The Modeling & Simulation Behind Improving Everyday Life

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The power to transform.
Investors Know P&G …

• Large, Global, & Successful Consumer Goods Company
  • Sales: $82.6 Billion FY June 30th, 2011
  • Net Earnings: $11.8 Billion
  – 4.2 billion Consumers purchase a P&G product about 40 Billion Times a year.

• Builds lasting shareholder value
  – P&G has paid Dividends (Without Interruption) Since 1890
  – 55 consecutive years of Increasing Dividend Payments at a annual compound average rate of ~ 9.5%
  – Market Cap ~ 181 billion COB 2/12012

• Innovates to Grow:
  • Invest about $2 Billion/yr in R&D…
Consumers ... Know Us by Brands

Beauty & Grooming

Health & Well-Being

Household Care
Why “rocket science”? For such everyday things?
Performance Contradictions...

Materials ...
• strong but soft
• stretch not break,
• breath but contain,
• break...not tear.

Packages ...
• creative design drives sales, but makes it harder to pack
• strong but light,
• never leak...but open easily.
Performance Contradictions...

Formulations ...
• protect fabrics … but remove stains.
• Be compact, but used easily.

Liquids ...
• mixtures can’t separate,
• must dispense easily… but stay where applied.
Scale: How to Sell $1B

P&G makes billions of things…
…and sell them for < $10

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Scale: Make a Billion Diapers…

How long does it take to make a billion Pampers?
...Atoms to the Enterprise

Product/ Materials/ Device/ Package

Process

Production Plan & Schedule, Reliability

Converting & Machines
Our Technical Challenges lead to collaboration with the best Scientists
Dr. Michael Klein, Temple University

“Coarse Grained Molecular Dynamics Studies of Vesicle Formation and Fusion”
Understanding Body Wash Formulations – Micelles!

Why are some formulations thicker (e.g. rheology) at different concentrations?

- spherical micelles
- rod shaped micelles
- wormlike micelles
- branched micelles
Solid Mechanics:

- Rigid Body Kinematics
- Finite Element Analysis (FEA):
  - Implicit
  - Explicit
  - Linear
  - Non-linear
  - Massive Contact
  - Complex non-metal

The new premium shaver ...
Bathroom Floor Drop

Lots of Small Parts...

...Everyone must work!
Fluids / Thermal

- Computational Fluid Dynamics (CFD):
  - Free Surface Flow
  - Contained Turbulent Flow
  - Multi-Phase Flows
  - Creeping & Low Reynolds’ Number Flows
  - Non-Newtonian & Visco-Elastic Material Properties
  - Flow in Porous Media
Mixing Non-Newtonian Fluids
Fluids: Making Absorbent Diapers

Multi-Phase Turbulence…
with Material Accumulation At the Boundaries

CFDlib w/ FLIP Markers
(Bucky Kashiwa)
@ Los Alamos National Labs

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Bottle Drop Simulation

What You Don’t Want to Happen In Store Or Your Laundry Room!
Looking Ahead… Rehearse Reality!

– Tackle ‘Bigger’ more complex Problems more Completely

– Solve Larger equation sets…

– Do parametric studies (UQ) vs. point estimate Calculations

– ‘Turbo Tax©’ Complexity… Democratize Analysis to non-analysts