In-Service Support of Surface Navy Combat Systems

Safety, Effectiveness, and Affordability Reviews

The Systems Engineering Process at NSWC PHD

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NPS Acquisition Research Symposium
10-12 May 2011

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Agenda

- SEAR Process Overview
- SEAR Elements
- Lessons Learned
- Benefits and Impact on Industry
- Way Ahead Recommendations
- Conclusion

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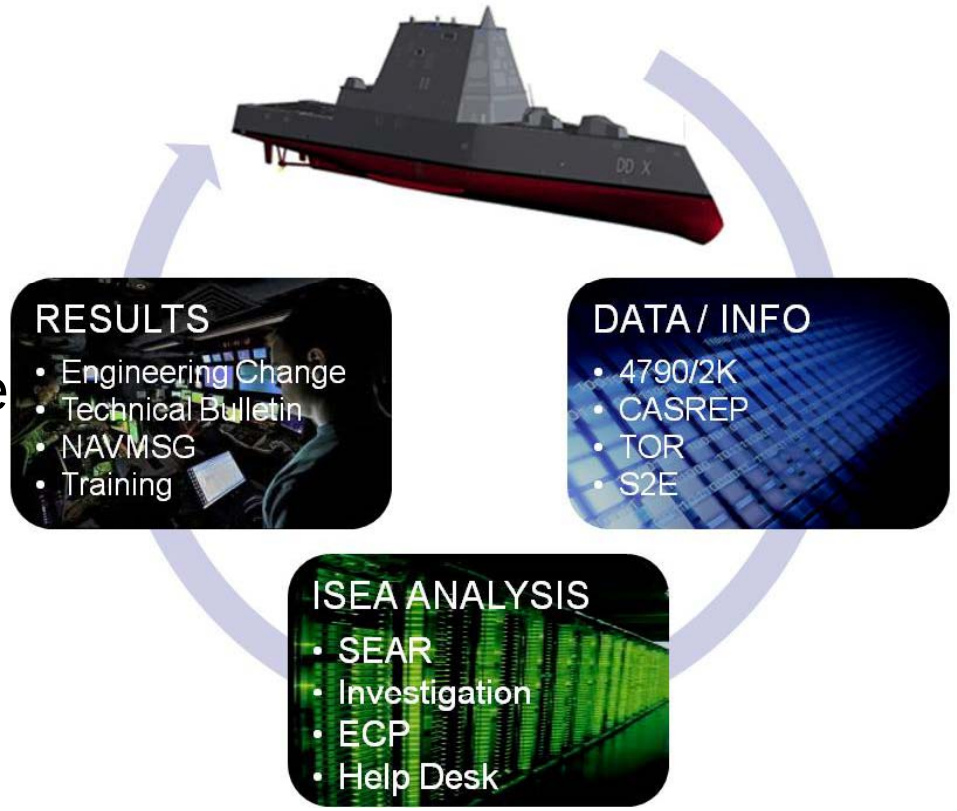
Safety, Effectiveness, Affordability Review (SEAR) Process Overview

- A systems engineering process used by the In-Service Engineering Agent (ISEA) to effectively execute its mission
- Allows ISE to make informed recommendations with respect to readiness, life cycle maintenance and modernization
- Promotes the sharing of best practices and lessons learned
- Key to knowledge management

Closed Loop Engineering Process



Improves Fleet Readiness from a safety, capability, maintainability and availability aspect.

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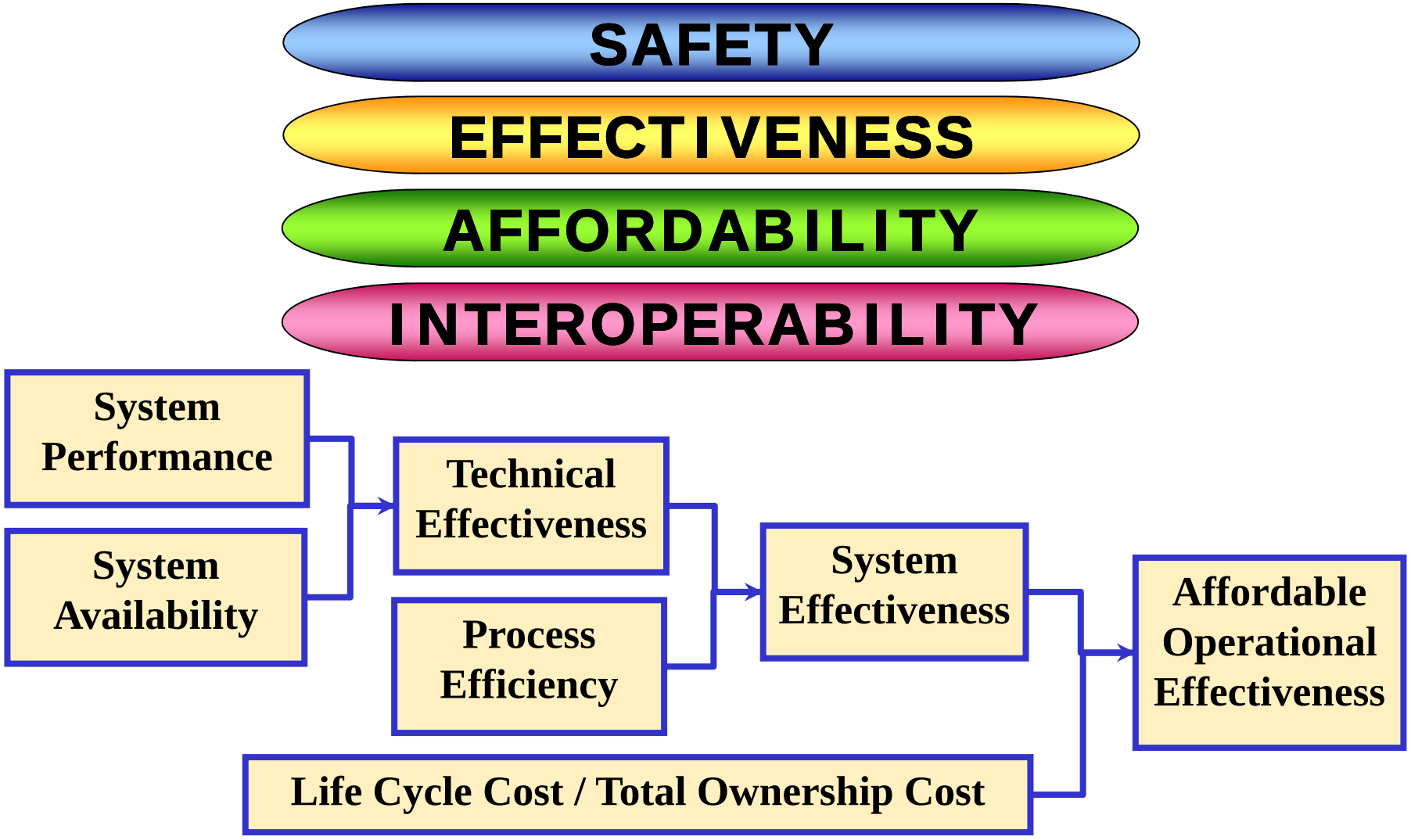
SEAR Process for Affordable Operational Effectiveness



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Effectiveness

- Effectiveness consists of:
  - Capability – Perform specific mission
  - Availability – Operational availability
  - Personnel – Documentation, Training, HSI

$$E = f\{ P_C, A_O, P_P \}$$

A_O = Operational Availability
P_C = Probability of Capability
P_P = Probability of Personnel

Expressed as a function of Capability, Availability and Personnel

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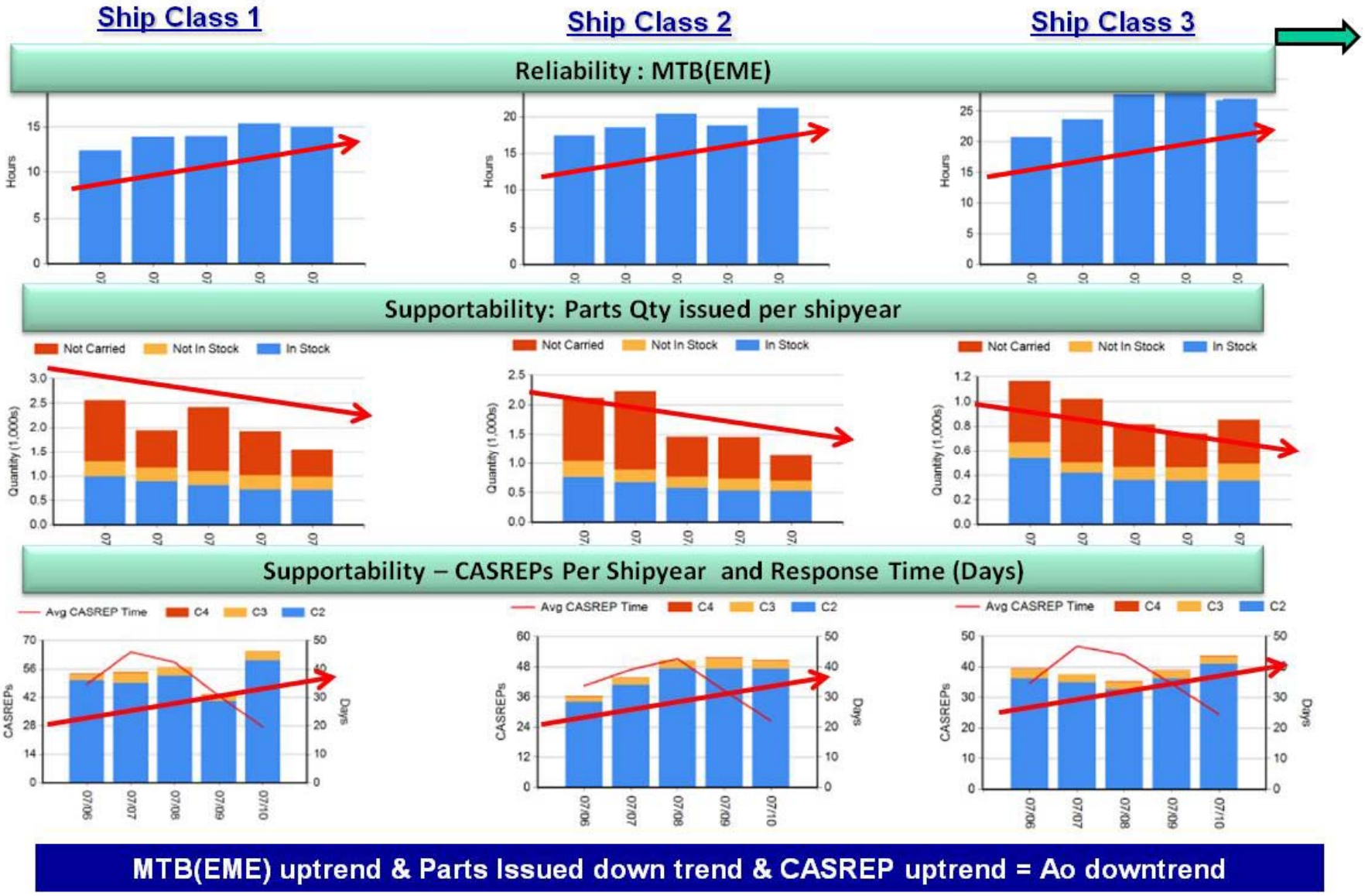
Effectiveness: Availability Sample RMS Metrics

Five 1 year periods each ending JUL31



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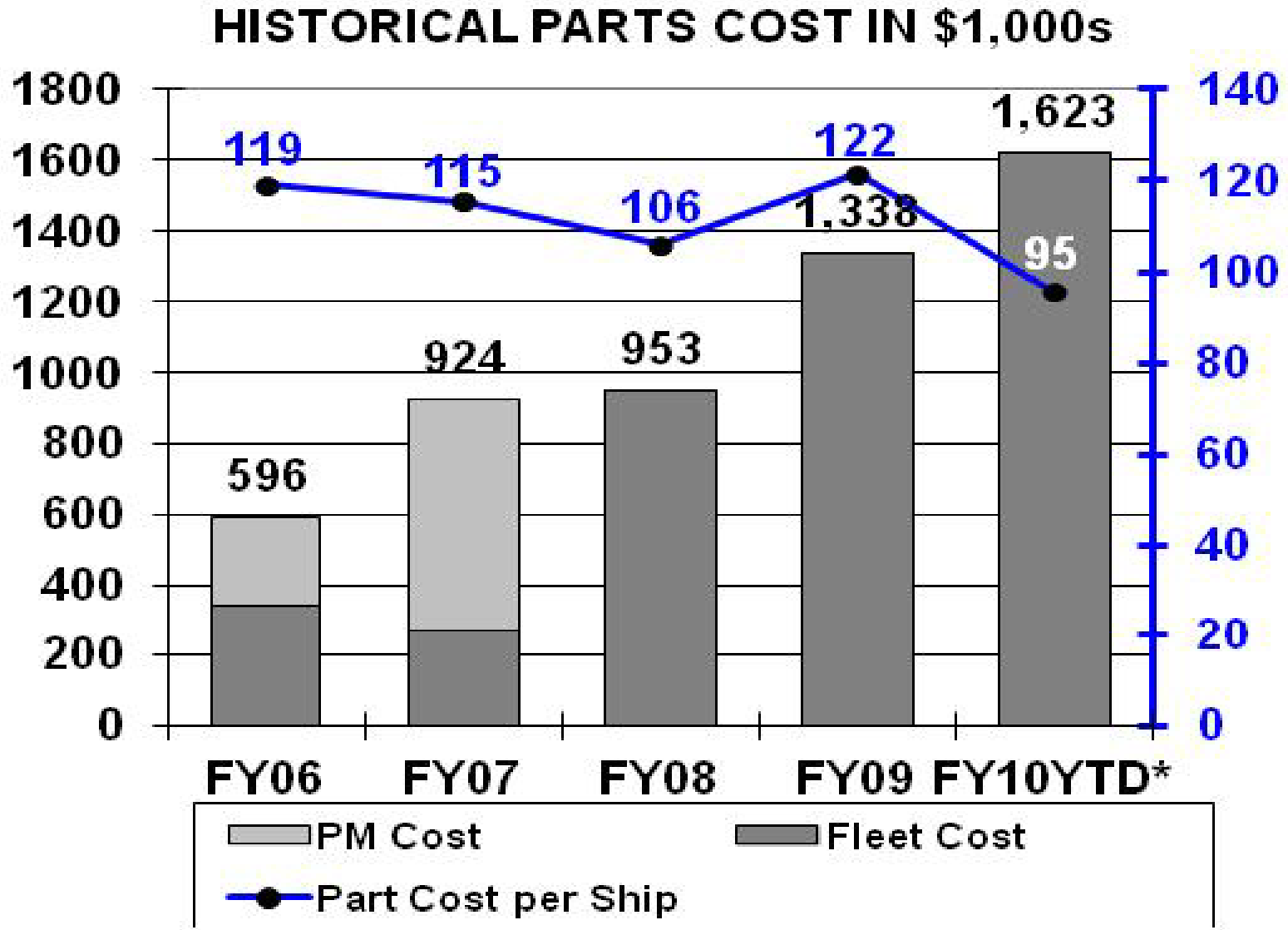
Affordability Example



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SEAR: Interoperability

	Air & ASCM Defense	SUW	USW	MIW	EW	STRK	AMB
	PCD	PCD	PCD	PCD	PCD	PCD	PCD
Surveillance Track Reporting							*N/A*
Identification				*N/A*	*N/A*	*N/A*	*N/A*
Mutual Tracking			*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
Positively ID Friendly Forces			*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
Engagement & Force Status			*N/A*	*N/A*			*N/A*
Air Control Support				*N/A*	*N/A*		*N/A*

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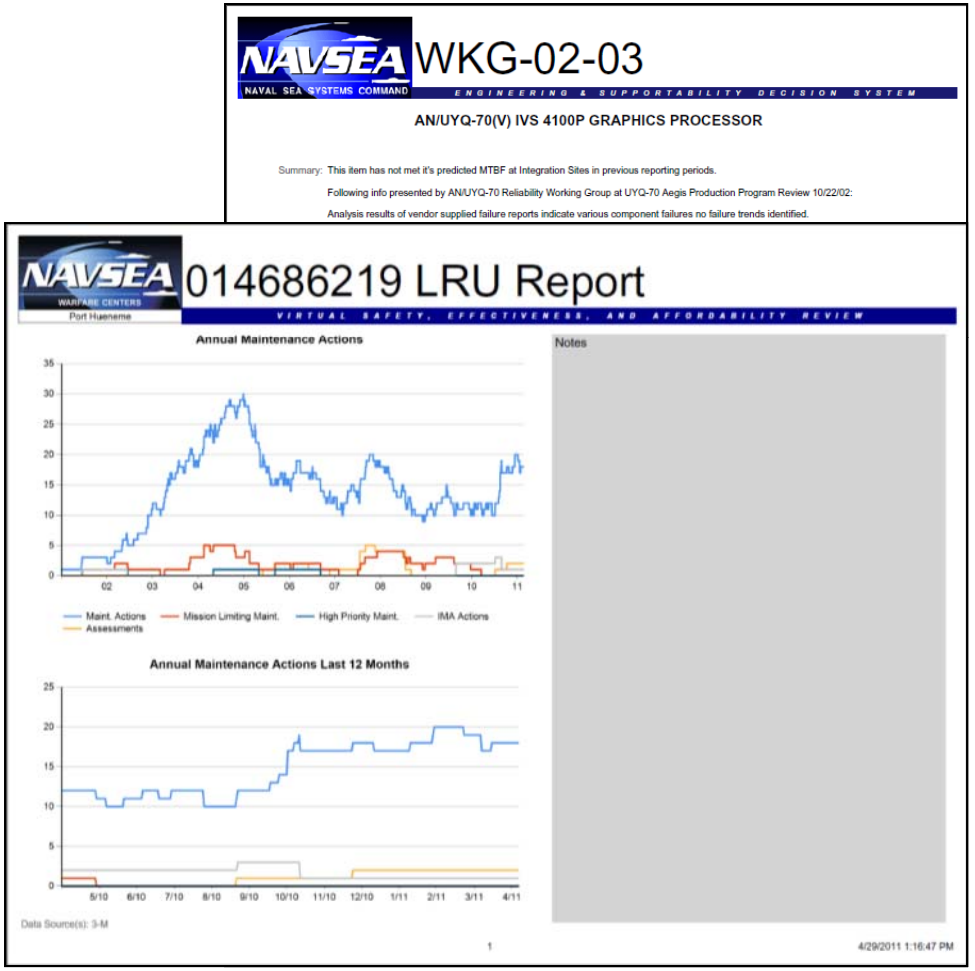
Lessons Learned/Recommendations: Poor Reliability

- DATA / INFO
  Graphics Processor exceeds predicted Failure Rate
- ISEA ANALYSIS
  Various component failures and workmanship issues
- RESULTS
  OEM implementing workmanship and process control improvements through out manufacturing process.



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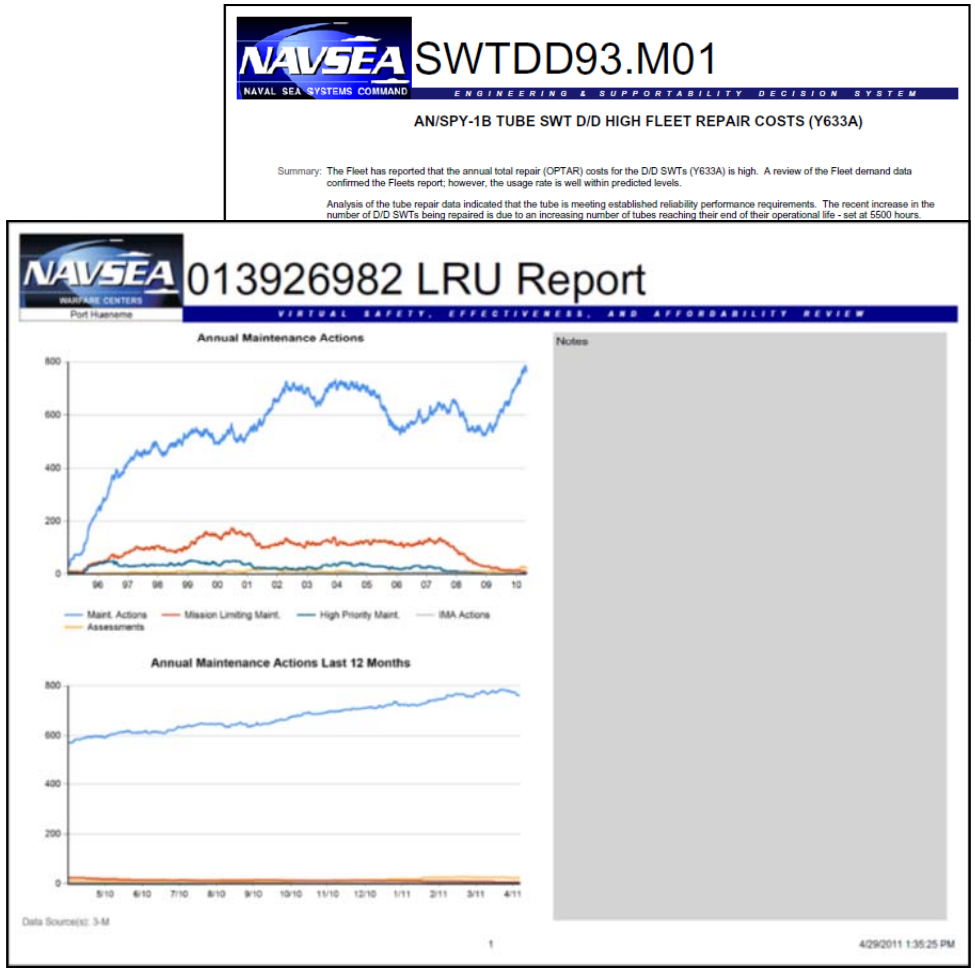
Lessons Learned/Recommendations: High Fleet Repair Cost

- DATA / INFO
  OPTAR costs for DD SWT is high
- ISEA ANALYSIS
  DD SWTs are within predicted failure rate. DD SWTs are reaching end of life
- RESULTS
  ISEA and OEM identified a more robust filament wire thereby doubling the MTBF.



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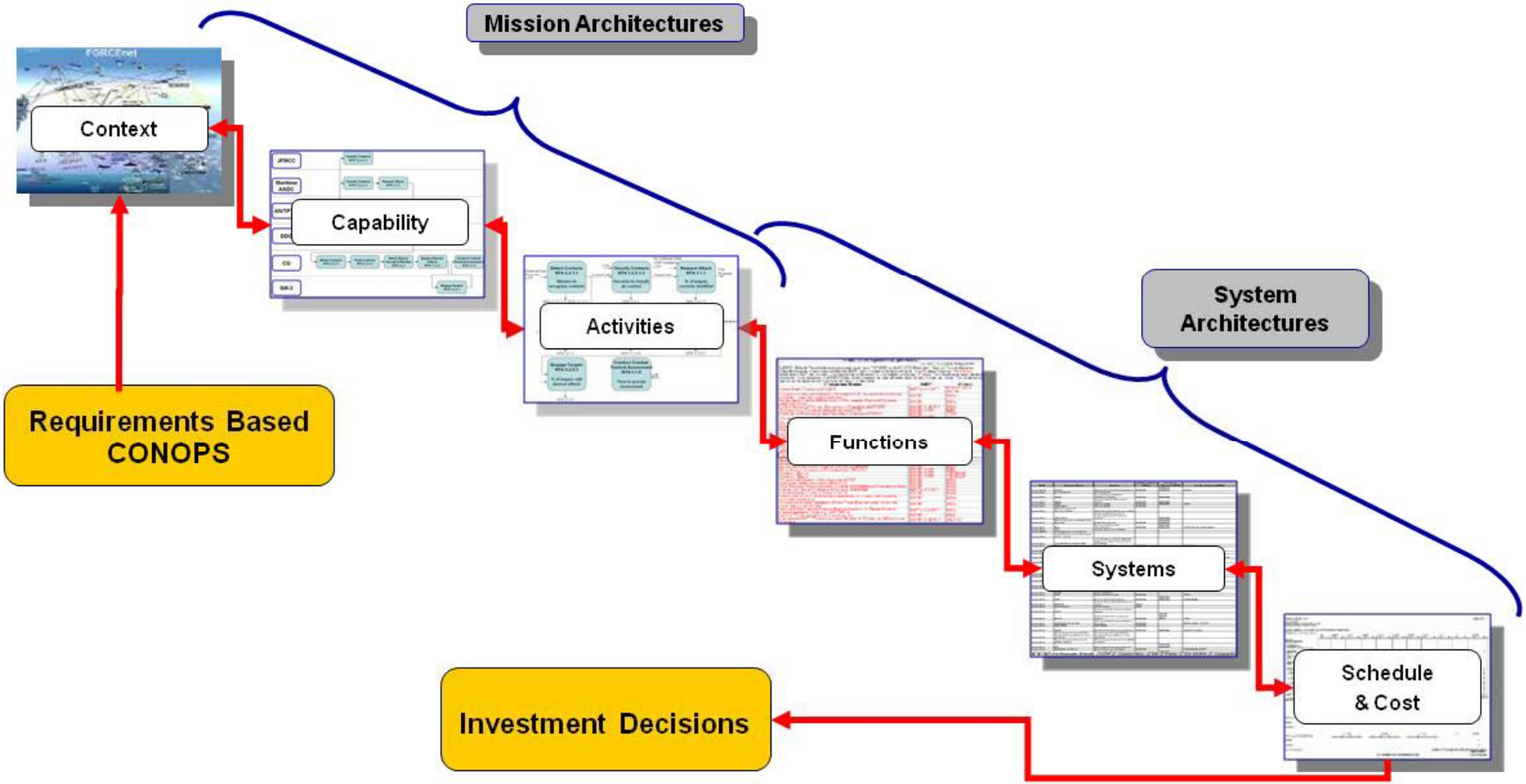
Future State



Architectures Help Link CONOPS Requirements To Investment Decisions

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Future State

DoDAF / SEAR

All View

- Information pertinent to the entire architecture

Operational View

- Tasks or activities performed, and the information that must be exchanged to accomplish DoD missions

System View

- System, service, and interconnection functionality providing for, or supporting, operational activities

Technical View

- Minimal set of rules governing the arrangement, interaction, and interdependence of system parts or elements

Safety

- The condition of being safe from undergoing or causing hurt, injury, or loss

Capability of Performance (Pc)

- Capability to perform a given mission

Operational Availability (Ao)

- Likelihood that, when required, a system is operating at a pre-defined performance level and for a sufficient duration of time to accomplish its mission

People Factor (Pp)

- Probability of humans performing all of the necessary steps on time to properly set up and operate one or more systems and complete the mission

Affordability

- Relationship of safe and effective metrics to cost

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Benefits & Industry Impact

Benefits

- Systems Approach
- Addresses Fleet Support Concerns
- Readiness Improvement Recommendations
- Risk Mitigation
- Cost / Decision Tradeoffs
- Knowledge Management
- Facilitates Reduced Life Cycle Cost

Industry Impact

- Feedback through PEO
- Collaboration via IPTs & WGs
- Life cycle lessons rolled back into Design
  - New System, capability & baseline development
- ID improvements in:
  - Design
  - Reliability
  - Life Cycle Cost reductions
  - HSI
  - Manufacturing QA process
  - Tools & training

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Way Ahead Recommendations

- Expand this process across the ISEAs to allow for all elements and systems to be rolled up into the platform level SEARs
- Predict potential failures of a critical parts and recommend replacement to prevent a system casualty while underway.
- Provide recommendations with clear impacts to a warfare area requirement, major combat operation requirement, or a specific mission thread requirement
- Data Analysis and recommendations should be provided to technical and acquisition community, including industry partners

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Conclusion

- SEAR process is fundamental to the ISEA's system engineering process.
- Closed loop and disciplined process that is applied to the examination and internal sharing of data and information
  - Equipment, Combat System, Ship Class, and Strike Group
- Facilitates integration of by requiring the sharing of information between the levels and by promoting best practices across organizational boundaries.
- The SEAR process enables the ISEA to arrive at informed decisions, anticipate Fleet and program sponsor issues
- SEAR process provides technical and acquisition community with recommendations that will improve fleet readiness and future designs.

Safe, Effective and Affordable Combat Systems