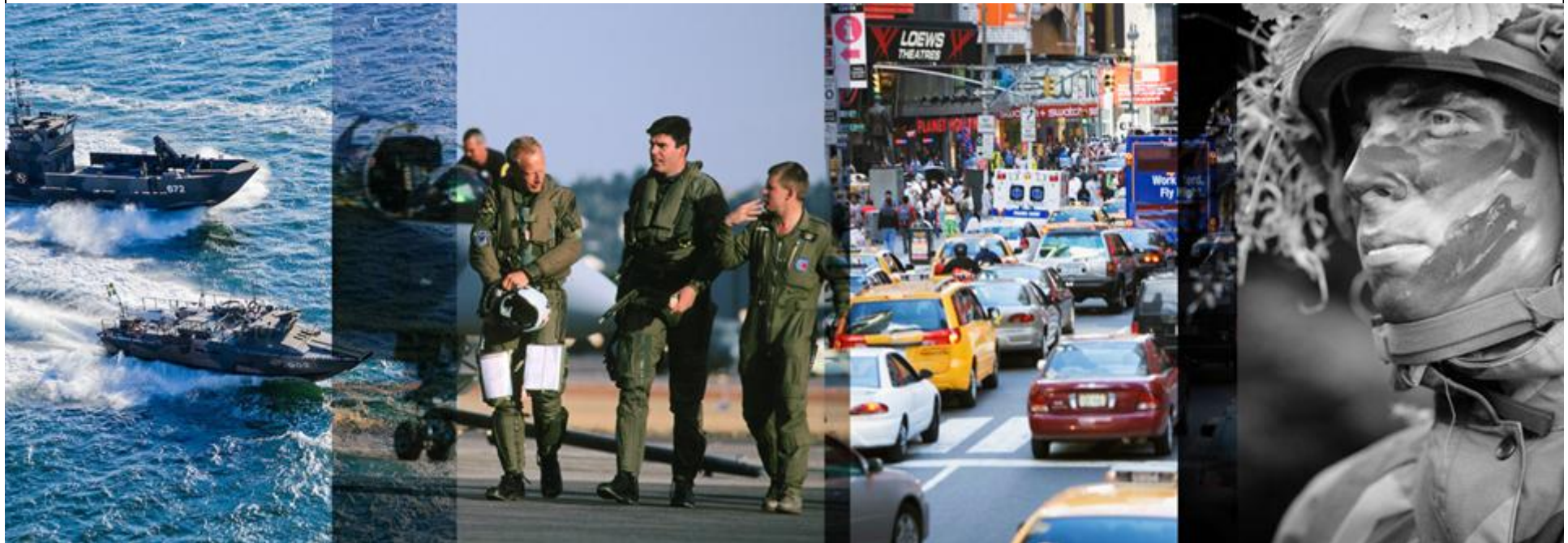




2015 ICAS Workshop on Systems Integration, Krakow
**Systems Integration for Capability, Flexibility and Affordability-
Gripen Avionics Upgrade**



Billy Fredriksson
Gunnar Holmberg
Anders Pettersson

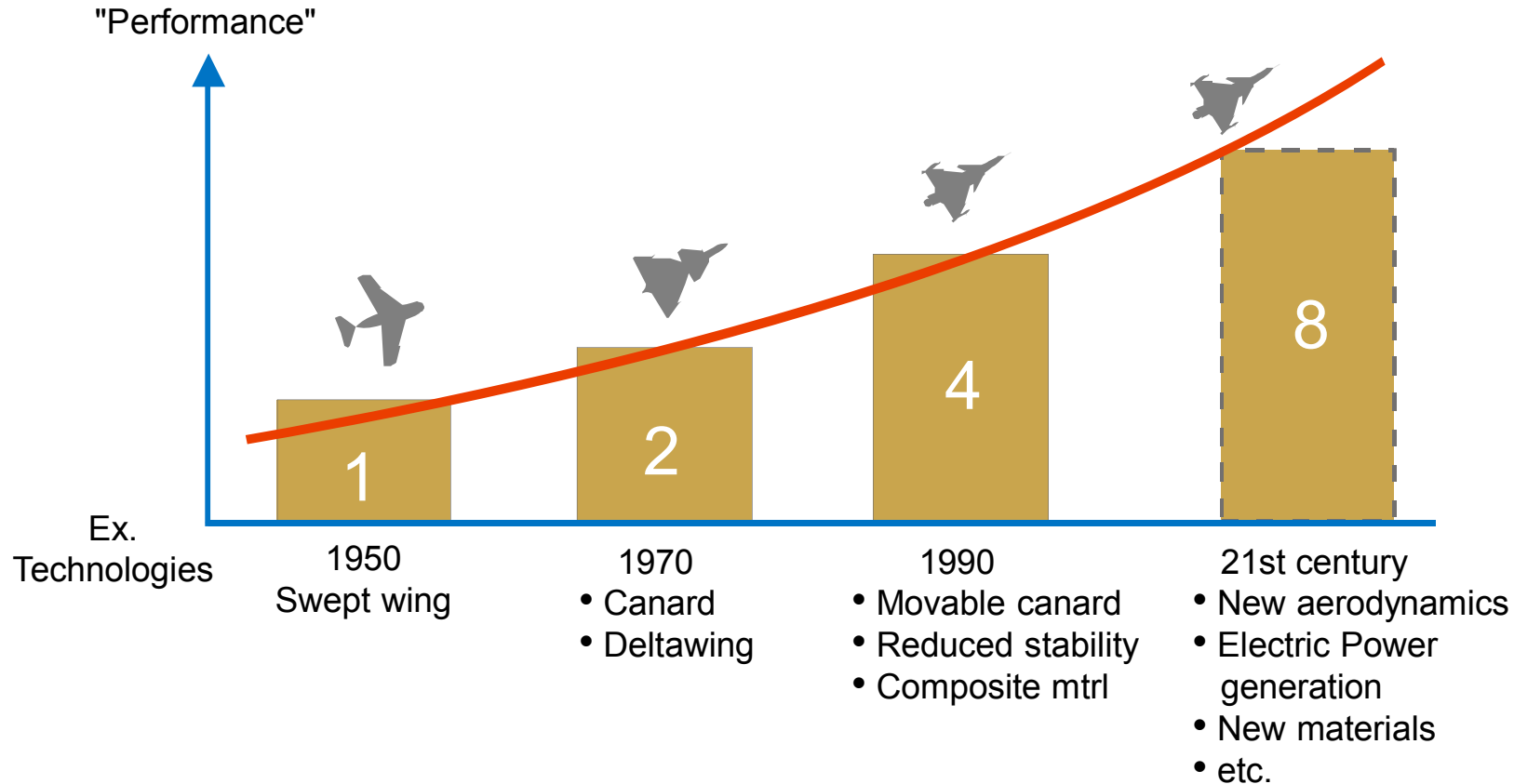
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JAS 39 GRIPEN



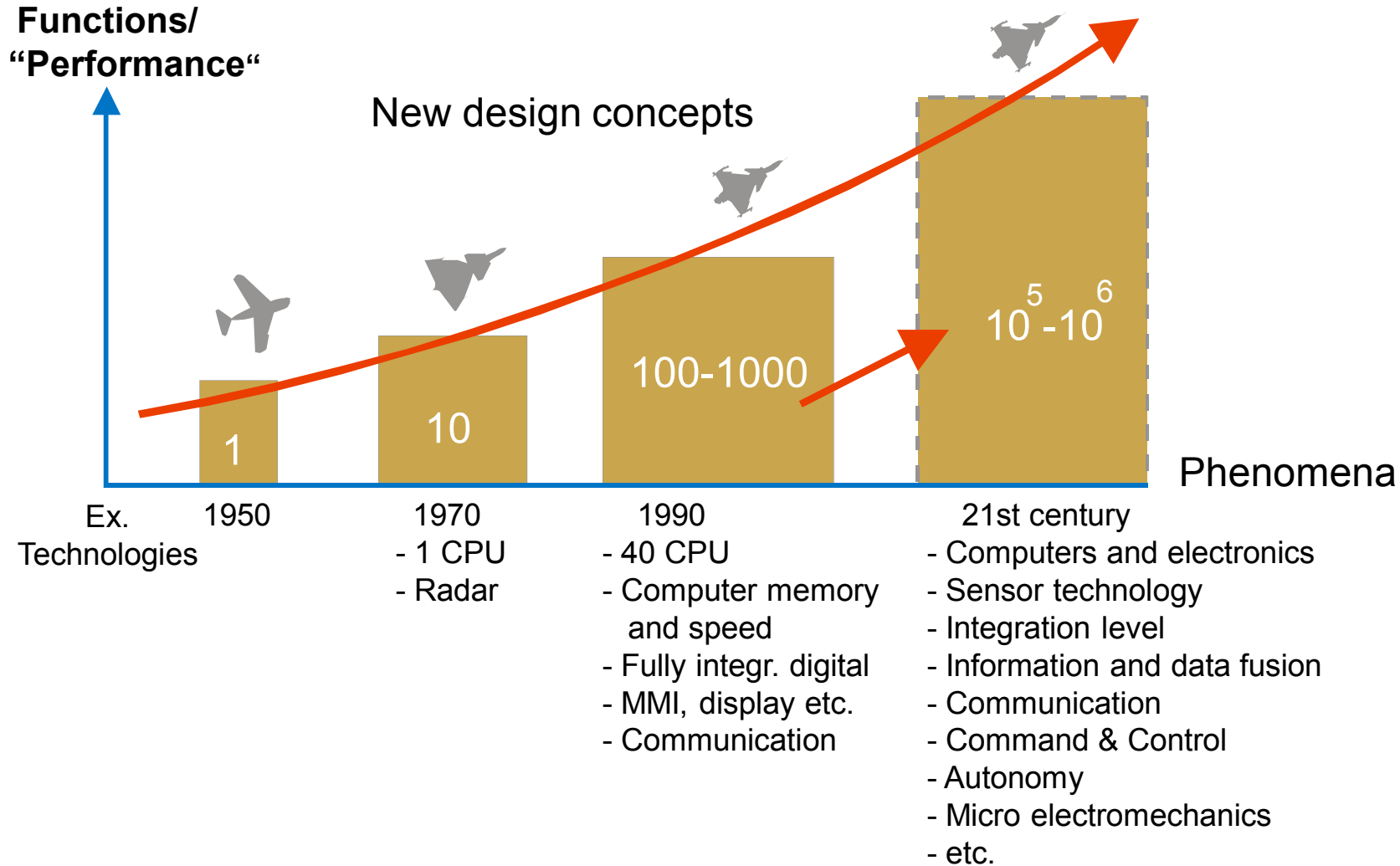
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Technologies - Performance and growth Mechanics and Material



Slide originates from mid 80ies

Technologies - Performance and growth Systems and information technologies



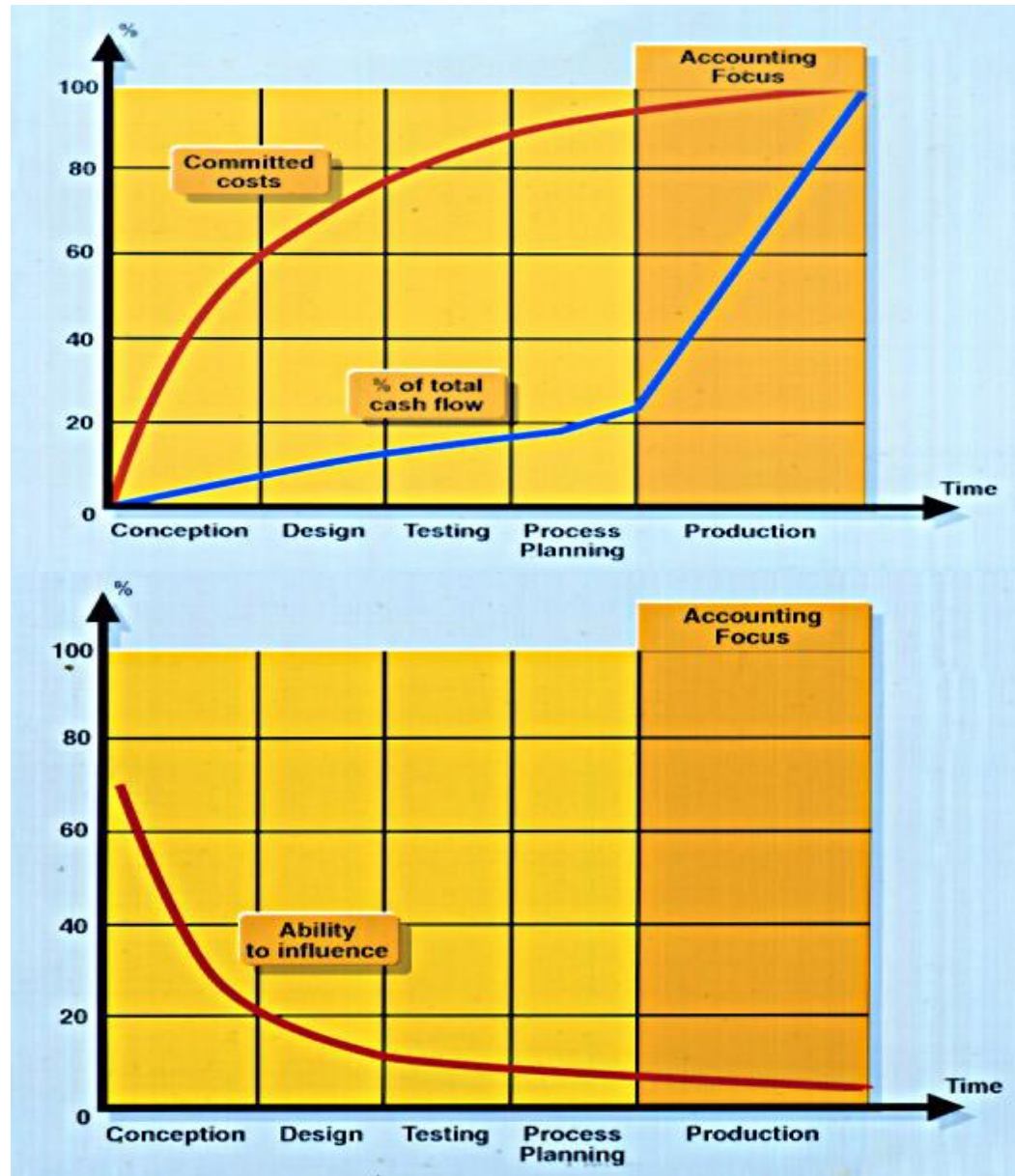
Slide originates from mid 80ies

- Large number of new technologies to integrate
- Increased system complexity



- Innovative environment
- Efficient architectural design and systems integration
- Management of supply chain
- New methods, tools and processes

Comitted costs and ability to influence



Slide originates from mid 80ies

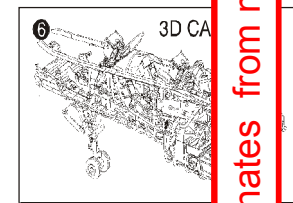
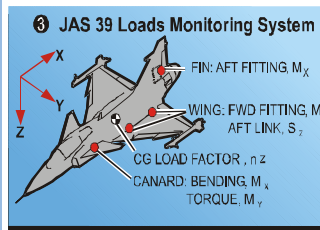
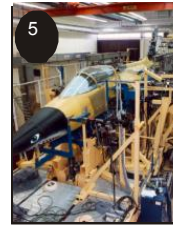
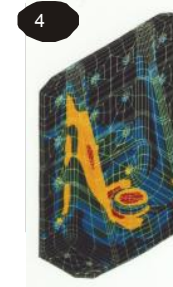
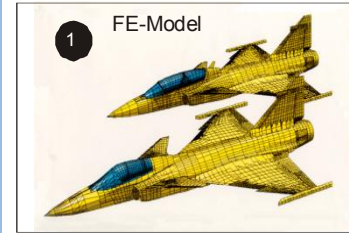
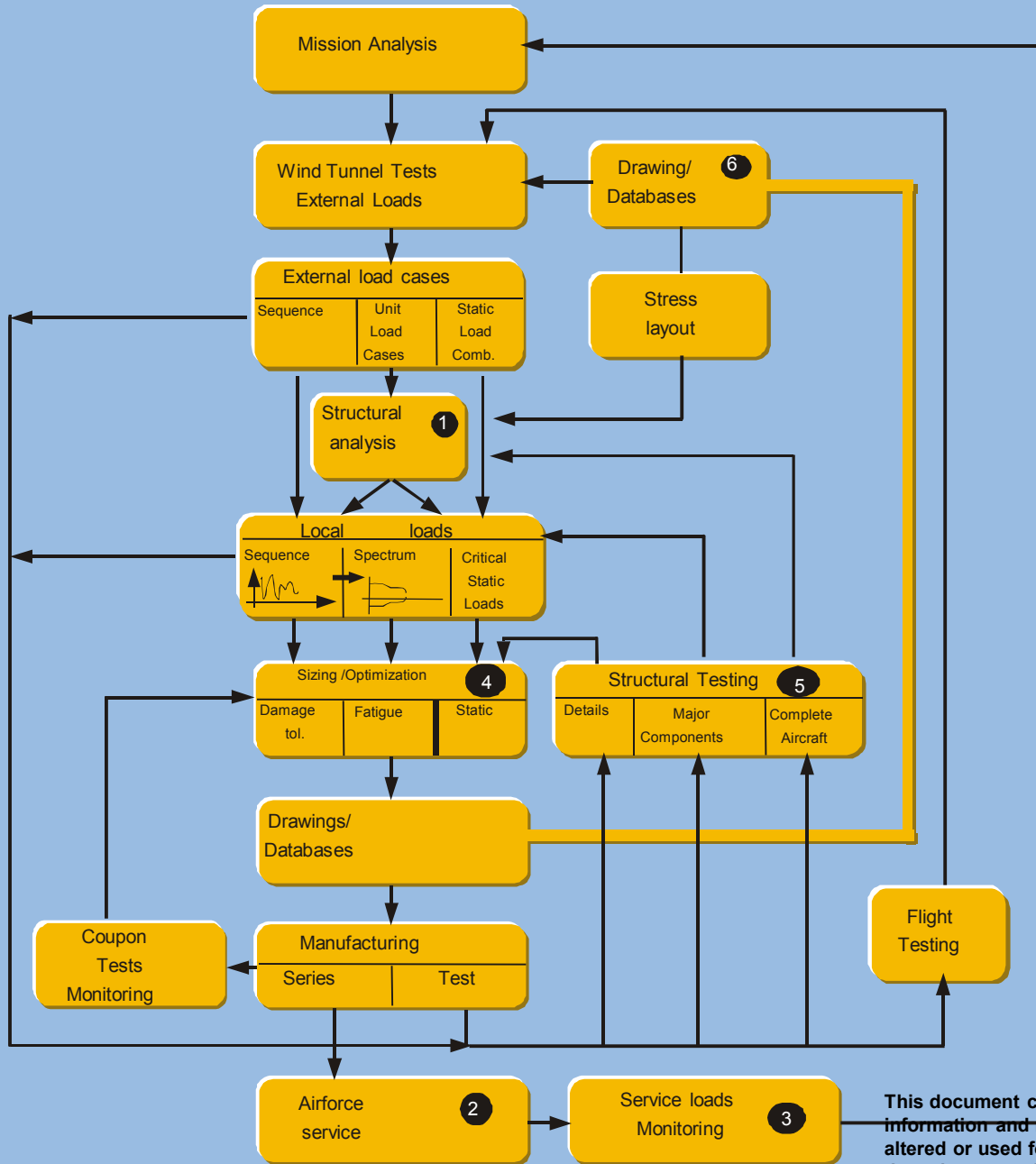
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Importance of early knowledge



Model Concept - Model Based Systems Engineering, MBSE

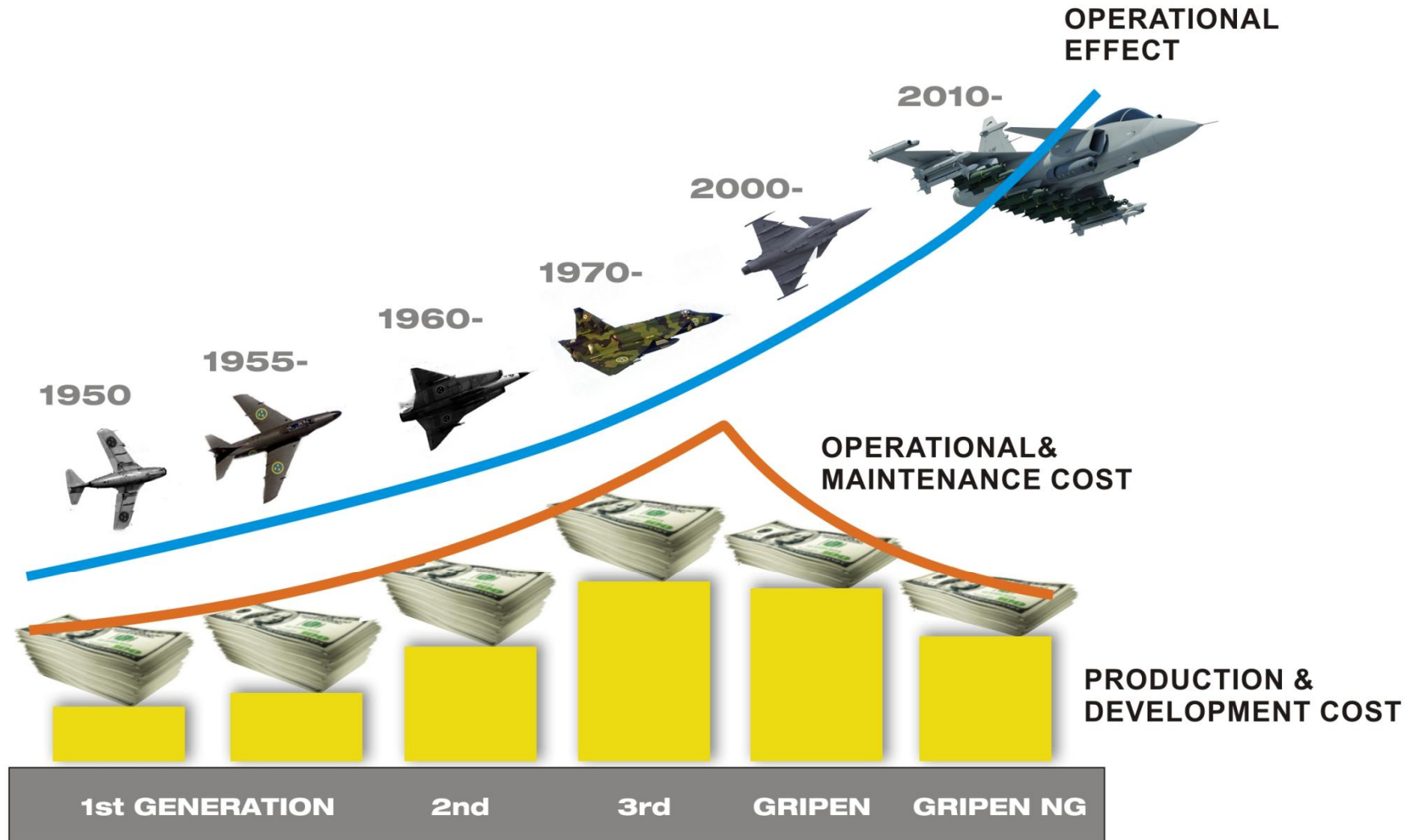
Model Concept: Stress Engineering



Slide originates from mid 80ies- Published in Military Aircraft 1995

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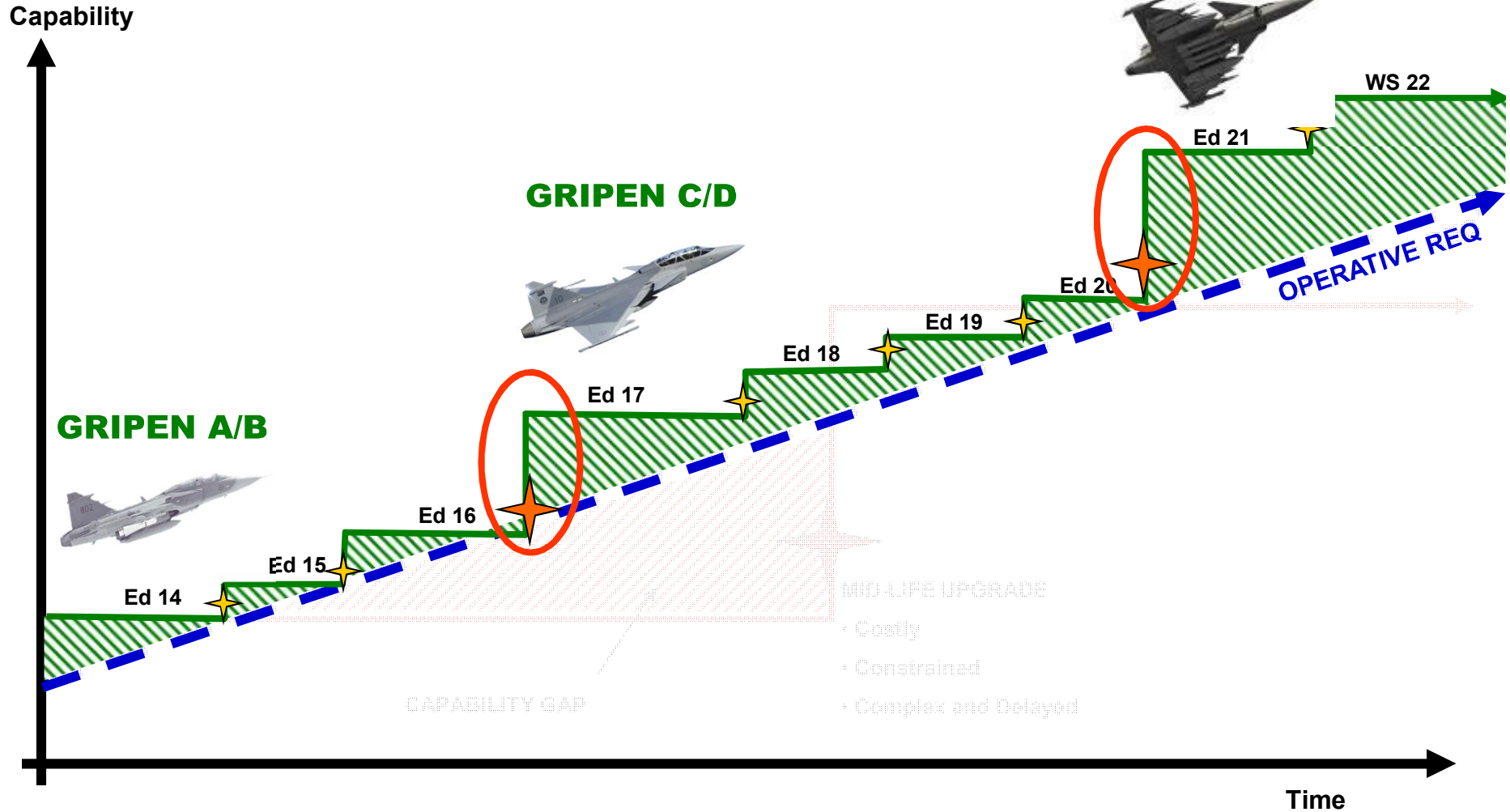
GRIPEN –Breaking the cost curve



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Spiral development VS. “MID-LIFE UPGRADES”



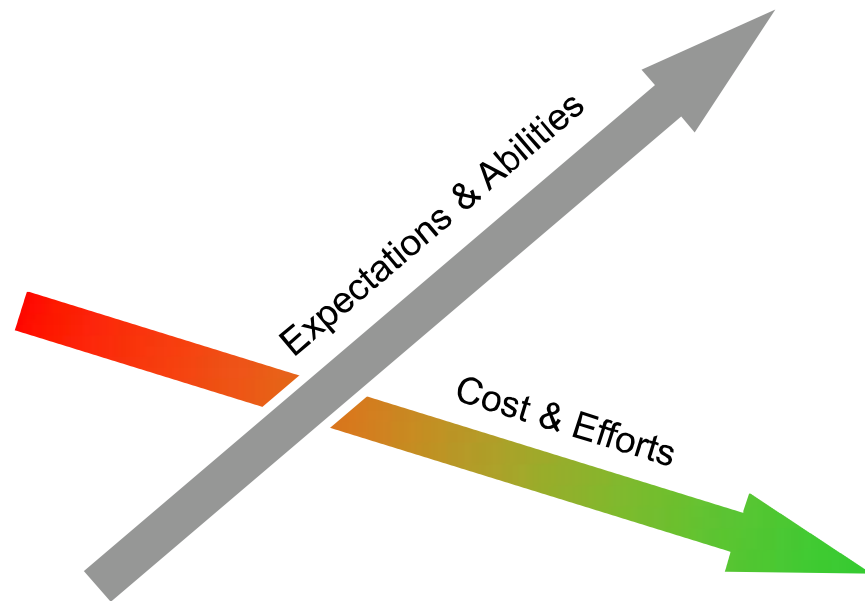
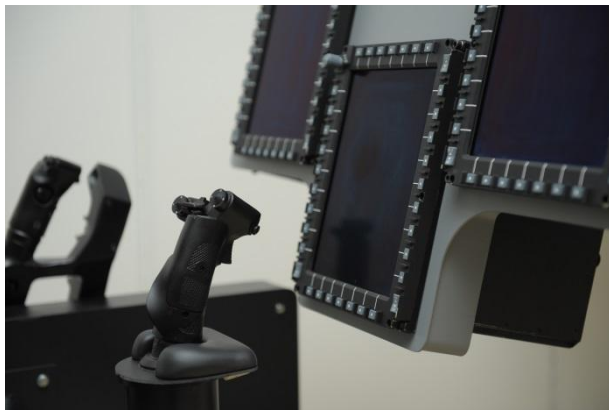
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New Avionic System Structure

Drivers

- Reduce total cost of ownership for customer
- Easily adapt to new operational requirements
- Respond to customers expectations on performance and functionality increase
- Substantially decrease development cycles
- Reduce cost to integrate systems and functions
- Reduce effort to upgrade equipment
- More efficient distributed development - facilitate for partner and customer to participate in development



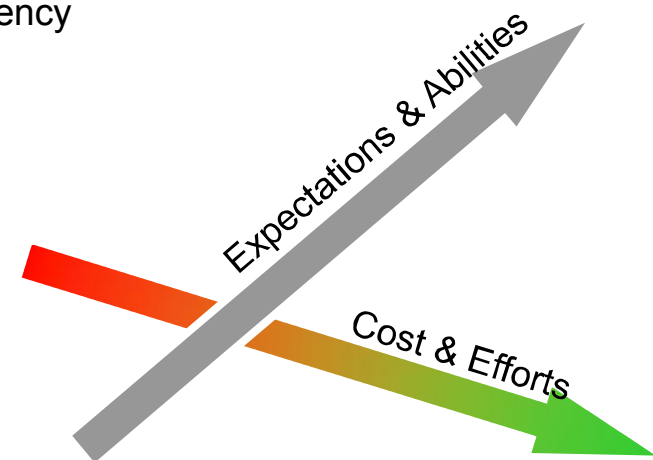
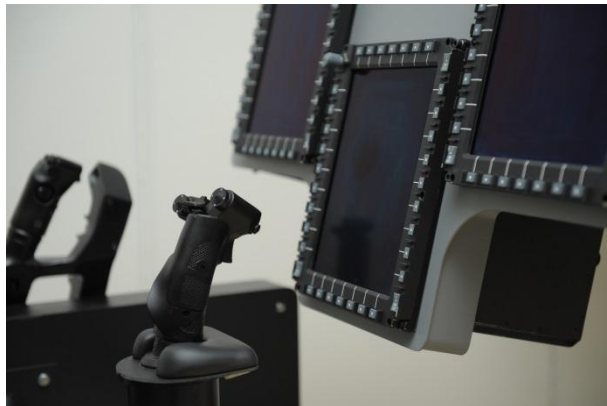
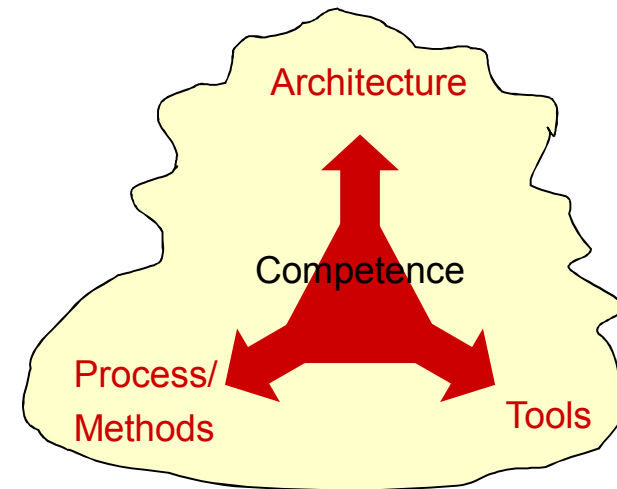
Affordability Scalability Portability Reuse Supportability Openness Growth potential Re-configurability Testability

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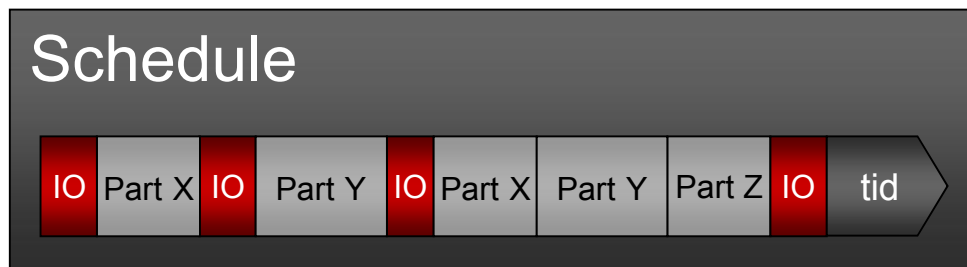
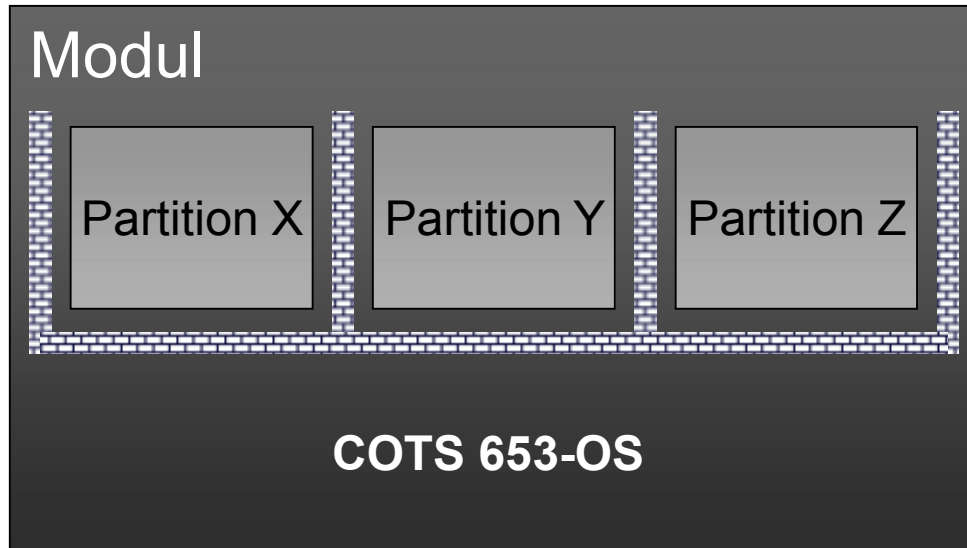
New Avionic System Structure Strategies

- Utilize technology leap:
 - Efficient architecture
 - Optimized methods and processes
 - Model Based Systems Engineering tools with auto coder
- Challenges -> new engineering values
 - Radical change in working
 - All disciplines are effected
 - Competence (general and specific domain)
- Gripen Demo indicates >> 50% increased development efficiency



Affordability Scalability Portability Reuse Supportability Openness Growth potential Re-configurability Testability

IMA – Integrated Modular Avionics



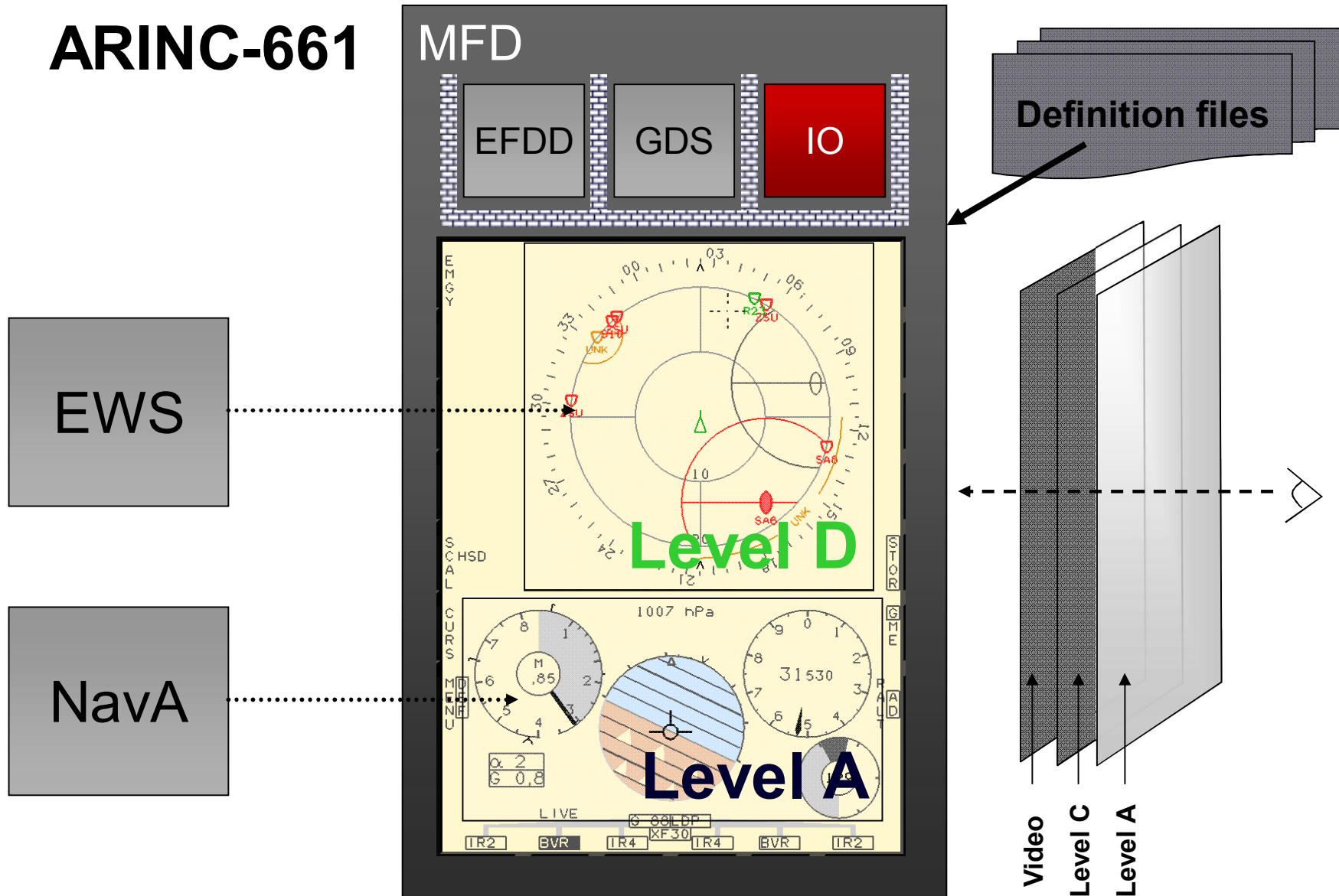
Advantages

- Execution errors isolated to single partition
- Modification only requires updated verification of involved partitions
- Criticality could vary between partitions
- Partitions can be outsourced

Disadvantage

- Communication between partitions always requires time Δt

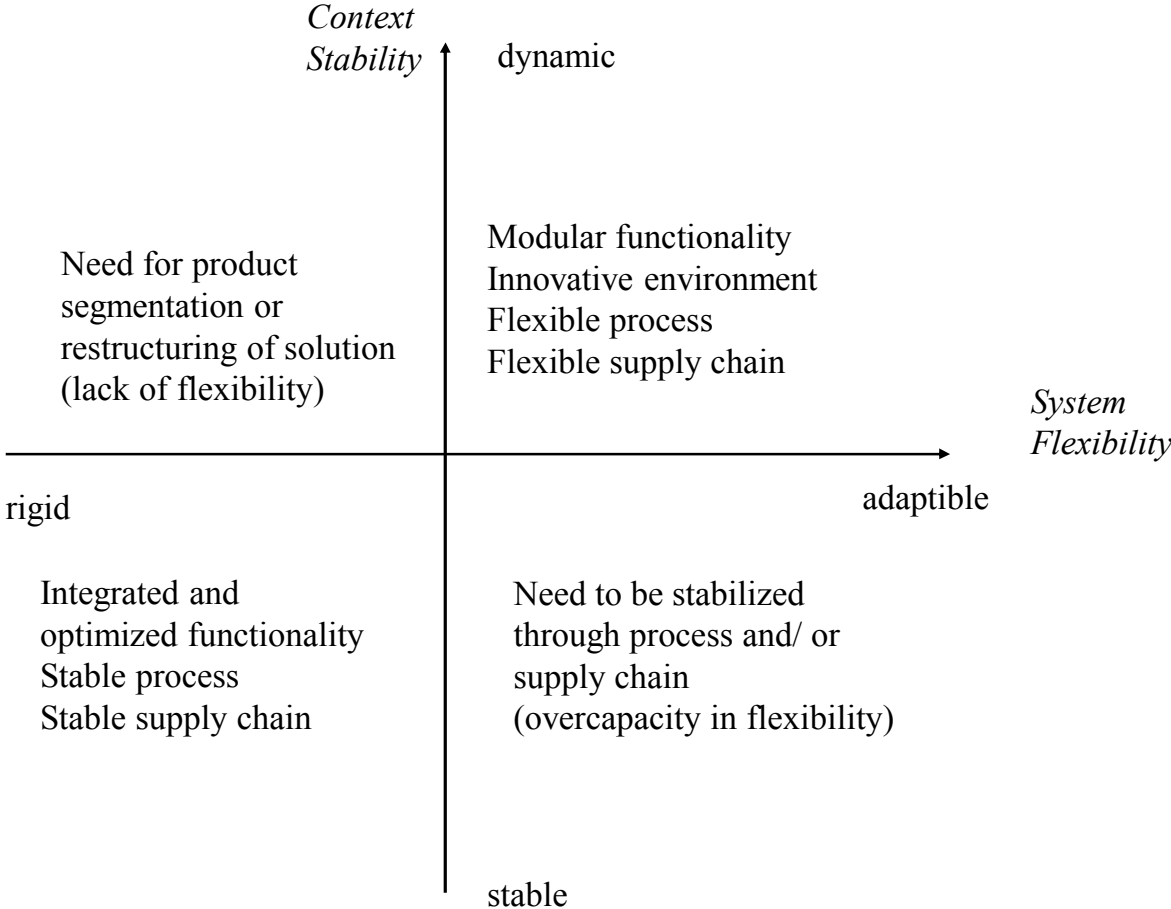
ARINC-661



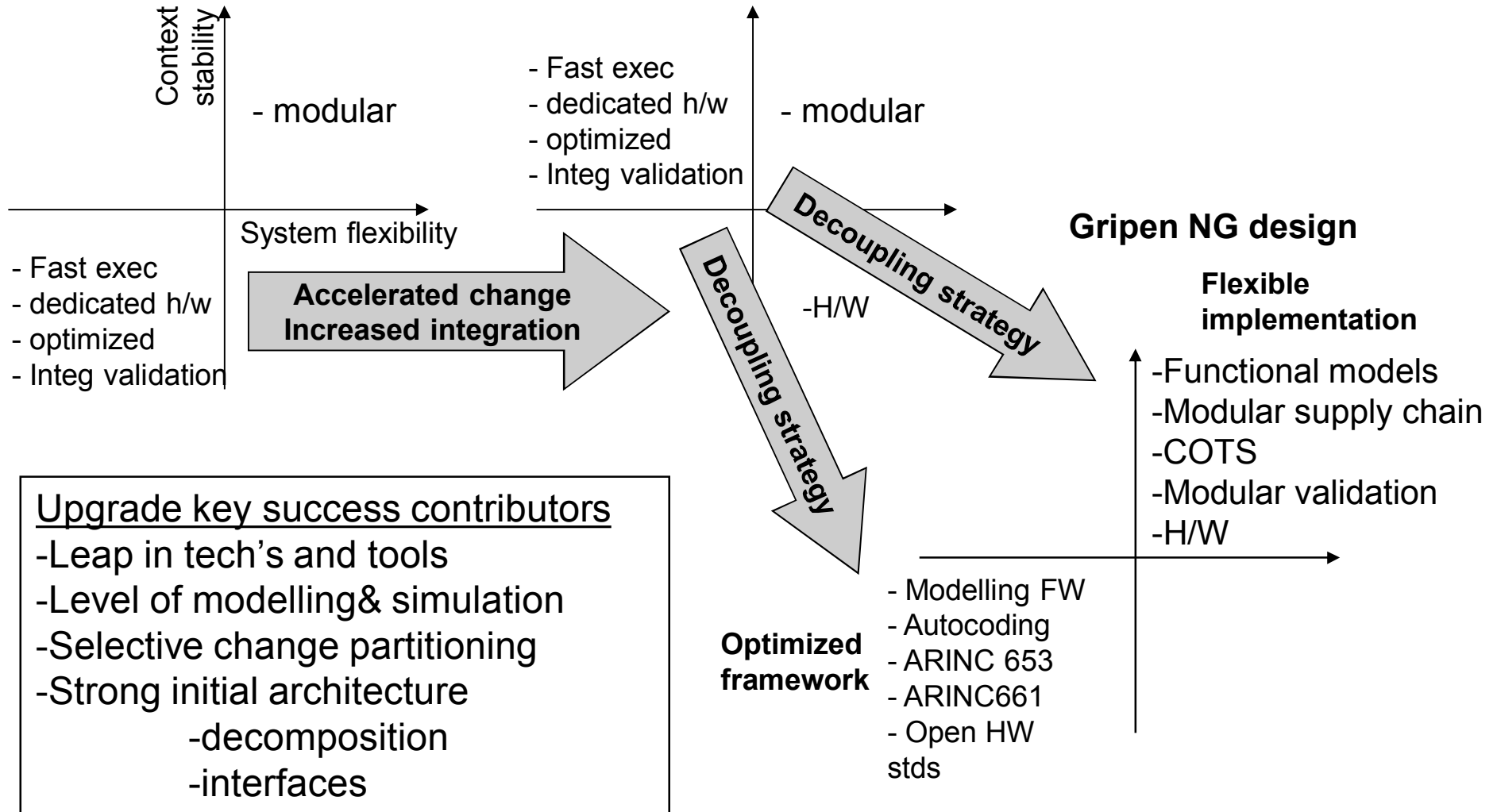
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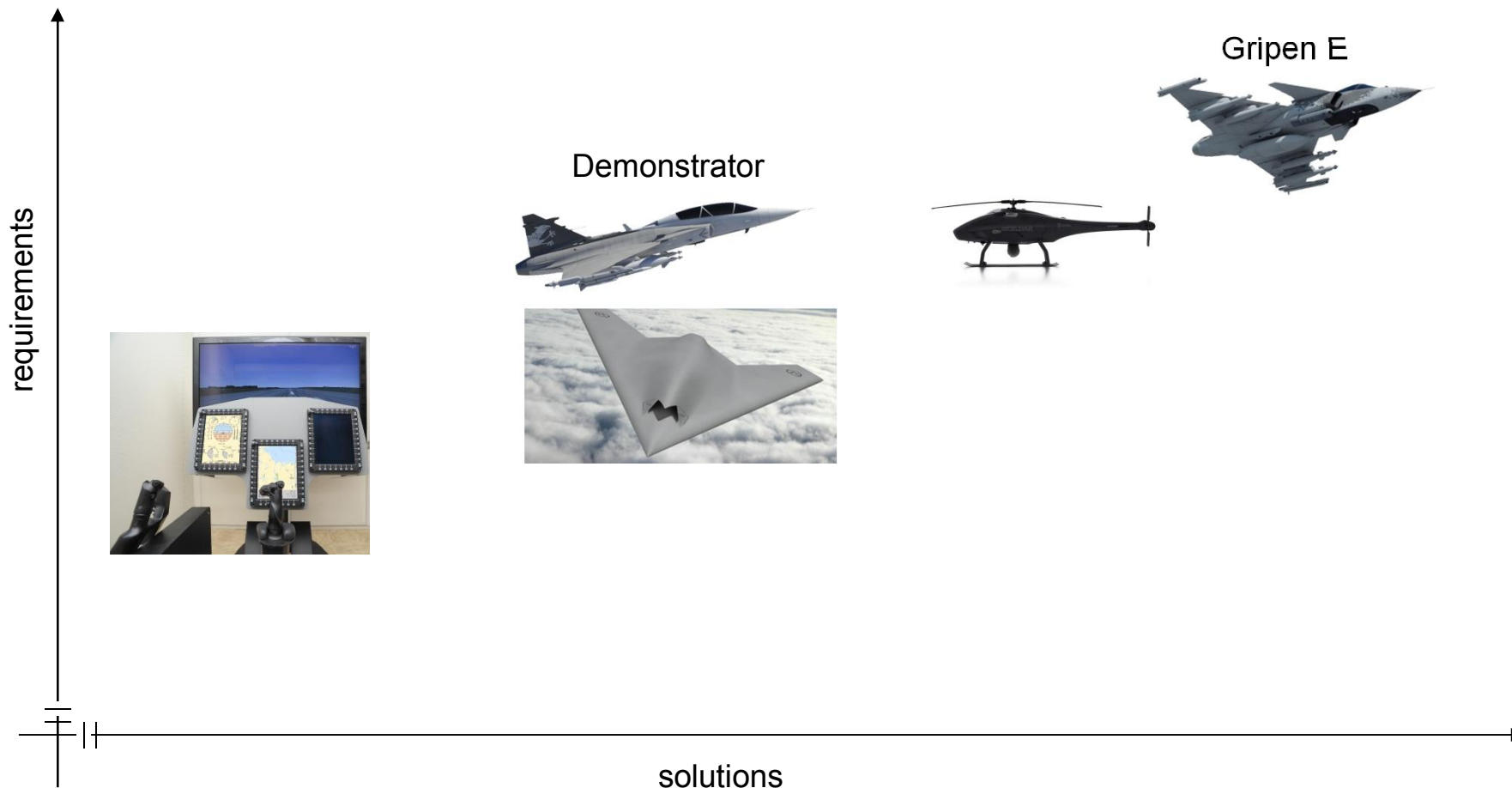
System characteristics: Flexibility vs. context stability



Gripen Avionics Step Change



Gripen Avionics Step Change -build up



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Conclusions

- Architectures and Integration are key for Capability, Flexibility and Affordability throughout the life cycle
 - Decomposed in flexible domains and optimized domains
 - Able to meet new operational requirements affordably
 - Able to benefit from upgraded technologies and technology shifts
 - Handles product, process and supply chain in a coordinated way

- Model Based Systems Engineering allows to utilize the potential
 - Early Knowledge and storage of knowledge throughout life cycle
 - Shared understanding of requirements and solutions
 - Needed for competitive lead times and quality
 - Increased confidence and reduced testing