Creating an Environment...

...for Innovation at 3M

Larry A. Wendling
3M Corporate Research Laboratory

© 3M Company 2010
Company Overview

- Sales: $25.3 billion
- Net income: $3.5 billion
- 6% to sales R&D Investment
- 63% of sales outside the United States
- Sales in 200 countries
- Over 79,000 employees
- 55,000+ products
- 489 U.S. patents issued in 2008

Six Market Leading Businesses

- Consumer & Office
- Display & Graphics
- Electro & Communications
- Safety, Security & Protection Services
- Health Care
- Industrial & Transportation
7 Elements of Innovation

- 3M Innovation
- Flawless, Continuous Execution of Mutually Supporting Elements
- An Individual Expectation
- Connected to Customer Need
- Ready Access to Multiple Technologies
- Measurement Accountability
- Networking
- Key Element of Corporate Culture
- Relation To Vision/Business Model

3M Innovation
7 Elements of Innovation

- Connected to Customer Need
- Measurement Accountability
- Networking
- Ready Access to Multiple Technologies
- Key Element of Corporate Culture
- An Individual Expectation
- Relation To Vision/Business Model

3M Innovation
Legacy of Innovation

Innovation is 3M’s Business Model
Organic Growth Remains Top Priority

- More predictable and profitable
- What our company is based on
- It’s what our culture drives and expects

The Core 3M Strength
**Innovation** = Practical Application And Use of Creativity & Discovery

- **Creativity**: The aptitude of the mind to construct or formulate ideas, concepts, or images in which the essential newness or freshness is embodied in new relationships, associations, or linkages.

- **Innovation**: Is the use or application of creativity to get a practical output which is new or novel (e.g., a new product or process).
The Innovation Process

Technology

Creativity
(Thinking of New Things)

Innovation
(Practical Application Of Creativity)

Markets/Customer

Commercialization is Implicit to 3M Innovation
7 Elements of Innovation

- Connected to Customer Need
- Networking
- Measurement Accountability
- Ready Access to Multiple Technologies
- Relation To Vision/Business Model
- An Individual Expectation
- Key Element of Corporate Culture

3M Innovation
“As our business grows, it becomes increasingly necessary to delegate responsibility and to encourage men and women to exercise their initiative. This requires considerable tolerance. Those men and women … are going to want to do their jobs in their own way.

**Mistakes will be made.** But if a person is essentially right, the mistakes he or she makes are not as serious in the long run as the mistakes management will make if it undertakes to tell those in authority exactly how they must do their jobs.

Management that is destructively critical when mistakes are made kills initiative. **And it is essential that we have many people with initiative if we are to continue to grow.**”

- William McKnight, 1948
Beginnings
3M Heroes of Innovation

- **Dr. Sumita Mitra**
  Corporate Scientist
  - ACS Award for Creative Invention granted in 2005 for development of Filtek™ Supreme©
  - ACS Heroes of Chemistry Award 2009

- **Dr. Andy Ouderkirk**
  Corporate Scientist
  - Inducted into the National Academy of Engineering in 2005 for development of Multilayer Optical Film
Culture of *Innovation*

- 7,100+ technical employees around the world
- R&D at ~6% of sales
- Technical depth and breadth
- Bring multiple technologies to each customer
- Entrepreneurial culture
- Individual initiative ~15% time
- Legacy of boundaryless culture
7 Elements of Innovation

- Connected to Customer Need
- Networking
- Measurement Accountability
- Ready Access to Multiple Technologies
- Key Element of Corporate Culture
- Relation To Vision/Business Model
- An Individual Expectation

3M Innovation
# 45 Core Technology Platforms

<table>
<thead>
<tr>
<th>Materials</th>
<th>Processing</th>
<th>Software, Analysis and Control</th>
<th>Applications</th>
<th>Bio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ad Adhesives</td>
<td></td>
<td></td>
<td>Ac Acoustic Control</td>
<td></td>
</tr>
<tr>
<td>Ab Abrasives</td>
<td></td>
<td></td>
<td>Im Imaging</td>
<td></td>
</tr>
<tr>
<td>Am Advanced Materials</td>
<td></td>
<td></td>
<td>Bi Biotech</td>
<td></td>
</tr>
<tr>
<td>Ce Ceramics</td>
<td></td>
<td></td>
<td>Di Display</td>
<td></td>
</tr>
<tr>
<td>Fi Films</td>
<td></td>
<td></td>
<td>Lm Light Mgmt</td>
<td></td>
</tr>
<tr>
<td>Do Dental &amp; Orthodontic Materials</td>
<td></td>
<td></td>
<td>Dd Drug Delivery</td>
<td></td>
</tr>
<tr>
<td>Fl Fluoro-materials</td>
<td></td>
<td></td>
<td>Ec Energy Components</td>
<td></td>
</tr>
<tr>
<td>Em Electronic Materials</td>
<td></td>
<td></td>
<td>Mf Mechanical Fasteners</td>
<td></td>
</tr>
<tr>
<td>Mr Micro-replication</td>
<td></td>
<td></td>
<td>Md Medical Data Mgmt</td>
<td></td>
</tr>
<tr>
<td>Pd Particle &amp; Dispersion Processing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rp Radiation Processing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>We Accelerated Weathering</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In Inspection &amp; Measurement</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fs Filtration, Separation, Purification</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Op Opto-electronics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mi Microbial Detection &amp; Control</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nw Nonwoven Materials</td>
<td></td>
<td></td>
<td>Fe Flexible Electronics</td>
<td></td>
</tr>
<tr>
<td>Me Metal Matrix Composites</td>
<td></td>
<td></td>
<td>Po Porous Materials &amp; Membranes</td>
<td></td>
</tr>
<tr>
<td>Mo Molding</td>
<td></td>
<td></td>
<td>Se Sensors</td>
<td></td>
</tr>
<tr>
<td>Pm Polymer Processing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Su Surface Modification</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>As Application Software</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pr Process Design &amp; Control</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fc Flexible Converting &amp; Packaging</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tt Track and Trace</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wo Wound Mgmt</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CRL is primary keeper of 3M’s technology platforms

3M’s uniqueness is having access to multiple technology sets
Product & Technology
Migration At 3M
Microreplication Technology


Technology-Driven Business Building
3M Global Technical Operations

CTO

Corp. R&D Exec

Corporate Research Labs

726 FTE

Build Technology

R&D Exec

EVP Business Centers

GM

Strategy

Implementation

Business Center Labs (optional)

Division Labs

6,260 FTE

Build Products

726 FTE

6,260 FTE
CRL Strategy

- Develop differentiated technology to drive/support 3M’s future businesses
- Align technology with high growth markets
- Provide technology to support Big B core growth
- Acquire external technology
- Develop a global technology plan
- Serve as an entry point for high potential technical staff on a global basis. Re-prime the hiring pipeline on a global basis
3M Corporate Research Materials Laboratory

**Technology Focused Clusters**

**Adhesives, Advanced Materials & Modeling**
- Adhesion Science
- Polymers
- Organic & Macromolecular Synthesis
- Materials Modeling and Characterization

**Electro-Materials**
- Electro-Polymer Composites
- Electrochemistry
- Optics & Structured Surfaces

**Performance Materials and Coatings (PMC)**
- Fluorochemical Fluids, Gases, Monomers & Additives
- Performance Coatings
- Adhesive Release Materials
- Energy Materials
- Surface Science, Struc./Prop., Characterization

**Biological & Sensor Technologies**
- Microbial Detection & Control
- Sensor Materials
- Bio-energy
- Separation Materials

**Applied Physics**
- Microstructured Surfaces
- LED Lighting
- Optical Materials
- Electronic Materials

**Nanotechnology & Inorganics**
- Nanoparticles & Nanocomposites
- Nanocatalyst
- Inorganics & Ceramics
- Self Assembled Materials
3M Corporate Research Process Laboratory

Technology Focused Clusters

**Nonwovens, Membranes & Ultrasonics**
- Meltblown
- Card & Bond
- Ultrasonics
- Membranes Development

**Precision Coating & Web Processing**
- Coating
- Web Handling
- Drying & Curing
- Ultra Clean Coating
- Structured Coating

**Advanced Materials & Radiation Processing**
- Nanomaterials Processing
- Specialty Chemical Processing
- Radiation Processing
- Laser Processing

**Vapor Coating & Surface Modification Processes**
- Organic Vapor
- Particle Processing
- Plasma Processing
- Surface Modification

**Polymer Processing & Precision Replication**
- Extrusion/Co-Extrusion
- Compounding
- Precision Replication
- Precision Molding

**Measurement & Inspection Systems**
- Automated Inspection
- Sensors & Measurement
3M Corporate Research SEMS Laboratory

**Integrated Systems**
- New customer solutions by combining software, electronics, materials and mechanical devices
- Data management and workflow functions to detect, analyze and transmit actionable business information
- User interfaces and industrial design to create an overall customer experience
- Commercialization capabilities, including regulatory compliance and design for manufacturing

**Application & Platform Software**
- Mesa Software Platform
- Data Warehousing, Mobile, Reporting
- Sharepoint, Silverlight
- GUI, BI, Web 2.0, ESL
- .NET, Vista, Windows 7
- Agile Development

**Regulatory Compliance**
- Design for Safety & Durability
- EMC Certification
- Global safety & regulatory
- Risk & hazard analyses
- WEEE/RoHS/REACH support
- Environmental, HALT, drop testing

**Electronics Applications**
- Wireless Networks
- RF, Analog, Digital
- Antenna, Tags, Readers
- Control, Measure & Test
- Analog & Digital systems

**Predictive Engineering & Analysis**
- Structural analysis
- Heat & Mass Transport
- Computational Fluids
- Filtration science, microfluidics
- Electromagnetics
- Coupled-field problems
- Systems modeling

**Design & Vision Science**
- Visual attention, conspicuity
- Usability: Software & Hardgoods
- Culture & trend analysis
- Human performance research
- Aesthetics - Color, Finish, Materials

**Mechanical Systems**
- Mechanical systems design, development, & commercialization
- Product verification, validation, reverse engineering
- Rapid prototyping
- Injection molding
- Microfabrication
- Manufacturing support
3M Corporate Research Analytical Laboratory

**Capability Platforms**

**Polymers & Material Science**
- Thermal Analysis
- Mechanical
- Electromagnetics
- Viscoelastic Properties
- Abrasives
- X-Ray Diffraction

**Nanocharacterization**
- Nanoscale structural and chemical analysis capabilities
- Nano-scale mapping: AFM
  - Large format & property-dependent measurements
- Microscopy
  - FESEM
  - TEM: High resolution (atomic scale) imaging
  - Electron tomography
- FIB sample prep
- Profilometry
- Particle Analysis

**Bioanalytical & Separations/Mass Spec**
- Microbiology
- Tissue Proteomics & Imaging
- Immuno Assay
- Ultrapermmeation Measurements
- Outgassing/Odor
- Trace/Residue Analysis
- “Green” Chemistry
- Materials of Public Interest

**Intellectual Property Support & Protection**
- Litigation Support
- Claim Substantiation
- Infringement
- Competitive Analysis
- Reverse Engineering

**Optical Properties**
- Ellipsometry
- Interferometry
- Scatterometry
- Refractive Index

**Surfaces & Interfaces**
- Surface chemistry mapping
- Surface contamination
- ESCA
  - Interface Depth Profiling
  - C60 Ion Gun
- TOF-SIMS
- Auger

**Chemical, Elemental & Molecular Analysis**
- FTIR, Confocal Raman
- Ion Chromatography
- ICP, XRF
  - trace element analysis at ppb and ppt levels
- GC-MS, HPLC
- Solution & Solid State NMR
Technology/Business Alignment

Technology Drivers
- CRL Technology Plan
- New Technology
- Big B Technology Plan
- Big B/Division New Products
- Technology Platform Building

Business Drivers
- Corporate Growth Strategy
  - Core Business Growth
  - Creation of New Business
  - Complimentary Acquisition
  - International Growth
Technology / Market Development

YEARS

+30 ➢ Sustained Technology/Business Dev.

+10 ➢ New Markets
➢ Adjacent Markets
➢ Core Markets
➢ Technology Deployment/Transfer

+ 5 ➢ Emerging Markets Of Future

Present

- 5

-10 ➢ Technology Feasibility

-20 ➢ Technology Exploration

YEARS
7 Elements of Innovation

Connected to Customer Need

Measurement Accountability

Networking

An Individual Expectation

Key Element of Corporate Culture

Ready Access to Multiple Technologies

Relation To Vision/Business Model

3M Innovation
What is Tech Forum?

The Ultimate Professional Society

The 3M Tech Forum is a principal organization for productive technical interaction at the interpersonal "grass roots" level. Through networking & communication, TF fosters an environment of creativity and cooperation that leads to innovation and growth.

Founded in 1951

Membership Eligibility

Membership in the 3M Tech Forum will be limited to regular full-time and part-time 3M employees who are engaged in technical work and who have signed a 3M employee agreement.

4900 members in St. Paul

9200 members Globally
Tech Forum Activities

- **30+ Active Special-interest Chapters**
  - Imaging
  - Nanotechnology
  - Project Management
  - Adhesives
  - Imaging
  - Microreplication
  - New Business Development
  - Photochemistry
  - Life Sciences
  - Biotechnology
  - Inorganic Materials
  - Polymer Processes
  - Product Design

- **Events and Recognition**
  - Technical Information Exchange / Annual Event
  - Virtual and in-person technology and knowledge sharing events
  - Worldwide expert network
  - New technical employee orientation
  - Inventor recognition events
  - Circle of Technical Excellence & Innovation awards
  - Carlton Society

One Tech Forum Event/Day in St. Paul
3M Networking
Making Connections, Finding Answers

FIND THE EXPERTISE
- InTeK: 3M’s technical knowledge repository
- 3M Technical Skills: R&D expertise locator
- ATLAS Electronic Library: Locate prominent external researchers
- Global R&D Work Center: Connect with 3M’s corporate and division scientists
- University Relations: Locate university experts
- 3M Connections: Enterprise-wide employee profiles

MAKE THE CONNECTION
- Annual Event & Spring Symposium: Technical networking events
- Lotus Mail: Corporate e-mail system
- Global Crossing: Global phone conferencing
- Web Meeting: Virtual meetings with desktop sharing
- Sametime: Instant messaging
- eMeeting: Desktop video conferencing

SHARE THE KNOWLEDGE
- Maven: 3M Technical Service shared solutions
- 3M Connections: Blogging, wikis, shared bookmarks
- 3M Tech Ed: 3Mers teaching global technical colleagues
- Sharepoint: Virtual team collaboration spaces
- 3M TV: Global video knowledge transfer
- DIY Video: 3M’s internal YouTube
- 3M Wiki Enterprise: 3M’s Wikipedia
- vTIE: Virtual technical information exchange event
- DMR: Digital media repository for image sharing
- 3M TV: Global video knowledge transfer
- DIY Video: 3M’s internal YouTube
- 3M Wiki Enterprise: 3M’s Wikipedia
- vTIE: Virtual technical information exchange event
- DMR: Digital media repository for image sharing
Global Tech Forum Networking

3M’s Secret Weapon
The Key to Innovation

One Impassioned & Empowered R&D Organization
Transcending Organizational Boundaries
3M Tech Forum

Innovating Influencing Inspiring Invincible

Are you In?
7 Elements of Innovation

- Connected to Customer Need
- Networking
- Measurement Accountability
- Ready Access to Multiple Technologies
- Relation To Vision/Business Model
- Key Element of Corporate Culture
- An Individual Expectation

3M Innovation
Personal Expectations

**Dual Ladder**

3M has two parallel career paths in the technical organization. In addition to management, there is a technical path which is identical in prestige, position, compensation and perks. It allows employees to be promoted without abandoning what they do best -- research and development.

The highest level on the technical side is corporate scientist.

3M's former CEO Allen Jacobson described the Dual Ladder System, "Some innovative people would rather face mustard gas than budget forecasts. What these people need is a system that rewards them for their innovative abilities, without forcing them into a manager's desk, where they'll be miserable."

Career progression is tied to:
- technical content
- commercial contribution
- and recognized leadership
**Circle of Technical Excellence & Innovation**
- Annual Award
- ~330 Individual Awards Globally
- ~ 75 Team Awards Globally
- Peer Nomination/Selection

**Carlton Society**
- 3M’s Hall of Fame
- Peer Nomination
- 170 Total Members

**3M Genesis**

**Genesis Grant**
- $50-100K Grants to Support Non-Job Related Innovation
- ~15-20 Awards Annually
- Creates New Products
- Reinforces Culture
7 Elements of Innovation

- An Individual Expectation
- Connected to Customer Need
- Networking
- Ready Access to Multiple Technologies
- Measurement Accountability
- Key Element of Corporate Culture
- Relation To Vision/Business Model

3M Innovation
### 3M R&D Balanced Scorecard

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Financial</strong></td>
<td>• Top Line New Product Revenue Growth</td>
</tr>
<tr>
<td></td>
<td>• R&amp;D Spend</td>
</tr>
<tr>
<td><strong>Business Processing</strong></td>
<td>• Product Speed to Market</td>
</tr>
<tr>
<td></td>
<td>• Deliver on Financial Forecasts</td>
</tr>
<tr>
<td></td>
<td>• Technology Introduced into Products</td>
</tr>
<tr>
<td><strong>Intellectual Property</strong></td>
<td>• Number of Annual Patents Issued</td>
</tr>
</tbody>
</table>
7 Elements of Innovation

- Connected to Customer Need
- Measurement Accountability
- Networking
- Ready Access to Multiple Technologies
- Key Element of Corporate Culture
- Relation To Vision/Business Model
- An Individual Expectation

3M Innovation
3M’s First Customer Inspired Innovation…

Two-tone cars were in demand…

But a clean paint line was very hard to achieve…

Which 3Mer Dick Drew observed while visiting to sell sandpaper…

…and he remembered some stuff he’d seen in the laboratory…
Customer Technical Centers …

Japan

Brazil

U.S.

Mexico

…Places to Innovate
Questions / Thoughts for the next few days...

7 Elements of Innovation
7 Elements of Innovation

- Connected to Customer Need
- Key Element of Corporate Culture
- Networking
- Ready Access to Multiple Technologies
- Measurement Accountability
- An Individual Expectation
- Relation To Vision/Business Model

3M Innovation

- Is Innovation the primary driver for your respective organizations?
- Is there a path from Innovation to commercialization and business building?
7 Elements of Innovation

- Can you define your organization’s culture? Is it aligned with Innovation?
- How do we innovate effectively across entities having different cultures?
7 Elements of Innovation

- Connected to Customer Need
- Networking
- Measurement Accountability
- Ready Access to Multiple Technologies
- An Individual Expectation
- Key Element of Corporate Culture
- Relation To Vision/Business Model

3M Innovation

- The U.S. has the technology. We seem to lack the incentive to innovate, commercialize, and build businesses
- Critical to allow foreign nationals educated in the U.S to remain in the U.S.
7 Elements of *Innovation*

- **An Individual Expectation**
- **Key Element of Corporate Culture**
- **Relation To Vision/Business Model**
- **Ready Access to Multiple Technologies**
- **Networking**
- **Measurement Accountability**
- **Connected to Customer Need**

In spite of e-tools...open, free-flowing collaboration across organizations is a challenge.

Is conventional IP management a barrier to open networking?
7 Elements of Innovation

- Connected to Customer Need
- Measurement Accountability
- Ready Access to Multiple Technologies
- Relation To Vision/Business Model
- Key Element of Corporate Culture
- Networking
- An Individual Expectation

- Is career development aligned with Innovation within your organization?
- New university graduates seem more attuned to Innovation than ever before
7 Elements of Innovation

1. Connected to Customer Need
2. Networking
3. Ready Access to Multiple Technologies
4. Measurement Accountability
5. Key Element of Corporate Culture
6. An Individual Expectation
7. Relation To Vision/Business Model

- How does your organization measure Innovation?
- Need common metrics across collaborating organizations
7 Elements of Innovation

- An Individual Expectation
- Key Element of Corporate Culture
- Networking
- Ready Access to Multiple Technologies
- Relation To Vision/ Business Model
- Measurement Accountability
- Connected to Customer Need

- The reason we exist
- What is the connection between “Technology Providers... Customers.... and Commercializers?”

3M Innovation
It is driven by a system of principles and practices which support and encourage the coupling of technology and creativity to satisfy customer needs.