PBL Overview, Business and Metric Discussion

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Agenda

- General Insights and Findings
- PBL Structure
- Literature Results
- PBL Analytical Framework
- Performance Metrics
- Future Research

General Insights

PBL Intent

- Satisfy warfighter requirements
- Create an optimized weapons system support infrastructure which capitalizes on the best of government and industry capabilities
- Total weapons system support structure designed to meet end user needs
- Utilizes the best of both contractor and government capabilities to achieve support objective
- Purchase total lifecycle support versus the components of support
- Implements best commercial practices associated with supply chain management
- Spreads risk traditionally born exclusively by the government
- Reduces the transactional intensity associated with a traditional support system
- Leverage commercial investment in technologies and industry best practices

Is it Really PBL?

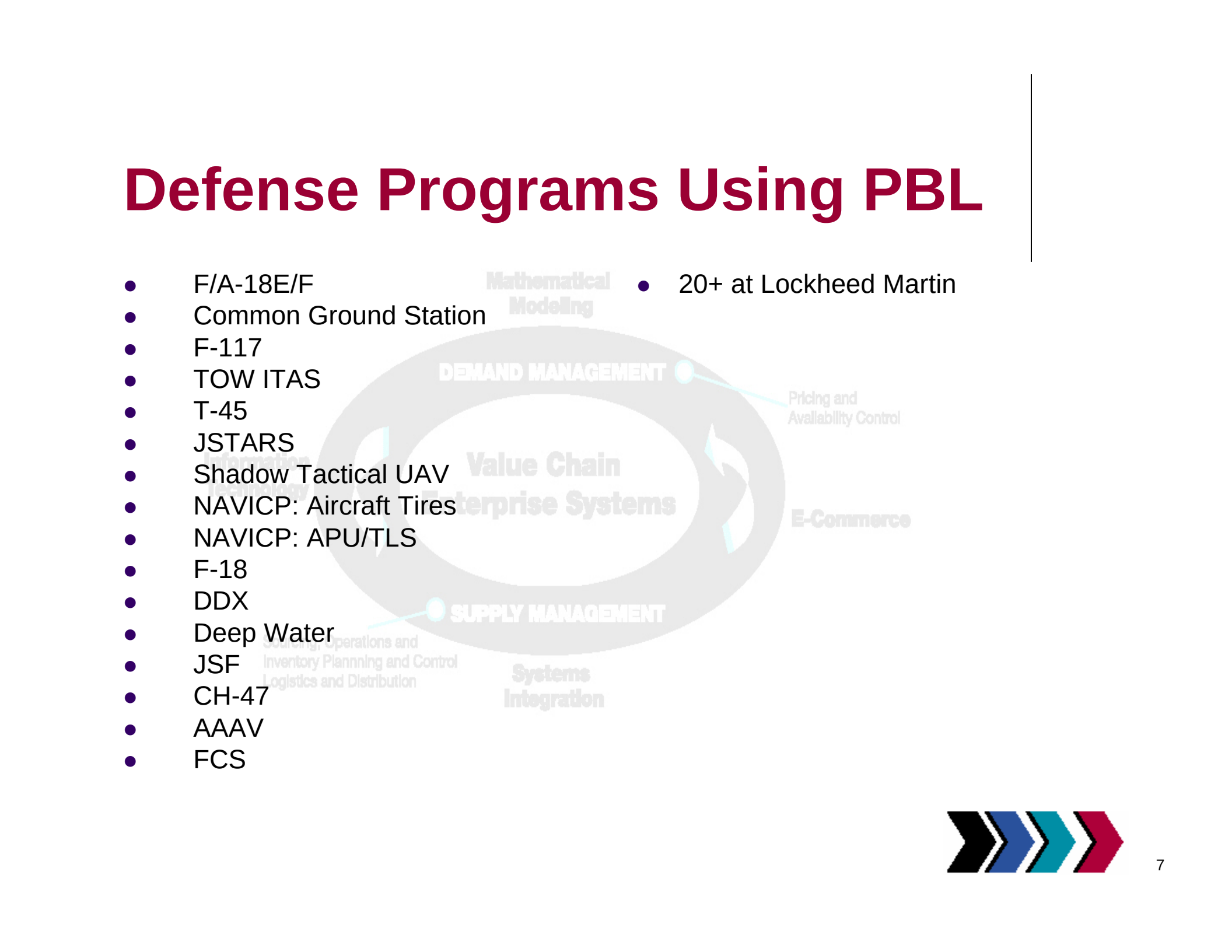
- Not every contract with “performance based” written into it is a PBL contract
  - Performance based contracting in place for years
    - Value based contract awards based on factors other than cost
    - Performance Metrics
    - Incentive fees and penalties
  - True PBL is much more expansive
    - Fixed-price-per-unit of output (i.e., flight hour, cycles of operation); efficiency assured
    - Fixed-price-per-unit-per-period
    - Higher profits because contractors share risk
    - Incentive to continuously improve product reliability (effectiveness)
    - Improve capabilities through system modernization

Commercial Precedence to PBL

- PBL has been in use by Commercial Industry for over 20 years and is emerging as an Industry best practice.
- Aircraft Industry has led the way with concepts such as Power by-the-hour (unit of output)
  - GE - Jet Engines
  - UT Jet Engines
  - Pratt Whitney - Jet Engines
  - Rolls Royce - Jet Engines
  - Honeywell - Avionics
  - Rockwell Collins – Avionics
  - Lucas Aerospace - Landing Gears
  - Garrett - Auxiliary Power Units

Defense Programs Using PBL

- F/A-18E/F
- Common Ground Station
- F-117
- TOW ITAS
- T-45
- JSTARS
- Shadow Tactical UAV
- NAVICP: Aircraft Tires
- NAVICP: APU/TLS
- F-18
- DDX
- Deep Water
- JSF
- CH-47
- AAAV
- FCS
- 20+ at Lockheed Martin



PBL: Difference from Traditional Logistics Support

- Traditional Log Support
  - Time and material contracts
  - Contractor paid as service is delivered regardless of impact on warfighter
  - Government owns all of the performance risk
  - Under defined or lack of defined scope
  - No investment by contractor beyond that paid for by government
  - Government sunk cost in materials
  - Government owns the results if they accept the product or service
  - Contractor gets paid for correcting deficiencies he may have created
  - Government responsible for mitigating obsolescence issues
  - No incentive to introduce improvements

PBL: Difference from Traditional Logistics Support

- PBL represents a state change
  - Focuses directly on meeting warfighter defined goals
  - Shifts weapons system lifecycle sustainment responsibility to the PM
  - Payment based on results not delivery
  - Fixed price per unit of output
  - Performance Metrics driven incentives and penalties
  - Long term contracts
  - Contractor profits based on level of risk sharing
  - Implicit assumption that the contractor will invest in infrastructure and inventory
  - Freedom to execute the work the most efficient manner
  - Oversight based on performance metric results rather than inspection, cost and pricing data certification, etc.
  - Incentive to improve reliability to lower operating costs
  - Incentive to upgrade to maintain product viability
  - Simplifies financial transactions

PROFITS RESULT FROM AVOIDING COST AND DOING THE RIGHT THING but.....

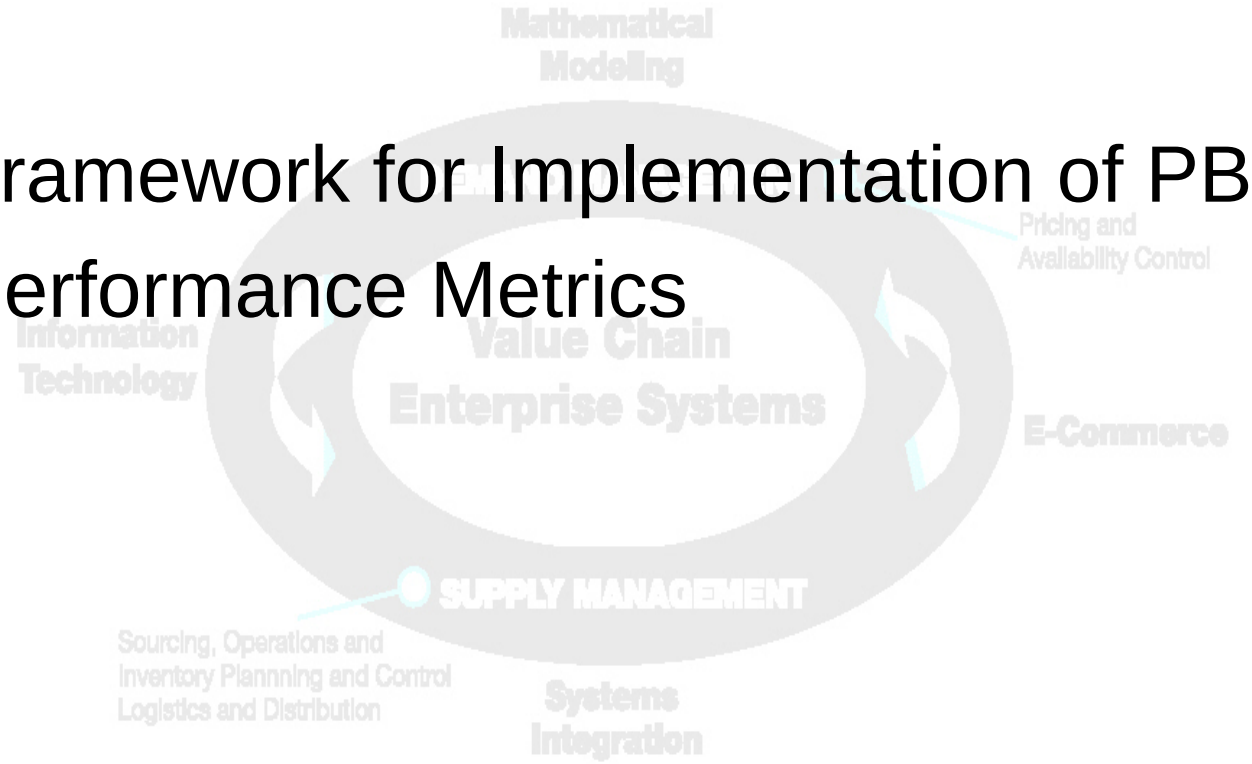
PBL Literature Review

PBL Literature

- Most of the research on PBL is dedicated to developing definitions and framework for implementation of PBL.
- Just two refereed publications in scholarly journals.
- Most of the research are in the form of in-company reports.

What Exists

- Framework for Implementation of PBL.
- Performance Metrics



What is Missing

- Strategies for operationalization of PBL.
- Models for evaluation of PBL metrics
- Optimization models for management of various asset classes under PBL
- Obsolescence Management
- Risk Analysis

Publications in Refereed Journal

- Berkowitz, D., Gupta, J N D., Simpson, J T and Mcwilliams, J B., 'Defining and Implementing Performance Based Logistics, *Defence Acquition Review Journal*, 255-267, 2005.
- Cunic, B. Performance Based Contracting, *Hydrocarbon Processing*, December 2003, 43-46.

Literature outside Public Sector

- Buyer-Supplier relationships have been studied extensively in the marketing channels and supply chain management literature.
- Even in supply chain management literature, little research has considered the performance outcomes.

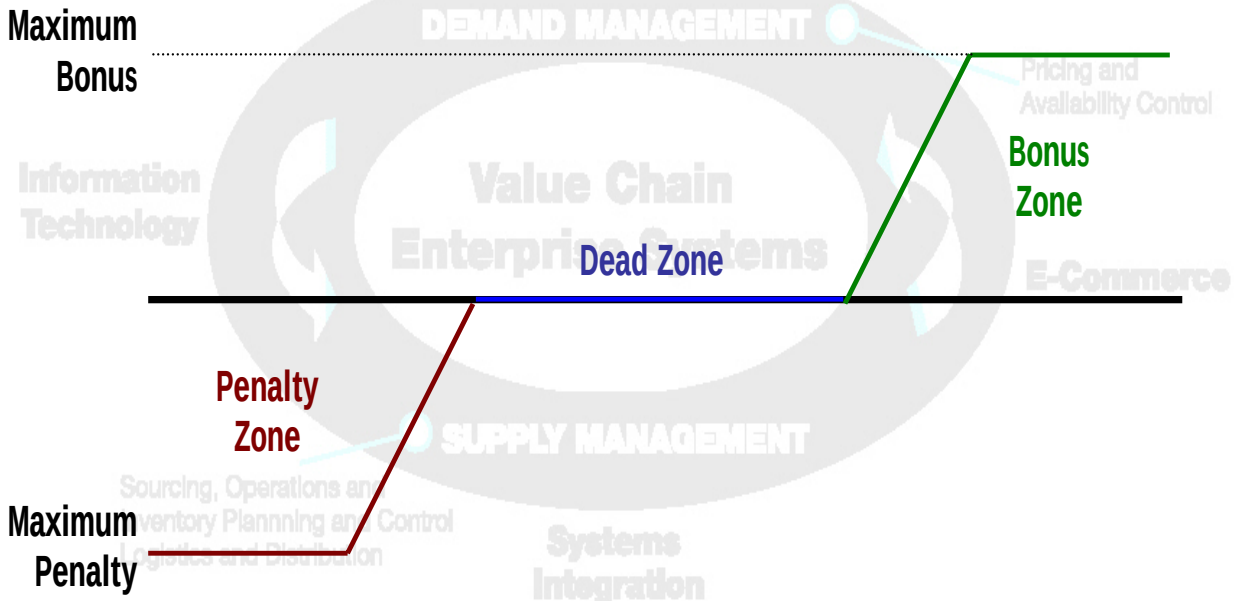
PBL Structure

PBL Key Findings

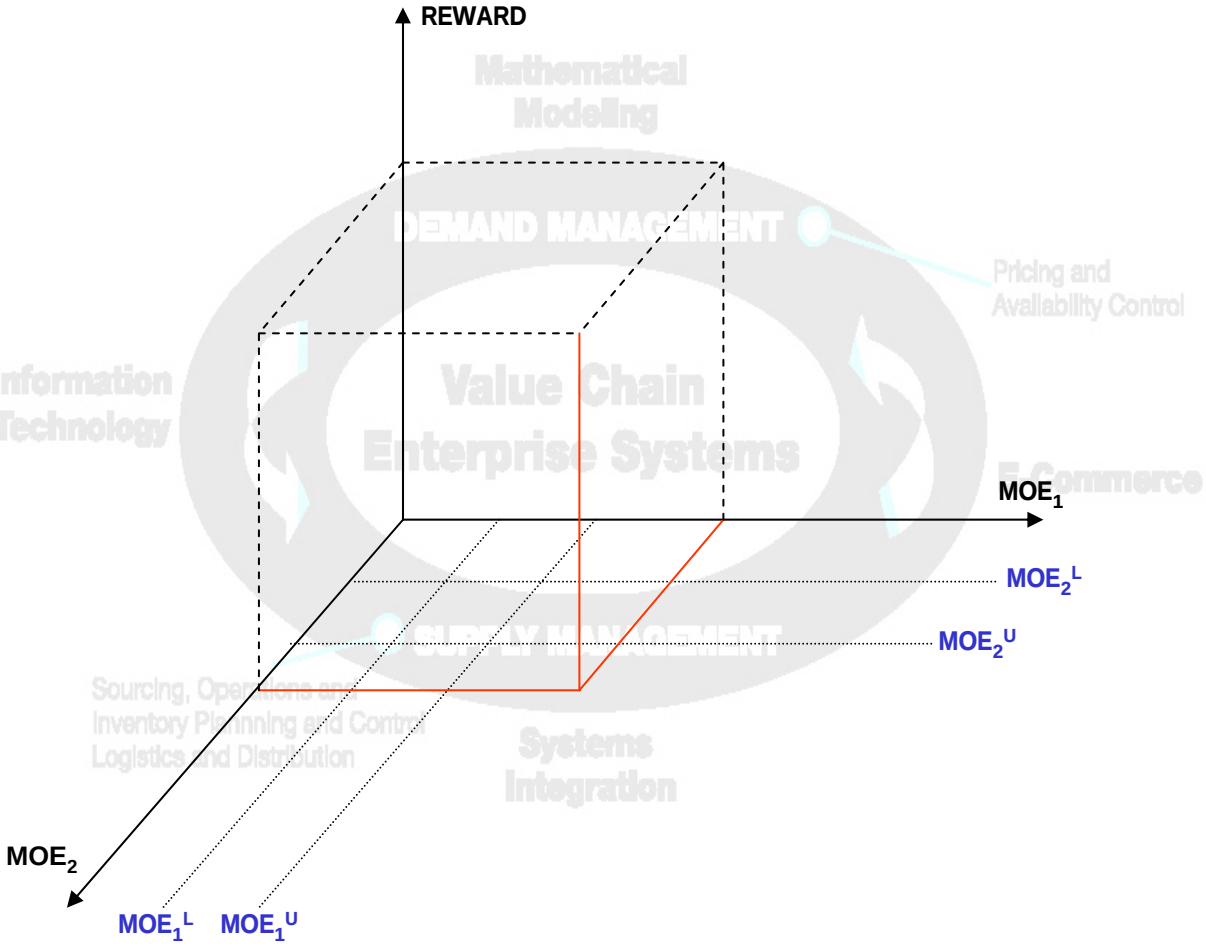
Author	Domain	Key Findings
Berends	Oil, Chemical (Netherlands)	• Incentives for demonstrated performance should be attractive to the contractor over the entire contract duration. • Critical staff on both parties should have continuity over contract duration.
Billinton	Utilities (Canada)	• System performance is to be evaluated against a performance baseline based on historical data.
Billinton, Pan	Utilities (Canada)	• Continuous risk assessments should be carried out, based on actual data.
Brown, Burke	Utilities (US)	• The payment scheme should differentiate between a dead, reward and penalty zones, delimited by upper and lower performance thresholds. • Clients can mitigate their risks through the adequate definition of the geometry of the mentioned zones.
Cunic	Chemical sector	• Essential or strategic aspects of performance need to be identified, and ad-hoc contracts should be arranged.
Fearnley, Bekken, Norheim	Public transportation (Norway)	• Historical performance data are essential in setting sound objectives in PBLS contracts • Clear delimitation of responsibilities of client and contractor will diminish likelihood of eventual disputes. • Performance guarantees or bonds are recommended to cover potential difficulties for clients in materializing penalties imposed on contractors for system under-performance.
Gilbertson	Defense	• Ad-hoc warranties should be set for essential system performance requirements. • Objectives of operational performance are to be set with regards to a reference point.
Hensher, Houghton	Public transportation (Australia)	• System utilization profiles need to be adequately defined. • Communications and data exchanged between client and contractor should be transparent. • As important as the transition or migration to a PBSL scheme is the definition of a post-transition growth strategy.
Rogers	Communications (US)	• Application of a PBLS strategy from the early stages of product design and development can lead, by controlling the dominating design parameters, to significant reductions in life-cycle costs.
Smith	Defense (US)	• Performance goals and schedule for achieving them are the main elements of a PBLS contract. • A plan should be set for the refurbishment of critical components over the useful life of the system.
Wasserman, Lamberson	Defense (US)	• A reliability growth program has to be set to compensate for the decline over time of the system reliability characteristics.
(1)	Defense (Spain)	• Multiple contracts, not always duly cross-referenced, complicate the true determination of responsibilities when assessing fulfilment (or not) of system performance goals, and thus consistency and coherence of all inter-related contracts is a must.
(1)	Public transportation (Spain)	• Appropriate delimitation of responsibilities is essential, as failure to do it may mean that the contractor is eventually held responsible for under-performance of the system caused in part for reasons beyond his control.

(1) Based on the authors' experience and the interviews conducted as part of this research effort.

Concept of Dead, Bonus and Penalty Zones



3-D of Dead, Bonus and Penalty Zones



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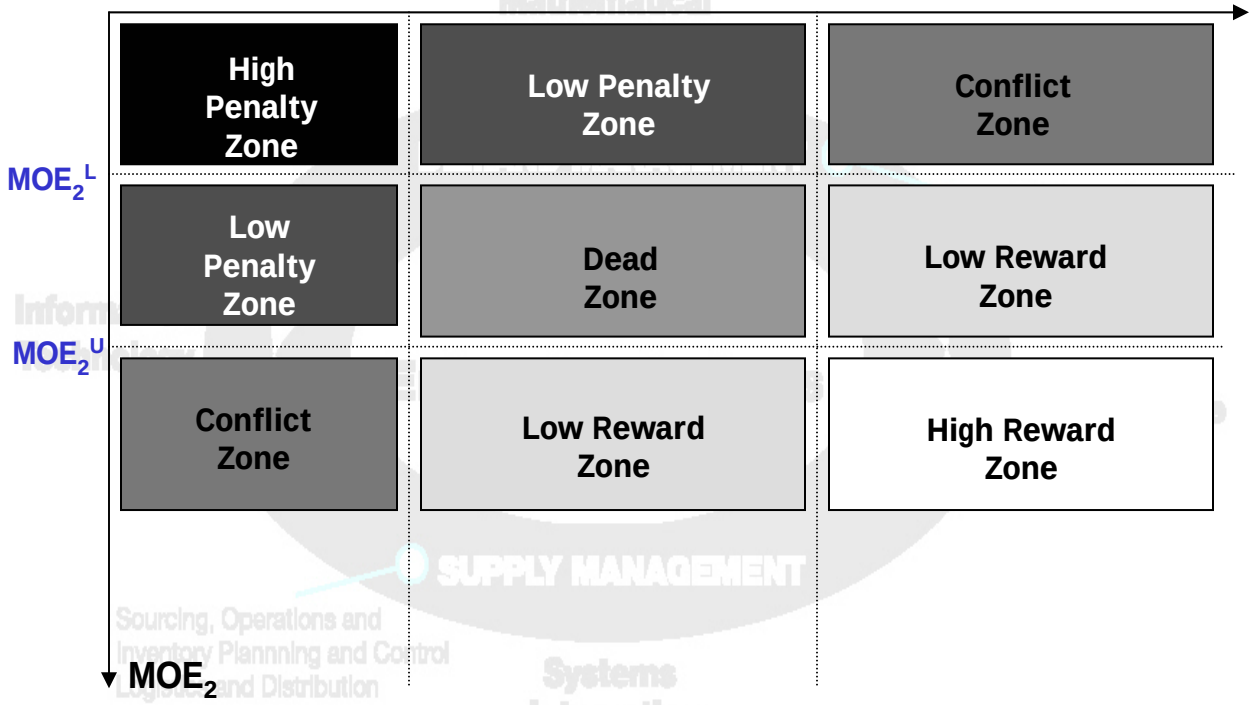
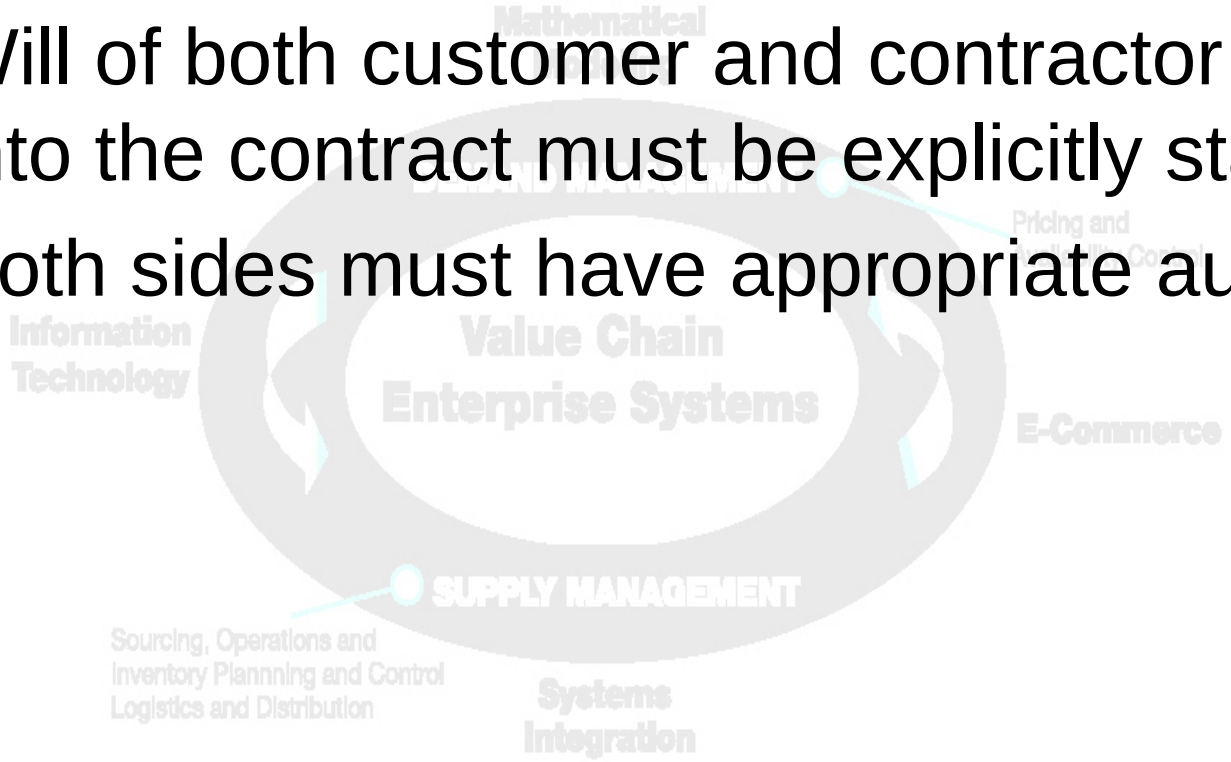


Contract Framework

- Three Critical Aspects
  - Will and capability of entering into commitments
  - Contract Purpose
  - Rewarding/Penalty Scheme
- Additional Recommendations
  - Legal
  - Policies
  - Information
  - Supportability

Will and Capability

- Will of both customer and contractor to enter into the contract must be explicitly stated
- Both sides must have appropriate authority



Contract Purpose

- Must clearly define the system for which support is sought
- Must include
  - Definition of boundaries
  - Primary external interfaces
  - Definition of primary system elements
    - Hardware, software, human actions, activities
- Details of support objectives
- Contract exclusions
- System operational life defined
- Mission profiles and durations
- Measures of performance, how they are measured including frequency of measurement
- Continuity of key personnel
- Identify key focal points

Legal

- Fuzzy and/or ambiguous statements and clauses are to be avoided.
- The contract, both in its spirit and in the specific wording of its clauses, is to be in full accordance with all applicable laws and regulations.
- The contract is to be fair and balanced, avoiding being one-sided in either direction.
- The contract is to define applicable jurisdiction, in case of litigation, as well as the procedures for arbitration

Policies

- regarding confidentiality and the non-disclosure to third parties of sensible information, without the pertinent approval of the other party
- The contract is to reflect that both parties, customer and contractor, commit to sharing all the needed information and to revealing it to each other with transparency and objectivity.
- The contract is to identify the applicable language for exchange of communications in the program

Information

- The contract is to clearly identify the inputs required from third parties, whether they are information, services or products, that may affect system performance and that fall out of the responsibility domains of both the customer and the contractor.

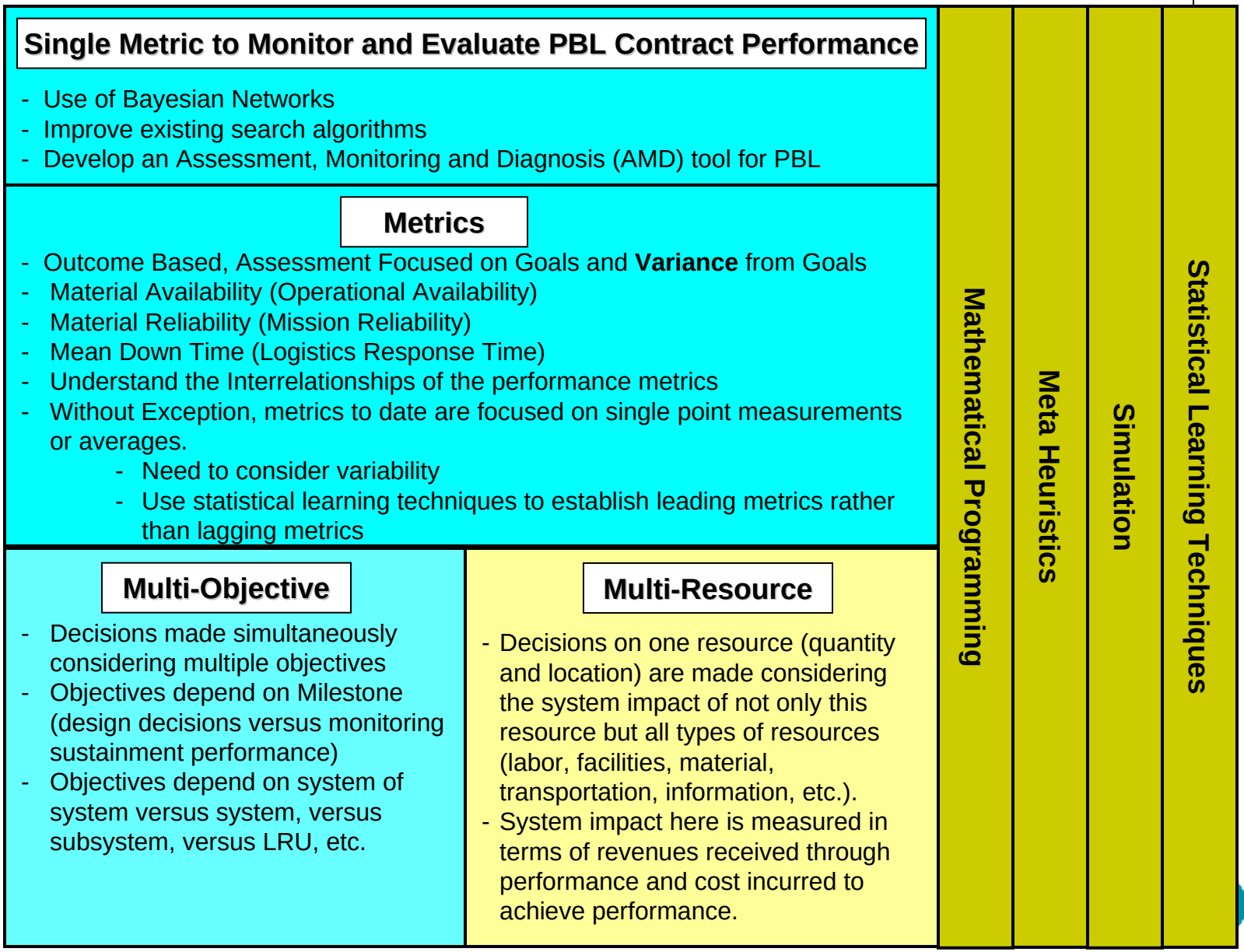
- The contract is to define the scope, frequency and details of the reports to be submitted by the contractor to the customer relative to the development and results of the reliability growth program, to be agreed upon between customer and contractor.

Supportability

- The contract is to define the procedures to be followed by the contractor and the customer in order to reduce to the minimum the risk of components obsolescence and consequently its negative effect on system performance.
- The contract is to include a technology refreshment program for all system COTS elements.
- The contract is to define the scope and details of a reliability growth program aimed at compensating the wear-out or negative effect of time and use on system reliability.
- The procedures for dealing with refurbishment of critical components and for the pro-active replacement of marginal reliability components prior to failure (conditional maintenance) are to be defined and agreed upon between customer and contractor.
- The contract is to define the configuration management procedures, essential for the effective and efficient conduction of other activities aimed at ensuring system performance.

PBL Analytical Models and Metrics

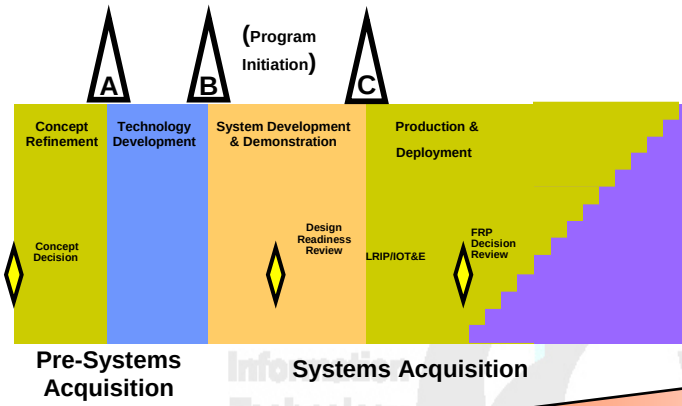
A Framework of Analytical Models to Support Initiating, Tracking and Evaluating PBL Contracts



Performance Metrics

- Material Availability
- Material Reliability
- Mean Downtime
- Outcome Based Assessment Focused on Goals and Variances from Goals

Life Cycle Metrics



65-80% of the Life Cycle Cost

Operations & Support

Sustainment

PRE-IOC AND POST IOC SUPPORTABILITY ASSESSMENTS

JCIDS → KPP → SEP → DAES → DAES-S

Warfighter Support

One set of Metrics throughout the System Life Cycle

Emphasis on Materiel Readiness

Materiel Availability

$$\text{Materiel Availability} = \frac{\text{Number of End Items Operational*}}{\text{Total Population of End Items}}$$

* Operational means in a materiel condition such that the end item is capable of performing an identified mission.

Materiel Reliability

Materiel Reliability = Mean Time Between Failure

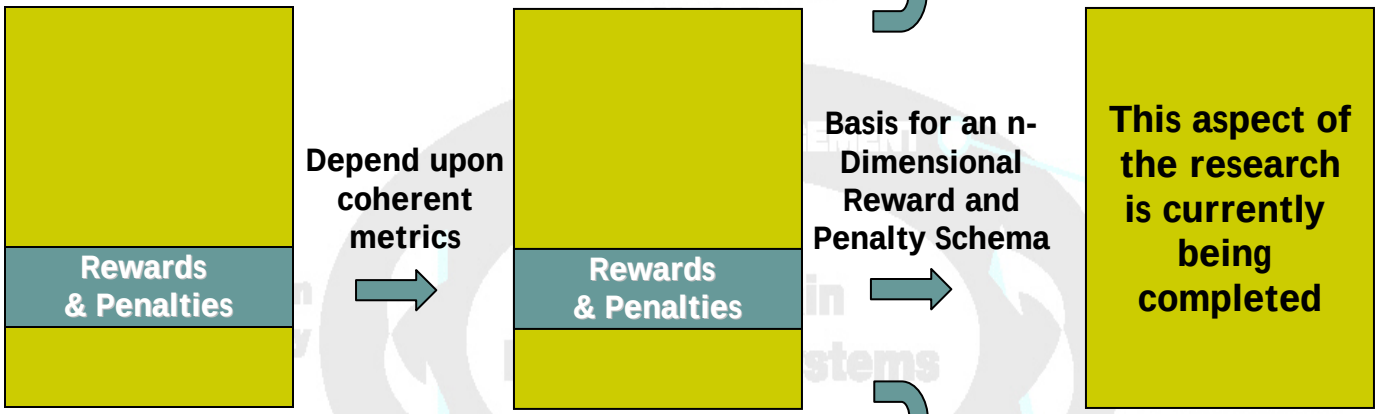
measured as $\frac{\text{Total Operating Hours}}{\text{Total Number of Failures}}$

The research alluded to an absence of good models for the modeling of multiple resources simultaneously. This aspect of the research (multi-resource optimization) is being led by Dr. David Nowicki.

PBL Contractual Structure

Performance Outcome Metrics/Models

N-Dimensional R&P Scheme



Initially, the research involved studying PBL contracts in the commercial and public sector to understand their structure. This research resulted in the development of a PBL contract structure template. The focus from this point forward was on the reward and penalty aspect of Performance or outcome based contracts.

Given the dependence of good performance based contracts on coherent and sound metrics, the research next involved a considerable survey and review of metrics and models.

The research alluded to an absence of good models for systems with degraded modes of operation. This research took a deep dive into this aspect of system reliability modeling. The research was accepted for publication in *Reliability Engineering and System Safety*.