EEVC NEWSLETTER

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TRYING OUT A HONDA CNG CAR
Pete Gruendeman


Honda's natural gas-powered Civic

October 10, 2010 was promoted by www.350.org as a day of environmental awareness, especially in regards to atmospheric CO_2 levels. Honda Motorwerks of La Crosse, WI hosted an event to teach the public about alternative fuel vehicles, including NEVs and Honda compressed natural gas (CNG) cars. A lot of information was presented. To make sure nobody was snoozing, there was a quiz at the end. The person with the most right answers was awarded the use of a CNG Honda Civic for a month. That was me!

I took possession of the CNG Civic on Nov. 14th. The remarkable thing about the CNG Civic is that it is not remarkable. It's a fine car that does what a gasoline car does but costs about half as much to fuel. Its acceleration is much better than my '01 Prius. I put 220 miles on the first tank of CNG as I didn't yet trust the fuel gauge. Running out of gas with a CNG car is remedied by calling a tow truck. One does not just walk to a gas station and buy a gallon of fuel.

Fueling a CNG car is a challenge at this time. La Crosse has one fueling station; Madison and Milwaukee each have several. Minneapolis/St. Paul has ONE. The fueling stations are costly or very costly, depending on whether they compress the gas as needed or compress it and store it in the compressed state. The latter version allows for fill-ups in seconds. The former takes 1-2 hours. Federal money is available to pay for CNG fueling stations in areas of poor air quality, such as Milwaukee and Chicago. At-home fueling is also an option for those with natural gas piped to their homes. Here the process takes many hours, comparable to charging a battery EV.

The most interesting thing about natural gas or methane as a fuel is that it is renewable. Digesters on some of the larger farms create methane from manure and burn it to generate electricity. Methane is also the primary ingredient of landfill gas. Making electricity from methane is a low value-added process, especially compared to using it for motor fuel in a CNG vehicle. Honda Motorwerks has invested in a storage tank and a truck

to bring the methane to their facility so their customers' cars can run on renewable methane. "Net-metering" this pipeline grade methane into the existing natural gas pipeline structure is not yet a reality but Motorwerks is working on it. Stay tuned.

NEWSFLASH
Oliver Perry

"Brutal Winter for Northeast Rail System"

"Mechanical breakdowns, stranded trains, rising fares, and the governor's plans to cut another $100 million from the Metropolitan Transportation Authority's budget have left travelers fuming. An onslaught of snowstorms has exposed the rail system's weaknesses, shorting out electric motors and snapping electric lines. On Monday the Metro-North commuter line will cut service on its popular New Haven Line because half of its trans are in the shop."

"Snow storms have blown snow into the cooling vents atop trains that were built in the 1970s. The melting snow has since shorted out the electric motors that move the cars." "Snow has also shorted out door motors and safety sensors."

The Obama Administration has called the Northeast Corridor a gem and wants to replicate its success nationwide with a $13 billion dollar plan for new high speed rail lines. Obama wants to bring high speed train travel to 80% of Americans.

"Bill Henderson, executive director of MTA citizens' advisory committee, said federal money might be better spent fixing the trains that exist."

BEFORE THE EV-1 CAME THE IMPACT
The Car that Could, Part III
Oliver Perry

Review

In 1987 GM hired AeroVironment, a small R&D firm located in the San Gabriel Valley, California and founded by Paul MacCready to build a solar powered car to compete in a highly publicized race across Australia. GM's famous Sunraycer resulted.

Why would GM build a solar car?

At the time, many analysts and shareholders were critical of GM's recent purchase of Hughes Aircraft (18 months previous) for $5.7 billion. Roger Smith, CEO of GM, talked excitedly of transferring the space age technology of Hughes to the auto industry. Howard Wilson, a GM VP at Hughes, was expected to find a way to do this. Hughes made solar panels for satellites and no other company in the world knew the technology better. There were those in GM, such as head of North American operations Lloyd Reuss, who were skeptical of the value of a solar powered car project to a company that sold millions of cars. But a few other key executives, Bob Stempel one of them, felt the idea was worth pursuing. They knew that although solar paneled vehicles had no future on US highways, (there is not enough energy per square foot of sunlight to power a ton of mass) there might be a future for battery powered electric cars. A solar race vehicle would give GM engineers experience in developing the advanced electronics needed for mass production of electric cars, and demonstrate to the skeptics that the Hughes Aircraft purchase offered future promise.

The GM Sunraycer outperformed all other competitors in the Australian race, became a legend touring hundreds of schools, and found a home in the Smithsonian Institute. It provided GM incredible positive publicity for years.

After the Sunraycer project proved successful, an engineer on the AeroVironment team, Alec Brooks, presented a proposal to GM to fund the building of a prototype electric car based upon Sunraycer technology. This car would be more practical than the Sunraycer, built along the lines of a sports car, a vehicle that might practically compete in the marketplace.

The secretly produced prototype called the Impact made a hit at the 1990 Los Angeles auto show (see Nov *EEVC Newsletter* issue). Ken Baker, a seasoned GM project manager, was assigned to hand build a small quantity of Impacts, making them suitable for a mass production manufacturing process. Transforming the Impact, the Electric Show Stopper, a one-of-a-kind model into an assembly line product, within a short time span measured in months, became Baker's challenge.

In the December issue of the *EEVC Newsletter* I reviewed some of the major problems that had to be overcome in order to mass produce the Impact, including the assembly of cheaper workable Cocconi inverters. The enormous stress and disagreements experienced by the engineering staff working on the inverter and charging systems eventually lead to Cocconi's self willed exit.

Part III : From show car to production car continues...

In 1991 Stempel and Reuss, the leaders of GM, had a terrible year. GM sold fewer cars than in 1990 and posted losses of $3 billion. Standard and Poor's placed GM on a credit watch. The GM board of directors demanded that Stempel and Reuss take action. As result, six assembly plants were closed and 74,000 jobs were cut. Baker was told that his Impact program would have $40 million deferred to the following year. But taking an extra year to make the Impact ready for production could be suicidal for the electric car. Baker realized that he had to produce the first hand build Impacts before the GM board aborted the whole effort. Many within GM felt that it was only a matter of time before the Impact program would be axed. In a Star Wars type movie at this point some character would magically step forward with a million dwarfs, raise his crystal stone stolen from the mountain, and make it happen. But not at GM. It would take time to turn the prototype Impact into a feasible reproducible assembly line car. To do this in a short amount of time would take a miracle and there were no miracle-working dwarfs around to do this. How could Baker produce assembly line ready Impacts before time ran out, without miracles?

A "fast build" needed

A GM employee by the name of Latham Redding, who once had overseen a team at Saturn build a working prototype in a short period of time, appeared on the scene.

"Redding argued that if they did a fast build quickly enough they could apply what they learned by midsummer of 1992 to the first batch of thirty Impacts to be constructed at the Tech Center's small experimental assembly line.... The fast built would give top management a car that they could see, touch, and drive. It would be a (production) car that might stir excitement and keep the program alive."

"To an outsider, Baker's fears for the program's fate might have seemed almost irrational. In California, after all, the mandate was set, its timetable ticking inexorably toward 1998. But, its coverage was limited... few in Detroit thought the mandate would hold when lobbyists like Sam Leonard swung into action." And, if it did hold up GM could supply the CARB requirements like the other major auto companies by supplying cheaper made conversions. So Baker had every reason to feel in a hurry to complete his project. He wanted a "here now" ready for production vehicle.

*But, Baker was still not sure he could build a saleable Impact for California. He KNEW that he couldn't build one for the Northeast." The cold winters would rob the Impact's range. In spite of his doubts Baker was not about to walk away from the obstacles in his path. He wanted to pull off a miracle and produce an electric car with which GM could met the CARB requirements.

Scenes from the fast build floor: skeletal structure

"Stages of the fast build Redding could schedule with military precision. But for all the parts added from brakes to to batteries, to seats to wheels — he had to rely on the Impact's engineers to give him the latest designs. As Redding soon realized, not all were available; or if they were, the designs conformed to earlier versions and might be crucial millimeters off. That got the vehicle expert mad." When delays began holding up the build Redding doubled up his designer team without permission. When upper management complained there was no money for the added staff Redding screamed, "You can't put so many constraints on me! Something's got to give!" In the end Redding resorted to utilizing his own men and pattern making equipment to solve problems on the spot.

Meanwhile a struggle with the inverter

The Delco Electronics team produced a key piece of the inverter puzzle, engineering a heat resistant case containing the IGBTs and other electronics that switched 320 volts

of power 20,000 times a second and passed along 100,000 watts of power. Sometimes engineers have greater trouble eliminating unwanted side effects (heat in this case) than they do in making the device achieve its designed function.

Cocconi's MOSFETs (metal oxide semiconductor field effect transistors) had been replaced with IGBTs (insulated gate bipolar transistors) because fewer were needed (see Dec EEVC Newsletter). But the IGBTs had become a fierce point of contention. Hughes Industries and Delco Electronics vied over which would choose a supplier. Whoever controlled the IGBTs would own the heart of the inverter. When Delco won that battle Hughes retaliated by targeting the computer brain that controlled the IGBT switches. Delco had merely refined Cocconi's analog controller. But in 1991 Hughes came up with a digital version. It programmed the inverter so precisely that when hooked up to a motor it could direct the motor's hum to sound like the notes of a Christmas carol. Eventually the chiefs took the project away from Delco and gave it to Hughes.

Stempel and Reuss demoted

After GM's losses reached an all time high for a US corporation in 1992- in spite of the cuts Stempel had made, GM placed a former Proctor & Gamble CEO in charge. He concluded that Stempel's plan had been too little and too late. Although Reuss and Stempel were demoted, Reuss was still left in charge of Saturn and Impact. Feeling as if their whole program was about to come to an end, the Impact team worked grimly on. Amazingly they kept their 100 day "fast build" schedule and even beat it by one day. Baker announced that the car would be exhibited May 1st, 1992. Typical of many prototypes, the car (that was about to become the first production electric car) had its final preparations completed minutes after show time.

At 10:20 AM with zero miles on the odometer the car was rolled off the its blocks. Silently the car rolled from the construction room across a test track and into the crowded conference room. Amid the applause Baker fought back a welling of emotion. Reuss attended the meeting and experienced strong emotions of his own. Perhaps it would be his last chance to salvage his career. Along with everyone else he signed the underside of the Impact deck lid.

Tweaking the Impact

In the days following the Impact prototype unveiling, several top officers stopped by to give the car a spin. They were pleased, very pleased.

But Ken Baker was not totally satisfied. When Stempel came for a ride in the car he hit his head on the door frame. Baker felt another inch of headroom was needed. In addition Baker felt that the 3 percent over target of mass was not acceptable. He also was not happy with investment and piece costs which were too high. On May 12th Baker told his team that the car was not ready for graduation from Phase Zero to Phase One — from concept car to production car. He wanted 30 more days to make minor improvements. These improvements would prove to be most difficult.

So it was back to work for the Impact engineers. This time around they would strive to shave off grams and make the slight improvements on the existing challenges, while at the same time seek for ways to cut manufacturing costs. The next thirty days would be very stressful on everyone. Rich Marks was an ever-pervasive presence on the workroom floor with his clipboard trying to lose a gram here and a gram there. "How about titanium?" Marks would say. "Wouldn't it be lighter?" At 100 times the cost of steel it would be indeed.

to be continued ....

Personal thought

We live in a miracle age. We live in an age of instant gratification. Young people today take for granted the technology they are surrounded with. Many take for granted the growth of plants and the rising and setting of the sun. But the fact is that tiny computers and amazing cell phones didn't evolve automatically without blood, sweat and tears of real people. Thousands of incredible engineers, fabricators, computer programmers, accountants, managers, CEOs and laborers, toiling away in shops and labs for hours on end have brought our present day technology

into existence.

But, even we adults have become so used to seeing the impossible become the possible that we tend to feel that any problem can be solved if we throw enough effort into solving it. We begin to demand miracles, damning the politicians and companies if they don't provide those miracles immediately.

If one takes the time to read the book *The Car That Could* by Michael Shnayerson, one may better appreciate the challenges involved in bringing an affordable well performing electric car to market.

Those without understanding seem to be the most vocal ones clamoring that electric vehicles are here and now. They believe that we can have plenty of them to purchase if the government will force automakers to bring them to market. But the fact is that affordable electric cars are not here now. Some concepts are still futuristic, unproven, and uneconomical. The story of the EV-1 makes it clear how difficult it is to provide customer satisfaction with an electric car and still remain profitable in a competitive market. Yes, engineers solved space age problems and got us to the moon, but it was on a space age budget. Profitable plentiful electric cars to sell to the public may prove to be an elusive quest for car companies as long as fossil fuels remain plentiful. Electric cars are still in the expensive and costly developmental stage, existing on tax payers money (government grants, loans, and stimulus packages).

I am proud to say that many of us in the EEVC understand the situation. We understand and appreciate electric car technology and we understand and appreciate ICE technology. We understand and show respect for the value systems of our neighbors. We know that moving from an ICE world to a future dominated by electric cars at this point in time may be more of a pipe dream than a reality. But, that does not mean we are anti-electric car or in favor of investing in a fossil fuel economy. It simply means we recognize that there is more research and work to be done before our nation becomes more independent from fossil fuel transportation. The birth of mass produced electric cars could be a slow one and could be financially painful.

Presently it appears as if natural gas is positioned to become a bigger player in the world wide energy sector. Supposedly natural gas is cleaner than petroleum and coal but it is a fossil fuel nevertheless. Is natural gas the best way to go at this point? It is affordable. Maybe renewables will have to wait a few more decades before their time will come to dominate.

Of special note: Mike Manning has been helping close up the Speed Shop he has worked for for many years, rebuilding ICE racing engines. The owners have been losing money. It seems as if demand for large rebuilt racing engines has dwindled. Change is in the wind, no pun intended.

"Electric Cars Make Sense Now, Their Future is Bright"

Taken from "Letters to the Editor" The *Wall Street Journal*

I failed to date the two letters to the editor that appeared in a relatively recent issue of the *Wall Street Journal* in late 2010. The first was written by Mark Reuss, president of North American General Motors Co. (Is Reuss still president? Things change so quickly in GM that I can't keep up with who is in charge.)

Quote from Reuss: "Remember when mobil phones fit in a brief case, weighed 40 pounds and were affordable to only the wealthy? Now cell phones fit in your hands."

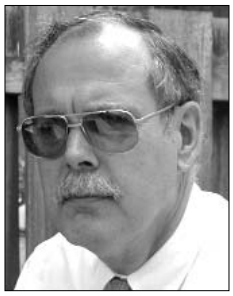
Reuss went on to extol the merits of the Volt in his letter and concluded with the following. "Electric vehicles will be an important part of the future, here and around the globe, and we are proud to help lead the way." Our question for Mr. Reuss is, "How far off is the future?"

The second letter was written by Thomas R. Kuhn, president of Edison Electric Institute in Washington. "Noting that nearly half of the nation's electricity is produced with coal based electric generation, the Natural Resources Defense Council and Electric Power Research Institute teamed up to study potential impacts of PHEVs on electricity use and the environment." Kuhn stated that widespread use of PHEVs could amount to removing 82.5 million passenger vehicles from the road when it came to greenhouse gas emissions, and to saving 3-4 million barrels of oil per day.

The only drawback to getting excited over

these conclusions is that the savings were predicted for 2050, which is 40 years down the road! I made predictions 40 years down the road myself once, and am darn glad nobody remembered what they were. I am assuming that the Research Institute chose 2050 because they felt that plug hybrids will not be in widespread use until then. And I am not sure how precisely they were able to predict the number of vehicles that will be on the road 40 years from now or what the average mpg of a non PHEV car will be. But, those who conducted the study no doubt felt good about receiving their paychecks for doing the research. Personally I think the money might have been better spent if it were donated to the EAA. However, such information, if accurate, could, I suppose, lead to helpful legislation which might push things forward faster.

PUTTING IN THE INFRASTRUCTURE
By California Pete



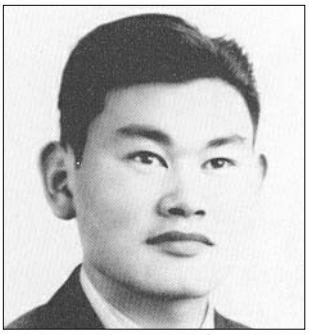
The *San Francisco Chronicle* reported on February 3 that the Bay Area Air Quality Management District has awarded $3.9 million to four companies to install charging stations in homes and public places. The effort is directed mainly at helping to install 2750 home chargers in the Bay Area. "The money also will pay for installing 30 fast-charging stations in places accessible to the public, such as stores, restaurants or government buildings.

"The funds come from a surcharge on vehicle registration fees."

The companies involved are Ecotality Inc., based in San Francisco; Coulomb Technologies of Campbell, CA; AeroVironment of Monrovia, CA and ClipperCreek Inc. of Auburn, CA.

Honors for a quiet hero

January 30 has been officially chosen as Fred Korematsu day in California, who thus became the first Asian American to have a day officially named for him. Over the years several schools, highways and other things around the state have been named for Mr. Korematsu, the latest being the new ninth grade campus of San Leandro High School. But who is, or was, Fred Korematsu?



Fred Korematsu was a second-generation Japanese American. Born in Oakland in 1919 of immigrant parents, he worked at his parents' flower shop in San Leandro. When World War II began he considered enlisting in the army but was told by the recruiting officer, "We have orders not to accept you."

He was called for the draft but declared unfit for duty by the Navy because of stomach ulcers. He then took a job as a welder, but was soon fired for being Japanese.

When orders came though in 1942 requiring all those of Japanese descent on the west coast to be rounded up and shipped to internment camps in the interior he refused to go, and in 1942 was arrested in San Leandro, subsequently being shipped to a camp in Utah with his family.

Korematsu didn't take it lying down, and fought in court, eventually reaching the U.S. Supreme Court (Korematsu v. United States) which affirmed his conviction despite reservations as to the law's constitutionality.

Years later the political climate had changed, and in 1983 his conviction was formally vacated as having been based on (among other things) false information.

In 1998 President Clinton awarded Korematsu the Presidential Medal of Freedom, the highest civilian honor in the United States, and in 2010 Governor Schwarzenegger signed into law a bill that designates January 30 of each year the Fred Korematsu Day of Civil Liberties and the Constitution. Korematsu, however, had died in 2005.

This month's Left Coast silliness

San Francisco is in a fiscal bind, but at least one department, the San Francisco Municipal Transportation Agency (Muni), which runs the city's transit and parking operations, has come up with an inventive way to get more money: write more parking tickets.

Muni can usually count on about $99 million per year in parking tickets, but that total has fallen off; faced with a $21 million budget hole, the agency has decided to send its people out to gather as much revenue as they can. It should be pointed out that San Francisco's parking meter fines are the highest in the country at $65.

Just in from the People's Republic

The lead from the Bloomberg news story says it all: "Berkeley, California, facing $252.8 million in deficits for pensions, disability and worker's compensation, may set aside $20,000 a year to reimburse municipal employees for sex-reassignment surgery." That was on January 19. The next day word came that item had been pulled from the agenda "pending further research." Uh, Huh.

NEWS UPDATE

Phony EV credits

A February 4 AP story by Ken Thomas reports that thousands of U.S. taxpayers have claimed tax credits for EVs that they have not purchased; in fact more people have claimed the credits than there are EVs in the country — nearly 13,000 people, for a total of about $33 million, according to the IRS, in the first six months of 2010.

Some of the claims apparently were made in error, although that seems a poor explanation for the IRS employees who tried it, or for the 29 convicts who tried to claim the credits from prison.

Georgia Power and EPRI to study solar PV installation effect on power lines

On February 2 Georgia Power and the Electric Power Research Institute (EPRI) announced they were conducting an 18-month study to evaluate how solar photovoltaic (PV) power systems may affect the utility's distribution system.

Fifty PV systems are being installed in seven cities around the state. Seven to eight small systems will be installed on one distribution line in each city. Sites were identified based on a number of environmental parameters. Selecting cities around the state will allow evaluation of a variety of conditions such as temperature, cloud cover and solar intensity.

EPRI will monitor each module's power output and sunlight input at one-second intervals for the entire 18 months to determine how much electricity they generate and how well they perform under diverse weather conditions. The panels will remain in place at the end of the project and Georgia Power will continue to monitor long-term results.

"An installation of this size will not create a noticeable increase in the amount of energy on our distribution system," says Scott Gentry, Georgia Power's distributed generation services project manager and coordinator for this project. "However, the data we collect from each module will provide useful information on PV generation as it relates to the utilities grid."

Biodegradable bottles meet opposition

A Feb. 7 story by AP writer Angelique Soenarie reports that a man in Mesa, AZ has developed an additive that, when added to the resin used to make polyethylene terephthalate (PET) water and soda bottles, renders them biodegradable; instead of lasting for hundreds of years, the bottles break down in anywhere from 250 days to five years, depending on conditions. In all other respects they're the same as regular water bottles, apparently. If all bottle were made this way it could have a significant effect on the plastic litter that fouls both land and sea.

But no good deed goes unpunished, it seems; the plastic recycling industry has come out foursquare against the idea, claiming that the bottles might not be useable for the purposes that old bottles are used for now — carpeting, clothing, and new bottles — or at least cost more to process.

This might be a compelling arguement if almost all plastic bottles were indeed recycled, rather like the lead used in car batteries. But, while we see few if any scrap car batteries left by the side of the road, huge numbers of plastic bottles never enter the recycling stream.

Getting away from rare earth elements

On January 17 AP ran a story reporting that Toyota is developing a new induction motor design for its hybrid and electric cars that requires no rare earth metals. This should help relieve dependence on supplies of rare earth metals from China, which has greatly

reduced shipments, and on occasion even cut them to zero for Japan. While several countries, including the United States, have deposits of rare earth elements, China, which has 30 percent of the world's supply, has much lower production costs and has been able to capture the lion's share of the market.

Volvo shows PHEV

At the 2011 Geneva Motor Show, Volvo Cars will be unveiling the V60 Plug-in Hybrid with carbon dioxide emissions below 50 g/km, which translates into fuel consumption at 1.9 l/100 km (124 mpg).

The car is a so-called road-coupled hybrid, with a 215 hp five-cylinder 2.4-litre D5 turbodiesel driving the front wheels and a 70 hp electric motor powered by a 12 kWh lithium-ion battery pack driving the rear. All-electric range is up to 50 km (27 miles).

Unveiling will be March 1 in Geneva.

COMING EVENTS

EV Charging Infrastructure USA 2011
Feb 28 - Mar 1, San Francisco. www.electric-vehicle-charging-infrastructure.com/

Fuel Cell Expo 2011
Mar 2-4, Tokyo. Go to http://www.fuelcelltoday.com/events/event/2011-03/FC-EXPO-2011---7th-Int-l-Hydroge

IEEE-USA Electric Vehicles & Personal Transportation Workshop
Mar 4, Austin, TX. Go to www.ieeeusa.org/calendar/workshops/EVPT/default.asp

Green Truck Summit
March 7-10, Indianapolis, IN. Contact Susan Romeo, sromeo@calstart.org, 626-744-5600

Photovoltaics World Conference & Expo
Mar 8-1-, Tampa, FL. Go to www.pvworldevent.com.

2011 AltCar Expo
Mar 10, Austin, TX. For info go to www://eventful.com/austin/events/2011-alt-car-expo-/E0-001-034098391-2.

SAE 2011 Powertrain Electric Motors Symposium — for Electric & Hybrid Vehicles
March 23, Indianapolis. Go to www.sae.org/events/training/symposia/emotor/

Spring Car Show
March 26-28, Daytona Beach, FL. The newly-formed Central Florida EV Club plans to display vehicles and invites more to participate. For info contact Larry Wexler, 407-256-6244.

Plug-in Electric Vehicle Infrastructure Conference & Exhibition USA 2011
Mar 31-Apr 1, San Diego. Go to www.evupdate.com/electricvehicleusa/index.shtml

SAE 20110 World Congress
Apr 12-14, Detroit. Go to www.sae.org/congress/

EDTA 2011 Conference & Annual Meeting
April 19-21, Washington, DC. Go to www.edtaconference.org.

EVs in Macungie
April 30, Macungie (PA) Memorial Park. Contact jisaacs@buckscountyrenewables.com.

Solar 2011
May 16-21, Raleigh, NC. For info go to www.ases.org/index.php?option=com_content&view=article&id=18&Itemid=147

1st International Electric Vehicle Technology Conference 2011
May 17-19, Yokohama. For info go to www.evtec.jp.

11th Challenge Bibendum
May 18-22, 2011, Berlin, Germany. Go to www.challengebibendum/en

DoE Solar Decathlon 2011
Sept 23-Oct 2, Washngton, DC. Go to www.solardecathlon.gov/

MEETING SCHEDULE

Meetings are held in Room 49, Plymouth-Whitemarsh High School, 201 East Germantown Pike in Plymouth Meeting, PA, and begin at 7:00 p.m.

Mar 9

Apr 13

May 11