



*PRESENTS*

EDUCATIONAL SEMINAR  
**Lean Product Design**

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*Director of Engineering*



move

measure

mix

control

dispense

spray

Worldwide Leaders in Fluid Handling

[www.graco.com](http://www.graco.com)

## Graco Lean Product Development



- ▶ Company Overview
- ▶ Product Development Process
- ▶ Customer Requirements
- ▶ Field Testing
- ▶ Design for Manufacturing
- ▶ Technology Sharing

## Business Overview



- ▶ Graco is a \$1.6 Billion company that manufactures premium equipment to pump, move, meter, mix and dispense a wide variety of fluids and coatings
  - Difficult to handle materials with high viscosities, abrasive and, corrosive properties
  - Two component materials
- ▶ Graco competes on quality and technology
  - New products are a key growth strategy with heavy investment in this area
- ▶ 80%+ of production is based in the United States
  - Standard products are sold world wide, equally in all regions of the world
    - Many large customers are world wide as well
  - Products are low volume/high mix. 50% of our sales is generated from products we make less than one per day
  - Graco has three divisions and 5 large engineering organizations in the twin cities area



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## Industrial Products Division - IPD



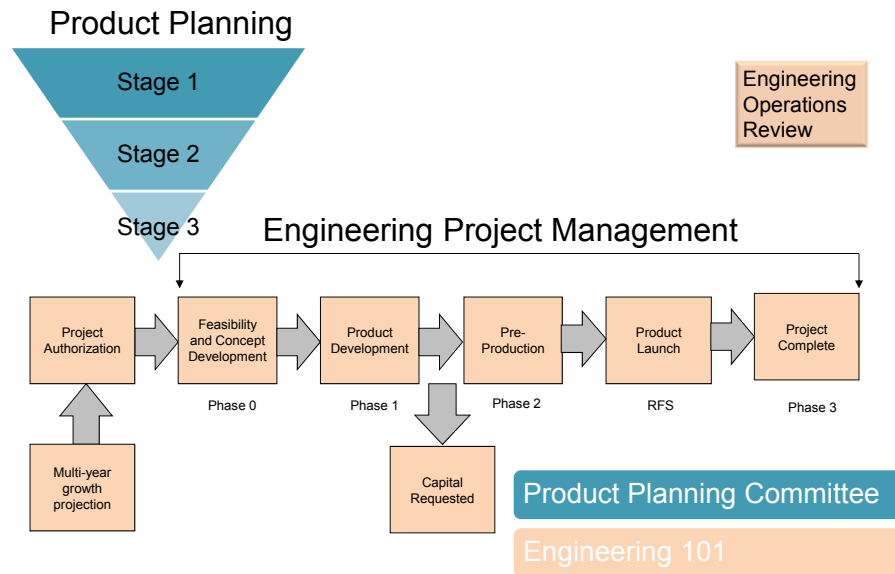
### ▶ Finishing

- Aerospace
- Automotive
- Furniture
- Window and Door
- Paint Systems and Applications



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## New Product Process Flow



## Developing the Product Plan



- ▶ The Product Planning Council - PPC
  - Discussions with Product Development, Sales, and Marketing from all world regions.
  - Three phases of research
- ▶ Ranking based on key criteria
  - Strategic Importance
  - Preliminary ROI and NPV
  - Estimated incremental sales from all regions
- ▶ Scheduled based on resource availability
  - Mix of technical skills
  - Could include manufacturing

## NPD Project Phases - Return on Investment



- ▶ An ROI must be estimated to get a project kicked off
  - Project Cost Estimate
  - Product Cost Estimate
  - Forecast
  - Pricing
- ▶ The ROI is firmed up during the feasibility phase
- ▶ For 5 years after release, ROI is reviewed with upper management
- ▶ Competing for funds with other Graco investment options

## NPD Project Phases



### Feasibility – Phase 0

- ▶ Set Specs – features, perf, cost, forecast...
  - User interviews
  - Competitive evaluations
  - Cost estimates and schedule
- ▶ Develop a design/prototype
  - ProEngineer layouts
  - Rapid prototyping
- ▶ Can it meet the specs?
  - Lab testing
- ▶ And the ROI must be good



## NPD Project Phases



### Design – Phase 1

- ▶ Detail Mechanical Design
  - Design analysis
    - CFD
    - FEA
- ▶ Lab Testing
  - Burst
  - Impulse
  - Life
  - Performance
- ▶ Field Testing
- ▶ Software Development
- ▶ Agency Approvals

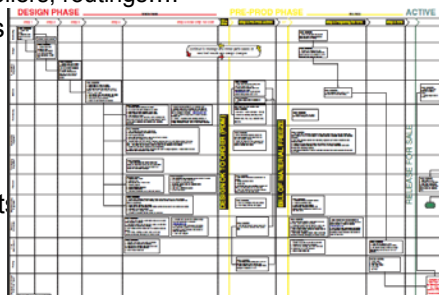


## NPD Project Phases



### Preprod – Phase 2

- ▶ Bring the Design Through Manufacturing
  - Production tooling
  - Develop processes
  - Establish costs
  - Load the system with BOM's, suppliers, routings....
- ▶ Build and test full production units
- ▶ All lab tests complete
- ▶ All field tests complete
- ▶ CE marking
- ▶ CSA/UL approvals
- ▶ Compare Product to Requirements
- ▶ RFS



## NPD Project Phases



### Production – Phase 3

- ▶ Ship Production Units
- ▶ Launch Activities
- ▶ Project Review
  - Lessons learned
  - Warranty
  - ROI



## Customer Requirements

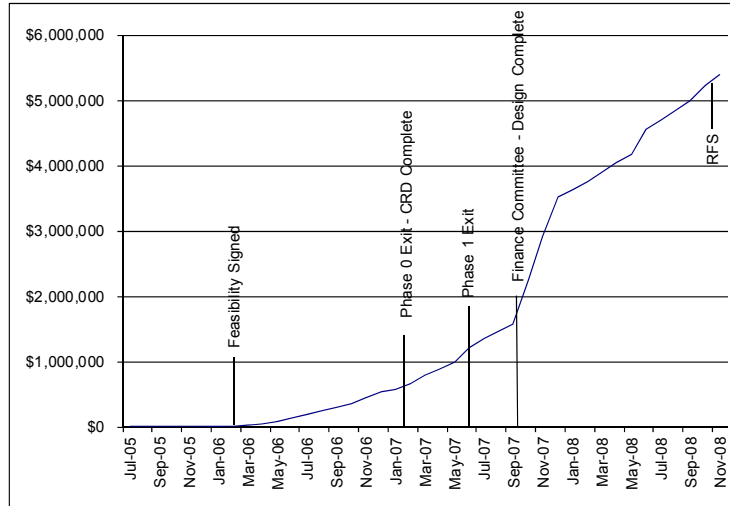


Getting it right the first time – measure twice, cut once

- ▶ Customer Requirements Document is developed during phase 0
  - Completed by engineering and marketing
    - Field visits with customers
    - Visits to end users sites
    - Review of competitive equipment
    - Develop of prototypes to test key concepts
  - Contains
    - Performance and life requirements
    - Features
    - Costs
    - What won't be included
- ▶ CRD is reviewed and updated during phase 1
  - Field tests
  - Performance and life tests



## Project spending



## Customer Requirements



### ► Dealing With New Requirements

- Follow on projects
- Small engineering team dedicated to continuous development
  - Works well with systems and software
  - Close collaboration with sales and marketing
- PD2K Example
  - Request for a change in the software
  - Approximately 3 months of work
  - Took 2 weeks to develop a prototype



PD2K Auto Applications.mp4



## Customer Requirements



- ▶ A Project That Went Well
  - 18 month project, \$2.5M development
  - Met all the goals
    - One time, to budget, met requirements
  
- ▶ CRD Well Defined
  - Good customer and distributor visits
    - Upgrade to an existing product
  - Competitive testing
  - Concept prototyped and tested in parallel
    - Risky technology
    - This is key



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## Customer Requirements



### A Project That Didn't Go Well

- Project significantly late and over budget
  - Shuffled resources and delayed other projects
  - Outsourced some development
  
- Poor CRD Definition
  - Not all features defined up front, a lot of scope creep
  
- Complex product with mechanical and electrical development
  - Too many assumptions about development complexities
    - Did not develop and test key concepts
  
- Met customer expectations
  - Hit target in terms of product performance, features, and cost.



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## Field Testing



- ▶ Key way for gathering and validating requirements
- ▶ Testing out the design and technology
- ▶ Validating quality
- ▶ Gather success stories
  - Used for launch activities
  - Early selling
- ▶ Kick start sales with end users



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## Field Testing



- ▶ End Users
- ▶ Partners
- ▶ All project Phases
  - Early prototypes, heavily supported by engineering
  - Preproduction units
  - “Market Seeding” units. Saleable after release to sell

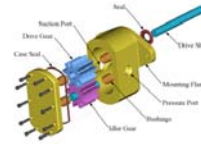


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## Design for Manufacturing



- ▶ Assembly
  - Dedicated and skilled assembly work force
  - Assembly can be difficult
  - Assembly is not one off work
  - Consider issues and fixtures during design
    - Formal design reviews include assembly



- ▶ Machining
  - Design reviews include manufacturing engineers and can include machinists



- ▶ Co-Location of design, marketing, and manufacturing is powerful



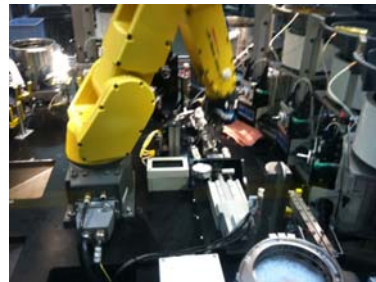
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## Technology Sharing



Technology teams across divisions

- ▶ A powerful advantage of closely located multiple divisions
- ▶ Share technology developments
  - Wear coatings
  - Atomization research and tools
- ▶ Key components developed to be used across divisions and industries
  - Higher volumes – reduced cost, automation
  - Improved quality
  - Reduced development time
    - Controls
    - Pumps
    - Valves
    - Software
- ▶ Example
  - Pilot valves
    - Used across multiple product lines
    - Additional volume reduces the cost approximately in half
    - Used on multiple projects, reduces design time
    - Automation improves quality
    - Multiple Industries
      - Industrial, automotive, food and beverage, lubrication





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