

Value Creation Through Integration Workshop

**Lean
Aerospace
Initiative**



Integration - Framing

January 30, 2002

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MIT*



- **21st century aerospace challenge**
- **Industry maturity perspectives**
- **Implications on the aerospace industry**
- **LAI direction**



Higher, Faster, Farther - The 21st Century Enterprise Challenge

Aerospace has four core missions:

- Enabling the global movement of people and goods
- Enabling the global acquisition and dissemination of information and data
- Advancing national security interests
- Providing a source of inspiration by pushing the boundaries of exploration and innovation

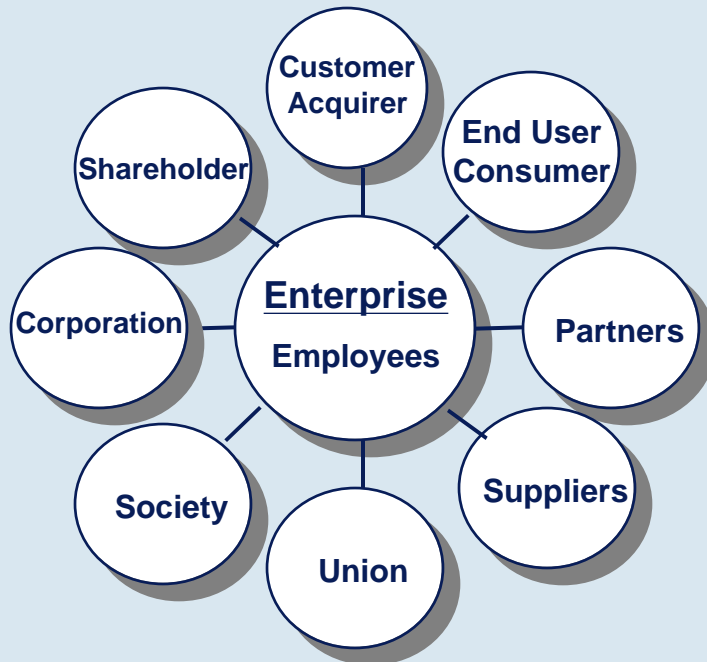
These missions will never be routine and require the best technology and the best organizations

“The core challenge for industry in the 21st century involves identifying and delivering *value* to every stakeholder. Meeting that challenge requires *lean* capability at the *enterprise* level.”



Better, Faster, Cheaper? - Lean Enterprises

Application of Lean across the total enterprise is needed to realize its full benefits. Leadership is critical at all levels.



Stakeholders

Program	F22
Corporate or Government	Boeing Lockheed-Martin USAF
National or International	Primes, Government, Suppliers,...

Three Levels of Enterprises

A lean enterprise is an integrated entity that efficiently creates value for its multiple stakeholders by employing lean principles and practices.



➤ Won the cold war



➤ Overpowering in all recent conflicts



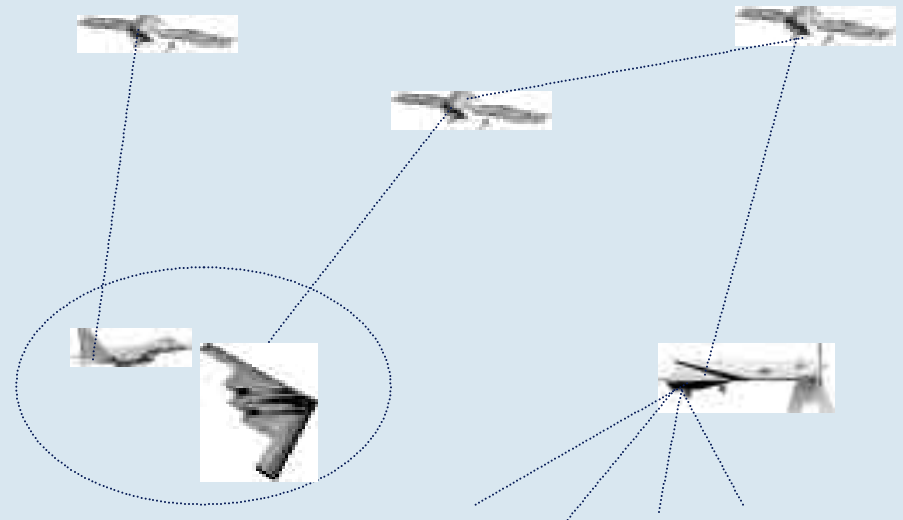


The Needs of Aerospace Customers are Changing

**From a focus on single vehicles
to platforms...**



**To networks of platforms
and...**

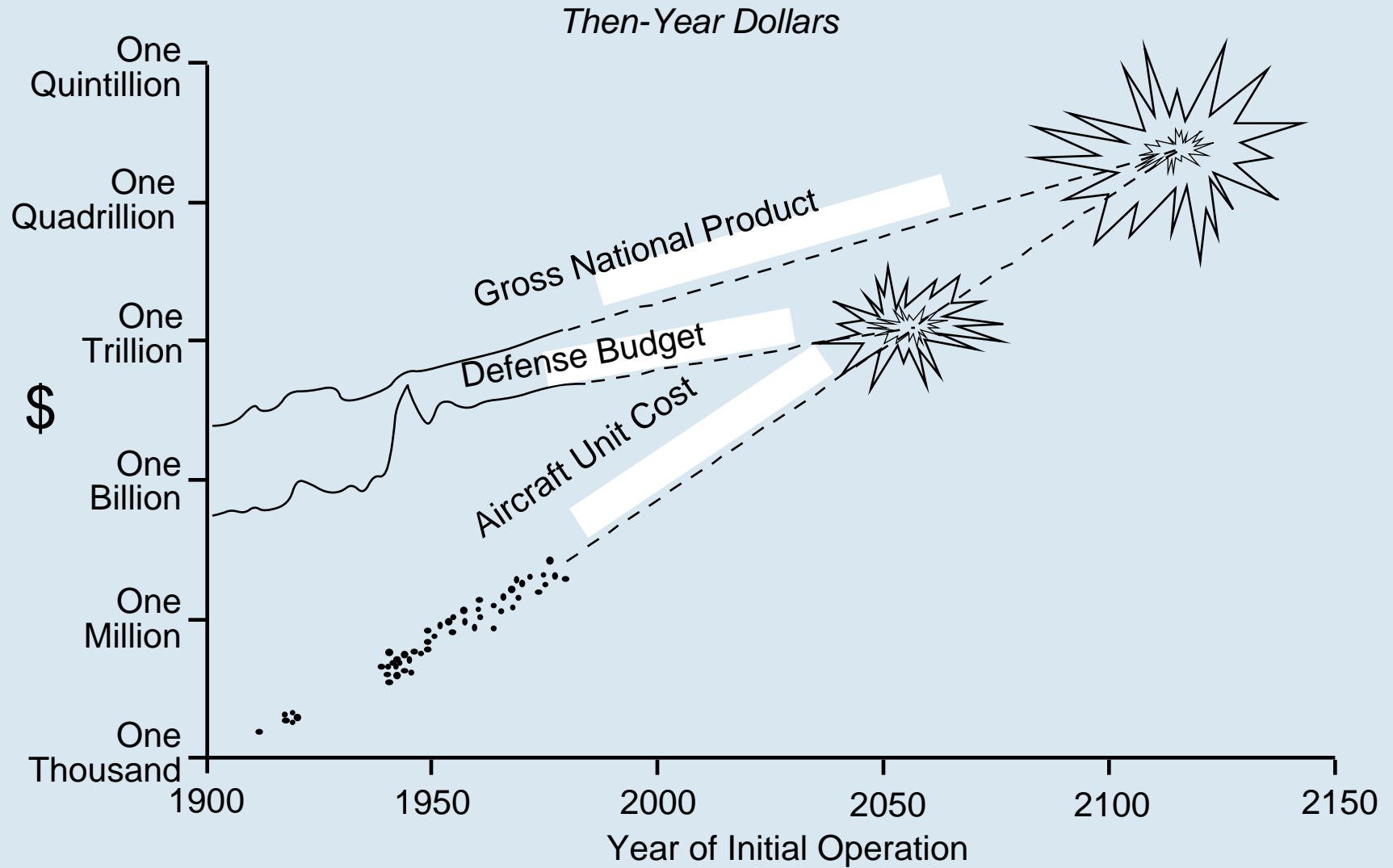


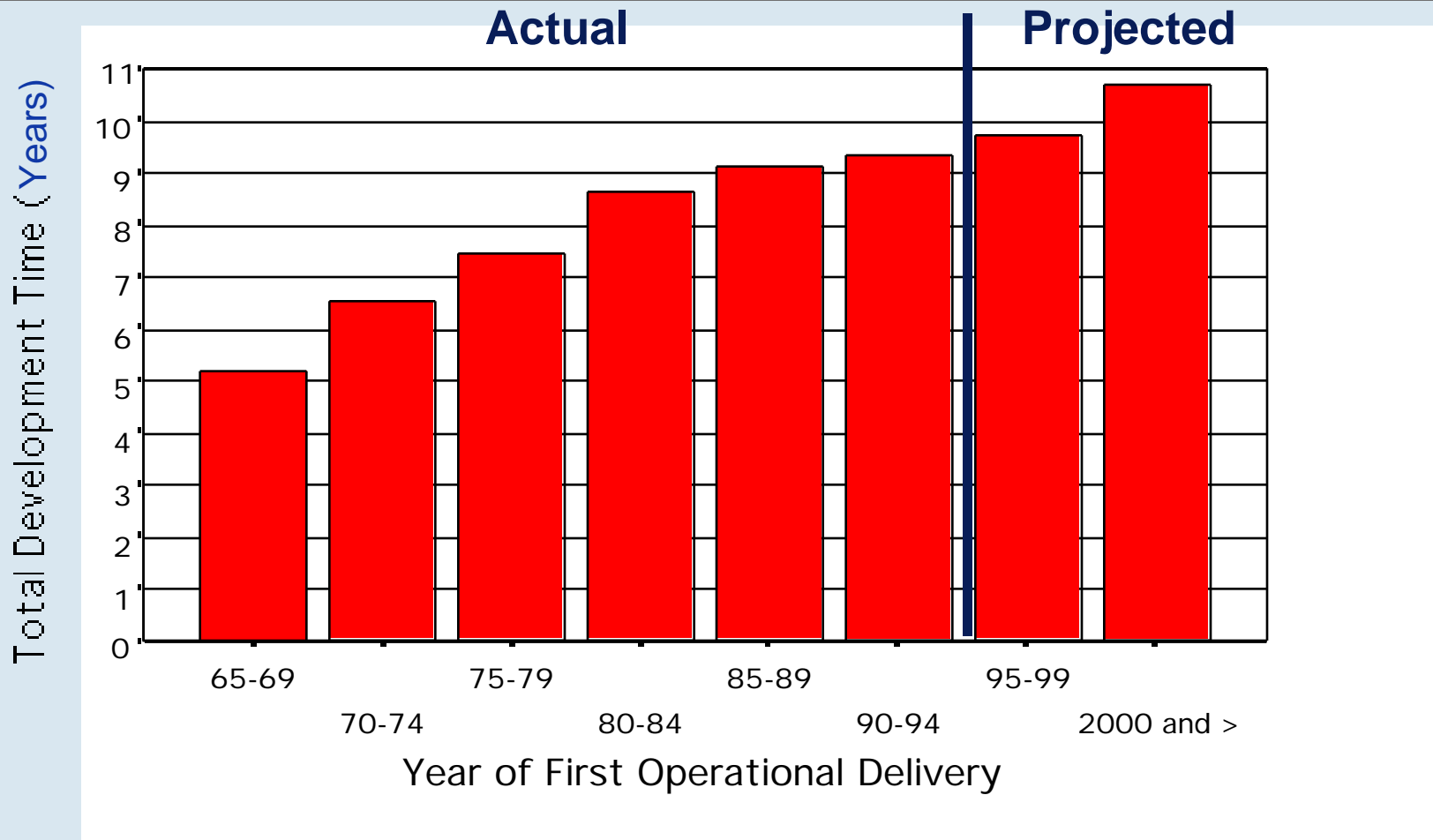
**More flexible challenges
in their employment**

**Innovation in the industry is thus shifting from
single vehicles to networks of capability**

Cost of Tactical Aircraft

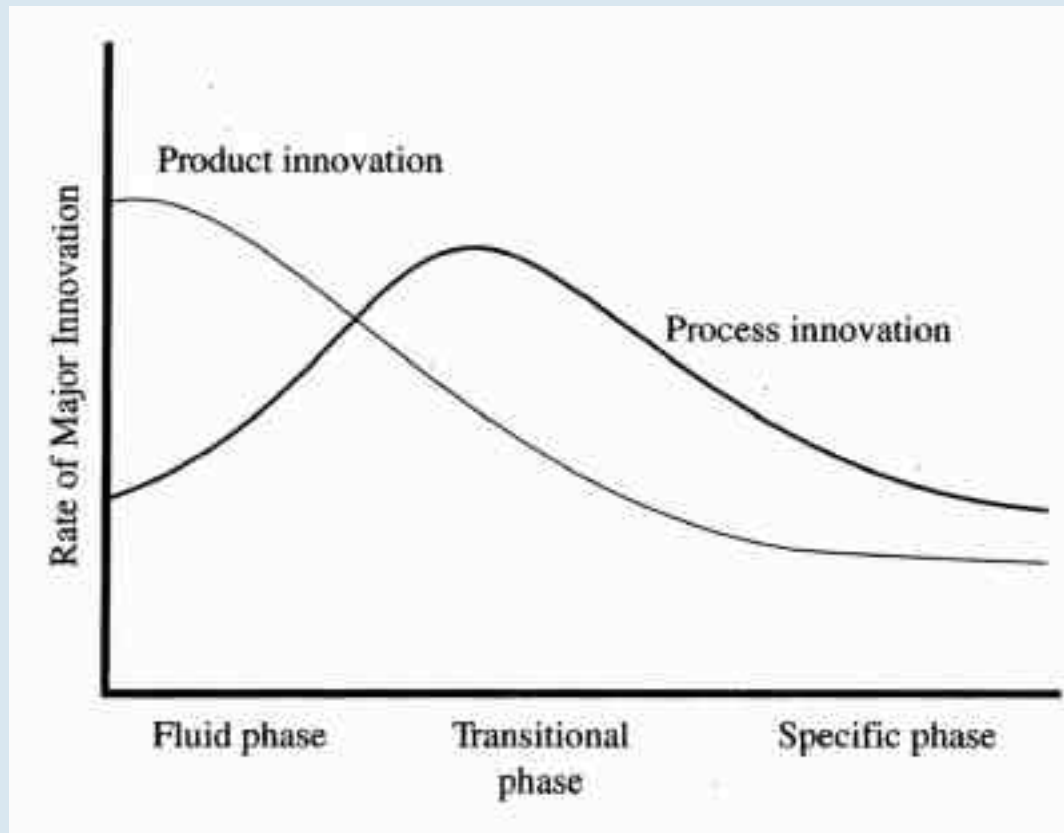
Source: Augustine's Laws





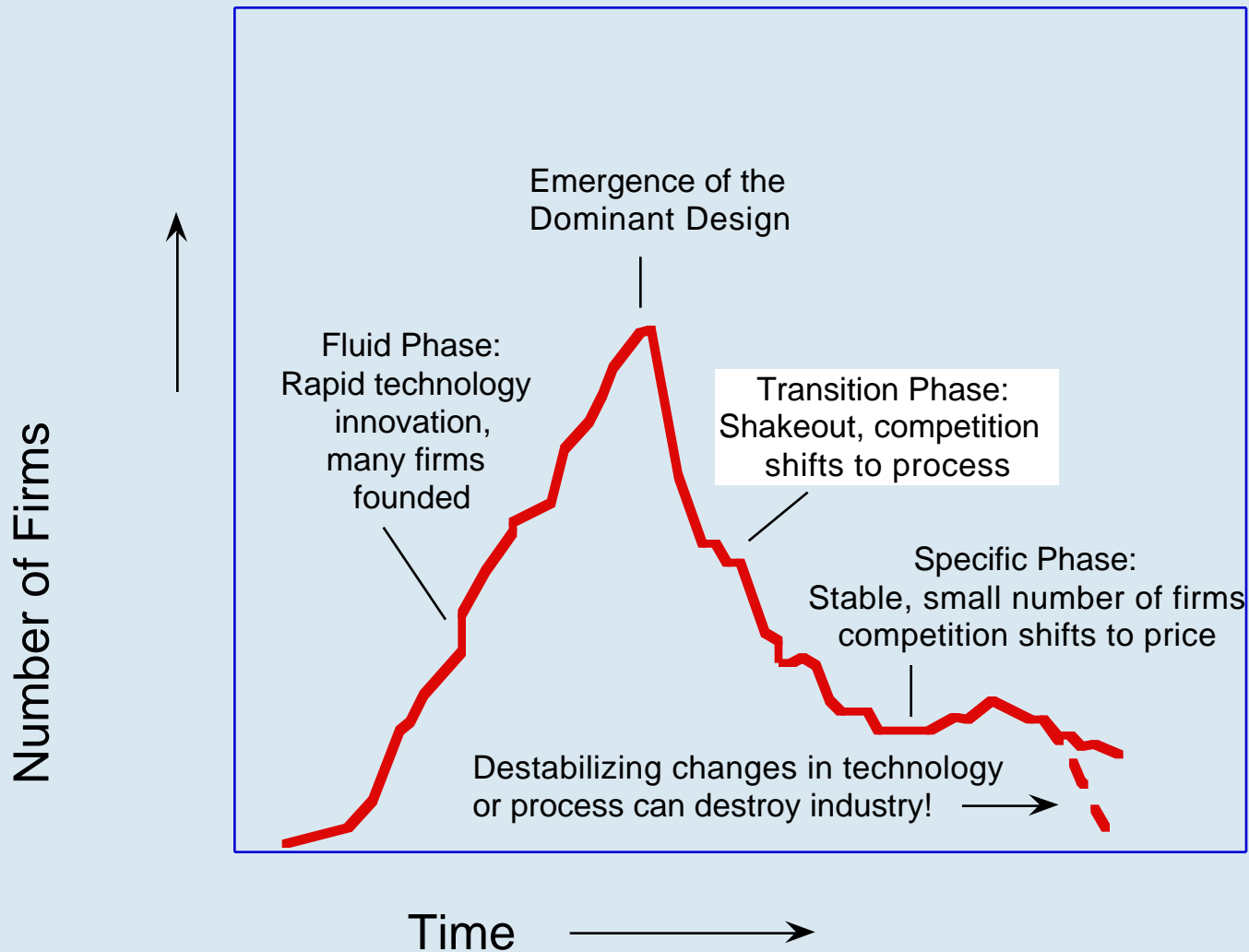
$$\text{Dev Cost (\$M)} \sim (1.36 + 0.03 \times \text{Dev Time(months)})^4$$

All Major Defense Acquisitions Programs. Milestone 1 to First Operational Delivery Data from RAND Selected Acquisition Report Database. Current as of Dec 1994.



Source: William Abernathy & James Utterback, 1978

- Rate of product innovation highest during formative years
- As product matures rate of process innovation overcomes product innovation
- Very mature products have low levels of both product & process innovations



Source: Utterback, *Dynamics of Innovation*, 1994 as adopted by Hugh McManus, 2001



Dominant Design?



1958



1995



Dominant Design?



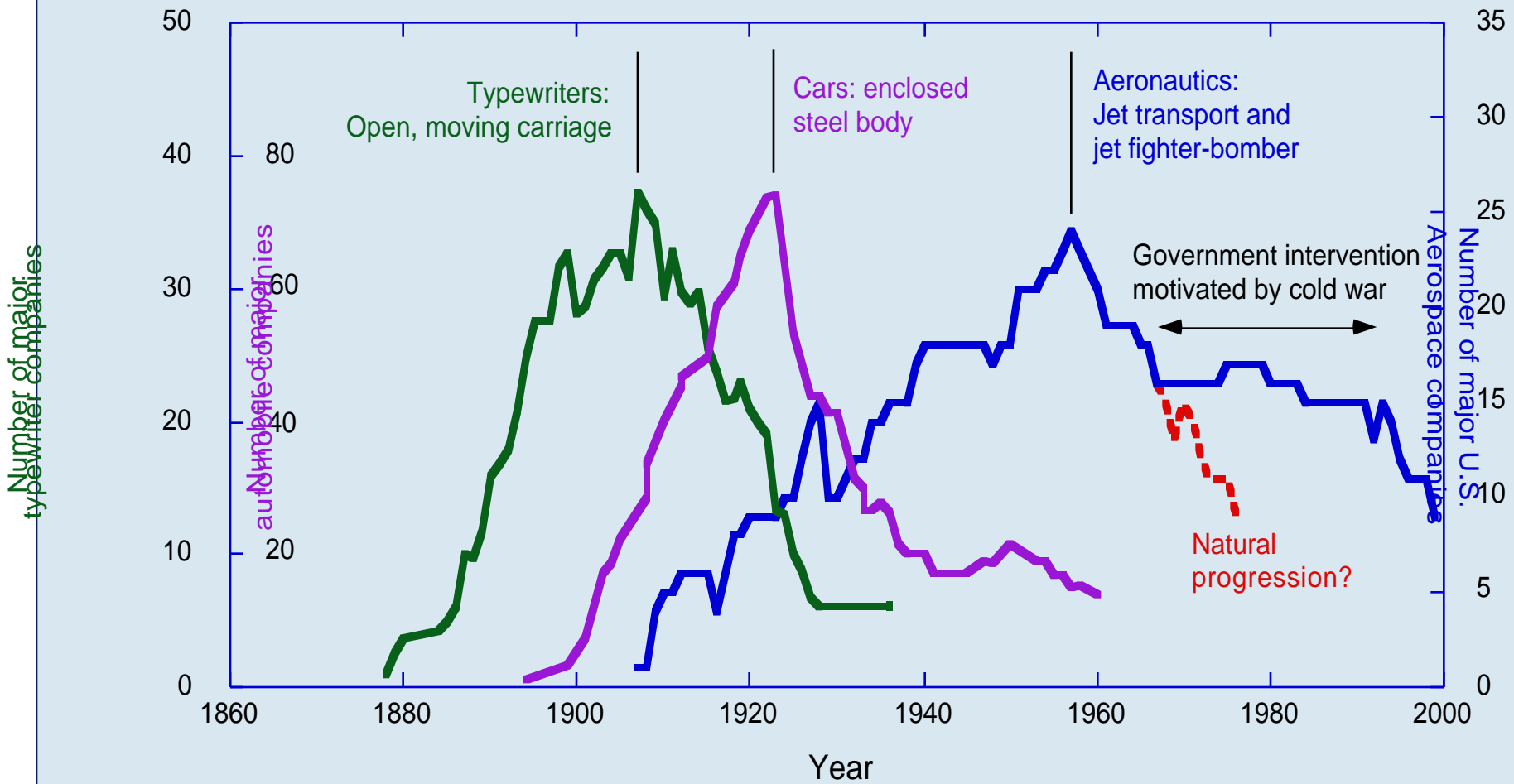
1953



1972

2002





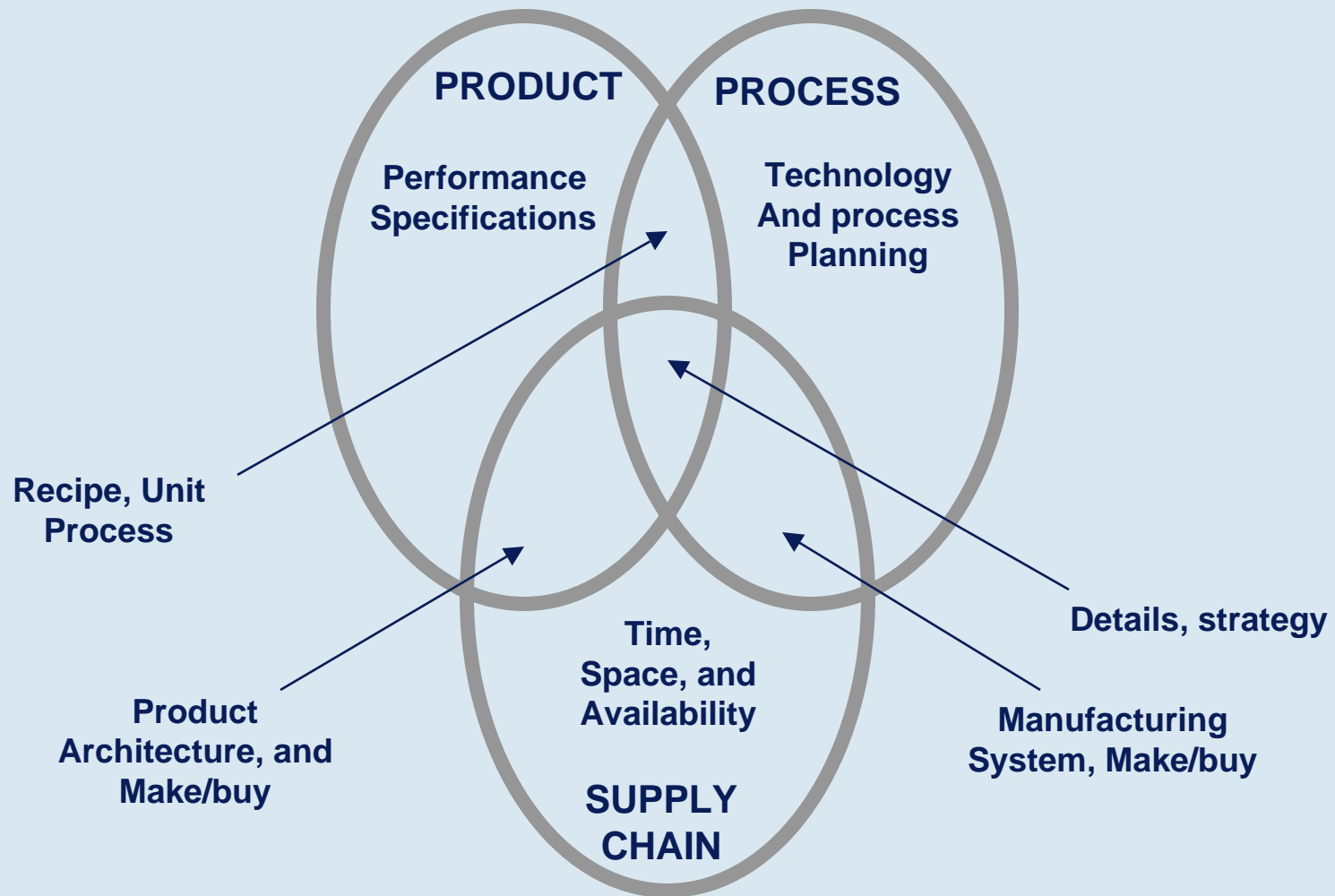


Implications of Post Dominant Design (Transition Phase)

- Little product differentiation
- Incremental product innovation
- Acquisition cost becomes focus
- Operating costs more of a concern
- Mergers, acquisitions & exits
- Process innovation dominates
- Organizations become more rigid & hierarchical
- Less risk taking

= AEROSPACE INDUSTRY?

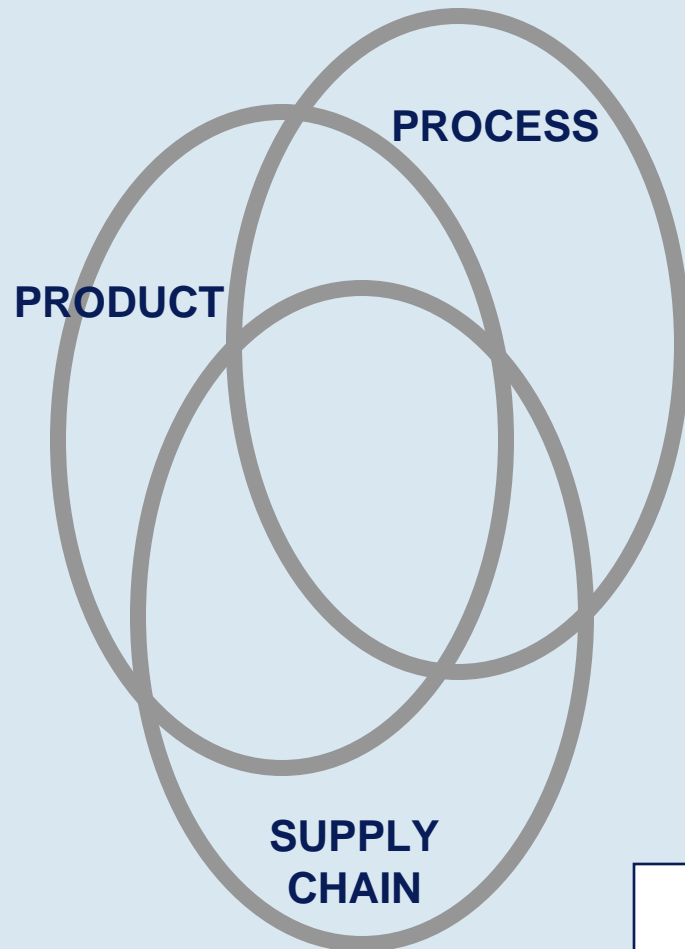
Fine's 3-D Concurrent Engineering Model



Source: Charles Fine, *Clockspeed*, Perseus Books, p. 146



Fine's Model and the Aerospace Industry in the Transition Phase



In a post dominant design environment two relationships predominate

- **Product interactions become more interlinked with process and the supply chain**
- **Supply chain integration and process improvements have a predominant impact on cost**

Design must be much more interactive with mfg & suppliers



- **Aerospace industry innovation shifting to systems of systems**
- **In a maturing single product environment**
 - **Product and life cycle cost predominate**
 - **Best addressed by process & supply chain improvements**
- **Lean beyond the factory floor means shifting the enterprise focus to product realization from product design**
- **Enterprise strategy should change in recognition of this new competitive landscape**



Achieved success in functional areas

- **Product development**
 - Design process improvements through application of Lean
 - Application of value stream analysis to make development and testing more efficient
- **Manufacturing systems**
 - Major process improvement efforts
 - Shifting from batch and queue to flow
- **Supplier networks**
 - Improvements in quality, supplier mgmt,
 - Improvements in communications, supplier roles



**Major improvements through
the integration of design,
manufacturing and the supplier
network**



Frameworks for Integration...

- **...from the manufacturing perspective**
- **...from the product development perspective**
- **...from the supplier networks perspective**