

Functional Product Development

By Ola Isaksson, Volvo Aero, 27th April 2006
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VOLVO AERO

Functional Product Development *A Simulation driven approach*

2006-04-27

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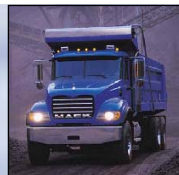
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Functional Product Development

Volvo 2005

- 85.000 employees
- Sales SEK 231 billion

Mack Trucks



Renault Trucks



Volvo Trucks



Buses



Trucks



Construction
Equipment



Volvo Penta



Volvo Aero



Financial Services

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Volvo Aero Product Specialization

Fan/compressor structures

Shaft

Turbine structures

Vanes

Fan Case

Spool

Diffuser Case

LPT-Case

Turbines

Nozzles

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Functional Product Development

Agenda

- Business drivers
- Functional Product perspective
- Functional Product Design
- Functional Product Development

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Functional Product Development Business drivers

Business drivers

Business drivers

Functional Product perspective

Functional Product Design

Functional Product Development

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Functional Product Development Business drivers

Volvo Group Business case scenario (all BA's)

Business	Trend	Customer needs	Technologies
On-line services	↗	Freedom for profitable business	Telematics, New Services
Used Products	↗	From used products to updating and customisation	Modular engineering for HW and SW
Sales services	=	Freedom for management	LCC estimation, performance simil.
Maintenance contrats	=	Freedom – cost per X	Diagnostics, predictive maintenance
Maintenance shop	↘	No stop, 24/24 availability	Reliability
Spare Parts	↘	Reduction of cost	Low cost technologies, standardisation
New Hardware	↘	Reduction of product price	Low cost technologies

■ New concepts ■ Full solutions ■ Cost per X
■ Soft products ■ Hardware

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AB Volvo Business drivers

The Product and Service Package of today, delivered to the customer from the Volvo Group or our partners (e.g. dealer interface)

Related products & services						
Supporting products & services						
Facilitating products & services						
Core products						

AB Volvo
A. Dencker, Dept. 710, 2005-08-31 -14- VOLVO

Functional Product Development Business drivers

Continuously increased lead time pressure

Utvecklingsledtid (år)
Från koncept till FETT (first engine to test)

Model	Date	Lead Time (years)
Vulcan 2	1995-01-01	~3.5
RM12 F.H	1997-01-01	~4.0
RM12 FF	1998-07-02	~2.8
Vinci	1998-08-20	~3.5
Trent 900	2001-05-01	~2.0
LMS 100	2003-03-31	~1.8
V2 NE FRP		~0.5
GE9x		~1.8
747A		~1.5

Requirements on 6-7% Annual Improvement in Development Process Efficiency

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Functional Product Development Business drivers

What happens to the product ?



The Product and Service Package of today, delivered to the customer from the Volvo Group or our partners (e.g. dealer interfaces)

It is evident that forthcoming products are something more than a traditional hardware product + it's services...

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Functional Product Development Functional Product Perspective

Functional Product perspective

Business drivers

Functional Product perspective

Functional Product Design

Functional Product Development

Let us take a Product Perspective on the product and its services

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Functional Product Development Functional Product Perspective

Products - More than Hardware - "Functional Product"

Information Training Leasing Physical products Software Culture & Values Knowledge

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Functional Product Development Functional Product Perspective

Product developed in a Virtual Enterprise rather than a Company with suppliers

Customer(s) Product OEM Supplier A Supplier B

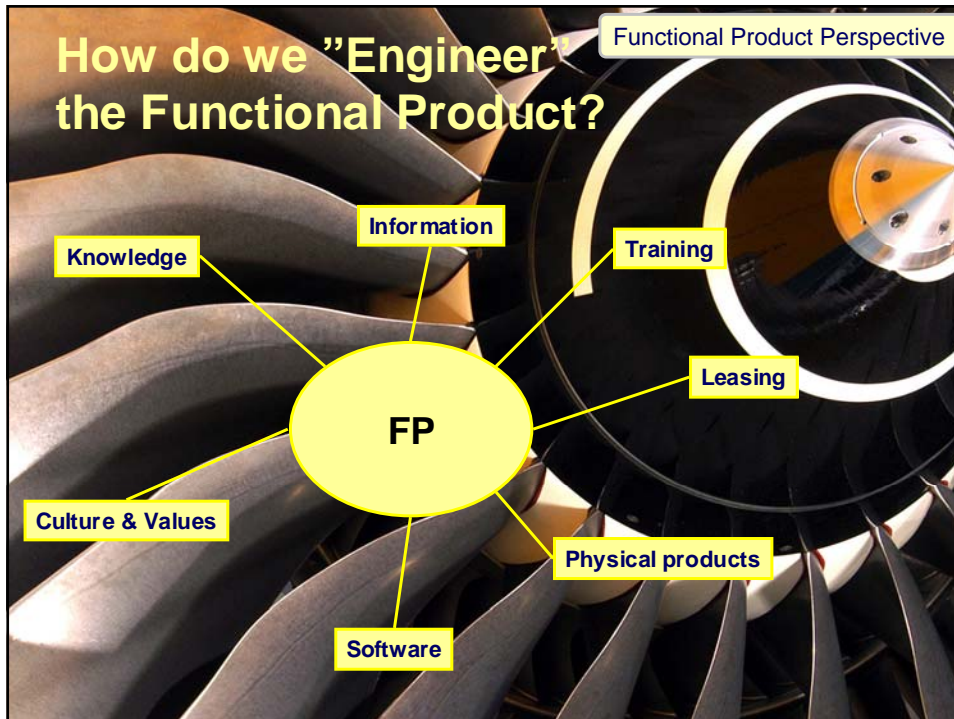
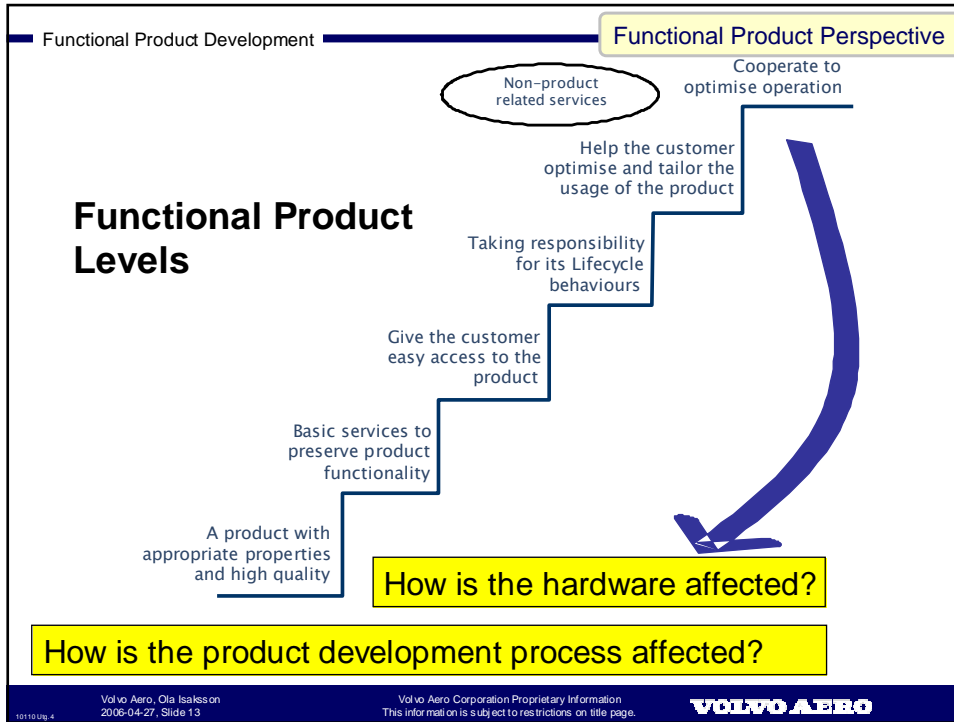
Customer(s) Functional Product OEM Supplier A Supplier B

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Functional Product Development | Functional Product Design

Functional Product design

Business drivers

Functional Product perspective

Functional Product Design

Functional Product Development

- What are the requirements on the product and how can it be designed?

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Functional Product Development | Functional Product Design

Requirements on upcoming products in Aeronautics



Continuously Increased Flight Volumes

Energy Challenges
Environmental Challenges
Economy Challenges

2020 Vision Goals

- Reduce CO2 by 50%
- Reduce NOx by 80%
- Reduce perceived noise by half
- Eliminate noise nuisance outside airport boundaries
- Substantial cuts in operating costs
- Five-fold reduction in accident rate
- Drastic reduction in the impact of human error
- 99% of flights within 15 minutes of timetable
- New standards of quality and effectiveness
- Halve the time to market
- Improve synergies between civil and military research

From ACARE SRA - Advisory Council for Aeronautics Research in Europe

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Functional Product Development | Functional Product Design

How is the hardware affected?

2020 Vision Goals

- Reduce CO2 by 50%
- Reduce NOx by 80%
- Reduce perceived noise by half
- Eliminate noise nuisance outside airport boundaries
- Substantial cuts in operating costs
- Five-fold reduction in accident rate
- Drastic reduction in the impact of human error
- 99% of flights within 15 minutes of timetable
- New standards of quality and effectiveness
- Halve the time to market
- Improve synergies between civil and military research

- Requires real innovative product solutions.
- Requires collaboration with other disciplines/ businesses

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Functional Product Development | Functional Product Design

Functional Product Design

The "design parameters" now also constitute parameters traditionally found "only" in the market offer.

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graph TD; subgraph Stages; direction LR; Dev[Development]; Man[Manufacturing]; InS[In Service]; end; subgraph Product; direction TB; K[Knowledge]; I[Information]; T[Training]; L[Leasing]; P[Physical products]; S[Software]; CV[Culture & Values]; end; FP((Functional Product)); Dev --- DR1[Design Requirements]; Man --- DR2[Design Requirements]; InS --- DR3[Design Requirements]; FP --- DR1; FP --- DR2; FP --- DR3;
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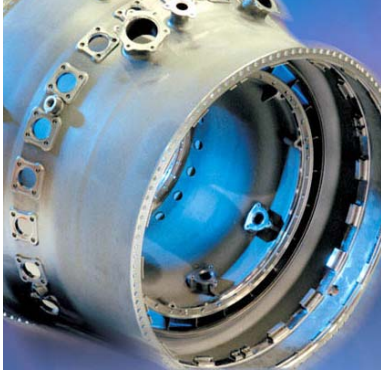
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Functional Product Development Functional Product Design

Example: Functional Product Design of a Flange

- How to design a “simple” Flange with alternative Manufacturing and Maintenance Concepts



Hardware alternatives

Manufacturing alternatives

Maintenance alternatives

Example

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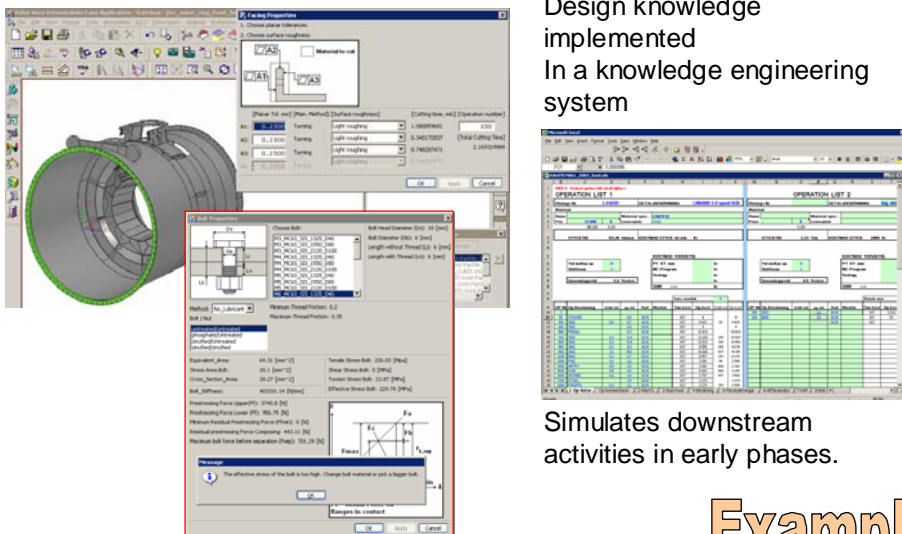
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Functional Product Development Functional Product Design

Flange design, cont.

Design knowledge implemented
In a knowledge engineering system



Simulates downstream activities in early phases.

Example

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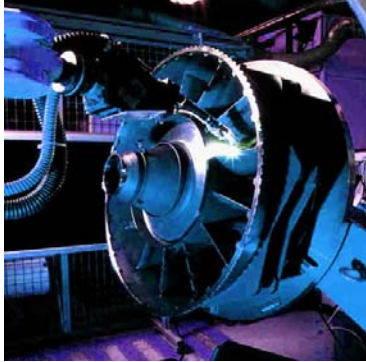
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Example 2: Simulation of the Welding Manufacturing Process



- Is it possible to treat the welding process operation as a conceptual design parameter?


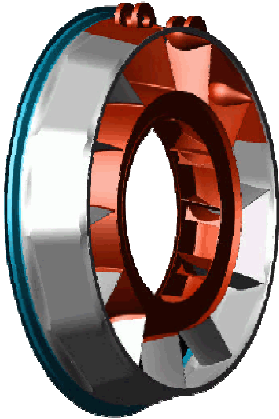
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Weld simulation, cont.



Modeling of welding and heat treatment...
...for optimized combination of small castings, sheet and forged rings...
.. available for conceptual design studies

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Functional Product design

- Business drivers
- Functional Product perspective
- Functional Product Design
- Functional Product Development

- How to conduct the entire functional development process?

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Functional Product Development

Functional Product Development – What is New?

80's 90's Futur

	Traditional Product Development	Integrated Product Development	Functional Product Development
Organization	Homogenous Design Team: In House Department vis Sequentia	Heterogenous Design Teams: In House Outsource Cross Department Concurrent Activities	Heterogenous Design Teams: Cross Company Cross Discipline: Concurrent Activities
Strategies	Vertical Information Flow Systematic Design Approach	Horizontal Information Flow Projects	Communication Knowledge sharing Extended Enterprises Distributed Engineering
Goals	Development of Excellent Good	Development of Excellent Good Shorter time to market	Development of Function Shorter time to Market Shared responsibility Total Offer Functional Sales

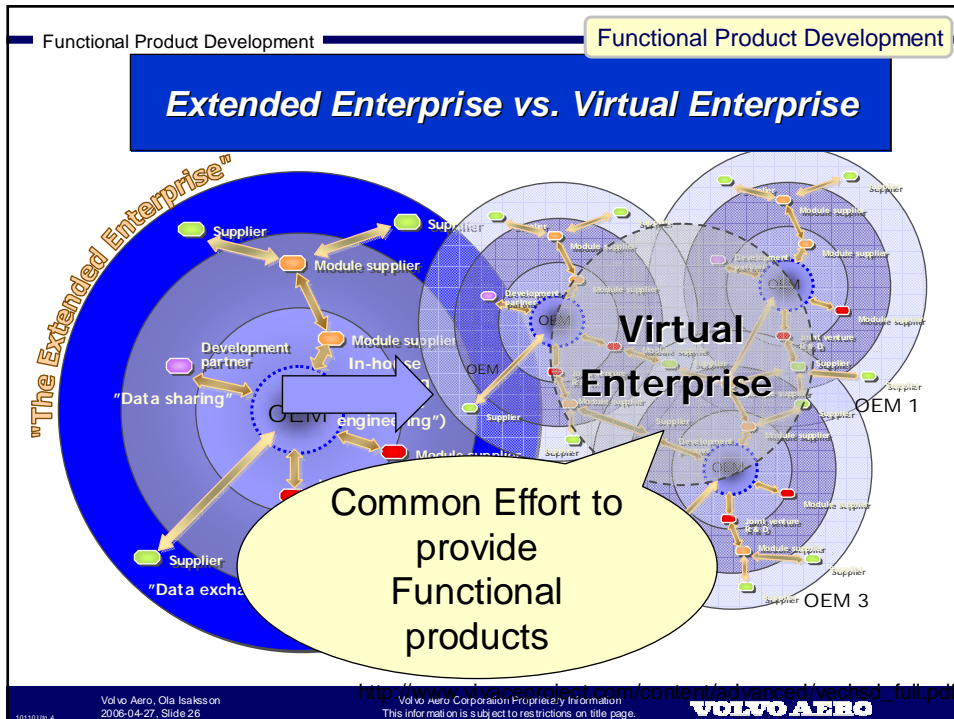
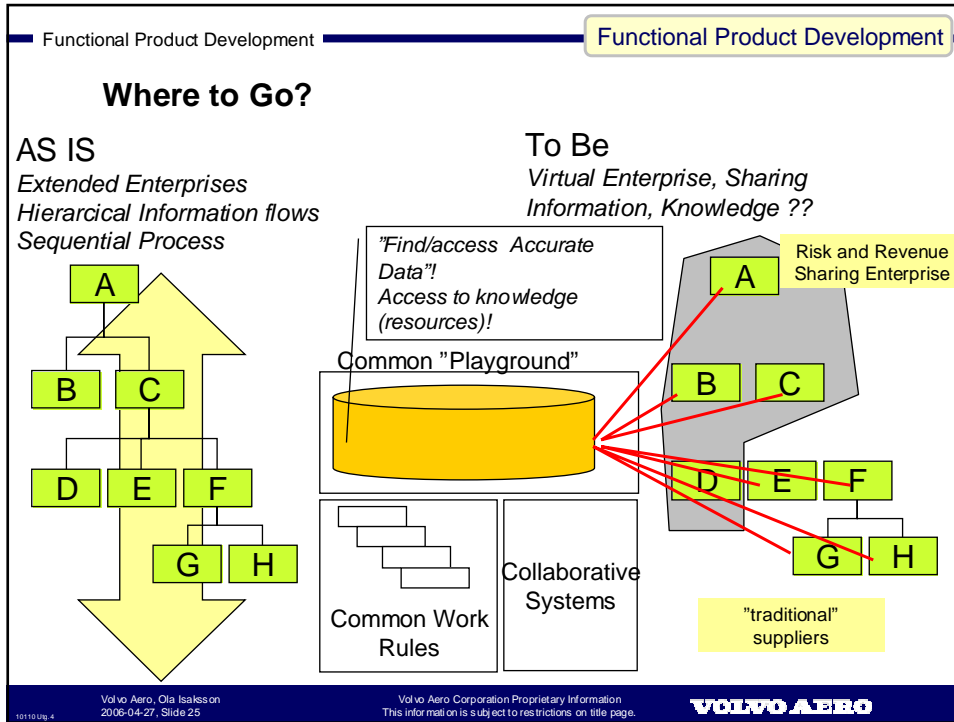
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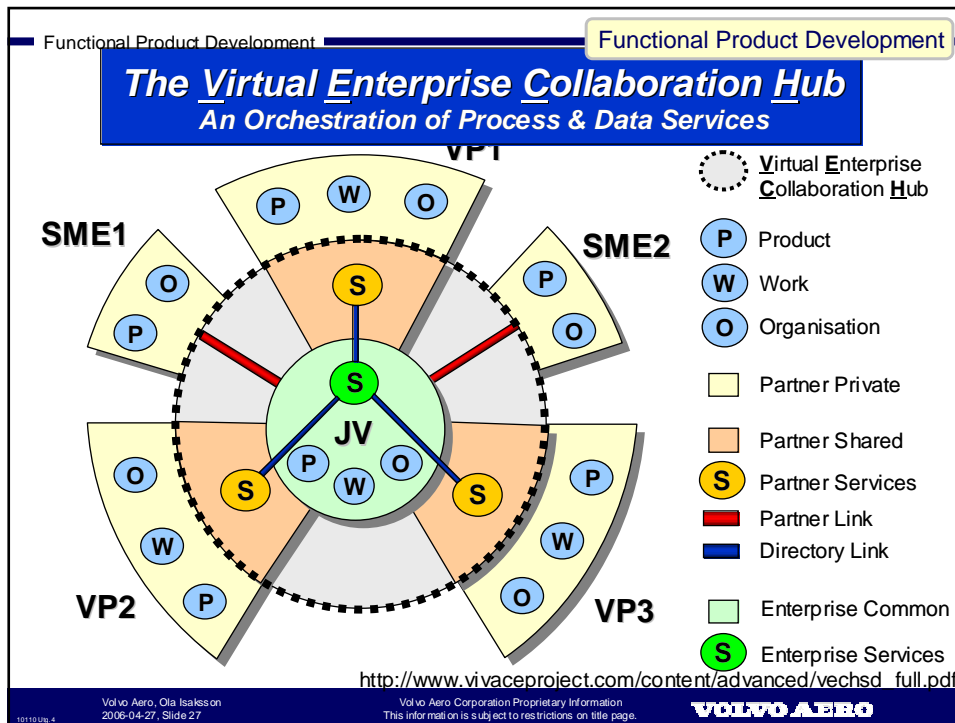
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Closure Comments

- A Functional Product approach "allows" to deploy design principles for business models already here
- Simulation of Functional Products calls for multi-disciplinary, cross organisational simulations
- Enterprise mode for product development urgently states that we need to find work methods and technologies while maintaining Intellectual Properties and obtain "Enterprise Trust"
- Business is enterprise oriented and sharing of information is a key for efficient work

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Thank You for your Attention!

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