Adapting Systems Engineering to the Development of Regional Jets

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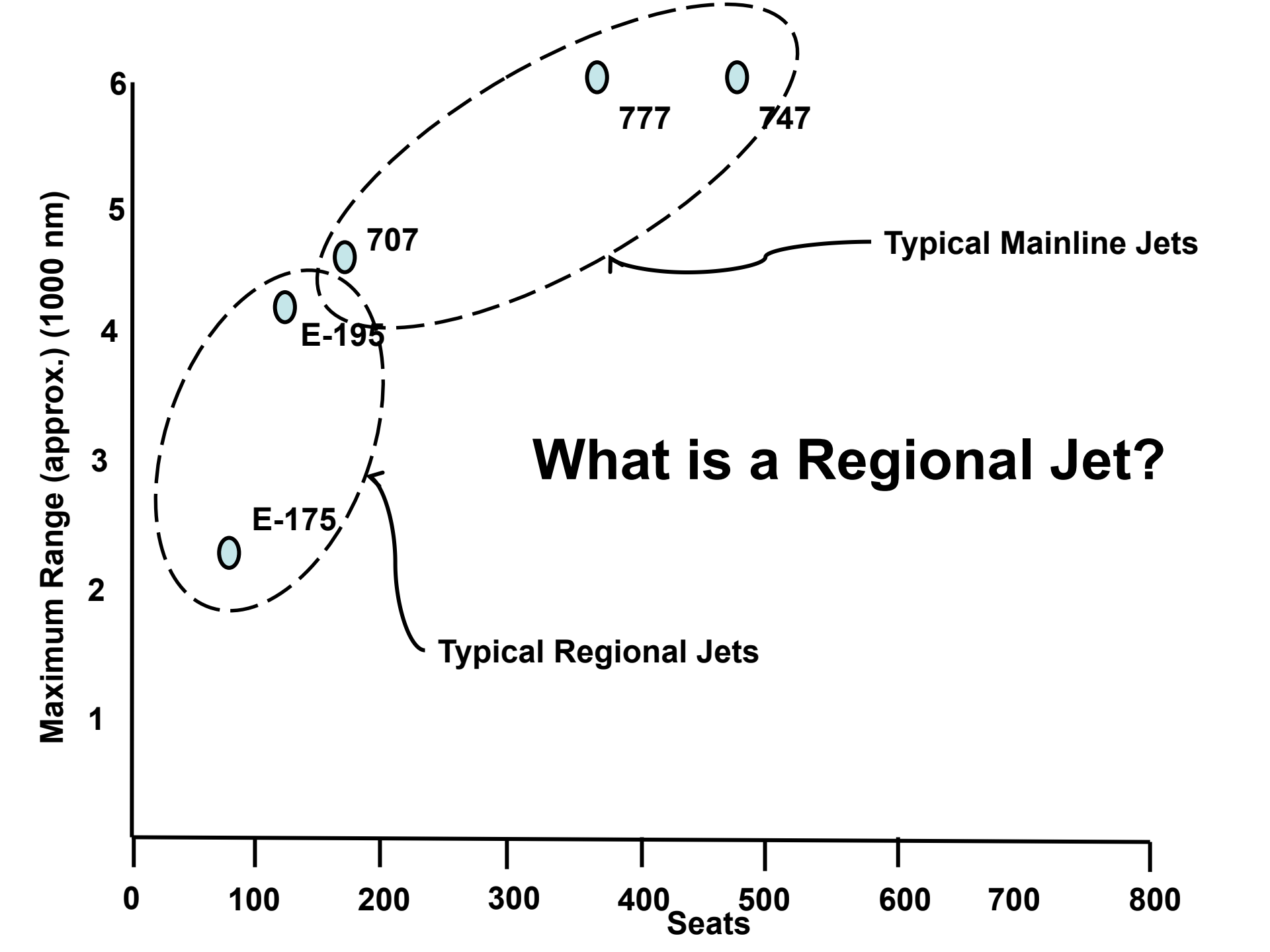
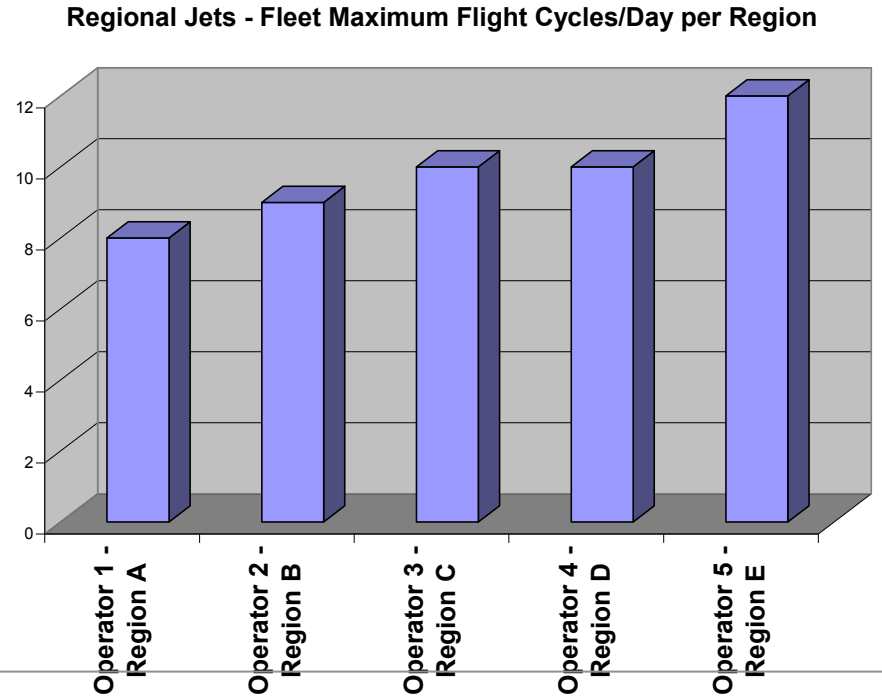

What is a Regional Jet?
Maximum Range (approx.) (1000 nm)
6
5
4
3
2
1
0
100
200
300
400
500
600
700
800
Seats
777
747
707
E-195
E-175
Typical Mainline Jets
Typical Regional Jets

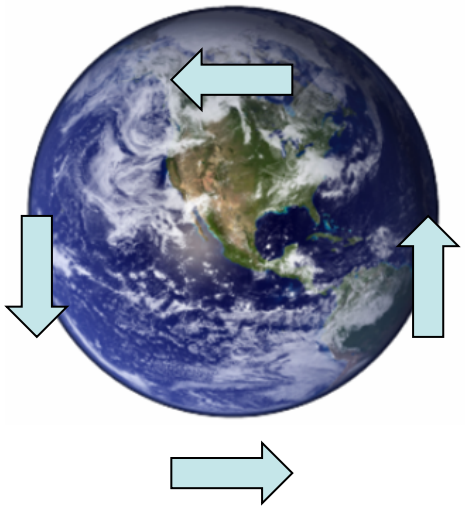
Regional Jets Have More Severe Operational Environments than Mainline Jets



These demands result from a more severe life cycle environment compared to mainline jets.

This severe environment is seen to have a more far-reaching impact on the architecture and requirements than one would expect.

Operational Life Cycles – More Severe due to the diverse operational environments around the world.



Regional airlines encounter a strong operational relation at airports that support regional traffic.

In this manner, stakeholder requirements capture and customer support engineering become major issues with respect to the severe environments.

Flight operations, maintainability and reliability engineering become increasingly important in a systems engineering context, and systems engineering has an opportunity to apply the stakeholder requirements process, with different methods and tools to capture data and information in a systemic approach with widely available tools that results in good stakeholder requirements.

Severe Life Cycle Environment + Stakeholder Requirements ➡ Complexity

Severe life cycle Environment

Regional jet developers, like those for mainline jets, must strive to meet the needs of their customers while complying with rigid regulatory requirements.

Accurate Functional View on life cycle

Complexity

Through years the industry has observed an increase number of functionalities of the product followed by embedded electronics and software. This way, the top level requirement are has more difficult to be flowed down in a technology centered domain.

Flow down value throw complexity

In this manner, stakeholder requirements capture and customer support engineering become major issues with respect to the severe environments. Flight operations, maintainability and reliability engineering become increasingly important in a systems engineering context

Putting Metrics on stakeholders concerns of value

Multiplicity of Constraints Demands Rigorous Requirements Screening

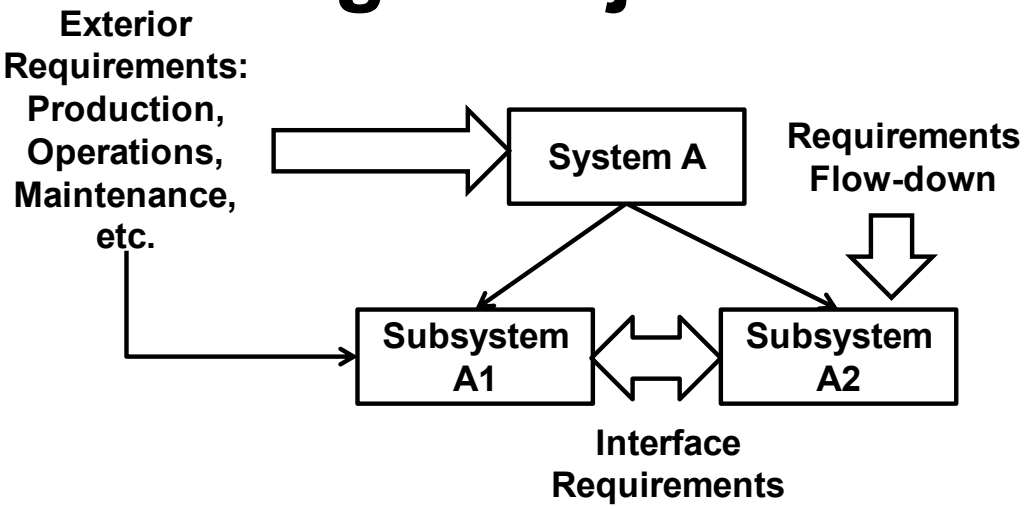
Constraints: safety, environmental, weight, spatial, noise, emissions, cost, loads, shock, vibration, EMI, durability, reliability, human factors, maintainability, design standards, transportability, producibility, etc. etc.

Screening by:

- **design engineer**
- **specialty engineer**
- **project manager**
- **systems engineer**



Requirements conflicts have many sources on both mainline and regional jets



There are Five Common Methods for Resolving Requirements Conflicts (not mentioned in many texts)

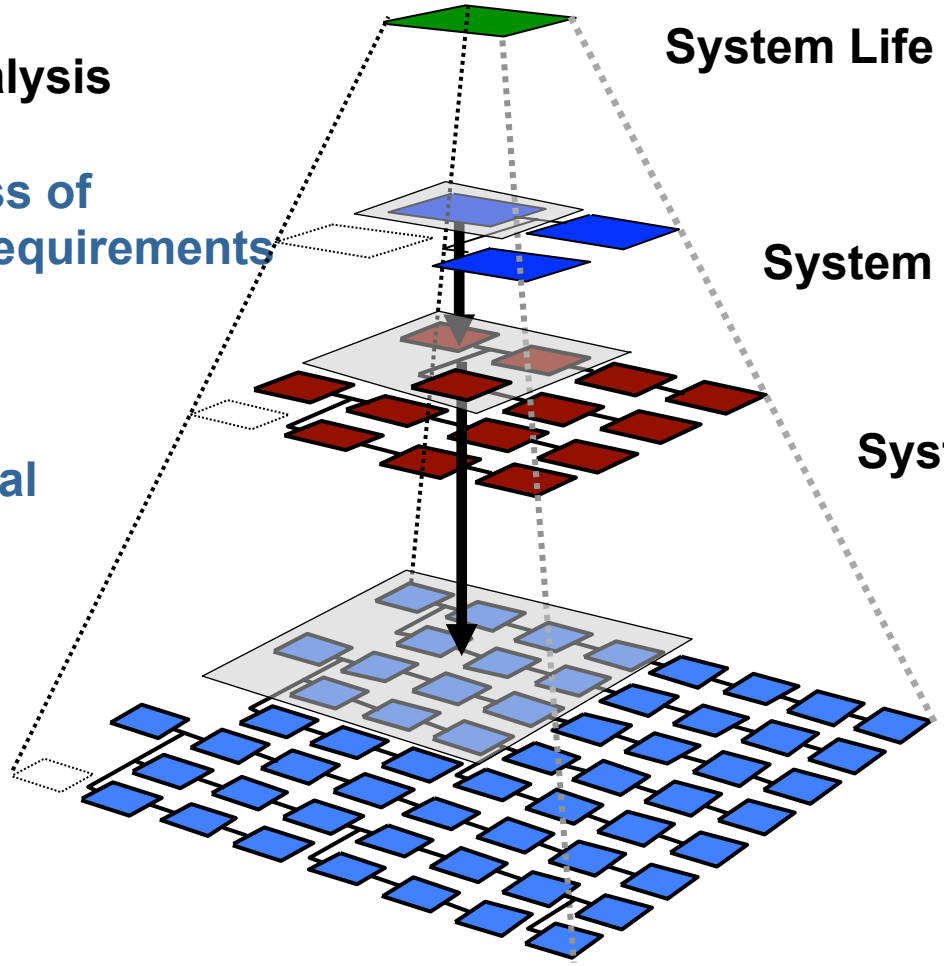
- Linear addition
- Modeling
- Requirements Weighting
- Absolute Limits
- Reallocation

Severe Life Cycle Requirements Affect Subsystems and Components

The architectural process must be rigorously traceable to the requirements process to deal with the top level requirements.

Functional analysis

- ✓**Completeness of performance requirements**
- ✓**Traceability**
- ✓**Environmental constraints**



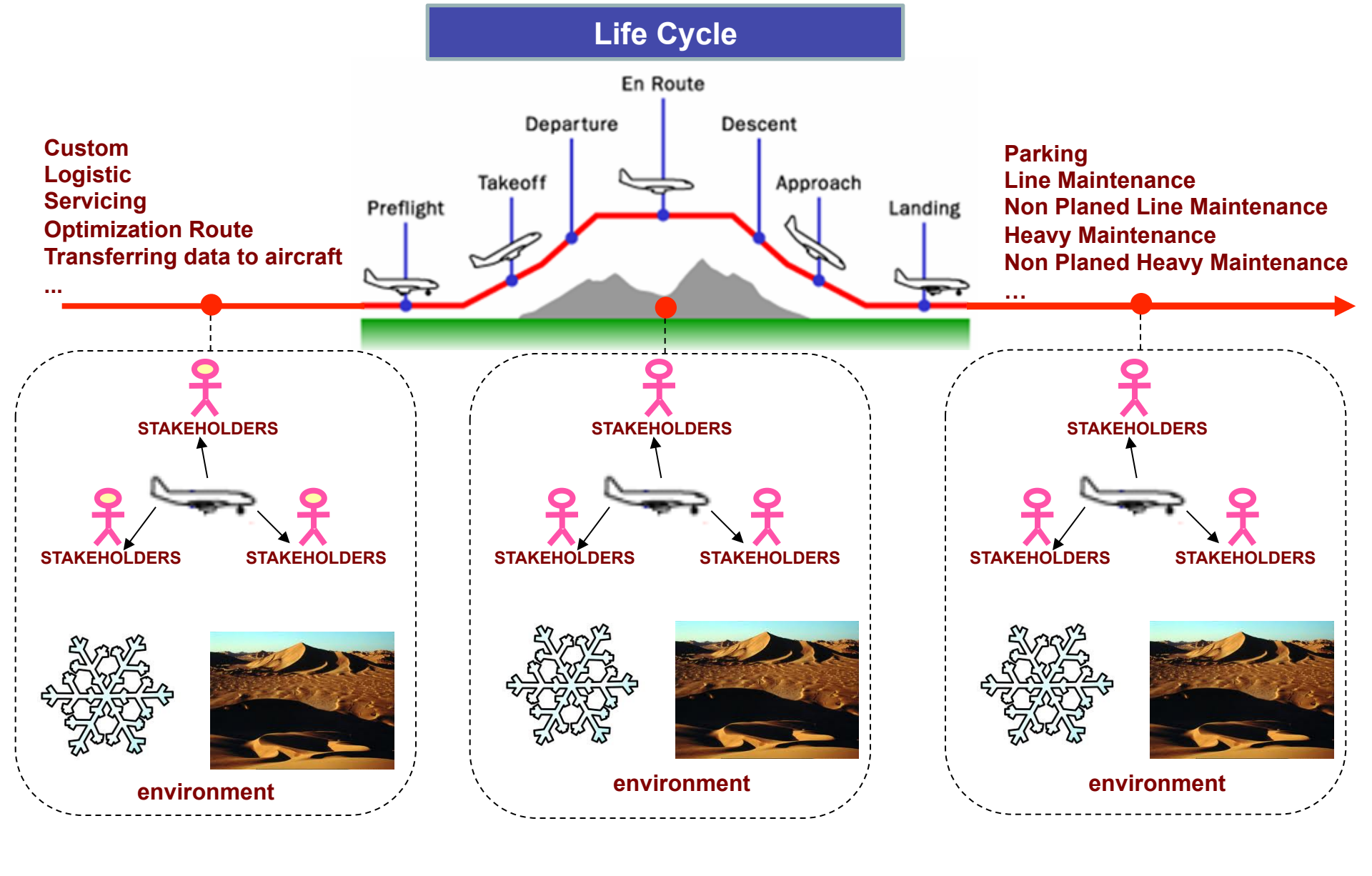
System Life Cycle

System Life Cycle Functions

System Functions

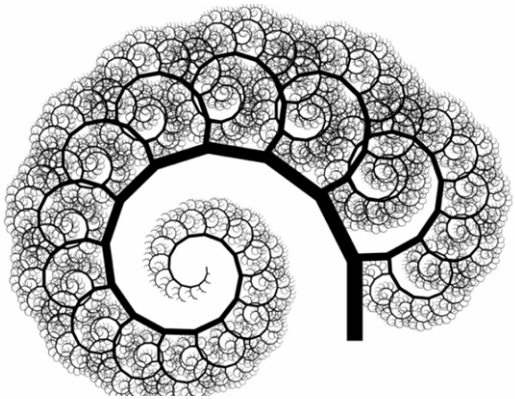
Sub system Functions

The Aircraft Life Cycle Gives Rise to Hundreds (perhaps thousands) of constraints



Regional Jets are as Complex as Mainline Jets and Maybe More

COMPLEX



Not Necessarily is

Complicated

The treatment of stakeholder requirements and requirement analysis needs to be efficient due the complexity and severity of the operational environment and life-cycle scenarios.

Systems Engineering makes “value” emerge as behavior from systems complexity

New technologies that when incorporated in regional jet architectures result in high levels of complexity to deal with high level of performance.

Do not lose “value” emerge as behavior from systems complexity

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For further reading . . .

http://www.ashgate.com/isbn/9781472439215

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