



DESIGN AND EXERCISE OF FLEXIBILITY IN A BLENDED WING BODY (BWB) TYPE AIRCRAFT

Lean Aerospace Initiative
LAI Plenary Conference

April 18, 2007

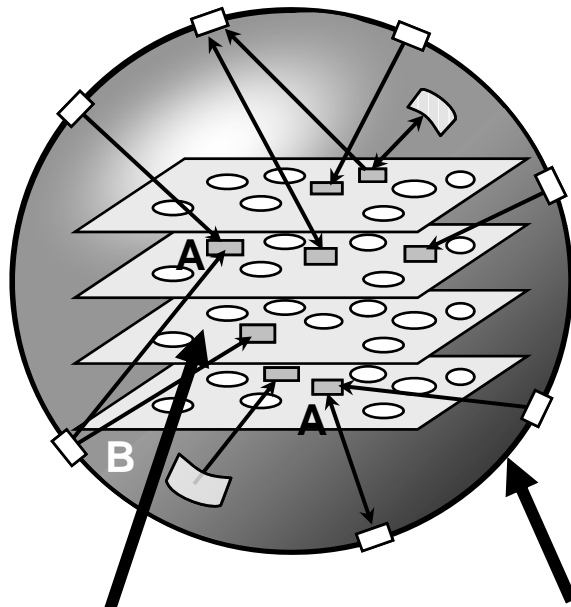
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Large Commercial Aircraft Enterprises as a Complex System

Nested Complexity



Physical Domain

- Aircraft
- Manufacturing
- Airports
- etc.

Institutional Sphere

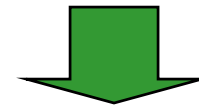
- Manufacturers
- Suppliers
- Airlines
- Governments
- etc.

- Large system, large stakes
- Time scales
- Non-linear effects
- Evaluative complexity
- **Difficult to predict future behavior**



LAI Case Study:

Market demand for aircraft derivatives, focus on BWB type aircraft



Understand:

- **Use technology and architecture to create flexible BWB**
- **Can existing airframer enterprise architecture utilize flexible BWB?**

Flexibility in the BWB Technical Architecture and a Supporting Enterprise Architecture

Flexibility allows system configuration to adapt to future circumstances, at a reduced cost

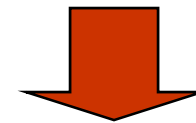


BWB technical architecture creates flexibility to more quickly and inexpensively create BWB derivatives across families



Increased flexibility in meeting changing market demand

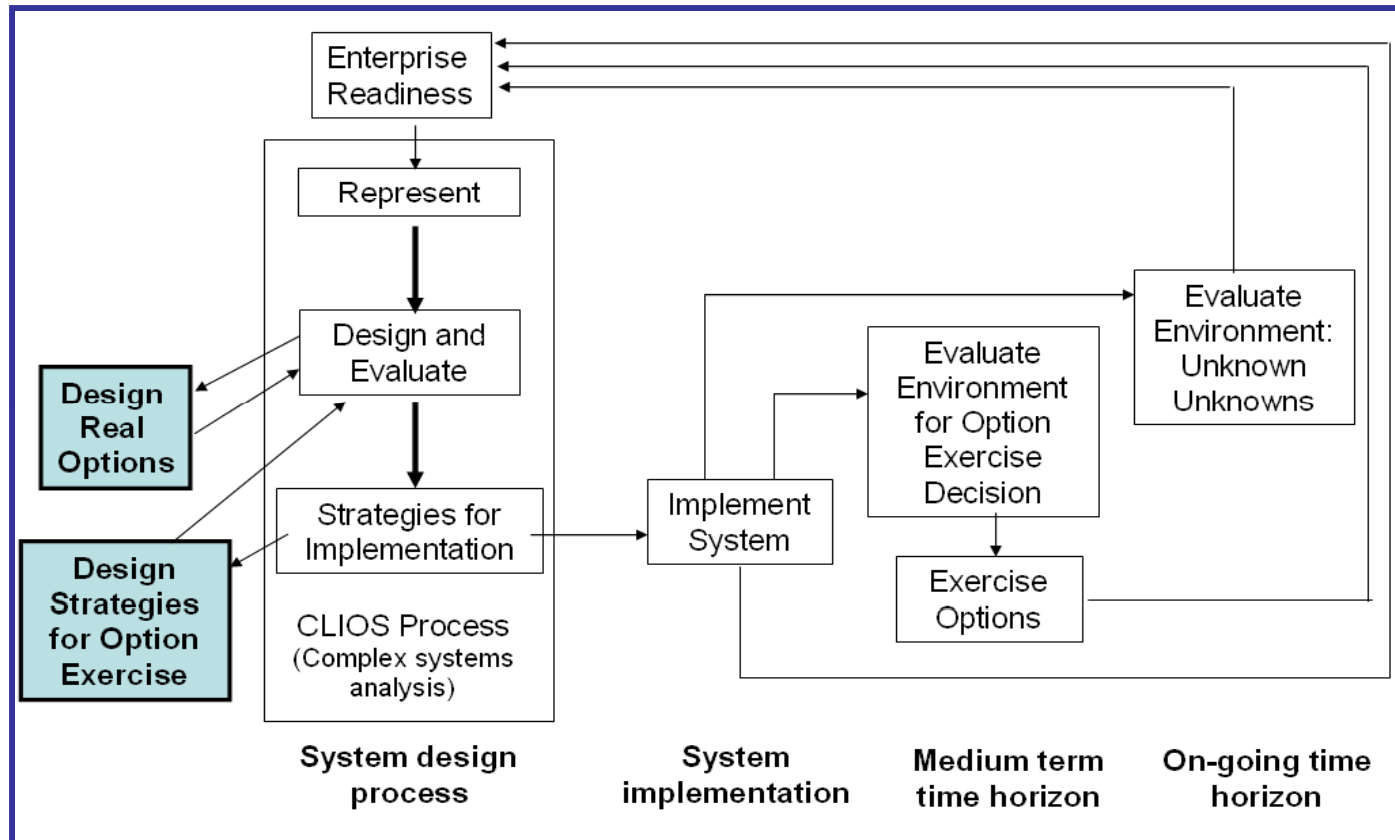
Airframer **enterprise architecture** able to take advantage of flexible BWB architecture?



To utilize flexible architecture, need for:

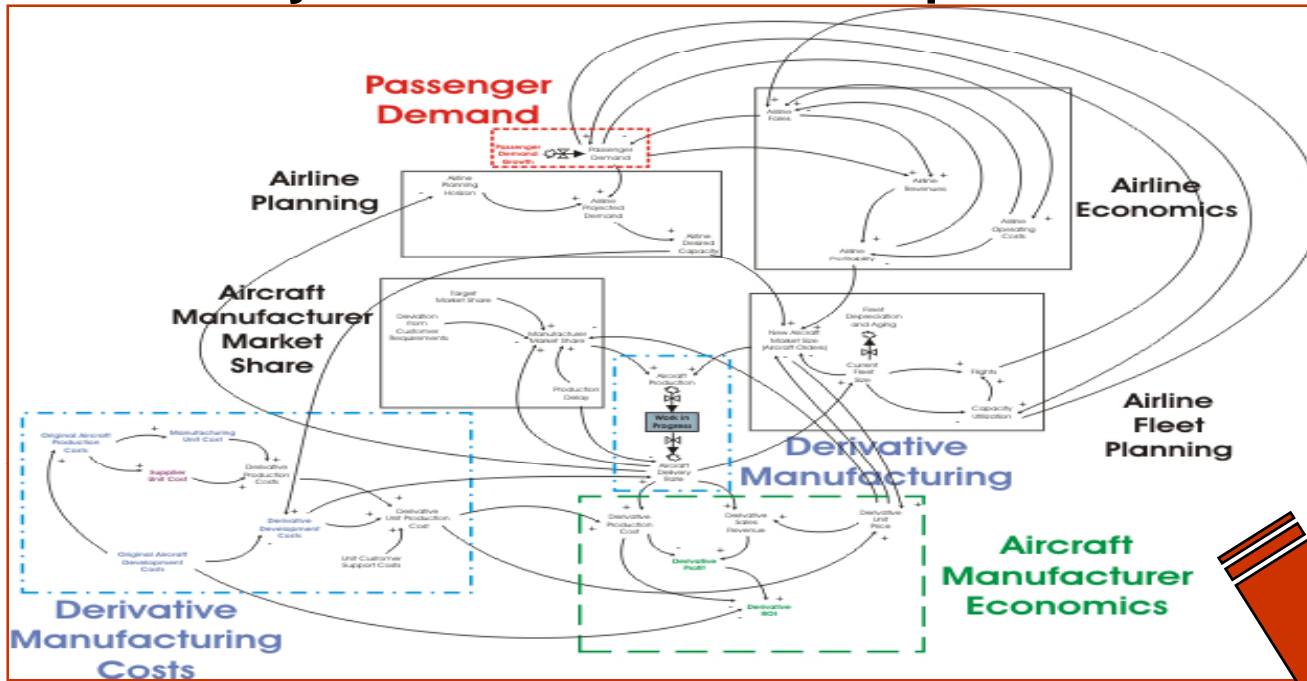
- timely analysis of market conditions and customer needs
- supply chain capable of changing assemblies quickly

Research to Date (I): Life-Cycle Flexibility Framework



- **Overview:** framework for activities needed to enable, design and support flexible systems: both technically and within enterprise

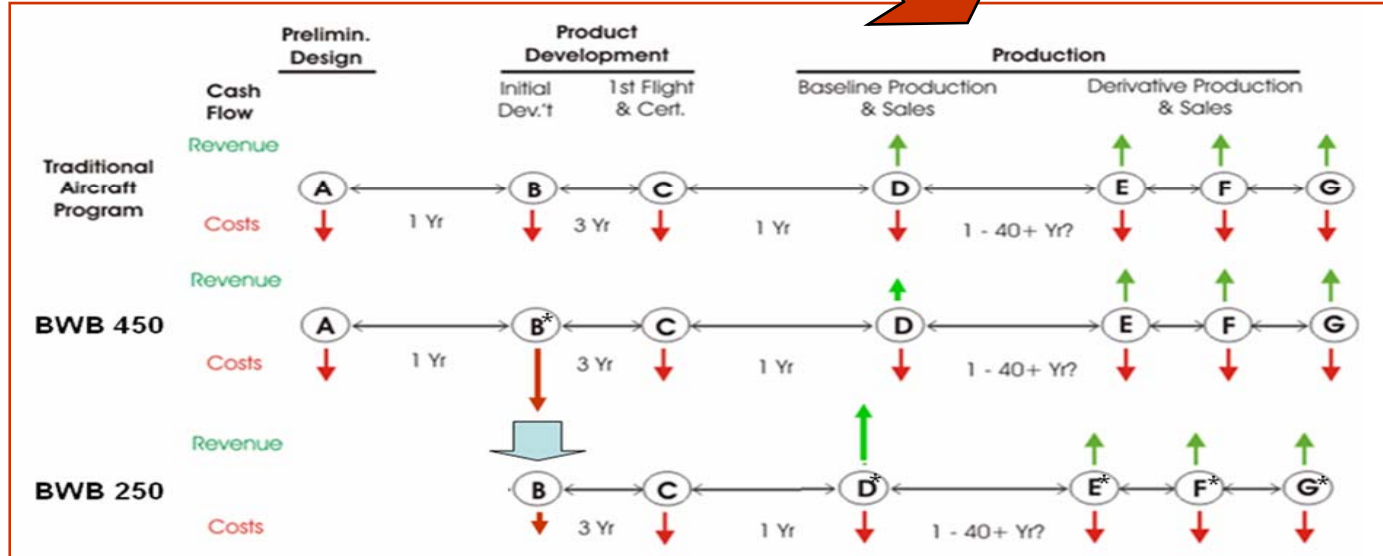
Research to Date (II): Analysis of BWB Derivative Options



System Dynamics Model Overview:
evaluate benefits and costs of technical architecture related to faster and cheaper BWB derivative development and manufacturing times



Real Options Analysis Overview:
evaluate value of option created by BWB technical architecture



Research to Date (III): Analysis of Enterprise Architecture (EA)

Product Architecture

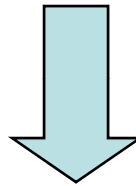


Enterprise Architecture



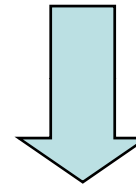
Global Supply Chain

BWB
Derivative

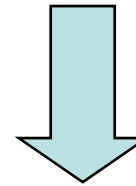


Customer
Responsiveness /
ID Changing
Environment

Product
Development

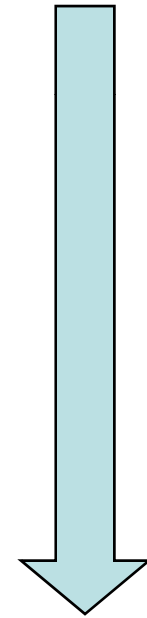


Life-cycle
planning



Design and
development
coordination

Product
Manufacturing

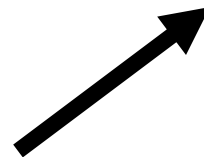
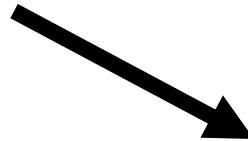


Flexible
manufacturing

Applicability of Research to LAI Members

Areas of Interest to LAI

- Use real options to cope with uncertainty
- Create and evaluate (benefits and costs) flexibility in technical architectures
- Enterprise architectures for harnessing benefits of flexibility



Research Focus

- Life-cycle flexibility framework addresses issues with flexibility throughout life-cycle, at technical system and enterprise levels
- BWB case study provides real world application at both the technical system and enterprise levels