ECAT - TESLA TURBINE

Transportation
Land, Sea, Air and Beyond

Roger Green and Bill Donavan
www.Ecat.tech

Practical Considerations

Overview

- LENR produces two energy emissions: Particle (beta and gamma flux) and heat
- Power conversion is the challenge
- How do we do this?
  - 1) Thermal conversion. There are several methods for this which will be discussed and features the Tesla turbine.
  - 2) Capture the particle emission and use alpha or beta voltaics to generate power.

Why use LENR?

- Zero Emission
- Long Life
- Little maintenance
- No need for refueling or recharging stations
- Overall low cost per mile compared with conventional vehicles

Disadvantages of Conventional Electric Vehicles

- Fires! Lithium Ion Batteries can have internal faults that cause the vehicle to self-destruct.
- Lack of range: The best batteries can only supply power to run for 300-400 miles. After that it can take hours to recharge.
- Some trips must be planned: If a trip is out of range, there is pressure to use a car that runs on conventional fuels.
- Geopolitics: Supplies of lithium can be at risk with an internal civil war or change of administration (Chile, Bolivia).

Advantages of an LENR/Electric Hybrid

- Unlimited Range – Vehicle charges as it goes
- Either batteries or supercapacitors can be used for a storage medium. Capacitors have a longer life, and less maintenance.
- Less maintenance than batteries alone.
- Heat source for cold weather – selling point in northern countries.
- Heat can also be used in an evaporative-type air conditioner.

BMW i8 Electric Vehicle

The Time is Now!

- A. Rossi, Leonardo Corp.
  - Stable reactors producing heat >600 Deg. C.
  - New gen. 10 KW reactors currently running in Florida
  - Currently collecting many hours of test data
  - Will present data in 2016
  - Warm cat produces 120 degrees
  - Hot cat independent report last Oct 2014 produces 1400 degrees
  - Ecat needs to convert stream into electricity
  - Tesla turbine is the most eff. turbine design
  - Easily scaled to fit into a car / hybrid that re-charges a battery so that the car never needs to stop to re-charge
  - In fact- park the car in your garage and it will continue to charge your house/ business

LENR Engineering Options- Do's and Don'ts

- Do use as high a conversion efficiency as possible – using lower tends to reduce the overall efficiency.
- Do have as robust a system as possible – added weight is compensated as higher safety.
- Do have a high reliability for each component – one can act as a weak link in a chain. If possible, multiple backups for redundancy.

LENR Engineering Options- Do's and Don'ts

- Do not use a system just because it is "popular" – it may be an inappropriate use of technology.
- Do not use low efficiency conversion just because it is "off the shelf." Better to use innovation and tailor it to LENR.
- Do not make vehicles that are "throwaways". These are not suitable for the industry, consumers or environment.

What Can We Do Within These Constraints?

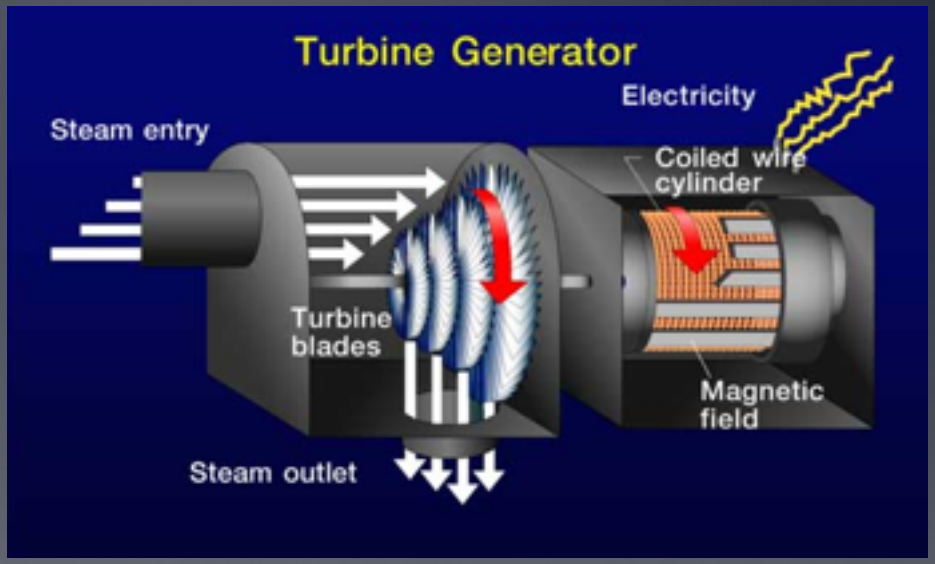
- Innovation – market "firsts" that lead the way.
- A future industry standard – others may imitate, but never truly compete.
- Charge more for quality – Apple has demonstrated this example, and is climbing to be a nearly trillion dollar industry as a result – forget niche – think demand.
- Strategic partnerships with suppliers – this "locks them in" and locks out competition. Let them have first rights for related tech that is developed.

Details, Details…The Tech

Let's Look at Power Conversion Methodologies

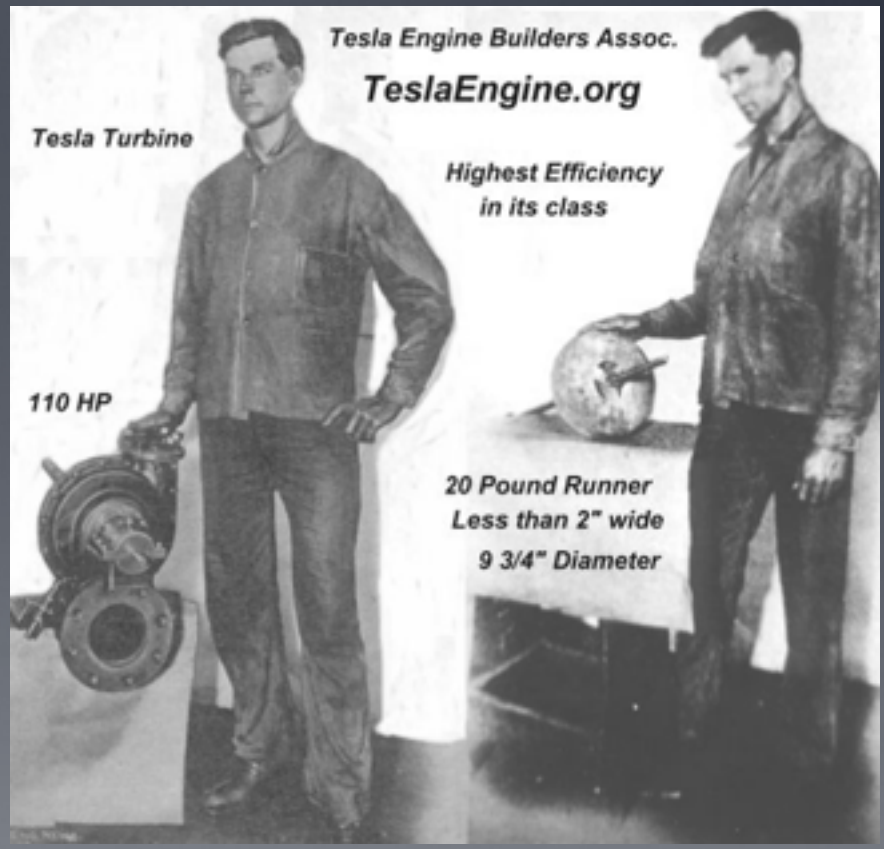
Conventional Turbine

- Low efficiency – 30%.
- Overall efficiency with 80% efficient alternator is only 24%!
- 76% of heat is wasted.
- Only feasible with co-generation for heat recovery.
- This is how conventional power plants operate – as environmental heaters!
- Hardened blades act as shrapnel, and are extremely dangerous if the turbine fails.



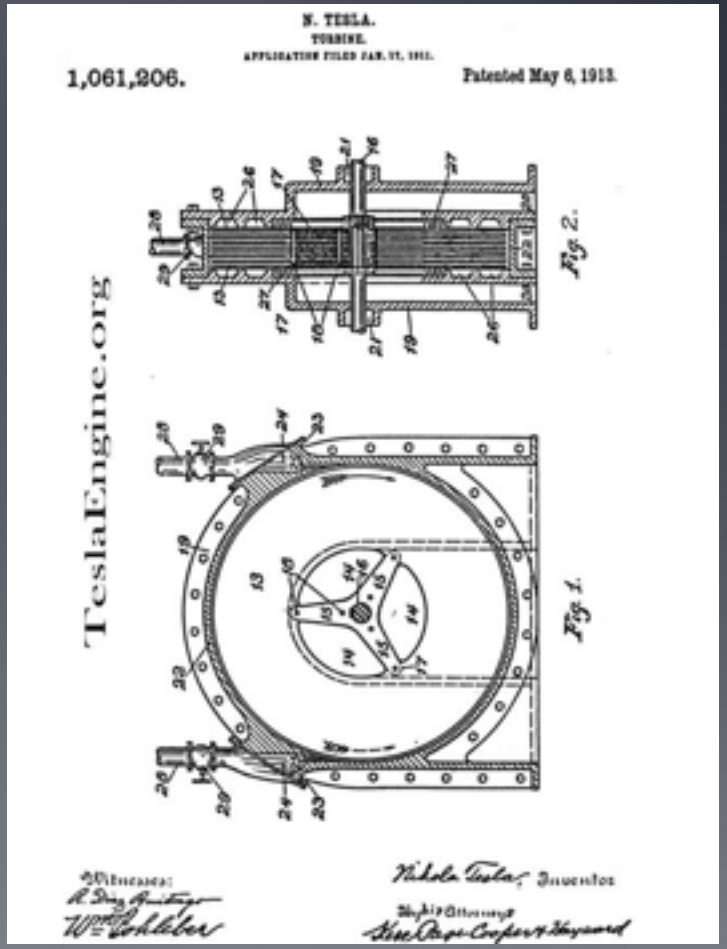
Tesla Turbine

- High efficiency – 50-80%.
- Lowest efficiency with 80% efficient alternator is 40%!
- 50% of heat is wasted in 50% eff. turbine, however that number drops to 36% with 80% eff.
- Co-generation for heat recovery still preferable.
- Mature technology – proven in 1911!



Tesla Turbine Practice – Manufacturing

- Blades are either stamped, or laser cut.
- No de-stressing of blades needed as in conventional turbines.
- Ease of manufacture – no exotic materials needed for saturated steam and low pressure.
- Casings can either be cast or injection molded composite.
- Tesla turbines are the ONLY turbine that can use saturated steam!

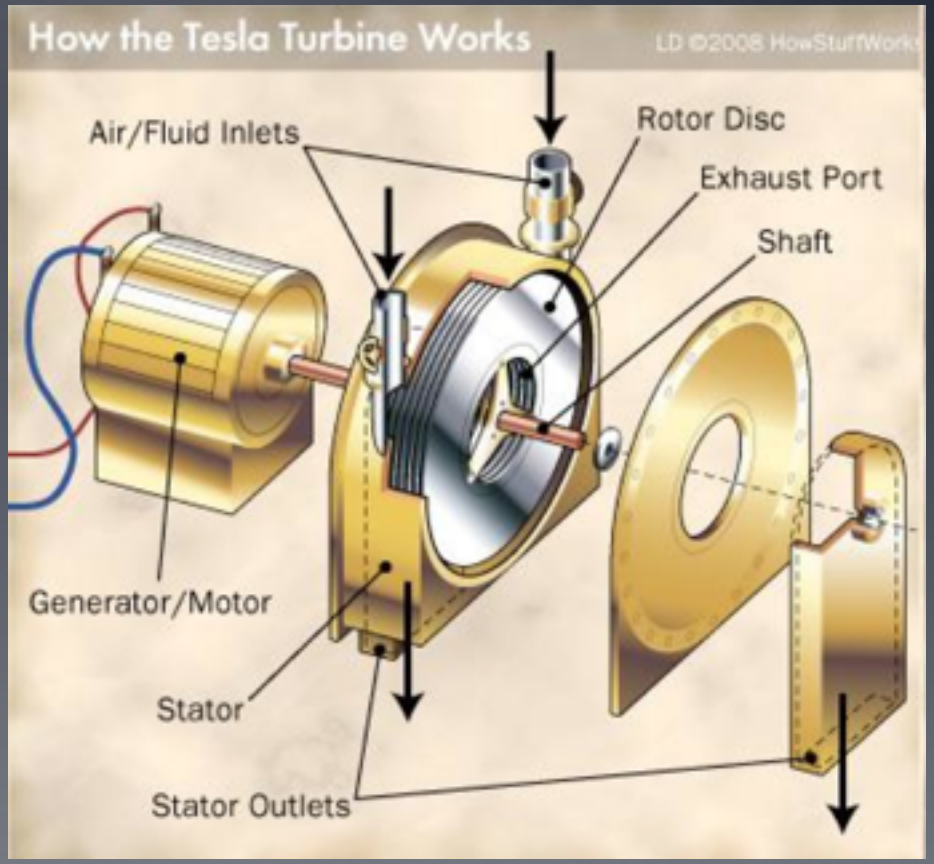


Tesla Turbine Practice – Manufacturing Cont.

- Both turbine and alternator can be incorporated into an integrated package for reduced costs.
- Advanced materials technology means higher reliability and longer life than conventional turbines.
- Safer than conventional turbines in both endurance testing and end use – If ceramic blades are used, when they fail they self-destruct and pulverize into dust.
- It is possible to integrate the turbine and reactor into one unit, further reducing cost.

Tesla Turbine Practice – Integrated Design

- Turbine/powerplant is integrated with a reduced-size battery rack, which is only used for acceleration and passing.
- Batteries are used in startup, and emergency shutdown, if needed.
- Reduced battery rack means reduced weight and better vehicle performance.
- Hybrid design means optimal efficiency, as reactor runs at the peak of it's power curve.
- Turbine and powerplant can be a "black box" labeled with "No user serviceable components." It can be unplugged and sent to the factory if needed.



Tesla Turbine
Practice – Land Vehicle Advantages

- Power plant can run continuously if needed with bi-annual refueling. For long haul truckers, this means no fuel stops, and less down time.
- For trucks, no auxiliary generator needed at truck stops – heat and power are supplied continuously.
- In gridlock, reactor can go into standby unless A/C or heat is needed.
- Higher efficiency means less environmental heat generated, and urban "Heat Islands".

Tesla Turbine Practice – Locomotive Advantages

- Diesel electrics can be easily retrofit with 1MW reactor packages.
- Bi-annual refueling means less down time.
- Increases profitability of rail travel & lowers shipping costs, also lowering ticket prices allowing trains to become more competitive with air travel.
- "Luxury" rail travel comes back.
- High speed maglev, which is energy intensive, becomes extremely practical.
- Long distance tunnel drilling for subway travel becomes practical. These trains can reach velocities as fast as aircraft.

Tesla Turbine Practice – Aircraft Advantages

- Revives the near-dead private aviation industry – prohibitive cost of fuel has driven this sport to near extinction.
- Heat exchangers are located on the tops of wings – "Hot Wings" concept gives increased lift and integral wing de-icing.
- No explosive chemical fuels means increased crash safety. There is less chance of a fire.
- No chemical contaminants released means no contrails. Less environmental pollution.

French firm Airbus is best known for its large passenger jets--including the double-deck Airbus A380--but its latest project is rather smaller.

The E-FAN is a small experimental aircraft, powered entirely by electricity.

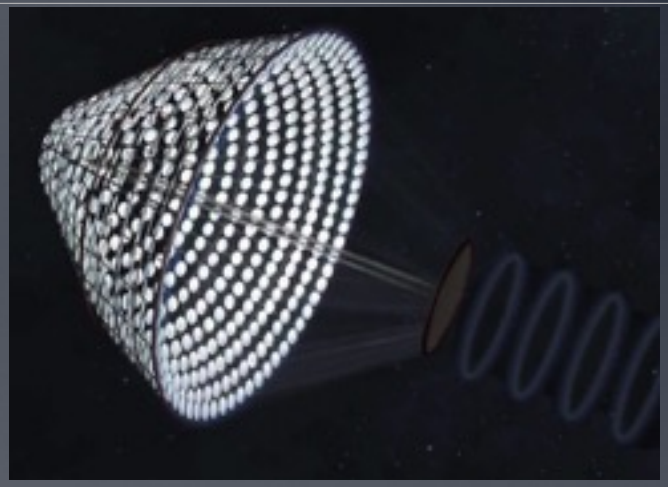
It's small, much quieter than a typical combustion-engined light aircraft, and could cut the cost of an hour-long flight from around $55 to just $16--so it has the same economic benefits as its electric road-going cousins.

Tesla Turbine Practice – Ship Advantages

- No engine contaminants dumped overboard – better environmental safety.
- Near unlimited range – bi-annual refueling means fewer fuel stops needed at questionable locations.
- More cargo capacity due to a lack of a fuel hold.
- The real possibility of a cargo submarine – less likelihood of accidental sinking with better speed and range of operation.

Tesla Turbine Practice – Space Advantages

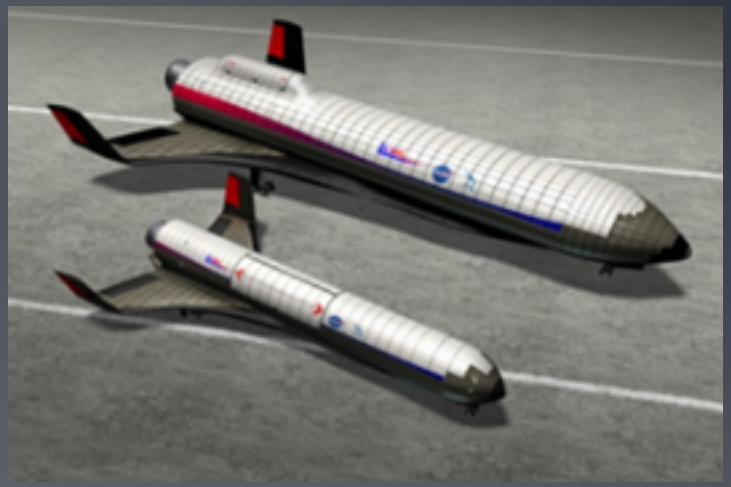
- Removes limitations of chemical rockets – ion and field-based propulsion are energy intensive, and looking for a good power plant.
- Less dangerous than RTG systems in satellites – can be engineered to last nearly as long.
- RTG radioactive contamination of components causes limited lifetime – LENR and Tesla turbines mitigate that problem.
- Solar power satellites have been proposed, but the cost of PV panels covering square kilometers was cost prohibitive. Tesla turbine based power generation would make that practical.
- The new industry of asteroid mining will be EXTREMELY energy intensive, and the concept of fission power was considered and abandoned. LENR/Tesla technology would make this more practical as well as safe. This is a multi-TRILLION dollar business. The human race finally begins to move off world, along with polluting industry.
- In the event of a global disaster, these colonies become "lifeboats."



Stanford Torus – as seen from interior

Review - Applications of LENR

- Adsorption type refrigeration systems & HVAC.
- Transportation- Hybrid cars & trucks.
- Transportation- Substitute for diesel-electric locomotives .
- Transportation- Turbine driven ships & submarines.
- Space- Substitute for "hot Isotope" RTG units.
- Space planes & exotic propulsion.
- Site generated power.



Photos Courtesy of Pure Energy Systems

Conclusions – Conversion Tech.

- Almost all technologies have merit.
- When nanoantennas are available, that one will be the most efficient (we may have to develop that in our own facilities).
- So far, thermoelectrics are not cost competitive with mechanical power conversion.
- Tesla turbine are best for cost as well as efficiency.
- The only ones THAT DO NOT measure up, are conventional power conversion systems.

Strategies: A Closer Look

- Location is dependent upon 4 things:
  1. Vehicle to be manufactured – is it a car, boat or air/space craft? Support systems will be needed, and access to coastal terminals.
  2. Local economy – is it a high crime area with unemployment, or is it stable? Is financing available with friendly banks? Is inflation high or low? How stable is the monetary unit? Parts will need to be imported – what kind of duties will have to be paid?
  3. Politics – is it friendly to innovation, and are there green incentives for zero-emission vehicles? How stable is the government? Is there a likelihood of the gov nationalizing the company?
  4. Geology – What's the climate like? Is there a possibility of damage due to hurricane or volcanism?

Strategies: A Closer Look Cont. Vehicle: Ship or Boat

- Must be located close to a point of launching. Assembly building must have direct sea access.
- Assembly bay needs to be sealed against storm surges.
- Hyperbaric chamber needed for testing pressure hulls if submarine.
- Choice of jet or MHD propulsion – both are suitable for LENR.

Strategies: A Closer Look Cont. Vehicle: Car & Truck

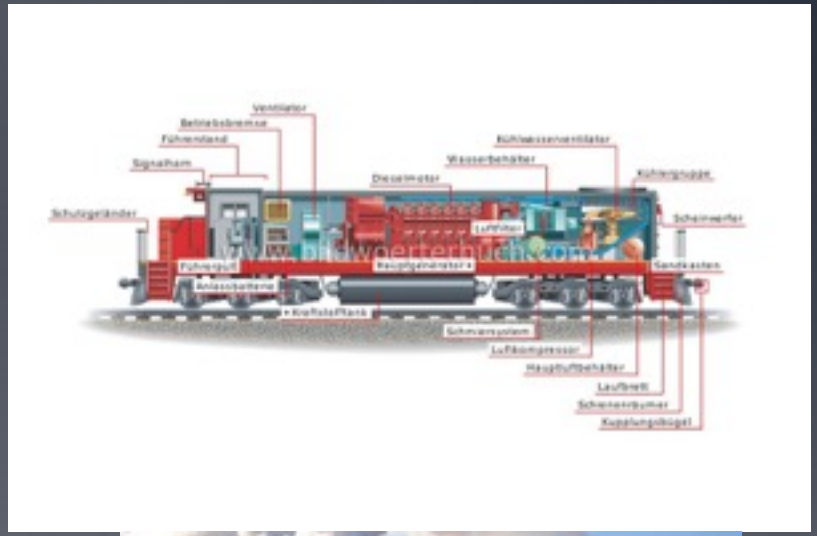
- Location must have access to critical materials – Subassemblies can be done at different locations and imported for final assembly. What's the shipping like? Are there delays due to constant labor strikes? Are there problems with hijacking and theft? Is there rail access?
- Test track – This is used both pre-production and for endurance testing. Location must have enough land for construction of track.
- Two different main designs possible – Direct drive or hybrid – detailed studies needed for both. Purely electric drive can be used as a backup in case of reactor shutdown.

Chinese firm AUCMA Electric Vehicle Co. Ltd has selected Sevcon as the motor controller supplier for its new light truck, the A-2.

Aimed at municipal fleets in both domestic and overseas markets, the new A-2 light duty truck is powered by a 72V 16kW AC motor and Sevcon will supply its Gen4 digital motor controller with regenerative braking technology to the company based in Qingdao, Shandong Province.

Strategies: A Closer Look Cont. Vehicle: Locomotive

- Location needs to be or have access to train yards for finished product.
- Diesel electric systems can be readily adapted for LENR genset – as well as steam locomotives for open-cycle operation.
- 1 MWH module can be used for power plant.
- Long life with need of refueling only on a bi-annual basis.



Strategies: A Closer Look Cont.
Vehicle: Aircraft

- Location near airport advantageous – for small aircraft, customers can fly it home. Craft has unlimited range with Tesla turbine spinning either propeller or turbofan. Airbus has a small aircraft running on electricity, as seen on right.
- Climate and Weather – a mild climate is needed for test flights. This would most likely be a warm arid climate.
- For larger airframes (passenger jets), a strategic partnership with Airbus, Boeing or a similar manufacturer of stock fuselage would be a good idea to cut down on manufacturing costs. The airframe would be refitted with the fusion reactor, most likely 1 megawatt. Reactor would be modular in 1MW increments.

French firm Airbus is best known for its large passenger jets--including the double-deck Airbus A380--but its latest project is rather smaller.

The E-FAN is a small experimental aircraft, powered entirely by electricity.

It's small, much quieter than a typical combustion-engined light aircraft, and could cut the cost of an hour-long flight from around $55 to just $16--so it has the same economic benefits as its electric road-going cousins.

Strategies: A Closer Look Cont.

- 10 reactor modules would be needed for a conventional rocket. Water would be used as reaction mass for propulsion ("fuel").
- Power densities allow for single stage to orbit operation. Landing areas need to be near a large body of fresh water for refueling. Cost per kilogram is projected to be 1/10 of conventional launch vehicles.
- Perfect vehicle for proposed asteroid mining as well as satellite orbital insertion. This is our market. We can undercut ALL the competition. When asteroid mining begins, the ice discovered on the lunar poles can be used for reaction mass – last stop for gas before Mars!
- Second market is space tourism. Hilton has been looking for a reasonable cost per kilogram to build an orbital hotel. Millionaires need not be the only ones with personal access to space.

Hilton

LOS ANGELES / As NASA Vehicle: Spacecraft assembles the international space station high above the Earth, private lodging and travel companies are taking a serious look at orbiting hotels and other projects that could make space the final frontier of tourism.

Interest in space tourism was piqued this week, when Hilton Hotels Inc. disclosed that it is looking into the feasibility of a space hotel.

"We want to take a hard look at it and see if Hilton can be first into space," said Hilton spokeswoman Jeannie Datz. "It's certainly not going to happen tomorrow. We're talking 15 to 20 years down the road, if any of it makes sense."

Conclusion

- LENR is the next step in terrestrial propulsion and beyond. Cars have had the same fuel source for more than 100 years. Rocketry has been nearly the same.
- Due to the negative impact that conventional fuels is having on the environment, change is not only possible, but ABSOLUTELY NECESSARY for our continued survival.

We can no longer keep doing

"business as usual."

- contact
- Roger Green
- info@Breakthru-Technologies.com
- www.Ecat.tech
- www.Breakthru-Technologies.com