Foothills Amateur Radio Society
Relay

February 2005 Volume 35, Number 2

February Club Meeting

Date: Friday, February 25, 2005.

Time: Socializing at 7 pm, Meeting at 7:30

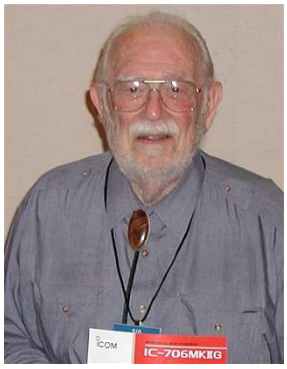
Place: Covington School, 205 Covington Road, Los Altos

Speaker: Dr. Keith Snyder
Northrop Grumman Electromagnetic Systems Laboratory
Topic: "Better antenna modeling through advanced computational electromagnetics"
The use of computer modeling tools for antenna design has exploded. A VHF antenna will be modeled on a Humvee by using the program FEKO. FEKO uses the same general method of analysis as EZNEC, viz. the method of moments, but is more powerful. FEKO Lite is a free download that will get you started assuming you are proficient at antenna modeling with EZNEC.

FARS / PAARA 2005 Winter Banquet Report

The banquet was a huge success. Nearly 100 attended. At the banquet, Trey Garlough, N5KO, spoke about "Contesting in the Galapagos." Pictures showed the island where Trey and others set up a contesting complex with buildings, antennas and gear.

Trey Garlough, N5KO



Sig Rich, KG6HRU

Sig Rich, KG6HRU, carried away the first place raffle prize, an ICOM IC706 mobile radio. Congratulations to Sig and all winners. See more banquet report later in this Relay.

Upcoming Events

Feb 25	7:00 PM, Club meeting, Covington School
Feb 26	1-4 PM, SPECS Emergency Communications class
Mar 3	7:30 PM, Board Mtg at the Los Altos Town Crier
Mar 5	8 AM to 9 PM, AM-Tech day, SLAC
Mar 6	Livermore Flea Market
Mar 12	6 AM to noon, Electronics Flea Market
Mar 25	7:00 PM, Club meeting, Covington School
Thursdays	8:00 PM, FARS net, 145.230(-), 100 Hz PL

See more events, FARS Calendar
<http://www.fars.k6ya.org/events/calendar.shtml>

Presidents Corner

Membership. I want to remind everyone that it's time to renew your FARS membership if you have not already done so. Membership is only $20 a year and provides the funds we need put on our monthly programs, our popular Am-Tech Day, and Field Day each year. The most important part of FARS is YOU! Our members are what make FARS special.

Winter Banquet. It was a big success again this year. I very much enjoyed our speaker Trey Garlough N5KO. I want to thank Dave Cooper, KE6PFF, for handling the signups and coordination with the restaurant. I want to thank Howard Takaoka, KG6GRO, and Ron Green, KG6RLG, for handling prizes, badges, etc. I want to thank PAARA members Jim Rice, K6AK, and Ian Brune, K6IAN, for arranging for our speaker and handling the raffle. Great job everyone.

Am-Tech DAY. March 5 is our next Am-Tech Day at SLAC, check the FARS web site (www.fars.k6ya.org/) for details on the location or subscribe to the FARS Announcement list (www.fars.k6ya.org/mail/) to make email notices.

Flea Market. The Electronics Flea Market returns to Sunnyvale on Saturday March 12. See www.asvaro.org for more details.

- de Mikel, KN6QI

Board of Directors Meeting Minutes

Thursday, January 6, 2005. Called to order at 7:37 p.m.

Conf. Room, Los Altos Town Crier, 138 Main Street, Los Altos

Present: Richard Baldwinson, Dave Cooper, Rob Goodson, Ron Green, Phil Hawkins, Ruth Lacey, Steve Leander, Mikel Lechner, Steve Stearns, Howard Takaoka. Absent: Robert Flemate, Mark Hardy

December 2nd meeting minutes were read and accepted as corrected.

Dave Cooper reported that 55 people had signed up for the banquet so far. The cost of the speaker, Trey Garlough, will be split between FARS and PAARA. Discussion followed on details of check-in, food and publicity. The Board agreed on the necessity for a big publicity effort for the banquet speaker on the local net. President Lechner stated that the Relay would be out early. He also emphasized that the annual banquet was for members only and their guests.

At 8:00 p.m. the Board took a short break to check in on the Tuesday evening net. Dave Cooper made announcements about the banquet and the January 15 Am-Tech Day at SLAC.

After the break, Dave Cooper summarized the preparations needed for January 15, including the routing of cables, the provision for portable outlets for outdoor use and equipment brought in that meets accepted standards. Dave will provide a short write-up of Am-Tech Day with a picture or two for the Relay and create a flier that can be hand-distributed and also placed on the FARS website for downloading.

Dave, club Treasurer, reported a bank balance of $6720.39 as of 1/6/05.

Dave and board member Phil Hawkins will check FARS insurance policy, updating it to agree with the club's current equipment.

Future possible meeting programs were discussed. A possible March topic: "Repeaters."

Dick Baldwinson requested weekly updates for board members on signups for the annual banquet and Dave Cooper agreed to do this.

The meeting was adjourned by President Lechner at 9:05 p.m.

- de Ruth Lacey, Secretary

CLUB INFORMATION

President:	Mikel Lechner, KN6QI
Vice President:	Steve Stearns, K6OIK
Treasurer:	David Cooper KE6PFF
Secretary:	Ruth Lacey, KG6RZG
Radio Officer:	Phil Hawkins, KA6MZE
Training Officer:	Mike Zensius, KG6GUE
Relay Editor:	Mark Hardy, KG6GRR

FARS Board: Dick Baldwinson N6ATD, Howard Takaoka KG6GRO, Robert Flemate KE6TFU, Rob Goodson N2RAG, Steve Leander KV6O, Ron Green KG6RLG.

Station Trustee: Stan Kuhl, K6MA
FARS Web Page: http://www.fars.k6ya.org
Download Relay: http://www.fars.k6ya.org/relay

Club members and non-members are encouraged to subscribe to the FARS Announcement list by browsing www.fars.k6ya.org/mail, clicking on Subscribe/Unsubscribe and following the instructions under "Subscribing to fars-announce.

You may also submit an announcement to the FARS Announcement at fars-announce@svpal.org. The list is moderated and messages will be posted as approved by the list moderator.

The FARS board of directors may be reached at fars-board@svpal.org

Club meetings are held at 7 PM on the fourth Friday of each month except January (Winter Banquet); and sometimes there are changes for June (for field day) and Nov. & Dec (for holidays).

Annual club membership is $20. Club badges are $6. Visitors are always welcome! Directions in this newsletter. Talk-in: N6NFI (145.23-, 100 Hz) or W6ASH repeater (145.27-, 100 Hz).

The FARS *Relay* is the official monthly newsletter of the Foothills Amateur Radio Society. Contributions to the newsletter from members, family, and guests are earnestly solicited! Contributions subject to editing and/or compression. ASCII files via Internet or diskettes preferred; but all readable forms welcome.

Here is how to reach the editor:
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Mail: 2998 Jerald Avenue
Santa Clara, CA 95051
Voice: 408-243-0701 (Before 9 PM, preferred)
Fax: 408-243-0701
Email: kg6grr@arrl.net, At FARS meetings.

Dr. Know-It-All

Question: I've noticed that physics students study "E&M" from textbooks titled "electrodynamics," while electrical engineering students study "field theory" from textbooks titled "electromagnetics." Is there a difference between these subjects, *electrodynamics* vs. *electromagnetics*? From Andy, KR6DD, and Michael, N6EMR.

Answer: There is an important distinction between "electromagnetics" and "electrodynamics." The story takes place in another century. Electromagnetics is the 19th century theory of James Clerk Maxwell. It was the first "field" theory in physics. Researchers before Maxwell studied the forces between like entities. For example, Gilbert studied the force between magnets, Coulomb studied the force between charges, and Ampere studied the force between currents. Maxwell introduced the idea of a field as an intermediary to explain such forces. If one charge produces an electric field in space, then another charge may experience a force due to the field produced by the first charge. Likewise, if one current produces a magnetic field in space, then another current may experience a force due to the field produced by the first current. The introduction of the field as an intermediary to explain force was crucial to Maxwell's development of electromagnetic theory because it allowed him to discover and repair a defect in Ampere's Law. Maxwell reasoned that a term was missing in Ampere's Law. He guessed at the term on purely mathematical grounds, whereupon he made a startling discovery – that the missing term predicted electromagnetic radiation in the form of waves in space.

In Maxwell's theory, current is charge flow, but the nature of current is otherwise undefined. There is no conception that charge is carried in packets by discrete particle carriers, or that charge is quantized. In Maxwell's view, current can well be a continuous fluid. Mass does not enter the theory, the ideas of kinetic energy and momentum being absent. However, energy conversions among different forms are recognized, e.g., via resistors, motors, and generators.

Oliver Heaviside (Scots EE) rewrote electromagnetics in terms of vectors and vector differential operators in the early 1880's, after Maxwell's death in 1879. Heaviside's vector equations for Maxwell's theory, are shown in Figure 1. The equations are widely but incorrectly called "Maxwell's equations." By convention, the symbol E represents the electric field, and H represents the magnetic field. E and H are vector fields, i.e., they each have magnitude and direction that varies with location in space. This is obvious because force has direction; therefore a field that explains force must have direction too. Alternate formulations of Maxwell's theory have been developed in recent times that don't involve vectors and are based on either differential geometry or Clifford algebra. The former is useful for understanding relativity, while the latter is useful for understanding spinors in quantum mechanics.

Faraday's Law of electromagnetic induction

$$\nabla \times \mathbf{E} = -\frac{d\mathbf{B}}{dt}$$

Maxwell's generalization of Ampere's Law

$$\nabla \times \mathbf{H} = \mathbf{J} + \frac{d\mathbf{D}}{dt}$$

Gauss's Law for electric charge

$$\nabla \bullet \mathbf{D} = \rho_e$$

Gauss's Law for magnetic charge

$$\nabla \bullet \mathbf{B} = \rho_m$$

Figure 1. Heaviside's equations for Maxwell's electromagnetic theory

Electric flux density **D** and electric field strength **E**

$$\mathbf{D} = \varepsilon\mathbf{E}$$

Magnetic flux density **B** and magnetic field strength **H**

$$\mathbf{B} = \mu\mathbf{H}$$

Conduction curent density **J** and electric field strength **E** (Ohm's Law)

$$\mathbf{J} = \sigma\mathbf{E}$$

Figure 2. Constitutive relations among fields in a medium

A medium is defined by the constants of proportionality ε, μ, and σ, called the permitivity, permeability, and conductivity of the medium respectively. A simple medium is one that is constant, linear, and isotropic, and for which ε, μ, and σ, are ordinary numbers. However, a medium can be anisotropic, either electrically, magnetically, or ohmically. In such cases, the vectors in the pairs D and E, B and H, or J and E, may have different directions, and the constants of proportionality ε, μ, or σ are second order tensors. Common examples of such media are crystals, laminated transformer cores, and the conductive rubber strips that connect LCD displays to circuit board pads. A medium can be time-varying rather than constant. In this case, $\varepsilon(t)$, $\mu(t)$, and $\sigma(t)$, are functions of time. A medium can be nonlinear rather than linear. In this case, ε(E, H), μ(E, H), and σ(E, H), are functions of the local electric and magnetic field strengths. A medium can also be nonlinear with memory, having properties that depend on the past values of the field strengths. An example is magnetic hysteresis exhibited by ferromagnetic materials. Lastly, a medium can be an engineered metamaterial. Such man-made substances don't occur naturally. For such materials, ε and μ, but not σ, are negative numbers.

The early 20th century brought several innovations in physics. Soon after 1905, Einstein was surprised to discover that Maxwell's theory needed no modification to account for special relativity. Indeed, Maxwell's theory implies relativity, although that was not how Einstein arrived at the idea. After the birth of the atomic theory of matter, the idea emerged that charge is carried by particles that also have mass. These ideas (plus others from statistical mechanics) were added to electromagnetics to form the subject of electrodynamics. The standard modern physics text on the subject is John David Jackson's *Classical Electrodynamics*, now in 3rd edition [1].

Likewise the early 20th century brought many changes to electrical engineering. Steinmetz developed a-c circuit theory based on complex numbers, introduced phasor notation, impedance and admittance. Foster published the reactance theorem which initiated a 30-year development of passive network synthesis theory based on the properties of positive real rational functions. Low frequency antennas were developed. (19th century antennas were limited to horns, reflector antennas, and dielectric lenses.)

A good deal of electrical engineering is based only on electromagnetics; other parts require electrodynamics or more. Roughly speaking, d-c and a-c analog circuit analysis using resistors, capacitors, and inductors, transmission lines, waveguides, antennas, power transmission, telegraphy, telephony, and wave propagation in free space can be explained and understood strictly in terms of electromagnetic field theory or derived circuit theory concepts. The analysis of motors and generators is traditionally partitioned such that the electrical and mechanical aspects are separate. Any discussion of momentum is confined to the mechanical side and doesn't enter into electrical analysis of such machines. The classic electrical engineering textbook, Julius Adams Stratton's *Electromagnetic Theory*, 1941, is unfortunately out of print [2]. Nowadays, it's Balanis [3], Kraus and Fleish [4], and the ever popular Ramo, et al., [5].

Conversely, electrodynamics is required to understand "electronics," i.e., devices such as diodes, transistors, thermionic emission devices, vacuum tubes, photo-multiplier tubes, klystrons, magnetrons, certain kinds of radiation, and wave propagation through plasmas (the ionosphere) – not to mention black holes and quantum mechanics. Momentum emerges as an important concept in such contexts, where mass is a required concept.

So there you have it. Electronic device design may require knowledge of electrodynamics, but antenna and circuit design proceeds nicely within the tidy subset called electromagnetics or its special cases, circuit analysis and transmission line theory. Physicists continue to explore the frontier while electrical engineers have tidied up the house, developing new and systematic ways to solve differential equations using computers, and using those tools to design ever smaller chips and microwave circuits for modern wireless wonders.

That's it for this month. You can send your comments or questions about any aspect of Amateur Radio to Dr. Know-It-All. Written comments and questions are accepted at the monthly meetings of the Foothills Amateur Radio Society, by email to FARS officers and board members, or through the FARS web site at http://www.fars.k6ya.org.

References:

1. John David Jackson, *Classical Electrodynamics*, 3rd ed., Wiley, 1998, ISBN 047130932X. first edition published in 1962.

2. Julius Adams Stratton, *Electromagnetic Theory*, McGraw-Hill, 1941, ISBN 0070621500.

3. Constantine Balanis, *Advanced Engineering Electromagnetics*, Wiley, 1989, ISBN 0471621943.

4. John Daniel Kraus and Daniel A. Fleisch, *Electromagnetics*, 5th ed., McGraw-Hill, 1999, ISBN 0072899697. First edition published in 1953.

5. Simon Ramo, John R. Whinnery, and Theodore Van Duzer, *Fields and Waves in Communication Electronics*, 3rd ed., Wiley, 1994, ISBN 0471585513. First published as *Fields and Waves in Modern Radio*, General Electric, 1944.

Stanford Dish

On Sunday, April 3, the Palo Alto Historical Association will present a program on the Stanford Dish that was supposed to have been demolished long before this date. According to the dish website, the demolition has been delayed by Stanford's School of Engineering until after June 30th of this year to give the Friends of the Bracewell Observatory time to create a rescue plan and get enough financial support and volunteers to restore and operate it. (www.bambi.net/stanford_dishes/rescue.html)

The proposal will be to open the restored site to the public, i.e. amateur groups interested in radio astronomy, schools, and of course, Stanford itself.

The April 3 speaker is Dr. Bob Lash, a past Director of the Society of Amateur Radio Astronomers. He'll talk about the 50 year history of Site 515, where Prof. Bracewell built the Stanford Radio Astronomy Observatory, and describe the effort to save the dish from demolition.

The presentation will be given in the ballroom of the Lucie Stern Community Center on Middlefield Road in Palo Alto, just north of Embarcadero.

- deRuth, kg6rzg

FARS/PAARA 2005 Banquet

Attendees

Attendees

FARS would like to thank **Ham Radio Outlet** in Sunnyvale, CA for the very generous donation of books and gear to the Banquet Raffle.

Prize Winners

1	Sig Rich, KG6HRU	IC706
2	Dennis Vernier, W6ALC	FT8800R
3	Howard Califf, W6HOC	Handbook
4	Stanley Towle, WA6ZGI	Antenna Bk
5	Andy Nagorski, KG6HST	Dig MultiMtr
6	Patricia Nagorski, KG6HRJ	Dig MultiMtr
7	Steve Stearns, K6OIK	Bk-Ham Dummies
8	Jay Melvin, WA6SBO	Bk-Ham Dummies
9	Stan Kuhl, K6MA	HF Dig Hdbk
10	Andy Nagorski, KG6HST	HF Dig Hdbk
11	Chuck Walter, N6CAW	Bk-Yaggi ant
12	Terry Ridgeway, N6ZAG	Bk-Yaggi ant
13	Peter Griffith,WA6VAQ	VoIP book
14	Marvin Brune, KG6TKP	VoIP book
15	Susan Thomas, KG6RZI	Spotlight

[Apologies for any errors in the above table as the notations were sometimes difficult to align in the handwritten list– ed.]

FARS Membership Form

PLEASE fill out the form for all new/renewal memberships.

FARS 2005 MEMBERSHIP RENEWAL FORM Date: _____

Name(s) & Callsign(s) & Class (E-A-G-T-N-None): _____

_____

Mailing Address: _____

_____

Home phone: _____ Work phone: _____

Fax (H or W?) _____ Packet BBS Address: _____

E-mail: _____ ARRL Member(s)? _____

Preferred modes: (e.g. HF-SSB/VHF/QRP/Other): _____

I'm willing to Elmer new hams with: _____

_____

Special topics of interest / suggestions for club meeting speakers:

_____

Dues: $20 per year, new members add $6 for badge fee. Please write one check for both banquet and membership.

Please note: Membership runs from January 1 to December 31.

Send your check payable to FARS, to:

David A. Cooper, KE6PFF
270 Redwood Shores Parkway
PMB 41
Redwood City, CA 94065-1173

How to get to regular meetings:
(Visitors always welcome)

Our meetings are held at the Covington Elementary School (directions below) on the fourth Friday. Socializing at 7 PM with the regular meeting at 7:30 PM. There may be changes in the meeting dates for January, June, November, and December.

DIRECTIONS:

From Interstate 280. take the El Monte exit Northeast. Cross Foothill Expressway. (A) At the first traffic light turn right on Covington. (B) Immediately at the fork take the left street (Covington). Go about 1/10th of a mile. Turn left into the parking lot. The gym is the tall building to your right with red and white stripes.

From Foothill Expwy. From Foothill Expressway, take the El Monte exit and go Northeast; then follow directions as above at point (A).

From US101 or El Camino: take San Antonio Road west (to Foothill Expressway). Then follow directions as above at point (A).

TALK-IN via the N6NFI (145.230-; 100Hz PL) repeater or the W6ASH 145.27- (100Hz PL) repeater