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Stakeholder Value and the Evolution of Commercial Aircraft

Paul Collopy
Engineering Economist
DFM Consulting, Inc.

Stakeholder Value and the Evolution of Commercial Aircraft

- Evolution of Commercial Aircraft
  - Aerospace Products are Complex Adaptive Systems
- Stakeholder Value
  - Who are Stakeholders?
  - Surplus Value Theory
  - Applications

Motivation for this Research

- A simple paradigm for understanding success and failure in commercial air transport
- A guide to developing successful air transportation equipment
- A decision support model for airline strategies
- Basis for a technology evaluation model over the domain of aircraft, airlines, airports, etc.

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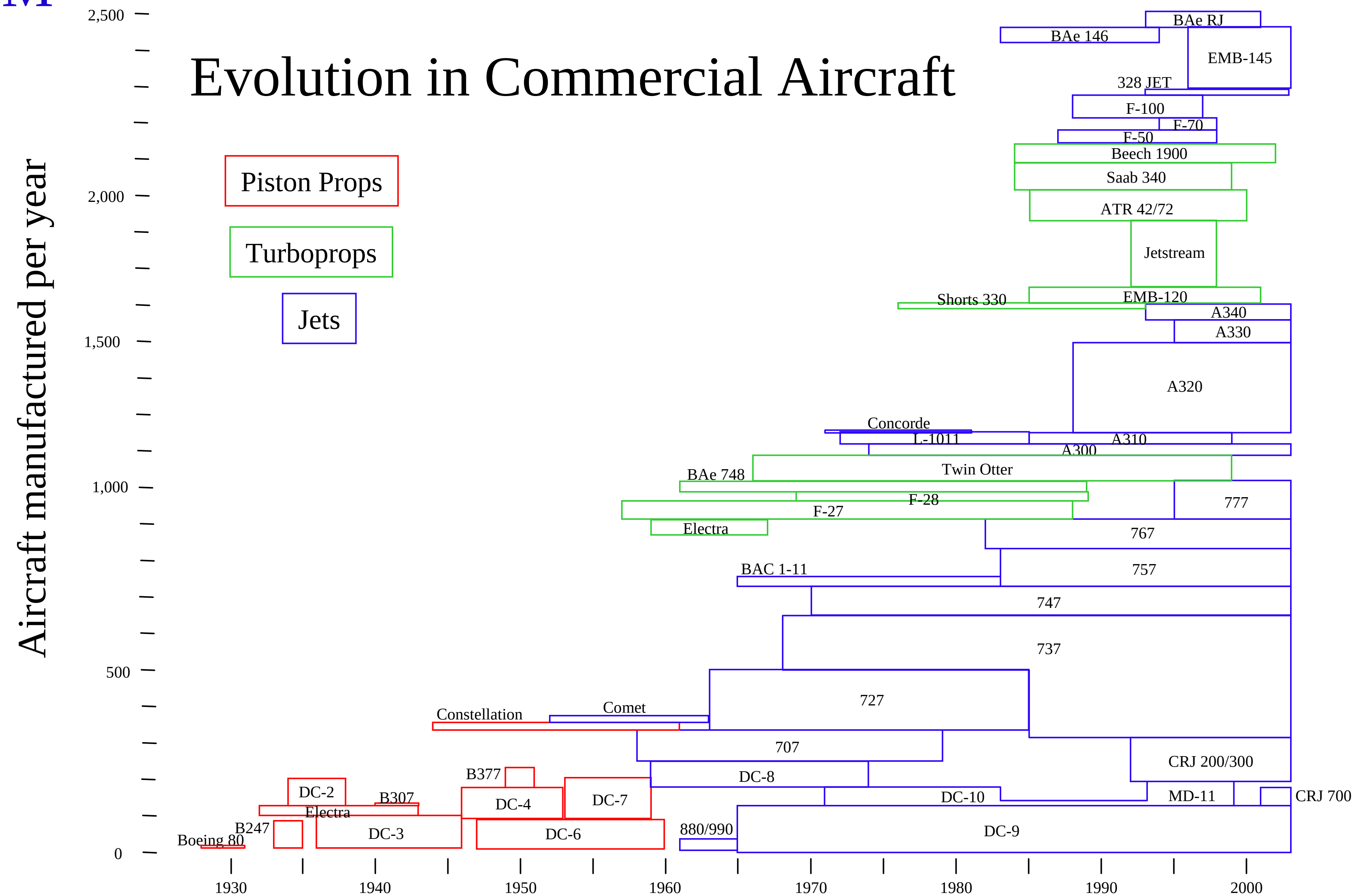
Evolution in Commercial Aircraft



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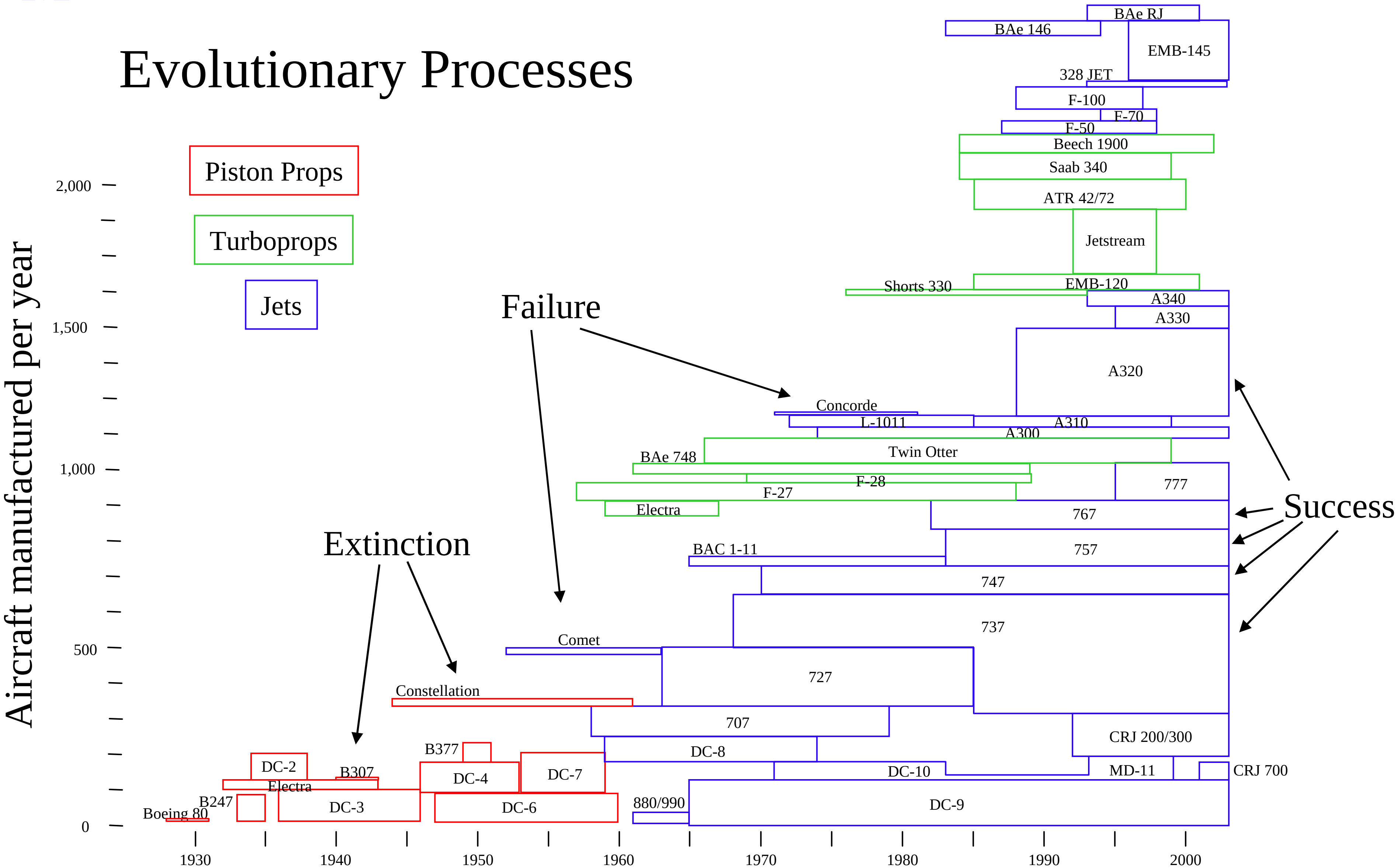
Evolutionary Processes



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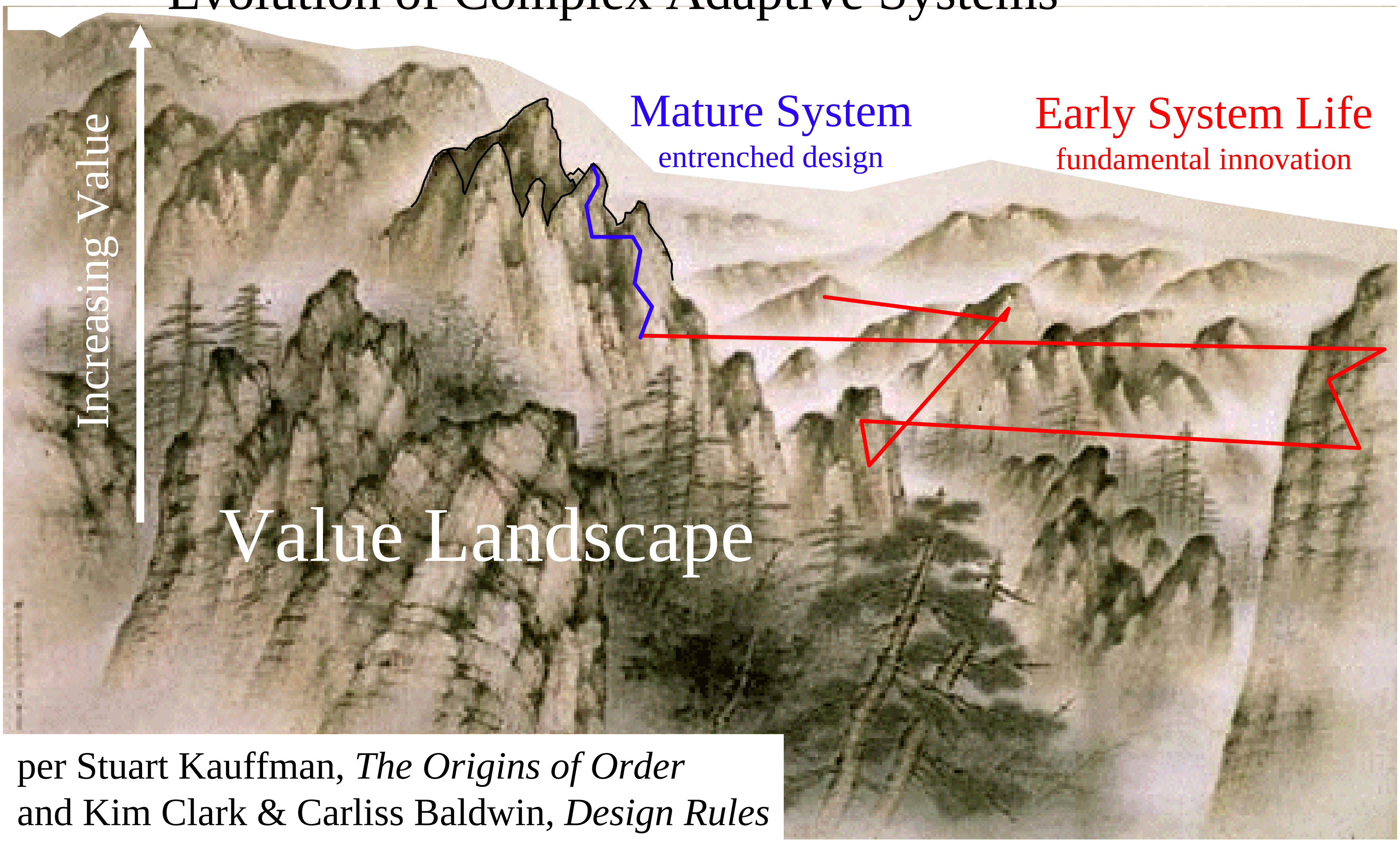
Evolution of Complex Adaptive Systems



per Stuart Kauffman, *The Origins of Order*
and Kim Clark & Carliss Baldwin, *Design Rules*

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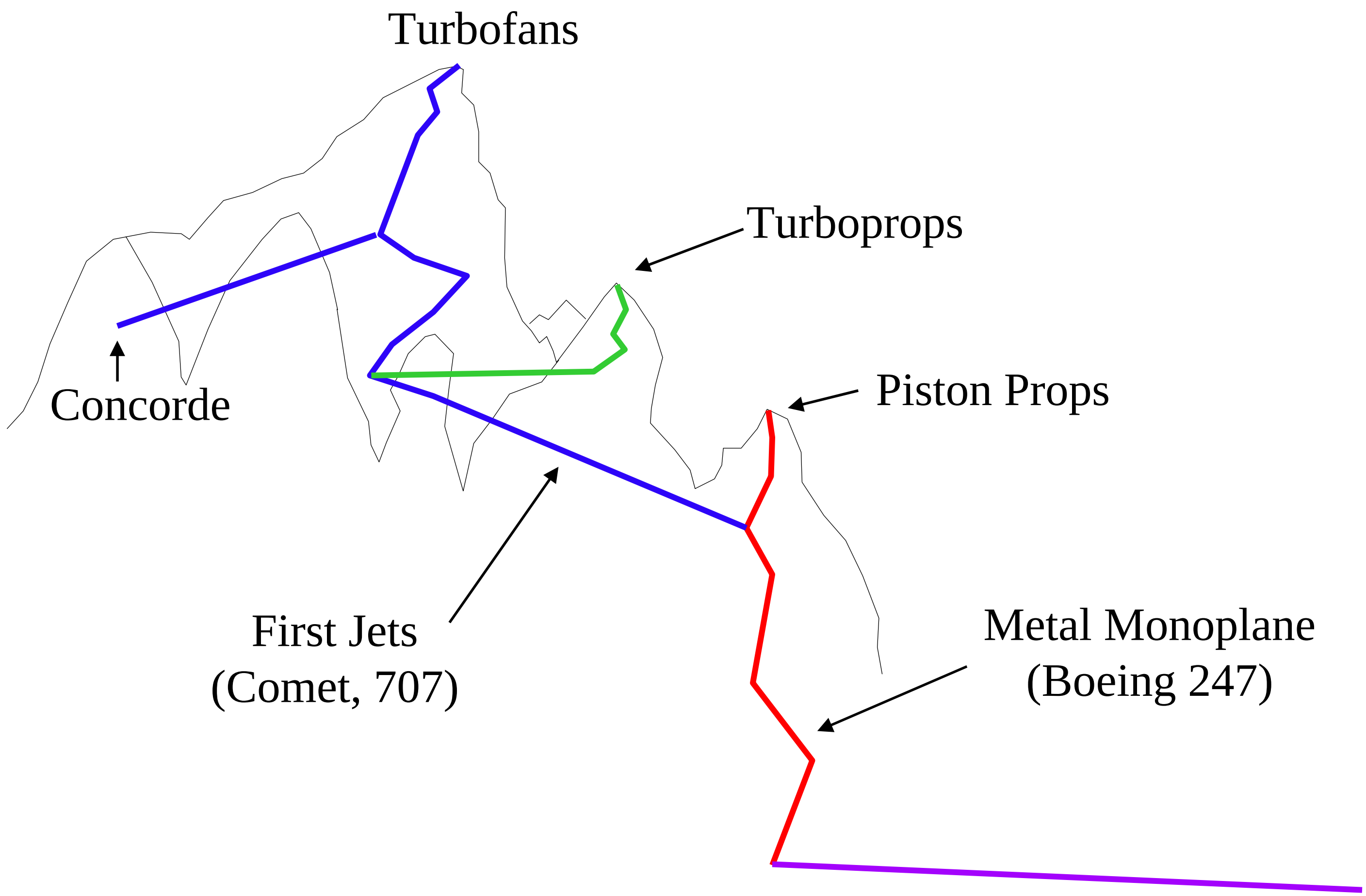
A Closer Look at Evolution



What Is Value?

Altitude in the Mountain Metaphor

- Net Value delivered to Stakeholders
  - Benefits minus costs or penalties
- Almarin Phillips (RAND) rule:
  - New DOC + Cost of Capital < Old DOC
- Questions Remain:
  - Who are Stakeholders?
  - How is value to particular Stakeholders combined?

Stakeholders

- Passengers
  - Freight Customers
- Airlines
- Airports
- Equipment Manufacturers
  - Airframes
  - Engines
- Society (Externalities)
  - Noise and Pollution
  - Economic Growth

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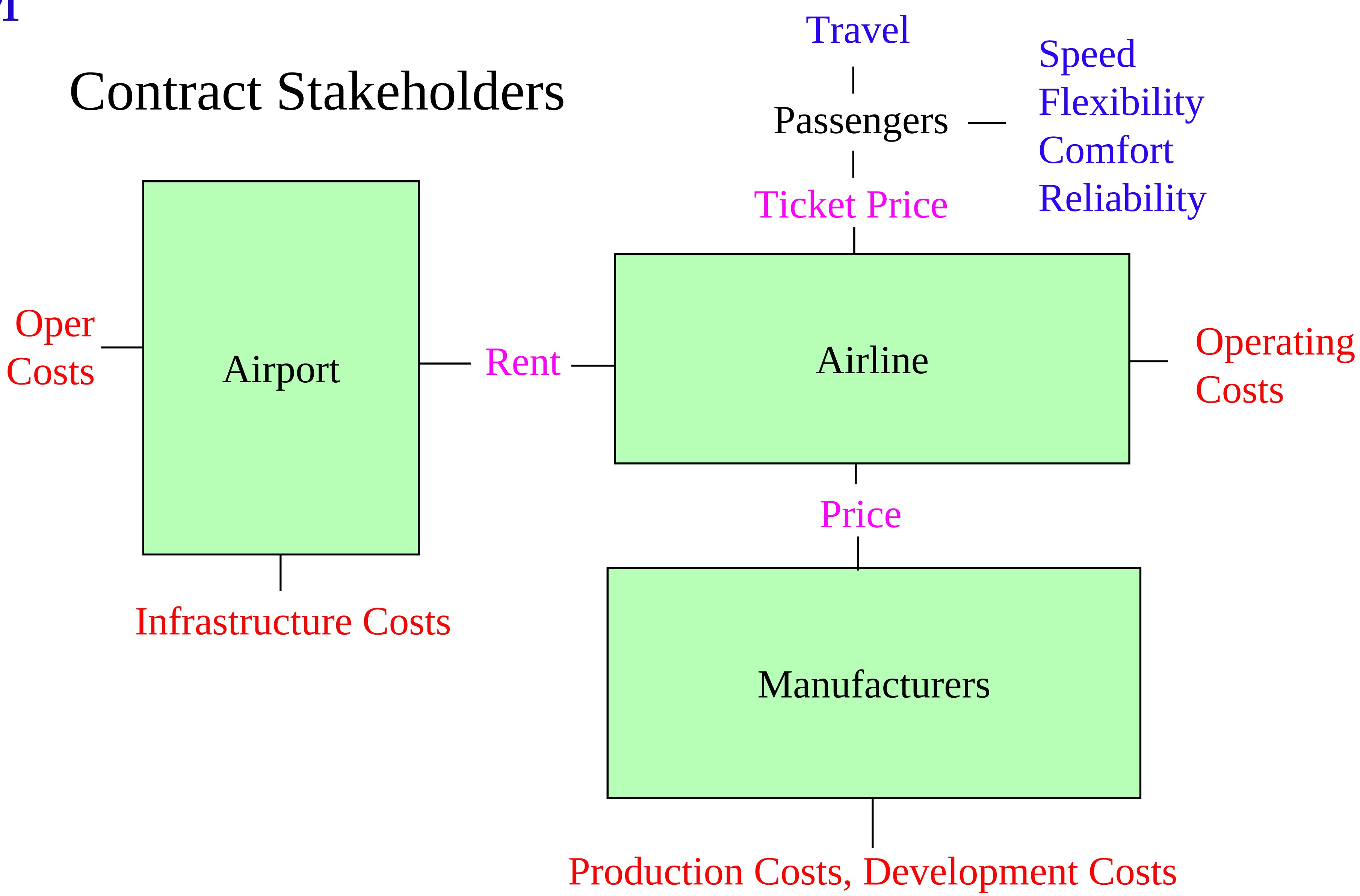
Contract Stakeholders



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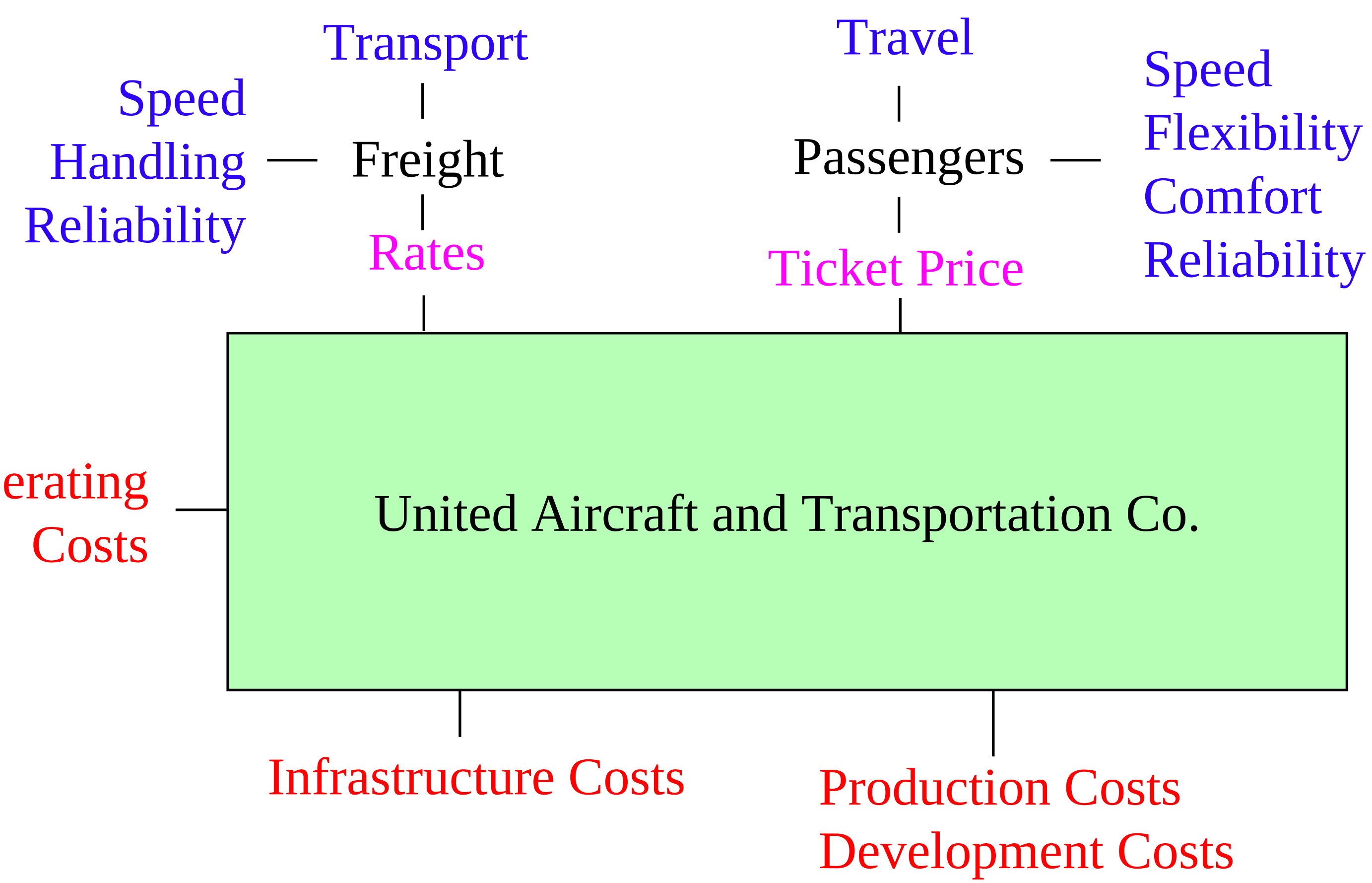
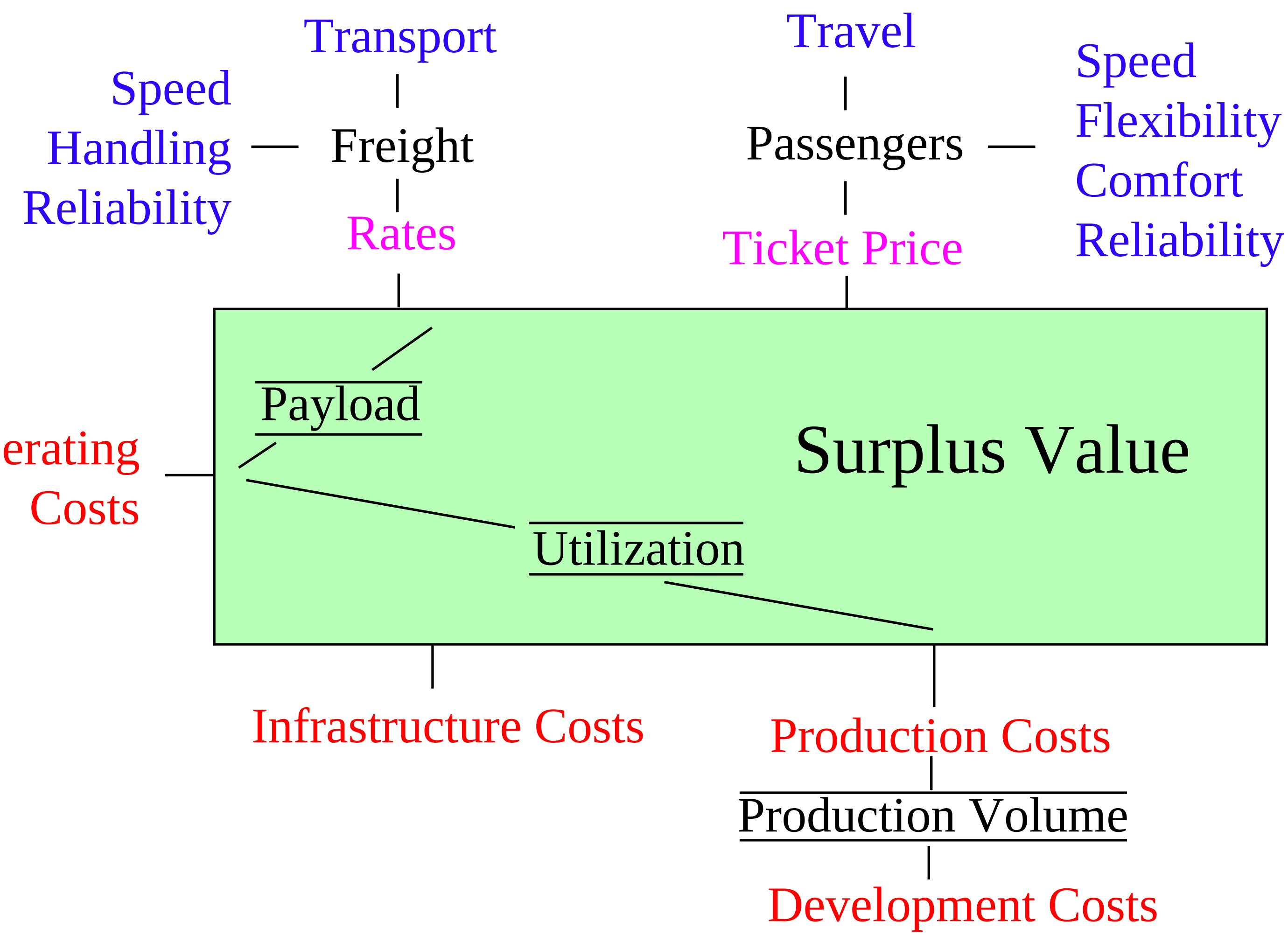
Single Firm Model



Single Firm Model — Elaborated



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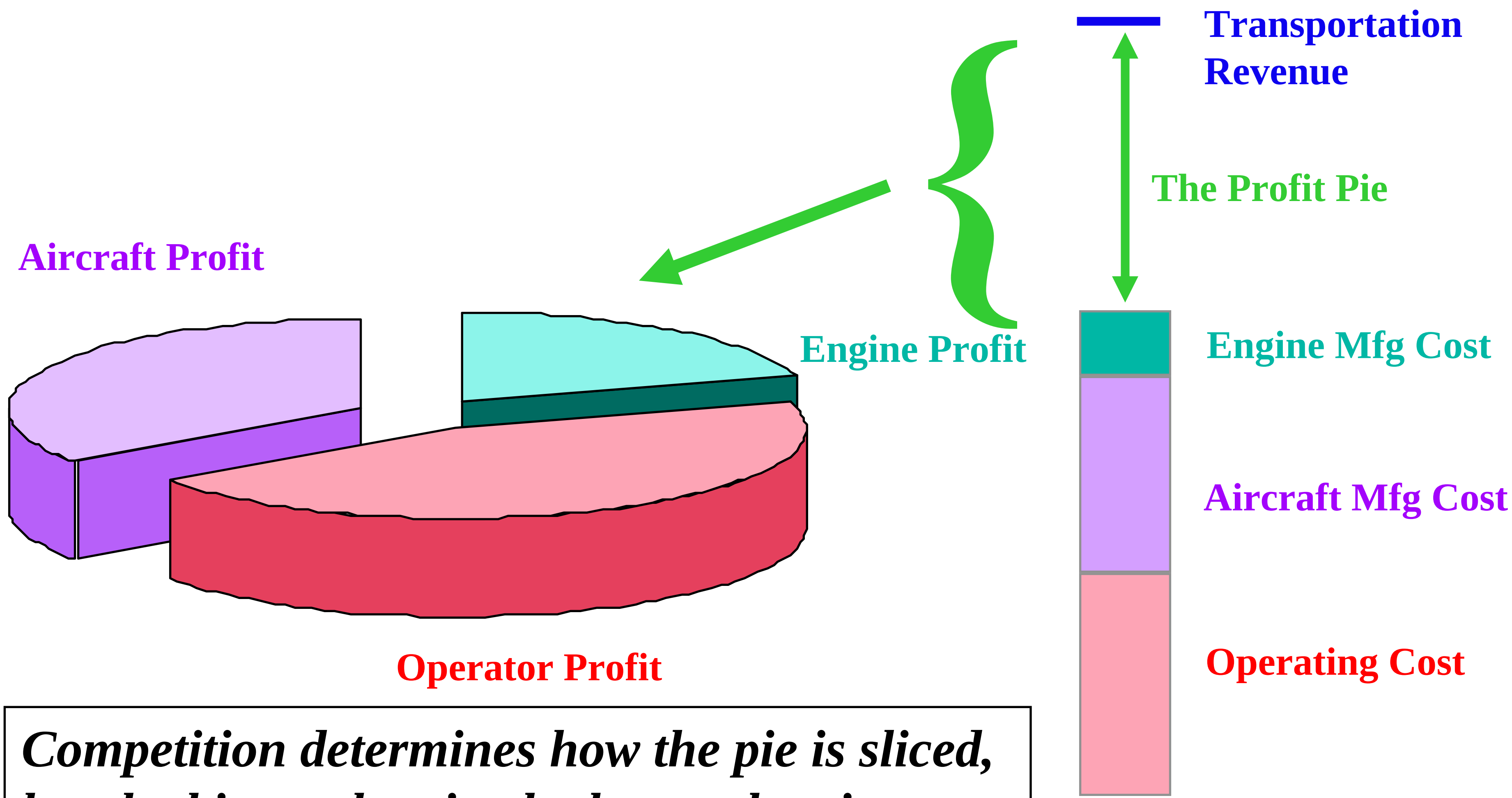
Surplus Value Theory



Competition determines how the pie is sliced, but the bigger the pie, the larger the pieces

Key Theorem of Surplus Value Theory

Any technology, product design, or strategy the increases surplus value will increase or not affect the profits of each contract stakeholder, assuming effective bargaining.

A rising tide lifts all boats

Example: Surplus Value Maximizing Networks

- Lowest cost per mile traveled is on point to point service
- Surplus Value maximizing networks concentrate traffic on point-to-point service by discounting nonstop flights
- Revenue maximization, on the other hand, leads to
  - hub and spoke network
  - premium charge for point to point (what the market will bear)
- In the long run, Surplus Value maximizers will drive revenue maximizers to extinction
  - or, at least, to small niche operation

Some Implications for the Future

- Great leaps across the design space are difficult until we better understand optimal design
  - Blended wing body aircraft are out of reach
- Passenger networks will tend more toward point-to-point
  - Aircraft designs that cater to point-to-point service will be more successful
  - Boeing’s 7E7 is better targeted than Airbus A380
    - However, 7E7 does not seem to balance cost / performance to maximize surplus value (trade $250 mfg cost / lb. of weight)
    - Same argument suggests engine bypass ratio should be < 8

Evolution of Commercial Aircraft — Summary

- Commercial aircraft can be viewed as a community of complex adaptive systems
  - branching and extinction are common processes
- Evolutionary success is determined by relative contribution to surplus value
  - Revenues minus costs around the boundaries of unified contract stakeholders provides a simple model of surplus value, the driving force for evolutionary success
- Surplus value model provides a metric for comparing aircraft designs, prospective technologies & airline networks