A Path to the Realization of “A Day Made of Glass”

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A Day Made of Glass 2 – Advancing the Vision
Corning Incorporated

**Founded:**
1851

**Headquarters:**
Corning, New York

**Employees:**
29,000 worldwide

**2011 Sales:**
$7.9 Billion

**Fortune 500 Rank (2012):**
328

Corning is the world leader in specialty glass and ceramics.

We create and make keystone components that enable high-technology systems for consumer electronics, mobile emissions control, telecommunications, and life sciences.

We succeed through sustained investment in R&D, more than 150 years of materials science and process engineering knowledge, and a distinctive collaborative culture.
## Corning Market Segments and Additional Operations

<table>
<thead>
<tr>
<th>Segment</th>
<th>Products/Services</th>
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<tbody>
<tr>
<td><strong>Display Technology</strong></td>
<td>- LCD Glass Substrates&lt;br&gt;- Glass Substrates for OLED and high-performance LCD platforms</td>
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<tr>
<td><strong>Telecom</strong></td>
<td>- Optical Fiber and Cable&lt;br&gt;- Hardware and Equipment&lt;br&gt;- Fiber optic connectivity products</td>
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<tr>
<td><strong>Environmental Technologies</strong></td>
<td>- Emissions Control Products&lt;br&gt;- Light-duty gasoline vehicles&lt;br&gt;- Light-duty and heavy-duty on-road diesel vehicles&lt;br&gt;- Heavy-duty non-road diesel vehicles&lt;br&gt;- Stationary</td>
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<tr>
<td><strong>Life Sciences</strong></td>
<td>- Cell Culture and Bioprocess&lt;br&gt;- Assay and High-Throughput Screening&lt;br&gt;- Genomics and Proteomics&lt;br&gt;- General Laboratory Products</td>
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<td><strong>Specialty Materials</strong></td>
<td>- Corning® Gorilla® Glass&lt;br&gt;- Display Optics and Components&lt;br&gt;- Optical Materials&lt;br&gt;- Semiconductor materials&lt;br&gt;- Specialty fiber&lt;br&gt;- Polarcor™&lt;br&gt;- Optics&lt;br&gt;- Aerospace and Defense&lt;br&gt;- Ophthalmic</td>
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<td><strong>Other Products and Services</strong></td>
<td>- Emerging Display Technology&lt;br&gt;- Drug Discovery Technology&lt;br&gt;- New Business Development&lt;br&gt;- Equity Companies&lt;br&gt;- Cormetech, Inc.&lt;br&gt;- Dow Corning Corp.&lt;br&gt;- Eurokera, S.N.C.&lt;br&gt;- Samsung Corning Precision Materials Co., LTD (SCP)</td>
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Innovation Recipe Drives Strategic Actions

Deep understanding of a specific technology

Identification of customers’ difficult systems problems

Demanding Requirements

Material + Process

Unique Keystone Component
A component that is a system enabler

Differentiated by:
Uniqueness
Intellectual Property
Specialized Capital Investment
Outline

• The history of a trend…and the making of a vision
• Underlying technology…what is real, what is ready, what is not
• Opportunities and Challenges
Key themes of display with glass as the common denominator…why?

Vivid

Large

Novel

Interactive

GLASS

3D TV DISPLAY GLASS
Vivid & Immersive, Frameless Design, Next-Gen High

WALL-FORMAT DISPLAY GLASS
Durable, Seamless Wall-Size Coverage, Touch Sensitive

WALL-FORMAT DISPLAY GLASS
Durable, Seamless Wall-Size Coverage, Touch Sensitive
Attributes needed to realize the vision of DMOG

**DISPLAY**
- Thin
- Light weight
- High resolution
- Small-large size
- Damage resistant
- Flexible
- Bezel free
- Touch
- Smudge free
- Anti-microbial
- Low power
- Environmentally friendly

**COMMUNICATION**
- Bandwidth
- High speed
- Wireless
- Flexible
- Software
- Device to device communication
Our products in the value chain for Ubiquitous Connectivity & Display

Information Delivery

Information Display

User Interface: Touch Screen Cover

Corning Optical Fiber, Cable, Components & Wireless Solutions

EAGLE XG® & Lotus™ Substrate Glass for High Performance LCD & OLED

Corning® Gorilla® Cover Glass
A Day Made of Glass…”Why Glass”?

Consumers want to interact with information anytime, anywhere

Specialized glass delivers enabling attributes at the human visual & tactile interface

- Vivid & Compelling Display
- Accurate & Engaging Touch Experience
- Light, Slim & Green
- Value Add (e.g. Sound)
- 3D
- Thin
- Superior Optical Qualities
- Conformable
- Superior Mechanical Attributes
- Precision Surface
- Green
Damage resistance is a critical attribute for many applications

Greater damage resistance.

It takes more load to initiate radial cracks in the glass.

Greater retained strength.

There is less strength degradation after scratching.
High Resolution display is required for next generation display

- Lower compaction
- Lower compaction variation
- Higher modulus
- Enhanced mechanical properties
Internet growth has enabled display revolution which in turn drives need for bandwidth.

Source: Corning
A virtuous cycle enabled by Corning capabilities

More HD Visual Content → Increasingly Vivid Display → More & Larger Screens → Increased System Bandwidth → More HD Visual Content
A Technology Scale applied to key effects in the original “Day Made of Glass” video

Here & Now
Just Add Money
Eventually Achievable
Challenging
Very Challenging
Interactive Bathroom Mirror

• Displays in mirror exist today – very expensive, just for TV and non-interactive
• It would be possible to use existing technology to incorporate touch
• Requires additional function to toggle between reflective & viewable.
Multifunctional Kitchen Surface
Specialty glass enables PV application

Demonstrated 2% improvement in efficiency
Flexible Display, Transparent Display, Displays Talking to Displays
Corning’s ultra-slim glass is flexible enough to be rolled

Typical 100µm thick glass can be rolled on a 150mm spool
Large-Format Sunlight-Readable Displays
Autostereoscopic 3D

HANDHELD DISPLAY GLASS
Thin & Lightweight, Damage Resistant, 3D-Projection Ready

3D TV DISPLAY GLASS
Vivid & Immersive, Thin & Lightweight, Frameless Design
Challenges with the Day Made of Glass Vision
Smudge free surface enhances touch - Progress made with anti-smear coating

Easy to Clean (Smudges) vs. Anti-Smear (Reduced Smudges)
Low Cost, High Volume Capability For 3D Parts
Edge-to-edge Display

Technology to create bezel-free display is under development
Anti-microbial surfaces with high kill rate and low cost will enable new applications

* Based on JIS Z 2801 Japanese Test for Anti-microbial Activity and Efficacy
A Day Made of Glass Vision for the Future Connected Home

A combination of wireless and fiber connectivity

- HDTV display
- Wireless base
- Fiber connectivity
- Network switches
- PC and storage
- Control devices
- DVR
- Camcorder
- Gaming console
Device-to-device communication can be enhanced by 60 GHz technology and AOC

USB 3.0 at 4.8 Gb/s

Copper
2m max length
Bulky

Fiber
50m length
Small, light, flexible
Challenges

• Combine functionality
• Anti smudge
• Glass mold interaction
• Lower loss fiber
• Low temperature sealants
• Role of Sodium in CIGS
• Lower cost high strain point glass
• Modeling of composition
• Process innovation
Acknowledgements

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