

# Motor Vehicle Product Development and Lead Time

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# Building the Way Forward

1. Identify key barriers - Address and remove issues that are precluding/impeding progress
  - Technology Barriers – e.g., design/interface standards/lower floors may interfere with EV battery placement
  - Regulatory Barriers – CAFE – can we turn a barrier into an incentive? CAFE credits for accessible vehicles?
  - Social Barriers – consumer readiness/acceptance – realistic expectations
  - Economic Barriers – Work within realities of vehicle development and manufacturing
  - Coordination/management obstacles – Can't deliver all at once.
2. Develop coalitions that are pulling in the same direction.
3. Work to develop effective interface standards that can be used by vehicle and wheelchair manufacturers
4. Develop market/purchasing power of market – GSA style/Pooled purchasing
5. Leverage incremental steps – Lock in gains as they can be achieved – crawl, walk, run – focus on highest bang for buck first – but don't forget those not addressed initially
6. Build on success

# Advance Vehicle & Production Vehicle Development Process

## Motor Vehicle Product Development and Lead Time

- Model/Platform Distinctions
- Advance Vehicle and Production Vehicle Development Process & Timeline
- Product Lifecycles

## When Design Can Best Be Influenced

## Guidelines and Standards

## Model/Platform Distinctions

- “Platform” means the basic structure of a vehicle.
- A “platform” typically includes the suspension, steering components, driveline (engine and related power transmission components), pan stamping (floor pan and fire wall), and fuel tank.
- Each body built on a “platform” is marque-specific and is often referred to as the “hat.”
- As OEMs increase the flexibility of their manufacturing processes, some platforms are now able to support sedan, CUV, and minivan variants.

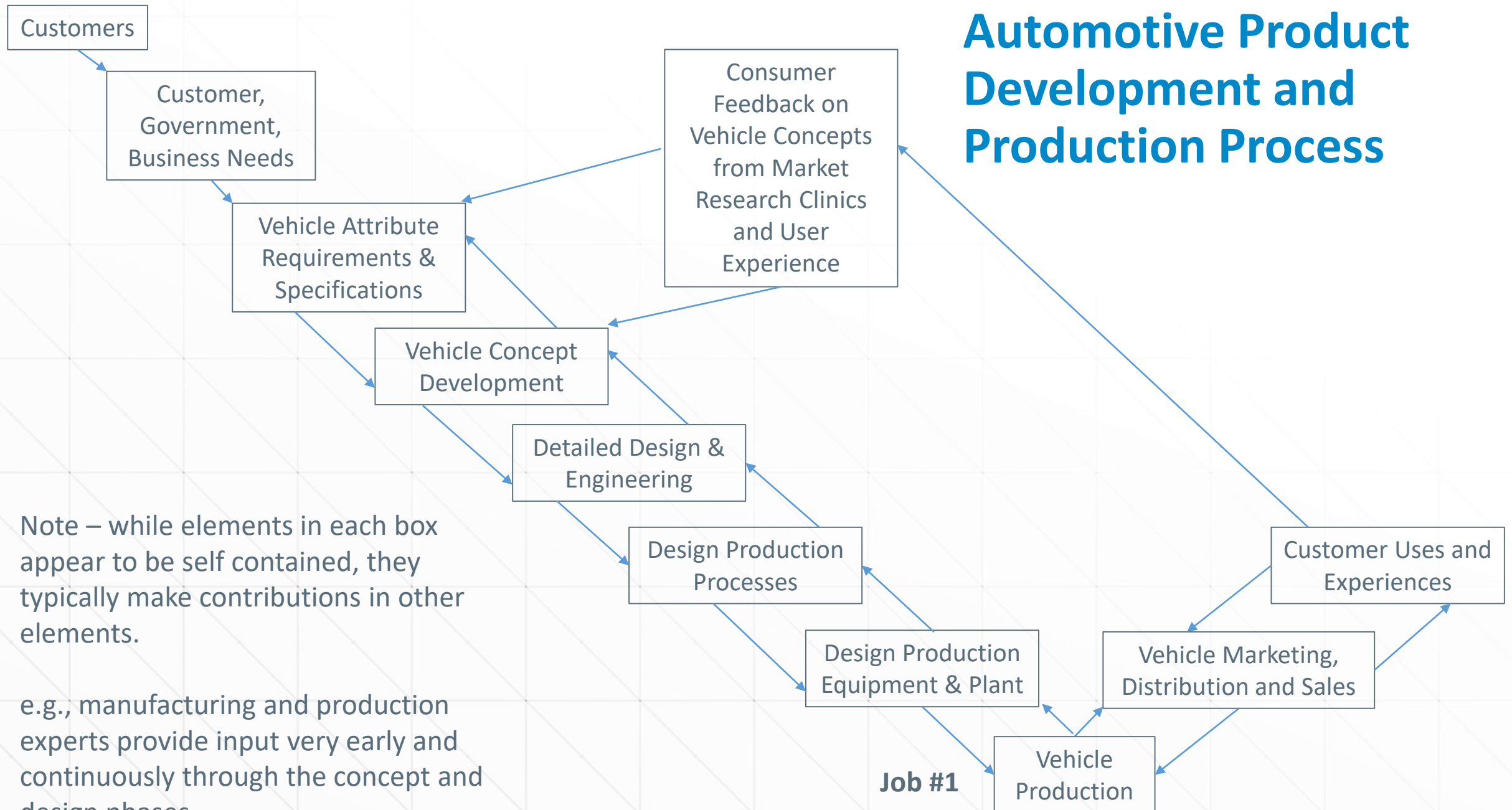
## Model/Platform Distinctions

- “Model” means a name that a manufacturer applies to a family of vehicles within a make which have a degree of commonality in construction, such as body, chassis or cab type.
- Within a model designation there can be a number of trim levels offered.
- In the United States market, ~ 300 different vehicle models are produced from 75 different platforms.

# Complex Product – Many Competing Requirements, Design, Validation Functions

- The Automotive Product is Technically Complex and Requires all Systems to Work Together to Achieve Desired Marketability and Performance.
- Key Requirements are:
  - Consumer Market Driven Requirements
  - Regulatory Requirements (# FMVSS, # Emissions, plus others)
- Constraints
  - Technology development
  - Cost
  - Fabrication/manufacturing
- Many Requirements/Design Goals Conflict
- Addition of ADS Technology Adds Even Greater Complexity.

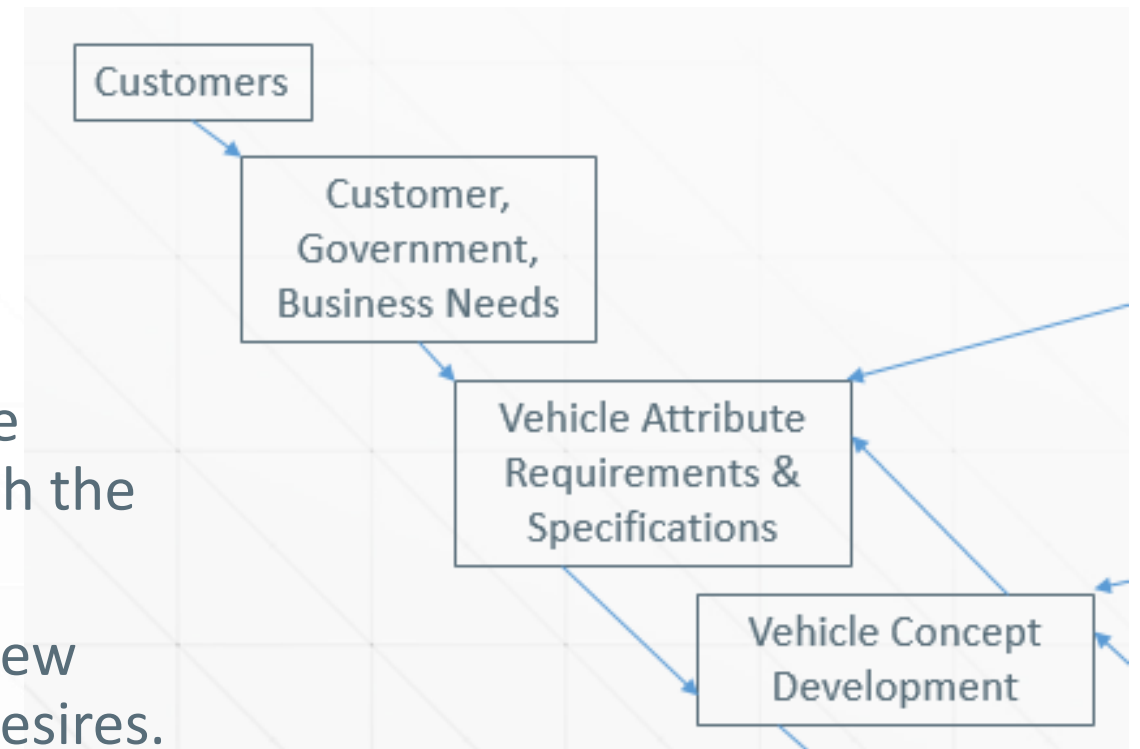
# Automotive Product Development and Production Process





# Customer Needs/Concept Development Stage

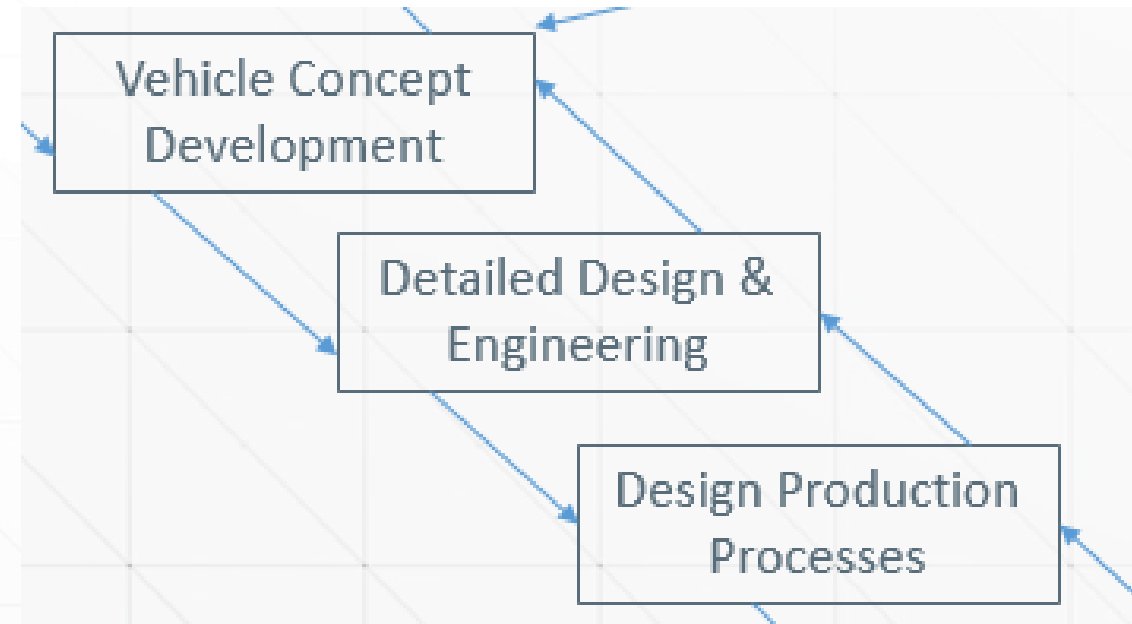
- Unlike the movie “Field of Dreams” vehicle manufacturers **DO NOT** build a vehicle with the hopes that “they will come”.
- A lot of work is expended to ensure that new models will fill real consumer needs and desires.
- Investment in new product is predicated on a strong market desire for the product - including profitability.
- Vehicle concepts are extensively focus group tested to ensure that the product will achieve market success once developed/deployed.



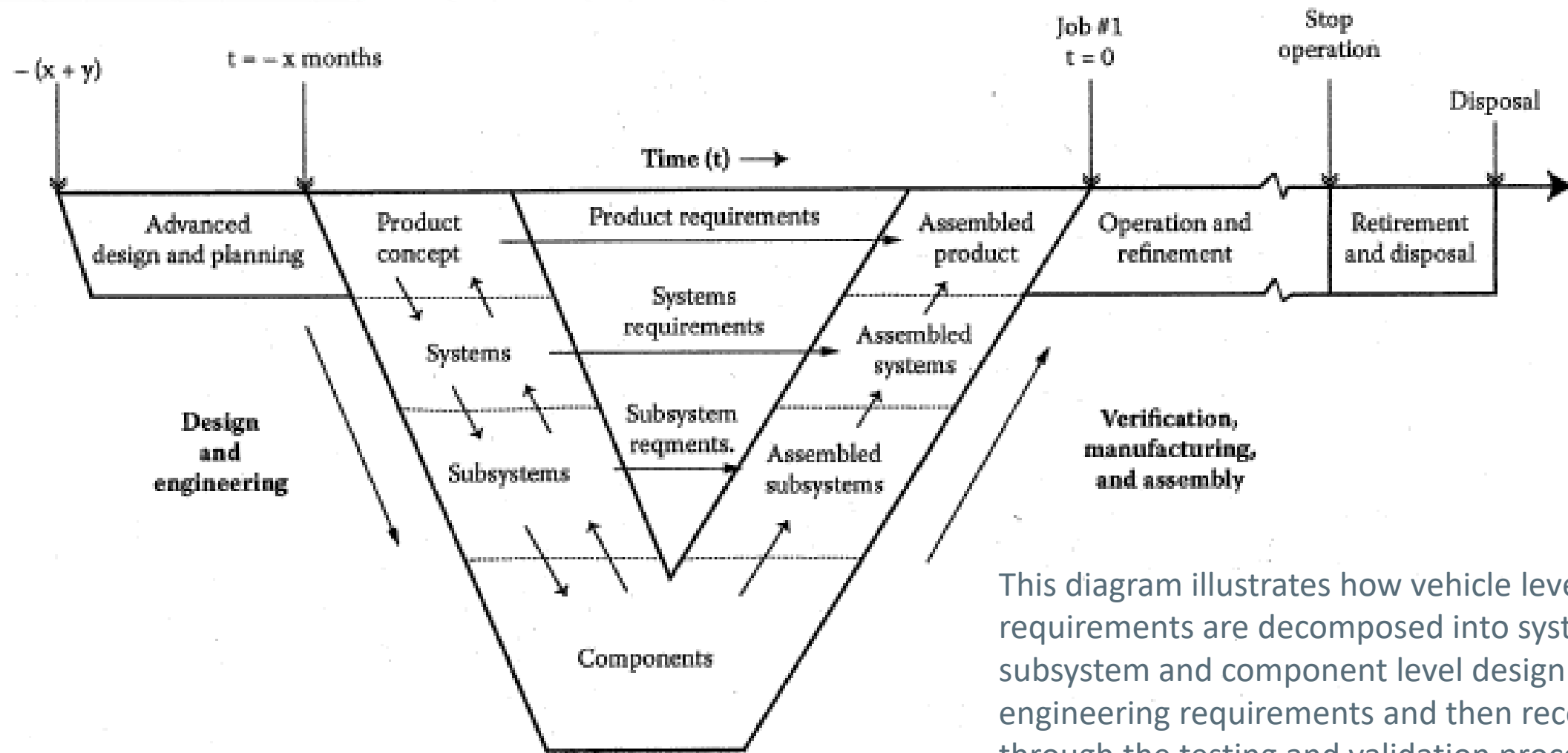


# Vehicle Design/Development (Concept to Pre-production)

- Detailed vehicle design/development ramps up in the concept development phase and continues to the pre-production phase.
- Process largely follows a classical systems engineering approach as detailed on the next slide.
- Notice that production process design also influences detailed engineering design



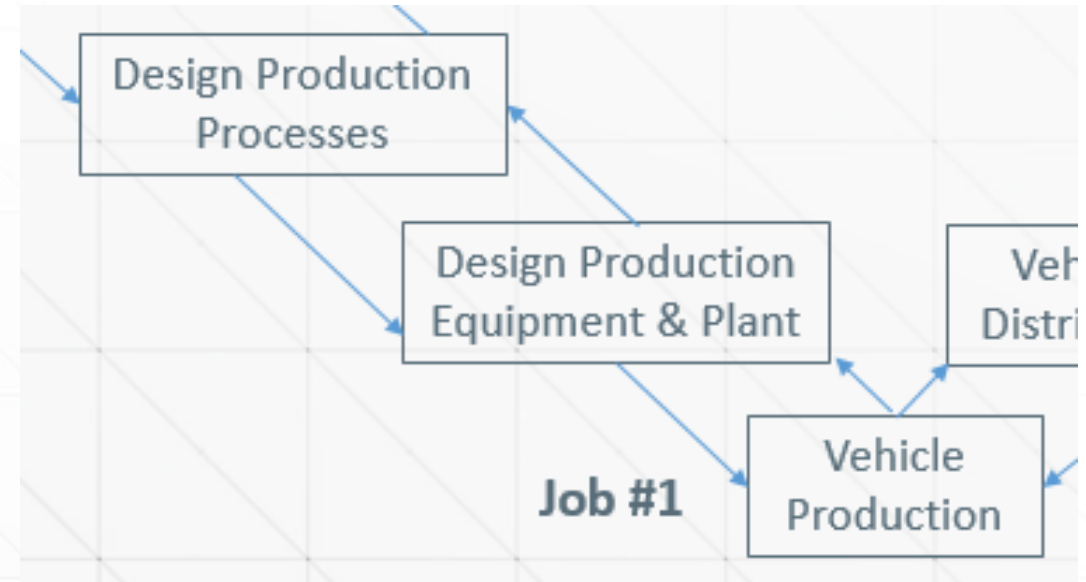
# Systems Engineering Approach



This diagram illustrates how vehicle level requirements are decomposed into system, subsystem and component level design and engineering requirements and then recomposed through the testing and validation process.

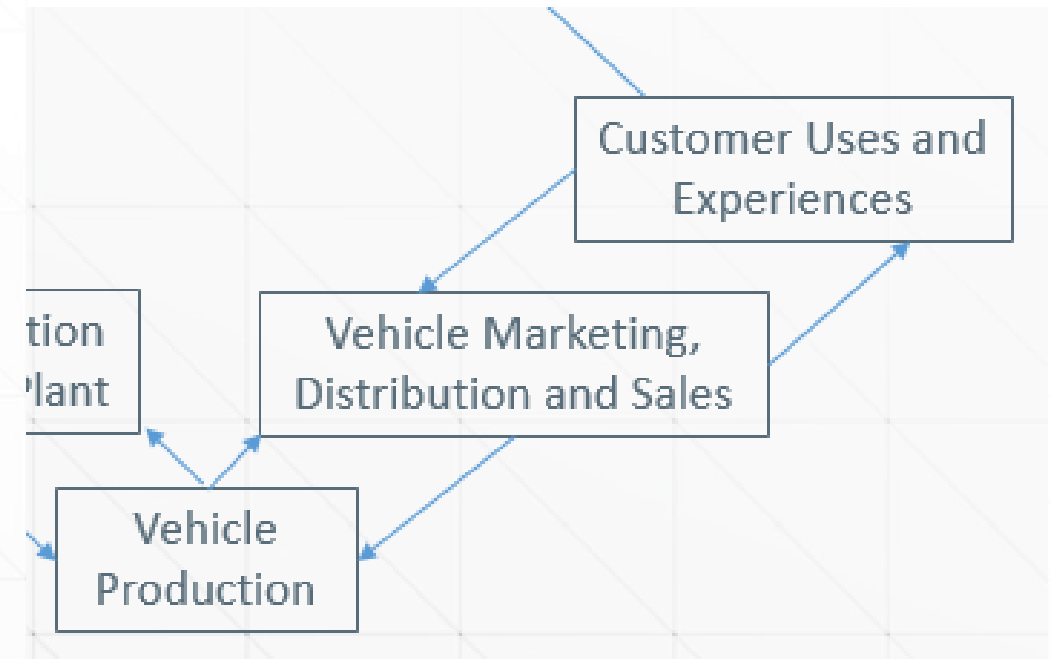
# Vehicle Production Process Development to Production (Job#1)

- Vehicle design development is essentially completed.
- Any changes to vehicle design that require significant changes in production processes and tooling (i.e., impacting body-in-white) would be very costly at this point.
- Design and deployment of production processes and plant tooling are completed and Job #1 vehicle production starts



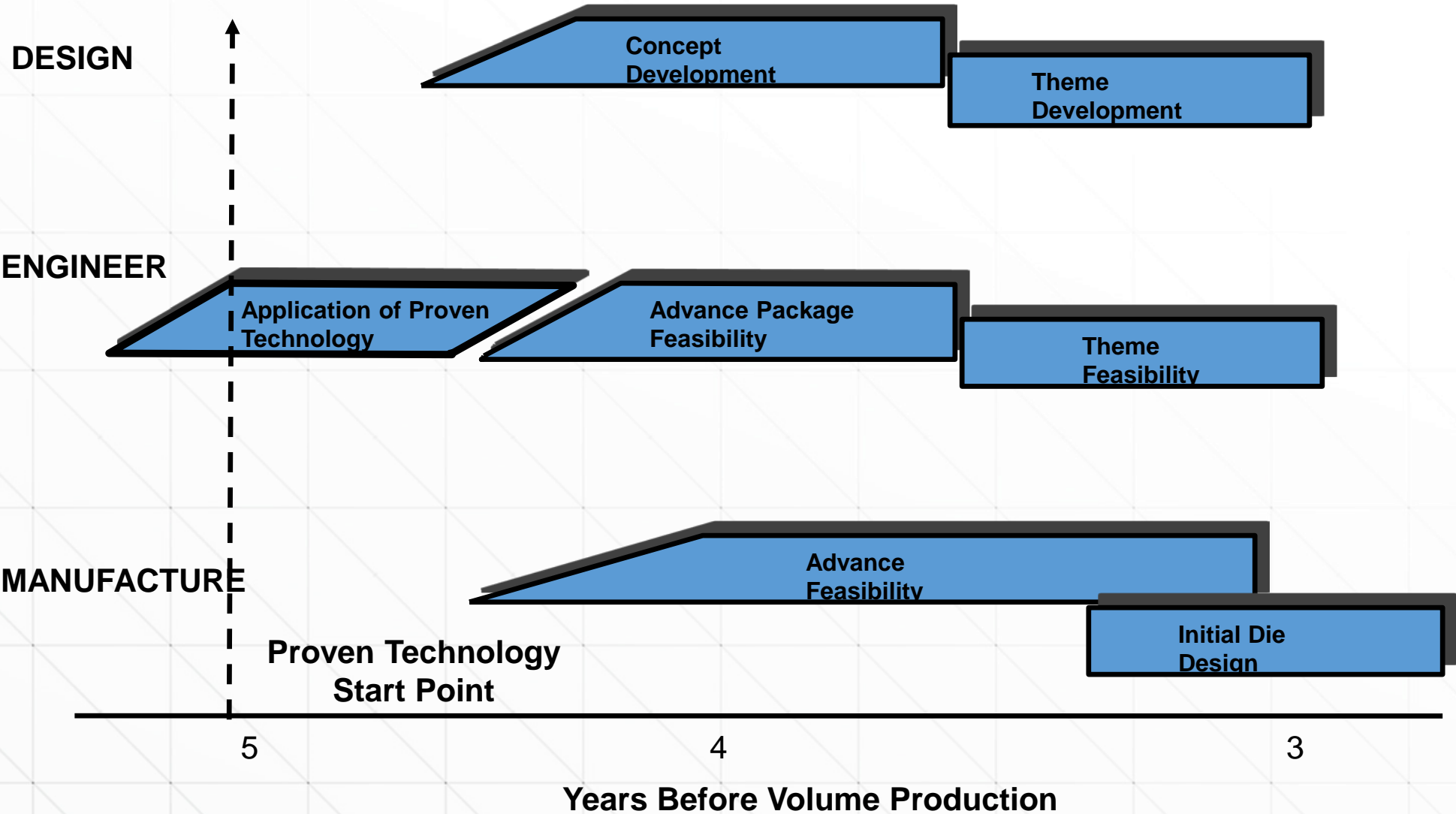
# Production Market Support/Customer Responses

- Vehicle production has started and active marketing, distribution, and sales efforts are underway
- Customer response and any field issues are recorded and feedback into the program for consideration on future products or design modifications to address any field issues.



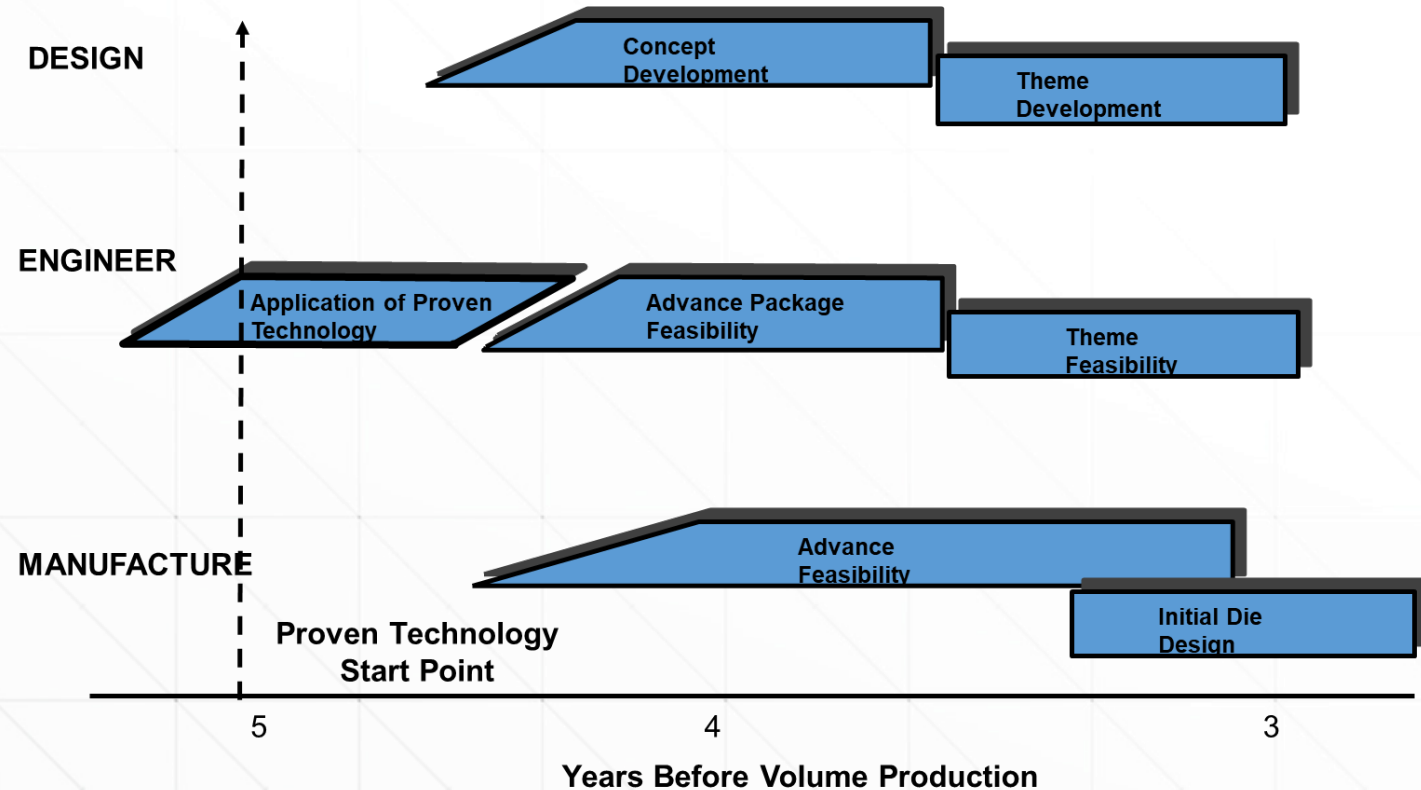
# Process Timeline

# Advance Development Phase Averages 2 Years for Proven Technology



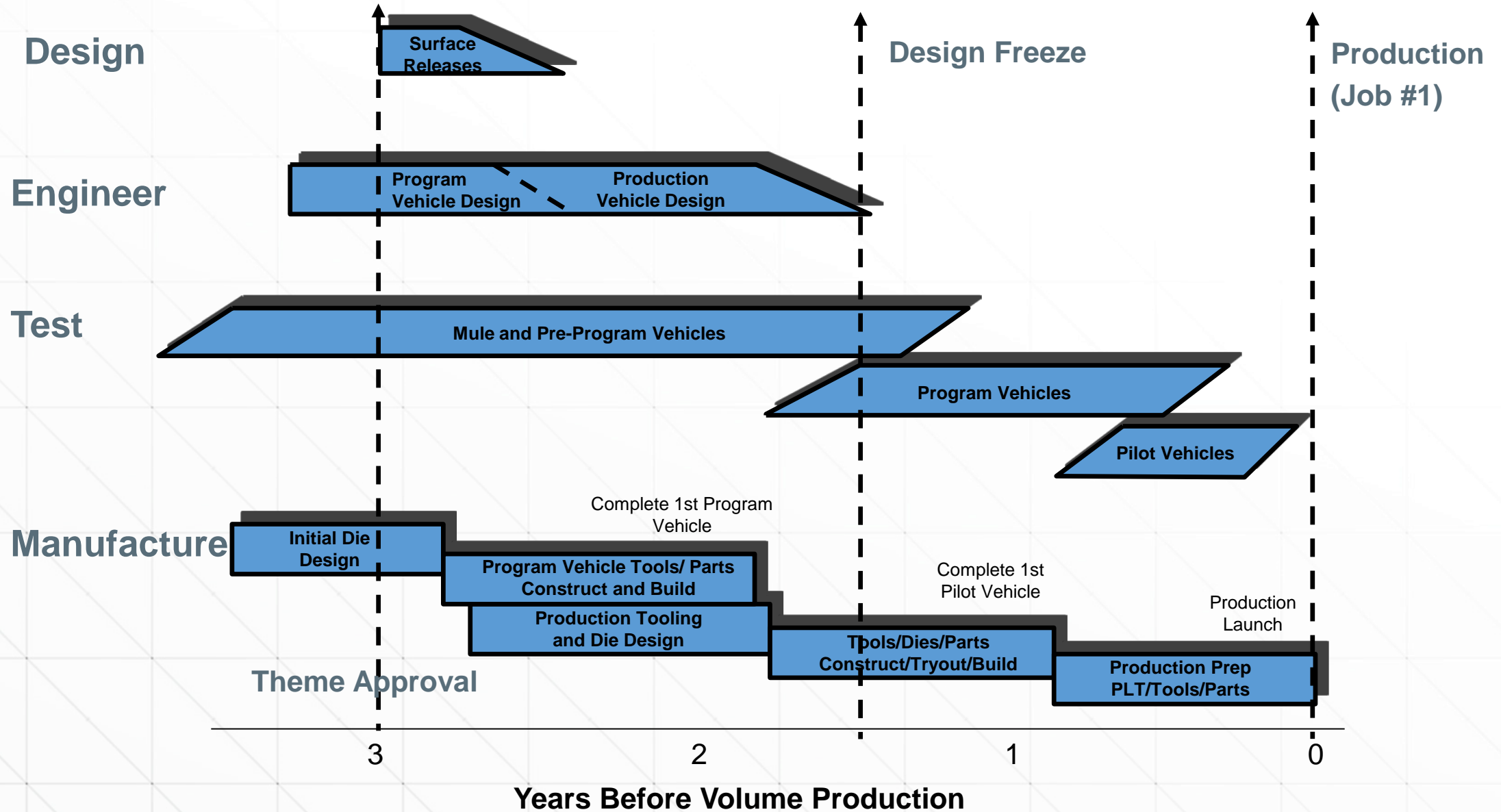
# Advance Vehicle Concept & Theme Development 60 to 36 months (5-3 yrs) before Production (Job#1)

- General vehicle concept
- Arena of innovation
- Define the sales region  
US / export
- Define the market  
segment





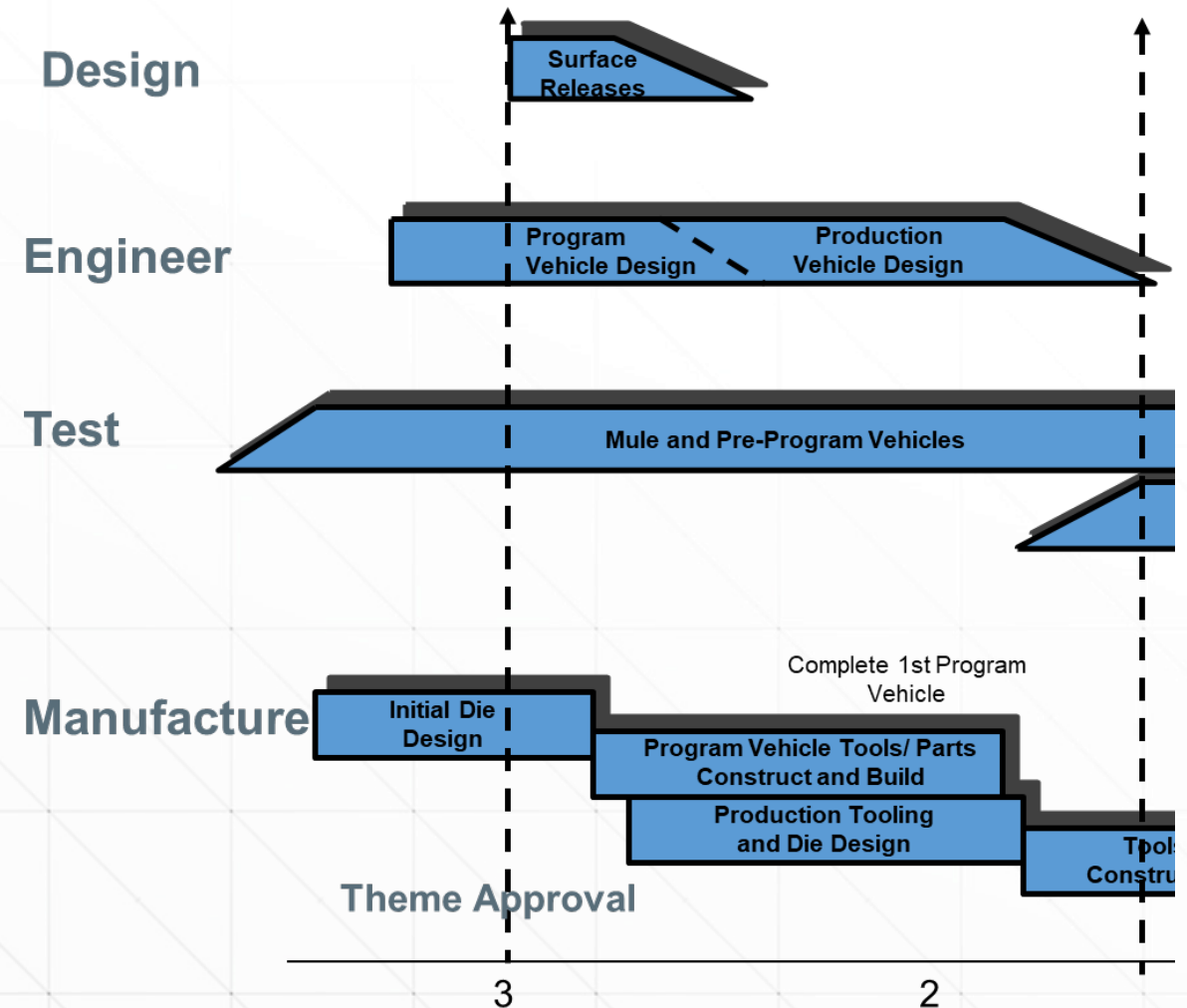
# Pre-Production Phase Averages 3 years



# Production Vehicle Development “Vehicle Ready Invention”

## 36 - 18 months (3-1.5 years) before Production (Job#1)

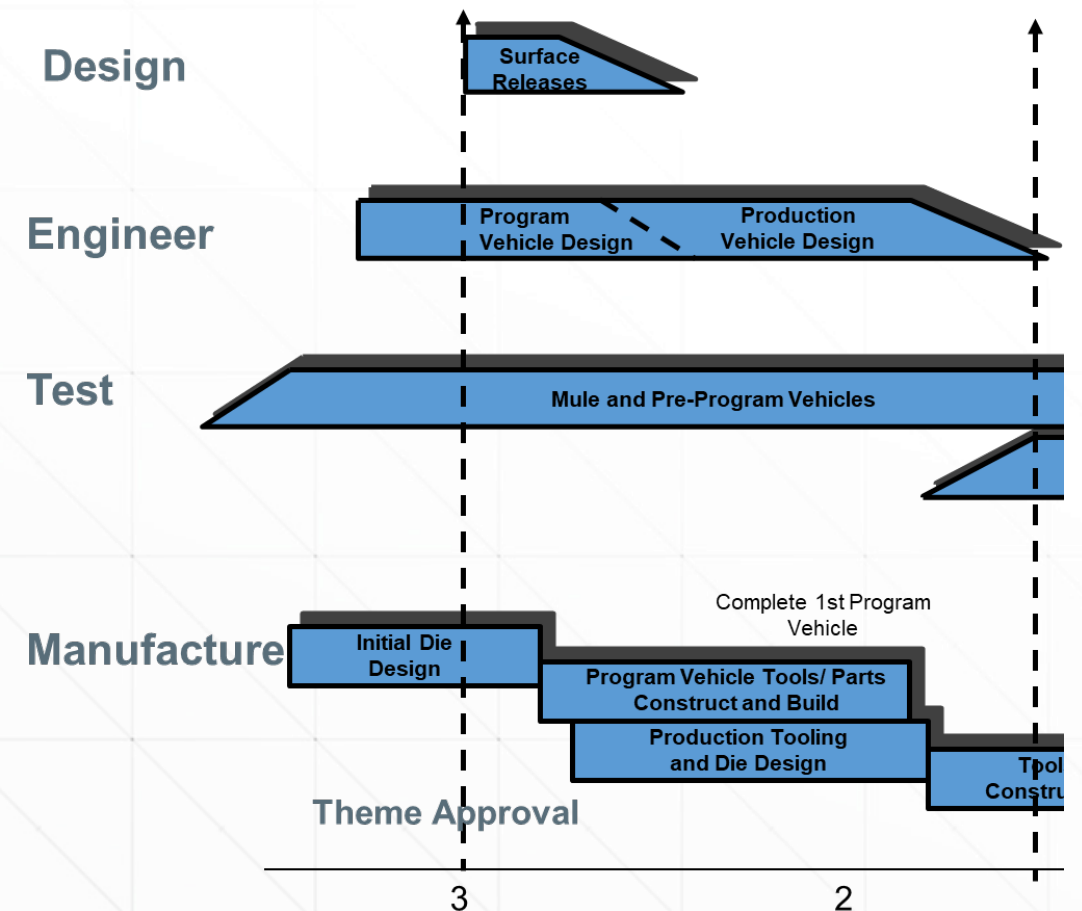
- On-going development work
- Technical confidence assured
- Environmental testing – temp., humidity, dirt and dust, coffee spills
- Testing of mule and preproduction vehicles
- Intensive development on manufacturing processes and tooling



# Production Vehicle Development “Vehicle Ready Invention”

## 36 - 18 months (3-1.5 yrs) before Production (Job#1)

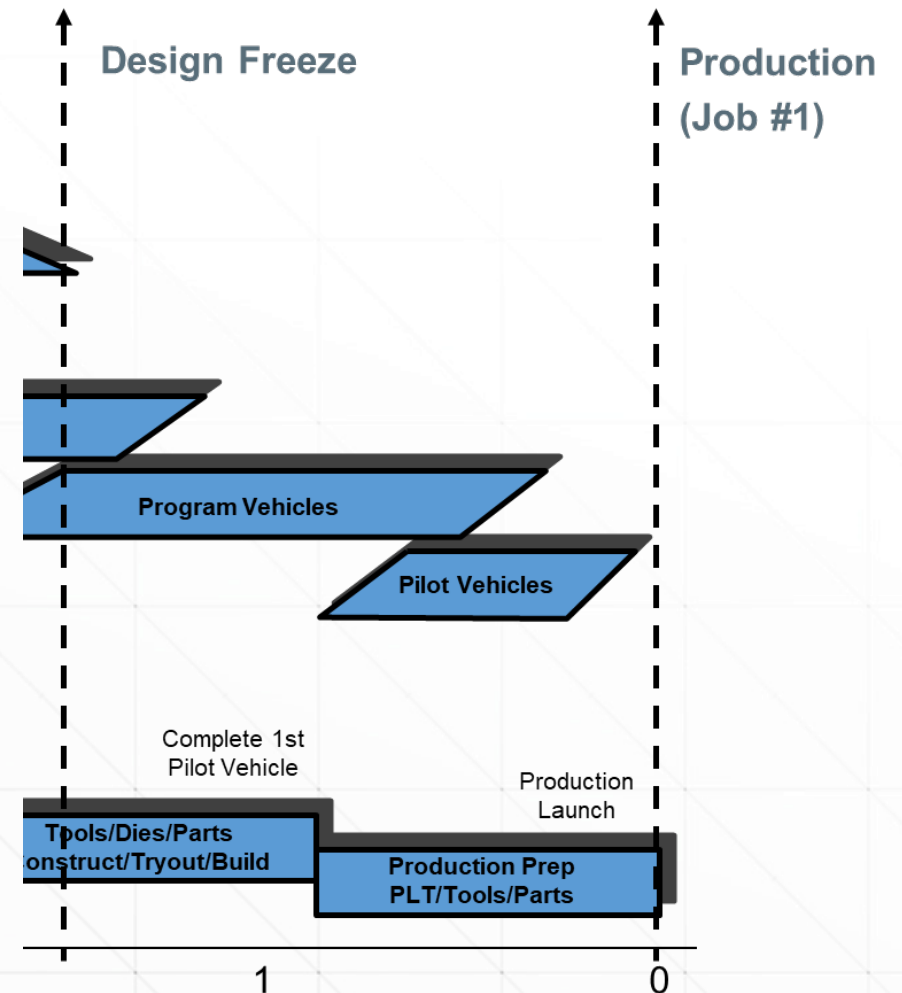
- If invention is not ready for installation on a vehicle, mass production will be delayed.
- Unless the invention has been completed, the testing required during Production Vehicle Development can not be completed in time for production commitments to be finalized.



# Design Commitment/Freeze

## 18 months (1.5 years) to Production (Job#1)

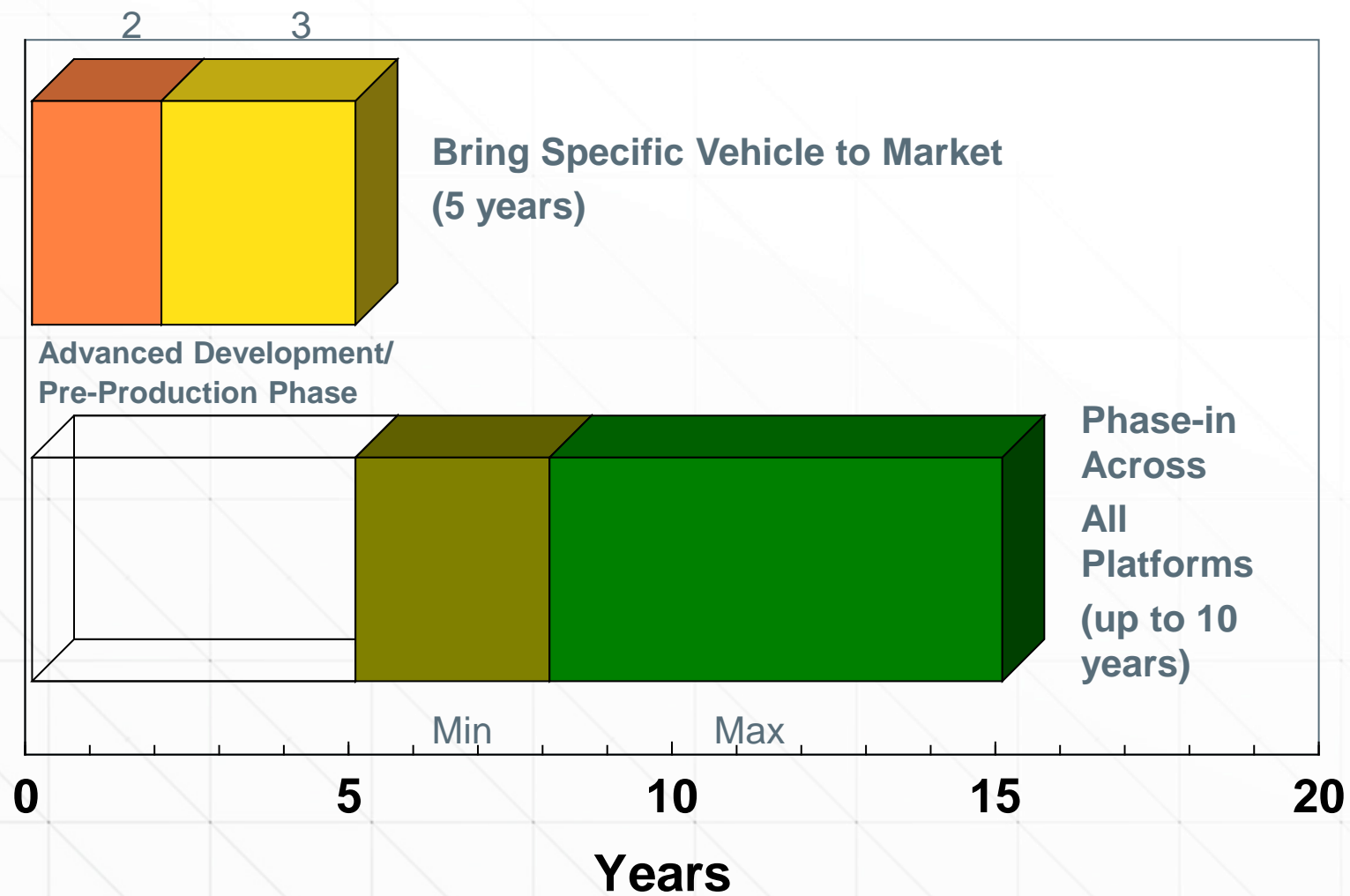
- DESIGN FREEZE
- Final testing is completed
- Certification validated
- Tooling / Process commitment
- Final engineering / Quality sign-off



# **Phase-in of “Invention” Through Product Portfolio**

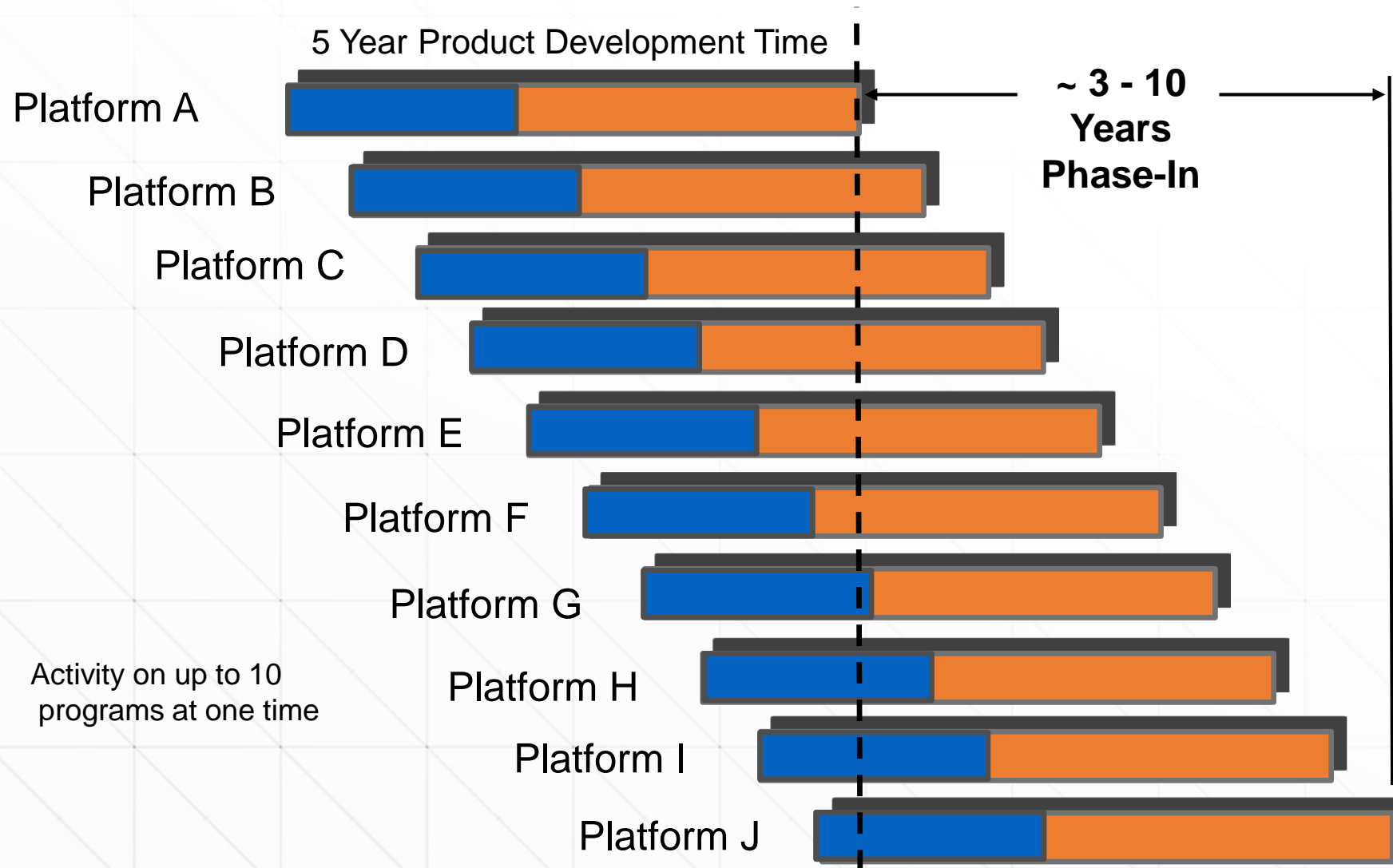
**Product Cycles are Staggered**

# Key Phases of Introduction (Platform to Fleet)



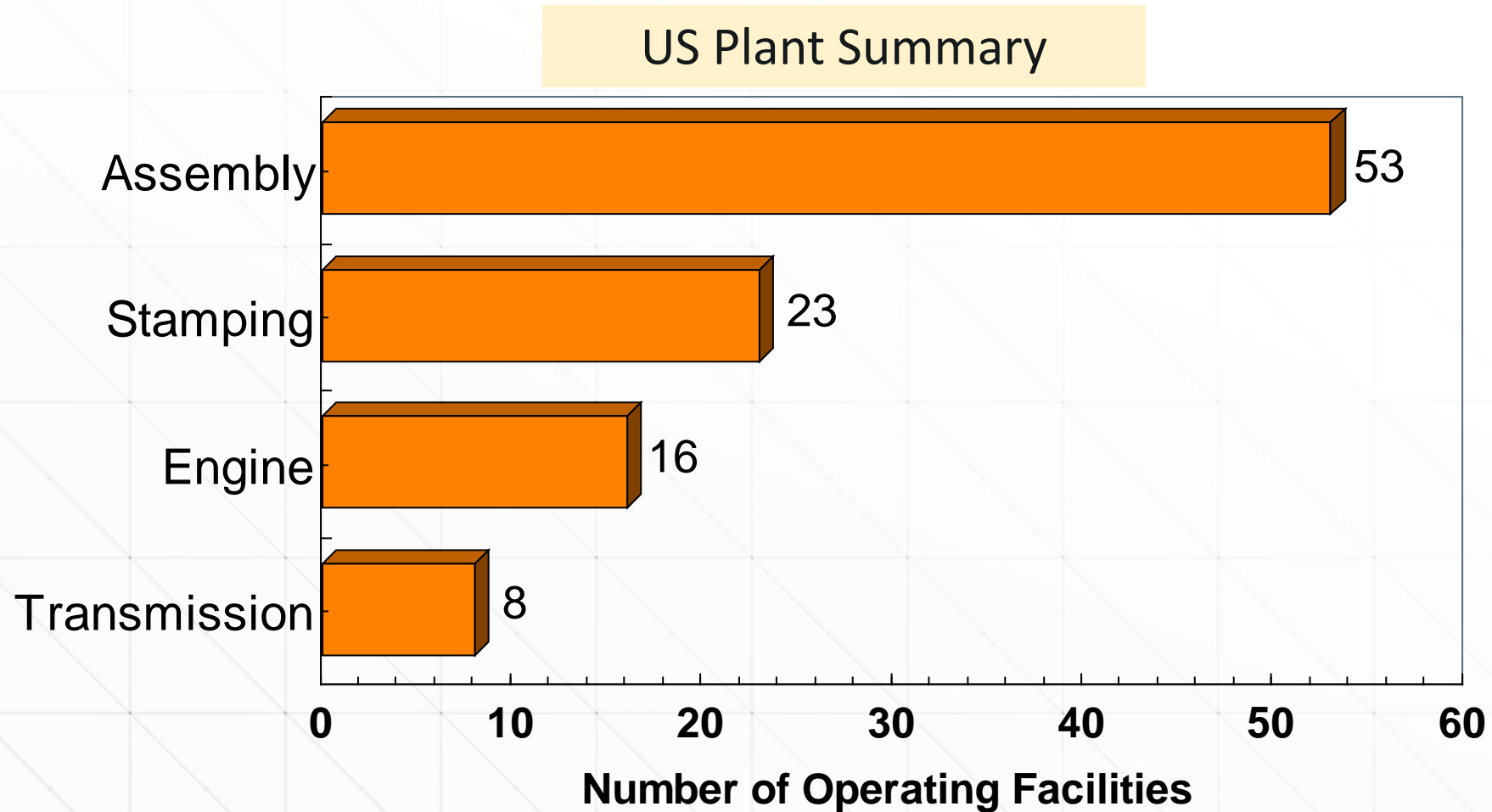
# Technology Phased-in Across Platforms

## Smooths Workload

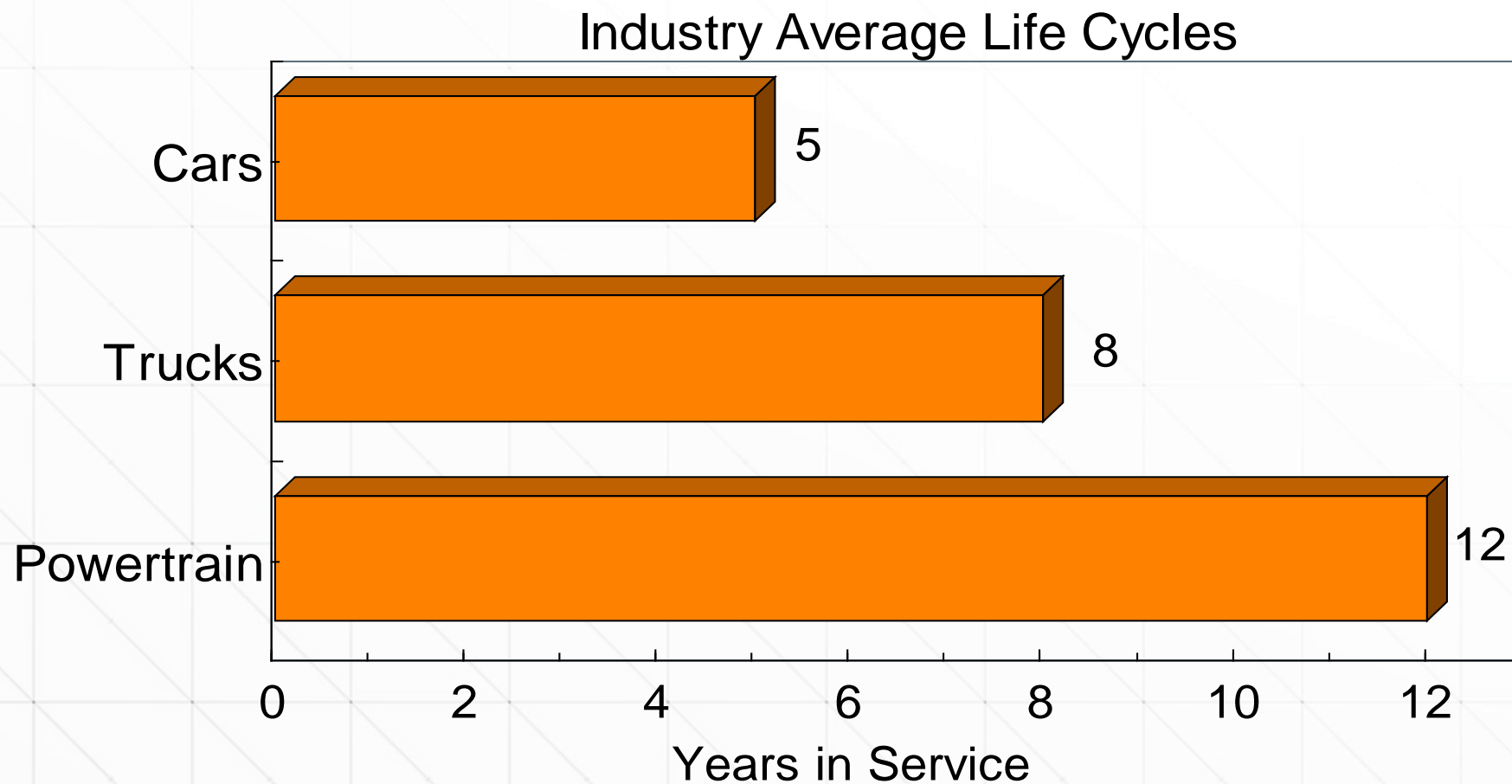




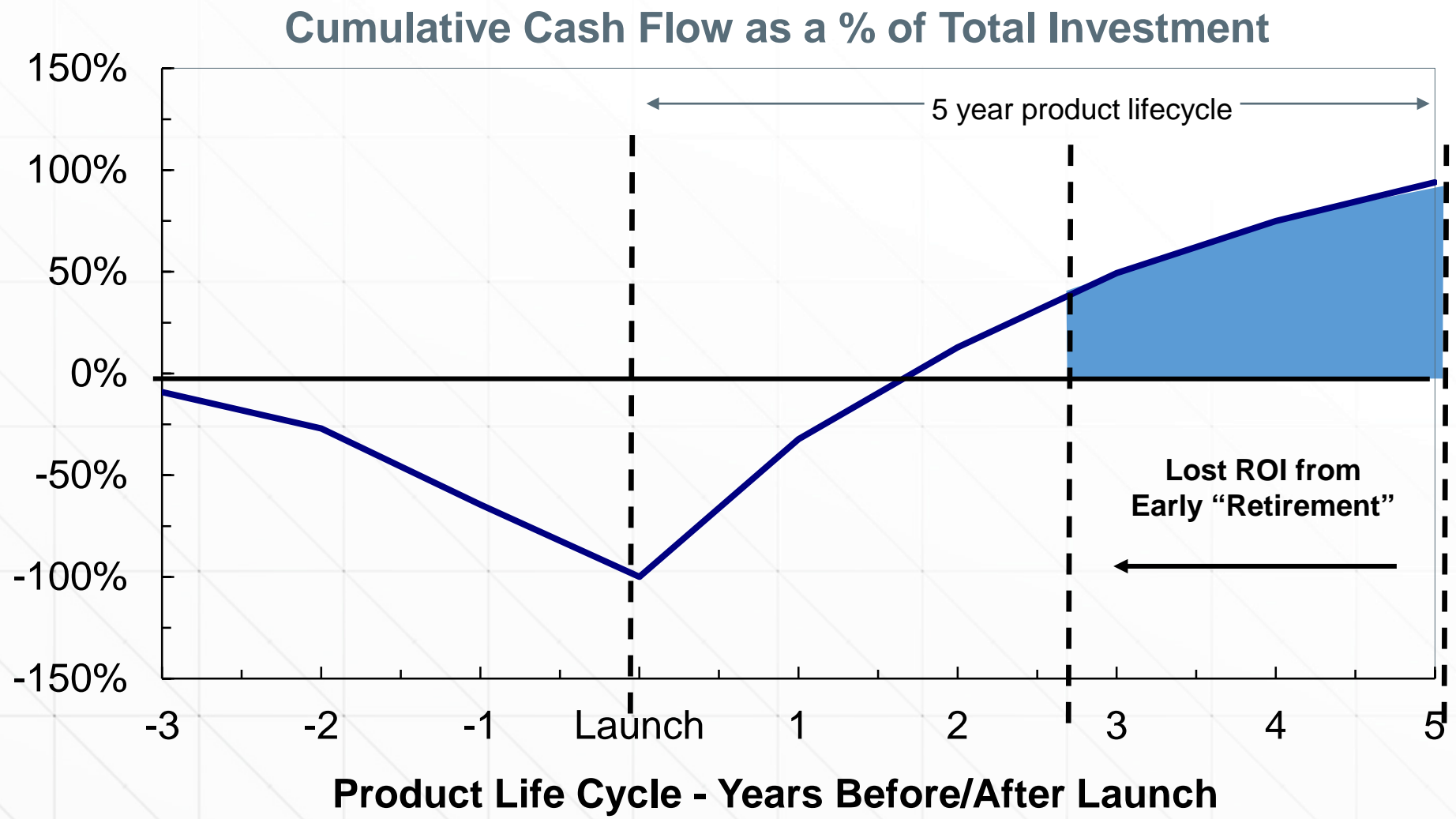
# 100 Major US Facilities Must be Converted Each Product Cycle



## Lengthy Product Development Cycles and Capital Intensive Facilities Lead to Long Product Life Cycles



# Early “Retirement” Affects Economic Viability



## Summary

Long product development cycles:

- Key packaging decisions are made early

- Lead time is critical – Especially for major changes to vehicle architecture (“body in white”)

Automotive industry is very capital intensive, forcing long product life-cycles:

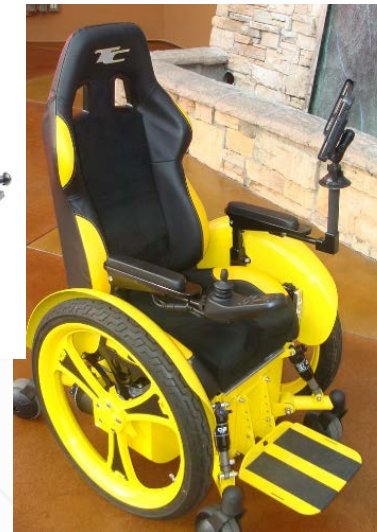
- The impact of pulling ahead a product renewal is huge

# **Guidelines and Standards Vehicle Interface with Wheelchairs**





## Diversity of Designs



# Wheelchair/Vehicle Interface Issues:

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Incredible Diversity of Wheelchair Design Provides a Technical and Market Barrier

- Size/Footprint/Maneuvering Space

- Weight/Floor Pressure

- Approach, Breakover, Departure, Inclined

- Occupant Cognitive and Motor Capabilities (is an attendant necessary)

Crashworthiness Requirements (including due care)

- Frontal Impact

- Side Impact

- Rear Impact

- Rollover

Are restraints integrated into the wheel chair? If not, how do we ensure proper routing?



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# Wheelchair Restraint Systems – Federal Transit

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Title 49, Part 38 – Americans With Disabilities Act (ADA) Accessibility Specifications For Transportation Vehicles.

Details:

- Ramp/Lift Requirements (including maximum inclines)
- Space requirements for Maneuvering Wheelchairs
- Securement Systems (note they are not automatic and only restrain chair/not occupant also load requirements in forward direction only)



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