Technology Transition and Issues in Developing Roadmaps for Maritime Energy & the Next Generation Integrated Power System

Electric Machines Technology Symposium
May 19, 2010

Norbert Doerry

Technical Director, SEA 05 Technology Group

SEA05TD

Norbert.doerry@navy.mil

202-781-2520

NAVSEA Priorities

- ***Sustain Today's Fleet Efficiently and Effectively***
- ***Build an Affordable Future Fleet***
- ***Enable our People***

VADM McCoy
COMNAVSEA

RDML Eccles
SEA 05

Agenda

- Technology Transition
- NGIPS Roadmap (then and now)
- Maritime Energy Roadmap

Technology

"The practical application of knowledge especially in a particular area"

Merriam-Webster Dictionary

Technology Transition

"Transfer of knowledge from those people that create it, to those people that require the knowledge to impact a change on a ship."

- People have to be paid
- People generally are in different organizations

- Two aspects of Technology Transition
  - Transfer of Knowledge from one organization to another
  - Transfer of Fiscal Responsibility from one organization to another

Not all technology is worthy of transfer

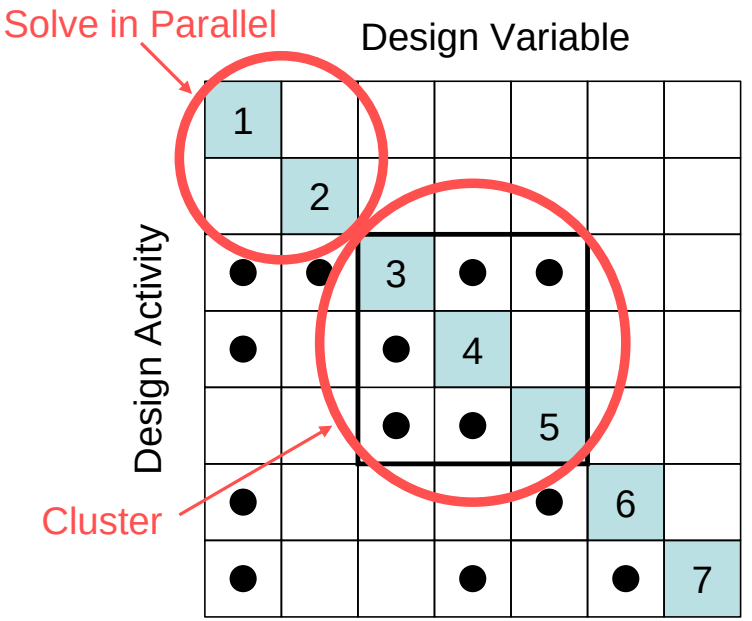
- Technology must be
  - Useful
  - Legal and moral
  - Predictable (required for design)
  - Affordable
  - Producible
  - Able to be integrated into existing systems and processes (or replace them completely)
- Technology Transition must be
  - Legal (Intellectual Property Laws)
  - Affordable
  - Receptive by involved individuals / organizations

Getting a new technology Component / System on a ship

- New Construction
  - Written into Ship Specifications
  - Engineering Change Proposal
  - Written into Component Specification / Standard
- In Service
  - Ship Change Document (Planned configuration change)
  - Alteration equivalent to Repair (AER)
  - Fit Form Function replacement of a repair part
    - Via Stock System
  - Alteration during Depot Maintenance
  - “requirements” for consumables (MRCs, TMs, etc.)

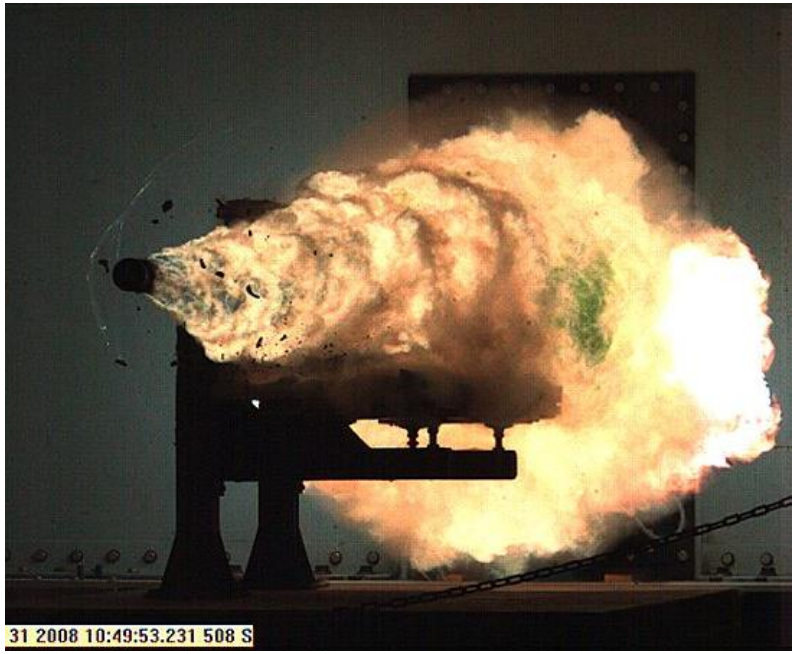
Getting a new Process / Tool Invoked

- Modify Process Documentation
  - Standards and Handbooks
  - Work Instructions and Standard Practices
  - Modify SOWs and specs
- Modify infrastructure
  - Tools
  - Software
  - Workspace layout
- Train Workforce
- Monitor and act on relevant metrics

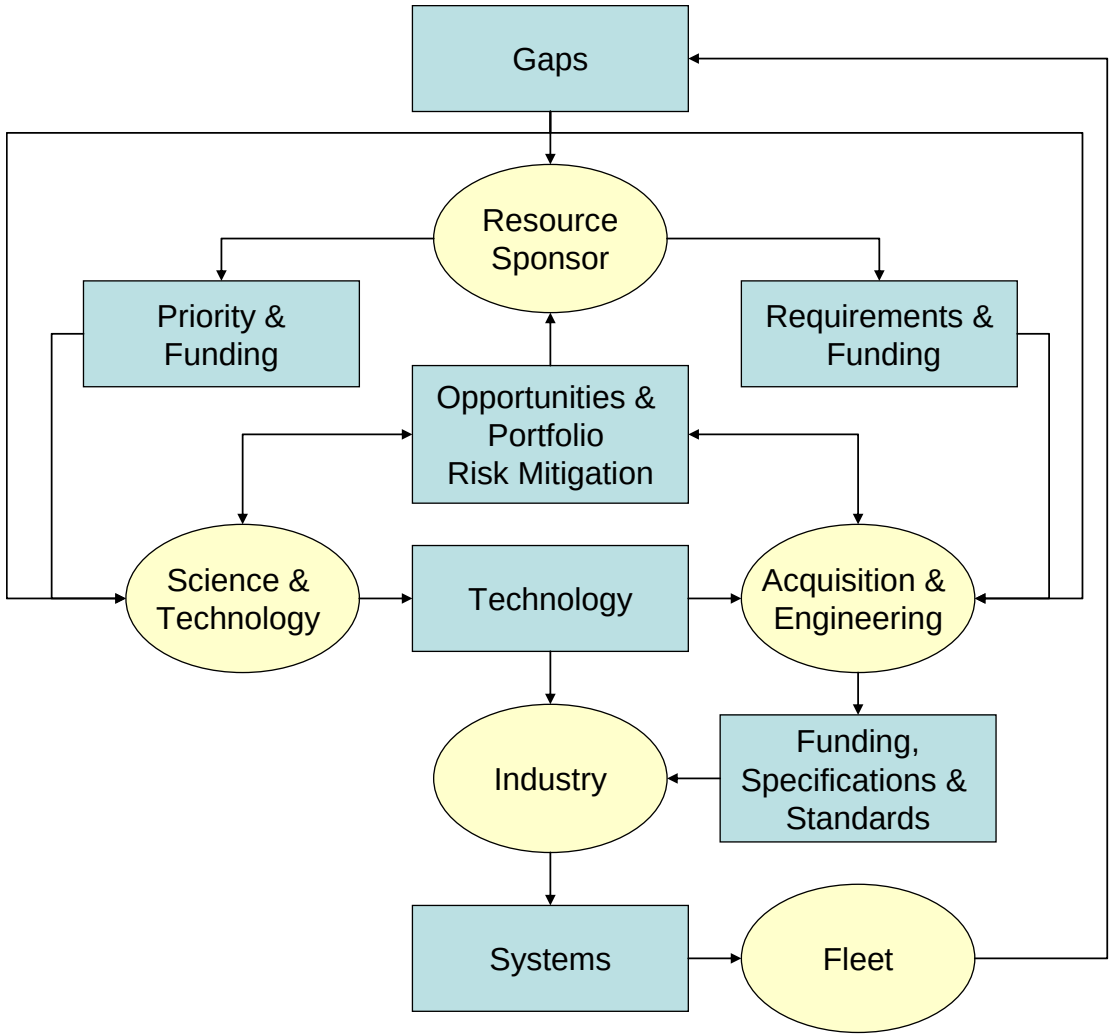


Reasons to Adopt a new Technology

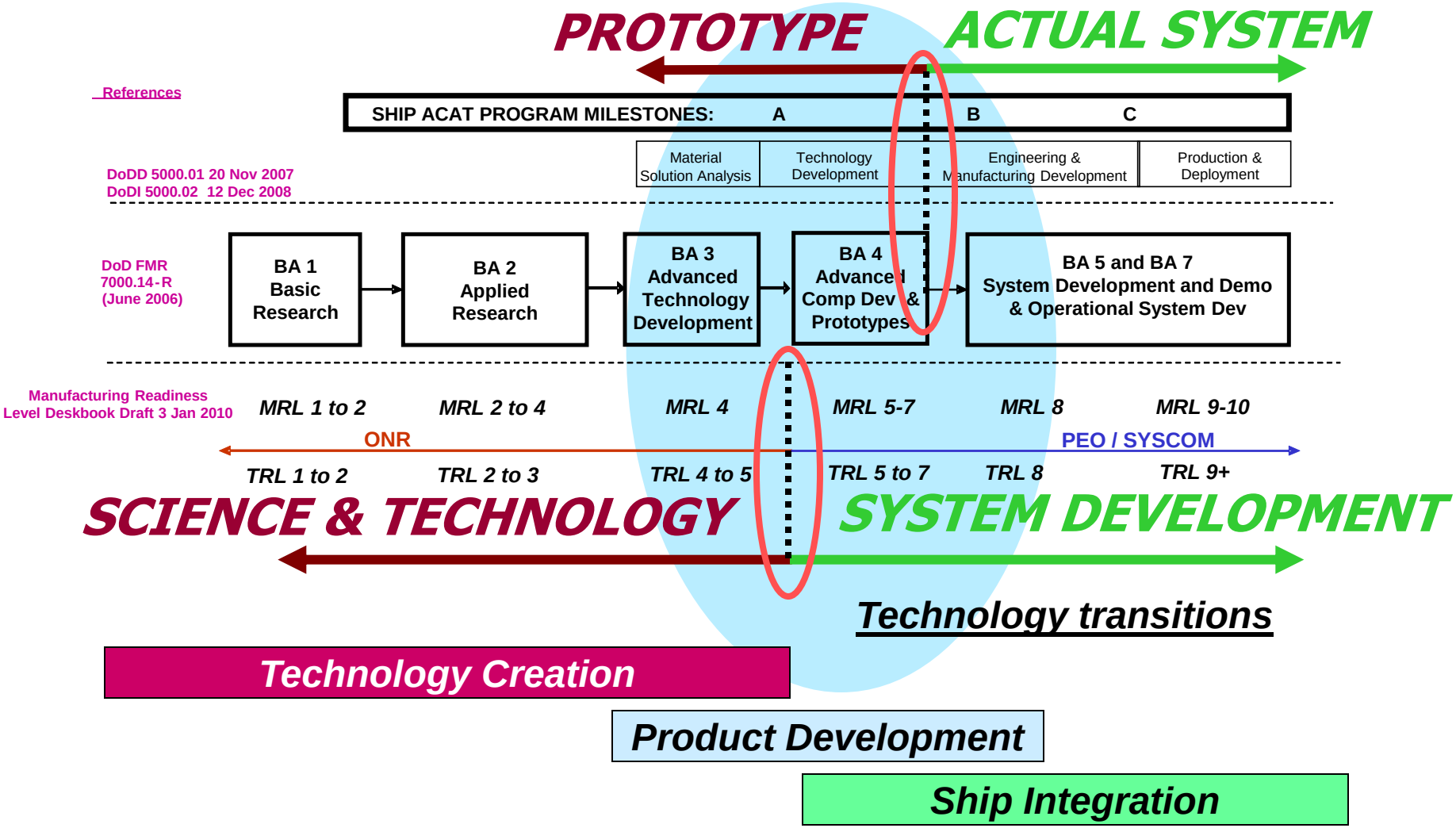
- **Gap (Best way to fulfill an unmet operational requirement)**
  - Advances in adversary capabilities
  - Changes in CONOPS
  - Changes in law and regulations
  - Loss of industrial base to reproduce existing system
- **Opportunity (Perceived benefits outweigh the risks)**
  - Acquisition Cost Reduction
  - Total Ownership Cost Reduction
  - Enable new CONOPS
- **Risk Management**
  - Improve Flexibility to react to potential future gaps (Requirements Risks)
  - Mitigate risk of disappearing Industrial Base or source of raw materials
  - Mitigate risk of a technology for another more critical program



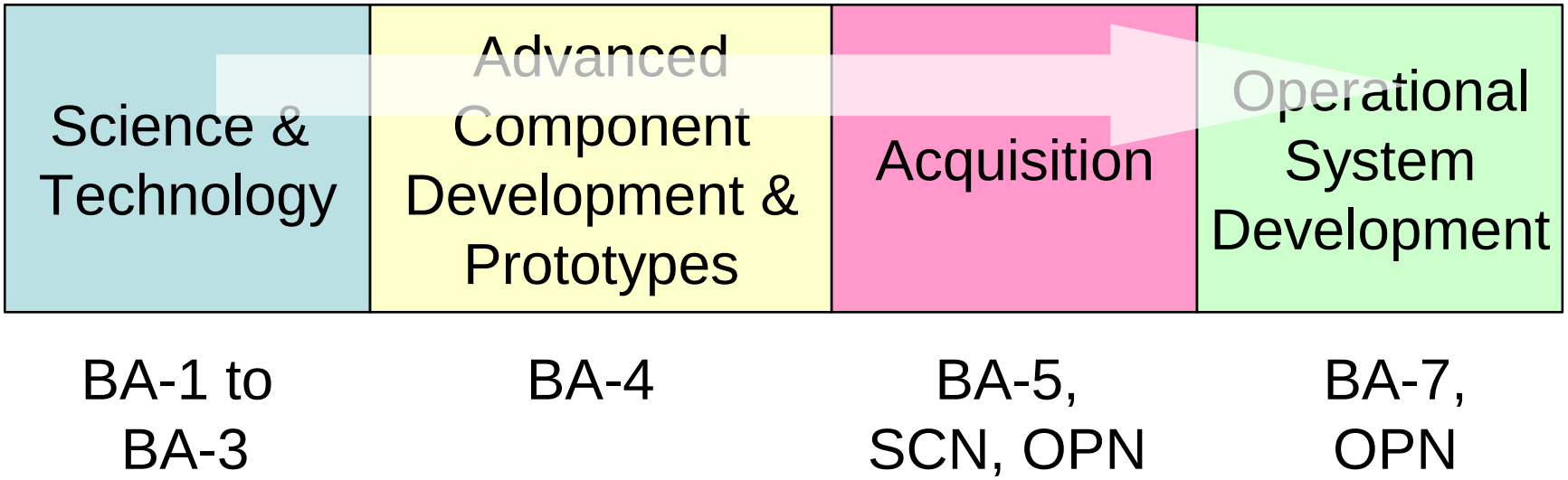
Technology Transition Interactions



Technology Transition

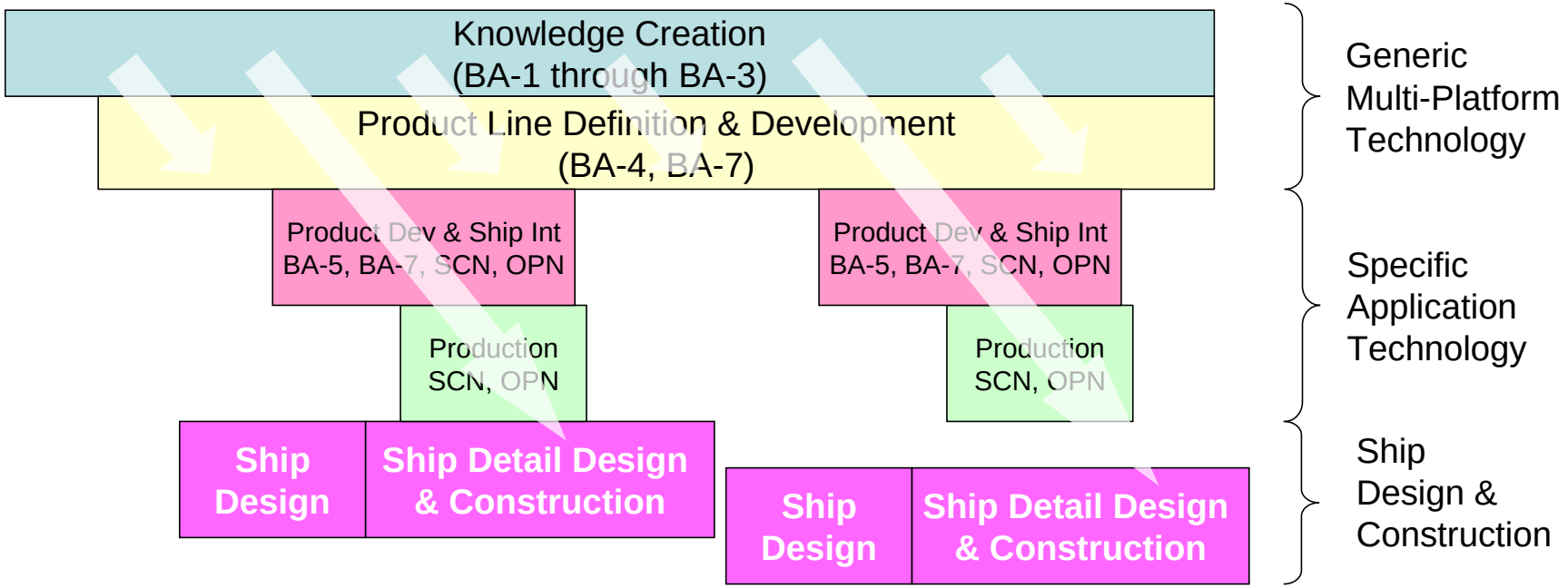


Traditional Technology Transition Model



- Observations
  - Serial (long) Process
  - Does not promote commonality across platforms

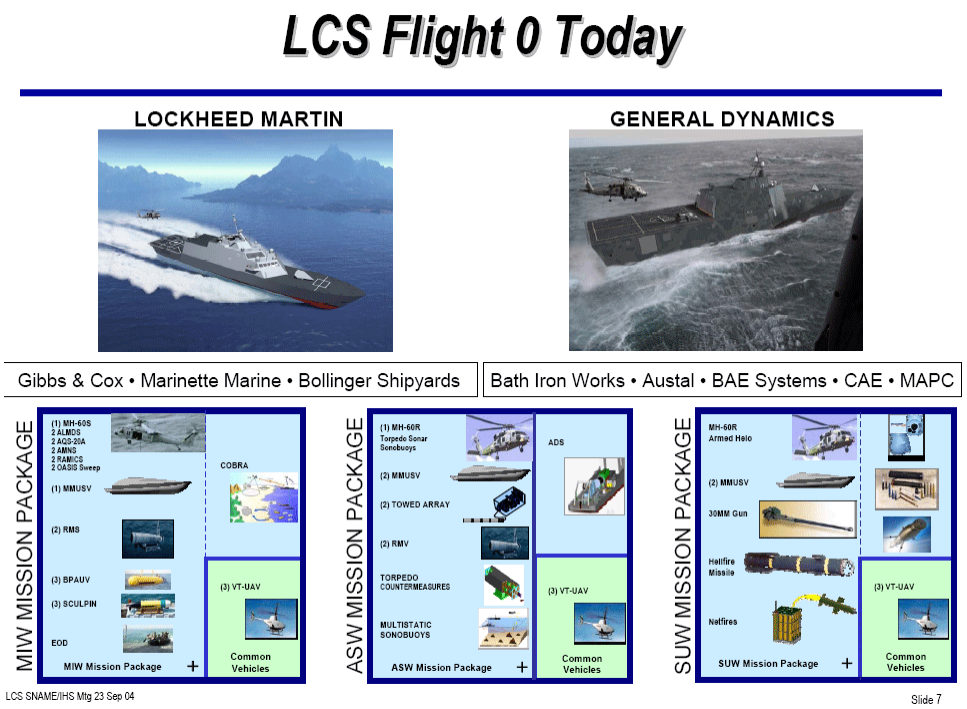
Alternate Technology Transition Model



- Product Lines are the ability to create and produce specific applications when needed.
- Product Lines promote Commonality across Ship classes.
- Technology Development Roadmaps facilitate communication across Technology Development boundaries.

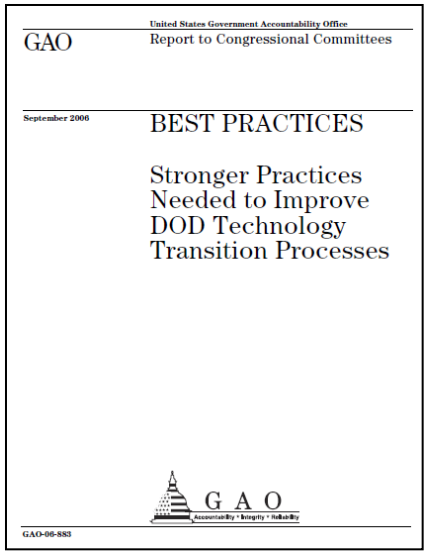
Product Lines

- Decouple S&T from specific ship applications
  - Eliminate churn in aligning S&T and ship acquisition programs.
- Capture knowledge in Specifications, Standards, Handbooks, Design Data Sheets, Rules, etc.



Technology Transition Enablers

- Technology Transition Agreements
- Relationship Managers
- Metrics


United States Government Accountability Office
GAO
Report to Congressional Committees
September 2006
BEST PRACTICES
Stronger Practices Needed to Improve DOD Technology Transition Processes
GAO
GAO-06-883

GAO, "Stronger Practices Needed to Improve DOD Technology Transition Processes," GAO-06-883, September 2006

Technology Transition Agreements

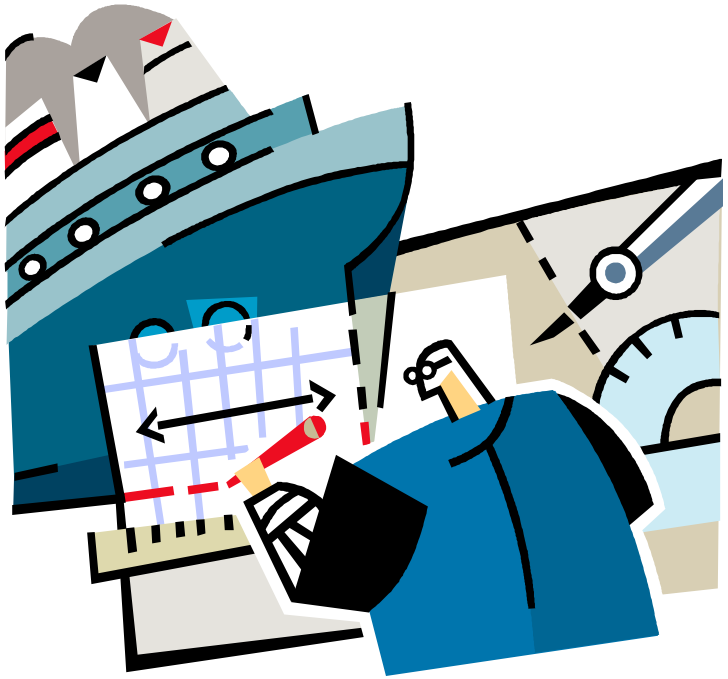
- "The agreements put in writing the technology and business-related expectations, such as specific cost, schedule, and performance characteristics that labs must demonstrate."
- "The agreements also may require documenting manufacturing costs or specifying whether certain lab scientists will be loaned to the product line to provide continuity in technical knowledge."

DEFINES A RELATIONSHIP BETWEEN
TECHNOLOGY CREATION AND PRODUCT LINE DEVELOPMENT

SHOULD INCLUDE MUCH MORE THAN A COMMITMENT
TO FUND FURTHER DEVELOPMENT

Relationship Managers

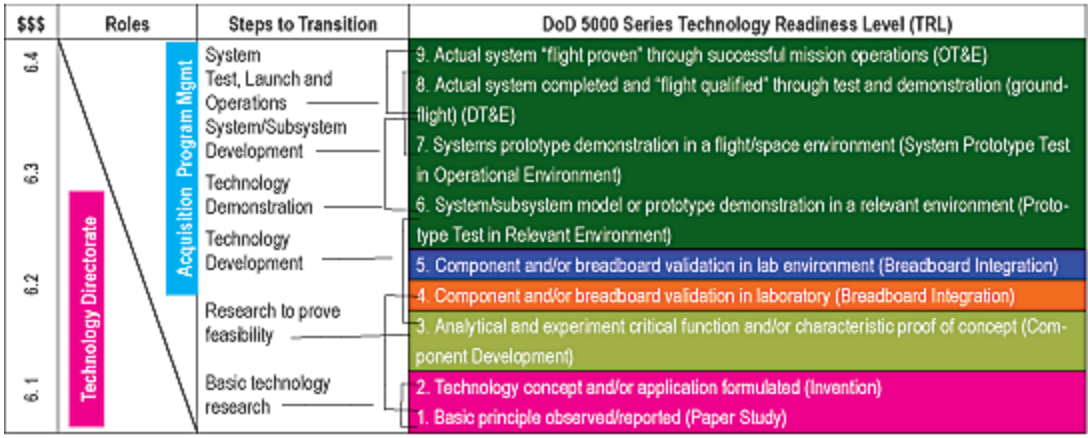
- Communicate across the labs and product lines to address transition issues.
- Ensure the right knowledge gets to the right person to make the final product a success.
- Facilitate feedback from the product development back to the technology developers to guide the creation of new technology.



Metrics

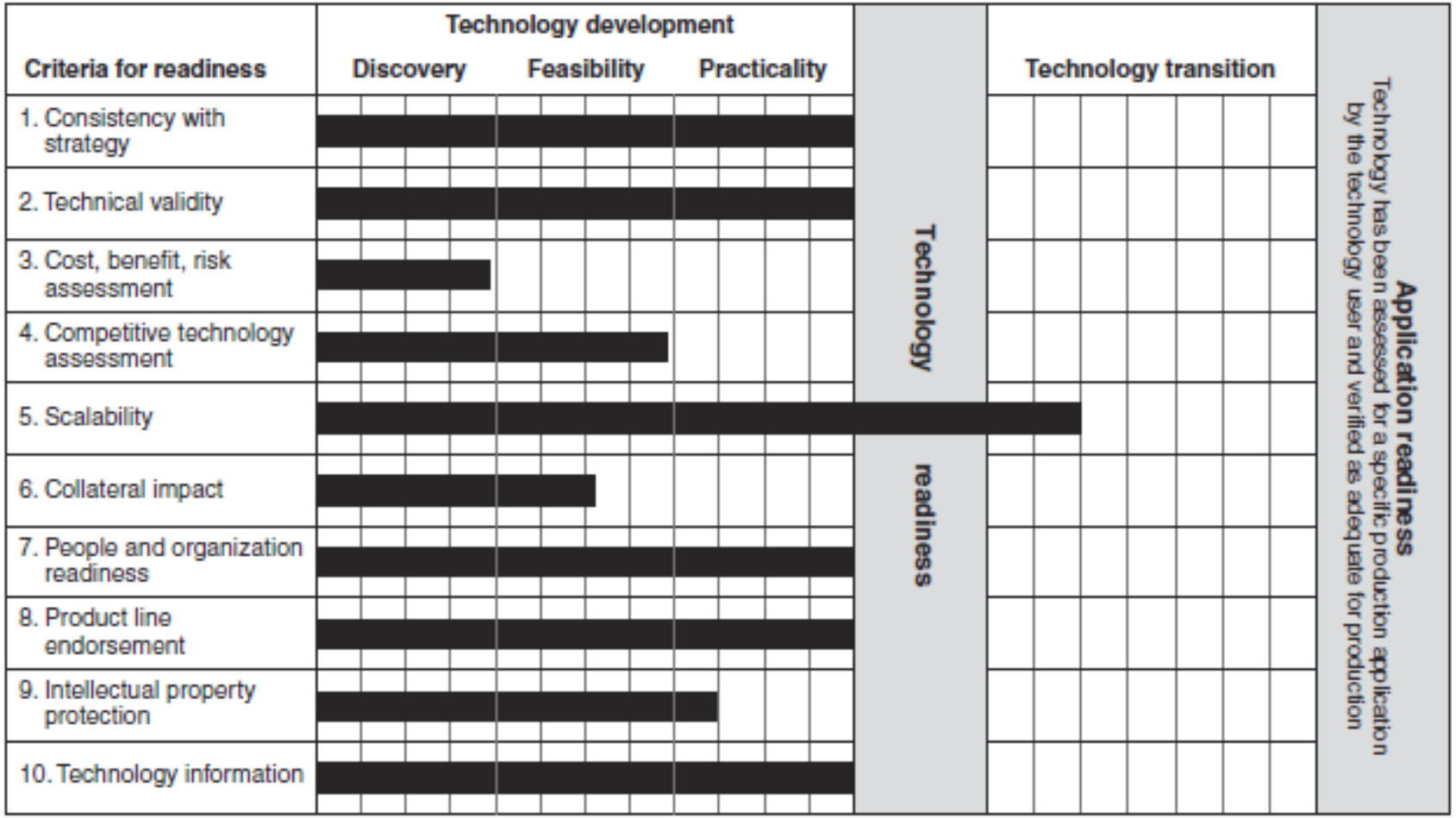
- DOD Metrics
  - Technology Readiness Level
  - Manufacturing Readiness Levels
- Commercial Industry Metrics
  - More Inclusive of all aspects of Technology Transition

Figure 2. Technology Readiness Levels (TRL).



MRL	Definition	Phase	BA
1	Basic Manufacturing Implications Identified	Pre Materiel Solution Analysis	1
2	Manufacturing Concepts Identified	Pre Materiel Solution Analysis	2
3	Manufacturing Proof of Concept Developed	Pre Materiel Solution Analysis	2-3
4	Capability to produce the technology in a laboratory environment.	Materiel Solution Analysis(MSA)leading to a Milestone A decision.	2-3
5	Capability to produce prototype components in a production relevant environment.	Early Technology Development Phase	4
6	Capability to produce a prototype system or subsystem in a production relevant environment.	Prior to completion of Preliminary Design and the start of Contract Design	4
7	Capability to produce systems, subsystems or components in a production representative environment.	Late Technology Development Phase leading to Milestone B	4
8	Pilot line capability demonstrated. Ready to begin low rate production.	Engineering & Manufacturing Development (EMD) leading to a Milestone C decision.	5 - SCN
9	Low Rate Production demonstrated. Capability in place to begin Full Rate Production.	Production & Deployment leading to a Full Rate Production (FRP) decision.	5 - SCN
10	Full Rate Production demonstrated and lean production practices in place.	Full Rate Production/ Sustainment	SCN

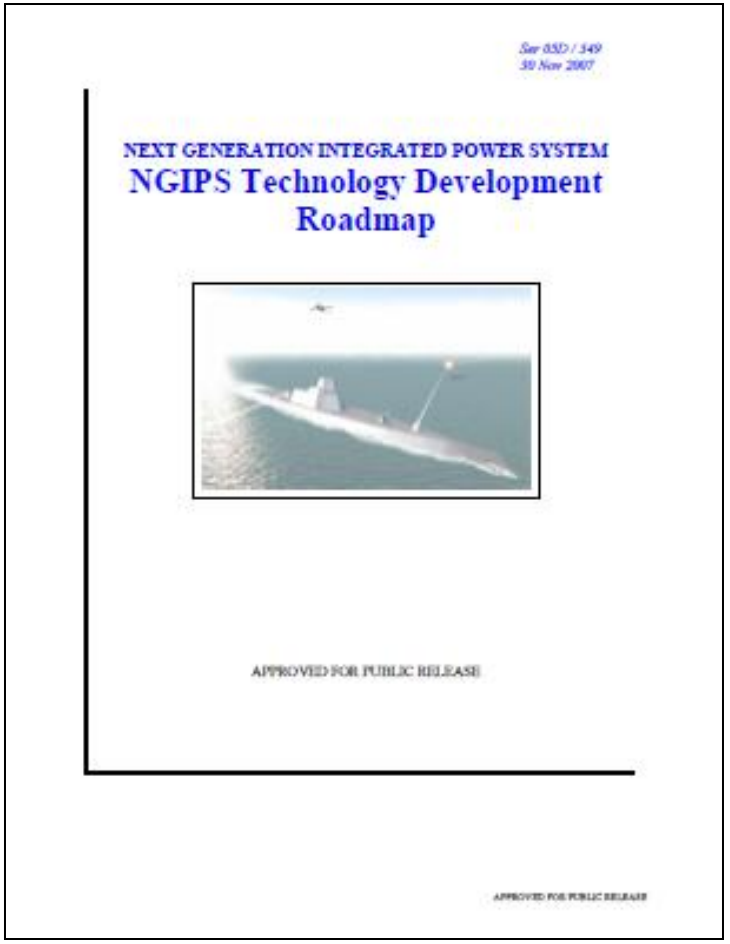
Boeing Technology Maturity Scoreboard



Source: GAO analysis based on The Boeing Company's scorecard.

NGIPS Technology Development Roadmap

- Developed in 2007
  - Coincident with establishing the Electric Ships Office
- What it Did
  - Defined the state of the technology
  - Defined the Need
  - Defined Architectures
  - Listed technology developments needed
  - Proposed a Business Model
- What it Did Not Do
  - Define an Execution Plan



2007 NGIPS Roadmap

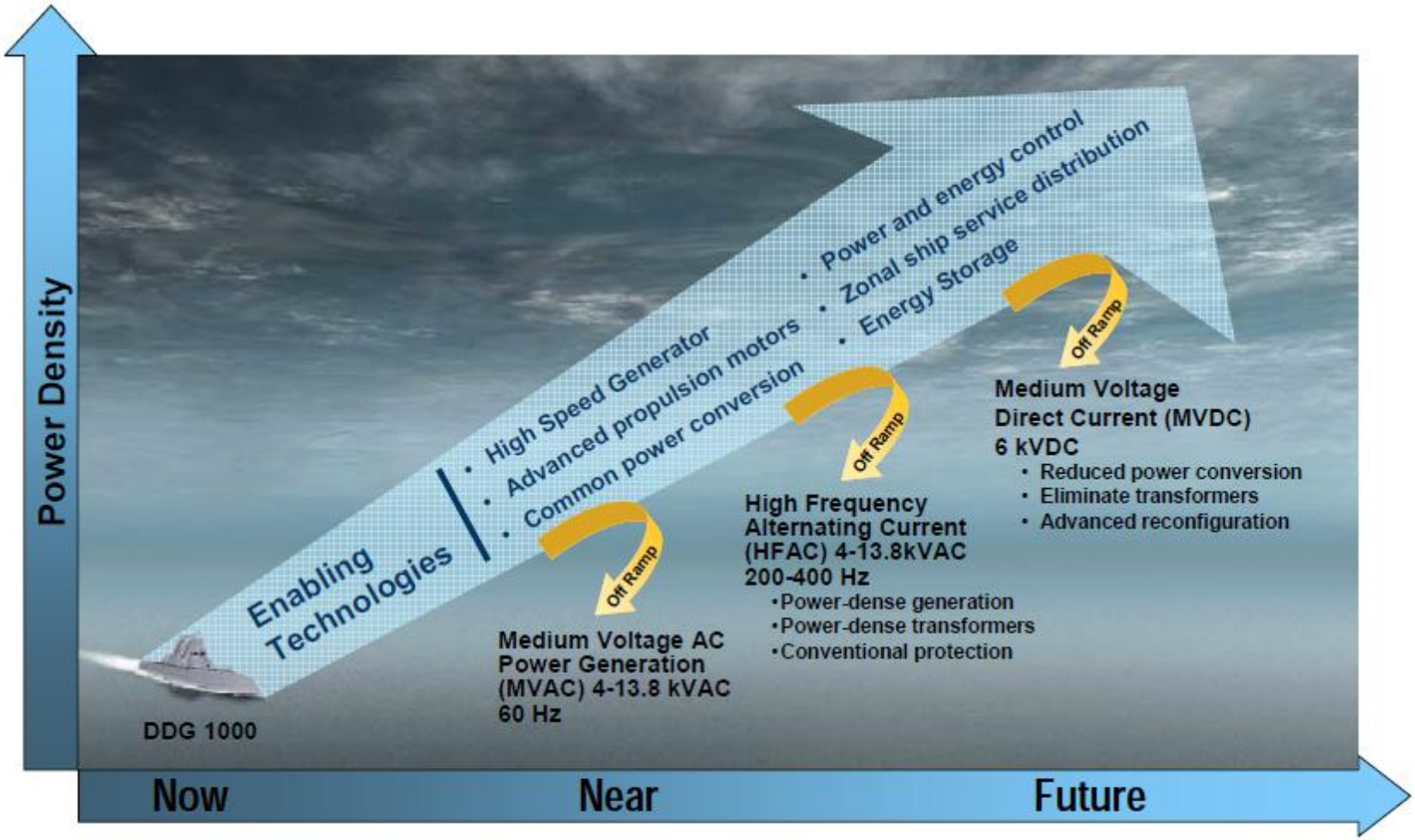
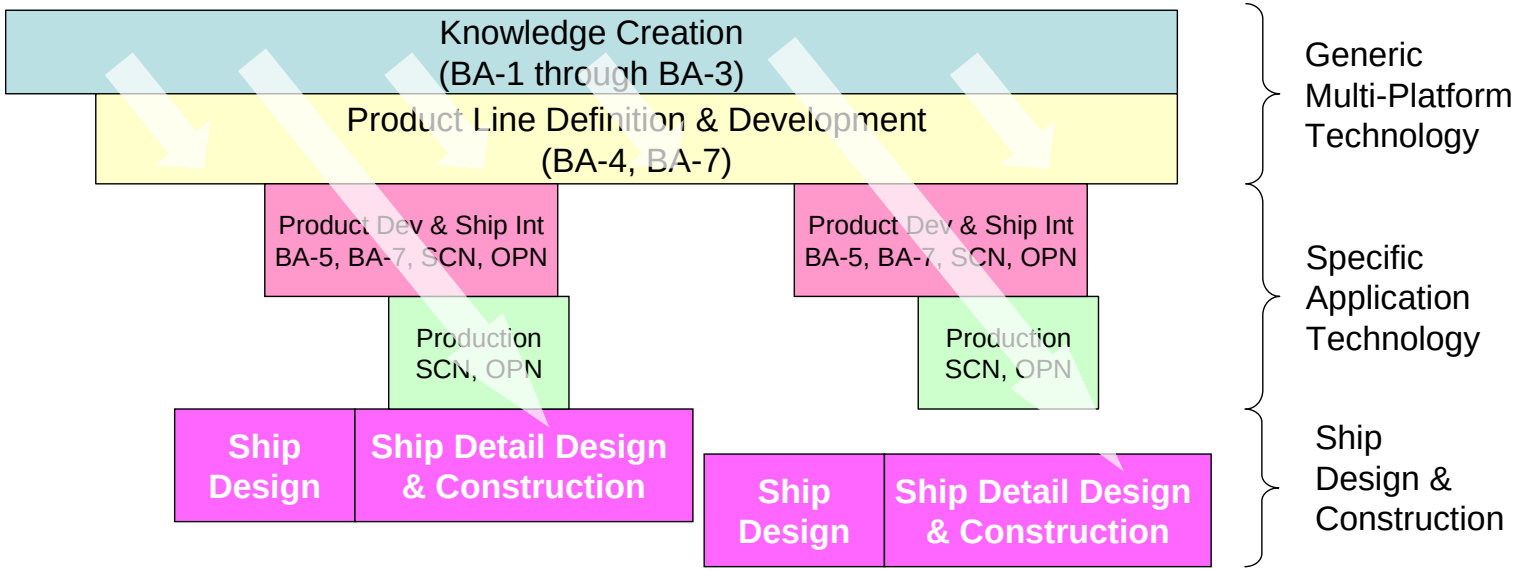
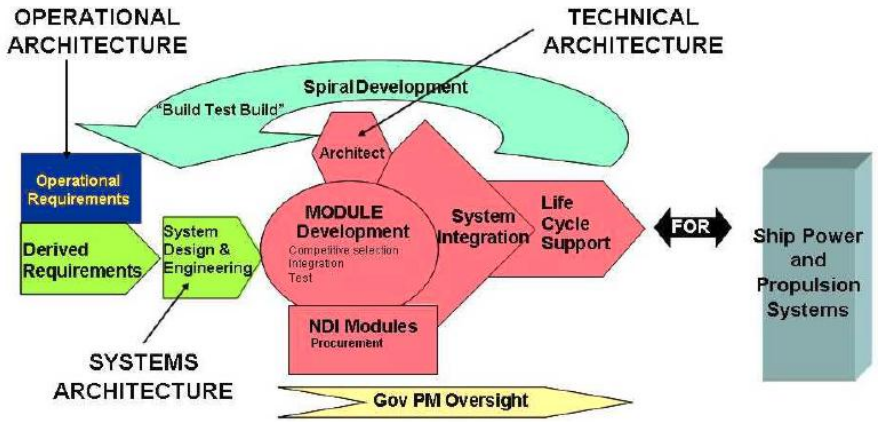


Figure 1: NGIPS Technology Development Roadmap

Business Model proposed a "Product Line" approach





Lessons Learned

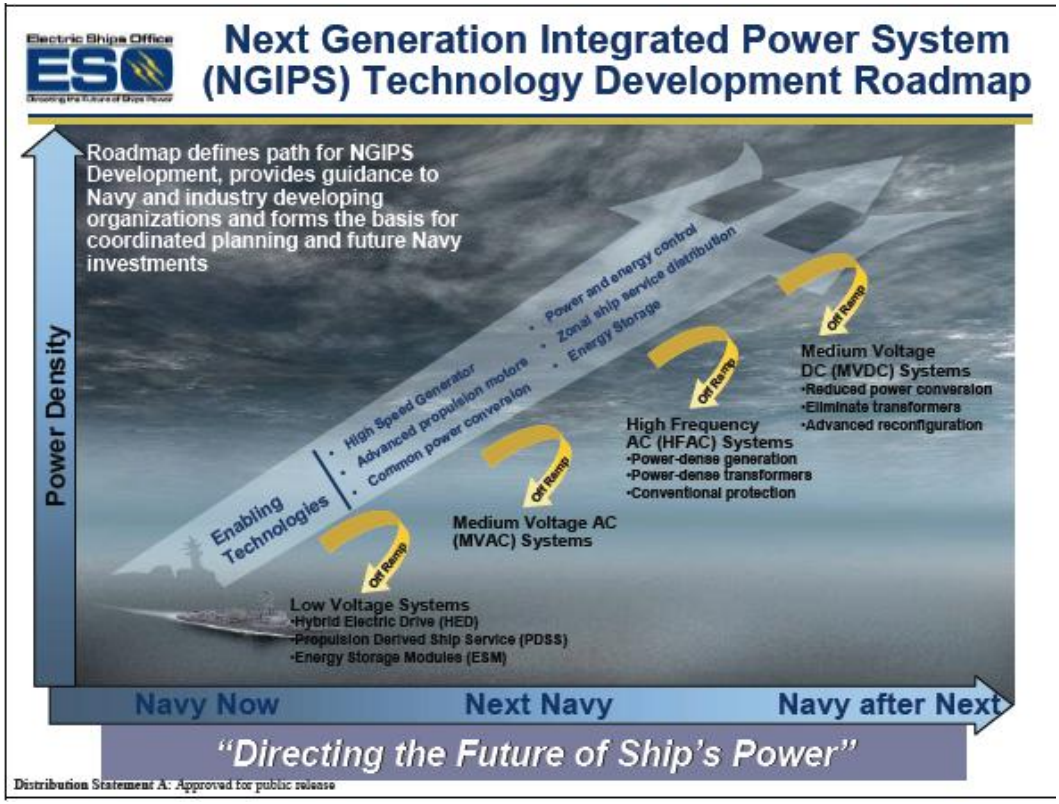
- Engagement of all stakeholders important
  - ONR
  - PEO's
  - Technical Warrant Holders
  - Industry
  - OPNAV
- Stakeholder alignment as important as the document.
- Distribution Statement A important.
  - Facilitated a shared vision through out academia, industry, and the Government

Another look 3 years later

- The technology descriptions are still good.
- Progress has been made in achieving the roadmap objectives.
  - The plan allowed for decentralized execution.
  - Industry, ONR, NAVSEA, and Academia have aligned much of their Power Systems R&D with the roadmap.
  - IEEE standards development has been very productive.
- Good and Bad with not including Execution Plan
  - Good: Stakeholder could agree on what needed to happen as long as they didn't have to commit to funding it.
  - Bad: Many tasks were not funded
- Progress in implementing the Business Model has been slow.
- The focus on new design ships is not in alignment with current acquisition approach to relying on modified repeat designs.

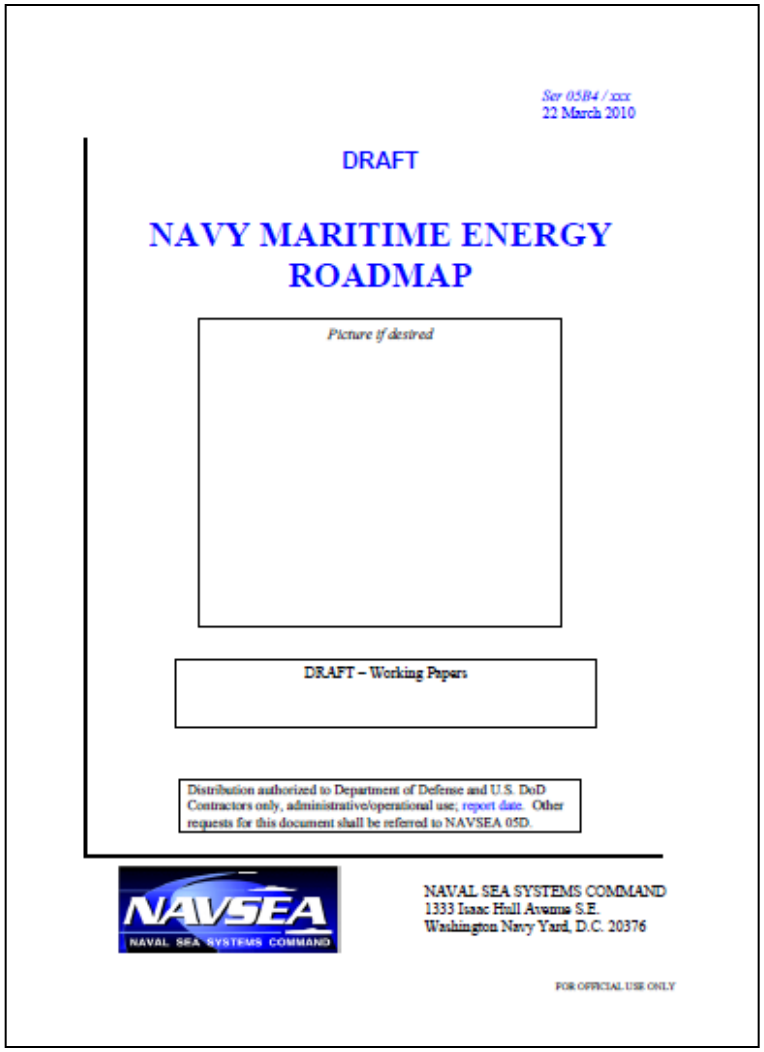
2010 Update to NGIPS Technology Development Roadmap

- Reflect evolution of the 30 year shipbuilding plan
- Directly address legacy Low Voltage Distribution systems
- Increase coverage of Hybrid Electric Drive
- Updating of tasks
- Refinement of Business Model
- Separate Program Plan being Developed



Navy Maritime Energy Roadmap

- Ongoing effort to support Task Force Energy
- Characterizing Technology is straight forward
  - Many captured in INEC 2010 Paper “Energy and the Affordable Future Fleet”
- Stakeholder involvement challenging
  - No organization analogous to the Electric Ships Office to focus efforts
- Technology Transition and Business Model Challenging



Ser 05B4 / xxx
22 March 2010

DRAFT

NAVY MARITIME ENERGY ROADMAP

Picture if desired

DRAFT – Working Papers

Distribution authorized to Department of Defense and U.S. DoD Contractors only, administrative/operational use; report date. Other requests for this document shall be referred to NAVSEA 05D.

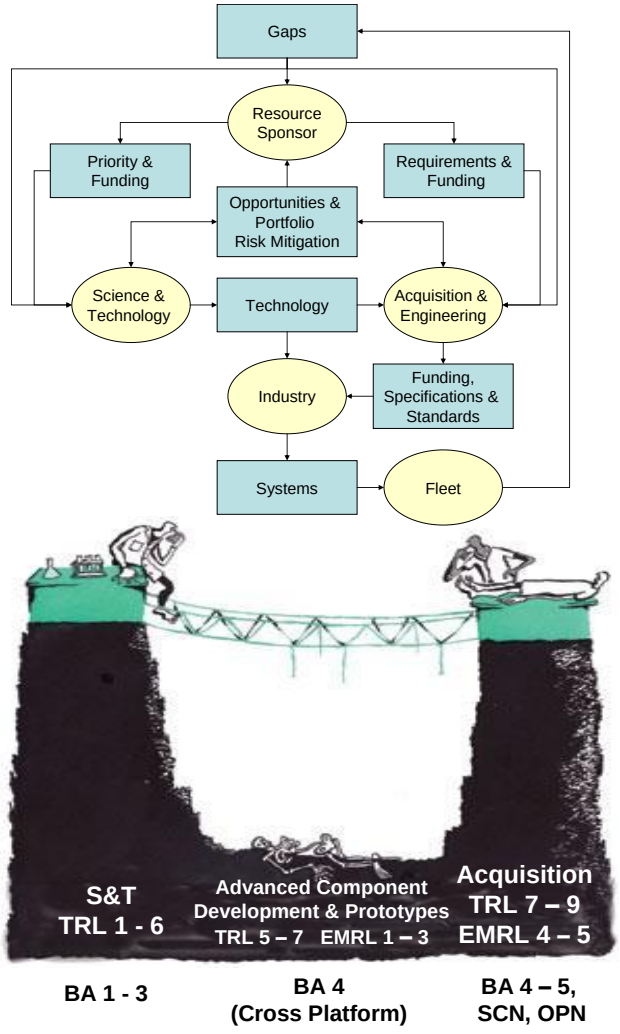
NAVSEA
NAVAL SEA SYSTEMS COMMAND

NAVAL SEA SYSTEMS COMMAND
1333 Isaac Hull Avenue S.E.
Washington Navy Yard, D.C. 20376

FOR OFFICIAL USE ONLY

Navy Maritime Energy Business Model Issues

- Technology Transition processes currently optimized for filling "Gaps"
- Energy efficiency improvements are typically "opportunities"
- Responsibility is diffused among many organizations.
- R&D "Valley of Death" hinders ability to transition S&T to the fleet



Summary

- Technology Transition
- NGIPS Technology Development Roadmap
- Maritime Energy Roadmap