Alternative Forms Of Transportation
The Fuels and Technologies That Power Them

By Christopher Hollis

In this edition, we explore the topic of alternative forms of transportation, and the fuels they use. There are many different forms of transportation. There are cars, buses, trains, boats, and other ways to get around. Many of these methods pollute the environment, which has caused many to look to other forms of transportation, ones with little to no pollution. One of the most popular forms of alternative transportation using an alternative source of fuel, is by that of the electric vehicle.

The hybrid vehicle, one that is electric and gas, is most efficient, and practical for today's use. These cars are relatively inexpensive, and cause no more trouble, if not less than your normal car. In this edition we'll go over what types of alternative forms of transportation there are, how they work, if they are practical in their current form, and when they should be available, or should be more widely available to the public. We'll also go over how they are being introduced to the public.

Although not known by many, electric vehicles used to be about as common as regular cars. Before Henry Ford's time, even before his birth, electric cars were around. Some came about in the 1830's. "J. K. Starley, an English inventor, and Fred M. Kimball of Boston, Massachusetts," were credited "with building the first practical electric cars in 1888." "In 1896, the Woods Motor Vehicle Company of Chicago became the first American manufacturer." (Encarta)

In 1904, some of the largest cities in the nation, including New York, had over one-third of their cars powered by electric motors. They died out quickly when Henry Ford came around, but have sprung up when environmental factors, or economic factors, like a gasoline shortage, make the public look to other forms of transportation. The current increase in gas prices has sparked interest in getting the most mileage for the gallon. Such interest has meant a decline in SUV sales this year, since their gas mileage is much less than an average car. President Woodrow Wilson actually had an electric car while he was President. Today, Honda, Toyota, and General Motors lead the electric and hybrid vehicle production battle. Honda makes the Insight, which is a hybrid. Toyota makes the popular Prius, which is one of the most recommended of its kind, since it is a four door, five passenger car, which is unlike the others. It's also recommend by the EPA. The EV1, by General Motors, is a fully electric two passenger car, which is very light, and made up of mostly batteries. It can't go far on one charge, and therefore cannot go on long trips. It is mostly for driving to school, to work, or to some other place close by. Someone in this production battle that you probably haven't heard about, is General Motors. They actually have some great projects in development. The question is, when will their electric, hybrid, and even hydrogen powered car be available?

Electric vehicles are powered by electricity. Hybrids are powered by electricity and gasoline. Regenerative braking, which uses opposing magnetic fields, turns some of the vehicles momentum into electricity, which powers the car. The batteries are then charged. The rotational motion from the engine converts that energy into electrical energy which charges the batteries. The technology is effective. Most of these alternative forms of transportation not only add more mileage per gallon, but reduce harmful emissions into the environment. Some of these vehicles don't even have emissions. Electric cars and hydrogen powered cars have zero emissions. Hydrogen powered cars only produce water!

Other forms of transportation, like solar energy, transform the suns heat into energy. Cars that use solar power are not very practical right now. Many people, as a hobby, race solar powered cars. One race in Australia has homemade cars that people build to run on just solar energy. Since it takes many panels to get enough energy from the sun converted to a form of energy that can charge a car, solar energy will not work on cars. It can't get enough power to make a car, or more than one occupant, go. Solar energy may work better on buses, since there is more space to have solar panels. Buses also have room on top for another type of fuel, hydrogen. "Hydrogen is stored in pressurized tanks on the roof of the buses, providing the bus with a range of 350 miles between fillups. Ballard Power introduced a 40-foot Zero Emission Bus powered by a 275 horsepower (205 kW) fuel-cell engine in 1995. Its range is 400 km (250 miles) before requiring refueling. It is extremely quiet, has good acceleration and produces zero emissions other than water." (American Electric Power) Three of these buses are currently being tested in Chicago, and three more will soon be tested in Vancouver. This technology is still expensive. However, passenger cars with this technology may enter the market as soon as 2004. The 70 horsepower fuel-cell engine is expected to become 60 to 70 percent cheaper by the year 2010, costing about $3,400 for the engine. As soon as this becomes feasible, and generally accepted, it might be a viable replacement for gasoline powered cars.

There are a lot of other ways people plan on getting electricity. Some ideas include power beaming satellites. Giant discs about 5 km wide would capture solar energy and beam electricity that is generated back to earth. Ideas like that have been considered for the last 35 years, and is something that NASA is looking at. "Space solar power is something that should be explored seriously, not written off as science fiction" (Space.com), says bryan Erb, president of the Sunsat Energy Council in Houston, Texas.

We need to look at other forms of energy that can power our transportation. We need to find solutions now, but plan for the future as well. There are many projects that may one day get a chance to be tested, but we do have alternative fuels and transportation that we need to look at today, since some are already available, and may be the future of transportation.

Most people think about the cost savings of something when they consider purchasing it. How much money will I save from not buying gas if I buy a hybrid? People pay more for the use of gas than they do for electricity. And despite popular belief, alternative fuel vehicles aren't that expensive. Most are around $20,000.00, while the fully electric cars that are available, go for around $35,000.00.

The electric vehicle, although not widespread, is in existence. One such example can be found in parts of California and Arizona. The EV1, built by General Motors, is one of the only pure electric vehicles. There are a few other companies like Solectria who also have electric cars. Solectria actually makes only alternative fuel vehicles, like the Solectria Force. The pure electric cars are not practical though, since they travel only a short range before they require charging. "The expected real-world range is 55-95 miles for the high-capacity lead-acid EV1. Expected real-world range for the optional nickel-metal hydride EV1 is 75-130 miles." (General Motors) Even so, if I went to Orlando from my home in Tampa, I would have enough power on one charge to get over there, but not to come back. Although, if I plugged my car in, I could charge it if I was there long enough. What we really need is more places to charge electric vehicles, but most importantly, a way to do it faster. There are some chargers that do it faster, but it still takes at least a few hours. Depending on the battery, it could take as long as 2 1/2 to 6 hours to charge. The EV1 can travel from 0 to 30 mph in under 3 seconds, and 0 to 60 mph in under 9 seconds. "A modified EV1 prototype set an electric vehicle land speed record in 1994 at 183 mph." (General Motors) There is a more practical solution. Build a car in between. A few major auto manufactures have already done that. One of the most popular cars is the Toyota Prius, which runs 90% cleaner than regular gasoline powered cars. It is a hybrid, meaning that it is half electric and half gasoline powered. The alternative fuel decision is easy for some Pennsylvania residents, since on February 15, 2001, Gov. Tom Ridge of Pennsylvania, and Department of Environmental Protection (DEP) Secretary James M. Seif, reminded people that it was there last chance to apply for over $7 million dollars for the promotion of alternative fuels. This included paying $1,500 per person to buy a hybrid-electric vehicle.

The hybrid vehicles are not as widespread as gasoline powered cars, and some are not as easily available. The Toyota Prius can only be ordered on the Internet. An individual can also only own one. That shouldn't be a problem. The biggest problem is that if you order one now, you wouldn't get it until August. I just found that out a few days ago. But this is actually good, as long as your not trying to get one. The initial release in the US must be going good, since their website indicated that they were getting orders every day for this car. They want to make sure that the hybrid technology catches on here like it has in Japan, where over 35,000 of these cars travel the road. I've even seen several advertisements for the Toyota Prius. Hollywood seems to like the electric and hybrid cars too. Both have been featured on many of the major network TV series and shows. Many people in Hollywood also have alternative fuel vehicles. The public is slowly learning more and more about this new technology. People don't like abrupt change, so slowly

introducing new technology is a good way to go.

There are other forms of transportation that are gaining popularity that should be looked at for mass transit improvements. Many people travel in cars, and more will travel in cars as time goes on, and as the population increases. Airplanes are a fast way to get from one place to another, while trains are much slower, usually.

Researchers at the Marshall Space Flight Center in Huntsville, Alabama, are working on something called magnetic-levitation technology (maglev). The maglev trains use magnetic fields to float off the ground. I always thought that using positive and negative forces would be a good way to move an object at a fast speed without the force of friction. They actually use superconductors. This type of system has been proposed to operate between Houston Intercontinental Airport and Dallas-Fort Worth International Airport. The track there would be 197 miles including the two loops they would need for a turnaround. The cars run on a single track. The figures from the Senior Students in Engineering and Administrative Sciences Colleges joint project indicate that the basic design of maglev could accommodate up to 1200 passengers per hour, and up to 75 people per car in several cars that would form a train. They could travel at a speed of 300 miles per hour. The following paragraph is from the joint project listed above.

"Two sidewalls run the length of the path. These sidewalls contain all of the magnetics that will support, guide, and propel the vehicle down the guideway. Small support pads maintain the rigidity of the structure while providing a space for water and debris drainage. Deflections will be avoided in order to maintain a one inch gap between the vehicle and magnetics. If the vehicle decelerates below a speed of 164 ft/s it cannot levitate. In this situation, the vehicle will deploy small road wheels as well as rest on metal skids. To reduce wear on the vehicle and guideway as well as maintain a smooth ride, a high tolerance running surface is used on which the vehicle can roll with little or no vibration. All of these components are supported by a concrete slab that runs the length of the route with expansion joints to allow for thermal expansions. A gravel ballast subbase is used to allow for even weight distribution as the vehicle passes overhead. The guideway components are designed for a fifty year service life with little or no maintenance required." (University of Alabama in Huntsville)

Research institutions are certainly not the only ones getting involved in maglev. Boeing, one of the most recognized transportation companies in the world, is working on maglev, and has for a while. General Atomics, Boeing, Bechtel, and Foster-Miller are all working on parts to this project. I was really interested in this project, but I haven't found very much information on it yet.

Here's a summary of how the maglev system at Boeing works. "The heart of the MagLev system is its superconducting (SC) magnets or coils. The SC coils are made from wire made from the defunct Superconductor Super Collider program.

The material is a high-performance superconducting Niobium-Titanium alloy encased in a copper sheath. This wire is wound around a bobbin to form an oval with an appropriate major axis of 18 inches and minor axis of 9 inches. The coils are designed to operate in a bath of liquid helium (4.2 degrees K) and in its superconducting mode to operate at 217 amps...forever, or as long as the temperature is 4.2 degrees K." (Boeing) Superconductivity can be defined as "a complete disappearance of electrical resistance in a substance especially at very low temperatures". (Merriam-Webster)

The object can travel fast, and does it less than an inch off the ground. Using guideway beams, they can make sure that the structure can withstand the magnetic force. They use stainless steel fibers in a mixture of whatever they use to build the beams with. The guideway also allows the vehicle to follow a track, and to drop wheels and use breaks when it slows down. They say that "magnetic fields interact with the copper inducing currents and themselves become magnetic." (Boeing) That makes the vehicle be able to go forward and backward. Two types of coils in the beams allow horizontal and vertical motion.

On October 6, 1999, in a test at the MSFC, a model spacecraft was accelerated from 0 to 60 mph in less than a half-second. Theoretically, it could travel from 0 to 600 mph in 9.3 seconds. Sherry Buschmann, manager of launch technology at MSFC, said that the necessary electricity will cost only about $75 to launch a spacecraft, saving tens of thousands of dollars per space launch. This would not include the cost of the spacecraft, or any fuel required after the initial speed is gained. In a report prepared by the US Army Corps of Engineers (USACE), the National Maglev Initiative (NMI) concluded that "maglev technology has been demonstrated as a technically feasible transportation system and could be deployed with reasonable risk. Furthermore, a US-developed maglev would yield several design improvements that could result in significant performance and economic benefits compared to the other high-speed ground alternatives. Most important, by developing an advanced maglev system, the US could compete in both the non technical and technical aspects of the global maglev market." The rest of the report states that the US maglev concept even rivals foreign maglev designs in many areas, and its costs could pay for itself, along with helping the transportation systems of the United States as of now become less busy.

A maglev system will most likely be put between Baltimore and Washington D.C. This project has been in the works since 1994, and as of now, environmental tests should be in the process of being conducted. In 2003, they will most likely finalize the selection of the Baltimore Washington corridor. In 2004-2005, the design would be completed, and they would acquire the land. In 2005-2009, the system would be constructed, and then finally tested in 2010-2011.

"The Federal Surface Transportation Bill has authorized $950 million for the design and construction of a demonstration project such as the one being studied between Baltimore and Washington." (bwmaglev.com) Other funding would be from

private sources, businesses along the route, or from the city or state. Seven sites are competing for the maglev system, but the BW corridor will most likely win it. Pittsburgh also has a good chance. Each project was funded so that it could come up with designs and builders who could construct a transportation system such as this.

Some have said that the maglev system is nothing more than a "high-tech tourist ride", like Gary Stix of Scientific American said. The train does go faster than high speed trains as of now, but only saves a little bit of time. These trains need to be put in places that they can travel long distances, so that the train can gain speed, rather than short distances where the speed of the speed of a maglev train would not be needed. There are other forms of maglev that are less expensive, and are less involved.

The first Magnetic Levitation System to be for the public's use, may be one that is in development at Old Dominion University in Virginia. It may begin to be constructed as early as a year from now. The $14 million dollar project is being funded in part by Lockheed Martin and Dominion Resources who will contribute $3.5 million each. "The maglev technology allows the 50,000-pound car to be lifted one-quarter inch above the rail using the power equivalent to running 20 hair dryers," said Ronald Tola, the ODU facilities management director. The train could carry about 100 people, and would go about 3,200 feet. It would connect buildings at ODU. There would be 3 stations along a straight line. It would take about 3 to 5 minutes to travel across the campus at a top speed of 40 mph. The car would be driven by computers, and not by a driver. This type of technology is still new to the US, so they are slow to build a large system. Small systems like this may encourage future development.

There are other forms of alternative fuels as well, including ethanol, natural gas, and other fuels that run many types of vehicles likes cars, trucks, and buses.

As the pollution on the earth gets worse, and fossil fuel supplies deplete, we will need other forms of transportation. The conversion to something completely other than gasoline in our cars would be a long and difficult process, but one that needs to be started now. Environmental factors are something that should eventually influence people to switch to other forms of transportation that use less pollutants.

The process of developing cleaner fuels, and developing forms of non polluting transportation has increased in the last few decades, but has most likely declined in the last year due to economic problems. Some of the car companies for example, are expected to make more alternative fuel vehicles. This may not be the case due to the continuous weakening of the economy.

Some companies are slowly making their vehicles get better gas mileage. However, because of SUV's, the problem of pollution remains. Some of the recent

ads on TV have advertised cars that go farther on the gallon. This form of mass media to the consumer may boost interest in these new forms of transportation.

Other economic factors, like who is President, affect the trend of environmental protection, or environmental oversight. Our current President does not support the environment like former President Bill Clinton did.

"The United States Energy Information Agency projects that between now and the year 2020, US oil production will decline by 0.7 percent annually while demand, lead by the transportation sector, is expected to increase by 1.8 percent annually." (EV WORLD) If we only have about 100 years of fossil fuel left, how can we afford not to find other modes of transportation. Unfortunately, since natural gas is so expensive to get, even though there seems as though there is a lot under the earth's surface, we can't get to it. Scientists in a few places in the US are working with hydrogen, to find a way to produce a clean fuel source that could be applied to the mass market. That's a solution that is far from happening though. Even if they came out with the technology, it would take years to incorporate it into our everyday uses. We have electric cars, but do we take advantage of them? Even if we had hydrogen powered cars, would we take advantage of them?

The continuation of programs to encourage other means of transportation is vital to our environment, and to ourselves. This is why the subject of alternative fuels and transportation is so important, and why it needs to be addressed.

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