

Chantilly High School Academy

*Envisioning the Future:
Fueling the Engineering Workforce Pipeline*

National Engineering Mathematics Consortium

June 16, 2009

Is Our Nation Falling Behind?

- Engineering remains a low priority for US students: Among the 25 top engineer producing countries, the United States ranks No. 22 on a per capita basis.
- Undergraduate degrees awarded in natural science or engineering by country (2004)

South Korea	38%
France	47%
China	50%
Singapore	67%
U.S.	15%
- According to the National Science Foundation, 32 percent of freshmen in higher education plan to major in a science or engineering field. Although 37.9 percent of male freshmen enter those majors, only 27.2 percent of female freshmen do.
- 56% of PhDs in engineering awarded in the US are to foreign born students (2004)
- Only four American companies ranked among top 10 corporate recipients of patents granted by the *United States* Patent and Trademark Office (2005)

Virginia's New Economy...

Richmond Times-Dispatch

FINAL

www.timesdispatch.com

RICHMOND, VIRGINIA

VIRGINIA'S NEWS LEADER
A DAILY GENERAL NEWSPAPER

THURSDAY, MARCH 24, 1996

VIRGINIA'S CHANGING ECONOMIC LANDSCAPE

From Marlboros ... to microchips



1997 exports

Computer chips

Cigarettes

Computer memory chips have supplanted cigarettes as state's No. 1 manufactured export.

BY JEFFREY KELLEY
AND JOHN REID BLACKWELL
Times Dispatch Staff Writers

merged into a variety of consumer electronics products such as portable music players, videogame consoles and mobile phones.

"This is an incredible shift," said Pat Arne, vice director at Micron Technology Inc.'s semiconductor plant in Manassas. "That's 400 years of history that's changing."

Virginia sent \$945.6 million worth of chips

ships — also known as integrated circuits or semiconductors — are the state's top manufactured export behind coal, the top export overall. Lead windows and aircraft parts round out the top five.

While chips have risen, the state is faced with a major gap left by the loss of Virginia's





Career & Technical Education @ Chantilly Academy

- ✓ Mission - Engineering and Scientific Technology
- ✓ 1,200 students – sophomores, juniors and seniors
- ✓ Students are from Chantilly High School and 19 Fairfax County high schools
- ✓ 26 program areas; including pre-collegiate engineering education (133 Students).

Pre-Collegiate Engineering Education

- Nine years of experience in delivering pre-collegiate engineering education:
 - Engineering Systems 1
 - Engineering Systems 1 – Girls Exploring Engineering GE² (*All-Girls Section*)
 - Engineering Physics (*Upper Level Physics Course*)
 - Engineering Systems 2
 - Independent Research - Engineering (*Senior Capstone Course*)
 - Engineering Mathematics (Fall 2009)

Girls Exploring Engineering – GE²



- ✓ All-girls section of Engineering Systems 1 (18 students)
- ✓ GE² Advisory Board – Higher Education, Industry and Government
- ✓ Engineering Service Learning Project (8-Week Design Challenge)
- ✓ One-on-One mentorship; each girl matched with a mentor – professional women in engineering higher education, industry or government. Email contacts and four mentorship events in engineering problem-solving.
- ✓ “Behind the scenes” engineering tours/field trips/guest workshops
- ✓ `07-`08 GE² - 14 seniors; 12 Fall 2008 & 3 Fall 2009 Engineering College Freshmen,
- ✓ `08-`09 GE² - 9 seniors; 8 Fall 2009 Engineering College Freshmen

Engineering Service Learning Project - GE²

- “Real-world” problems with local impact; biomedical, civil/transportation/environmental, energy/sustainability, or rehabilitative engineering challenges.
- Projects have a social context and community benefit outcome.
- Builds on classroom learning with “work-based learning”
- Solutions will not necessarily to be delivered as a professional product.
- Project teams of 3 students work closely with public or private service organizations, volunteer mentor(s) (professional women in engineering), and their classroom instructor.
- SY `09-`10 – EPICS High Affiliation

Engineering Service Learning Project - GE²

- Student teams perform work
 - 3-5 hours a week during class hours
 - A minimum of 2 hours additional group work each week
 - Individual research and design execution



Engineering Service Learning Project - GE²



Final project presentations include:

- Project Poster & PowerPoint Presentations
- Written Technical Reports; project descriptions, exhibits, calculations, illustrations/photographs.

Independent Research - Engineering



Course Code:	846526
Credits:	1 Credit
Length of Course:	36 Weeks
Grades:	12

Independent Research - Engineering is a one-year senior capstone course designed to provide students with a work-based learning and mentorship experience in engineering at a selected industry, centers of higher education or government organization. Student research placements are made on an individual basis for each enrolled student.

Independent Research – Engineering students in `07-`08 celebrated the new educational partnership with the **Naval Center for Space Technologies – US Naval Research Lab (NRL)** where they led the systems engineering for an NRL CubeSat.

Chantilly Engineering



Co-Curricula Engineering Activities



Chantilly Academy Partners In Education



Industry –

ExxonMobil
Lockheed Martin
Micron Technology
Micron Technology Foundation
Noblis
Northrop Grumman
Rolls-Royce N.A.
SAIC

Higher Education –

Northern Virginia Community College
George Mason University – Volgenau School
of Information Technology and Engineering
George Washington University – School of
Engineering & Applied Sciences
James Madison University – School of
Engineering
University of Maryland – A. James Clark
School of Engineering
University of Maryland – Baltimore County
Old Dominion University
Sweet Briar College
University of Virginia
Virginia Commonwealth University
Virginia Polytechnic and State University
Wright State University

Associations –

IEEE – Northern Virginia Section
ABC of Virginia (Architecture, Engineering and
Construction Technology)
Engineers Without Borders – DC Chapter

Government –

Naval Center for Space Technologies –
US Naval Research Laboratory, Washington, DC



A Most Promising Announcement...

2009 Technology-Based Learning Grants Award-Winning Organizations

WASHINGTON — U.S. Secretary of Labor Elaine L. Chao today announced \$10 million in grants to increase access to technology-based learning. Twenty projects were selected from a pool of 193 applications...

"These \$10 million in grants will increase workers' access to skills training through the Internet, video teleconferencing and other technology-based learning media," said Secretary Chao.

<u>Organization</u>	<u>City</u>	<u>State</u>	<u>Industry</u>	<u>Amount</u>
Northern Virginia Community College	Annandale	Virginia	Geospatial Technology	\$492,458

Articulation to George Mason University

Schools Scout Out Tomorrow's Engineers

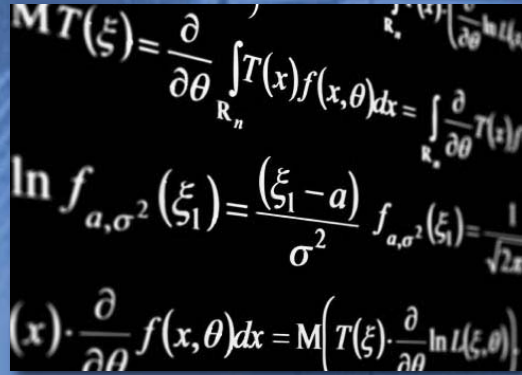
The Chantilly Times
By Matthew Perrone
02/02/2005

Two leading members of the Fairfax County educational community got a little closer when the president of George Mason University and the superintendent of Fairfax County Public Schools signed the *first-ever* articulation agreement between the schools.

Under the document signed by Superintendent Jack Dale and GMU President Alan Merten, **students who complete Chantilly Academy's Engineering Systems 1 and Engineering Physics classes will receive three college credits for each course.**

Just as if they were students at GMU...

Engineering Mathematics – Chantilly Academy

A blackboard with mathematical formulas. The top formula is $M T(\xi) = \frac{\partial}{\partial \theta} \int_{R_n} T(x) f(x, \theta) dx = \int_{R_n} \frac{\partial}{\partial \theta} T(x) f(x, \theta) dx$. The middle formula is $\ln f_{a, \sigma^2}(\xi_1) = \frac{(\xi_1 - a)}{\sigma^2} f_{a, \sigma^2}(\xi_1) = \frac{1}{\sqrt{2\pi}}$. The bottom formula is $(x) \cdot \frac{\partial}{\partial \theta} f(x, \theta) dx = M \left(T(\xi) \cdot \frac{\partial}{\partial \theta} \ln l(\xi, \theta) \right)$.
$$M T(\xi) = \frac{\partial}{\partial \theta} \int_{R_n} T(x) f(x, \theta) dx = \int_{R_n} \frac{\partial}{\partial \theta} T(x) f(x, \theta) dx$$
$$\ln f_{a, \sigma^2}(\xi_1) = \frac{(\xi_1 - a)}{\sigma^2} f_{a, \sigma^2}(\xi_1) = \frac{1}{\sqrt{2\pi}}$$
$$(x) \cdot \frac{\partial}{\partial \theta} f(x, \theta) dx = M \left(T(\xi) \cdot \frac{\partial}{\partial \theta} \ln l(\xi, \theta) \right)$$

Grades 11, 12 Credit: One
(Mathematics)

Prerequisite: Algebra 2

Co-requisite: Pre-Calculus with
Trigonometry

- ☐ Upper Level Mathematics Elective; 36 - Week Course
- ☐ Career & Technical Education Academy; student enrollment opportunities from 20 division high schools.
- ☐ High School Mathematics Certified Instructor(s) with engineering undergraduate and/or graduate degrees.
- ☐ Classroom & Laboratory Instruction; 90-minute classes

Engineering Mathematics

Year One - Outcomes

- ❑ Curriculum Re-design
 - ❑ 10 - Week → 36-Week Course
 - ❑ Course rationale, course standards, benchmarks and indicators.
 - ❑ Mathematics topics sequencing to align with Review of Pre-Calculus w/ Trig
 - ❑ Additional content instruction time on topics

Engineering Mathematics

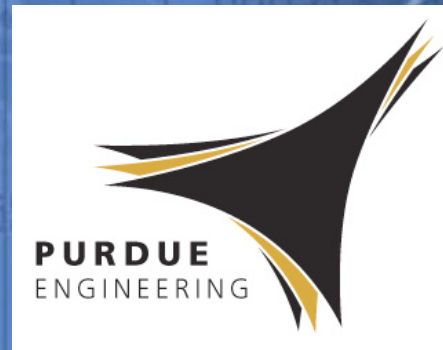
Year One - Outcomes

- ☐ Registered one full-section; 18 students
- ☐ Self – identified future undergraduate engineering students
- ☐ Team-teaching; year one.
- ☐ Initiated review of existing engineering course curriculum; increased rigor of Engineering Physics.
- ☐ Interest in dual enrollment and/or articulation agreements.

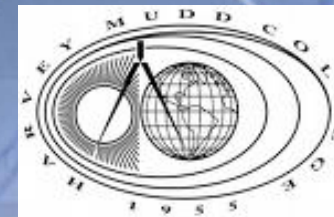
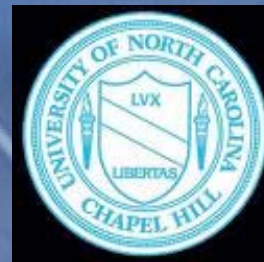
It's ALL about our students...

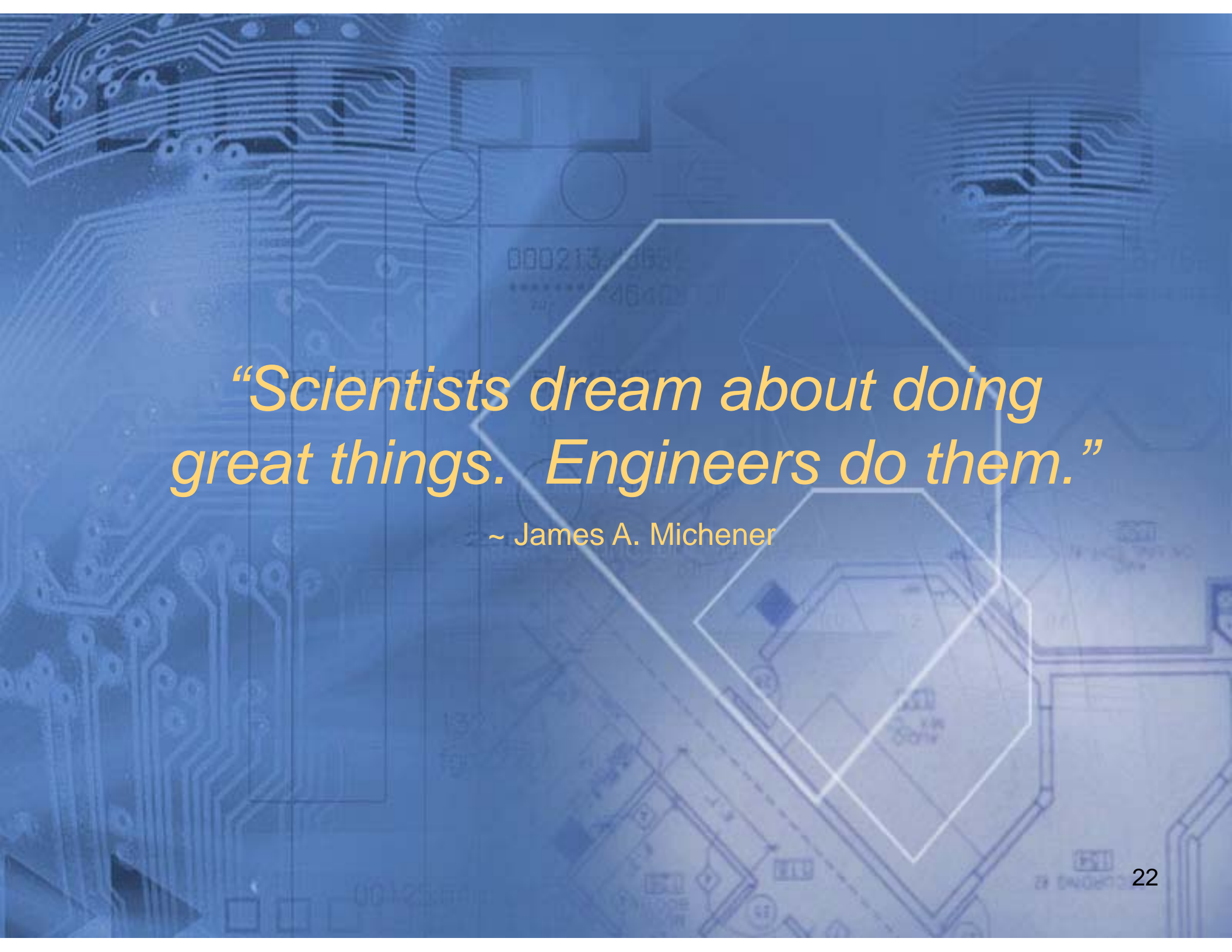


And their bright futures in Engineering...



And their bright futures in Engineering...





*“Scientists dream about doing
great things. Engineers do them.”*

~ James A. Michener