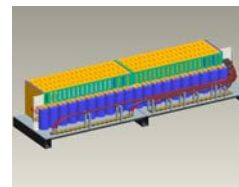
SOFC APU

Advanced Track



Energy Storage

- 3-D Advanced Battery Technology
- Isolated BiDirectional DC-DC Converter
- Hybrid Si/SiC Battery-to-Bus DC-DC Converter
- Advanced Battery Development
- Advanced Fuels Validation - Military Ground Vehicles
- DC-DC Converter (soft switching)
- Logistical Fuel Processors
- Efficient Reliable Superlattice SiC MOSFET
- High Power Density High Temperature Battery to Bus DC DC Converter
- HMMWV Battery Pack
- Large Area Micropipe Free SiC Superlattice Semiconductor
- LFP Battery Module
- Li-ion Battery Manufacturability
- Live Fire Testing
- Logistical Fuel Processor Development
- Mechanism of Battery Thermal Runaway
- Military Fuels Research Program
- NiZn Batteries
- Prismatic Cell w/Integrated Liquid Cooling
- Rolled-Ribbon Lithium Ion Cells
- Si-C MOSFET
- Solid State Disconnects
- Thermal Mgmt Demo
- Transportable Synthetic Fuel Manufacturing Modules



Integrated Capacitance / Assembly



Li-ion Battery Pack



Compact Diesel w/adv Turbocharger

Power & Thermal Management

Advanced 42-Volt Technologies
Advanced Control Techniques
Advanced Interconnects/Cable Systems
Advanced Thermal Management Controls
Cognitive Power Management System
Electrical Power Architecture SIL
Foam Heat Exchanger
High Output Alternator Control System
High Performance Integrated Thermal Module
High Temperature Environment Cooling Fan for FCS
Improved Performance/Compact Heat Exchanger
Lightweight Adaptive Control Network
PEO GCS CMPS - Electrical System Modeling
Point of Use/Load Switching/Conversion
Power/Thermal API
Learning Approaches to Vehicle Power Mgmt
Vehicle Networking using Ultra Wideband (UWB) Technology
Virtual Prototyping Architecture
Virtual Prototyping Vehicle Electrical System Management Design Tool



Advanced Heat Exchanger



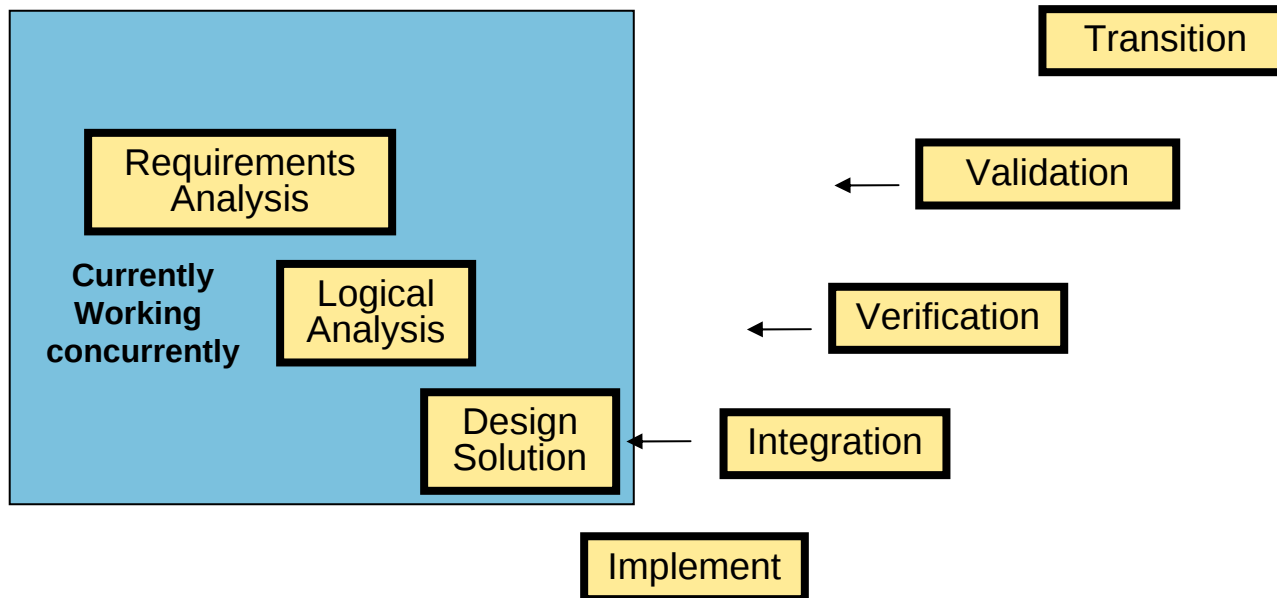
Electrical Power Architecture SIL

**130 Active P&E
Programs at TARDEC
In FY07**

Capability	PM-FCS	PEO GCS	PEO CS/CSS
Mobility	• Improved Powertrain efficiencies • High mileage lightweight track • Reduced component weights • Thermal management improvements • Intelligent power management • Improved suspension	• Low fuel consumption • Common power architecture • Improved power train • High mileage track	• Low fuel consumption • Restore payload and performance • Improved rollover protection/active suspension • High output onboard electrical power • Exportable power
Lethality	• Networked LOS/BLOS/NLOS fires • Aided target recognition • RWS	• Improved target recognition	• Plug and play weapons • RWS • Integrated ITAS and missile racks
Survivability	• Active armor • Active protection/jammers • Cover to cover dash speed • Transition between power sources • Signature management • Extended silent watch	• Active protection • Increased silent watch • IED electronic countermeasures	• Plug and play armor • Extended silent watch • Active protection • Laser, NBC and IED warning
Communications	• Networked battle command • Integrated JTRS	• Networked battle command • Integrated JTRS	• Networked battle command • Integrated JTRS

Systems Engineering Processes are driving the strategy development

Systems Engineering Technical Processes



Systems Engineering Enabling Technical Management Processes

Decision Analysis

Technical Planning

Technical Assessment

Requirements Management

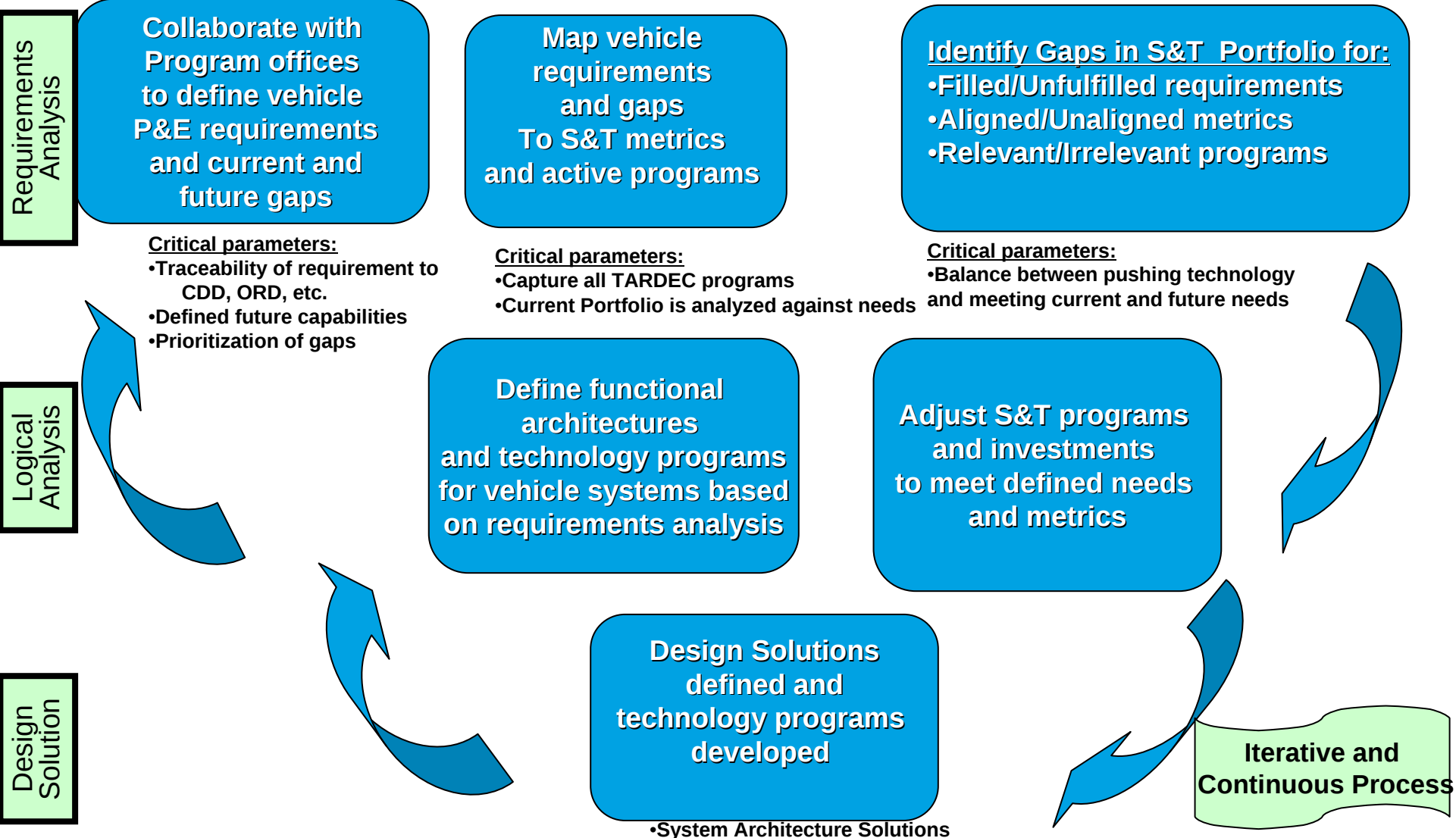
Risk Management

Configuration Management

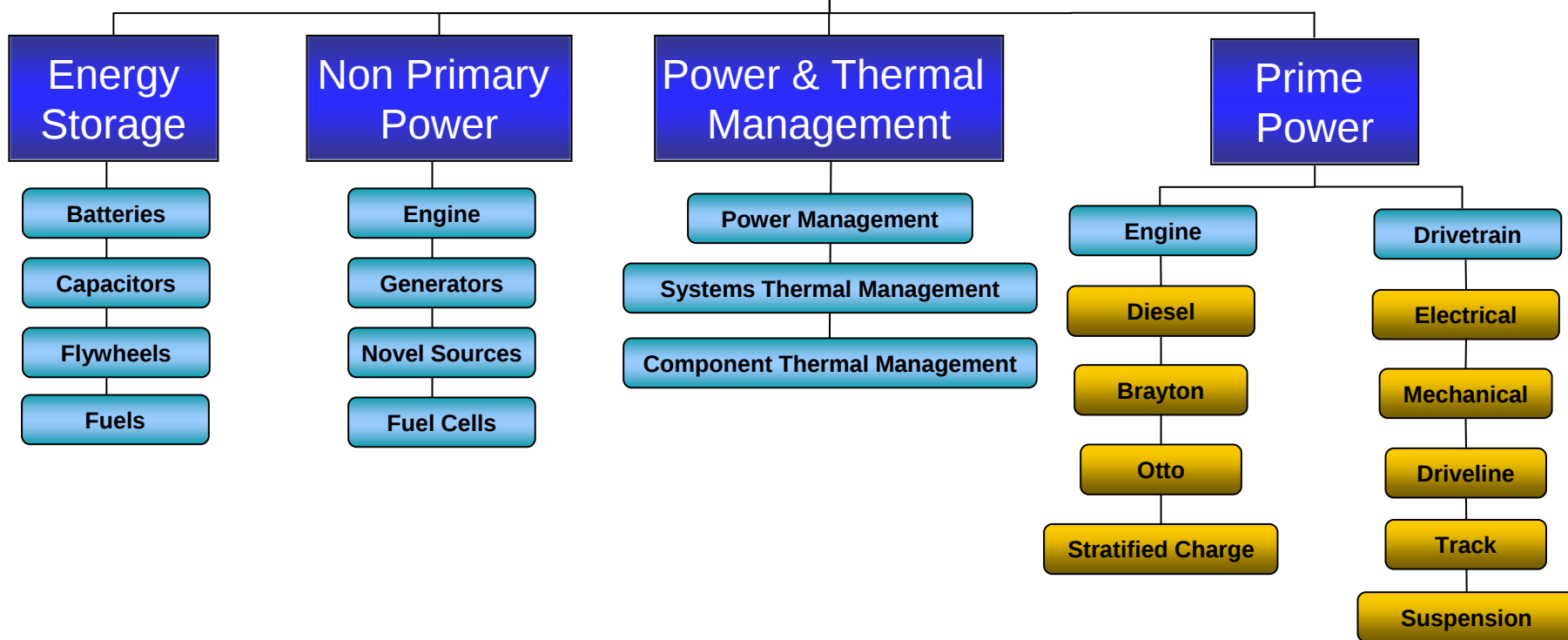
Tech Data Management

Interface Management

Established working groups



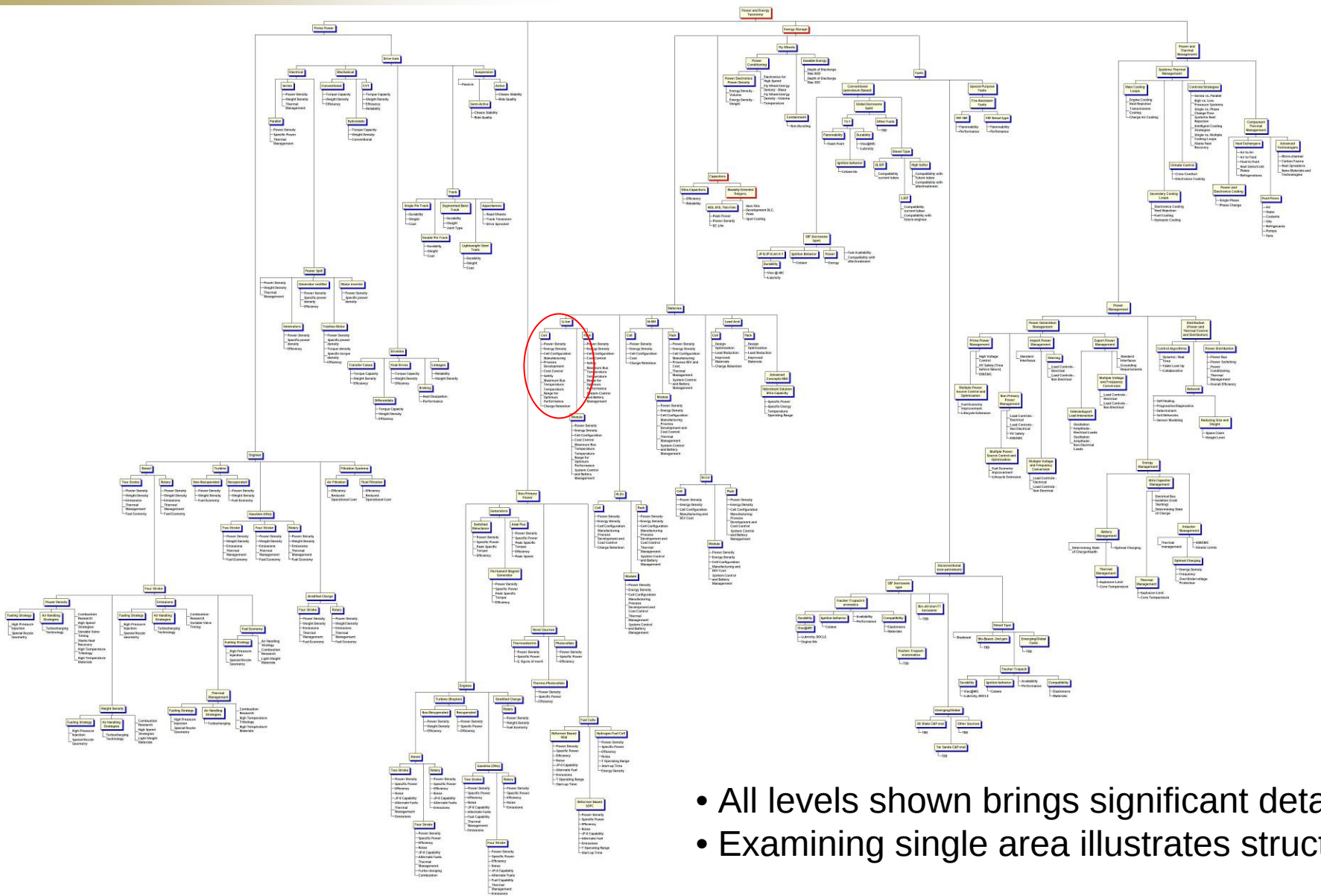
Ground Vehicle Power and Energy



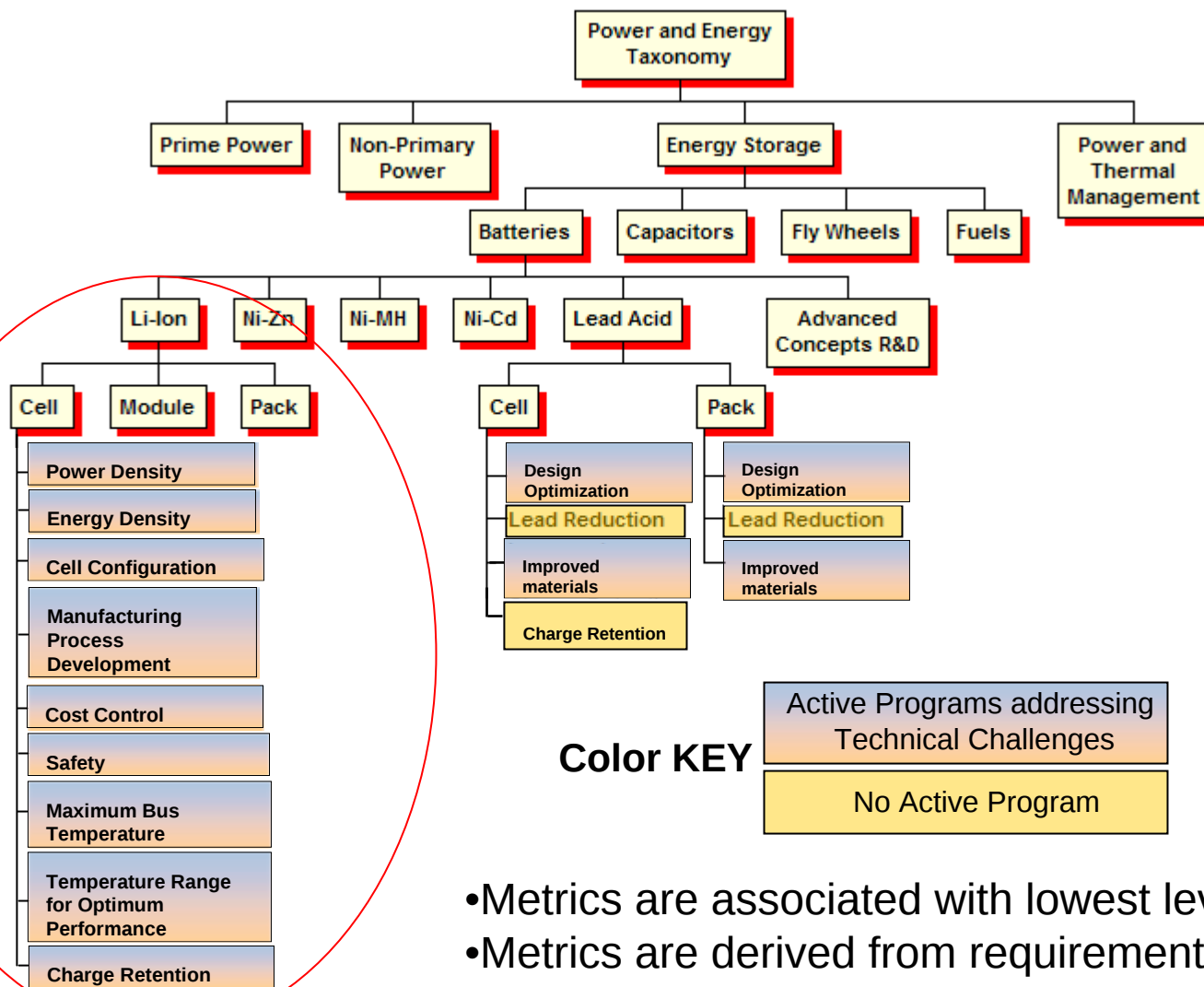
1 kW 10 kW 100 kW 1 MW 10 MW



Functional Decomposition The 30,000 Foot View



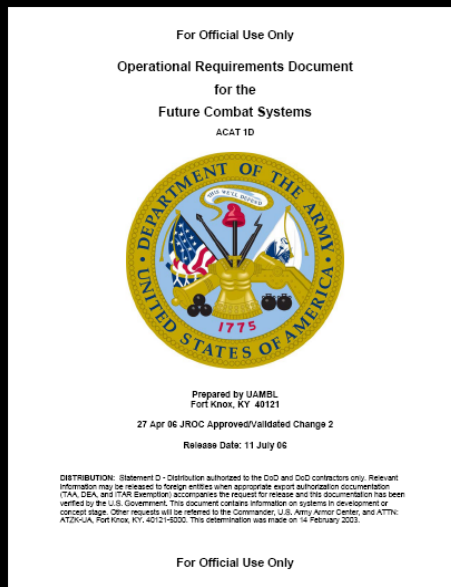
- All levels shown brings significant detail
- Examining single area illustrates structure



- Metrics are associated with lowest level
- Metrics are derived from requirements documents
- S&T Initiatives pursuing metrics are linked

**OPERATIONAL REQUIREMENTS DOCUMENT
FOR THE
FAMILY OF STRYKER VEHICLES, CHANGE 1
ACAT I**

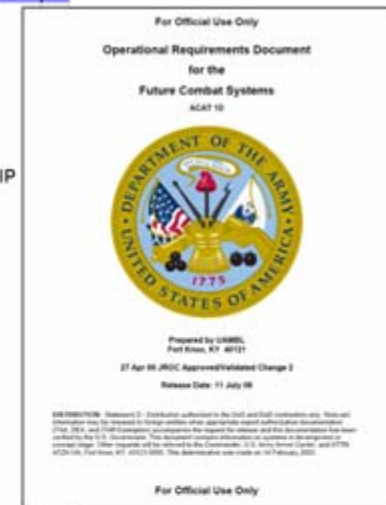
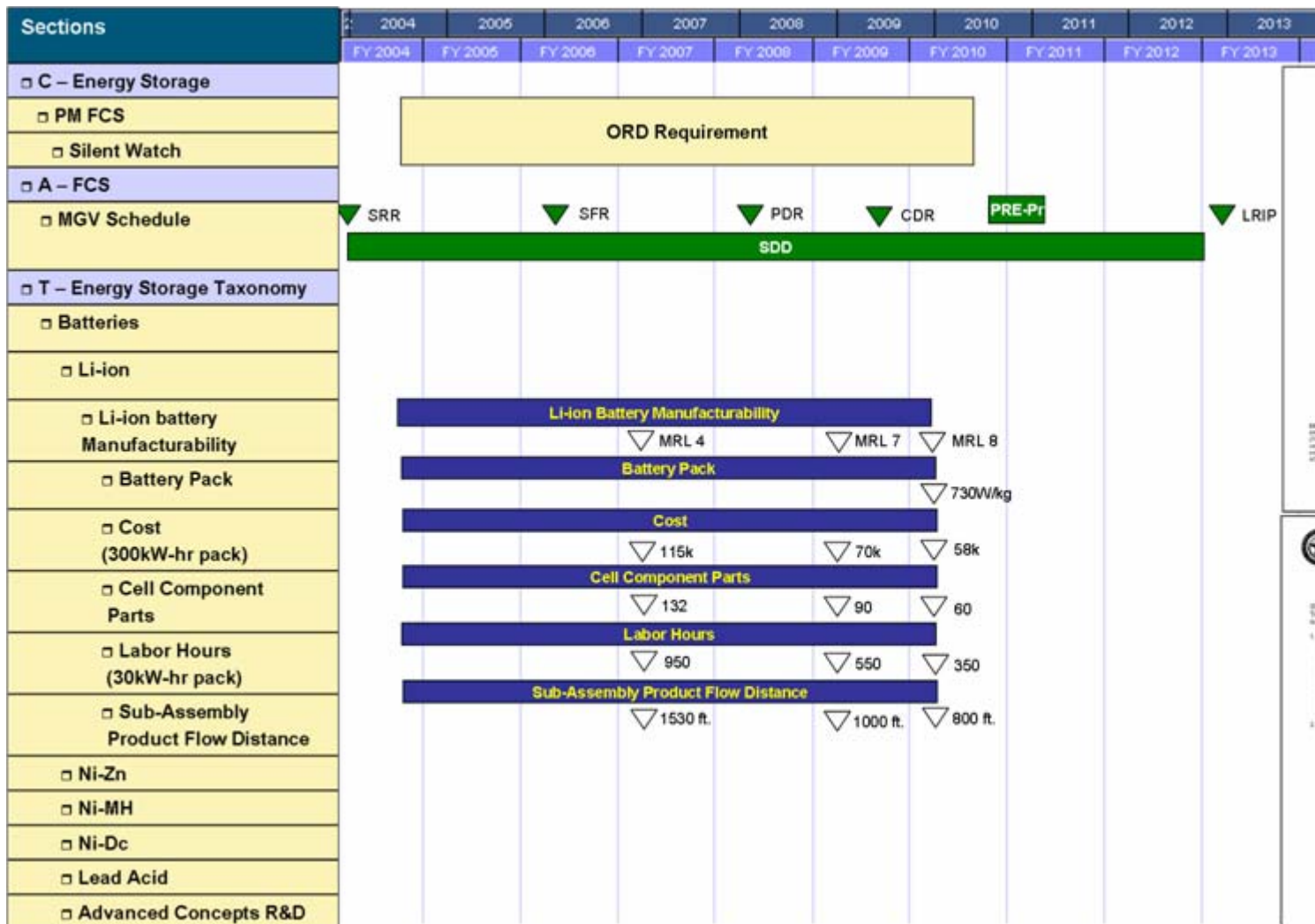
Validation Authority: JROC
Approval Authority: JROC
Designation: JROC Interest
Milestone Decision Authority: AAE
Prepared for Milestone C Decision for MGS & NBCRV
Variants
Draft Version 2.1
8 December 2006
As of 8 Jan 07
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(706)545-1915.



**CAPABILITY DEVELOPMENT
DOCUMENT
FOR
Joint Light Tactical Vehicle
(JLTV)
VERSION 2.6
ACAT: I**
Validation Authority: JROC
Approval Authority: JROC
Milestone Decision Authority:
USD/AT&L
Designation: JROC Interest
Prepared for MS B Decision
Current as of 18 Apr 2007



**Establishes Traceability
Identifies Needs
Defines Gaps**



- Collaborate with PEOs and PMs on P&E needs for upgrades, modernization and new vehicles
- Establish P&E needs traceability to respective CDDs, ORDs and specifications
- Align and/or execute new S&T projects to meet the customer needs
- Update and maintain P&E technology decomposition