Albemarle Catalysts: Growth Vision & Strategies

John Nicols
Vice President, Catalysts

Longbow Research
Albemarle Bayport Plant Visit
September 11, 2007
Albemarle Catalysts
Analyst Road Show, September 2007

- Financials

- Strong Market Fundamentals
  - General
  - HPC
  - FCC
  - Alternative Fuels
  - Polyolefin Catalysts

- Albemarle Strategies For Profitable Growth

- Conclusions / Q&A
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Catalysts: ‘Company Changing’ Segment → Step Out Growth

**Net Sales**
Dollars in millions

<table>
<thead>
<tr>
<th>Year</th>
<th>02</th>
<th>03</th>
<th>04</th>
<th>05</th>
<th>06</th>
<th>1H'07</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>92</td>
<td>83</td>
<td>*283</td>
<td>738</td>
<td>839</td>
<td>443</td>
</tr>
</tbody>
</table>

**Segment Income (excluding special items)**
Dollars in millions

<table>
<thead>
<tr>
<th>Year</th>
<th>02</th>
<th>03</th>
<th>04</th>
<th>05</th>
<th>06</th>
<th>1H'07</th>
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<tbody>
<tr>
<td></td>
<td>12</td>
<td>13</td>
<td>35</td>
<td>92</td>
<td>123</td>
<td>72</td>
</tr>
</tbody>
</table>

* Akzo Nobel Refinery Catalyst acquisition Aug. ’04
Focused & Driven For Catalysts

- Great Acquisition For Albemarle
- Great Acquisition For This Catalyst Business
- Complementary Strengths Continue To Merge Together
- One Company Culture Emerging Where Were Two

Catalysts Are Core To Albemarle

- Fine Chem = 26%
- Polymer Add's = 39%
- Catalysts = 35%

% of Albemarle's 2006 Sales Of $2.4 Billion Globally
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World conversion capacity additions are expected to be strong as the industry responds to tight capacity . . .
Crude Toward Heavier and Higher Sulfur

Source: Hart World Refining and Fuels Service
Two Basic Functions That Albemarle Catalysts Serve For Refineries

Objective
- Clean
  - Remove impurities from crude oil and other petroleum streams/products

Examples of key processes
- HPC pretreatment
- HPC post-treatment
- Resid hydrotreating

- Product slate
  - Allows refiners to produce a desired product mix from crude oil

Examples of key processes
- Fluidized cat cracking (FCC)
- Hydrocracking
- Isomerization
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Hydroprocessing Catalysts (HPC)

- Nickel-Molybdenum (NiMo) catalysts are preferred for hydrogenation and hydrodenitrogenation (HDN)
- Cobalt-Molybdenum (CoMo) catalysts are preferred for hydrodesulfurization (HDS)
- Tri-metallic (NiCoMo) catalysts are sometimes used to achieve a balance of HDS and HDN
Reduced Limits on Sulfur, Aromatics etc

* Also 500 ppm from 2003 and 350 ppm from 2006

** Northwestern frontier zone

Source: International Fuel Quality Center, June 2006
HPC Volume Fundamentals

Cat/barrel (1990 = 100)

Catalyst Demand

Oil Consumption

MM Bpd/KMT/y

Albemarle’s Hydroprocessing Catalysts: Growth, Differentiation, Advantage

We Offer:

- **Leading Portfolio of grades for all major applications**
- **Custom tailored “stacks”**
- **Total Catalyst Management**

![Market growth (t/a)](chart1)

![Activity progression](chart2)
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Fluid Cracking Catalysts (FCC)

**Binder**
- Silica or Alumina

**Functional Components**
- Crystalline Silica/Alumina,
- ... .......

**Filler**
- Clay

**Pores**

**Zeolites**
- Y, ZSM-5

- Accessibility/strength
- Active ingredients
- Sinter resistance
- Low cost/large scale
- Endless Differentiations

65 µm
Global FCC Supply & Demand (Excluding China)

Global Capacity = 536kt

Albemarle Estimates
Albemarle’s FCC Catalysts
Profit Growth Outlook Bright

• *Unique Value Through Differentiated Technology & Customer Servicing*

• *Improved Value Through Tightening Supply & Demand Fundamentals*
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Renewable Fuels Outlook 2020

- Alternative liquid transportation fuels expected to grow at 7.3%, from 2.3 to 5 million BPD.
  - Biofuels expected to grow at 15% pa, from 430 BPD to 2.2 million BPD.

- With mandates, biofuels could grow to higher levels

- Feedstock diversity will become increasingly important with coal, NG and renewable playing a bigger role
Albemarle Alternative Fuels Technology
Developments Across CTL / GTL / Biomass Conversion

(remote) GAS
Steam Reforming
Coal Gasification
Fischer Tropsch
Upgrading
DIESEL
COAL
Coal Gasification
Biomass Gasification

BIO-MASS
Vegetable Oil Crop
Veg. Oil Hydroconv.
Upgrading
“BIO” DIESEL

Albemarle Catalyst Developments Across
Albemarle Catalysts
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Polyolefins Global Market
Growing Almost 2 x GDP

Projected PE growth rates by region
(2004 to 2009)

Mideast/Africa
Other Asia Pacific
China
Japan
East Europe
West Europe
Latin America
North America

World average = 5%

AAGR, % per year

CMT Asia Olefin Conference – June 07, 2006
The Polyolefin Value Chain

Polyolefin Manufacturer

- Reactor
- Extruder
- Compounder
- Fabricator
- Consumer

Refiner

- Ethylene
- Propylene

Catalyst

- Single Site Catalysts
  - Finished catalysts
  - Activators
    - MAO
    - Organoborons
    - Other proprietary systems
  - Metallocene manufacture
- ZieglerNatta
  - Finished catalysts
  - Organometallics

Additives

- Custom Blends containing:
  - AOX
  - Stearates
  - Clarifiers
  - Other proprietary ingredients

Additives

- AOX
- Flame retardants

Albemarle’s offering
Supports
PO Value Chain
Albemarle Catalysts Integral To Polyolefins

**Ziegler-Natta**

\[ \text{MgCl}_2 / \text{TiCl}_4 / \text{donor ligand} / R_x\text{AlCl}_{3-x} \]

- Generic Polymer Properties
  - Broad MW distributions
  - Comonomer incorporation less consistent
  - Less stereo-specific
- Lower catalyst costs

**Albemarle Offerings:**

- Leading Organometallic Producer
- Custom Finished Catalysts

**Metalloocene/Single-site**

- Unique Polymer Properties
  - Narrow MW distribution
  - Comonomer incorporation well controlled
  - New Stereo-specific polymers
- Higher Catalyst Cost

**Albemarle Offerings:**

- Leading MAO Producer
- Custom Metalloccenes
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Albemarle Catalysts

VISION: The World’s Leading Catalyst Solution Provider

Strategies To Accomplish:

I. Invest To Serve Selected Customers & Segments Where Our Service & Technology Are Valued

II. Build & Operate Globally Optimized, Low Cost, Environmentally Sound Manufacturing Technologies

III. Leverage External Partner Competences Into Our Global Business Systems

IV. Invest To Develop New, Sustainable Product Technologies And To Enter Attractive New, Sustainable Market Arenas

V. Position For Leadership In World’s Fastest Growing Regions

VI. Acquire For Consolidation & To Extend Catalyst Market Reach

Continue Step – Out GROWTH
External Execution Is Key

CUSTOMERS & MARKETS

SALES & SERVICE

COMMERCIAL TECHNOLOGY

BUSINESS MGMT

Roles
- Develop Account Strategies
- Build Broad & Deep Relationships
- Negotiate Optimum Value
- Maintain Excellent Customer Information Systems

- Develop Segment & Pricing Strategies
- Cross Functional Coordination / Planning
- New Product Priorities To R&D
- Capital & Resource Deployment

- Application Technology Excellence
- Develop & Maintain Key Technical Relationships In Industry
- Apply Newly Developed Technologies
- Product Quality “Cops”
- Maintain Excellent Technical Information Systems

Metrics
- Share of Wallet
- Overall Customer Satisfaction
- Growth & Margins

- Market Share
- Profit & Loss
- Growth & Margins

- Tech Proposal Success Rate
- Growth & Margins
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Continue Step – Out GROWTH
Nebula: World’s Most Active Hydroprocessing Catalyst

- Nebula 20: Industry Breakthrough Penetrating
- Nebula 30: 50% More Active
- More Tech Enhancements In Development
High Throughput Experimentation (HTE)

- Foundational element of new catalyst development
- >5 fold increase in ideas tested
Lower Sulfur Gasoline Needed in the Future

- Lower sulfur gasoline enhances operation of vehicle emission control hardware that can significantly reduce emissions
- The Refining Industry has made significant advances in last decade to produce lower sulfur in gasoline while still meeting key gasoline quality specifications
- SCANfining removes sulfur from key refinery streams while conserving octane

<table>
<thead>
<tr>
<th>Region</th>
<th>Current Sulfur, ppm</th>
<th>Future Sulfur, ppm (date)</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>California</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>EU</td>
<td>50/10</td>
<td>10 (2009)</td>
</tr>
<tr>
<td>Japan</td>
<td>50/10</td>
<td>10 (2008)</td>
</tr>
<tr>
<td>Korea</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Thailand</td>
<td>500</td>
<td>50 (2012) Proposed</td>
</tr>
<tr>
<td>Singapore</td>
<td>500</td>
<td>10 (2010) Proposed</td>
</tr>
<tr>
<td>China</td>
<td>150/500</td>
<td>150 (2010) Proposed</td>
</tr>
</tbody>
</table>
Large Number of New Catalysts Screened

- Nearly 500 new catalyst formulations tested with HTE method in ~6 months
  - Wide variety of materials and synthesis conditions
  - Differences in performance readily identified

In collaboration with Symyx

RT-235 Discovery
Propylene Market

MT Propylene / MT Ethylene

Propylene demand increasing faster than supply from conventional sources

Growing Demand For "On-Purpose" Propylene

Source: CMAI 2005
Leading Industry To Increase Propylene Yields


- Amorphous
- Zeolitic Cracking
- Riser Cracking
- Resid Cracking

- **ZSM-5 Additives**
  - K1000
  - K2000
  - ZOOM

- **Novel Additives**
  - Provantage
  - Provantage-R

- **Max Propylene Catalysts**
  - AFX

Novel ZSM-5 Additives
State of the Art ZSM-5 Additives
Max propylene catalysts
Max Propylene
Quality of Future Crude Oil Feeds

- Steady trend towards higher density, higher sulfur and more acidic crudes
- Growth of oil sands and other non-conventional sources
- Sources of New Oil Production:
  - OPEC Expansions
  - Deep Ocean
  - Arctic
  - Heavier Fields
  - Tar Sands

API Gravity and Sulfur Content over Time
Source: EIA
Leading Industry For Heavy Crude Conversion

Amorphous


Zeolitic Cracking

Riser Cracking

• **Topaz**
  – Accessibility
  – New Upgrader

• **Novel Additives**
  – Resolve 950
  – Eliminox

High SAR Zeolites for maximum stability

Ni & V Traps

Topaz Technology Platform for high AAI

Resid Cracking

Max Propylene
World Petroleum Product Demand

- Gasoline and Distillate is over 80% of the Petroleum Demand
- Distillate experiences fastest growth, due to increased trucking.

Source: Hart World Refining & Fuels Service, 2006
Changing the FCC Product Slate

- Lt. Olefins
  - Petrochemical feedstock >10% of feed
- Additives
- Gasoline
  - Gasoline volume reduced
- Catalyst
  - Increase volume
  - Reduce aromaticity
- LCO
- Fuel Oil
  - Demand going down
  - Low sulfur required
Albemarle Catalysts

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Continue Step – Out GROWTH
Largest Increased Product Demand in Asia

Average annual percent growth noted inside bar

* China Annual Growth average 5.7%

Incr. Demand 2005-2020 MMBPD

<table>
<thead>
<tr>
<th>Region</th>
<th>Demand Increase</th>
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<tbody>
<tr>
<td>North America</td>
<td>1.3 MMBPD</td>
</tr>
<tr>
<td>Latin America</td>
<td>1.3 MMBPD</td>
</tr>
<tr>
<td>West Europe</td>
<td>0.6 MMBPD</td>
</tr>
<tr>
<td>SE Europe</td>
<td>2.0 MMBPD</td>
</tr>
<tr>
<td>CIS</td>
<td>2.4 MMBPD</td>
</tr>
<tr>
<td>Asia Pacific</td>
<td>*3.0 MMBPD</td>
</tr>
<tr>
<td>Middle East</td>
<td>2.7 MMBPD</td>
</tr>
<tr>
<td>Africa</td>
<td>2.3 MMBPD</td>
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</table>

Source: Hart World Refining & Fuels Service
Polyolefin demand growth
China becomes largest global market

Source: Borouge and Borealis
Middle East becomes a major exporter of ethylene derivatives

Source: Borouge and Borealis - 2010 versus 2015
Position For Leadership In World’s Fastest Growing Regions

• New Dubai Office To Serve Middle East & India

• Continue Build Up Of Infrastructure In China
  – Sales Offices Today In Beijing, Shanghai & Guangzhou
  – New R&D Center In Nanjing
  – Nanjing Organometallic Repackaging

• Build Up To Serve Rest of Asia
  – ALB Korea in Seoul
  – Alb Asia Pacific in Singapore
  – Nippon Ketjen For HPC

Invest To Serve Developing World’s Customers & Needs
Consideration Of More Strategic Options That Make Economic Sense
Leverage External Partner Competences Into Our Global Business Systems

<table>
<thead>
<tr>
<th>Business Process</th>
<th>ALB Controlled</th>
<th>Externally Controlled</th>
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</thead>
<tbody>
<tr>
<td><strong>R&amp;D</strong></td>
<td>Amsterdam, Houston, Baton Rouge</td>
<td>NK, FCCSA, Other R&amp;D Alliances</td>
</tr>
<tr>
<td><strong>Sales</strong></td>
<td>Clear Lake, Amersfoort, Baton Rouge</td>
<td>NK, FCCSA, NAA, UOP Alliance</td>
</tr>
<tr>
<td><strong>Manufacturing</strong></td>
<td>Amsterdam, Houston, Baton Rouge</td>
<td>NK, FCCSA, NAA</td>
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<tr>
<td><strong>Total Catalyst Mgmt</strong></td>
<td>REACT</td>
<td>Eurecat, NK</td>
</tr>
<tr>
<td><strong>Hydrotreat Design</strong></td>
<td></td>
<td>UOP Alliance</td>
</tr>
</tbody>
</table>

- **Setup To Extract Maximum Benefits:**
  - Capital Sharing
  - Idea / IP Generation & Global Translation
  - Improved Global Reach & Service Capabilities
  - Expansion Of Albemarle’s Service Offerings

- **Requires:**
  - Partners’ Continuous Alignment
  - Complex Coordination Systems

*We Know How To Create & Sustain Long Term Partnership Value*
Albemarle Catalysts

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*Continue Step – Out GROWTH*
Acquire for consolidation and to extend Albemarle’s catalyst market reach

$12 billion catalysts industry

3-5% growth annually

~$500MM/yr

source: SRI, 2004
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Albemarle’s Drive To Become
The World’s Leading Catalyst Solution Provider

Lead PO Components Supplier
→ Lead Refinery Catalyst Solution Provider
→ Leverage To Become Broader Solution & Service Provider To Polymers
→ Alternative Fuels Catalyst Leader
→ Lead in Asia & Mid East
→ Synergistic Acquisitions
→ Best New Technologies

STEP – OUT GROWTH
Questions?