A Day in the Life of an Electrical or Computer Engineer
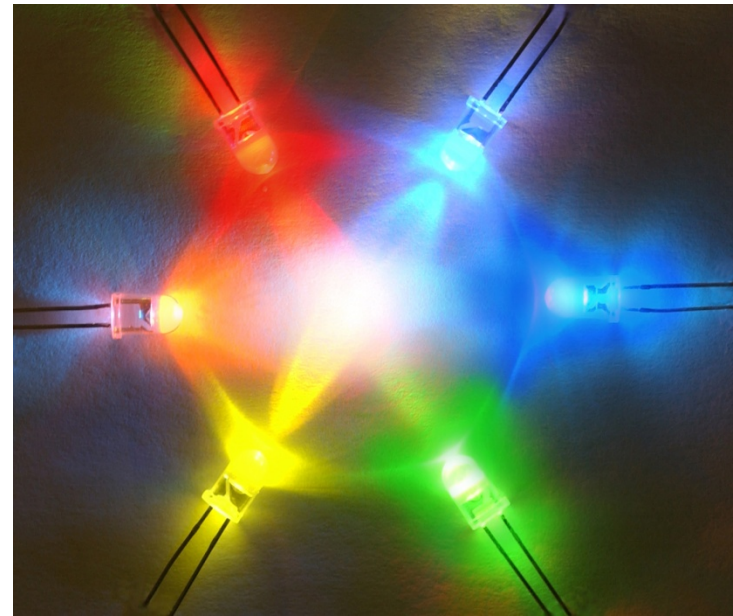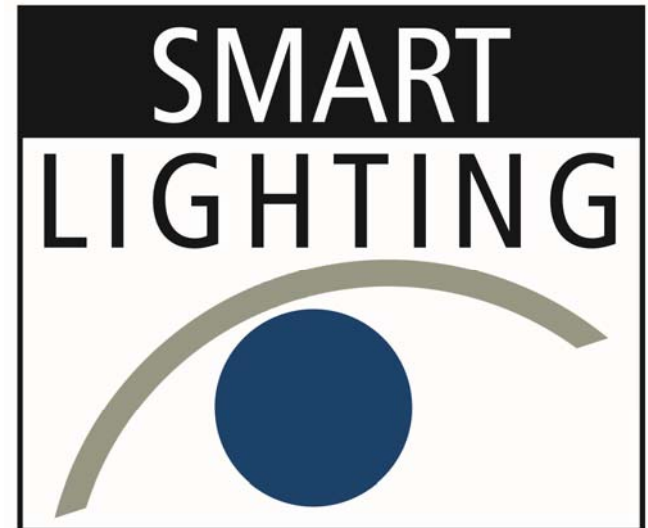

Rensselaer
Department Of Electrical, Computer, & Systems Engineering
RPI

SMART LIGHTING

K. A. Connor
27 October 2010

Overview

- Who Am I?

- Why be an Engineer?

- EE and CSE?

- ECSE Alumni (with one ringer)

  - Demos

- What are Alums Doing Today?

  - Demos

- Questions

K. A. Connor

RPI ECSE

Who Am I?

**Rensselaer**

- ## My name is Ken Connor

I am a Professor of Electrical, Computer, and Systems Engineering and Information Technology and Education Director for the SMART LIGHTING Engineering Research Center

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Why am I an Engineer?

- October 1957 – Sputnik 1 **(Спутник-1)**
- 6th Grade Class – 4 students selected for advanced studies
- 7th & 8th Grade Math & Science Combined
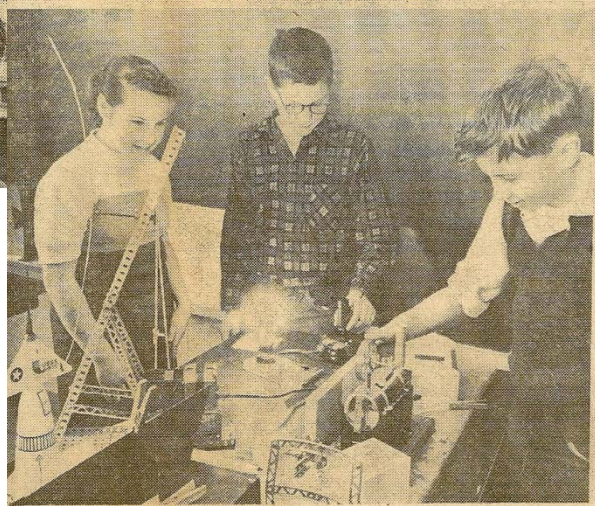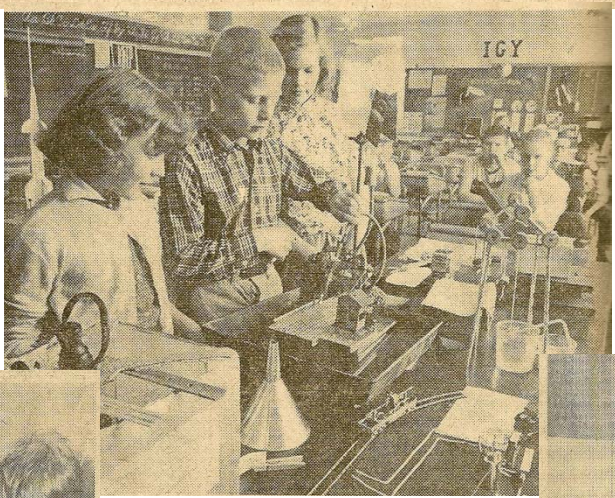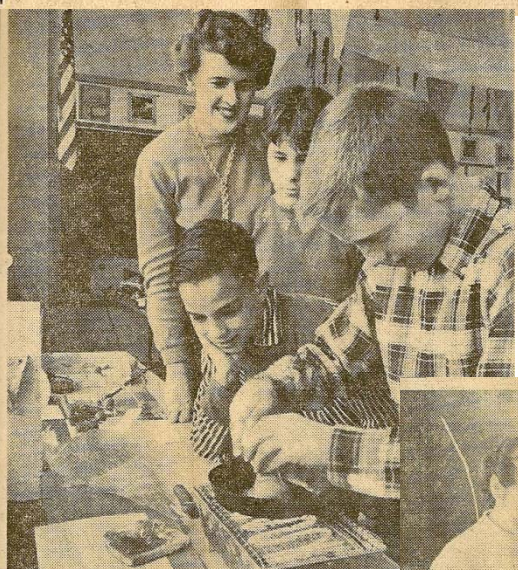- Began HS Math & Science in 8th Grade
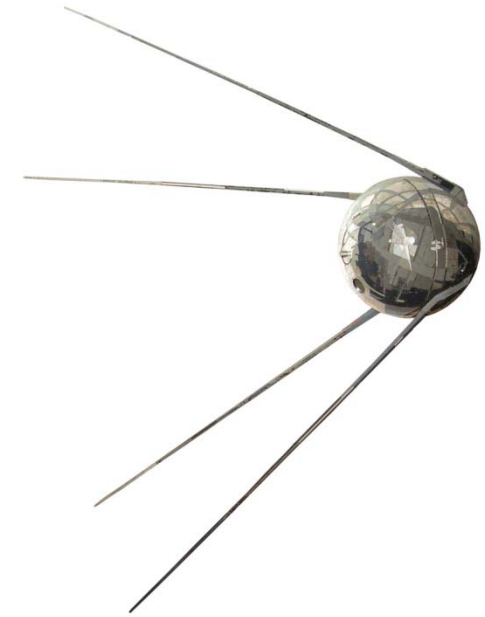
Diameter = 58.5 cm

Inside

Sounds

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Me

Several weeks of scientific study and project work were climaxed recently when pupils of the sixth grade at Mendota School staged their second annual Science Fair. Various ingenious "gadgets" developed by each pupil were displayed and prizes were awarded for the best entries. An evening open house was held so parents could inspect the projects. The first-prize winner is in the picture at the upper left. The teacher, Carolyn Anderson is in the background. The others (rear to front) are Cheryl Moore, Eddy Gadzia, and Ronnie Trachte, who is dropping an egg into a pan, which is resting on an electric "stove" made by Ronnie. At the top, right, Steve Sprague (center) is demonstrating his water generator which won second prize. Watching are Polly Frihart (left) and Kim Klipstein. The group at the lower left includes Mary Joe Gross (left), who is watching closely as Leslie FaFard (center) and Ken Connor show off their respective electric eye and atomic generator devices. The three (lower right) include Mary Joe Gross (left); Jim Cron, pointing to simple machines made by him, and Janice Menge. (Photos by Clarence E. Olson)

29 March 1958

Why am I an Engineer?

- Why did I go to engineering school when none of the other three accelerated students from my elementary school did?

- My theory – my dad was the 'go to' person for our extended family … if anyone had a problem they could not solve, they asked him to help. This made his sons problem solvers … it does not matter what the problem was, we do our best to find a solution.

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Why be an Engineer?

- Engineers make a world of difference
- Engineers are creative problem-solvers
- Engineers help shape the future
- Engineering is essential to our <u>health</u>, <u>happiness</u> and <u>safety</u>

From the NAE

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Also From NAE

My Research Area

Clearly ECSE Areas

Also ECSE Areas

Essentially all problems can be addressed from an EE or CSE platform

SMART LIGHTING

Light Source
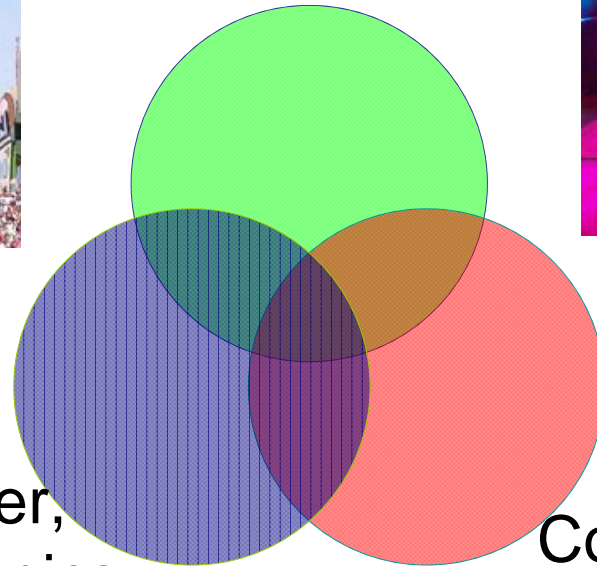
Electrical Power,
Sensors, Electronics

Computer Control

Smart Lighting System

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RPI ECSE
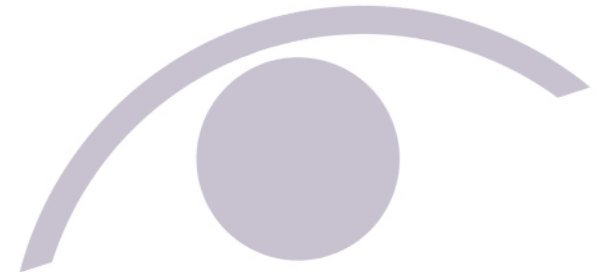
Similar to Robotics

Mechanical

Electrical

Computer

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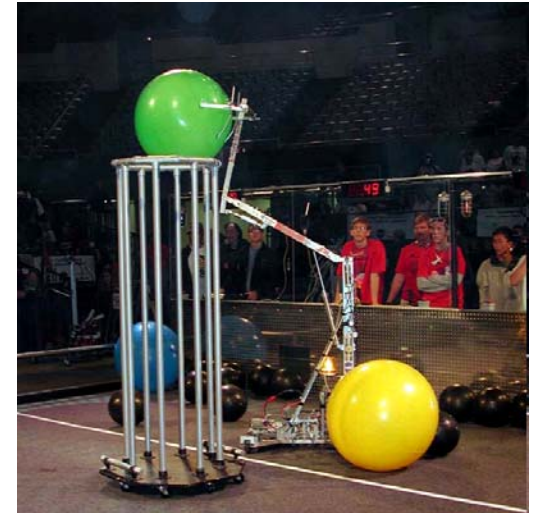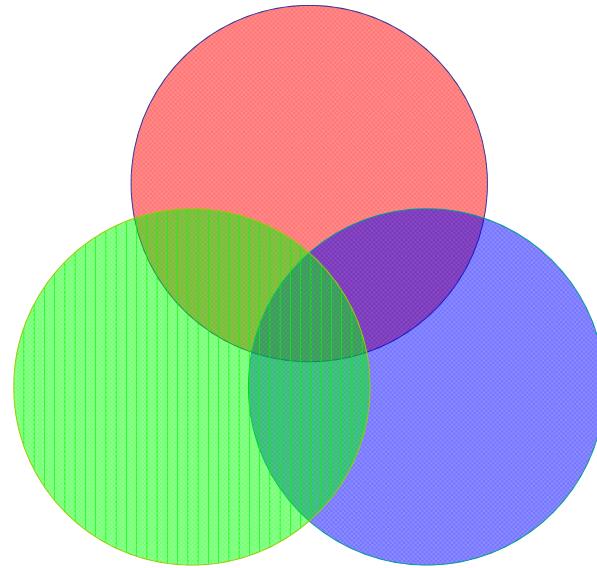
EE and CSE Subdisciplines

- Circuits and Electronics (Analog & Digital)
- Signals and Systems
- Controls
- Communications
- Electric Power
- Radio Frequency Waves
- Information (e.g. sound and images)

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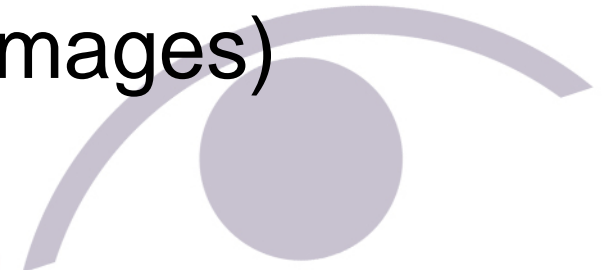
IEEE (Nearly 400k Members)

- Aerospace and Electronic Systems Society
- Antennas and Propagation Society (9,000 Members)
- Broadcast Technology Society
- Circuits and Systems Society (16,000 Members)
- Communications Society (50,000 Members)
- Components Packaging, and Manufacturing Technology Society
- Computer Society (88,000 Members)
- Consumer Electronics Society
- Control Systems Society (10,000 Members)
- Council on Super Conductivity
- Dielectrics and Electrical Insulation Society
- Education Society

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- Electromagnetic Compatibility Society
- Electron Devices Society (13,000 Members)
- Engineering Management Society
- Engineering in Medicine and Biology Society
- Geoscience & Remote Sensing Society
- Industrial Electronics Society
- Industry Applications Society
- Information Theory Society
- Intelligent Transportation Systems Council
- Instrumentation and Measurement Society
- Lasers & Electro-Optics Society (9,000 Members)
- Magnetics Society
- Microwave Theory and Techniques Society (12,000 Members)
- Nuclear and Plasma Sciences Society
- Neural Networks Council

- Oceanic Engineering Society
- Power Electronics Society
- Power Engineering Society (22,000 Members)
- Professional Communication Society
- Reliability Society
- Robotics & Automation Society
- Sensors Council
- Signal Processing Society (18,000 Members)
- Society on Social Implications of Technology
- Solid-State Circuits Society (14,000 Members)
- Systems, Man, and Cybernetics Society
- Ultrasonics, Ferroelectrics, and Frequency Control Society
- Vehicular Technology Society

Courses

Electrical Engineering

- Computer Science I & Computer Components and Operations

- Multivariable Calc & Eng. Probability

- Electric Circuits & Intro to Electronics

- Signals and Systems & Electrical Energy Systems

- Fields and Waves I & Microelectronics Tech.

Courses

Computer and Systems Engineering

- Computer Science I, Data Structures, Intro to Algorithms,

- Computer Components and Operations & Computer Architecture, Networks and Op. Sys.

- Multivariable Calc, Discrete Structures & Eng. Probability

- Electric Circuits, Intro to Electronics & Signals and Systems

http://www.ecse.rpi.edu/Templates/14_Templates_revised_8-10.pdf

Standard Dual Majors

- EE & Applied Physics – 138 Credits
- EE & CSE – 135 Credits
- CSE & CS – 134 Credits
- EE & BME – 135 Credits

Co-terminal degrees are also becoming more common.

Top 10 Starting Salaries 2010

Major	Average Salary Offer
Petroleum Engineering	$86,220
Chemical Engineering	$65,142
Mining & Minteral Engineering (incl. geological)	$64,552
Computer Science	$61,205
Computer Engineering	$60,879
Electrical/Electronics & Communications Engineering	$59,074
Mechanical Engineering	$58,392
Industrial/Manufacturing Engineering	$57,734
Aerospace/Aeronautical/Astronautical Engineering	$57,231
Information Sciences & Systems	$54,038

*Where 10 or more offers were reported.

Source: NACE

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Allen Dumont

1938 DuMont Model 180

America's First Commercial Electronic TV Set
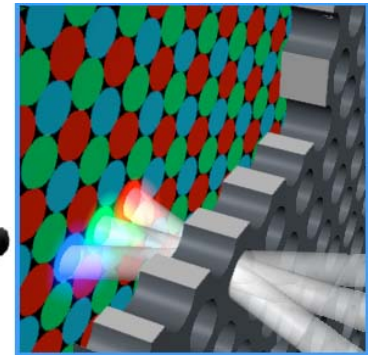
-- Inside --
Rear View

EE '24

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Displays
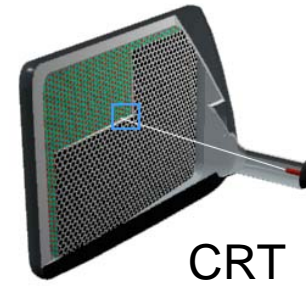
CRT

Mirasol
MEMS

Plasma

TI LED DLP MEMS

LCD

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RGB

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Remote Controls

DTV Remote Functions

1 **CBL** Turns cable box ON/OFF
2 **VCR Power** VCR/DVD ON/OFF
3 **TV Power** ON/OFF
4 **GUIDE** Displays Picture-in-Picture Program Guide
5 **SETTINGS** Displays Settings menu
6 **MUTE** Turns sound ON/OFF
7 **VOL** Volume control
8 **A, B, C** Used for on-screen options. On-screen display
   indicates which button to use for various functions.
9 **LAST** Return to last channel viewed
10 **REWIND** VCR/DVD/DVR/On Demand
11 **PAUSE** VCR/DVD/DVR/On Demand
12 **STOP** VCR/DVD/DVR/On Demand
13 **BYPASS** (Future use)
14 **INFO** Displays program information
15 **PAGE** Displays next or previous page in Program Guide
   and Info screens
16 **SELECT** Selects highlighted on-screen options
   and channels
17 **EXIT** Exits interactive screens
18 **ARROWS** Scroll through interactive screen options
19 **CH** Channel up/down
20 **NUMBER PAD** Enter channel or PIN #
21 **FAV** Selects favorite channels
22 **FAST-FORWARD** VCR/DVD/DVR/On Demand
23 **PLAY** VCR/DVD/DVR/On Demand
24 **RECORD** with VCR/DVR
25 **VCR/VOD** To operate your VCR/DVD, switch must be set
   to VCR. Set to down position for On Demand programming.
26 **TV/VCR** Switch control between TV and VCR/DVD
27 **SYSTEM POWER** Turns cable box, TV, VCR/DVD
   and audio ON/OFF
28 **AUD POWER** ON/OFF
29 **HELP** Provides more info
30 **DAY +/-** Skip forward or backward a whole day in the
   Program Guide
31 **(+)** Future use
32 **MENU** Displays Program Guide
33 **ENTER** Immediately tune to the channel number
   you've just entered
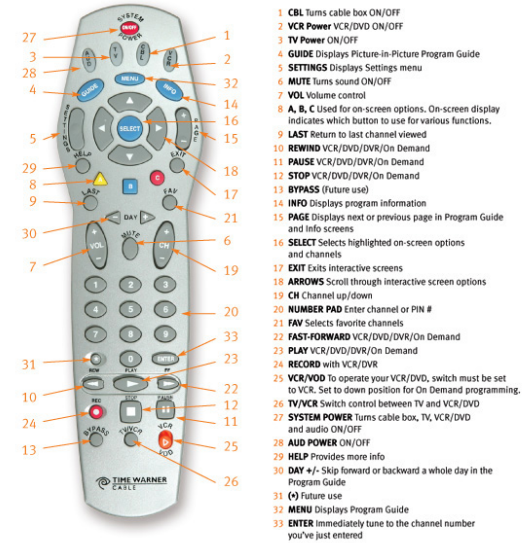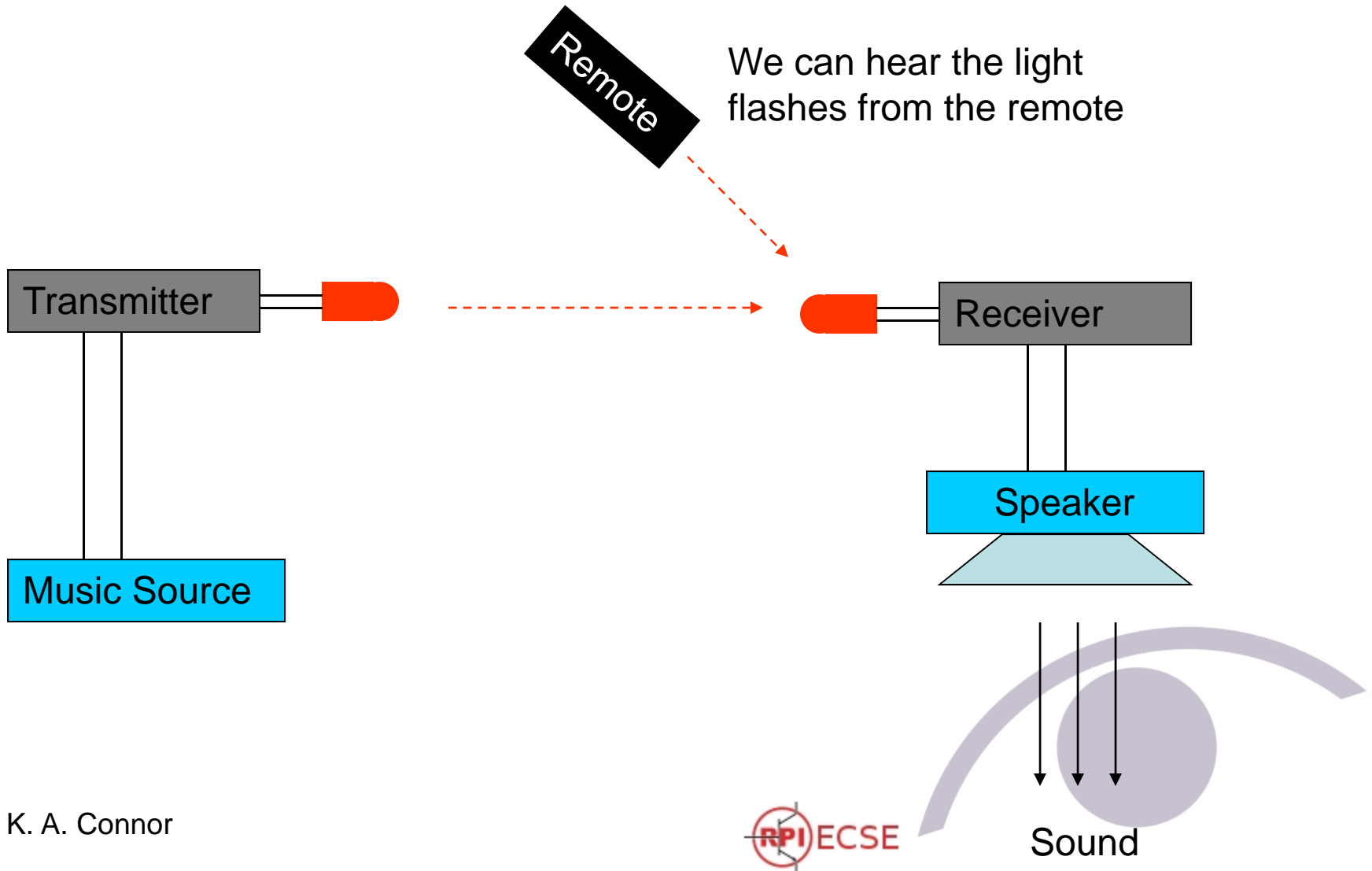
- # Infrared Light
- # Cannot be seen by humans
- # Can be seen by digital camera
- # Remote control sends light flashes to TV or any other device it is to control

Example of Information Transfer System

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Music Traveling on Light Flashes

Remote

We can hear the light flashes from the remote

Transmitter

Receiver

Music Source

Speaker

Sound

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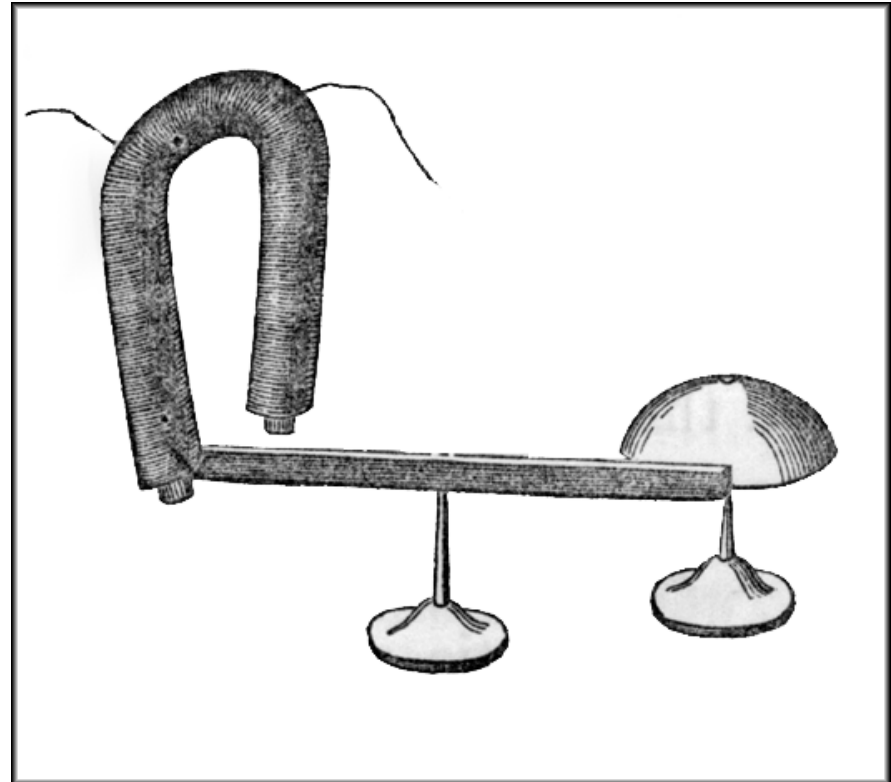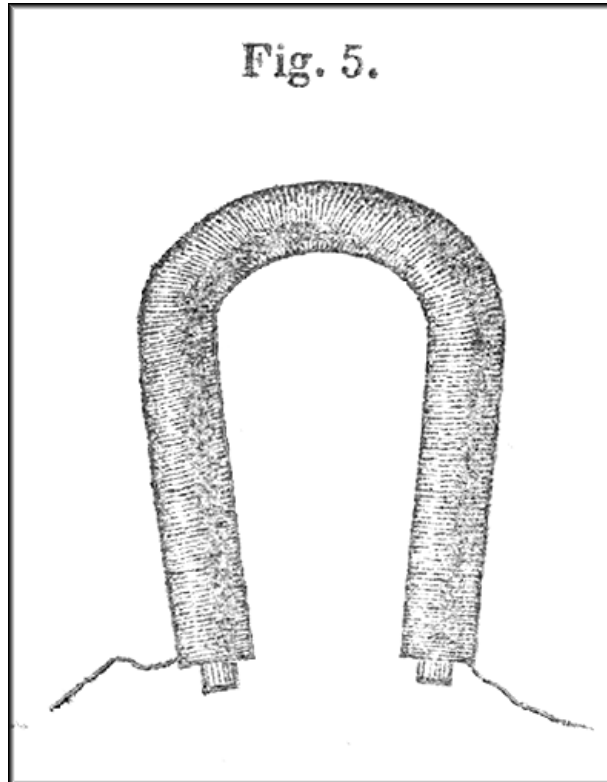# Joseph Henry

- http://maps.google.com look up Albany, NY
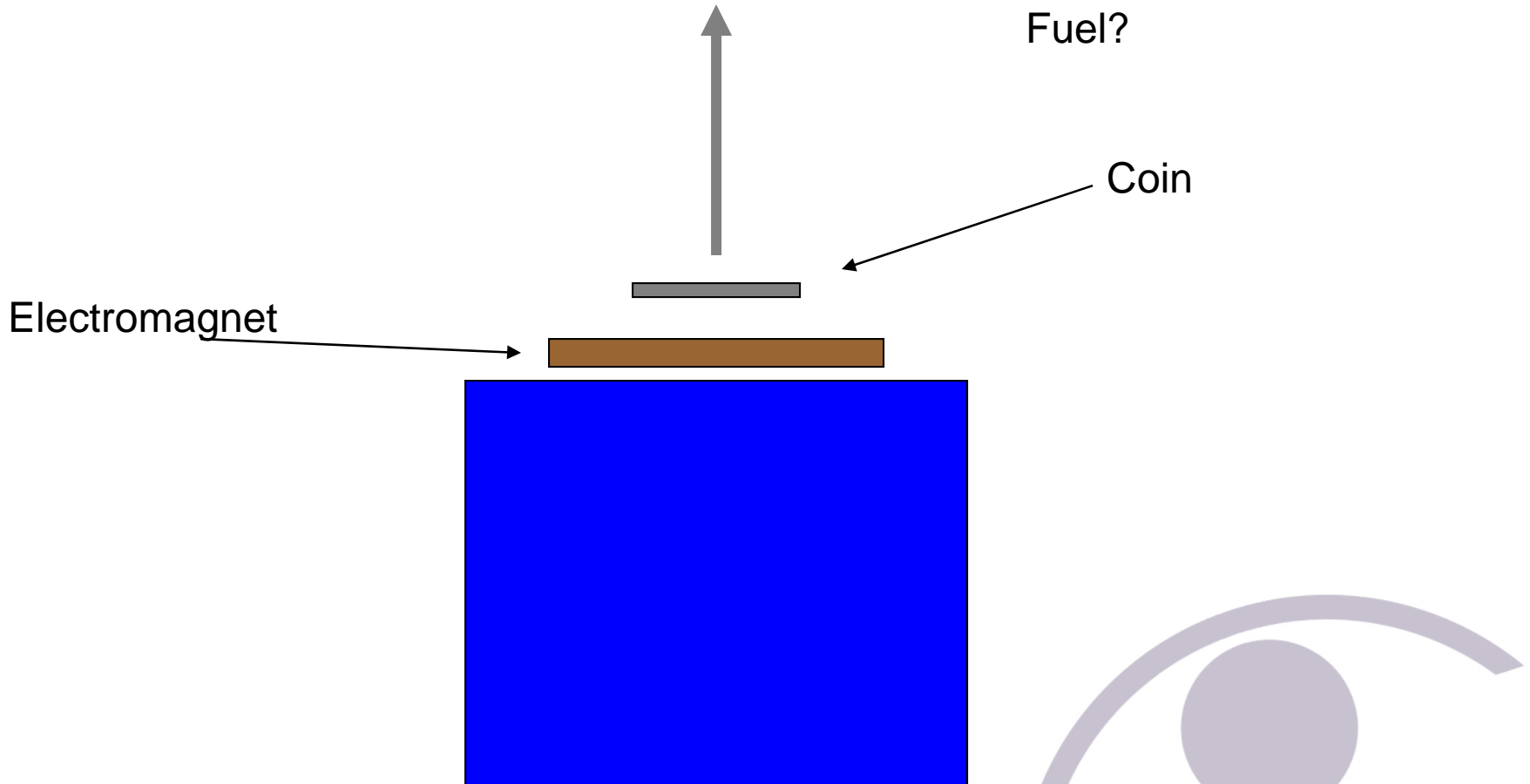
Joseph Henry

Fig. 5.

He recognized that the magnet could be the key part of a long distance signaling device – this became the telegraph

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Coin Flipper

Launch Rockets Without Rocket Fuel?

Coin

Electromagnet

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ECSE

Maglev Experiment
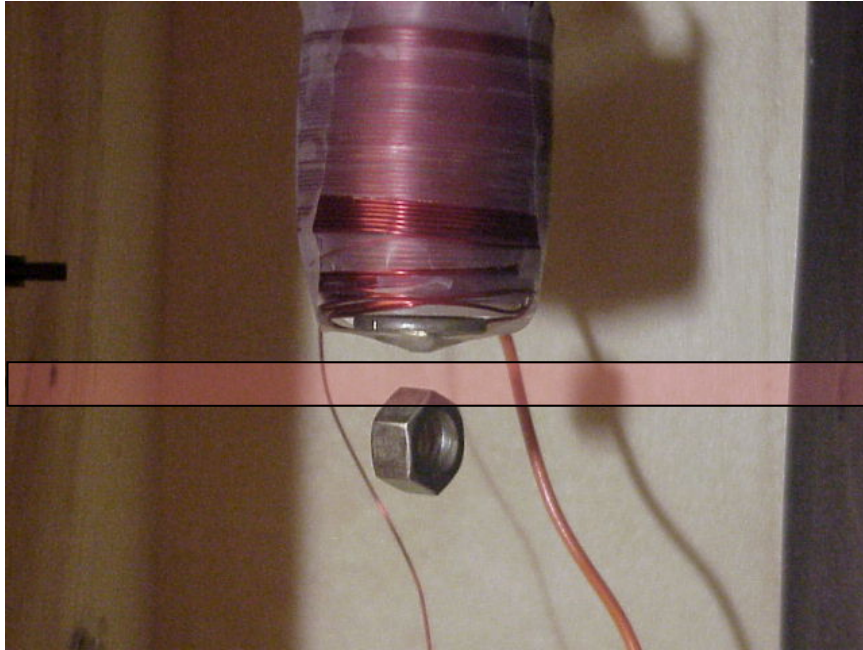
- Close up photos showing levitation of washer and ball bearing with magnet attached. Some preferred orientation is necessary for stability.

An invisible (IR) light beam 'sees' where the object is and tells the magnet how powerful it has to be to hold it in place.

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Marcian E. (Ted) Hoff

- 1937 Born in Rochester NY
- 1958 EE Degree from RPI
- 1962 PhD from Stanford
- 1971 Invented the Microprocessor (Intel 4004)

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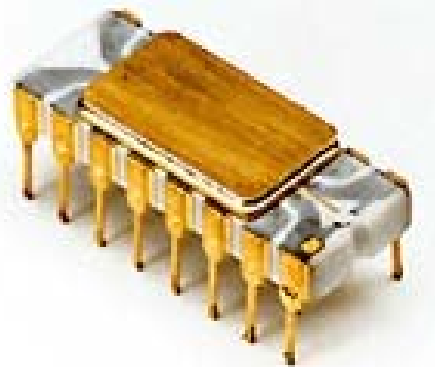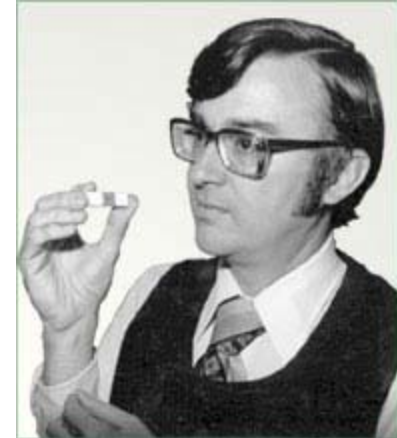
Two Rensselaer Alumni Receive National Medal of Technology and Innovation

- **Steven Sasson** (Class of 1972) for the invention of the digital camera.
- **Dr. Marcian E. "Ted" Hoff, Jr.** (Class of 1958), for the conception, design, development and application of the first microcomputer.

Dr. Marcian E. "Ted" Hoff, Jr. (Class of 1958), and Steven Sasson (Class of 1972)

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Ted Hoff Inspired

This is basically an EE, CSE project, with the emphasis on the latter.

What is this?

Video processor/codec
Broadcam VideoCore BCM2722
processor using
VideoCore II engine

Click Wheel controller
Cypress PSoC CY8214
mixed-signal array

USB power manager
and battery charger
Linear LTC4066

Audio codec
Wolfson
Microelectronics
WM8758

SDRAM
256 MB

Power-
management
unit (PMU)

DC-to-DC
converter

Voltage step-down switching regulator:
National Semiconductor LM34910SDX (40V, 1.25A)

Firmware Flash
module, 8 MB:
Silicon Storage
Technology
SST39WF800A

Microprocessor
PortalPlayer PP5021C including two 32-bit ARM7TDMI
microprocessor cores with audio processing and 180 MIPS
codec support; sends audio signal to audio codec for
output through headphone/speaker jack

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Marshall Brain

EE 1983

ECSE Graduates

- Analog Devices
- Lockheed Martin
- ST-Ericsson
- Nikon Precision
- Time-Warner Engineering
- Raytheon
- Verizon
- NXP
- Toyota InfoTech Center

- Applications Engineer
- Software Engineer
- Consulting Engineer
- President
- Director
- Video Network Eng.
- Product Engineer
- Analyst
- Sr. Principal

LinkedIn: search groups for ECSE

ECSE Graduates

- BAE Systems
- National Instruments
- Bright View Tech
- Intel
- Mitsubishi Electric Research Lab
- Current Group
- Siemens Healthcare
- Applied Materials
- GE

- Electrical Engineer
- RF Systems Engineer
- General Manager
- Microprocessor Eng
- Senior Principal Member Research Staff
- CTO
- VP R&D
- Researcher
- Project Manager

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LinkedIn: search groups for ECSE
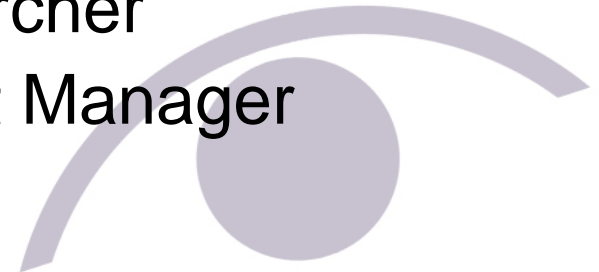
ECSE Graduates

- Cadence
- Altera
- Arista Networks
- Maxim-IC
- uReach Technologies
- ESPN
- Microsoft
- IBM
- International Rectifier
- Barclays
- Cypress Semiconductor

- General Manager
- Sr Marketing Manager
- Technical Staff
- Managing Director & General Manager
- Sr Product Manager
- Process Engineer
- Device Design Eng
- Systems Integration and Testing Engineer
- CEO

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LinkedIn: search groups for ECSE
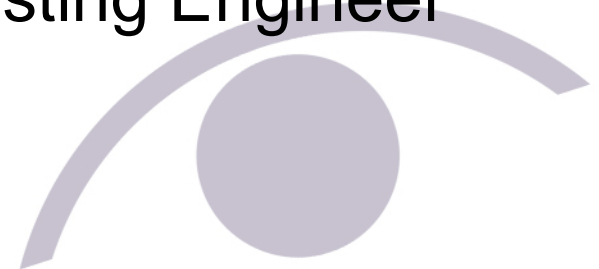
ECSE Graduates

- Nordic Windpower
- Marvell
- Harris
- Sikorsky Aircraft
- Google
- Seagate
- Technicolor
- Fairchild Semiconductor
- Northrop Grumman
- USAF

- Product Manager
- Sr Design Eng
- Sr Scientist
- Project Engineer
- Network Engineer
- Sr Engineering Director
- Patent Attorney
- Quality Engineer
- Lead Systems Architect
- Colonel

LinkedIn: search groups for ECSE

Our turbine is a 2 bladed, 1 MW machine. Most of the time I do product development work, but since our company is so small, and I have a lot of controls and system integration experience, I have had the opportunity to help out in the field a few times. Here is one of my most recent days doing some wind turbine commissioning in Indiana. We were having some issues with some of the sensors on top of the nacelle. We climbed the 70 m tower and got on top of the nacelle to make sure that all the instrumentation was in working order. Then we checked all the wiring in the cabinet in the nacelle and found that the issue was with noise on the RS485 comms network. I added a termination resistor at the and of the line and that took care of the problem. That may be more detail than you need... but I'm an engineer. I don't know how not to give too much information.

Carrie McLaughlin EE 2001
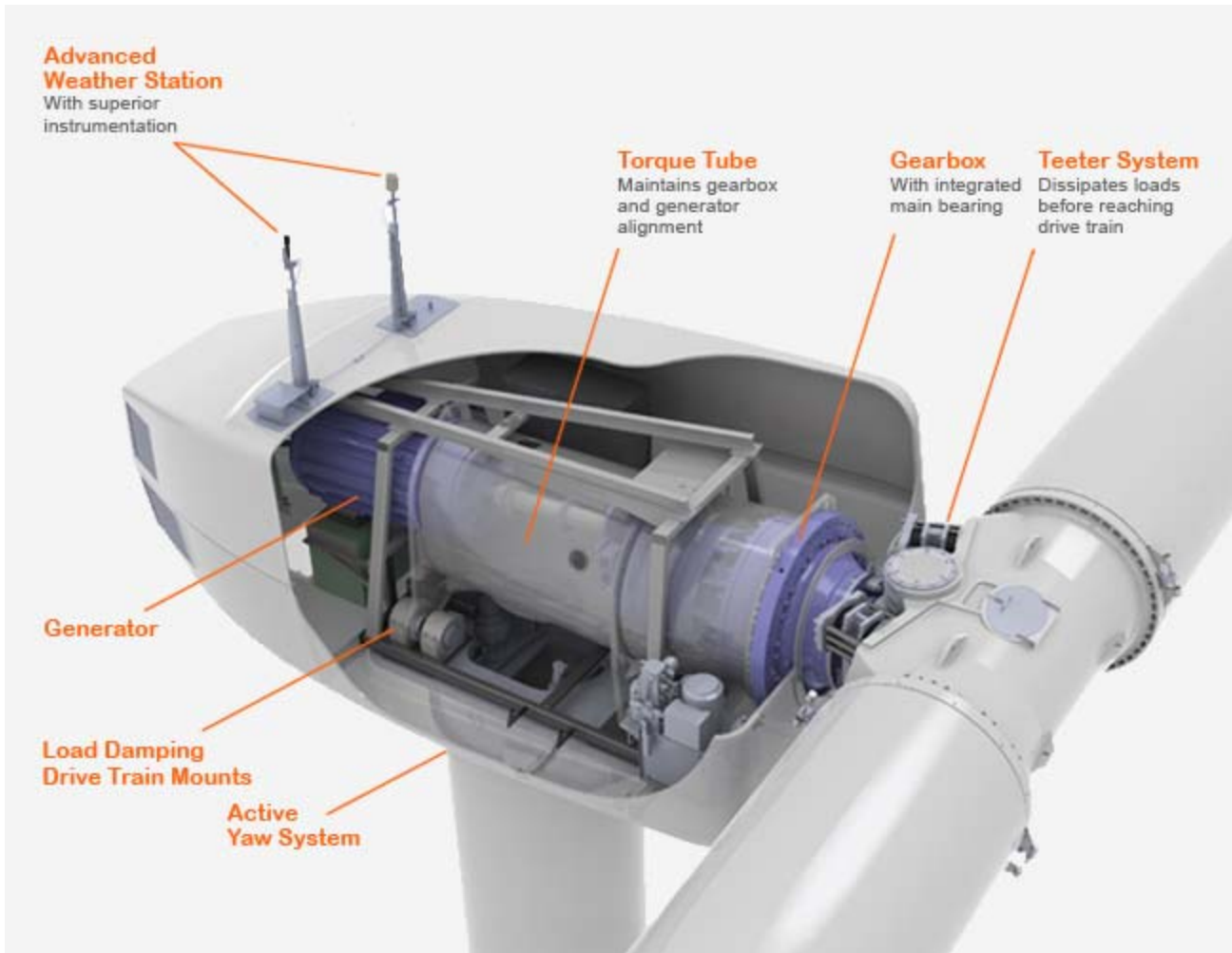
I started out in engineering as an applications engineer where the majority of my day would be spent in some combination of the following:

1. Evaluating new silicon in the lab (taking TOCs, measuring key parameters, testing it in application circuits, and generally trying to break it). Great practical experience.
2. Technical writing (data sheets for the new silicon, app notes and article for publication in magazines and the web). Gained a great detailed understanding of the parts.
3. Answering customer support questions over the phone or by email (I had to essentially be able to help a customer troubleshoot their circuit remotely on any of our over 2000 parts at the time. Really learned to be more intuitive about circuits.

After moving into marketing, my role changed significantly.
1. Many weeks of international travel meeting customers and defining specs and features for new products.
2. Business and operations tasks. Forecasting, pricing, advertising, production planning, etc.
3. Writing and presenting business plans to executive management. Revenue responsibility.
4. Many more meetings.

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Eventually, I moved into a general management and an executive role.

1. Strategic planning
2. Leading large, multidiscipline organizations (current team is over 150 people) with offices in US, China, India, and Europe.
3. Business development – acquisitions, partnerships, contracts, etc.
4. Full P&L responsibility
5. Many, many more meetings. Lots of these meetings are highly technical and require my engineering background. The large majority of my employees are engineers.

Team Maxim rode to raise money for MS.

Here are some fun facts from last year's Team Maxim ride:
Miles Rode = 151.14 miles
Average Speed = 16.4 mph
Max Speed = 42.3 mph
Total Climb = 10,459 ft
Total Riding Time = 9 hours 13 minutes
Calories Burned = 11,271

Dan

William S. Yerazunis
MERL Research / Technical Staff
Senior Principal Member Research Staff & Hardware Team Leader
Ph.D., Rensselaer Polytechnic Institute, 1987

William Yerazunis is a Senior Research Scientist at Mitsubishi Electric Research Laboratories in Cambridge, Massachusetts, USA. He received the B.S., M.Eng, and Ph.D degrees in Systems Engineering from Rensselaer Polytechnic Institute, in 1978, 1979, and 1987, respectively. Since then, he has worked in a number of fields including optics, machine vision, and signal processing (for General Electric's jet engine manufacturing); computer graphics (at Rensselaer's Center for Interactive Computer Graphics); artificial intelligence and parallel symbolic computation (for DEC's OPS5, XCON and RuleWorks); radioastronomy and SETI (at Harvard University), transplant immunology (for the American Red Cross), virtual and augmented reality, realtime physical and chemical sensing, and ubiquitous computing (for Mitsubishi Electric), and realtime statistical categorization of texts (the CRM114 Discriminator anti-spam system). He is also a Visiting Scientist at Dublin City University in Dublin, Ireland. He has appeared on numerous educational television shows, holds 35 U.S. patents, sports an Erdos number of three, a Kevin Bacon number of three, holds FCC ham radio Extra class and Commercial Broadcast/radar engineer licenses, and was voted one of the 50 most powerful people in networking by NetworkWorld magazine in 2006.

00:00   Asleep.

02:30   Awakened by crying 9-month-old identical twin babies. Deal.

03:00   Asleep again.

05:50   Up to shower, shave, dress.

06:27   Off to the train

06:37   Sit down on the train, surf on wireless a bit, and notice a bug in some C machine learning programs.

07:55   Get a Taquito at 7-11

07:59   At my desk. Check into the email

08:30   Done with email.

08:31   Check the spambucket.

08:32   Done with spambucket.

08:33   Grab an orange juice, start debugging the C machine learning code.

09:30   Find out we really are demoing an "oooh aaaah" project to visitors from headquarters.

09:40   Check the demo setup one last time. No problems.

09:50   Pick up some new parts for an infrared light project from Lou in Receiving. Can't resist playing with them for 20 minutes or so.

10:10   Back to the C machine learning code debug session.

11:00   Into Japanese language class.

11:30   Pop out of Japanese class to do the "oooh aaaah" demo.

11:45   Achieve goal of "oooh aaaah" (literally! Managers make that noise if you apply enough shock and awe)

11:55   Back into Japanese class.

12:00   Lunch! Decide to ditch a meeting on a project I'm not useful for.

MITSUBISHI
ELECTRIC

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12:30   Scour YouTube for videos on the Chilean mine rescue in progress that actually show the hardware!

12:50   Thwarted by Faux News, who saturates YouTube with crud.

13:00   Do a consult on a mechanical servo design. Minor changes needed.

13:40   Check a box of stuff to be scrapped - mostly old fuel cell parts. I fish out the hard-to-get platinium catalysts, and toss the rest.

13:50   Back to the C code debug session.

14:30   Small meeting on whether to patent some stuff or just publish it as soon as possible and move forward.

14:50   Do a consult on network security for the company. Bottom line is that we need to redo the mailservers and need to find someone competent and trustworthy because we're all overbooked.

15:00   Back to the C debug session. Seems to be a problem in growing the db, as it goes away if I init the db really large to start.

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16:00 Start a first draft of the project proposal for next fiscal year

16:26 Phone alarm goes off to tell me to get my stuff together and get on the train for the evening commute.

17:00 Onto the train. Make another attempt to see what's going on with the Chile rescue. CNN.com says 26 up already (yeah!)

17:05 Find the company making the Plan B drills. Center Rock, in Berlin, PA. Consider sending them an "Attaboy" letter, because they're the real heroes in this.

17:06 Back to this ^*&*(% C code debug on the laptop.

17:57 Back home! Make some cheesy rice and cold-and-sour soup for the 3-year old (he likes it cold. Go figure), and some hot and sour soup for me. Wife wants her leftover Chinese too. The twins are already fed and falling asleep.

18:30 Gear up and head to Kung Fu workout.

20:05 Back home from Kung Fu.

20:10 Soak in hot tub till legs stop hurting.

20:30   Check email for a conference schedule I'm helping on. No joy.

20:40   Oh- rereading con-com's reply, that teleconference is tomorrow night, not tonight. Silly me.

20:41   Drown my sorrows with chocolate milk and Chocolate Fudge Oreos.

20:42   Decide between "Supernatural" and "Team Fortress". Team Fortress wins.

21:20   Manage a nice backstab as a Spy disguised as a Medic in TF.

22:07   Decide it's time for bed.

22:10   In bed.

22:11   Asleep.

23:59   Dreaming about what a control system GUI should look like.

MITSUBISHI ELECTRIC

In the office he's William Yerazunis, PhD. On the *Junkyard Mega-Wars* set, he's Crash, team captain and self-proclaimed nerd. Yerazunis, who works as a research scientist at Mitsubishi Electric Research Laboratories, is a regular on the The Learning Channel (TLC)'s *Junkyard Mega-Wars*, a program in which two teams compete to build a vehicle from discarded materials.

TW Broadcast Operations Control Room

James Manchester - President Network Operations & Engineering NYC/NJ at Time-Warner Cable EE 1995

Inspection of a fiber closure that was run over by a bus in Manhattan. The bus ran through our safety cones while our plant maintenance teams were repairing a massive fiber issue that resulted when Verizon conduit caught fire underground. The bus never stopped. There were multiple 400+ count fibers in the closure.

A Day at Time Warner Eng.

- 8 am - 9 am: Breakfast with Headend and Hub techs. Breakfast and open forum for the headend and hub techs to talk to me about issues, concerns, etc..

- 9 am - 10 am: Bi weekly meeting with our Commercial Services Sales Organization. Meeting to review various projects to support 20% commercial services revenue growth. This year we have added fiber to our infrastructure to make serviceable 1,900 buildings opening up 17,000 commercial establishments.

- 10 am - 12 noon: Hub C Visit. Hub C serves 110k customers on the upper east size and is currently out of space and power and as a result is also suffering from HVAC issues. A review of the facility shows the dire condition it is in. Numerous devices are not on dirty power (not on protected power). A deli next door has been leased to place spot coolers to try to alleviate cooling issues. A dispute with the landlord is preventing us from moving forward with desperately needed upgrades and we will have no choice but to move the Hub to a new location. We tour some suggested sites nearby recommended by corporate real estate. A move of the Hub will cost about $10M and take about 18 months from start to finish.

- 12 noon - 1 pm: Lunch at City Crab on Park Ave with sales vice president from Arris to review the status of their dense QAM deployment in our Queens footprint.

RPI ECSE

A Day at Time Warner Eng.

- 1:00 - 3:00: Weekly Performance Metrics review with regional vice presidents. In this meeting we review weekly outages and their resolutions, trouble calls per hub, major events, VOIP readiness, High Speed Data growth, utilization and trending, Set Top Box performance, and VOD and Switched Digital utilization reports. Action items are assigned to mitigate any problems or negative trends that are identified.

- 3:00 - 4:00: 2011 Budget Review with the Capital Management team. Continue to refine capital budget for 2011 with significant focus on trimming maintenance costs associated with capital.

- 4:00 - 5:00: BST Digitization Business Case. Review status of the business case for digitizing analog basic. The plan is centers around recovering 30 QAMs worth of bandwidth but we would have to put a digital box on every basic only customer connecting directly to our system viewing analog channels.

- 5:00 - 6:00: Personal Time. Catch up on email, return phone calls, review personnel situations (promotions, recognition, and disciplinary issues), and review and approve/deny new purchase requests.

- Throughout the day I am also monitoring all the NOC notifications on issues in the field.

- Then I usually head home and eat dinner and try to relax a little. I try to leave by 6 pm because the job is 24x7. You could keep working and working, etc.. Inevitably something major happens (fiber cut, power outage, etc) in the evening resulting in me joining a bridge or preparing a status report for the CEO/CTO/COO of the company.

RPI ECSE

Lorenz Redlefsen – Arista Networks

Background: I finished my BS ECSE at RPI (class of '95), then went on to grad school at Stanford, thinking I'd do a PhD, but "dropping out" with an MS EE in '97. While I'm an "EE" in title, I'm a "software guy" day-to-day. I started my work career at Cisco, where I wrote software for their Catalyst 4000 series of Ethernet LAN switches for 8 years, then went to Arista Networks, where I have been writing software for Ethernet switches since 2005.

Most people think of infrastructure like networking boxes as boring stuff, until they learn more about what goes on inside them. There are very interesting problems to be solved, and the products are used all over the place.




http://www.redlefsen.com/

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ARISTA

Day-to-day stuff:

Most people refer to the software running on embedded devices as "firmware", but on modern devices, we're talking about a real operating system. Arista's OS is basically a full-blown Linux distribution (Fedora 12), with our own software running on top. This software includes drivers for special-purpose chips ("ASICs") and components such as lasers and DSPs that operate at 10Gbps (meaning these components have 0.1ns (100ps) per bit!), as well as networking protocols and system management code. It runs on a dual-core x86 CPU with 4GB of RAM -- a real computer! Our code is written in C, C++, and Python.

Our products are used as the "glue" that connects together thousands of computers for massive websites (think Google, Amazon, Facebook, Twitter, Ebay, etc.), and also to build cost-effective supercomputers ("clusters" of thousands of servers).

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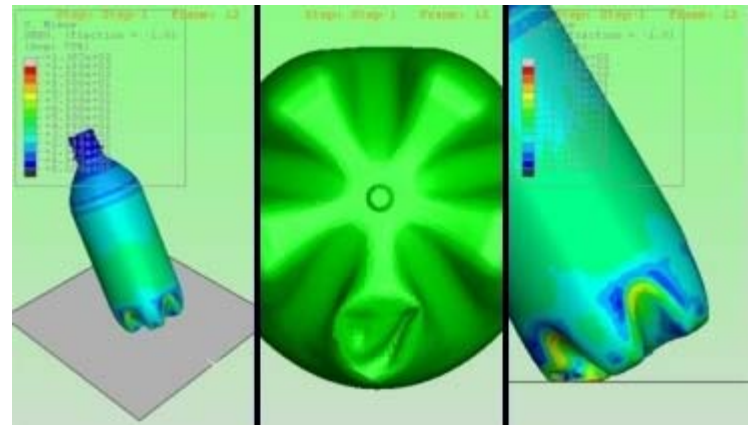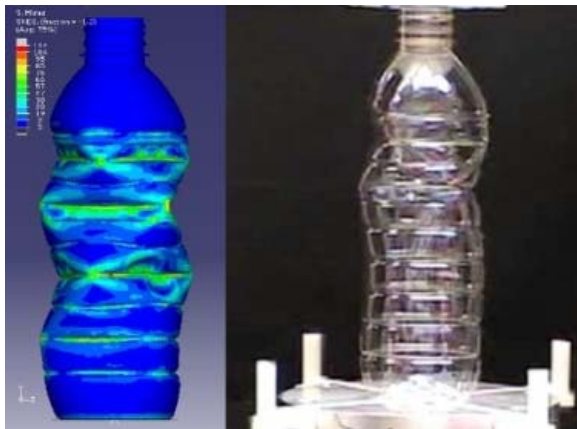
The key is to drive down the cost of large-scale computing by taking low-cost commodity x86 servers and connecting them using low-cost networking gear. Just two examples of how this is helpful:

1. Car companies can do "virtual crash tests" -- nowadays, they pretty much know the outcome of a crash test before they ever build the first prototype and smack it into a wall.

2. Packaging companies perform finite element analysis on things like plastic water bottles, minimizing the amount of plastic required to make a stable bottle. (Have you noticed how plastic water bottles have gotten thinner over the last couple of years?) Multiplied by billions of bottles per year, this results in significant reduction of the amount of plastic used for these bottles. http://www.plastictechnologies.com/services/td/fea/

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Nikon Precision - North American lithography subsidiary of Nikon Corporation

David Huchital – Former Chief Executive Officer and President

The day I chose is one in which a had a lot of fun and was also able to make a significant contribution. It would have been in the 1970's and I was working in the Research Department of Perkin Elmer Corp. My fellow researcher, George Steinberg, and I had been tasked with trying to **improve the discipline of atomic absorption (AAS) spectroscopy,** a mainstay of PE's business. AAS is an elemental analysis technique requiring generation of resonance radiation from the element in question and directing it through a hot burner into a monochromator tuned to the resonance wavelength. A sample is aspirated into the flame and presence of the element in question is indicated by an absorption of transmitted wavelength.

To that point the radiation had been generated in a glow discharge tube which used the subject element as part of the cathode structure, thus atoms were sputtered out of the cathode and electron collisions excited them to produce radiation. These so-called "hollow cathode lamps" were the weak point of the technique as the radiation was of low intensity and unstable. Attempts had been made at microwave excitation but the results were little improved. We had **heard that rf excitation might be effective and proceeded to build a simple resonance circuit and midnight-procure a small rf generator**. Our glassblower sealed small flecks of the required metal into evacuated glass ampules that had been backfilled with a few mm pressure of a rare gas.

The results exceeded our expectations, especially for the high-vapor pressure materials such as arsenic, mercury, thallium, cadmium, etc. Detection limits for these (dangerous) trace metals were reduced by several orders of magnitude with significant implications for the environment especially in water supplies.

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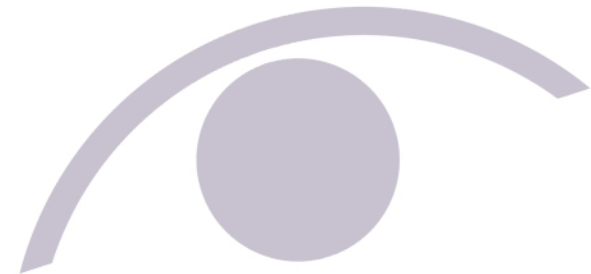
KRISTA J. GILE
Assistant Professor
Department of Mathematics and Statistics
University of Massachusetts

Ph.D.: University of Washington, Statistics, 2008
M.S..: Virginia Polytechnic Institute and State University, Science and Technology Studies, 2000
B.S.: Rensselaer Polytechnic Institute, Electrical Engineering, 1998

Research: developing statistical methodology for social and behavioral science research, particularly related to making inference from partially-observed social network structures.

Russell Tessier
Associate Professor
Electrical and Computer Engineering
University of Massachusetts

EDUCATION:
B.S.C.S.E., Rensselaer Polytechnic Institute, 1989
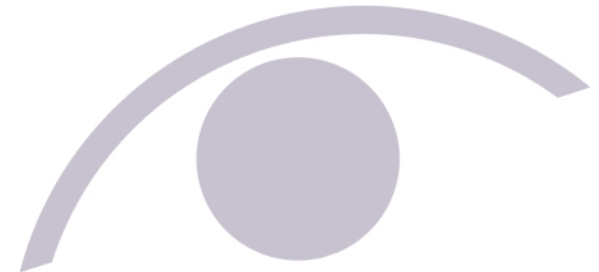M.S., MIT, 1992; Ph.D., MIT, 1999

RESEARCH INTERESTS: Reconfigurable Computing. Field-Programmable Gate Array Architecture. CAD Algorithms for FPGAs. FPGA-based Logic Emulation.

One Last Demo

Go to my webpage to see many useful links with career information.

Also go to MobileStudioProject.com to learn about this protypical EE, CSE project.

K. A. Connor

ECSE

The End

- Best of luck

- Questions?