invites the public to the
36th Sir Winston Scott Memorial Lecture
to be delivered by

Barbadian Prof. The Hon. Cardinal Warde
Professor of Electrical Engineering,
Massachusetts Institute of Technology
Internationally-recognised scientist and distinguished educator, recipient of numerous honours and awards including The Companion of Honour of Barbados, November 2003

ON THE TOPIC
"Science, Technology and Business Education Reform for the Caribbean"

Monday, November 21, 2011 - 8:00 p.m.
at the Frank Collymore Hall.
Science, Technology and Business Education Reform for the Caribbean

Prof. Cardinal Warde
Interim Executive Director of the Caribbean Science Foundation
and
Professor of Electrical Engineering
Massachusetts Institute of Technology

November 20, 2011

MIT Photonic Systems Group
Department of Electrical Engineering & Computer Science

warde@mit.edu
My Limited Credentials

MIT Faculty Director for:

1. STEM (Science Technology Engineering and Math)
   A five-week summer program for students entering 6th, 7th, 8th or 9th grade followed by a 9-month mentoring program

2. SEED (Saturday Engineering Enrichment and Discovery)
   Hands-on curriculum strengthens foundational math, science and communication skills of 9th and 10th graders

3. MITES (Minority Introduction To Engineering and Science)
   6-week residential program for high school seniors
   Core courses: Physics (I, II, or III), calculus (I, II, or III), Humanities, and either chemistry, biochemistry, or biology
   Hands-on Enrichment Courses: Digital Design, Engineering Design, Genomics, Architecture or Electronics

Also served on two advisory boards of the New England Board of Higher Education
A MITES Superstar

SEED students at work

Mites Class of 2011
Challenges in the Region

• Weak entrepreneurial culture
• High unemployment
• High import bill - Low exports
• Weak Infrastructure (roads, schools, ports, etc.)
• Inadequate inter-island transportation systems
• Digital divide
• **Educational systems in need of reform**
• Low levels of relevant research and development
• Food insecurity
• Energy insecurity
• Inadequate health care problems
• Poverty and crime
• Environmental damage at sea and on land
The Challenges of Education Reform

• What is it?

• Why do we want it?

• Is it really necessary?

• What is the purpose of Education?

• How do we achieve it?
<table>
<thead>
<tr>
<th>Rank</th>
<th>Country</th>
<th>Literacy Rate [between 1995 and 2005]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Georgia</td>
<td>100.0</td>
</tr>
<tr>
<td>2</td>
<td>Cuba</td>
<td>99.9</td>
</tr>
<tr>
<td>2</td>
<td>Estonia</td>
<td>99.8</td>
</tr>
<tr>
<td>2</td>
<td>Latvia</td>
<td>99.8</td>
</tr>
<tr>
<td>5</td>
<td>Barbados</td>
<td>99.7 [2003 UNESCO data]</td>
</tr>
<tr>
<td>5</td>
<td>Slovenia</td>
<td>99.7 [2007 UNESCO projection]</td>
</tr>
<tr>
<td>5</td>
<td>Belarus</td>
<td>99.7</td>
</tr>
<tr>
<td>5</td>
<td>Lithuania</td>
<td>99.7</td>
</tr>
<tr>
<td>5</td>
<td>Ukraine</td>
<td>99.7</td>
</tr>
<tr>
<td>5</td>
<td>Armenia</td>
<td>99.7</td>
</tr>
<tr>
<td>11</td>
<td>Kazakhstan</td>
<td>99.6</td>
</tr>
</tbody>
</table>

Source: http://en.wikipedia.org/wiki/List_of_countries_by_literacy_rate
Source: Registrar’s blog at www.CXC.org
A few Questions for “Barbados”

• We boast greater than 97% literacy. That’s truly impressive!!

• Why are we a nation buried in debt? Why can we not feed ourselves?

• Yes, we have computers in the classroom. What happened?

• Why are we still lagging behind in reforming our educational system?

• In love with the 11+ exam? Why? Brainwashed?
Signs of Hope

1. The will to change in face of limited budgets is still lacking in most countries, but we are beginning to talking about it in the Region

2. I understand that St. Kitts has eliminated the 11+ exam

3. CXC is taking positive action and will have to significant leadership role in the way forward

4. Re-examine the guiding principles on which CXC operates (your constitution)
WHY WE NEED TO REDEFINE EDUCATION

There are five main reasons why we need to redefine education in the Caribbean:
1. Tinkering with the system no longer works; we need a new vehicle of human empowerment and social transformation
2. The implications of the internationalization of education in a globalized world
3. The rapid obsolescence of knowledge in the information revolution
4. Our education systems are no longer working
5. Education is too rapidly becoming a panacea for all problems

Source: Registrar’s blog at www.CXC.org
CXC’s Guiding Principles include:

1. **Ideal CARICOM Person** (adopted as far back as July 1997 by Caribbean Heads of Government)
2. **UNESCO Imperatives for Learning** specifies the abilities that ought to be developed

| Learn to Live Together | • Communications  
|                        | • Conflict resolution  
|                        | • Cultural sensitivity  
|                        | • Multi-lingualism  |
| Learn to Be            | • Self-esteem  
|                        | • Emotional intelligence  
|                        | • Critical thinking  
|                        | • Cultural awareness  |
| Learn to Do            | • Skills  
|                        | • Capacity to act  
|                        | • Ability to apply knowledge  |
| Learn to Learn         | • Solid academic base – reading & numeracy  
|                        | • Comprehension  
|                        | • Ability to research and analyze  |
The Leaky Pipeline

The pyramid Principle

Choices:
Make the base larger and plug the leaks

http://www.mathsisfun.com/geometry/pyramids.html
Low-Cost Approaches

Children are naturally curious. Exploit it early
Ignite curiosity early

Hands-on learning the key

Purchase science-based toys for your children

Learn from low-cost approaches and examples in Chile, France, Venezuela
Use of computers in Education

1. Good for repetitive learning 24/7 at any pace
   (a) Salman Khan -- founder and faculty of Khan Academy (www.khanacademy.org)
   (b) Dr. Janak Sodha at UWI (Barbados)

2. Information searching and researching complements libraries
   Can enhance creativity
   Information is power – innovation

3. Demonstrations and simulations
   (not a total replacement for the hands-on experience)
Nuture the Superstars, especially the nerds

- While you need the “science is cool” factor for the masses,
- Identify exceptional talent in S or T in the early years (not necessarily the most scholarly)
- Identify the creative geniuses in the early years
- More Mathematics Olympiads
- More Science Fairs
- More Science museums
- Feature winners on TV
- Teachers must have clear sense of what to do when they spot talent – new mentors, incubators, internships, special summer programs, etc
- Send some to CSF!!
Teacher Training in STEM

• CSF with private sector will intervene here!

• Must find ways to motivate the teachers like we do the children

• We will show by example what is possible with trained teachers and our STEM-rich curriculum in a few pilot programs.
Governing Council

Sen. The Hon. Franka Alexis-Bernardine – Min. of Ed. Grenada
Mr. Nicholas Brathwaite - Partner & CTO, Riverwood Capital
Dr. Jeanese Badenock – UWI, Barbados
Dr. Basil Burke - UWI Consulting
Prof. John-Paul Clarke - Georgia Institute of Technology
Dr. Sheena Francis- UTech, Jamaica (Young Scientists Rep)
Dr. Ken Harewood - formerly North Carolina Central University
Dr. Jermey Matthews - Associate Editor, AIP
Mr. Dodridge D. Miller- CEO, Sagicor Insurance
Prof. Baldwin Mootoo - UWI, Trinidad - Treasurer
Prof. Suresh Narine - Trent University, Ontario, Canada
Mr. Hollick Rajkumar - Managing Director, HRC Associates
Senator-Professor Harold Ramkissoon - UWI, Trinidad & Tobago
Mr. Ravi Ramkissoon - Oracle Corp, Redwood Shores, CA
Mr. Robert Riley, BP, London
Dr. Brian Tom - Cambridge University, Cambridge, England
Dr. Dinah Sah - V.P. Research, Alnylam Pharmaceuticals
Prof. Maya Trotz - Univ. of South Florida, Tampa, FL, USA
Dr. Arnoldo Ventura - Former Science Adviser to Jamaica PM
Mr. Richard Vieira - BMO Capital Markets
Professor Cardinal Warde - MIT (President of CADSTI)
Mr. Gervase Warner - CEO, Neal & Massy
Mr. Richard Williams - RFW Associates
Chair of the Caribbean Council for Science and Technology
Honorary Board of Governors of CSF

- Prime Minister responsible for S&T in the CARICOM
- President of Caribbean Association of Industry and Commerce
- President of the Caribbean Academy of Sciences (CAS)
- Executive Secretary of CARISCIENCE
- Hon. P. J. Patterson (former prime minister of Jamaica)
- Mr. Bowen Wells (former UK MP)
- Mr. Chris Rowlands (former Director of 3i Investments - Managing Partner for Asia)
- Sir Harold W. Kroto (1996 Nobel Laureate, chemistry)
- Dr. DeLisle Worrell, Governor of the Central Bank of Barbados
Caribbean Science Foundation: Mission

Assist with the diversification of the economies of the Caribbean Region, and to help raise the standard of living. Specifically, the CSF will help:

- Stimulate technology-based entrepreneurship - by identifying and funding science and technology projects in new and existing enterprises that are relevant to the economic development needs of the Region.

- Accelerate education reform that supports technology-based entrepreneurship - by promoting and funding programs that: (i) focus on the STEM (Science, Technology, Engineering and Math) disciplines, (ii) business and entrepreneurship education, and (iii) foreign languages and communication skills in schools, universities and other educational venues.

- Provide scientific and engineering advisory services to Caribbean governments - by working with CADSTI to leverage the expertise that resides in the Diaspora.
CSF’s Education Initiatives

- Curriculum Pilot Development: STEM, Innovation, foreign languages, business and entrepreneurship in primary schools and high schools
- Will include learning by doing, and competitive project-based assignments, often in teams. Winners will be celebrated
- Partnerships with Ministries of Education
- Partnerships with the business community
- Partnerships with CXC
- Partnerships with Universities in the Region
- Ignite discussions on re-engineering the university
  - Professors as entrepreneurs
  - Incubator formation when none exists
  - HS student Internships and special programs
MAJOR AREAS OF FOCUS FOR CSF

Major technology areas of focus include:
- Energy, Water and Materials
- Transportation
- Agriculture and Food Science
- Manufacturing
- Information and Communication Technologies (ICT)
- Environmental Science and Engineering
- Medicine and Health Care
- Crime Prevention
CSF Advisory Role to Governments and industry

- Assembles scientific advisory bodies
- Assists with the harmonization of regulations (especially safety) and the setting of industry standards, especially in rapidly evolving areas such as biotechnology, nanotechnology and genetic engineering.
- Assists in the formation of agreements and creation of funds together with governments and NGO’s to actively support and encourage industrial R&D cooperation between Caribbean industries and industries overseas.
- Helps the Governments of the Region to identify national needs as well as suitable technologies that match those needs.
- Assists in identifying and removing impediments, while helping to build the infrastructure for mutually beneficial economic and technological development.
## Funding Breakdown Goal by Percentage

<table>
<thead>
<tr>
<th>Donor</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 10</th>
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</thead>
<tbody>
<tr>
<td>International agencies/organizations</td>
<td>50%</td>
<td>50%</td>
<td>50%</td>
<td>40%</td>
</tr>
<tr>
<td>Caribbean Countries</td>
<td>5%</td>
<td>5%</td>
<td>5%</td>
<td>5%</td>
</tr>
<tr>
<td>Caribbean Private Sector</td>
<td>10%</td>
<td>10%</td>
<td>9%</td>
<td>8%</td>
</tr>
<tr>
<td>Dividends (CSF-invested companies)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>15%</td>
</tr>
<tr>
<td>Diaspora Organizations</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
<td>8%</td>
</tr>
<tr>
<td>Banks &amp; Credit Unions</td>
<td>2%</td>
<td>2%</td>
<td>2%</td>
<td>2%</td>
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<tr>
<td>CAIC</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
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<tr>
<td>Individuals</td>
<td>2%</td>
<td>2%</td>
<td>2%</td>
<td>2%</td>
</tr>
<tr>
<td>Private Foundations/Philanthropies</td>
<td>10%</td>
<td>10%</td>
<td>11%</td>
<td>9%</td>
</tr>
<tr>
<td>Diaspora Governments</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
</tr>
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</table>
# Preliminary 3-year Budget

<table>
<thead>
<tr>
<th>Expense</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salaries</td>
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<td>$ 200,000</td>
<td>$ 500,000</td>
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<tr>
<td>Employee Benefits</td>
<td>-</td>
<td>40,000</td>
<td>100,000</td>
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<tr>
<td>Part-time Help</td>
<td>20,000</td>
<td>30,000</td>
<td>50,000</td>
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<tr>
<td>Seed Capital Fund</td>
<td>1,500,000</td>
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<tr>
<td>Educational Activities</td>
<td>50,000</td>
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<td>500,000</td>
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<td>Outreach Activities</td>
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<td>Country Rep. Programs</td>
<td>15,000</td>
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<td>Advertising</td>
<td>15,000</td>
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<td>30,000</td>
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<tr>
<td>Conferences</td>
<td>100,000</td>
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<tr>
<td>Publications</td>
<td>5,000</td>
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<tr>
<td>Travel</td>
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<td>40,000</td>
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<tr>
<td>Office Expense</td>
<td>5,000</td>
<td>20,000</td>
<td>35,000</td>
</tr>
<tr>
<td>Rent</td>
<td>-</td>
<td>25,000</td>
<td>40,000</td>
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<tr>
<td>Utilities</td>
<td>-</td>
<td>5,000</td>
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<tr>
<td>Other OVHD Expenses</td>
<td>35,250</td>
<td>124,500</td>
<td>240,000</td>
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<td><strong>TOTAL</strong></td>
<td>$ 1,770,250</td>
<td>$ 3,954,500</td>
<td>$ 7,840,000</td>
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<tr>
<td><strong>GRAND TOTAL</strong></td>
<td></td>
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<td>$13,564,750</td>
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</table>
The Kibagare Good News Center School Nairobi, Kenya

http://www.spraguephoto.com/search.lasso?token.display=&keywords=6403+The+Kibagare+Good+News+Center+School+science+class,+Nairobi,+Kenya.&country=&category=&set=&number=&skip=0&token.advanced_search=true&token.showcaptions=Hide+Captions&token.max=18
My Cliches

... the next “Google” can start in Caribbean!

We are limited only by our imagination!

warde@mit.edu

http://caribbeanscience.org

http://cadsti.org