

GM Daewoo Auto & Technology

### Trends

#### The 2002 Toyota Camry

- Relied on Virtual Prototyping
- The Result:
  - 10 months less time
  - 20% fewer people
  - 30% less dev. cost
  - 65% less prototypes!

Ref) 2003 MSC User conference

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### Trends

#### Boeing 7E7 Dreamliner

- 200-250 passengers
- 747/777 speed and range capability
- 2,000-3,000 units required over next 20 years
- Improved passenger experience
- Designed for the environment
- 20% more fuel efficient

Ref) 2003 MSC User conference

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Trends

### Program Schedule

Authority to Offer

2002 2003 2004 2005 2006 2007 2008

Ref) 2003 MSC User conference

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Trends

### Virtual Product Development

Objective: Validate Product Requirements are Met Prior to Design Release

Ref) 2003 MSC User conference

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Trends

### Virtual Product Development Evolution

777 737 Next Gen 787

Ref) 2003 MSC User conference

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Trends

### Single Source of Data Enables Integrated Virtual Product Development

Ref) 2003 MSC User conference

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Trends

### Existing Validation Process

Completed Validation  
On going Validation (Analysis)  
On going Validation (Lab)  
On going Validation (Road)  
Waiting Validation

Required Long Product Development Time

x? Times

Ref) 2003 MSC User conference

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Trends

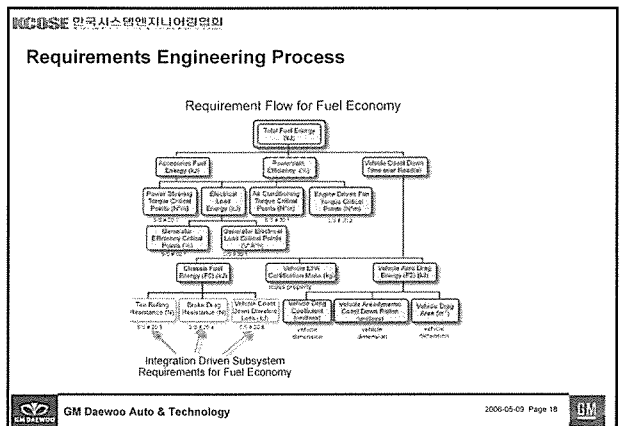
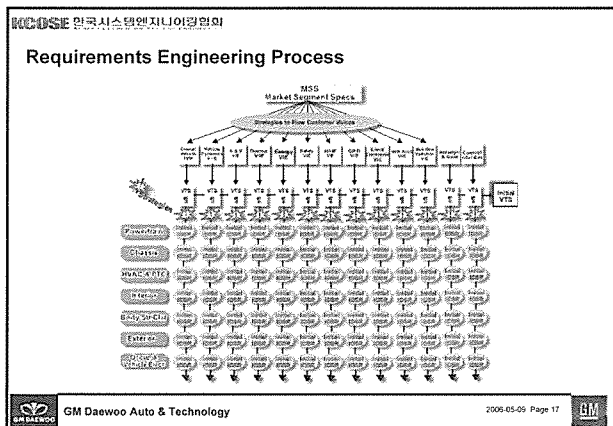
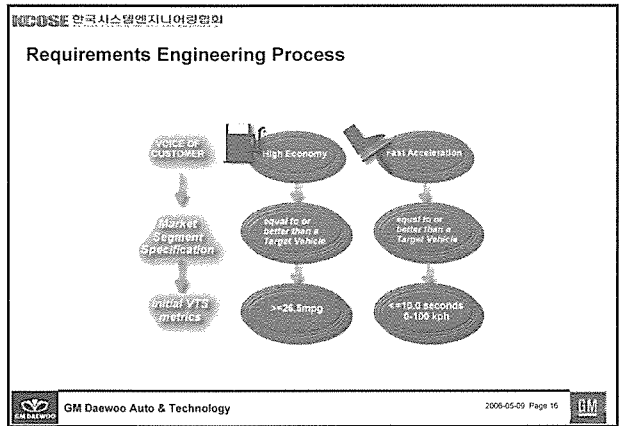
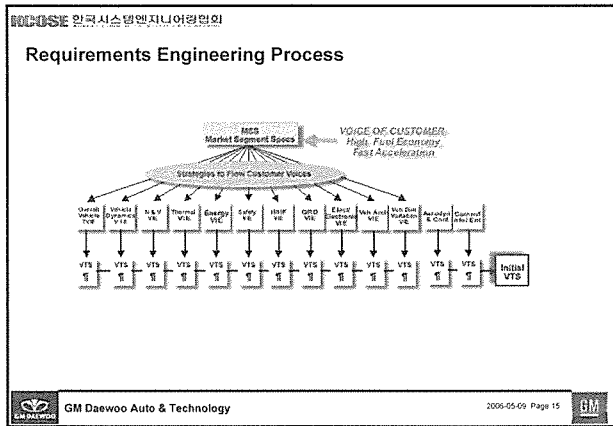
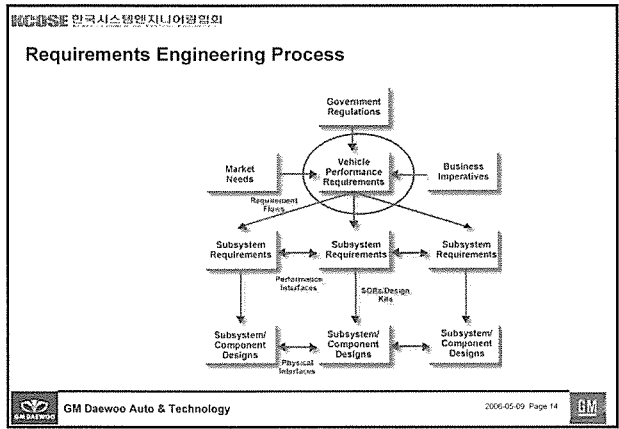
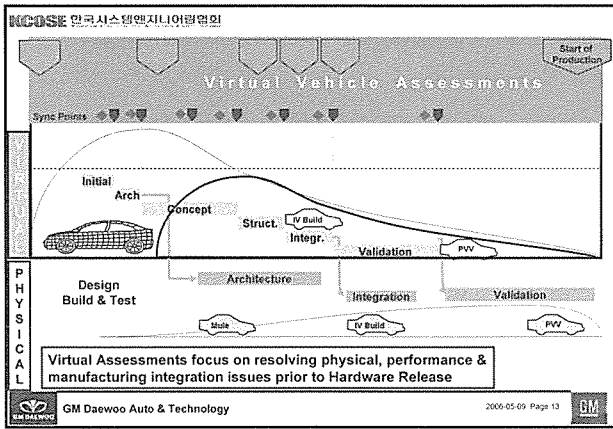
### Integrated Virtual Engineering Process: Road -> Lab -> Math

Virtual Engineering

Speedy Response

Ref) 2003 MSC User conference

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### Requirements Engineering Process

The diagram illustrates the Requirements Engineering Process. It is divided into two main sections: POWER-TRAIN and CHASSIS. Under POWER-TRAIN, there are two sub-sections: Fuel Economy (with metrics: Engine Displacement (L), Final Drive Ratio) and Vehicle Acceleration (with metrics: Engine Displacement (L), Final Drive Ratio). Under CHASSIS, there are two sub-sections: Tire Rolling Resistance (with metrics: Coast Down, Residual Drag (N)) and Tire Rolling Resistance (with metrics: Coast Down, Residual Drag (N)). A central 'CONNECT' box links these sections. To the right, a graph titled 'Performance vs. Fuel Economy Trade-off' shows 'LNA Components Fuel Economy, mpg' on the y-axis and 'Performance, Day 100' on the x-axis. A red circle highlights a specific data point on the graph.

Set the Target

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### Virtual Engineering Process

The purpose of Virtual Engineering is:

- Complete virtual analysis of engineering designs to:
  - Validate performance to requirements
  - Validate the BOM
  - Check part geometry interference
  - Validate the assembly process
- Communicate gaps to requirements
- Correlate virtual models to physical experience

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### Virtual Engineering Process

The diagram shows the Virtual Engineering Process as a central hub with various stages radiating outwards. The stages include: Supply Chain, Service, Styling/Performance, Performance Sim., Geometry, Design, Digital Mock Up, Prototype Shop, Manufact. Eng., Manufacturing, and Plants. Each stage is represented by a small image or icon.

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### Virtual Engineering Process

The diagram illustrates the Virtual Engineering Process flow. It starts with 'Synchroniz. Timing' leading to 'DesignData Definition'. This then leads to 'Vehicle Synchronization', which involves 'VAM', 'VPM', 'PIM's DMU', 'Veh. Perf. Sim.', 'Transport Supplier', 'Styling', 'ME', and 'Service'. A group of people is shown in a meeting. Below this, it states: 'Commonly agreed upon Design to be Evaluated in the Integrated Virtual Vehicle Assessment'. The process is part of 'Virtual Vehicle Assessments'.

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### Virtual Engineering Process

The diagram shows the Virtual Engineering Process flow. It starts with 'Virtual Vehicle Timing' leading to 'Loadcases, Deliverables-Lists'. This then leads to 'Virt. Veh. Assessment', which involves 'VAM', 'VLCE', 'VPM', 'PIM's', 'Veh. Perf. Sim.', 'Styling', 'DMU', 'ME', 'Supplier', 'Transport', and 'Service'. Below this, there is an 'Action Items' table and a 'Data Base' cylinder. The process is part of 'Virtual Vehicle Assessments'.

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### Virtual Engineering Process

The diagram illustrates the Virtual Engineering Process flow. It starts with 'VAS/ Data Sharing' (1) leading to 'Synchron. data' (2). This then leads to 'Loadcase/ Deliverables with all Partners', which involves 'VWA'. Finally, it leads to 'Engineering release' (3). The process is part of 'Virtual Vehicle Assessments'.

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### Global Vehicle Development Process in Virtual Engineering

Virtual Vehicle Assessments

Build

- Virtual engineering is a key enabler to finding and fixing design issues earlier
- Standard Virtual Engineering work will be executed using data from Sync points
- Data Sync points in GVDP need to be sacred & rally point for math
- Program Engineering teams make Go / No-Go decisions at Data Sync and Virtual Assessment Gates

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### Conclusions

- Balanced requirements from VTS based on systems Engineering
- Defined the Target / Deliverables/ Loadcases
- Assessed all deliverables required Virtual Assessment gate in GVDP

Performance

Cost

Time

Systems Engineering

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### Virtual Vehicle Assessments

PHYSICAL

Design Build & Test

Architecture

Integration

Validation

Gate

RV Build

PVV

Virtual Assessments focus on resolving physical, performance & manufacturing integration issues prior to Hardware Release

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### Q/A

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