# Engineering & Physics Club
# NEWSLETTER

**Sept/Oct 2003** **Volume 1, Number 1**


***"Education is not the filling of a pail, but the lighting of a fire."***
***- W. B. Yeats***

***Favorite websites:***

- **Engineeringcareerservices.com**
- **uspto.gov**
- **hotmath.com**
- **scientificcalculator.com**
- **findsounds.com**
- **theonion.com**
- **alltheweb.com**


**See this month's *Puzzler* -- p. 3**


## Welcome To Our First Issue

Our goal is to enhance the overall experience of engineering and physics students.

We welcome comments and contributions from students, faculty, and alumni. If you have an idea or informative article you'd like to submit, send it to gtoot1@comcast.net. Mark the subject line "Engineering & Physics." Selected articles will be printed in upcoming issues of the newsletter.

If you would like to become a member of the Engineering and Physics Club, send your name, address, e-mail address, phone number, and career choice to: President Ken Battinus -- kenbattinus@hotmail.com.

In this issue we feature an engineering marvel that proved *not* to live up to expectation (see "Great Engineering Disasters," page two). In future issues we will offer articles on other notable disasters, due in large to engineering miscalculations. Visit our Puzzler and be sure to read Barbara Dudas's excellent feature, on page four, about Colonel John Boyd, the man who "Changed the Art of War."

## Opportunities in Engineering & Physics

Dean Joe Kotowski and A. Patel, an engineer from UOP, gave a talk to a standing room only crowd of enthusiastic engineering students on Wednesday, September 17. From the responses and questions the audience posed, it appears there is a need for more interactive meetings such as this. A questionnaire had been passed around and the results are listed below. Because of the tremendous response, we expect a similar meeting in the spring. Next time we'll allow more time for questions and answers.

***Would visit Fermi Lab: 54%***

***Would visit UL Labs: 69%***

***Would visit a nuclear power station: 77%***

***Would visit an auto assembly plant: 92%***

***Would attend refresher courses for EIT or PE licenses: 69%***

***Suggestions for other tours: GE, NASA, and Argonne Labs***

## Does Schooling Pay Off?

In July 2003 and again in September 2003, engineers from two different companies gave talks to our engineering and allied students on Opportunities in Engineering. At both of these meetings, Mr. Jerry Chernin, a student, asked an interesting question to the presenters; "How much of what you learned in school do you use in your present work?" The answers he received may, or may not, surprise you. We'll give you their responses in the next issue and discuss what it could mean to you.

*"...the designers had insisted on square windows... The final result was explosions without warning, in mid-air."*

**Engineering & Physics Club**

**Ken Battinus, President**

**John Kalinowski, Vice President**

**James Pierce, Treasurer**

# Great Engineering Disasters

## The de Havilland Comet

After World War II, the British had jet engine capabilities few others could boast. The de Havilland Corporation capitalized on this skill and designed a revolutionary passenger aircraft that could fly higher, faster and quieter than anything else on the planet! After hundreds of hours of testing, they were ready. It was an immediate sensation. The company had the market to itself. Even the Queen of England had flown to her many Commonwealth destinations and waxed eloquent about the Comet. It was a beautiful bird, even by today's standards. Unfortunately there existed a fatal flaw. Two of their aircraft blew up months apart, inexplicably in mid-air with no survivors.

After detailed testing and several false starts, the engineers found that because the designers had insisted on square windows, so not to resemble a ship's portholes, it had turned out to be a big mistake. A crack occurred in a corner of one of the square windows, due to metal fatigue. This crack, not detected, propagated suddenly to a dome on the top of the fuselage. The final result was explosions without warning, in mid air.

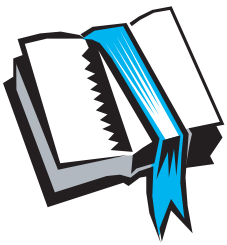
The Comet never really recovered from this bad rap. It was doomed to oblivion. By that time, Boeing's 707 and other U.S. aircraft manufacturers had viable commercial jet craft and continue to dominate the market today. Interestingly, the U.S. FAA would not give the Comet permission to fly over the U.S., because of the square windows. Take a look at present day aircraft windows; they all have rounded corners!

Next time, we'll discuss the Hyatt Regency, Kansas City Skyway disaster. What went wrong and how it could have been prevented.

# Meet Our Executive Committee

**Ken** **John** **James**

# Book Corner



***Ingenious Mechanisms for Designers and Inventors*** (four volumes), by Franklin Day Jones, Holbrook L. Horton, $150.00. This is a must for the serious machine designer. The book is also available through the libraries of Harper College, Glenbrook North and South High Schools, and NIU.

***John Boyd: The Fighter Pilot who Changed the Art of War,*** by Robert Coram, Little Brown & Company (see Barbara Dudas's article, page four)

# This Month's Puzzler

(Courtesy of Click and Clack, the Tappet Brothers)

The owner of a merry-go-round sends his two sons to measure the inside and outside diameter of the merry-go-round floor (the mechanics of the merry-go-round are located in the center of the floor), so he can place an order for some very expensive epoxy paint. The paint costs $75 a gallon and each gallon covers 250 square feet. The owner doesn't want to order any more paint than he can use, because he can't return it. The sons go out with a tape measure and come back with a number.

"70 feet, Dad! I couldn't measure the inside diameter, because the machinery is in the way, so I just measured a straight line from the outside edges, but the line is tangent to the inside diameter," says the younger son.

"You Dummy!" shouts the dad. "I can't use that number. Go out and measure the inside and outside diameters.

"Wait a minute, Dad," says the older son "I think we can use that information."

How many gallons of paint did they order? If you know the answer, send it with your calculations, to the Engineering and Physics Club mail box in the BSA office. The winning answer will be chosen at random and featured in our next publication.

## *The Engineering Challenge of the Century:*

# GM Bets Billions on a Hydrogen Car

***"…making cars today is a lousy business…"***

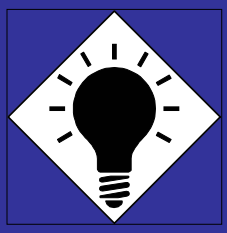
***"…a potential one trillion dollar market."***

In the October issue of *Business 2.0* magazine, Ralph King has opened a new chapter into GM's vision of the future and it may not include oil or gas. What the doubters don't get, and this includes the oil companies, is the simple economics has forced GM to be serious about hydrogen. Making cars today is a lousy business and GM sees this hydrogen future as a potential one trillion dollar market.

Bob Lutz of GM once famously dismissed fuel-cell cars by observing that humans and cows emit more greenhouse gases than cars. But the potential has gradually converted Lutz into a strong advocate of the project. Thus far GM has spent over a billion dollars and has committed 500 engineers and several hundred million dollars per year. The oil companies are less sanguine about it and don't believe it can be done. They don't want to upset the status-quo.

GM has competition: Toyota's FCHV, Ford's FCV, Daimler's F-Cell, Nissan's Xterra and Honda's FCX are all in there. GM's model is the Hy-wire and GM is committed to this project. They've pledged publicly to have a drivable version of the car by year end. Exxon and others don't believe GM can or really wants to commit to hydrogen. Who really wins will mean the end for one huge energy market and bonanza for another. The jury is still out.

## *Capitalizing on Problem Solving:*



# Insights into Brilliance

This year marks the centennial celebration of the Wright Brothers' extraordinary achievement. But there were other geniuses of that period: Thomas Alva Edison, Nikola Tesla, Alexander Graham Bell, Harvey Firestone, Philo Farnsworth and John Boyd.

How did these men crank out such incredible inventions and at a consistent rate? What was their secret? We know they liked to tinker. They had a great curiosity and liked to take apart and reassemble things. We all do that. But these inventors had something more. When Edison had an especially difficult problem and no apparent solution, he'd sit in a comfortable arm chair. In each hand he held a weight. Beneath each hand, on the flat arms of the chair, he placed a desk bell. As Edison grew sleepy, his arms would slowly lower until they hit the bell, thus awakening him. That would cause him to raise his arms again, and so forth. This way he maintained an alpha level of consciousness conducive to problem solving. Others have found their period of brilliance when jogging, walking, bathing, or just before falling asleep. (Continued next page 4)

Philo Farnsworth was another incredible inventor. He was born in 1906. He found his "alpha level" while plowing the wheat fields on his father's farm. At age 14, he came up with the concept for television; the stream of electrons coming across the picture tube, line by line. At age 21, he had a working model! His nemesis was RCA's David Sarnoff whose famous line," We collect royalties, we don't grant them" was a prelude to a long drawn out patent fight. Eventually, Farnsworth's high school teacher saved the day and the case by exhibiting an original sketch, completed by Farnsworth at age 14, detailing his transmission of televised data (see patent # 1773980). Farnsworth never became a household name because soon came the distraction of World War II and when it was over, his patents had expired. In Farnsworth's final words to his children, he urged them not to watch television. He said" There's nothing on there that's worthwhile." Farnsworth's best alpha moments may have come from plowing his father's fields.

It's up to you to determine your best method for "moments of brilliance."

## *Colonel John Boyd:*

# He Changed the Art of War

***By Barbara Dudas**, Oakton C. C. second year student*

Colonel John Boyd is one of engineering's greatest unsung heroes. His career with the Air Force spanned several decades and his contributions to aerospace engineering remain one of the industry's best-kept secrets.

Boyd joined the Air Force in 1951 as a fighter pilot. He quickly became the best pilot in his squadron and was know as "40 second Boyd" – capable of defeating any challenger in 40 seconds or less. After graduating flight school, he stayed on to teach aerial combat maneuvers at Nellis AFB.

At the time, fighter aircraft were often designed to perform as both fighter and bomber transport. The bulky designs frustrated Boyd who was constantly asking his superiors to improve maneuverability of the fighter aircraft, but Air Force engineers wouldn't listen to some hotshot fighter pilot and his crazy ideas about airplane design. Sick of being dismissed, Boyd took a 4-year hiatus from teaching aerial tactics and at the age of 34 got a degree in engineering.

Now he had the right equations and terms to explain what he was talking about. But, Boyd's outspoken character and knack for offending people by pointing out mistakes in their work earned him plenty of enemies. Instead of accepting him as a new peer, he was shunned and assigned to a janitorial post at a new base.

Boyd decided to begin testing and designing in secret. With the help of a friend in the computer department, he began running theoretical simulations of weight, design, and maneuverability on his planes. In 1962, he developed an energy-maneuverability theorem for quick assessments of an aircraft's possible flight options based on aerodynamics and weight. He would show his work to whoever would listen – and finally it paid off. Boyd was assigned to the F-14 project at the Pentagon.

Though met with opposition along the way, his remarkable E-M Theory was proven right again and again. His work accomplished radical changes: E-M offered a scientific method for teaching aircraft maneuverability and flight technique, which was previously based on "instinct" and "gut feel." Pilots could now be taught the why, not just the how. Because of his E-M theory, aircraft design technique also shifted; engineers started designing smaller, lighter, more maneuverable fighters.

After retiring from the Air Force, he transferred his focus to combat tactics. He began teaching warfare tactics at the Marine Base Quantico. The new strategies he developed, known as the OODA Loop or ""Boyd Cycle" were first used during the Gulf war. Only after his death did it become public knowledge that (then) Secretary of Defense Dick Cheney, a longtime observer of Boyd's quiet achievements, tossed out General Norman Schwarzkopf's original plan for the war and used Boyd's instead.

His engineering and tactical warfare theories changed the course of history, and are still used today by all branches of the military and many corporations. Boyd died in 1997 and is buried in Arlington National Cemetery.

**Want to learn more? Get the whole story in Robert Coram's new book*: John Boyd: The Fighter Pilot who Changed the Art of War.***

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**Oakton Community College Engineering & Physics Club**

**Room 1433 Des Plaines Campus**

**Contact: gtoot1@comcast.net**