DMEA Organization

Secretary of Defense

Under Secretary of Defense (Acquisition, Technology & Logistics)

Assistant Secretary of Defense (ASD) (Research & Engineering)

Deputy Assistant Secretary of Defense, Research

Director, Defense Microelectronics Activity

- Microelectronics Design & Integration Division
- Systems Assurance and Security Division
- Contracting Division
- Microelectronics Development & Test Division
- Microelectronics Operations & Support Division

Small Business
Program Control
Staff Counsel
Microelectronics Challenges for Defense Systems

Microelectronics: Key Critical Tech for ALL Mil / Intel Operations

• **Extended weapon system life cycles (20 – 40 years)**
  – Rapidly evolving, expanding missions
  – Performance degradation
  – Obsolescence

• **Commercial requirements dictate the technology & market**
  – Very high volumes for short terms
  – Lower environmental temperature ranges & quality thresholds
  – Unsecure manufacturing / distribution

• **Unpredictable Supply**
  – Counterfeits - Foreign Investment in US
  – Malicious Changes - Business Closures
  – Engineering Talent Squeeze

Apple sells an average of 385000 iPhones *per day*.

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DMEA Responsibilities

• **Provide microelectronics technology solutions**
  - Leverage advanced microelectronics technologies
    - Enhance / adapt capability and performance
    - Improve system reliability and maintainability
    - Address effects of rapid obsolescence
  - Accelerate delivery of technical capabilities to win the current fight
  - Address Increasing Risk in Trust and Assurance for defense microelectronics
  - Implement the DoD Trust Program
    - Provide access to DoD for processes / devices
    - Extend Trust to the entire supply chain

• **Provide critical microelectronics design and fabrication skills**
  - Address increasing requirements in traditional and irregular warfare
  - Ensure that the DoD is provided with systems capable of ensuring technological superiority over adversaries
  - High mix, low volume “unique” microelectronics are endemic to military needs and not commercially viable
  - Provide long term assured and trusted supply of microelectronics

• **Payoff**
  - Providing critical, quick turn solutions for DoD, intelligence, special operations, cyber and combat missions and the only source for a long term assured supply of microelectronic parts unobtainable in the commercial market.
  - Unique capability in world

• **Serve as joint resource for DoD / government agencies / industry / foreign allies**
Regional Distribution of Commercial Foundries

2011

- Asia-Pacific/ROW: 53%
- Europe: 10%
- Japan: 23%
- North America: 14%

2020

- Asia-Pacific/ROW: 74%
- Europe: 7%
- Japan: 12%
- North America: 7%
Where Do Your Parts Come From?

A “Typical” COTS Microcircuit Product Flow

Counterfeit Parts

Avionics
OEM

Design

Dist.

Test

Fab

Ass’y

Viruses/Worms

Trojan Horses
Issues with COTS

• Quality (Commercial vs. mil)

• Physics of failure
  – Plasma residue
    – Mechanical weakness
  – Hot carrier damage
  – Gate oxide failure
  – Interconnection current density faults
  – Electromigration

• Lead-free impacts
  – Restriction of Hazardous Substances Directive 2002/95/EC, RoHS
  – Reliability
  – Tin whisker failures
  – Solder cracks – configuration control
  – Lack of availability (DMS) of traditional SnPb finished components
    – Commercial industry is going lead-free
Flight Control System (FCS) avionics box with cover removed

DMEA / Industry Partnerships

- **More than one “industry”**
  - Semiconductor
  - Defense
  - Aftermarket

- **Each deals with microelectronics issues, but …**
  - Different issues for each industry
  - Different motivations
  - Different business models

- **Different partnerships for different industries**
  - DMEA created specific partnerships for specific industries
  - Each partnership combines unique technical approach with unique business models
Defense Industry Partnership

Program Offices

ATSP III – $6.047B
Fourth generation

- Joint Service Use
  - Unique Skill Set
  - Leveraged Technology
  - All Solution Options

- Single PM Point of Contact
- Coordinated Programs

- Total Life Cycle Systems Management
  - Adaptive Opportunities
  - New Capabilities
  - Multiple Problem Resolution

CRADAs
ATSP contracts
Task Examples in the Next Briefing
DMEA Outreach
Semiconductor Foundry Industry

• **Unique Government / Semiconductor Industry partnership**
  – Innovative adaptable *foundry*
  – Innovative business model

• **Government-held process licenses**
  – Prototype / low volume production by DMEA for government needs
  – High volume production by industry
  – No commercial conflicts – first right of refusal by industry

• **Transfers industry-developed (commercial) IP & technology**
  – COTS as a solution, not a problem
  – Saves processes, not parts

• **Assures continued DoD supply as industry moves with market**
DoD’s Advanced Reconfigurable Manufacturing for Semiconductors (ARMS)

- **Main focus** – Adaptive operations for conventional & irregular warfare
  - Insert advanced technology into DoD weapon systems
  - Prototype / low volume production of new designs
  - Quick turn design / prototype / production

- **War surge support**
  - Agile
  - Responsive

- **Trusted Parts**

- **Assured Supply**

“Offset state-of-the-practice & state-of-the-art”
- Adm. Timothy Keating, USN, Commander USPACOM
The Trusted Foundry Initiative

• **Implements DOD Trusted IC Strategy**
  – Provides access to DoD for processes / devices
    – Classified circuits
    – Trusted designs / manufacturing

• **Trusted Accreditation Program**
  – Provides a “Trusted Process Flow” at each vendor
  – Vendors must be located in US / UK / Canada / Aus / NZ
  – DMEA is the vendor accreditation authority
  – Extended beyond foundries to entire supply chain
Dashboard

As of 27 January 2014
56 Trusted Suppliers

As of 27 January 2014
DMEA Outreach
Government / Industry / Academia

• Develop researched technology for fielded applications
  – Productize / Producibility
    – Defense applications
    – Commercial use
    – Manufacturability
  – Supportability
    – Repairability
    – Reliability / Maintainability
    – Availability

• Utilize small business & university developed technology
  – Small Business Innovation Research (SBIR) and
  – Small Business Technology Transfer (STTR) projects
**National High Reliability Electronics Virtual Center (HiREV)**

### MOTIVATION

- Recent costly electronics failures in DoD programs highlighted need for government led quantitative assessments and lifetime prediction capability
- Acquisition community forced to use highly-accelerated tests that are unlikely to correlate with operational use
- Customers: National Security Space and others inserting emerging electronics

### TECHNICAL IDEAS

- Physics-based approach to replace current practice of statistics-driven projections
- Characterization of atomistic and interfacial phenomena in electronics — identify degradation mechanisms and rate of change
- Develop and apply multi-scale materials models – model and simulate degradation rates
- Multi-Organization Collaboration
- Government led program

### HiREV PAYOFF

- **Near-term** – Validated government owned lifetime analysis for acquisition decisions
- **Mid-term** - Updated practices (standards, guides, specs and methods)
- **Long-term** - No anomalies due to poorly understood electronics

- **Risks** – Difficult problem – Requires discovery
- **Costs** – Function of device technologies
DMEA Outreach - Other Engagements

- GOMAC – Steering Committee
- International Microelectronics And Packaging Society - Technical Team
- Semiconductor Industry Association
- SEMI World Fab Watch
- OSD Anti-Counterfeit Team
- NPGS & ICAF
DMEA Outreach Website*

http://www.dmea.osd.mil

- Program Description
- Services
- Facilities
- Contracting
  - ATSP Contract Page
  - Doing Business with DMEA
  - CRADAs
- Trusted Program
  - Links to List of Accredited Suppliers
  - How to become accredited
- Business Model
  - DMEA / Defense Industry Partnership
  - Semiconductor Industry Partnership
  - DMEA procurement flow chart for ICs
- Careers at DMEA
  - Internships
  - SMART Program
- Contacts

* Award Winning Website
DMEA: A Complete Strategy for Defense Microelectronics

• **Unique challenge**
  – Increased reliance on critical technology
  – Technology transition / Adaptive Operations
  – Decreased market leverage
  – No long term commercial support
  – Increased unstable manufacturing
  – Trusted supply for mil applications
  – Decreased skilled resources available

• **Unique solution**
  – License and transition OEM lines to DMEA’s ARMS foundry
  – Leverage DMEA /defense industry requirements / capabilities
  – Full use of commercial development – technology transition
  – Practical long term solution strategy

• **Investigate future DoD specific microelectronics issues & develop solutions**

• **Develop researched technology for quick application insertion**

• **Total Life Cycle Systems Management approach**
  
  *Agile – Adaptive - Supportable*