Today's Agenda

TOPIC / DISCUSSION	SPEAKERS	TIME
Opening Remarks	John Burrow	0900 - 0915
Status of Naval Open Architecture (OA)	CAPT Shannon	0915 - 1015
Morning Break		**1015 - 1030**
OA in the Business Environment		
□ Increasing Competition in Acquisition Strategies	Nick Mirales	1030 - 1045
□ Data Rights in Acquisition Strategies	Art Samora	1045 - 1100
□ OA Award Fee/Award Term Incentives	Robert Jackson	1100 - 1115
□ Changes in OA Contract Language	Rick Goff	1115 - 1130
➡ □ Peer Reviews / Integrated Product Teams	John Stapleton	1130 - 1145
Questions for Business Panel Speakers		**1145 - 1215**
Aligning Technical Standards	Gary Minor	1215 - 1230
Questions & Wrap Up	CAPT Shannon	1230 - 1245

Role of Peer Review in Open Architecture Development

Performance Driven Acquisition Reform

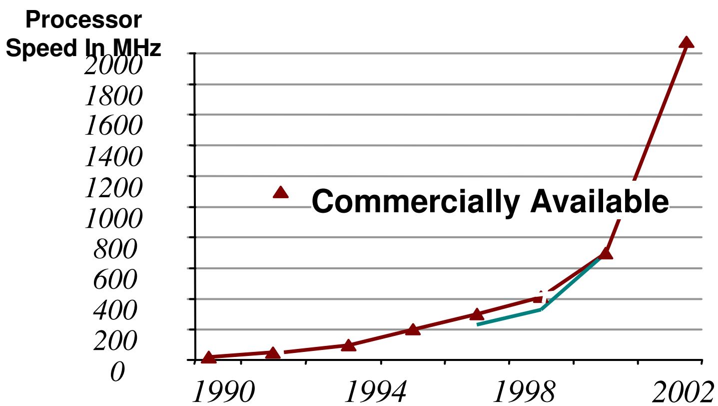
John Stapleton

**The Johns Hopkins University
Applied Physics Laboratory
Laurel, Maryland 20723**

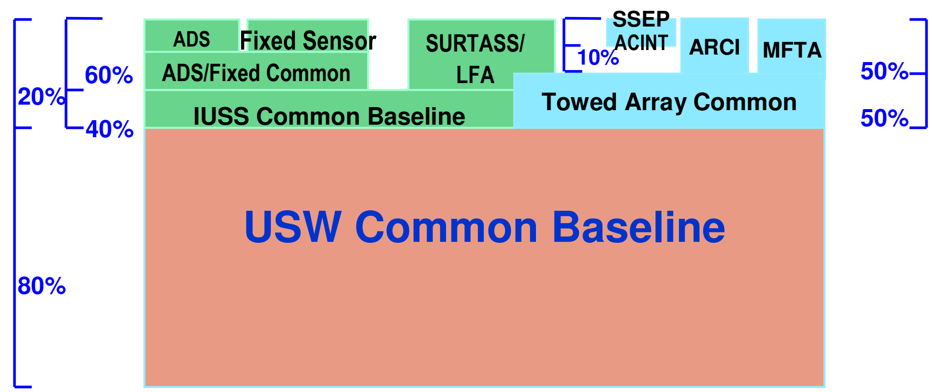
14 February 2006

Open Architecture

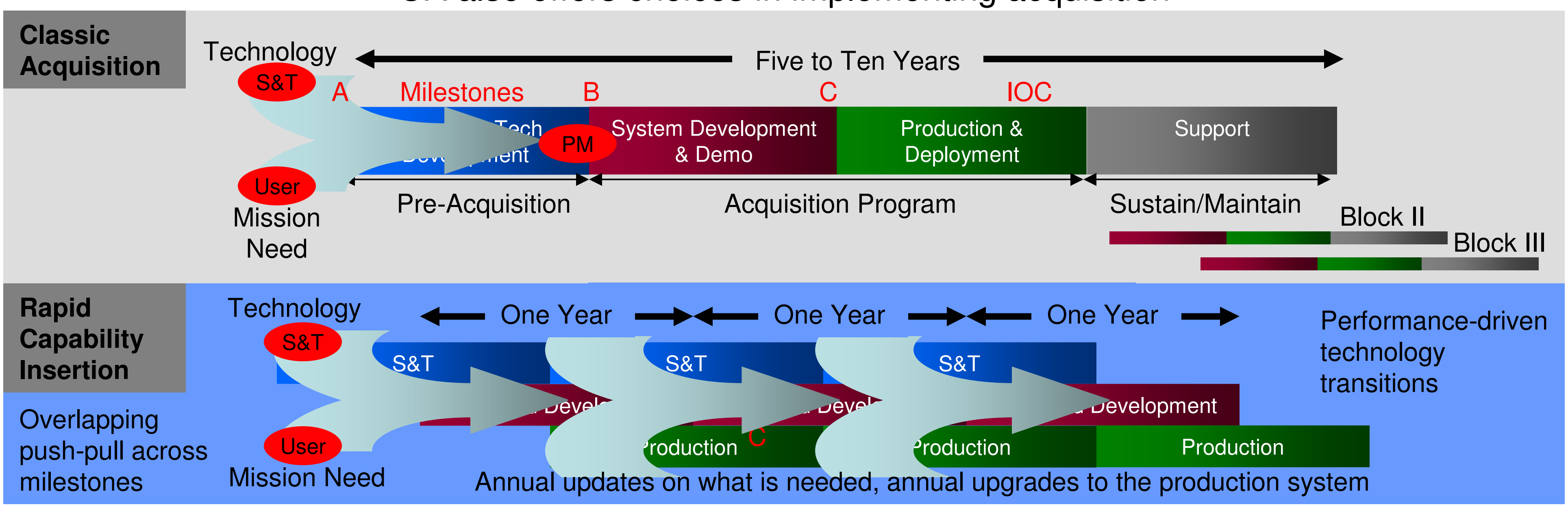
OA enables processing gains



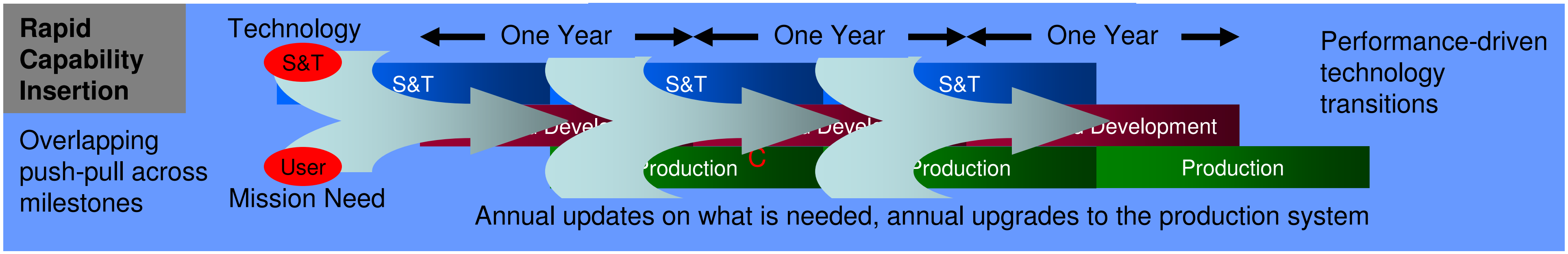
OA enables software reuse



OA also offers choices in implementing acquisition



Role of Peer Review



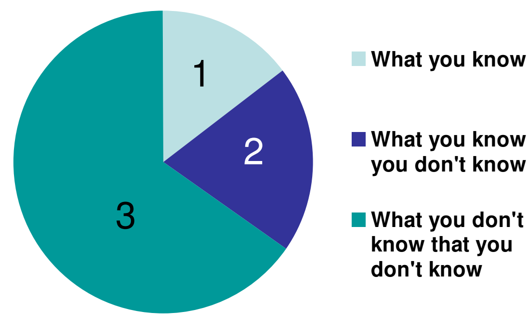
Well run peer review groups build early and interactive bridges between the Fleet operators and the algorithm developers.

They make transition recommendations to the sponsor based on *performance*.

Keys

- **Fleet participation**
- **Emphasis on real encounter data**
- **Distribution of open data sets**
- **Accessible read/write formats and utilities**
- **Published metrics**
- **Open competition, attribution of contributions**
- **Developer participation in evaluations**
- **Elevated standards for S&T maturity**
- **Transition recommendations that include technologies from inside and outside the peer group membership**

Well run peer groups solicit the best ideas from all three categories:



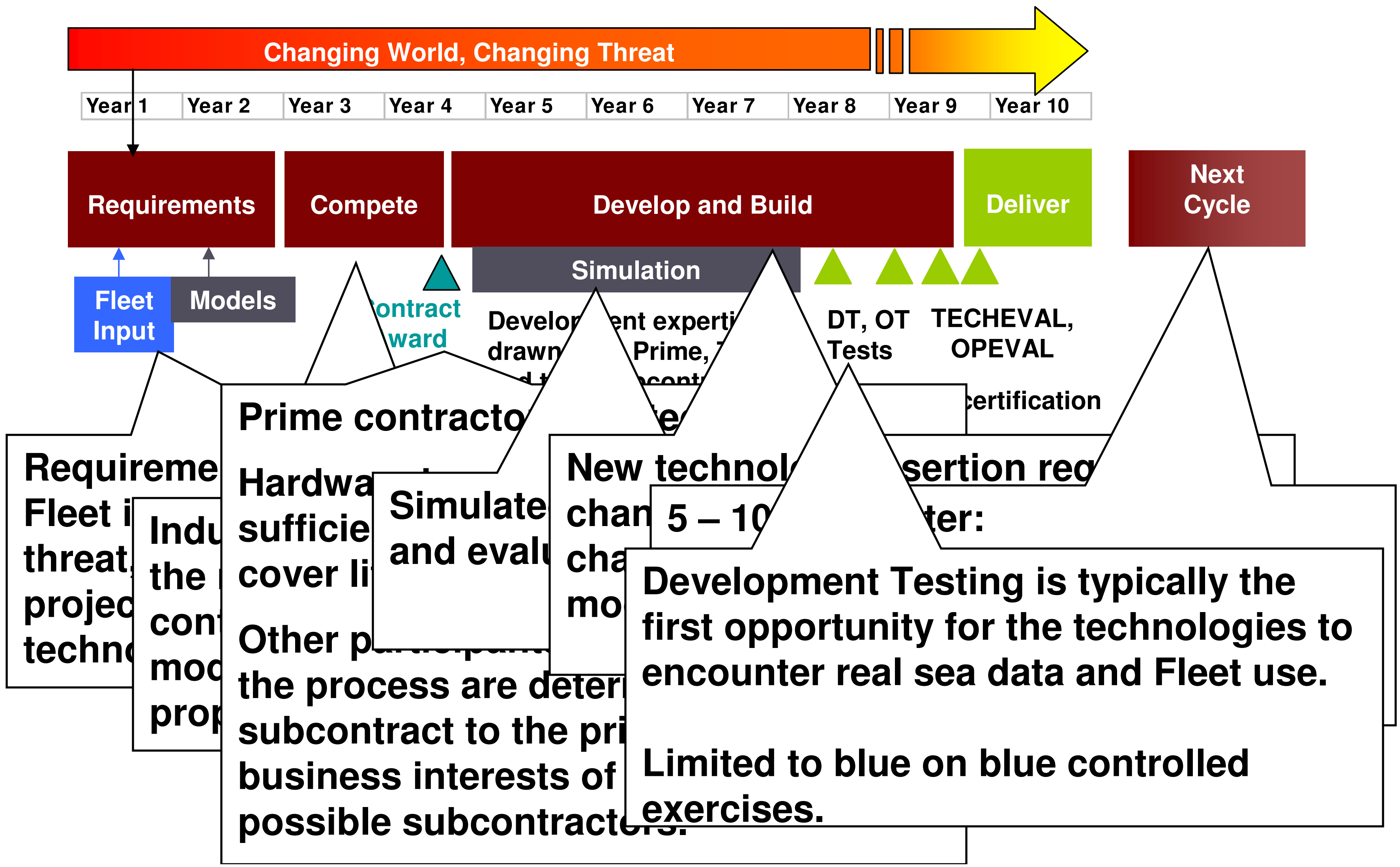
Programs based on a pre-selected team can only deliver technologies from that team's knowledge base (what you know).

The best developers gravitate to an open process where technology transitions are based on *performance*.

"No one organization has the full story"
- ARCI Axiom 8, CAPTs Jarabak and Sieve, 1997

Rapid Capability Insertion

Changes acquisition from this …



Rapid Capability Insertion

… to this:

4-Step Peer Review Process

Step 1
Survey R&D

Step 2
Algorithm Evals
• Common Metrics
• Common Data
• Recommendation

Step 3
Lab Eval
• End-to-End
• Sea-Ready
• Operator Tr

Step 4
At-Sea Test
• Performance
• Operability

To Production

Changing World, Changing Threat

Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 | Year 9 | Year 10

-05 -06

-04 -05 -06

OPEVALs

tion

ata archival

rrective feedback

Participation is open to anyone who has a candidate technology for transition. The process is best as a performance meritocracy.

4- Peer Revie process, led by "best and brig Peer g ps include Fleet repres

The produ m should include embedded

Annual insertion of new capabilities to the Fleet is the realization of the Navy's evolutionary build-test-build (spiral development) directive.

developers.

Tests to Tell if Peer Review is Real

Wide field of view for new ideas

Genuine peer review ↑

Peer Review

Open process

Multi-organizational peer review

Technologies transition from developers both outside and inside the peer group

Performance-based transition recommendations. Performance is measured and algorithm-level downselects are made prior to transition.

Bakeoffs among competing concepts

Outcome is often not what the sponsor expects

Transition failure is possible even for peer group members

Widest view for the best innovations

Most challenging to manage

Something else ↓

In-Between

Pre-selected teams

Multi-organizational team determines the technical approach

Technologies from within the team are defined to transition

Performance is measured after transition, with little time to make corrections before at-sea testing or production.

Workable for narrowly defined problems

Managed as a modified traditional program. Relatively easy to manage with early definition of technology approaches made by the pre-selected teams.

Traditional Program

Prime contractor and TDA **determine the technology pool**

Performance is measured as part of production, and corrected with ECPs

Easiest to manage – can defer many decisions to the TDA

Advanced Development Transition Keys

Preparing for Evaluation by a Performance-Driven Peer Group

Transition-readiness is based on the peer group's engineering judgments in the following areas:

Utility, Risk, Maturity, Operator Interface, and Sizing/Timing

- and -

Analysis with quantitative performance metrics in testing with open and closed data sets (with developer participation)

- Metrics for algorithms
- Metrics for OMI
- Metrics for other categories as needed

Peer group provides a recommendation,
NAVSEA program managers determine the transition

Advanced Development Transition Keys

Preparing for Evaluation by a Performance-Driven Peer Group

Readiness for Step 1 Evaluation

Utility

- Relevance to a fleet need
  - Op area, mission
- Identification of task in the operator sequence

Risk

- Enablers

  Signature characterizations, environmental inputs, required technologies
- Critical path algorithms
- Tuning/training/monitoring requirements

Operator interface preparation

- Information presentation
- Degree of operator assist

Maturity

- Functional description or algorithm description document
- Metrics identified
- Testing with real sea data
- Results of independent evaluation prior to step 1

Timing/sizing estimates

- Scratchpad software vs. building to OA used by the production system

  Using OA makes for an easier interface to the data and the testing, and speeds transition
- Utility and performance gains need to warrant the computational expense

Advanced Development Transition Keys

Preparing for Evaluation by a Performance-Driven Peer Group

Readiness for Step 2 Evaluation

Open testing

Real sea data sets available to developers

- Algorithm development and tuning
- Managing risk
- Enhancing maturity
- Operator interface prototyping

Prior evaluation results can be spot-checked by the peer group

Closed testing

Real sea data available only for peer group evaluations

Developers can participate in the evaluation to ensure that algorithms are tested properly

Developers who make use of lots of open data run into fewer surprises during closed testing

Transition-Oriented Development

Task-sequence based approach

(1) Identify steps in the operator task sequence. Iterate and update.

(2) Build displays and tools that will support the search. Iterate prototypes and OMI options.

(3) Automate tools with detection and estimation algorithms where possible. Iterate prototypes and OMI options with operators using ocean acoustic data.

(4) Maintain a system engineering and operator workload focus in prototypes for fitting algorithms together.

Working Automation

Algorithm based approach

(3a) Develop an algorithm in response to a requirement.

(3b) Develop a theoretical model for the algorithm.

(3c) Measure algorithm performance with ocean acoustic data.

(3d) Calibrate theoretical model with real ocean acoustic data.

(3e) Extend the model to project a bound on algorithm performance conditioned on available information.

(3f) Measure performance bounds with pre-screened ocean acoustic data.

Isolated Algorithms

Metrics

Metrics are NECESSARY but continue to be under evaluation.

- Once established, metrics tend to be relied upon more than is often warranted.
- Metrics often under-describe or miss key evaluation information, especially on new kinds of technologies

So: Metric results are accompanied by visual comparisons to enable best engineering judgments.

Open Access to the Data

Example distribution from a Measurement and Analysis Plan

Data	Media	POC			
AEP Tapes	AIT-2 Tapes	Scott D. Carter	NUWC	CarterSD@Npt.NUWC.Navy.Mil	(401) 832-8201
AEW Tapes	AIT-2	Terry Hammond	JHU/APL	Terry.Hammond@jhuapl.edu	240-228-
CMAR	AIT-2	Joe Izzi	NUWC	izzig@npt.nuwc.navy.mil	800-669-6892 ext 25717
CRH Data	Tape	Danny Linehan	ARL:UT	ndl@arlut.utexas.edu	(512) 835-3958
CTIMS	DDS-2	Joe Izzi	NUWC	izzig@npt.nuwc.navy.mil	800-669-6892 ext 25717
DDCS - AEMP	AIT-3	Terry Hammond	JHU/APL	Terry.Hammond@jhuapl.edu	240-228-
DDCS - Tactical	AIT-3	Joe Izzi	NUWC	izzig@npt.nuwc.navy.mil	800-669-6892 ext 25717
DDCS ACINT	AIT-3	Ben Kuiper	Progeny Systems	ben.kuiper@progeny.net	401-846-0111 ext 105
DDCS-T	AIT-3	Cory Sheffer	JHU/APL	Cory.sheffer@jhuapl.edu	240-228-0877
DGS-ECP002	DDS-2	Joe Izzi	NUWC	izzig@npt.nuwc.navy.mil	800-669-6892 ext 25717
DGS-ECP004	Files	Joe Izzi	NUWC	izzig@npt.nuwc.navy.mil	800-669-6892 ext 25717
EMURS	AIT-3 EMURS	Ben Kuiper	Progeny Systems	ben.kuiper@progeny.net	401-846-0111 ext 105
IVM	CD	Conrad Orloff	JHU/APL	Conrad.orloff@jhuapl.edu	240-228-6903
LTO Tapes - HF	LTO	Joe Izzi	NUWC	izzig@npt.nuwc.navy.mil	800-669-6892 ext 25717
LTO Tapes - SA	LTO	Joe Izzi	NUWC	izzig@npt.nuwc.navy.mil	800-669-6892 ext 25717
Persicope Image DVDs	DVD-R	John Barrett	JHU/APL	john.barrett@jhuapl.edu	240-228-8461
PMW		Dave Woodford	DSR	dwoodford@dsrnet.com	703-263-2801
SFTF Range Radar Data	Files	Craig Gardner	ANTEON	GardnerC@Npt.NUWC.Navy.Mil	(401) 832-8948
SFTF Range RV Stephan Contact Log	Files	Craig Gardner	ANTEON	GardnerC@Npt.NUWC.Navy.Mil	(401) 832-8948
SFTF Range RV Stephan NAV Data	Files	Craig Gardner	ANTEON	GardnerC@Npt.NUWC.Navy.Mil	(401) 832-8948
Slogger	DDS-2/3	Joe Izzi	NUWC	izzig@npt.nuwc.navy.mil	800-669-6892 ext 25717
Target WLY-1 EMURS	AIT-3	Ben Kuiper	Progeny Systems	ben.kuiper@progeny.net	401-846-0111 ext 105
TARPU	AIT-2	Joe Izzi	NUWC	izzig@npt.nuwc.navy.mil	800-669-6892 ext 25717
UNQ-9		Rich Gramann	ARL:UT	gramann@arlut.utexas.edu	512-835-3166
VSS	S-VHS, CDROM, DVCAM	Jeremy Shattuck	NUWC	Shattuckja@npt.nuwc.navy.mil	(401) 832-4603

Data collection plan is published in advance, and notification is sent to all interested parties.

Media are sent to multiple locations following the test, with POCs identified for distribution of copies.

This avoids “slow-rolling” of data requests.

Data Commonality/Standardization

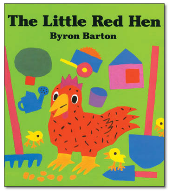
Common Data Exchange format

- Specifies time-aligned, integrated multi-sensor data
- Adoption community wide enables data distribution, sharing, tool development
- Enhances developer access to data
- Fuels new algorithm development

Embedded recorder

- Architected into the production system from the beginning (much more cost-effective than trying to do so later in development)
- Architected for scaling up (data collection requirements evolve as more/different questions have to be answered via data-driven means)
- Capable of recording data accessible via LAN
  - Algorithms, workstation state, automation, array/system health, etc.
- Data consumers request additional tap points
  - Profiles updated to accommodate request
  - Some requests necessitate "re-engineering" to accommodate

Embedded Recorders and Common/Standardized Data Formats Enable the Process



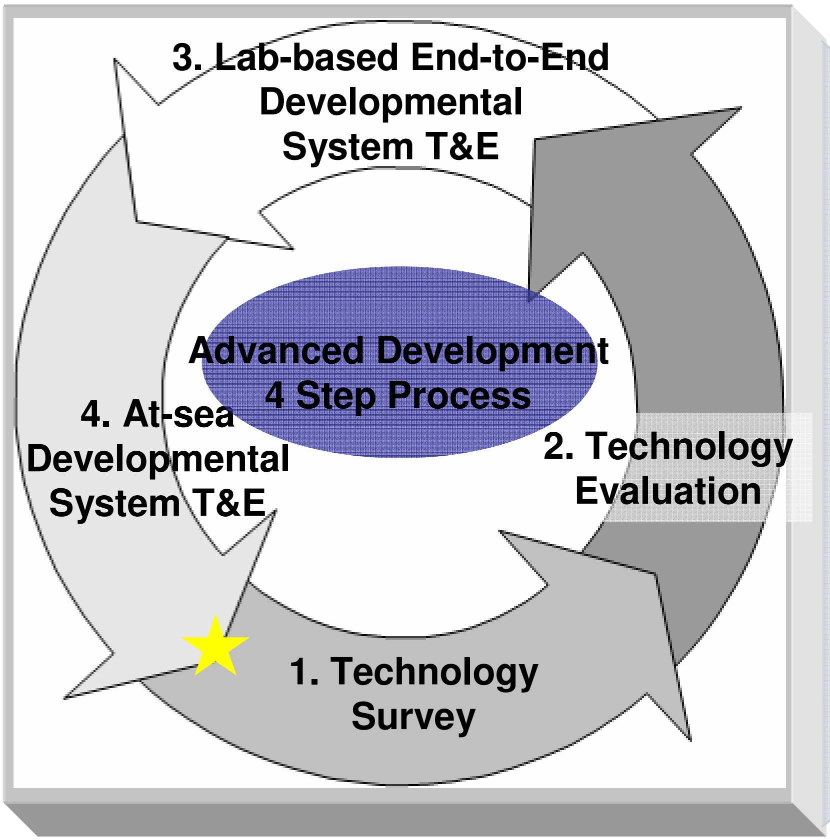
Attribution of Work, Tracking Entries, and Evaluation Results

An example from ARCI

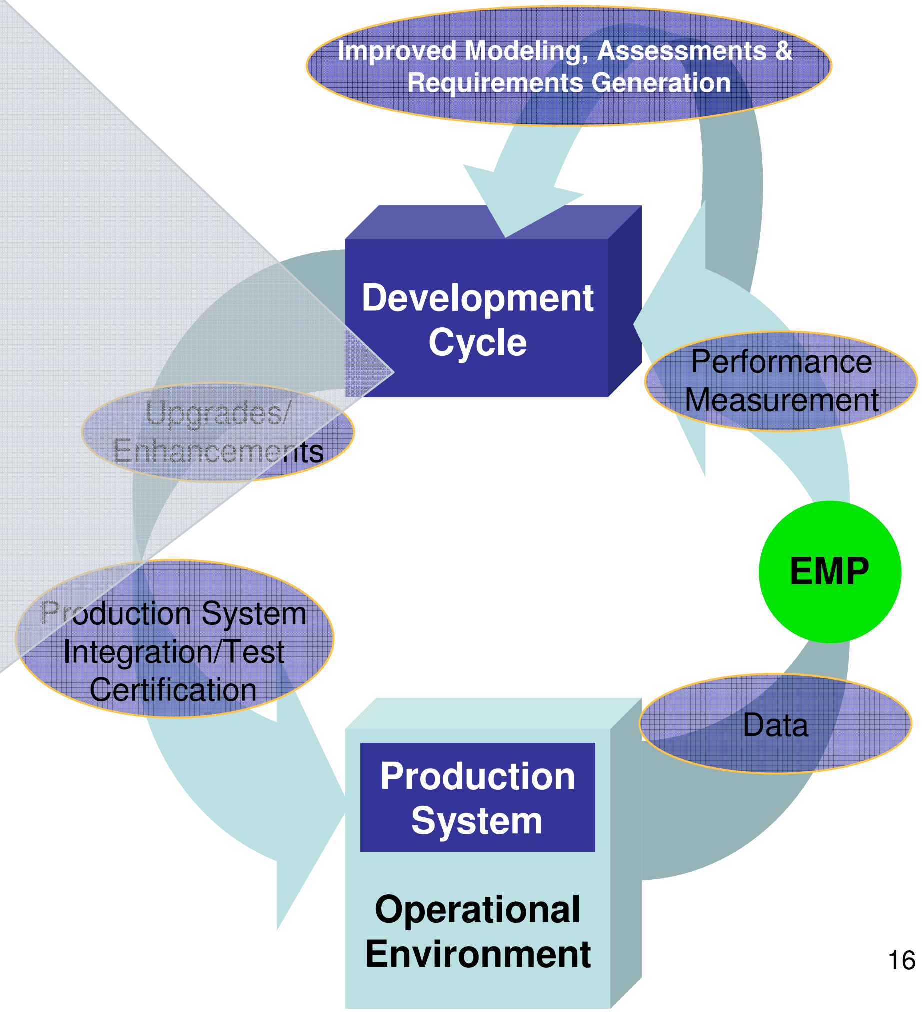
Candidate	Organization/Sponsor	Array	Improvement	Blueprint	Sizing	Utility	Maturity	Risk	OMI	Step 1	Step 2 Recommendation
C2 Classifier	Orincon/ONR	Sphere	New Bell	🟡	🟡	♠	🟡	🟡	🟡	🔴	🔴 Deferred
SATC-L	NUWC/ONR	Sphere	Update Bell	♠	♠	♠	♠	♠	♠	♠	🟡 Deferred
MHP Version 2.0	Orincon/ONR	TB-16/23	New Bell	♠	♠	♠	♠	♠	♠	♠	♠ APB-04
INTAUX	Orincon/ONR	TB16/23	New Bell	♠	♠	♠	♠	♠	♠	♠	♠ APB-04
SS_Striation	Orincon/CEROS	TB16/23	New Bell	♠	♠	♠	♠	♠	🟡	🔴	¶ Deferred
Striation	Orincon	TB16/23	OMI Change								¶ APB-04 OMI only
SCBR	JHU/Orincon/ONR	TB16/23	Combination Bell								
DSTD	JHU/Orincon/ONR	TB16/23	Update Bell	♠	♠	♠	♠	♠	♠	♠	♠ APB-04
DSTD-UA	JHU/Orincon/ONR	TB16/23	Update Bell	♠	♠	♠	♠	♠	♠	♠	♠ APB-04
MCSD	JHU/Orincon/ONR	TB16/23/29	Update Bell	♠	♠	♠	♠	♠	♠	♠	¶ APB-04, low risk
IPAC Orange	MIT-LL/ONR/ASTO	TB-16/23	New Bell/Signals	♠	♠	♠	♠	♠	♠	♠	♠ APB-04
BBI NUWC/ASTO	NUWC/ONR	TB-16/23	New Application	★	♠	♠	🟡	♠	♠	♠	🔴 Deferred to SEAMAST
Active Intercept	NUWC/ASTO	HF	HFM&Source ID	★	♠	♠	🟡	♠	♠	♠	¶ APB-04, minor change

Test Early, Test Often:
Advanced Development through Deployment

4-Step Process Transitions Advanced Development



Engineering Measurement Programs Assess System Performance Operationally

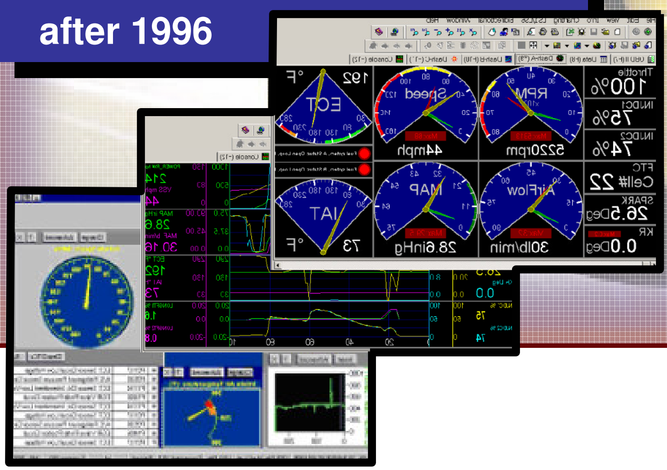


System Performance in Operational Context

EMPs Follow Best Commercial Practices

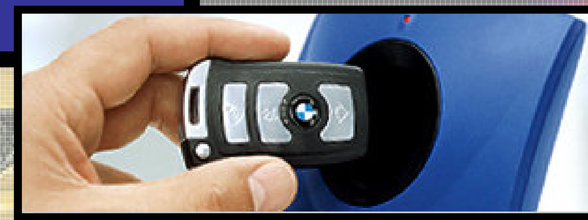
PERFORMANCE

- Onboard Diagnostics (OBD-II) taps into numerous vehicle subsystems
- US Government requires OBD-II on all vehicles after 1996



SERVICE

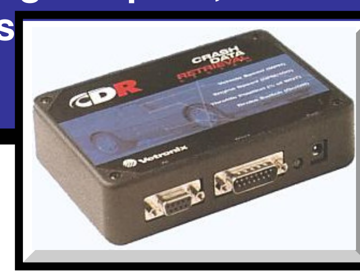
- Key collects/stores condition/service related information
- Key stores important vehicle information e.g. chassis number, mileage, condition of fluid levels, spark plugs, etc



SAFETY

- "Black Box" records pre/post-crash vehicle parameters
- *Captured data includes: vehicle & engine speed, throttle position, brake status, seat belt status

*source: Vetronix Corp



Production automobiles are equipped with data collection technology to improve performance, safety & service beyond T&E conducted on test tracks with Test Drivers & specially instrumented test vehicles

EMPs capitalize on production system's embedded recorders to improve performance based on analysis of results against real-world threats in threat environments beyond T&E that occurs with Blue-on-Blue, controlled test scenarios

Elements for Success

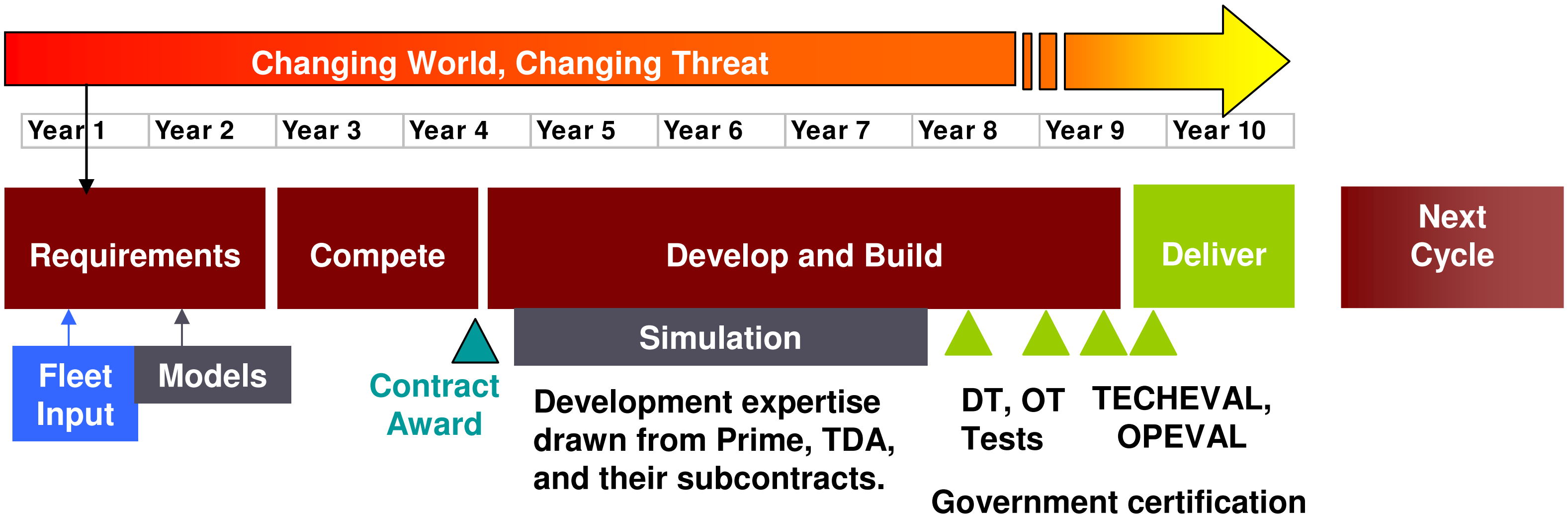
- High level backing (cover and funding)
- An urgent and well-targeted problem
- Defined transition path from S&T to capability acquisition
- Competition after contract award, credit to the contributors
- Peer-reviewed evaluations with developer participation
- Transitions from inside and outside the peer group
- Emphasis on well analyzed real sea data
- Accessible data and read/write formats and utilities
- Strong Fleet involvement and ownership
- Key individuals empowered to do the right thing

Backups

Printer friendly versions of vgs 4 and 5

Rapid Capability Insertion

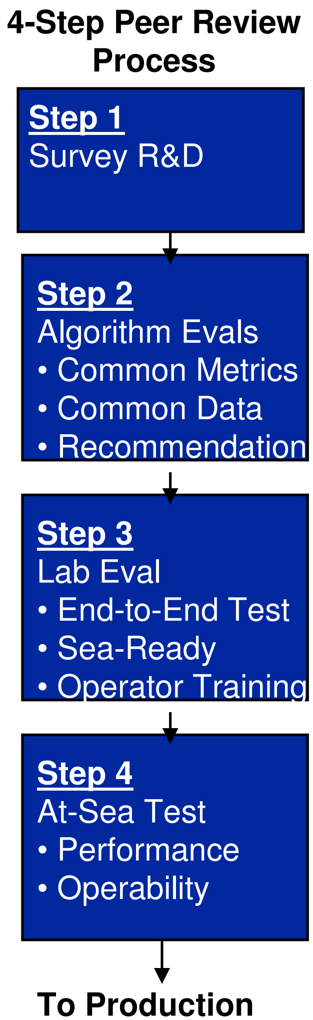
Changes acquisition from this …

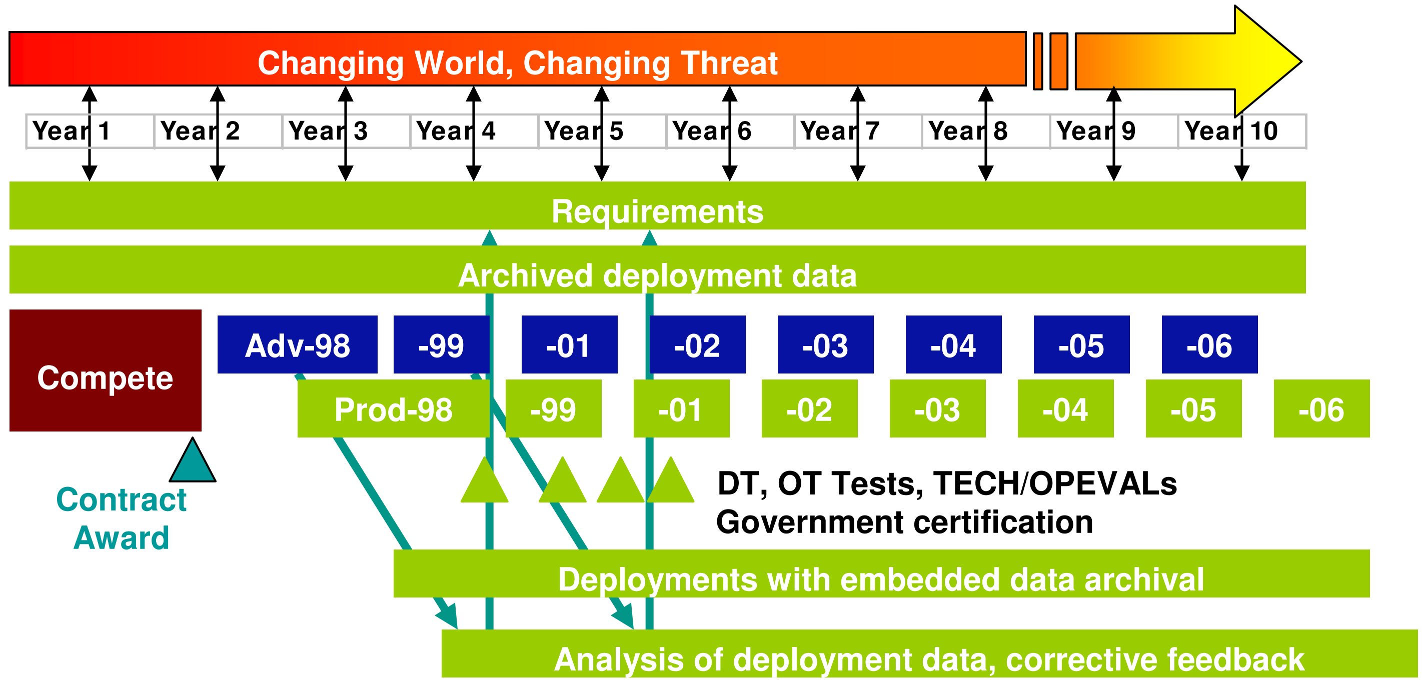


1. Overall requirements are established based on threat conditions, Fleet input, and models available in Year 1.
2. Prime contractor selected. Hardware baseline chosen, and sufficient hardware is procured to cover lifetime of the system. Other participants and technologies in the process are determined by subcontract to the prime, subject to business interests of the prime and possible subcontractors.
3. Industry develops proposals to meet the requirements. Downselect and contract award is based on modeled/simulated assessment of the proposed technologies, and costs.
4. Simulated data drives the development and evaluation of the technologies.
5. New technology insertion requires a changes in requirements, engineering change proposals, contract modification, and added expense.
6. Development Testing is typically the first opportunity for the technologies to encounter real sea data and Fleet use. Limited to blue on blue controlled exercises.
7. 5 – 10 years later: Next opportunity for reassessment of threat, new requirements, new hardware baseline, new technologies, and new participants.

Rapid Capability Insertion

… to this:





1. Requirements are Fleet-owned, and updated at least yearly to reflect the changing threat, the changing world situation, and measured performance from deployment data.
2. Participation is open to anyone who has a candidate technology for transition. Peer review should be a performance meritocracy. 4-Step Peer Review process, led by "best and brightest", Peer groups include Fleet representatives. Candidate technologies are evaluated with common metrics and common data (open and closed). Funding limits at NAVSEA, ONR, and DARPA put a practical limit on the number of organizations that can participate.
3. There is still a competition at the outset. A prime contractor is still competed and selected. But competition doesn't stop after contract award. Advanced development occurs on the production hardware. Hardware is refreshed every two years.
4. Algorithms are selected for transition based on performance versus competing algorithms. Testing is done with real sea data with threat targets, and measured against the baseline production system performance.
5. Ground truthed signature data is provided to the developers.
6. The integrated advanced development string is tested to ensure algorithm performance prior to at-sea testing. Real sea data with threat targets is used for testing.
7. Each advanced development string is tested at-sea to ensure readiness for transition to production.
8. The production system should include embedded data archival to support analysis under deployment conditions against threat targets, providing early corrective feedback to the process. (Engineering Measurement Program).
9. Annual insertion of new capabilities to the Fleet is the realization of the Navy's evolutionary build-test-build (spiral development) directive.