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A State-of-Practice Survey of the Automotive and Space Industry Product Development Strategies

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Introduction

- The goal of product development is to learn from an experience and generate value that can be utilized for further development of products to potentially gain competitive advantage
- As the world evolves into a global marketplace, companies must adapt their product development practices to achieve shorter cycle times
- The space industry is in a state of evolutionary change, with the cost to access space declining, new opportunities for mission execution are feasible
- Are there lessons to be learned from other industries that have transitioned through evolutionary changes?

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Product Design Method – Systems Engineering

- The goal of utilizing Systems Engineering is creating a whole, greater than the sum of the parts
- The three stages of Systems Engineering are Concept Development, Engineering Development and Post Development

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Product Architecture

- Product Architecture is critical when creating products as it classifies the system under development
- Integral and Modular types map the extremes of spectrum of architectures
- Common uses of integral architectures: racecars and satellites
- Common uses of modular architectures: automotive systems and electronic systems

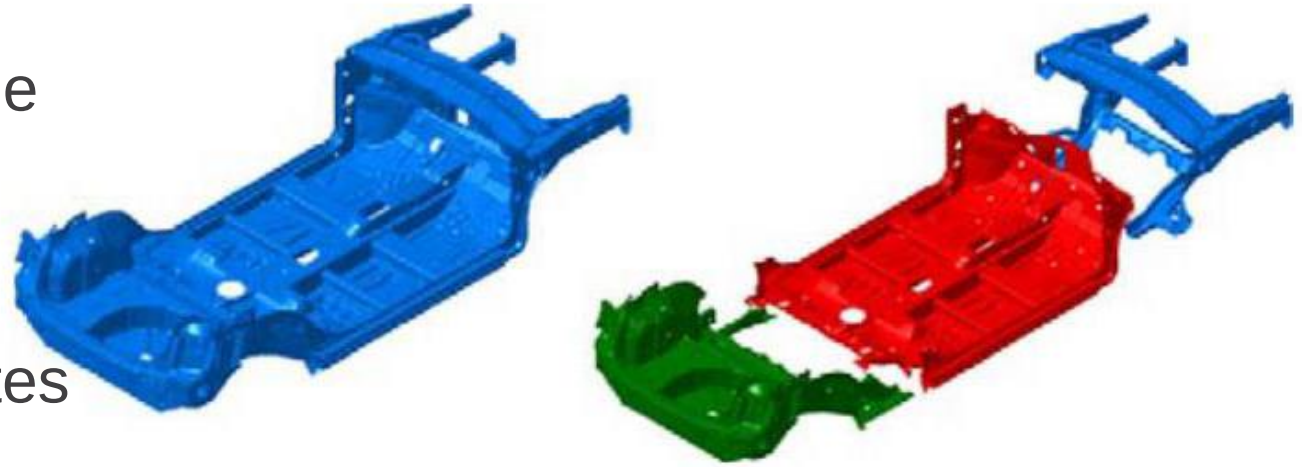

Figure 1. Integral under-body (left) and modular under-body (right) structures. (Paralikas et al., 2011)

Product Architecture – Integral

- A non-one-to-one mapping of function to system support
- Pro: Achievement of the highest performance system capable
- Con: Major subsystem requirement changes can cause significant redesign

Product Architecture - Modular

- A one-to-one mapping of function to system support
- Pro: A larger variation of products can be created to meet an array of needs
- Con: Significant investment in R&D is needed to identify, engineer and produce the variants

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Product Management

- The management of the product development process is just as critical as the product being produced
- The process with which the product is developed creates opportunities to obtain different product results

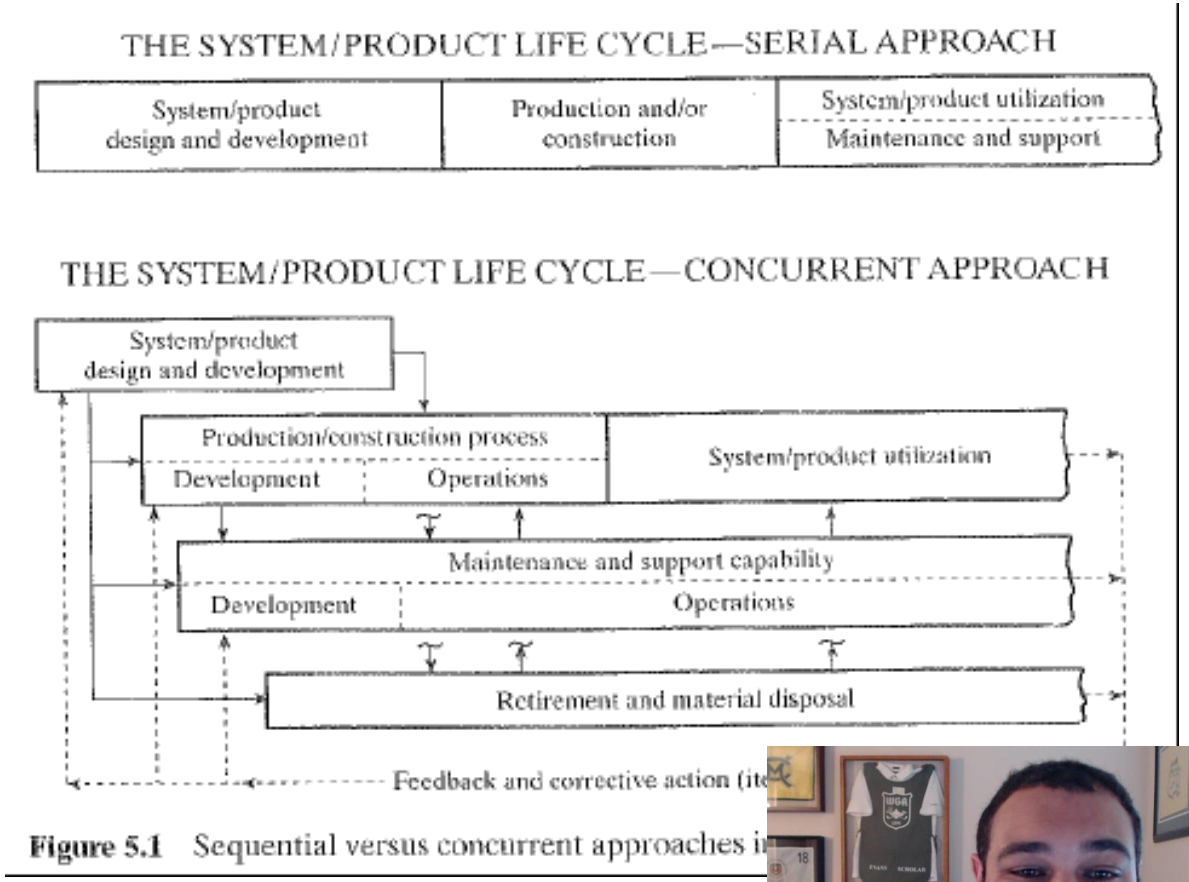

Figure 2. Serial versus Concurrent Engineering approach (F

Product Management – Stage-Gate

- Stage-Gate is a process that follows a linear flow from ideation though launch of the product under development
- The gates are a process that a team must undergo to move from stage to stage
- Success at each gate and stage allows a product to be released into the market

Product Management – Concurrent Engineering

- Concurrent Engineering was established to counteract the creation of silo teams
- Multi-disciplinary teams were given the autonomy to plan and manage conflict, while effecting change for the projec

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Consumer Automotive Methods

- Consumer Automotive Methods feed from a Concurrent Engineering Management focus and a Modular Architecture focus
- These focus areas allow for the product under development to have many variants as to meet the performance needs of a large and diverse customer base
- Concurrent Engineering and Modular Architecture focus enable the development of high mix – high volume products that can be redeployed to temper NRE costs

Small Satellite Methods

- Small Satellite Methods feed from a Stage-Gate Management focus and an Integral Architecture focus
- The focus areas allow the product under development to be tailored for extreme performance for a sole customer
- The Stage-Gate and Integral Architecture focus enables the development of high mix – low volume products that cannot be met by systems on the open market

Comparison

	Consumer Automotive Market	Small Satellite Market
Product Design Method	Systems Engineering	Systems Engineering
Product Management Method	Concurrent Engineering	Stage-Gate
Product Architecture Method	Modular Architecture	Integrated Architecture

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Conclusions

- As the development of the space industry continues to thrive and evolve, more opportunities will become possible
- For the small satellite market to take advantage of the future opportunities, new product development methods must be introduced
- With the changes observed in the consumer automotive industry, the small satellite industry can benefit from the implementation of some methods

Future Research

- Further review of other markets that compare well with the small satellite market
- Further review of product development methods other than those identified in this work
- New work to devise a method to compare the flexibility of product architectures

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