

# ***FUTURE ENERGY*** ***Annual*** ***2008***

*featuring*

**IRI Energy Recommendations for Obama Energy Task Force toward a  
Comprehensive National Energy Initiative**

*NOTE: See the online version at IRI website under "Related Links"  
in order to use the active links in the article*

**&**

**IRI Annual Report for 2007**

**Thomas Valone, Editor**



## **CREDITS**

**Integrity Research Institute wishes to acknowledge the following sources for the 2008 IRI Members' Annual Report**

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## **IRI OFFICERS AND DIRECTORS - 2008**

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### President's Letter

## Future Energy Surge of 2009



**WORLD FUTURE ENERGY**  
Abu Dhabi, 19-21 January 2009 SUMMIT  
www.WorldFutureEnergySummit.com

- World Future Energy Summit, Abu Dhabi, Jan. 19-21, 2009
- SPESIF Future Energy Source Workshop, Feb. 24-26, 2009
- Future Energy Forum, Bilbao, Spain, June 9-11, 2009
- Conference on Future Energy, Washington DC, Oct. 9-11, 2009 (third in a series, tenth anniversary)

**SPESIF 2009**





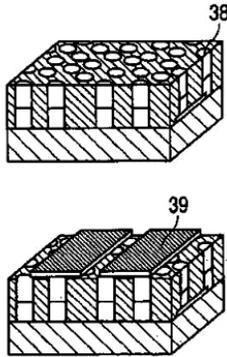
IntegrityResearchInstitute.org

With a new administration here in Washington DC we decided to do something different this year and give our IRI Members a very useful energy report that can be passed around to your Congressman, Senator or TV reporter for example. It contains this letter giving you the up-to-date future energy progress at IRI and the IRI Policy Recommendations for a Comprehensive National

Energy Initiative (CNEI) designed to do more for the US than the past two administrations. You will be surprised at recommendations in the 15-point plan and even more astonished at the support in the Appendix for the policy. I am hoping to meet with Heather Zichal on the Obama Energy Policy Team, who met with me before when she worked for Senator Kerry, to discuss the policy recommendations with her and even perhaps to connect IRI with some stimulus dollars that may be available.

IRI stands in a unique place compared with other nonprofit institutes because of the fact that our futuristic concepts have proven to be ahead of their time. Just take the name of this publication for example, "Future Energy." It was introduced for the first time at the First International Conference on Future Energy in 1999 and then perpetuated through the *Future Energy eNews* every month for years afterwards. Now in 2009, we are happy to say that it is being used all over the world for future energy conference titles. However, the First, Second, and Third Conferences on Future Energy held in DC actually feature real futuristic energy inventions, rather than the usual renewables found exclusively at these other imitation future energy gatherings! Don't forget to reserve October 9-10, 2009 for the best future energy

### Proposed Diode Energy Array Converter (DEAC) Design

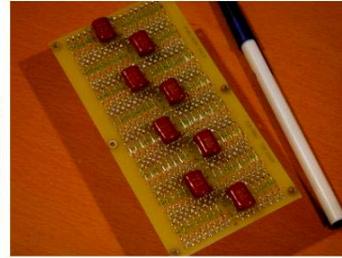
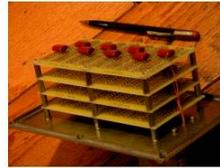


- 1) Kuriyama, Patent #7,183,127 cites Brown patent "Diode Array" #3,890,161  
Kuriyama: 1 nm diode pillars with 3 nm spacing yields  $10^{12}$  diodes /  $cm^2$
  - 2) Compares favorably to Hastas, 2003\* with GaAs Schottky diodes grown by atomic layer molecular beam epitaxy (ALMBE) yielding  $10^{11}$  diodes /  $cm^2$
- \*Hastas, *J App Phys*, 93, 7, 2003, p. 3990

conference in the world, right here in DC.

With a US green movement being popular once again, IRI is poised to contribute major energy inventions to the nation's progress toward energy independence. An example is my latest paper, **“Proposed Use of Zero Bias Diode Arrays as Thermal Electric Noise Rectifiers and Non-Thermal Energy Harvesters”** which was just presented at an American Institute of Physics meeting in Huntsville AL on February 24, 2009 at a Workshop on Future Energy Sources, published in the *Proceedings of Space, Propulsion and Energy Sciences International Forum* (SPESIF). It is also posted on our IRI website along with the slideshow in pdf format. We are submitting grant proposals to further development of this basic design for solid-state electricity generation that does not require fuel to operate. After I submitted the paper, I found two independent researchers who have done experiments with zero bias diodes, one of which is shown in a slide on this page that I prepared for the conference.

### Diode Array Example



Courtesy of Tom Schum

Other Bioenergetics Projects that are moving further along include the “Electric Antioxidant Clothing” patent application and prototype. We look forward to having Dr. Bev Rubik from the Frontier Sciences Institute supply some clinical data and tests of the product. IRI is also negotiating an EM-Probe substitute product line since the FDA forced Dr. Gordon out of business for no apparent reason. The OsteoPad product that he developed but never was able to bring into production is one that I personally hope to work on, since I have followed the bioelectromagnetic history of the pulsed EMF circuits that help brokent bone to knit faster and older bones to stop developing osteoporosis, with the patents and journal articles of Drs. Becker, Bassett and Pilla. Doctors for the past twenty years have routinely obtained FDA approval for such bone-strengthening devices but there are virtually none to be found on the market today as the consumer market has been ignored.

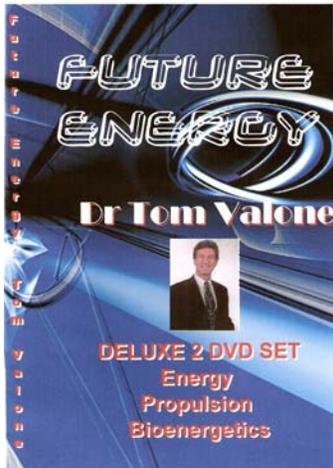
With President Obama releasing a 2009 memorandum that signals the importance he places on **scientific integrity** in federal policy making, we look forward to the energy development progress that should result from this shift in government attitude. Even Hollywood has joined in with the movie “Watchmen” star Adrian Veidt stating that “The world needs free energy!” Thank you for your continued support.

Sincerely,

Thomas Valone, PhD, PE  
President

## INTEGRITY RESEARCH INSTITUTE HIGHLIGHTS 2007

**Conferences and Presentations:** Our Institute had a busy year in 2007. Chief among many conferences was *“Humanity 3000”* sponsored by **the Foundation for the Future** in Seattle Washington. It included intensive workshops with other prominent scientists discussing mankind’s possible directions the next 1000 years. Also in Kona Hawaii, *“The Earth Transformation Conference 2007”* Dr Valone presented on earth friendly energy technologies. Also he presented at the **USPA Conference** in Skokie, Illinois giving an overview of future energy technologies. An important meeting organized by Major Todd Hathaway from the Pentagon and the **Green Salon**, a DC based nonprofit, was the *“Energy Consensus Meeting”* in Bethesda Maryland, where we presented all the major possibilities for energy generation in the next 50 years. Dr. Valone participated in the **Woodrow Wilson International Center for Scholars**, *“Exploring the Future of Energy”* at the Ronald Reagan Building. All of IRI Directors attended the **2007 Solar Decathlon**, sponsored by the **US Department of Energy** at the National Mall in Washington DC. Please see the review written by IRI Director, Wendy Nicholas in the article section. Last but not least was Dr Valone’s presentation at the **MUFON VA Chapter** meeting in November where he presented *“Future Energy Technologies of UFO origin”*.

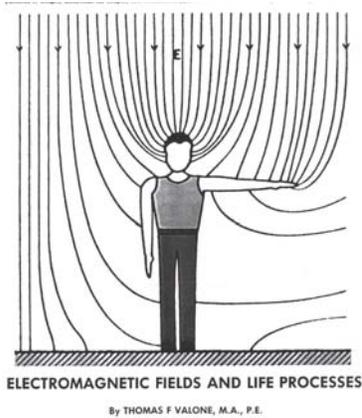
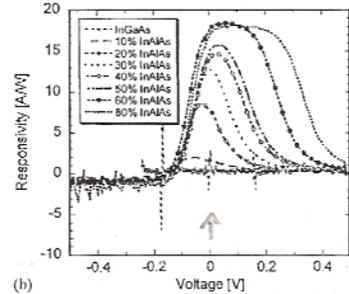


mastered and professionally produced by *Transvision*, a prominent filming firm based in Santa Monica, California.

**Spiral Magnetic Motor Program.** This program is researching the capability of a totally permanent magnetic motor design for mechanical torque production. This year Dr Valone and Dr Panting visited Howard Johnson in Blacksburg Virginia. Mr. Johnson holds several patents on magnetic motors. Intensive review was done of his work,

including video documentation, photos and personal conversations. Dr. Ted Loder also received a grant from our institute to further his research and production of a magnetic motor in a Wankel version. Also Dr. Valone attended the IEEE sponsored “Permanent magnet motor device design” a 2-day course in Philadelphia, PA.

**Zero Point Energy Program.** The research continues on with the zero biased diode project for thermal and non-thermal energy rectification. In our lab, we are currently researching this ability and many journal papers are being prepared for submission to several physics journals. Also our book “*Zero Point Energy, the Fuel of the Future*” is now our bestselling book. The hardcover edition includes 280 pages of the latest findings on zero point energy and extensive color figures and photos. Also popular is our “Practical Conversion of Zero Point Energy” book and the “Zero Point Energy and the Future” report for serious researchers. We are currently seeking more funding for this program through investors and VC’s alike.



**Bioenergetics Program.** This program is designed to research bioenergy, and electrotherapy. This program includes research on equipment, therapy machines and providers of bioenergy therapy. New projects like antioxidant producing “electric clothing” and EM field shielding are being currently researched and studied. Dr. Panting did extensive research on subtle energy healing, especially studying the work of Dr Chunyi Lin and Marie Diamond, both which do not use machinery but rather manipulate bioenergy with their hands. Further research will continue on all these bionenergetic techniques.

**IRI expanded Research Laboratory.** Thanks to your generous donations and increased yearly revenue, we have now an expanded laboratory space, with new equipment for measurements and analysis. IRI envisions a future world where pollution is a thing of the past and abundant energy is generated on site in every home.



## IRI VISITS SOLAR DECATHLON 2007

*By Wendy Nicholas*

“Solar Decathlon 2007” was setup on the National Mall this October. Tom, Jackie and I managed to visit on the last day. We caught the metro downtown and arrived practically on the back doorstep of the winning solar house from the Universität Darmstadt. The exterior of the German house was created from wood -- German oak. This first place team did the best job of incorporating the solar panels into their design. We had to get up close to see that solar cells had been embedded even in the louvered doors that made up the outer most layer of the house. They also included new lightweight energy efficient materials in the construction. Tom noted that having double layered outer walls is a recent innovation that has caught on.



University of Damstadt, Germany Solar House, Winner of the 2007 Solar Decathlon at the National Mall, Washington DC.

Twenty colleges and universities competed in this year’s international event by designing an 800 square foot home that was powered solely by energy from the sun. The student teams also had to work out the logistics of transporting their designs to the National mall in Washington D.C. A task that was certainly much easier for the second place team from the nearby University of Maryland. Students from the German team told us that their house had traveled by ship part of the way to its final destination close to the metro stop. Not only Germany, but also universities from Canada, Puerto Rico and Spain competed with the Americans in the 2007 decathlon.

Each house was given an “e4” electric vehicle manufactured by Global Electric Motor Cars. The house power design had to include enough energy to keep this vehicle charged. The cars are open and look like 4 seated golf carts. The decathlon website, [www.solardecathlon.org](http://www.solardecathlon.org), states that these vehicles can travel at speeds of 25 miles per hour and are legal to use where the posted speed limit is less than 35 miles per hour. Ok, so maybe they wouldn’t work out so well on the Washington beltway even though speeds are often less than 35 mph due to traffic.



The author with Jackie Panting, enjoying the Solar Decathlon display. In the background you can see many of the Solar homes as well as the US Capitol Building.

Speaking of traffic, there were long lines of people waiting to get a look at the inside of each house, so we opted to skip the lines and peak in the windows wherever we could. At the Penn State house, we noticed the first of many roof-mounted hot water heating systems, composed of a series of dark tubes. The Kansas State/University of Kansas project also used roof mounted tubes and received the top rating of 100 for their solar heated hot water.

At the house built by Team Montréal, the “green wall” really caught our attention for its beauty and functionality. We thought this was a spectacular accomplishment as it provides not only insulation, but also food such as leafy greens, herbs or even just flowers for aesthetic purposes.



The University of Montreal Solar House. Notice greenery on the outside walls.

This also was the first of many we would see this day. The team’s website explains that the green roof and green wall reduce the energy required for cooling, add insulation and provide a rain water recovery system for irrigation. This team took on the special challenge of developing solar power for colder climates.

Most of the solar homes included exterior plantings, if not in the walls, there would be planters on the decking. The Carnegie Mellon house included miniature green houses. Texas A&M had a water garden on the front deck. Their website explains that they can achieve high levels of carbon balancing.

Jackie and I liked the wood panels included in the house from the University of Madrid, Spain. It made this house stand out architecturally from the rest and look truly futuristic.



The University of Madrid Solar Home featured an exquisite futuristic wood frame design.

We are especially proud of the solar house designed and constructed in our home state. The University of Maryland had its best showing ever by taking the second place prize. The students took their inspiration from a leaf’s ability to transform solar energy into plant form. Thus, the house is named LEAFhouse. The main attraction, which we didn’t get to see, was the “Liquid Desiccant Waterfall” or LDW. This is a unique way of cooling the house by reducing the humidity. Humidity is absorbed by the liquid calcium chloride on the inside of the house and the desiccant is regenerated by heat that is released to the outside of the house. “LEAF” also stands for “Leading Everyone to an Abundant Future.”

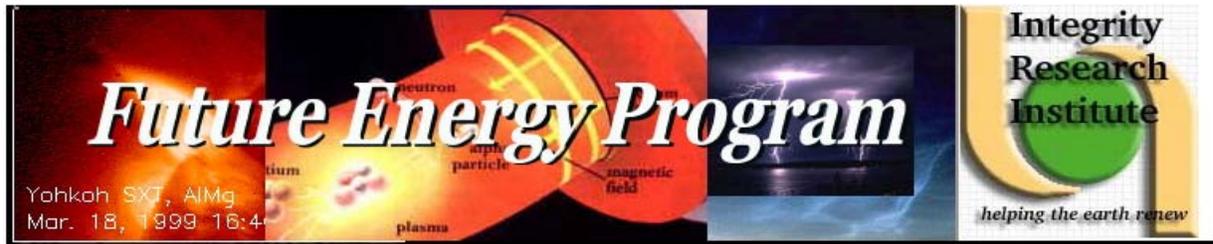


IRI President in front of the University of Maryland Solar House, Second Place Winner.

How fortunate we felt to be able to attend this event. The participating colleges and Universities certainly demonstrated the feasibility of solar energy to the hundreds of people who saw them first hand and for the thousands who heard about this event through the media. As well, they have brought innovations, new ideas and advanced research to such an important energy resource.

The Department of Energy, which is the decathlon’s main sponsor, is now collecting proposals for the 2009 event, so pass along the word to all those future leaders in solar energy. The dates are October 9-13 and 15-18<sup>th</sup>.





# Policy Recommendations For a Comprehensive National Energy Initiative

Attention: Energy & Environment Transition Team member **Heather Zichal**

Thomas F. Valone, PhD, PE  
Integrity Research Institute  
January, 2009

## Executive Summary

While over 500 submissions have been made to date to “Your Seat at The Table” of the **Energy & Environment Obama-Biden Transition Team** at Change.gov, only a handful identify specific new energy projects or programs that are truly clean (meaning carbon-free), sufficiently robust and will provide increased employment to solve our national energy crisis to create an 80% reduction in carbon emissions by 2050.

These Policy Recommendations for a Comprehensive National Energy Initiative looks at the cutting-edge energy technologies. It recommends the adoption of an aggressive future energy program of short term, intermediate, and long term goals that will revolutionize our country’s energy landscape. In addition, by focusing on *decentralized electric power*, it will make our country more disaster proof so that during a calamity, a million people don’t lose power as well as other losses.

**A) In the Short Term**, it is strongly recommended that 1) all state and utility-based limits on individual, private electricity generation be removed; 2) we initiate a federal program for the installation of piezoelectric crystal highway electricity generators for up to 400 kW/km of four-lane highway; 3) spearhead a 100,000 solar roof initiative as Germany has successfully done; 4) federally mandate at least one “out of sight” beyond top secret black project energy invention each year for the next four years; 5) enhance government

incentives, tax credits and equipment availability for giant off-shore megawatt wind turbines.

**B) For the Intermediate Term**, it is recommended that the U.S. government should 6) jump start the recently discovered algae biofuel revolution; 7) introduce phototransmutation of nuclear waste which uses a tabletop X-ray laser to produce short lived half-life waste; 8) give the green light to a NASA program for Space Solar Power (SSP) with a single satellite feasibility prototype launch; 9) expand field trials for the biggest U.S. energy reserve which is non-interruptible: geothermal energy; 10) offer policy and tax initiatives for new car designs that include the all-electric car and TheAirCar.com; 11) initiate enforcement of the Code of Federal Regulations that provide for examiners and managers to request a working model demonstration at the USPTO to vastly improve the validity of the flood of issued patents.

**C) For the Long Term**, it is suggested that the new Administration should also 12) supersize the Solar Revolution Project at MIT; 13) diversify the present single-track federal nuclear fusion program to include equal funding for many other viable fusion options; 14) initiate the Planktos Science ocean seeding of plankton blooms to sequester millions of tons of carbon dioxide to slow global warming temporarily; 15) support R&D in wild card energy discoveries such as permanent magnet gradient motors, zero bias diode converters, electrokinetic impulse force propulsion.

The **Appendix** contains articles and support material which substantiate the recommendations of this study.

## A) Short Term Recommendations

### 1) Remove all state and utility-based limits on individual, private electricity generation with an additional incentive of a guaranteed rate.

Presently, individuals who wish to sell their self-generated electricity back to the local utility company are strangled by a varying number of restrictions that limit them severely, including a hefty rental fee for the additional electric meter. The original intent of protecting the electric utility companies ability to provide power should now be supplanted by a greater public need for clean electricity that is reliable and decentralized. When *Germany's Hermann Scheer* initiated the **Renewable Energy Sources Act**, which ensured that *independent producers generating excess electricity can sell it to the grid at a **guaranteed price***, it launched **thousands of cottage industries** throughout the country, with **immediate self-employment** to help the economy, solving two problems at once so that today, renewables account for nearly 15 per cent of electricity generated in Germany. It is recommended that the U.S. will also benefit greatly from (a) a federally-guaranteed rate for unlimited self-generated electricity and (b) an upgraded smart grid as recommended by Al Gore (Ref: Appendix A).



**2) Initiate a federal program for the installation of piezoelectric crystal highway electricity generators for up to 400 kW/km of four-lane highway.**



AN ENVIRONMENTALLY friendly road that positively welcomes heavy traffic may sound odd, but by placing piezoelectric crystals under the asphalt that convert vibration into electricity, Israeli engineers will harvest energy from passing vehicles. Developer Haim Abramovich at the Technion-Israel Institute of Technology in Haifa says the crystals can produce up to **400 kilowatts from a 1-kilometre** stretch of four-lane

highway. His spin-out company, Innowattech, (<http://www.innowattech.co.il/>) also based in Haifa, will begin testing the system on a 100-metre stretch of road in northern Israel in January, 2009. Installing the technology need not produce unnecessary greenhouse gases, says Abramovich: "We're advocating that the system be fitted to roads only during routine maintenance, so there's no extra digging." However, since **the power output is so significant, it is possible to institute a national program** for installing piezoelectric crystal asphalt converters in all new roads as well. (Ref: 10 December 2008, *New Scientist* issue 2685, <http://www.newscientist.com/article/mg20026856.100-crystal-road-harnesses-power-of-passing-cars.html>)

**3) Spearhead a 100,000 Solar Roof Initiative as Germany has successfully done but now is even less expensive than ever.**



Today, a number of solar PV breakthroughs make solar photovoltaic (PV) panels more accessible than years ago. In addition to supporting continued research in PV as the **Council for Photovoltaic Research** advocates, the new Administration can jump ahead to implantation on a large scale to make a dent in the economy with low cost thin-film plastic PV roof tiles (Ref: Appendix B). This is also designed by the Germans to be a "one-two

punch" since the Recommendation #1 above has to be aided by this Solar Roof Initiative when a majority of the solar power recipients realize they can produce excess electricity to sell back to the utility companies for a profit.

#### 4) Federally mandate at least one major classified DOD Black Budget energy or propulsion invention for declassification each year for the next four years.

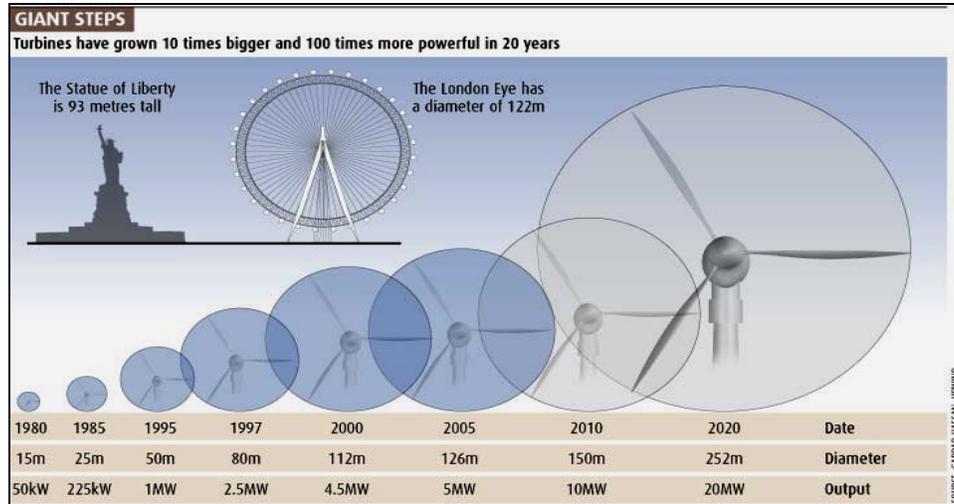


With two other “Your Seat at The Table” submissions targeting the a) “Right to Know” and b) “Disclosure,” it is appropriate to go further to look at the bottom of the secrecy pile as well as these surface issues (including e.g., [www.disclosureproject.org](http://www.disclosureproject.org)). By far the largest source of secrecy orders for technology involve the **Pentagon’s Classified Black Budget**, which is a one-way ticket, costing the taxpayer \$32 billion dollars (doubled during the Bush years) that are routinely unaccounted for. The Federation of American Scientists (<http://www.fas.org/blog/secrecy/?s=patent+secrecy> ) also notes that this policy has forced over 5000 patents to be secretized, usually for about fifty (50) years on the average, which prevents civilians, the economy and the inventors from ever benefiting from the inventions. It has recently been documented that many of the secret technical breakthroughs are rewriting the laws of physics for the black world.<sup>1</sup> However, the civilian scientific population has no access to these developments and instead, the inventor and every associate of his is normally placed under national security orders not to disclose any detail with threats of imprisonment, as reported to me by those whose inventions have been classified. Furthermore, there are examples of companies like Boeing, who have applied for declassification of their contracted work for use on commercial airliners, after developing an improved aviation efficiency invention for the U.S. Air Force, only to be turned down (Ref: DOE source). It is recommended that some minimal type of **black world disclosure and accountability** be mandated, at least for a single inventive energy or propulsion line item of declassification each year for civilian use, so that *billions of dollars need not be spent twice* to develop the same useful technology. This is also in keeping with the “sundown” rule suggested by the late Ben Rich from Lockheed’s advanced development division (Ref: Appendix C).

#### 5) Expand government incentives, tax credits for 160,000 giant off-shore megawatt wind turbines on the East Coast.

When many groups have simply lobbied for more energy research (e.g., NREL) and Vice President Cheney desired to install 300 MW coal-burning power plants every week for the next 20 years, the immediate availability of giant wind turbines has been vastly overlooked in the U.S. Thirty General Electric 10 MW wind turbines eliminate one polluting coal or natural gas power plant with no need for fuel. However, many groups oppose the installation of off-shore wind turbines including the Chesapeake community for no other good reason than a disruption of the “view”. However, in comparison, the more common and overwhelmingly disturbing sight of high voltage towers and power lines throughout the U.S. landscape has not created a single protest. It is recommended that federal support to this big, green renewable solution to the energy crisis will at least solve the East Coast energy needs with a recommended 160,000 offshore wind turbines (Ref: Appendix D). Have a look at U.S. Department of Energy’s map of Michigan’s wind resources (ranked by the U.S. government as one of the top 20 states for offshore wind

<sup>1</sup> LaViolette, Paul. *Secrets of Antigravity Propulsion*, Bear & Company, Rochester, 2008, p. 115



farms): [http://www.windpoweringamerica.gov/maps\\_template.asp?stateab=MI](http://www.windpoweringamerica.gov/maps_template.asp?stateab=MI). The European Wind Energy Association also forecasts rapid growth over the next decade ([http://www.ewea.org/fileadmin/ewea\\_documents/images/publications/offshore\\_report/ewea-offshore\\_report.pdf](http://www.ewea.org/fileadmin/ewea_documents/images/publications/offshore_report/ewea-offshore_report.pdf)) in Europe where the economic incentives are better.

## B) Intermediate Term Recommendations

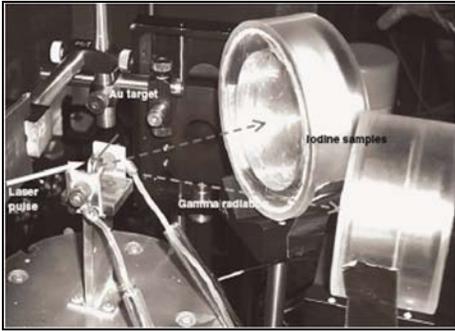
### 6) Jump-start the recently discovered Algae Biofuel revolution.

Better than the emerging cellulosic biofuel concept and the widely implemented corn-based biofuel, algae farms are probably the most ideal. Recently a company named Quantum Rabbit (<http://www.quantumrabbit.com/>) discovered an algae strain which is the most compatible with gasoline in its molecular make-up. When designed in vertical troughs, algae farms use very little space, become mature quickly, and are totally renewable. In 2008, the first algae biodiesel plant PetroSun went online with 4 million gallons of algal oil per year. The first **Algae Biomass Summit** was held in Seattle, October 2008 ([www.RenewableEnergyWorld.com](http://www.RenewableEnergyWorld.com)) and [Algal Biomass Organization](#) (ABO) was formed with the mission to accelerate the development of the algae industry. A federal endorsement and tax credit by the new administration in effect **would make a gasoline that is renewable** as opposed to a limited resource, without the food-chain and processing complications of the corn-based biofuel fiasco (Ref: Appendix E).



### 7) Introduce X-ray Phototransmutation of Nuclear Waste onsite to create short half-life waste that quickly becomes nonradioactive

Today, the electric utility industry is interested in new fission nuclear reactors without addressing the nuclear waste problem. During a recent panel discussion at the University of Maryland, Admiral Skip Bowman, President of the Nuclear Energy Institute ([www.nei.org](http://www.nei.org)), tried to convince every one in the audience, that the total nuclear waste per person in the U.S. is only a small soda can, but to no avail. (He also departed, perhaps



in protest, during my presentation on future energy when I reached the nuclear power issue, comparing it to a beautiful show dog that still leaves a pile on your lawn.) People still do not receive any realistic solution to the problem from these nuclear lobbyists. Even the Department of Energy simply wants to continue to research Accelerated Transmutation of Waste (ATW) that activates the mixed waste as it transmutes some of it. The DOE also advocates hot waste Yucca Mountain storage.

Instead, a major breakthrough is available by simply operating a tabletop X-ray laser to phototransmute **acrylic-encased mixed waste samples** ([www.iop.org/EJ/article/0022-3727/36/18/L01/d3\\_18\\_L01.pdf](http://www.iop.org/EJ/article/0022-3727/36/18/L01/d3_18_L01.pdf)) . All of the waste can be transmuted to *short-lived half-life isotopes* by operating in the 7 MeV to 10 MeV range exclusively, as discovered by the late Paul M. Brown (Ref: Proc. of COFE, IRI Pub., 1999). Europeans are very excited about this processing discovery (Ref: *J. Phys. D: App. Phys.* 36 (2003) L79) and it can be implemented on-site at every nuclear reactor facility to produce Class C shallow burial waste that has no dangerous radioactivity. It is recommended that **X-ray Phototransmutation** (with gamma radiation similar to that now used to irradiate food) should be implemented for onsite treatment of waste for every nuclear reactor and for Yucca Mountain as well, as a “pre-treatment,” so that the waste stored there will not endanger future generations at all (Ref: Appendix F).

**8) Give the green light to a NASA program for Space Solar Power (SSP) with a *single satellite SSP feasibility program.***

**Space-Based Solar Power Beams Microwaves**

Could collect enough power in one year to rival the entire world's oil reserves  
Generates gigawatts

**NATIONAL SECURITY SPACE OFFICE**

Space-Based Solar Power  
As an Opportunity for Strategic Security

Phase 0 Architecture Feasibility Study  
Report to the Director, National Security Space Office  
Issuance Recommendation  
Release 0.1  
10 October 2007

Kilometer wide array @ 1.3 kW/m<sup>2</sup>

1. Massive orbiting solar panels continuously collect energy.
2. Power is sent to Earth as microwave beams.
3. Earthbound receivers cover farmland, but let 50 percent of light through to crops.
4. Receivers supply power to the electrical grid.

Popular Mechanics, January, 2008 and Aviation Week, Jan. 2008

Many have heard of the popular **Space Solar Power (SSP)** project originally proposed by Gerard O’Neill from MIT twenty years ago. The biggest advantage is the ten-times (10x) improvement in the performance of any PV solar cell without the losses introduced by the atmosphere on sunlight. In other words, instead of only 100 Watts per square meter on the ground for the average solar PV conversion rate on an intermittent basis, we can expect **1,300 Watts (1.3 kW) per square**

**meter in space.** Today even the Pentagon has endorsed the concept for national security reasons and [a 2-minute video of demo](#) is online which features many experts that explain the advantages. We note that SSP offers *many stabilizing, round-the-clock features* that solve the intermittent nature of other renewable energy on the earth. IRI recommends that a single prototype should be funded by the incoming Administration to prove the feasibility and robust nature of the process. SSP is the only energy technology with the capability for replacing all of the electricity generation in the U.S. in a relatively short

time. A test satellite should be the number one priority for NASA as part of the new administration's Comprehensive National Energy Initiative (Ref: Appendix G).

**9) Expand Government-funded research and field installation trials for the biggest land-based U.S. energy reserve that is non-interruptible: *geothermal energy*.**

Currently, the U.S. is the world's biggest producer of geothermal energy. However, an amazing MIT study (Ref: The Future of Geothermal Energy, MIT, January, 2007) recently exposed a veritable U.S. gold mine. The study found that geothermal energy needs to be a major energy program in this country. It found that geothermal energy was a largely untapped resource. The advantages are that no fuel is required, it works day and night offering an **uninterruptible source of electric power**. Furthermore, geothermal resources are available nationwide with no major environmental impact issues except for meeting its water requirements. Sites that are now in use include California, Hawaii, Utah and Nevada. It is recommended that the major oil and natural gas companies should be encouraged to diversify into this industry with federal incentives, since the drilling and reservoir technologies are similar to that used for extracting oil and gas. It is further recommended that the shallow, extra-hot, high-grade deposits in the West should be explored and tapped first for commercial electric power generation (Ref: Appendix H).

**10) Offer policy and tax initiatives for new car designs that include the all-electric car and TheAirCar.com**

While plug-in hybrids are the center of attention with tax incentives and rebates proposed by the new Administration, it is our recommendation that all-electric cars and compressed air cars also deserve equal attention and benefits. Hybrids only offer reduced emission of greenhouse gases while all-electric and the Air Car ([www.TheAirCar.com](http://www.TheAirCar.com)) have zero emissions and the potential for high green rating when electricity generation evolves into a green industry as well. We predict that the all-electric, all-magnetic and the compressed air car are the future of the automotive industry in the Intermediate time frame and it is good for the U.S. to prepare the favorable legislation that will support their emergence into the mainstream markets (Ref: Appendix I). Perhaps GM will get the message too.

**11) Initiate enforcement of the Code of Federal Regulations (37 CFR 1.91) that provide for patent examiners and supervisors to request a *working model demonstration* at the USPTO “for any purpose in examination of an application” to vastly improve the validity of the flood of issued patents.**

*The following comments only represent my personal opinion and do not reflect present U.S. government policy or viewpoints.*

Today the U.S. Patent and Trademark Office (USPTO) issues more patents per year than ever before. Most people presume that the USPTO is doing the best possible job to ensure that only viable and valid patents are issued in this country, including those dealing with **energy inventions**. The statistics show that about 50% of all patent applications (which

increase every year) end up in a patent, with both pre-appeal and appeal review meetings designed to repeatedly discourage the examiner from fighting an appealed patent application. However, the process of evaluating, examining and allowing the patentability of new applications throughout the USPTO *exclusively relies* upon crude line drawings. Actual reduction to practice is not enforced since “constructive” reduction to practice is also equally acceptable by the USPTO. The result is that every patent examiner compromises any question of operability to a level of “possibility” and then half of the time allows the application, never requiring a working model. In my experience, every request for a working model is denied by the management with excuses like, “There is no facility except for NIST to test a working model.” As a result many patents, including energy patents, are issued without any possibility of them ever working or having utility. It is recommended that the CFR-mandated rules be given new life and enforcement with a specific policy and oversight for directing the USPTO toward clear implementation and evaluation of any examiner-initiated requests for working models. A new administration directive should encourage patent examiners to require working models whenever the operability is in doubt so that the manual will no longer have unenforced, empty words like: *“It is presumed that the witnessing of the demonstration or the reviewing of the exhibit is actually essential in the developing and clarifying of the issues involved in the application”* (Ref: Manual of Patent Examination Prosecution, 713.08).

## C) Long Term Recommendations

### 12) Supersize the Solar Revolution Project at MIT

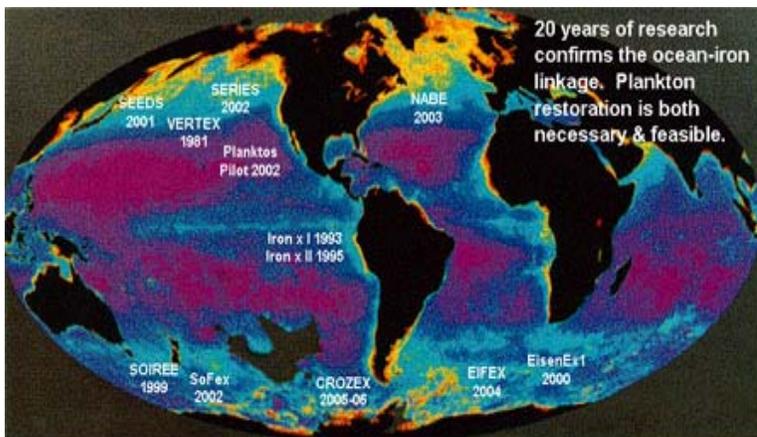
Now that the federally-funded Solar Revolution Project has achieved the wildest expectations: **artificial photosynthesis**. MIT has reproduced the photosynthesis process of plants for the first time and it is time to give it the upgrade in federal funding that it deserves. Another possibility that chief investigator Nocera is investigating is whether his catalyst can be used to split seawater. In initial tests, it performs well in the presence of salt, and he is now testing it to see how it handles other compounds found in the sea. If it works, Nocera's system could address more than just the energy crisis; it could help solve the world's growing shortage of fresh water as well. (Ref: Appendix J).

### 13) Diversify the present single-track federal nuclear fusion program to include equal footing and funding for a *Portfolio of Fusion Options*.

In 2003, the father of the U.S fusion program, energy expert Robert L. Hirsch, who also was the original director of the USDOE fusion department was fired from Rand Corp. on the recommendation of the USDOE for writing a 2050 Report that stated, U.S. **“fusion research is on the wrong track”** and as he told me when I called him, “will never become commercially viable” (Ref: [“Report Generates Negative Energy”, Washington Post, Tuesday, March 18, 2003; Page A27](#)). The Rand Corp. then rewrote the report to the USDOE liking, giving praise to its fusion program and submitted it to their client. Today, the USDOE still exclusively supports “magnetic confinement” fusion research, even though Sandia Lab reported success in 2003 with the Z-pinch fusion approach (Ref: *Nature* 422,

549 (2003); doi:10.1038/422549b April 10, 2003) and the Navy Research Lab in DC released a [report in 2003](#) declaring success with 6 out of 8 cold fusion experiments (Ref: *New Scientist* vol. 177 issue 2388 - 29 March 2003, page 36). Many other successful fusion experiments also have been undergoing R&D for years without federal funding and with only limited private funding. Upon close inspection, these inventions have less speculation, more commercialization potential and lower cost than the USDOE favorite, magnetic confinement (i.e., Tokamak and ITER). Furthermore, these alternative nuclear fusion projects such as [proton-boron \(p-B11\) focus fusion](#) (4x magnetic confinement fusion energy and designed for electricity production) researched by Dr. George Miley at the [University of Illinois Fusion Lab](#), deserve more major funding up to the level of equal funding as the magnetic confinement boondoggle. It is recommended that the USDOE adopt a Portfolio of Fusion Options including Reversed Field Pinches, Z-Pinches, Spherical Tokamaks/Electric Tokamaks, Field Reversed Configurations, Stellarators, Magnetized Target Fusion, Spheromak, Laser-Driven Inertial Fusion, Heavy-Ion Fusion, Cold Fusion, Focus Fusion, and Electrostatic Confinement (invented by Philo Farnsworth and tested at the University of Maryland), all of which have peer-reviewed journal articles published and major laboratory endorsements (Ref: Appendix K).

**14) Endorse and fund the Planktos Science field trials of ocean seeding of plankton blooms to sequester millions of tons of carbon dioxide to slow global warming in the interim while renewables are ramping up.**



When carbon dioxide (CO<sub>2</sub>) levels start becoming intolerable because of correlated and linked temperature and sea level rising, **only one time-tested process** has already been proven to provide short-term relief of atmospheric CO<sub>2</sub> in the range of **millions of**

**tons** and scalable to billions of tons of CO<sub>2</sub> sequestration: *plankton bloom stimulation* (see satellite images of blooms to left). However, every major media (Scientific American, Time, New Scientist, IEEE Spectrum, Popular Science, Harvard Business, etc.) created fear and panic last year for no apparent reason, even though the Planktos startup replicated a natural process that stimulates plankton growth in the oceans on the order of 50 tonnes of micro-nutrient iron rich dust (a tenth of the estimated 500 tonnes blown into the ocean from North Africa per year). It is recommended that since no other process has been tested to work on such a large scale and since the [Planktos Science](#) ocean seeding has proven to cause plankton blooms from satellite images, a federally-sponsored program should be instituted to move it to the next stage of acceptability and implementation, in order to slow the massive increase in CO<sub>2</sub> that is relentless and inevitably surpassing 400 ppm most likely in the next year or so (Ref: Appendix L).

**15) Support R&D in Advanced Energy Concepts such as permanent magnet gradient motors, zero point energy diode converters, electrokinetic impulse force propulsion, etc.**

Integrity Research Institute engages in scientific integrity research and supports a limited range of [energy research projects](#) in energy, propulsion and bioenergetics. Some of the notable projects have been the subject of books, reports, DVDs, and journal articles. While the electric gradient, thermal gradient, and gravity gradient are very familiar for energy conversion in producing energy, the magnetic gradient has been largely unexplored. Therefore, we are researching a Spiral Magnetic Motor based on the magnetic gradient concept. Another example is zero point energy. It is the energy that keeps the electron levels away from the nucleus and what keeps liquid helium liquid, even at microdegrees of absolute zero. McGraw-Hill also just published a textbook entitled, *Taking Sides* (Easton, ed., 2008) with a reprint from my book, [Zero Point Energy: The Fuel of the Future](#). However, research is not ongoing in this field anywhere in the U.S. government, despite its well-established U.S. patent and journal article basis. (I am presenting a paper regarding the use of solid state diodes for electricity production in a conference proceeding article for the [SPESIF conference in February 2009](#) on using "zero bias" diodes for rectifying ZPE quantum noise, which will form the basis for these converters of the near future.) Electrokinetics is another neglected force-production invention for which I published an [AIAA paper](#) and [book](#) to help document its development. It is recommended that a **USDOE Office for Advanced Concepts** be established to explore, catalog and fund research in advanced energy inventions much like the defunct [Office of Technological Assessment](#) used to do.

Respectfully Submitted,

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# Appendix

## Appendix A:

### Interview - Bring on the Solar Revolution

Fred Pearce, 21 May 2008, *New Scientist* Print Edition.

<http://www.newscientist.com/channel/opinion/mg19826572.000-interview-bring-on-the-solar-revolution.html>



(Image: Dominik Butzmann)

We have heard all about Al Gore's inconvenient truths on climate change. Now comes an extremely convenient truth from his German counterpart. Social Democrat MP **Hermann Scheer, who has been dubbed more revolutionary than Greenpeace**, says the great unspoken truth is how painless it will be to convert the world to renewable energy, especially solar power. So much so that the Kyoto protocol is a waste of time that makes what is easy and cheap seem hard and expensive. The sun king tells Fred Pearce we are as close to the solar revolution now as we were, a decade or so ago, to the cellphone revolution.

**You are not a physicist or an engineer, so how did you get involved in solar energy?**

It was in 1986. I was the spokesman on nuclear disarmament for the Social Democrats in the German parliament. This was at the time of Ronald Reagan's Star Wars, the Strategic Defense Initiative or SDI. I wrote a book called *The Liberation from the Bomb*, a strategy for global nuclear disarmament. That included ending our dependence on nuclear energy, so I had to think about energy alternatives.

I had not read a single book on renewable energy. I just did my own thinking and I wrote a chapter suggesting a new SDI, the Solar Development Initiative.

**So you began with political objectives?**

Yes. But while my book got good reviews, the main criticisms were about my solar proposals. The experts said I should stick to things I understood. So I made myself an expert, and my gut feelings were right. A large proportion of Germany's electricity could be generated from the sun, and the barriers to achieving this are political, not economic or technological.

**What did you do about it?**

Ten years ago, I called for a programme to install solar panels on 100,000 roofs in Germany, so that we could have mass production as soon as possible. I wanted it in my party's programme in the 1998 elections. Even Greenpeace said my plan was unrealistic, and my colleagues asked why we should be more radical than Greenpeace. But I persuaded them, and the programme was implemented within four years. In 2000, with colleagues, I launched the Renewable Energy Sources act, which ensures that independent producers

generating excess electricity can sell it to the grid at a guaranteed price. Now renewables account for nearly 15 per cent of electricity generated in Germany.

**You are very critical of the Kyoto protocol. Why?**

The protocol starts from the premise that the solutions to climate change will be an economic burden. So it is all about how we share this burden. But it is not an economic burden; it is a new economic opportunity. So I don't accept the idea of issuing emission rights that can be traded. It is like giving rights to trade in drugs, and saying drug dealers can buy and sell those rights.

**But you can't make all carbon dioxide emissions illegal, can you?**

No. But this is an ethical question. It is not normal in civilised societies to dump household waste in the street. You pay for it to be taken away. But with energy emissions we are allowed to dump our waste in the atmosphere.

I was the only person to vote against the emissions trading law in the Bundestag [the German parliament]. I said that it goes against all our experience on how technological revolutions happen. Of all the technological revolutions in the last 200 years, which of them happened because of an international treaty? Not one. They happened because they were accepted as important, superior and necessary for the future.

**What technologies should be part of that revolution? You pushed through tax exemptions for biofuels in Germany, but many people are now having second thoughts.**

Biofuels are a delicate problem. It is a mistake simply to replace fossil fuels with biofuels without ensuring the sustainability of the agricultural system that produces them.

**Is there enough land to supply both food and energy?**

Yes, but it all depends on how things are done. It is a great mistake to think about growing biofuels only from the few plants that provide food. You couldn't go about it in a worse way than trying to turn corn into ethanol, as the US is doing.

The first step should be to make use of residues from food production. Ninety per cent of the biomass, like straw, is not used for food. Refining it to make biofuels would provide a second income for farmers, and the waste from biorefineries, like ash, could be used to replace chemical fertilisers. In this integrated system, biofuels would be the basis for organic agriculture and there would be no competition for land between food and fuel.

**Don't these changes in energy technology require changes in the way our society is organised?**

To take advantage of this integrated system, we have to have localised energy production, near the farms. Solar and wind power is also best provided locally. This is completely different from the fossil fuel energy system, where production and consumption are separate - often on opposite sides of the world - and you need a huge amount of infrastructure to link them up.

The German government is talking about sticking with fossil fuels like coal, but capturing and burying the emissions. Isn't this a practical low-carbon solution?

I believe it is a fake. Carbon capture is technologically but not economically feasible. It reduces energy efficiency, because of the energy needed to capture the carbon dioxide and run the extra infrastructure. And at the end, you still have the problem of making sure the carbon stays safely in storage for thousands of years. It is like the problem with nuclear waste, possibly even worse.

Today, this idea is being used as a justification for building new coal-fired power stations, with the promise that in maybe 15 years the carbon could be captured. These promises won't be fulfilled. In any case, carbon capture would cost much more than renewables, so why bother?

People talk about introducing a low-carbon economy. I don't like that term. It is a way to smuggle in nuclear power generation and carbon capture. We should talk instead about a renewable energy economy. There is plenty of renewable energy for all our needs.

Many environmentalists are pessimists and don't believe in technical fixes. But you are a real techno-optimist.

Yes, because I see the opportunities for renewables. I see that they can provide 100 per cent of our energy, and they can be introduced very fast. All the great technological revolutions happen much more quickly than even the experts and enthusiasts guess. The forecasts for the spread of cellphones and IT were all overtaken by the reality. The renewables revolution will be the same.

The IT and mobile phone revolutions were also the first technological revolutions in modern times that were not about centralising power. They were about decentralising. And this will happen to energy from renewables. The big old-fashioned power stations and long supply chains will be replaced by local supplies for local markets. This is changing the tide of history.

**How is your house powered?**

By a solar panel. My roof produces more power than I need myself.

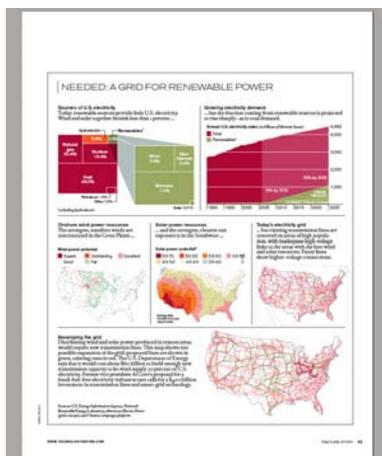
**Energy and Fuels** - Learn more about the looming energy crisis in our comprehensive special report.

**Profile**

Born in 1944, Hermann Scheer studied economics and social science, becoming involved in revolutionary student politics at the University of Heidelberg where he was president of the student parliament. He taught economics at the Technical University in Stuttgart before becoming a systems analyst at the German Nuclear Research Centre. In 1980 he was elected as a member of parliament, and has remained an MP ever since. He is president of the **European Association for Renewable Energy**, and chairman of the **World Council for Renewable Energy**, both of which he founded. His books include *The Solar Economy* (Earthscan, 2002) and *Energy Autonomy* (Earthscan, 2006)

**Link**

<http://www.technologyreview.com/files/22723/Jan09FeatureGridp45.pdf>



One page **Diagram** on the best regions in the U.S. for solar and wind and most importantly, the draft plan for an **Improved Smart Electrical Grid**.

“Needed: A Grid for Renewable Energy” from January/February 2009, *Technology Review*

## Appendix B:

### Flexible Solar Technology Gets White House Backing

Associated Press, March 08, 2007, <http://www.technologyreview.com/Wire/18298/>

A company trying to harness energy from sunlight and interior light to wirelessly power everything from cell phones to signboards now has financial backing from the White House. President George W. Bush's program to help solar energy compete with conventional electricity sources will help fund Konarka Technologies' development of flexible plastic solar cell strips -- material that could be embedded into the casings of laptop computers and even woven into power-producing clothing to energize digital media players or other electronics ([www.Konarka.com](http://www.Konarka.com)).

The technology, which received its first Pentagon funding three years ago, offers a lightweight, flexible alternative to conventional rigid photovoltaic cells on glass panels.

Energy Secretary Samuel Bodman is scheduled Thursday afternoon to tour Konarka's headquarters in a former textile mill in Lowell, where he's expected to announce funding from Bush's Solar America Initiative.

The award amount and other details were to be announced in a news conference at Konarka, a six-year-old private company that has attracted nearly \$60 million (euro46 million) in venture capital funding. Konarka's nearly \$10 million (euro7.6 million) in grant money to date from U.S. and European governments includes funding from the Pentagon to supply lightweight portable battery chargers and material for tents to draw power from sunlight. Chief Executive Howard Berke said the new White House support is a milestone for Konarka.

The first commercial product using Konarka's technology is not expected to hit the market until next year, and the company is not saying what that product might be. Konarka expects to provide prototypes in the second half of this year to commercial partners that would bring the technology to market. Konarka's approach "is potentially a great breakthrough technology, but like all breakthroughs, they don't happen instantaneously," Berke said in a phone interview.

Observers say Konarka has a good chance of becoming a leader in solar power, an industry enjoying a recent surge in initial public stock offerings by startup companies as well as growing investments from traditional energy companies -- for example, one of Konarka's financial backers is Chevron Corp. Konarka's development of plastic solar cell strips that can be manufactured like rolls of photographic film "has the promise of becoming a low-cost manufacturing technique," said Jeffrey Bencik, a Jefferies & Co. analyst who follows the solar industry. "Some of their laboratory production has worked as advertised. But can they mass-produce it and get the same result? That's the biggest question."

Among developers of solar technology for small-scale uses, Konarka is "definitely doing the best job at developing what ultimately will have to be a mass-manufactured material," said Dan Nocera, a Massachusetts Institute of Technology chemistry professor.

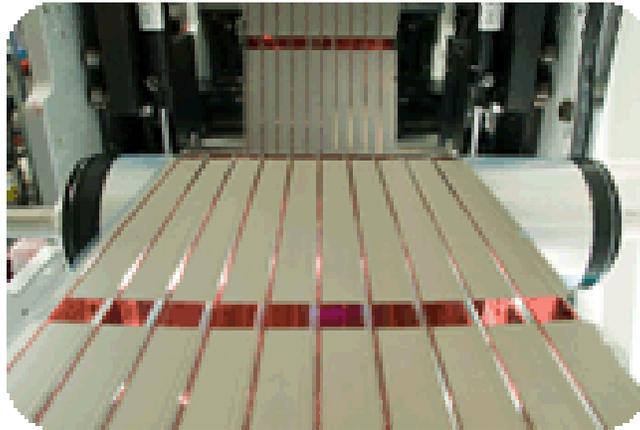
However, Nocera said it remains to be seen whether Konarka's so-called "Power Plastic" is sufficiently chemically stable to convert energy efficiently both when light is dim and when it's bright.

Konarka, which takes its name from an ancient temple in India dedicated to the sun god Surya, was founded by Berke and Alan Heeger, who shared the 2000 Nobel Chemistry prize for showing that certain plastics can be made to conduct electricity. The discovery about polymers -- long considered to be useful only as electrical insulators -- led to the development of new types of plastics to create flexible and lightweight alternatives to traditional solar cells on heavy glass panels.

Konarka developed low-cost plastics that could be used as the top and bottom surfaces of the photovoltaic cell. The 50-employee company says it has more than 280 patents and patent applications for materials, manufacturing and other processes and devices.

The company says its solar cells are efficient across a much broader spectrum of light than traditional cells, allowing them to draw energy from both the sun and indoor lighting. Konarka says its material is lightweight and flexible so that it can be colored, patterned and cut to fit almost any device. The firm envisions embedding its material in cell phones, laptops and toys to provide power on the go. Clothing could be woven with the material to supply power for handheld electronics, and signboards, traffic lights and **rooftops could be fitted with solar strips.**

Berke foresees wide use of such technology in the developing world and areas off the electrical grid. To that end, Berke said Konarka has held confidential discussions with the manufacturer of an inexpensive portable computer developed for the nonprofit One Laptop Per Child project, which seeks to provide computers to young students in the developing world. The project's current design features a hand crank for charging batteries. "In the developing world, great demand exists for off-the-grid support of electronic devices," Berke said.



### ***Recent Updates***

University of California Santa Barbara verifies 6% efficiency of Konarka polymer PV cells  
December, 2008

[http://www.konarka.com/index.php/site/press/university\\_of\\_california\\_santa\\_barbara\\_and\\_universite\\_laval\\_significantly\\_a](http://www.konarka.com/index.php/site/press/university_of_california_santa_barbara_and_universite_laval_significantly_a)

Konarka Opens World's Largest Roll-to-Roll Thin Film Solar Manufacturing Facility with One Gigawatt Nameplate Capacity  
October, 2008

[http://www.konarka.com/index.php/site/press/konarka\\_opens\\_worlds\\_largest\\_roll\\_to\\_roll\\_thin\\_film\\_solar\\_manufacturing\\_fac](http://www.konarka.com/index.php/site/press/konarka_opens_worlds_largest_roll_to_roll_thin_film_solar_manufacturing_fac)

## Appendix C:

### Inside the Black Budget

By [WILLIAM J. BROAD](#)  
April 1, 2008

Correction Appended

Skulls. Black cats. A naked woman riding a killer whale. Grim reapers. Snakes. Swords. Occult symbols. A wizard with a staff that shoots lightning bolts. Moons. Stars. A dragon holding the Earth in its claws.

No, this is not the fantasy world of a 12-year-old boy. It is, according to a new book, part of the hidden reality behind the Pentagon's classified, or "black," budget that delivers billions of dollars to stealthy armies of high-tech warriors. The book offers a glimpse of this dark world through a revealing lens — patches — the kind worn on military uniforms (see below).

"It's a fresh approach to secret government," Steven Aftergood, a security expert at the Federation of American Scientists in Washington, said in an interview. "It shows that these secret programs have their own culture, vocabulary and even sense of humor."

One patch shows a space alien with huge eyes holding a stealth bomber near its mouth. "To Serve Man" reads the text above, a reference to a classic "Twilight Zone" episode in which man is the entree, not the customer. "Gustatus Similis Pullus" reads the caption below, dog Latin for "Tastes Like Chicken."

Military officials and experts said the patches are real if often unofficial efforts at building team spirit. The classified budget of the Defense Department, concealed from the public in all but outline, **has nearly doubled in the Bush years, to \$32 billion**. That is more than the combined budgets of the [Food and Drug Administration](#), the [National Science Foundation](#) and the [National Aeronautics and Space Administration](#).

Those billions have expanded a secret world of advanced science and technology in which military units and federal contractors push back the frontiers of warfare. In the past, such handiwork has produced some of the most advanced jets, weapons and spy satellites, as well as notorious boondoggles.

Budget documents tell little. This year, for instance, the Pentagon says Program Element 0603891c is receiving \$196 million but will disclose nothing about what the project does. Private analysts say it apparently aims at developing space weapons.

Trevor Paglen, an artist and photographer finishing his Ph.D. in geography at the University of California, Berkeley, has managed to document some of this hidden world. The 75 patches he has assembled reveal a bizarre mix of high and low culture where Latin and Greek mottos frame images of spooky demons and sexy warriors, of dragons dropping bombs and skunks firing laser beams.

"Oderint Dum Metuant," reads a patch for an Air Force program that mines spy satellite images for battlefield intelligence, according to Mr. Paglen, who identifies the saying as from Caligula, the first-century Roman emperor famed for his depravity. It translates "Let them hate so long as they fear."

Wizards appear on several patches. The one hurling lightning bolts comes from a secret Air Force base at Groom Lake, northwest of Las Vegas in a secluded valley. Mr. Paglen identifies its five clustered stars and one separate star as a veiled reference to Area 51, where the government tests advanced aircraft and, U.F.O. buffs say, captured alien spaceships.

The book offers not only clues into the nature of the secret programs, but also a glimpse of zealous male bonding among the presumed elite of the military-industrial complex. The patches often feel like fraternity pranks gone ballistic.

The book's title? "I Could Tell You but Then You Would Have to Be Destroyed by Me," published by Melville House. Mr. Paglen says the title is the Latin translation of a patch designed for the Navy Air Test and Evaluation Squadron 4, at Point Mugu, Calif. Its mission, he says, is to test strike aircraft, conventional weapons and electronic warfare equipment and to develop tactics to use the high-tech armaments in war.

"The military has patches for almost everything it does," Mr. Paglen writes in the introduction. "Including, curiously, for programs, units and activities that are officially secret." He said contractors in some cases made the patches to build esprit de corps. Other times, he added, military units produced them informally, in contrast to official patches.

Mr. Paglen said he found them by touring bases, noting what personnel wore, joining alumni associations, interviewing active and former team members, talking to base historians and filing requests under the Freedom of Information Act.

A spokesman for the Pentagon, Cmdr. Bob Mehal, said it would be imprudent to comment on "which patches do or do not represent classified units." In an e-mail message, Commander Mehal added, "It would be supposition to suggest 'anyone' is uncomfortable with this book."

Each year, the Center for Strategic and Budgetary Assessments, a private group in Washington, publishes an update on the Pentagon's classified budget. It says the money began to soar after the two events of Mr. Bush's coming into office and terrorists' 9/11 attacks.

What sparked his interest, Mr. Paglen recalled, were Vice President [Dick Cheney](#)'s remarks as the Pentagon and World Trade Center smoldered. On "Meet the Press," he said the nation would engage its "dark side" to find the attackers and justice. "We've got to spend time in the shadows," Mr. Cheney said. "It's going to be vital for us to use any means at our disposal, basically, to achieve our objective."

In an interview, Mr. Paglen said that remark revived memories of his childhood when his military family traveled the globe to bases often involved in secret missions. "I'd go out drinking with Special Forces guys," he recalled. "I was 15, and they were 20, and they could never say where they were coming from or what they were doing. You were just around the stuff."

Intrigued by Mr. Cheney's remarks as well as his own recollections, Mr. Paglen set off to map the secret world and document its expansion. He traveled widely across the Southwest, where the military keeps many secret bases. His labors, he said, resulted in his Ph.D. thesis as well as a book, "Blank Spots on a Map," that Dutton plans to publish next year.

The research also led to another book, "Torture Taxi," that Melville House published in 2006. It described how spies kidnapped and detained suspected terrorists around the globe.

"Black World," a 2006 display of his photographs at Bellwether, a gallery in Chelsea, showed "anonymous-looking buildings in parched landscapes shot through a shimmering heat haze," Holland Cotter wrote in *The New York Times*, adding that the images "seem to emit a buzz of mystery as they turn military surveillance inside out: here the surveillant is surveilled."

In this research, Mr. Paglen became fascinated by the patches and started collecting them and displaying them at talks and shows. He said a breakthrough occurred around 2004, when he visited Peter Merlin, an “aerospace archaeologist” who works in the Mojave Desert not far from a sprawling military base. Mr. Merlin argued that the lightning bolts, stars and other symbols could be substantive clues about unit numbers and operating locations, as well as the purpose of hidden programs.

“These symbols,” Mr. Paglen wrote, “were a language. If you could begin to learn its grammar, you could get a glimpse into the secret world itself.”

His book explores this idea and seeks to decode the symbols. Many patches show the Greek letter sigma, which Mr. Paglen identifies as a technical term for how well an object reflects radar waves, a crucial parameter in developing stealthy jets.

A patch from a Groom Lake unit shows the letter sigma with the “buster” slash running through it, as in the movie “Ghost Busters.” “Huge Deposit — No Return” reads its caption. Huge Deposit, Mr. Paglen writes, “indicates the bomb load deposited by the bomber on its target, while ‘No Return’ refers to the absence of a radar return, meaning the aircraft was undetectable to radar.” In an interview, Mr. Paglen said his favorite patch was the dragon holding the Earth in its claws, its wings made of American flags and its mouth wide open, baring its fangs. He said it came from the [National Reconnaissance Office](#), which oversees developing spy satellites. “There’s something both belligerent and weirdly self-critical about it,” he remarked. “It’s representing the U.S. as a dragon with the whole world in its clutches.”

The field is expanding. Dwayne A. Day and Roger Guillemette, military historians, wrote an article published this year in The Space Review ([www.thespacereview.com/article/1033/1](http://www.thespacereview.com/article/1033/1)) on patches from secret space programs. “It’s neat stuff,” Dr. Day said in an interview. “They’re not really giving away secrets. But the patches do go farther than the organizations want to go officially.”

Mr. Paglen plans to keep mining the patches and the field of clandestine military activity. “It’s kind of remarkable,” he said. “This stuff is a huge industry, I mean a huge industry. And it’s remarkable that you can develop these projects on an industrial scale, and we don’t know what they are. It’s an astounding feat of social engineering.”

This article has been revised to reflect the following correction:

Correction: April 3, 2008

A picture caption on Tuesday with an article about military-uniform-style patches for secret Pentagon programs, using information from a new book about the patches, misspelled the name of a historic patch from the Civil War. It is Kearny (for Gen. Philip Kearny), not Kearney.



## Possible Declassification of Propulsion Technology, ISDC, May 20, 2005

Thomas Valone, reprinted from the book, [The Future of Energy, An Emerging Science](#), Integrity Research Institute, 2009

During his National Space Society lecture at the **International Space Development Conference** in 2005 (Washington DC), Dr. Paul Werbos from the National Science Foundation mentioned that he needed some black technology that he knew the military had classified, while looking directly at the NRO Deputy Director, Bennett Hart. Being an audience participant as well as a speaker for the conference, I photographed the exchange, which lasted several minutes. (NRO = National Reconnaissance Office, which is bigger than the CIA.)

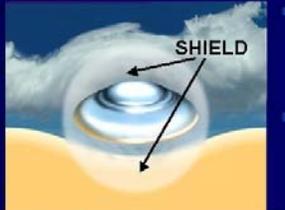
After Bennett's cryptic presentation calling for "major muscle moves", monthly missile launches and technology better than rockets, I asked Bennett during the Q & A if it was possible that he would consider some inter-agency advocacy to declassify technology we need for space travel. He repeated the question to clarify it and then said "yes."

**INERTIAL SHIELDING is LOGICAL**

**Force = (inertial mass) • acceleration**

A subject worthy of research and testing

**F = ma**  
depends only on inertial mass, not gravitational mass



**SHIELD INERTIA (m → 0) and "a" increases ASTRONOMICALLY**

Inertial force  $F_x = -\Gamma \hbar \omega^2 a / 4\pi^2 c^2$

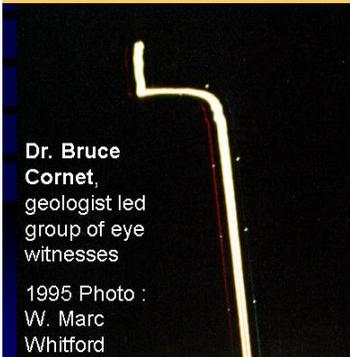
"Inertia as a zero-point Lorentz field" Haisch, *Phys. Rev. A*, V.49, N.2, 1994

Afterwards, I approached him personally to show him a few slides (see below) from my talk that included the discussion about **inertial shielding** and the triangular aircraft that have been sighted repeatedly all over the country, exhibiting right angle turns. Using Newton's law, force equals mass times acceleration, **F = ma**, this proves that inertial mass m can be reduced and shielded. With that technology alone, the lifting power or force F we currently used would be vastly improved with m greatly reduced and of course, the acceleration "a" would be

magnified proportionally.

Bennett Hart identified the concern for security issues and the fact that once something is classified, it usually goes up the levels of classification until "it is out of sight." He also indicated that even if they fail in a project that is classified, it still will not be declassified, which reminded me of a similar story that retired CIA agent Arthur Glenn Foster told me about his Project X (regarding the Moray Device) before he died. The conversation turned to issues of energy and propulsion that are decades old (even the photo above of the triangular craft plasma trail was over ten years old). Bennett indicated that they usually encourage industrial partners to pursue avenues of development "which we know exist," so that the invention may "come out at a

### Black Projects Have Inertial Shielding



- Pine Bush near Stewart AFB
- Delta-shaped aircraft 
- Two mobile white headlights
- Steady red, green lights and blinking yellow lights on tips of craft
- No visible contrail
- Abrupt change of direction
- Ability to hover motionless
- Inverse Doppler effect
- Audible but low engine noise

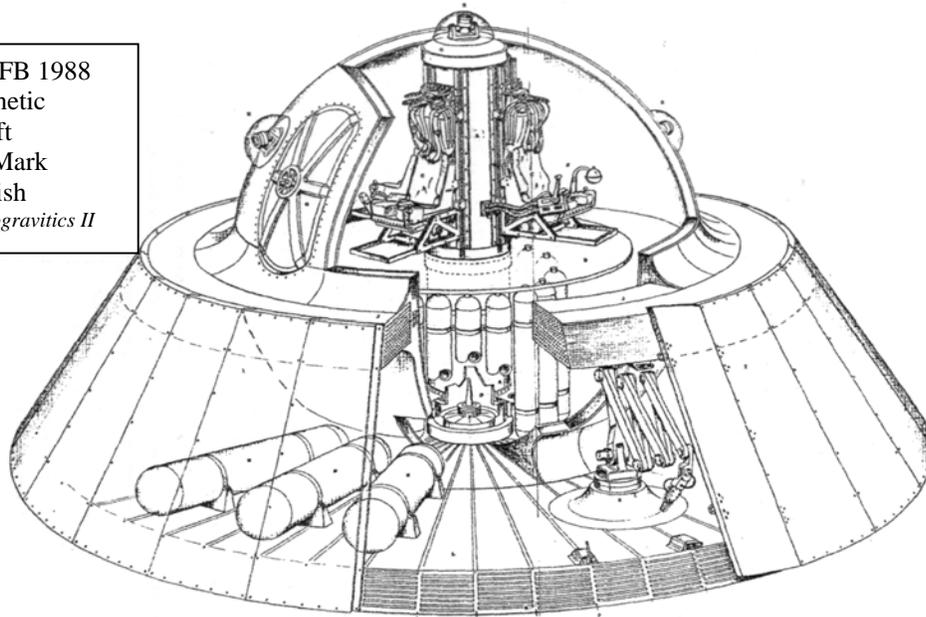
Dr. Bruce Cornet, geologist led group of eye witnesses

1995 Photo : W. Marc Whitford

lower classification level.” I complained that this means *the taxpayers will pay twice for it* and Congressmen have been quoted in the press saying the same thing. I also expressed my opinion that we are living with WW II technology that has been perpetuated by this military policy of not declassifying things soon enough for civilian economic benefit. He said that he thought it was trickling out fast enough. To the contrary, I showed him a *Washington Post* article from Dec. 10, 2004 and said that if he was right, the new **Public Interest Declassification Board** would not be necessary. Furthermore, I told Bennett that I am 54 years old and during all my life, I have not seen any new energy or propulsion technology released nor invented.

Then, I pulled out my two-volume *Electrogravitics Systems* books to show him the **1988 Norton AFB hovercraft** which has 1950’s rivets and hovers above the ground.<sup>2</sup> Even though it simply uses pulsed “electrokinetics” to produce impulse force (the subject of the second volume), it still has not been declassified. I said, since he indicated in his talk that he needs more lifting capability and faster launch schedules, he needs improved propulsion technology as much as the space program needs it. Several people had come to our Institute’s exhibit booth expressing the interest in new breakthrough propulsion technology as well.

Norton AFB 1988  
Electrokinetic  
Hovercraft  
© 2001, Mark  
McCandlish  
Ref: *Electrogravitics II*



I asked him if he knew Air Force people in high black areas who could be convinced to leak some of the propulsion technology to the public sector and whether he could do something about it. He said he would try. We ended the conversation with me stating that our economy would benefit and he would benefit as well -- a win-win situation. He agreed that we were both on the same wavelength and we shook hands. Only time will tell if this historic encounter will be the turning point for the future or whether it is routinely dropped like a hot potato. Historically, we take note of the U.S. government position: “Defense Secretary **Richard B. Cheney** said there was no near-term plan to declassify technology now trapped in the ‘black world’. He said the need to maintain a qualitative edge over potential adversaries ‘always will take precedence’ over economic competitiveness issues” (*Aviation Week & Space Tech*, Feb. 17, 1992, p. 17).

Thomas Valone  
Integrity Research Institute  
Washington DC

<sup>2</sup> Valone, Thomas. *Electrogravitics II, Validating Reports on a New Propulsion Methodology*, Integrity Research Institute, 2005



## Exposing the Black Budget

**The Cold War is over. So why, Paul McGinnis wanted to know, are major CIA, NSA, and Department of Defense programs still being kept secret from Congress and US taxpayers?**

*By Phil Patton*

[http://www.wired.com/wired/archive/3.11/patton\\_pr.html](http://www.wired.com/wired/archive/3.11/patton_pr.html)

It's the world's wildest high-tech toy catalog, the Pentagon's annual Dear Santa letter. It includes secret weapons programs with baffling code names such as Elegant Lady, Tractor Rose, Forest Green, Senior Citizen, Island Sun and Black Light, White Cloud and Classic Wizard. These are the "black budget" programs that pay for spy satellites, invent stealth cruise missiles, tinker with Ladar - laser radar - and experiment on aircraft that change color and helicopters that evade tracking systems. Covering expenditures for intelligence and weapons research, the Pentagon's black budget is the most titillating portion of the massive classification program that has swelled almost unabated since World War II.

The black budget is the government's illusory and tangled accounting of what it spends on intelligence gathering, covert operations, and - less noticeably - secret military research and weapons programs. It admits to no easy calculation, but by estimates of those who watch it, the black budget may hit US\$30 billion a year - a figure larger than current federal expenditures for education. It includes spending by the CIA, the Defense Intelligence Agency, the National Security Agency, and military R&D.

Documented - vaguely - in funding requests and authorizations voted on by select committees of the US Congress, the black budget is published with omitted dollar amounts and blacked-out passages. It hides all sorts of strange projects, not just from enemies, foreign and domestic, but from the public and elected officials as well. Last year, for instance, it was revealed that the National Reconnaissance Office had for several years used the black budget to hide from Congress the cost and ownership of a \$300 million office building, even though the structure was plainly visible from Route 28 west of Washington, DC.

With "program element" numbers, obscured figures, and code names that read like dadaist poetry, the details of the black budget are revealed to only a few select Congressional committee members - and sometimes not even to them. There are several different types of black budgets buried, for example, within the Pentagon's procurement budget and Research, Development, Test, and Evaluation budget - the tab for the toy testers. Others cover defense intelligence and research. An internal Pentagon memo from August 1994, which was accidentally leaked and showed up in Defense Week, revealed some hard numbers: the National Security Agency spends \$3.5 billion a year; the Defense Intelligence Agency \$621 million; and the Central Imagery Office \$122 million for spy-satellite work.

A code name not mentioned in black budgets but well known to those who watch them is Trader. It is familiar to readers of such Net mailing lists as the skunk-works digest ([majordomo@mail.orst.edu](mailto:majordomo@mail.orst.edu), subscribe: skunk-works in message body) or the newsgroup alt.conspiracy.area51. The code name Trader belongs to Paul McGinnis, who assembles and correlates public information to create a detailed estimate of items in the real budget. Several

years ago, McGinnis became fascinated with all the code names and turned himself into a one-man truth squad: collector, interpreter, collator, and online publicizer of the black budget and its associated "special access programs." McGinnis is one of a growing number of private citizens who have made a second career of tracking the military budget. His research complements traditional Washington watchers of government - the public-interest muckrakers, if you will.

One of the most respected is Steve Aftergood, who writes the Secrecy and Government Bulletin for the Federation of American Scientists, a public-interest group founded in the wake of the first A-bomb. Exposing weapons boondoggles and cost overruns, Secrecy and Government has helped formulate a fundamental critique of classification policy. What Ralph Nader was to Detroit, the federation has been to the Pentagon. (Aftergood's Bulletin appears on IntelWeb, a site for spy buffs at <http://awpi.com/IntelWeb/>.) Another famed watcher is Steve Douglass, the Amarillo, Texas, publisher of Intercepts, a newsletter for military-monitoring buffs (see "StealthWatchers," *Wired* 2.02, page 78). Douglass reads Lockheed in-house publications and local newspapers near Air Force bases for, say, reports of public-school expansion, which indicates the arrival of a new military unit.

Some of these investigators are merely curious. Some are ideologically opposed to black budgeting, arguing that it is wasteful and futile, that revealing the cost of a stealth fighter tells no more about how to build one than the cost of a Cadillac does. Black budgeting, its opponents argue, is more about hiding from Congress and the public than from any foreign enemies. Many black programs, such as the B-2 stealth bomber and the Milstar satellite system, ended up costing far more than anticipated. Others failed to work as advertised. The Bush administration, for example, killed the Navy's A-12 stealth carrier aircraft before it was unveiled to the public. Aren't there better things we could be doing with our money?

For many who track it, the black budget is more symbol than substance. In it, they hope to unearth a Rosetta stone that might decypher the mountain of secret information the Pentagon and intelligence agencies have amassed in recent decades. McGinnis, like many others, discovered the black budget through his passion for airplanes - spy planes and stealth fighters in particular. Like film or rock stars, these planes have their own fan clubs and groupies who post in AOL's aviation section or subscribe to the skunk-works mailing list, which provides information and lore about Lockheed Advanced Development Co.'s famous Skunk Works research center. Skunk Works created the SR-71 Blackbird spy plane, the F-117 Stealth fighter, and numerous weapons it won't admit to making. The company generally ranks as a triumph of the black budget world. It, of course, has had its share of failures - which black budgeting hides.

Fascinated by programs such as Aurora, a putative hypersonic spy plane that has been rumored for so long it is now almost legendary, McGinnis distinguished himself from other black budget watchers by filing Freedom of Information Act requests about programs whose names suggested they might be aircraft. The name Aurora, for example, first showed up in the 1986 Pentagon budget request as a mysterious line-item code name. The size of the appropriation for Aurora rose from \$8 million in 1986 to \$2.3 billion for 1987. The next year it vanished. Watchers soon suspected it was a successor to the SR-71 Blackbird spy plane.

McGinnis lives in Huntington Beach, California, and works long hours as a test engineer specializing in satellite data communications for a company whose name he would rather not drag into his private obsession. When he's not working, he goes through thousands of pages of government documents, most of them provided free by the issuing agencies, others picked up at the local library. In years of work, he has learned to read between the lines, discovering that the "Virginia Procurement Office" is really the CIA and that the "Maryland Procurement Office" is the National Security Agency. He can cite chapter and verse of such Pentagon reports as "Critical Technologies for the '90s." And he casts a trained eye on curious proposals in the Commerce Business Daily, the standard reference for federal contracts. He even consults with archaeologists for the Department of Energy - they were called in when a road

for a mysterious black budget project at the Nevada nuclear test site 70 miles northwest of Las Vegas impacted a Native American settlement.

Any delight or pride McGinnis takes in the chase is masked by a clipped and efficient tone of voice. Yes, he says, his work is "about causing some kind of change," but he is no fervid ideologue. He works behind the scenes, feeding information to politicians pushing for reform in classification policies. He speaks of "people inside government who are on our side," implying that most are not, but his comments hardly demonize the Pentagon or the intelligence agencies. When he does take some time off from his jobs, he's likely to be found hiking in the desert, enjoying the flowers and the birds, though he'll end up near a place like TRW's classified radar site in the hills east of San Clemente, its three white radomes glowing in the sunlight behind the chain-link fence. "I became interested in the subject of excessive military secrecy," McGinnis e-mailed me recently, "because it struck me as wrong that the US military was still acting as if the Cold War was happening. A turning point came with a September 1993 Freedom of Information Act case I filed on the classified aircraft codenamed Senior Citizen (Program Element 0401316F) and Groom Lake."

McGinnis found himself exchanging letters with an Air Force colonel named Richard Weaver (then Deputy for Security and Investigative Programs for the Secretary of the Air Force). Reading the censored case files he received from his request, McGinnis became convinced that the Air Force (and other military services) had large numbers of senior officials who held arrogant attitudes toward the average American taxpayer. "You can imagine the anger I felt when I saw censored internal Air Force memos from Colonel Weaver with lines like 'His appeal justification is the standard (blacked-out censored area) provided by almost everyone else who makes similar requests for this information. All have been turned down.' And 'Mr. McGinnis's rationale that he somehow should be allowed to perform those oversight functions of Congress, while novel, is not compelling.'"

This kind of response turned a mild-mannered inquirer into a much more fervent muckraker. "I was merely pointing out the Air Force's violations of US classification policy, contained in Executive Order 12356, and how secret spending violated Article I, Section 9, Clause 7 of the US Constitution," McGinnis argues with typical mastery of the obscure. He's referring to the requirement that Congress approve all federal spending. The black budget, McGinnis argues, violates that provision by hiding the purpose of expenditures. McGinnis is not alone in his dogged pursuit of military secrets. He took inspiration from *Blank Check: The Pentagon's Black Budget*, a 1990 book by reporter Tim Weiner. Now at *The New York Times*, Weiner covered the CIA's Aldrich Ames scandal and won a Pulitzer Prize in 1988 for his exposé of black budget programs for *The Philadelphia Inquirer*. In *Blank Check*, Weiner argued that the black budget represented an entire culture of deception - "the realm of nukes and spooks," he called it. Take a program such as element number 207248F. The program behind the number was called STUDS, for "special tactical unit detachments." It is hard to believe that any overtones of this acronym are other than intentional.

In one year this program went from \$885,000 to \$20 million. Budget readers know from the program number that STUDS is operational - not just a research project but a working unit, that it is tactical (rather than strategic), and that it is Air Force. More specifically, it is people flying captured or purchased foreign planes in the desert north of Las Vegas. The testing program is no secret - an Air Force general died several years ago flying a Russian fighter. But many of the aircraft have probably come into the country surreptitiously since the collapse of the Soviet Union and may include prototypes purchased from renegade generals or engineers. For fiscal 1995, the program number persists, sans its inflammatory acronym, but its budget has risen - to \$118 million, according to McGinnis.

Looking at other program numbers in a similar fashion, McGinnis took the work of Weiner and other reporters much further. He began assembling his own rendition of the black budget using Congressional and Department of Defense documents and made it available by ftp and on mailing lists through commercial online services. The Internet, thanks to McGinnis and

others, has emerged as a new tool for black budget watchers trying to change policy in the secret world. McGinnis is amused by the irony that the Internet, based on the original Arpanet created with Pentagon R&D money, provides a medium for revealing the secrets of the Department of Defense.

McGinnis spends much of his time analyzing such government documents as the House and Senate versions of the "National Defense Authorization Acts," scrutinizing both the reports and the supporting testimony to Congress. He consults the Pentagon's own guide to reading the budget, Department of Defense Handbook DoD 7045.7-H. He spends hours poring over publications with names like "FYDP Program Structure," "Supporting Data for Fiscal Year 1994 - Budget Estimate Submission - Descriptive Summaries - Research, Development, Test and Evaluation," and "Critical Technologies Plan for the Committees on Armed Services - United States Congress."

These are not exactly light reading: the plots are slow and hard to decipher. From his own reading of these texts, McGinnis believes there are misleading or meaningless nomenclatures, blank cost figures, and even phony line items in any code names that include the characters r 1 and p 1. And sometimes, he says, black projects are twinned, like binary stars, with "white," or open, projects. The Orient Express superplane program, announced publicly with great fanfare by Ronald Reagan in 1986, is widely thought to have been at least partially a cover for black research into a hypersonic reconnaissance craft or a pulse-jet engine.

McGinnis has posted his sketch of the black budget, a dinosaur skeleton with conjectural plaster bones filling in the gaps, on his ftp site ([ftp.shell.portal.com in the/pub/trader directory](ftp://shell.portal.com/pub/trader/directory)). He began an electronic newsletter, Neon Azimuth - a designation mocking the code names the Pentagon gives to its secret programs - and now has a Web page (<http://www.portal.com/~trader/home.html>). The site includes a novel directory of sources of satellite imagery, from the USGS EROS Data Center to Russian satellite pictures.

McGinnis also posts the results of his various Freedom of Information Act inquiries and makes available back issues of The Groom Lake Desert Rat newsletter, published online by Glenn Campbell, the self-appointed watchdog of the secret Groom Lake Air Force base in Nevada. McGinnis often quotes from Candide and claims Voltaire as a hero. But for all his Voltairean skepticism toward power and government, McGinnis and other black budget watchers may also share Candide's naïveté, which sometimes verges on self-righteousness. After all, can one reasonably expect the Pentagon to be wholly open about how much it spends on death rays or manta-shaped drones? Can anyone who's spent time watching C-Span fail to share the Pentagon's fear of leaks from the fairly piebald cast of Congressional characters known as our duly elected representatives?

But the forces that favor classification reform are growing, even as the strength and prestige of the intelligence community declines. Now that we know the CIA grossly overestimated the economic resolve of the former Soviet Union and, even worse, overestimated the allegiance of the agency's own employees such as Aldrich Ames, now that a succession of less and less satisfactory actors have played James Bond, even an ordinary citizen may be inspired to believe he can do a better job of spying than the professionals.

The political legitimacy - or lack thereof - of the black budget remains an important issue to many who watch it. McGinnis has political convictions, to be sure: he supplies reform-minded politicians with inside information. But **the black budget is the tip of an iceberg of secret government records** dating back to before World War II and increasingly exposed as the Cold War thaws. The list of odd numbers and funny words that constitute the budget stands for something more: a mountain of information that belongs to the American taxpayer. Gradually, that information is beginning to leak out.

Now that many KGB files are open, the mass of US classified information looms as a huge target for open-records activists, as well as for the curious. There is a sense that strange

wonders await discovery, bizarre, yet-undocumented programs from mind-control experiments to the half-revealed effort in the '70s to develop the "autonomous land vehicle," a giant walking tank reminiscent of the lumbering war machines in *The Empire Strikes Back*. There are hints of a program called **Iris**, still underway, to create an aircraft that changes color, and of **Black Horse**, a next-generation jet. There is **Brilliant Pebbles**, smart munitions in which hundreds of tiny dart-like missiles are fired at incoming ICBMs as part of Star Wars, which, McGinnis argues, "never really went away."

In *Skunk Works: A Personal Memoir of My Years at Lockheed*, published last year by Little, Brown, the late Ben Rich, former head of Lockheed's advanced development division, complained of the burden of doing black business: finding engineers who could pass security checks (and waiting six months for these to be completed), as well as suffocating and compartmentalized design processes, uninformed Washington inspectors, and many other constraints. He estimated that working in the black added about 25 percent to the cost of a weapons system (many estimates are higher). He cited the absurd case of a urinal-tube heater he designed in the late '50s for spy-plane pilots confronting the rigors of peeing at high altitude. The device was immediately classified, presumably so Russian pilots could not use American know-how to avoid frostbitten members.

**Rich advocated a two-year "sundown" rule that would automatically abolish secret classification unless other action was taken.** But for half a century now, classification has continued, propelled by its own momentum.

Classification can be viewed as the information equivalent of the national debt. Information we put off releasing is like debt we put off paying. Like the fiscal deficit, it costs a lot to service and maintain. Keeping things secret requires guards, vaults, background checks. A General Accounting Office study placed the cost at \$2.2 billion, but the office pointedly noted that its calculations had been hampered by the refusal of the CIA to cooperate. Private industry spends an estimated \$13 billion more adhering to government security standards.

There is evidence that the secrecy structure may collapse of its own weight before anything is done to fix it. Says Steve Aftergood, "The more secrecy you have, the thinner your security resources are spread, and there is a loss of respect for the system. That promotes leaks. It's hard to keep things secret. It's work. People have to sit and read boring hearing records and black things out. It's easy to imagine they would miss stuff." Aftergood believes that accidental disclosure has been growing. Part of the reason is incompetence, part is semi-official policy. He wrote in the *Bulletin* that "'accidental' disclosure has the great advantage that it does not require anyone to exercise leadership or to take responsibility. It has now become the preferred policy particularly since classification reform is not working. If current trends are taken to the limit, everything may eventually be classified - but nothing will be secret." Aftergood concludes the leaks are a sign of institutional decadence. "The government has found it easier to let the classification system disintegrate than to establish new standards that command respect and loyalty," he writes.

There are signs of reform. The Clinton administration has split the Advanced Research Projects Agency, which developed vital weapons (and the Internet) in the past, from the Pentagon and charged that its research should now focus on dual-use technologies with both civilian and military applications. And after years of heaving and groaning, a new policy seems to be arriving. Late last spring, President Clinton issued a long-awaited executive order on secrecy reform. Effective this last month, the order will declassify hundreds of millions of pages of Cold War documents. Under the new policy, most current secret documents will be automatically declassified after 25 years, and classification from now on will automatically expire after a decade - approximately the same length of time that has passed since government officials began drafting the new order.

There are loopholes, however, that will keep many sensitive documents under lock and key, including those relating to the president and to foreign government involvement. And it will be

the unenviable task of something called the Information Security Oversight Office to handle the laborious duty of declassification.

With this order and with John Deutch, the newly installed head of the CIA, promising both a fresh look at classification policy and a new spirit of openness, it might seem that the work of McGinnis and other black budget watchdogs has come to an end. But it is far from clear that the new openness is real. A Congressional committee on secrecy policy, which brings together such unlikely allies as New York Democratic Senator Pat Moynihan and North Carolina Republican Jesse Helms (both share a concern over excess security), has yet to produce specific recommendations for bringing the black budget out of the shadows. And the panic reaction that followed the arrest of Aldrich Ames has created a thick and swirling atmosphere of fear that dims the prospects of secrecy reform.

But the current administration has already declassified a huge number of documents - from World War II, the '50s, and the '60s. Many of these represent what the black budgets of the past really meant. They are the meat on the bones of old numbers. And, emerging like flickering images from some time machine's screen, they seem almost surreal: they represent in effect the government's first admission of things that every history book already records. The mass of newly declassified paper will supply McGinnis and others with all sorts of nuggets of information. And their role will increase in importance: it has been left to private citizens, not government professionals, to poke through the rubble and make sense of it all.

One thing they have found is details of how, in the early '60s, the Defense Advanced Research Projects Agency (DARPA) funded a program under the name **Corona** to find out if there was indeed a "missile gap" with the Soviet Union. Orbiting spy satellites snapped high-resolution photos (video was not good enough) and then ejected the exposed film in reentry pods aimed at convenient oceans. There, the plan went, C-130 cargo planes trailing great drag lines would snare the capsules and return them for processing and analysis. It took many tries before the somewhat improbable system worked.

In the official budget, Corona was advertised as a civilian space effort under the name Discoverer. In fact, the pictures from the secret project proved that the threat of Russian bombers and missiles was far less than had been feared. Recently, some 800,000 images from 1960 to 1972 were made available, with sample images online at <http://edcwww.cr.usgs.gov/dclass/dclass.html>. Looking at them today is to see laid out, with Kodak clarity, just how misguided the defense buildups of the '50s and '60s were.

These images mark the arrival of the news from past decades, like light from distant galaxies. To see spy-satellite photos from the once supersecret Corona program, snapshots of the Cuban missile crisis, and close-ups of Russian airfields and ICBM pads makes clear how widely divergent are the time tracks of the black world and the real world. In a sense, the black budget is the last legacy of the old Soviet threat: a mirror in which a now vanished Medusa of nuclear holocaust becomes, we hope, forever fossilized.

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*Phil Patton ([pattonp@pipeline.com](mailto:pattonp@pipeline.com)) is a contributing editor to Esquire.*

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## Appendix D:

# Offshore Wind Farm Could Blow Away Energy Needs

**By Andrea Thompson, LiveScience Staff Writer**

**14 February 2007**

[http://www.livescience.com/environment/070214\\_wind\\_farm.html](http://www.livescience.com/environment/070214_wind_farm.html)

**Wind power could supply all the energy needs of much of the East Coast** and then some, if a phalanx of wind turbines running from Massachusetts to North Carolina were installed offshore, a new study concludes.

Though local residents often object to wind farms intruding on their landscape and views, wind power has become an increasingly attractive option for generating clean energy and reducing greenhouse gas emissions for several countries. Offshore wind farms in Denmark and the United Kingdom are now used to generate electricity, with Denmark drawing 20 percent of its energy from wind power.

But determining just how much ocean area is available and how much energy a wind farm can actually produce is tricky and had yet to be done for this area of the Atlantic.

"In doing our surveys and watching the public debate, we saw that no one had solid empirical data on the actual size of the offshore wind resource, and we felt this was important for policy decisions," said study author Willett Kempton of the University of Delaware.



### **An ideal location**

Oceans make ideal locations for wind turbines because they "are particularly windy all over," Kempton said. The ocean's surface isn't littered with hills, trees and houses like the land is, so winds over the water are faster because there is less friction to slow them down.

The wind turns the three blades of the turbine, and their rotation is converted into electricity by a generator.

The Middle Atlantic Bight, a region of the Atlantic Ocean that runs from Cape Cod, Massachusetts to Cape Hatteras, North Carolina, turns out to be an ideal setting for wind turbines because it is a large area of shallow water, Kempton said

Locating a large body of shallow water is important because with current technology, turbines can only be built out to a depth of 20 to 30 meters (close to 20 or 30 yards). Otherwise, it is too difficult to erect the metal pole that the turbine sits atop.

However, experimental turbines have been built out to a depth of 50 meters off the coast of Scotland. These types of turbines may be in commercial use soon, Kempton said, and with reasonable additional costs, he foresees building them out to a depth of 100 meters.

"Anything deeper than that, and you're talking science fiction," Kempton told *LiveScience*.

### Surpassing energy needs

To estimate how much area would actually be available to place wind farms on in the Middle Atlantic Bight, the researchers had to exclude areas used for bird flyways, toxic waste sites and shipping lanes.

"We don't want to compete with that use," Kempton said.

The researchers also had to consider that wind turbines must be spaced half a mile apart, otherwise they create turbulence that interferes with other turbines.

Even with all those allowances, **the energy needs of most of the East Coast** could be met, or even surpassed, with the **installation of over 160,000 turbines**, according to Kempton's findings. But to achieve that energy, the turbines would have to be built out to a depth of 100 meters, according to the research published in the Jan. 24 issue of the journal *Geophysical Research Letters*.

The reduced use of fossil fuels would reduce greenhouse gas emissions from the area by 57 percent, even in New England, one of the world's most highly polluting areas, according to the study. "The fact that we could get such huge reductions there gives me hope for other places," Kempton said.

### Mixed opinions

Proposals for offshore wind farms have met with mixed opinions: residents of Cape Cod are vocal in their opposition to such a project, but those in nearby Delaware support building the turbines.

Common complaints against wind turbines are their unsightliness, their potential to destroy habitats and their potential effect on local weather patterns.

There would be "a realistic set of pluses and minuses--there would be some bird kills," Kempton said. But he pointed out that the pylons actually create habitat for fish, the turbines would not be visible from shore and local weather effects would be negligible.

Even with local opposition, Kempton thinks it is likely that one of these projects will be built. "I think it's a 100 percent probability," Kempton said.

And the whole area doesn't have to be built at once. He said: "It definitely could be done on a state-by-state basis."

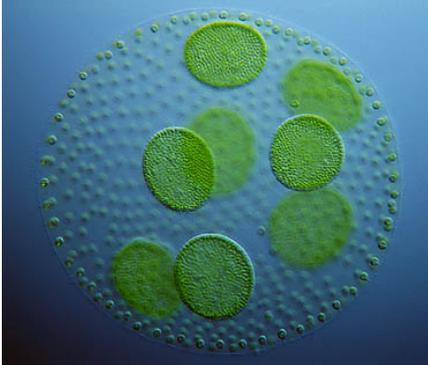
- [Top 10 Emerging Environmental Technologies](#)
- [Power of the Future: 10 Ways to Run the 21st Century](#)
- [Floating Ocean Windmills Designed to Generate More Power](#)
- [Several Massachusetts Communities Eye Wind Power](#)
- [Powerful New Map: Where the Wind Blows](#)

## Appendix E:

# First Algae Biodiesel Plant Goes Online

Clayton B. Cornell, March 29, 2008, [Algae](#), [Biodiesel](#)

[PetroSun](#) has [announced](#) the beginning operation of its commercial algae-to-biofuels facility April 1, 2008. <http://gas2.org/2008/03/29/first-algae-biodiesel-plant-goes-online-april-1-2008/>



The facility, located in Rio Hondo Texas, will produce an estimated 4.4 million gallons of algal oil and 110 million lbs. of biomass per year off a series of saltwater ponds spanning 1,100 acres. Twenty of those acres will be reserved for the experimental production of a renewable JP8 jet-fuel.

Gordon LeBlanc, Jr., CEO of PetroSun, had this to say: “Our [business model](#) has been focused on proving the commercial feasibility of the firms’ algae-to-biofuels technology during the past eighteen months. Whether we have arrived at this point in time by a superior technological approach, sheer luck or a redneck can-do attitude, the fact remains that microalgae can outperform the current feedstocks utilized for conversion to biodiesel and ethanol, yet do not impact the consumable food markets or fresh water resources.”

- » [Read more on Algae](#)
- » [See peer reviews of Biofuel Cars at Green Home](#)

[Microalgae](#) have garnered considerable attention, since acre-by-acre microalgae can produce 30-100 times the oil yield of soybeans on marginal land and in brackish water. The biomass left-over from oil-pressing can either be fed to cattle as a protein supplement, or fermented into ethanol.

The big problem has been figuring out how to collect and press the algae, and in the case of open ponds, to prevent contamination by invasive species. PetroSun seems to have figured it out, and this may be the first algae biofuel plant to get off the ground.

PetroSun won’t be making fuel immediately, but plans on either building or acquiring ethanol and [biodiesel](#) production plants. They’ve conveniently located themselves in an area accessible by barge, which should make fuel distribution a snap.

An aerial view (Google maps) of the algae farms can be seen [here](#).

This is NOT an April Fool’s joke! See the press release [here](#).

**Posts Related to Algae Biofuel and Biodiesel:**

- [Could We Grow 100,000 Gallons of Oil per Acre? Yes, Says Vertigro Algae Biofuel \[Video\]](#)
- [First Heavy-Duty Diesel Powered By Algae Biodiesel, Solazyme's "Soladiesel"](#)
- [Biodiesel Mythbuster 2.0: Twenty-Two Biodiesel Myths Dispelled](#)
- [World's First Commercially Viable Cellulosic Ethanol Plant Online 2009](#)
- [Algae Could Be Major Hydrogen Fuel Source](#)
- [Top 15 Unexpected Uses For Biodiesel](#)
- [How Solar Panels Could Power 90% of US Transportation](#)
- [How Biodiesel Fuel-Cells Could Power The Future \(And Your Car\)](#)

Application of Algae: <http://www.msnbc.msn.com/id/12834398/>

Also read: <http://www.cnn.com/2008/TECH/science/04/01/algae.oil/index.html>

There seems to be no end in the applicability of Algae as "50% or so of their weight is oil."

**Quantum Biofuels**

<http://www.quantumbiofuels.com/>

We at Quantum Biofuels are dedicated in bringing an environmentally friendly, gasoline-like alternate, which can be phased, into both commercial and consumer use without traumatic changes to everyday fuel usages. The processing inherently requires neither alterations nor endangerment to environmental ecosystems and represents a revolutionary way of thinking of conventional fuel as renewable rather than nonrenewable.

Our product actually represents a bridge between conventional gasoline to more expensive fuel technologies in developmental stages (e.g. hydrogen fuel cell, wind power, solar power, etc.) and offers a time lapse for more efficient fuel technologies to be developed with increasing cost efficiency. Our product offers the advantage of immediate phase-in by major oil manufacturers without the disadvantage of costly technological change for oil producers while not endangering the environment.

**Quantum Biofuels, *The Future Today***

"The ancient sunlight stored in fossil fuels is a limited resource. Today's sunlight, captured continually by algae and green plants, is a potentially unlimited source of energy."

-EDWARD ESKO Founder, Quantum Biofuels

"The development of a biologically based gasoline alternative is not a new idea, but the theory of gasoline-like fuels as a renewable resource is a novel concept. In truth, algae is widely held by conventional geochemical theory to be a principal contributor to the fossil fuel source of petroleum oil reserves. Taking the selected algae strains and simulating geological conditions in a process reactor is the novelty for making this idea a realistic conception.

-MOSHE SAHLER, Project Director

## Appendix F:

# Laser-Enhanced Radioactive Decay And Selective Transmutation Of Nuclei Revisited

Rainer Salomaa<sup>a</sup>, Pertti Aarnio<sup>a</sup>, Jarmo Ala-Heikkilä<sup>a</sup>, Antti Hakola<sup>a</sup> and Marko Santala<sup>a</sup>

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[http://www.sciencedirect.com/science?\\_ob=ArticleURL&\\_udi=B6V2P-4RTKMGH-1&\\_user=2502287&\\_rdoc=1&\\_fmt=&\\_orig=search&\\_sort=d&view=c&\\_acct=C000055109&\\_version=1&\\_urlVersion=0&\\_userid=2502287&md5=01d28a25f1a1bb7af9fe6a1cdf53061c](http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6V2P-4RTKMGH-1&_user=2502287&_rdoc=1&_fmt=&_orig=search&_sort=d&view=c&_acct=C000055109&_version=1&_urlVersion=0&_userid=2502287&md5=01d28a25f1a1bb7af9fe6a1cdf53061c)

## Abstract

We have investigated intense narrow-band electromagnetic radiation sources – ranging from visible to X-ray and gamma-ray region – and their application in direct photon–nucleus interactions. In particular, we discuss means of selective excitation of nuclear resonance states by narrow-band photons. In the relaxation process, an excited mother nucleus may return to its initial state, end up to another isomeric state, or decay into a new daughter nucleus. In the latter case, the mother nucleus is transmuted into a daughter which may have beneficial properties, for instance regarding its radioactivity. One potential application could be the destruction of long-lived nuclear waste isotopes into faster decaying ones. The essential presumption is that the excitation process is both selective and efficient enough compared to parasitic background phenomena. The paper consists of (1) a brief discussion of the generation of short wavelength narrow-band light sources, (2) an exploration of nuclear states excitable by induced photon absorption and of their decay channels, and (3) an assessment of the feasibility of this method. According to our findings, the method may be promising for basic nuclear physics studies but still calls for more efficient narrow-band sources. For processing macroscopic amounts of nuclides, no foreseeable improvements in technology appear sufficient to make the method practical.

**Keywords:** Laser-induced radioactivity; Graser; X-ray laser; Transmutation; Gamma transitions; Beta decay

## Related Links:

“Laser-Driven Photo-Transmutation of Long-Lived Nuclear Waste,” *J Phys D, App Phys* 36 (2003) L79 [www.iop.org/EJ/article/0022-3727/36/18/L01/d3\\_18\\_L01.pdf](http://www.iop.org/EJ/article/0022-3727/36/18/L01/d3_18_L01.pdf)

## THE MANAGEMENT OF UNWANTED NUCLEAR MATERIAL

Twenty First Century Books, 03/07/2002, <http://www.tfcbooks.com/articles/myth2.htm>

The threat to safety and security posed by the radioactive waste generated nuclear power plants and the growing stockpile of plutonium and other fissionable materials presently being recovered from disassembled nuclear bombs might be reduced. A theory offered by Tesla researcher Tom Bearden holds there may be a solution to the problem of dealing with unwanted nuclear material that is piling up after the disassembly of nuclear warheads. The process, which could be called the "Holy Grail" of nuclear engineering, will require, according to Bearden, the definition of a new class of nuclear interactions that would allow for the controlled transmutation of radioactive nuclei to an inert form. The proposed electromagnetic treatment of radioactive substances would, in effect, accelerate the rate of random nuclear decay. In addition to dealing with a result of the long awaited move toward disarmament, the ever increasing accumulation of radioactive waste from various civilian activities might also be dealt with. With the alternative being long term entombment, with all of the associated costs and perils, it would seem the possibility of the hypothesized electromagnetic to nucleus interactions actually existing should be investigated.

And now we have word from Paul Brown. His company, [Nuclear Solutions, Inc.](#) (NSOL), is said to be developing a system for the relatively quick [transmutation](#) of nuclear waste products to a short-lived or stable non-radioactive form through a process they call "photodeactivation." The technique involves a nuclear reaction known as photofission or nuclear fission induced by gamma rays. They claim the technology can also be used to create a new generation of accelerator-driven reactor systems for the safe production of electrical power. "The physical principles underlying the Photodeactivation technology are established conventional photonuclear principles applied in a new and revolutionary manner." It may be that all we need is an economical source of gamma rays.

The following is an abstract of Brown's paper "Photo-transmutation for Waste Management" that explains the basics.

"A linear accelerator, preferably of the monochromatic type, accelerates electrons which are directed onto a high Z target such as tungsten to generate gamma rays [hard x rays] about 9 MeV, which are directed onto the fuel material such as U-238 which results in the ( $\gamma$ , f) reaction, thus releasing about 200 MeV. A reactor built according to this principle requiring an accelerator driven by 1 MW will develop about 20 MW of power. The reaction is not self-sustaining and stops when the beam is turned off. This accelerator driven reactor may be used to "burn-up" spent fuel from fission reactors, if simply operated at 10 MeV. The photo-fission results in typical spent fuel waste products such as Cs<sup>137</sup> and Sr<sup>90</sup> which undergo photodisintegration by the ( $\gamma$ , n) [(g, n)] reaction resulting in short lived or stable products. Chemical separations of the spent fuel isotopes is not necessary. Of course, more than one accelerator may be used to drive the reactor to higher power levels, and speed-up the burn-up process. The fact that the reaction is not self-sustaining is a safety feature allowing immediate shut-down in the event of a problem."<sup>3</sup>

### Notes to Editors:

1. The application of photonuclear physics to nuclear waste is called Photodeactivation. Photodeactivation involves the irradiation of specific radioactive isotopes to force the emission of a neutron, thereby producing an isotope of reduced atomic mass. These resultant isotopes can be characteristically either not radioactive or radioactive with a short half-life.

The fundamental mechanism works on the laboratory scale, and preliminary research suggests

<sup>3</sup> Brown, Paul. "Photo-Transmutation of Nuclear Waste", [Proceedings of the First International Conference on Future Energy](#), Integrity Research Institute, 1999 (available on [www.Amazon.com](http://www.Amazon.com))

that this technology will also work on the industrial scale. NSOL is taking the steps necessary for commercialization of the technology. As for most of the advanced nuclear technologies developed today, computer simulation is one of the most important and necessary steps. NSOL will use and improve a series of nuclear simulation codes (MCNP). The new set of simulation codes will allow the NSOL research and development team to design, test, improve, and develop experiments and commercial facilities through computer modeling.

NSOL plans to capitalize on its patent and patent-pending technology by forming strategic alliances and joint ventures with well-established leaders in the nuclear industry. Continued revenue streams are expected through licensing of the technology with both upfront fees and ongoing royalties.

2. NSOL's technology, the HYPERCON (™) ADS process, is an X-ray based photodisintegration process. The technology could be developed into new applications for remediation of nuclear waste. The proposed process would operate at a sub-critical level, and be inherently safe. Any excess heat produced by the process could also be recovered to generate electricity.

3. NSOL holds a license for the exclusive worldwide rights to a proprietary technology for the removal of radioactive isotopes from contaminated wastewater called GHR. Water containing tritium and deuterium is currently stored in several locations worldwide due to the expense of available methods of treatment. Severe health problems for humans and animals are linked to these contaminants and pose a worldwide environmental threat. Several methods for the extraction of tritium from water are currently available. However these methods such as chemical, electrolytic, ion exchange, or distillation systems have high costs associated with their operation. As a result significant quantities of tritium-contaminated water are being stored rather than treated due to cost concerns. The storage of tritium-contaminated water poses a risk to the environment due to the high mobility of water after a containment failure.

**CONTACT:** for Nuclear Solutions, Inc.

Paul Kuntz, 1 (800) 518-1988

paulk@topstock.com

or

Information in German

www.zockstocks.com

<http://www.otcbb-informant.com>

Papers on this this emergent technology by the late Paul M. Brown, Nuclear Solutions, Inc.:

- "The Photon Reactor: Producing Power By Burning Nuclear Waste"
- "Photoremediation — An Emerging Treatment Technology"
- "Neutralizing Nuclear Waste Using Applied Physics"
- "Transmutation Of Nuclear Waste Products Using Giant Dipole Resonant Gamma Rays"
- "Photo-transmutation for Waste Management"

**Related Links:**

- Nuclear Solutions website [www.nuclearsolutions.com](http://www.nuclearsolutions.com)
- First International Conference on Future Energy (COFE)  
<http://www.integrityresearchinstitute.org/COFE/cofe1.html>
- "Nuking Nukes" **Wired magazine article** from 1999 about Paul Brown's discovery  
<http://www.wired.com/wired/archive/7.02/mustread.html?pg=19> (reprinted below)



## Nuking Nukes

### TOXIC WASTE

The US Department of Energy predicts that we'll spend \$150 billion to dispose of radioactive leftovers generated during four decades of Cold War weapons production. Paul Brown, a physics PhD from Boise, Idaho, says he can do it for less than a quarter of that price - without burying hazardous waste. How? Give the nukes a taste of their own medicine: Blast them with radiation.

If this sounds simple, it is. Beam an element with a stream of alpha particles and it turns into another element. This happens routinely in laboratory "atom smashers," where, for example, beryllium is commonly converted into carbon, with heat as a by-product.

Brown showed that when nuclear waste is showered with gamma rays, it's transformed into compounds that become safe within a few months, rather than thousands of years. "It's textbook radiochemistry," he says. But after searching the annals of atomic literature, he couldn't find anyone who had proposed the idea.

Bob Park of the American Institute of Physics, who routinely debunks fringe science, says Brown's scheme is not far-fetched. John Schiffer, senior scientist and an experimental nuclear physicist at Argonne National Laboratories, confirms that gamma radiation "could convert long-lived radioactive isotopes into shorter-lived ones."

The approach is not without its challenges, however. Schiffer complains that gamma rays would result in an enormous amount of excess heat. Adds Gary Doolen, a physicist at Los Alamos National Laboratories, "It's also very expensive to generate high-energy gamma rays."

But Brown has thought about all this already. He says the excess heat could generate electricity - more than enough to run the whole operation. The inventor adds that a typical neutron-beam research project costs \$1.3 billion, while he hopes to build an entire plant for just \$5 million.

With a patent for his idea pending, Brown formed Nuclear Solutions, a company that will soon run tests at the University of Illinois or MIT. And, since the Department of Energy already has spent \$2.5 billion on "innovative waste-cleanup technologies," he's negotiating with the agency to give him his meager millions to build a pilot plant.

"Some waste products have half-lives of 24,000 years," says Brown. "There's no such thing as a steel drum you can bury that will remain safe for that length of time." Processing nuclear waste with gamma rays would be a miracle tool for regulatory agencies doing radioactive cleanup.

Brown's ultimate vision is of nuclear-power stations that neutralize their waste as soon as it's created. "I'm not an antinuke activist," he says. "I'm a realist. Obviously, we need a method to remediate nuclear waste - and ours really works."

- Charles Platt, Wired Magazine

## Appendix G:

# Space Solar Power: Limitless Clean Energy From Space

National Space Society, Ad Astra, Vol. 20, No. 1, Spring, 2008  
<http://www.nss.org/settlement/ssp/index.htm>

[Featuring a Special Report on Space-Based Solar Power](#)  
[\[1.5 MB PDF\]](#) <http://www.nss.org/adastra/AdAstra-SBSP-2008.pdf>

The United States and the world need to find new sources of clean energy. Space Solar Power gathers energy from sunlight in space and transmits it wirelessly to Earth. Space solar power can solve our energy and greenhouse gas emissions problems. Not just help, not just take a step in the right direction, but *solve*. Space solar power can provide large quantities of energy to each and every person on Earth with very little environmental impact.

The solar energy available in space is literally billions of times greater than we use today. The lifetime of the sun is an estimated 4-5 billion years, making space solar power a truly long-term energy solution. As Earth receives only one part in 2.3 billion of the Sun's output, space solar power is by far the largest potential energy source available, dwarfing all others combined. Solar energy is routinely used on nearly all spacecraft today. This technology on a larger scale, combined with already demonstrated wireless power transmission ([see 2-minute video of demo](#)), can supply nearly all the electrical needs of our planet.

Another need is to move away from fossil fuels for our transportation system. While electricity powers few vehicles today, hybrids will soon evolve into plug-in hybrids which can use electric energy from the grid. As batteries, super-capacitors, and fuel cells improve, the gasoline engine will gradually play a smaller and smaller role in transportation — but only if we can generate the enormous quantities of electrical energy we need. It doesn't help to remove fossil fuels from vehicles if you just turn around and use fossil fuels again to generate the electricity to power those vehicles. Space solar power can provide the needed clean power for any future electric transportation system.

While all viable energy options should be pursued with vigor, space solar power has a number of substantial advantages over other energy sources.

### **Advantages of Space Solar Power** (also known as Space-Based Solar Power, or SBSP)

- Unlike oil, gas, ethanol, and coal plants, space solar power does not emit greenhouse gases.

- Unlike coal and nuclear plants, space solar power does not compete for or depend upon increasingly scarce fresh water resources.
- Unlike bio-ethanol or bio-diesel, space solar power does not compete for increasingly valuable farm land or depend on natural-gas-derived fertilizer. Food can continue to be a major export instead of a fuel provider.
- Unlike nuclear power plants, space solar power will not produce hazardous waste, which needs to be stored and guarded for hundreds of years.
- Unlike terrestrial solar and wind power plants, space solar power is available 24 hours a day, 7 days a week, in huge quantities. It works regardless of cloud cover, daylight, or wind speed.
- Unlike nuclear power plants, space solar power does not provide easy targets for terrorists.
- Unlike coal and nuclear fuels, space solar power does not require environmentally problematic mining operations.
- Space solar power will provide true energy independence for the nations that develop it, eliminating a major source of national competition for limited Earth-based energy resources.
- Space solar power will not require dependence on unstable or hostile foreign oil providers to meet energy needs, enabling us to expend resources in other ways.
- Space solar power can be exported to virtually any place in the world, and its energy can be converted for local needs — such as manufacture of methanol for use in places like rural India where there are no electric power grids. Space solar power can also be used for desalination of sea water.
- Space solar power can take advantage of our current and historic investment in aerospace expertise to expand employment opportunities in solving the difficult problems of energy security and climate change.
- Space solar power can provide a market large enough to develop the low-cost space transportation system that is required for its deployment. This, in turn, will also bring the resources of the solar system within economic reach.

### **Disadvantages of Space Solar Power**

- High development cost. Yes, space solar power development costs will be very large, although much smaller than American military presence in the Persian Gulf or the costs of global warming, climate change, or carbon sequestration. The cost of space solar power development always needs to be compared to the cost of *not* developing space solar power.

### **Requirements for Space Solar Power**

The technologies and infrastructure required to make space solar power feasible include:

- *Low-cost, environmentally-friendly launch vehicles.* Current launch vehicles are too expensive, and at high launch rates may pose atmospheric pollution

- problems of their own. Cheaper, cleaner launch vehicles are needed.
- *Large scale in-orbit construction and operations.* To gather massive quantities of energy, solar power satellites must be large, far larger than the International Space Station (ISS), the largest spacecraft built to date. Fortunately, solar power satellites will be simpler than the ISS as they will consist of many identical parts.
  - *Power transmission.* A relatively small effort is also necessary to assess how to best transmit power from satellites to the Earth's surface with minimal environmental impact.

All of these technologies are reasonably near-term and have multiple attractive approaches. However, a great deal of work is needed to bring them to practical fruition.

In the longer term, with sufficient investments in space infrastructure, space solar power can be built from materials from space. The full environmental benefits of space solar power derive from doing most of the work outside of Earth's biosphere. With materials extraction from the Moon or near-Earth asteroids, and space-based manufacture of components, space solar power would have essentially zero terrestrial environmental impact. Only the energy receivers need be built on Earth.

Space solar power can completely solve our energy problems long term. The sooner we start and the harder we work, the shorter "long term" will be.

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## Links

- [NSS Space Solar Power Library](#)
- [Wireless Power Transmission Demonstration \(2-minute video\)](#)
- [25-minute video of lecture on SSP by Dr. Guy Pignolet](#) (former ESA astronaut and current researcher at University of La Reunion LEEP Energy Lab)
- [Wikipedia entry on Solar Power Satellite](#)
- [Space Daily: The Case For Space Based Solar Power Development](#)
- [Space Based Solar Power – Charting a Course for Sustainable Energy](#)
- [The Space Review: The chicken and the egg: RLVs and space-based solar power](#)
- [The World Needs Energy from Space](#), by Peter Glaser
- [USINFO: Space Solar Energy Has Future](#)
- [Public discussion of 2007 National Security Space Office study of space solar power](#)
- [Space Power section of SpaceFuture.com](#)
- [Space Solar Power Workshop](#)
- [Space Solar Power Monitor](#)
- [Space Power Association](#)
- [Space Solar Alliance for Future Energy](#)
- [Citizens for Space Based Solar Power](#)
- [Japan Aerospace Exploration Agency \(JAXA\) testing space solar power system](#)
- [Kyoto University projects on space solar power](#), including the [Microwave Lifted Airplane eXperiment \(MILAX\)](#) with [video](#)

## Appendix H:

### HOW MUCH ELECTRICITY IS FROM GEOTHERMAL ENERGY?

Since the first geothermally-generated electricity in the world was produced at Larderello, Italy, in 1904 the use of geothermal energy for electricity has grown worldwide to about 7,000 *megawatts* in twenty-one countries around the world. The United States alone produces 2700 megawatts of electricity from geothermal energy, electricity comparable to burning sixty million barrels of oil each year.

### HOW MUCH GEOTHERMAL ENERGY IS THERE?

Thousands more megawatts of power than are currently being produced could be developed from already-identified hydrothermal resources.

Link: <http://geothermal.marin.org>

### Hot Clean Power Under Our Feet

New Scientist Print Edition, 27 January 2007, Issue 2588, page 4

<http://environment.newscientist.com/channel/earth/mg19325883.000-hot-clean-power-under-our-feet-.html>

America can kick its addiction to fossil fuels by drilling more wells, says a panel of experts at the Massachusetts Institute of Technology. Not for oil, but to tap Earth's heat.

Converting geothermal heat into electricity by pouring water onto hot rocks underground and using the steam to turn turbines is arguably the most promising - and renewable - source of "green" energy on the planet. So concludes the MIT experts' report, released on Monday, which examines what geothermal energy could do for the US in the 21st century.

The 18-member panel calculated that there is more than enough extractable hydrothermal energy available to generate the entire 27 trillion kilowatt-hours of energy consumed in the US in 2005. In fact, a conservative estimate of the energy extractable from the hot rocks less than 10 kilometres beneath American soil suggests that this almost completely untapped energy resource could support US energy consumption, at its current clip, for more than two millennia to come.

Developing a new generation of geothermal plants is thus a top priority for tackling global warming, the panel says. "By any kind of calculation, this is an extremely large resource that is technically accessible to us right now," says the study's lead author, Jefferson Tester. "It doesn't require new technology to get access to it. And there's never going to be a limitation on our ability to expand this technology because of limits of the resource."

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## MIT-Led Panel Backs 'Heat Mining' as Key U.S. Energy Source

January 22, 2007 <http://web.mit.edu/newsoffice/2007/geothermal.html>

A comprehensive new MIT-led study of the potential for geothermal energy within the United States has found that mining the huge amounts of heat that reside as stored thermal energy in the Earth's hard rock crust could supply a substantial portion of the electricity the United States will need in the future, probably at competitive prices and with minimal environmental impact.

An 18-member panel led by MIT prepared the 400-plus page study, titled "[The Future of Geothermal Energy](#)" (PDF, 14.1 MB). Sponsored by the U.S. Department of Energy, it is the first study in some 30 years to take a new look at geothermal, an energy resource that has been largely ignored.

The goal of the study was to assess the feasibility, potential environmental impacts and economic viability of using enhanced geothermal system (EGS) technology to greatly increase the fraction of the U.S. geothermal resource that could be recovered commercially.

Although geothermal energy is produced commercially today and the United States is the world's biggest producer, existing U.S. plants have focused on the high-grade geothermal systems primarily located in isolated regions of the west. This new study takes a more ambitious look at this resource and evaluates its potential for much larger-scale deployment.

"We've determined that heat mining can be economical in the short term, based on a global analysis of existing geothermal systems, an assessment of the total U.S. resource and continuing improvements in deep-drilling and reservoir stimulation technology," said panel head Jefferson W. Tester, the H. P. Meissner Professor of Chemical Engineering at MIT.

"EGS technology has already been proven to work in the few areas where underground heat has been successfully extracted. And further technological improvements can be expected," he said.

The expert panel offers a number of recommendations to develop geothermal as a major electricity supplier for the nation. These include more detailed and site-specific assessments of the U.S. geothermal resource and a multiyear federal commitment to demonstrate the concept in the field at commercial scale.

The new assessment of geothermal energy by energy experts, geologists, drilling specialists and others is important for several key reasons, Tester said.

First, fossil fuels--coal, oil and natural gas--are increasingly expensive and consumed in ever-increasing amounts. Second, oil and gas imports from foreign sources raise concerns over long-term energy security. Third, burning fossil fuels dumps carbon dioxide and other pollutants into the atmosphere. Finally, heat mining has the potential to supply a significant amount of the country's electricity currently being generated by conventional fossil fuel, hydroelectric and nuclear plants.

The study shows that drilling several wells to reach hot rock and connecting them to a fractured

rock region that has been stimulated to let water flow through it creates a heat-exchanger that can produce large amounts of hot water or steam to run electric generators at the surface. Unlike conventional fossil-fuel power plants that burn coal, natural gas or oil, no fuel would be required. And unlike wind and solar systems, a geothermal plant works night and day, offering a non-interruptible source of electric power.

Prof. Tester and panel member David Blackwell, professor of geophysics at Southern Methodist University in Texas, also point out that geothermal resources are available nationwide, although the highest-grade sites are in western states, where hot rocks are closer to the surface, requiring less drilling and thus lowering costs.

The panel also evaluated the environmental impacts of geothermal development, concluding that these are "markedly lower than conventional fossil-fuel and nuclear power plants."

"This environmental advantage is due to low emissions and the small overall footprint of the entire geothermal system, which results because energy capture and extraction is contained entirely underground, and the surface equipment needed for conversion to electricity is relatively compact," Tester said.

The report also notes that meeting water requirements for geothermal plants may be an issue, particularly in arid regions. Further, the potential for seismic risk needs to be carefully monitored and managed.

According to panel member M. Nafi Toksöz, professor of geophysics at MIT, "geothermal energy could play an important role in our national energy picture as a non-carbon-based energy source. It's a very large resource and has the potential to be a significant contributor to the energy needs of this country."

Toksöz added that the electricity produced annually by geothermal energy systems now in use in the United States at sites in California, Hawaii, Utah and Nevada is comparable to that produced by solar and wind power combined. And the potential is far greater still, since hot rocks below the surface are available in most parts of the United States.

Even in the most promising areas, however, drilling must reach depths of 5,000 feet or more in the west, and much deeper in the eastern United States. Still, "the possibility of drilling into these rocks, fracturing them and pumping water in to produce steam has already been shown to be feasible," Toksöz said.

Panel member Brian Anderson, an assistant professor at West Virginia University, noted that the drilling and reservoir technologies used to mine heat have many similarities to those used for extracting oil and gas. As a result, the geothermal industry today is well connected technically to two industry giants in the energy arena, oil and gas producers and electric power generators. With increasing demand for technology advances to produce oil and gas more effectively and to generate electricity with minimal carbon and other emissions, an opportunity exists to accelerate the development of EGS by increased investments by these two industries.

Government-funded research into geothermal was very active in the 1970s and early 1980s. As oil prices declined in the mid-1980s, enthusiasm for alternative energy sources waned, and funding for research on renewable energy and energy efficiency (including geothermal) was greatly reduced, making it difficult for geothermal technology to advance. "Now that energy

concerns have resurfaced, an opportunity exists for the U.S. to pursue the EGS option aggressively to meet long-term national needs," Tester observed.

Tester and colleagues emphasize that federally funded engineering research and development must still be done to lower risks and encourage investment by early adopters. Of particular importance is to demonstrate that EGS technology is scalable and transferable to sites in different geologic settings.

In its report, the panel recommends that:

- More detailed and site-specific assessments of the U.S. geothermal energy resource should be conducted.
- Field trials running three to five years at several sites should be done to demonstrate commercial-scale engineered geothermal systems.
- The shallow, extra-hot, high-grade deposits in the west should be explored and tested first.
- Other geothermal resources such as co-produced hot water associated with oil and gas production and geopressed resources should also be pursued as short-term options.
- On a longer time scale, deeper, lower-grade geothermal deposits should be explored and tested.
- Local and national policies should be enacted that encourage geothermal development.
- A multiyear research program exploring subsurface science and geothermal drilling and energy conversion should be started, backed by constant analysis of results.

Besides Tester, Blackwell, Toksöz and Anderson, members of the panel include: geomechanics expert Anthony Batchelor, managing director of GeoScience Ltd. in the United Kingdom; reservoir engineer Roy Baria from the United Kingdom; geophysicists Maria Richards and Petru Negraru at Southern Methodist University; mechanical engineer Ronald DiPippo, an emeritus professor at the University of Massachusetts at Dartmouth; risk analyst Elisabeth Drake at MIT; chemist John Garnish, former director of geothermal programs of the European Commission; drilling expert Bill Livesay; economist Michal Moore at the University of Calgary in Canada, former California energy commissioner and chief economist at the National Renewable Energy Laboratory; commercial power conversion engineer Kenneth Nichols; geothermal industry expert Susan Petty; and petroleum engineering consultant Ralph Veatch Jr. Additional project support came from Chad Augustine, Enda Murphy and Gwen Wilcox at MIT.

*A version of this article appeared in [MIT Tech Talk](#) on [January 24, 2007 \(download PDF\)](#).*

## **CONTACT**

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## **RELATED**

[The Future of Geothermal Energy – Impact of Enhanced Geothermal Systems \(EGS\) on the United States in the 21st Century](#) - (full report, 14.1 MB, PDF file) [Jefferson W. Tester](#) - MIT Department of Chemical Engineering

**Appendix I:**

**Air-Powered Car Coming to U.S. in 2009 to 2010 at Sub-\$18,000, Could Hit 1000-Mile Range**

Matt Sullivan, *Popular Mechanics*, February 22, 2008  
[http://www.popularmechanics.com/automotive/new\\_cars/4251491.html](http://www.popularmechanics.com/automotive/new_cars/4251491.html)

The Air Car caused a huge stir when [we reported last year that Tata Motors would begin producing it](#) in India. Now the little gas-free ride that could is headed Stateside in a big-time way.

[Zero Pollution Motors](#) (ZPM) confirmed to PopularMechanics.com on Thursday that it expects to produce the world's first air-powered car for the United States by late 2009 or early 2010. As the U.S. licensee for Luxembourg-based MDI, ([www.theAirCar.com](http://www.theAirCar.com)) which developed the Air Car as a compression-based alternative to the internal combustion engine, ZPM has attained rights to build the first of several modular plants, which are likely to begin manufacturing in the Northeast and grow for regional production around the country, at a clip of up to 10,000 Air Cars per year.



And while ZPM is also licensed to build MDI's two-seater OneCAT economy model (the one headed for India) and three-seat MiniCAT (like a SmartForTwo without the gas), the New Paltz, N.Y., startup is aiming bigger: Company officials want to make the first air-powered car to hit U.S. roads a \$17,800, 75-hp equivalent, six-seat modified version of MDI's CityCAT (pictured above) that, thanks to an even more radical engine, is said to travel as far as 1000 miles at up to 96 mph with each tiny fill-up.



We'll believe that when we drive it, but MDI's new dual-energy engine—currently being installed in models at MDI facilities overseas—is still pretty damn cool in concept. After using compressed air fed from the same Airbus-built tanks in earlier models to run its pistons, the next-gen Air Car has a supplemental energy source to kick in north of 35 mph, ZPM says. A custom heating chamber heats the air in a process

officials refused to elaborate upon, though they insisted it would increase volume and thus the car's range and speed.

The CityCAT, already being developed in India (bottom left), will be available for U.S. production in three different four-door styles. But it's the radical dual-energy engine, with a possible 1000-mile range at 96 mph, that could move the Air Car beyond Auto X Prize dreams and into American garages.

"I want to stress that these are estimates, and that we'll know soon more precisely from our engineers," ZPM spokesman Kevin Haydon told PM, "but a vehicle with one tank of air and, say, 8 gal. of either conventional petrol, ethanol or biofuel

could hit between 800 and 1000 miles."

Those figures would make the Air Car, along with [Aptera's Typ-1](#) and [Tesla's Roadster](#), a favorite among [early entrants for the Automotive X Prize](#), for which MDI and ZPM have already signed up. But with the family-size, four-door CityCAT undergoing standard safety tests in Europe, then side-impact tests once it arrives in the States, could it be the first 100-mpg, nonelectric car you can actually buy?

**RELATED STORIES**

- [FIRST LOOK: Air Car Coming to India for Summer 2009](#)
- [VIDEO: Air Car Inventor Explains Compressed Engine Tech](#)
- [DRIVE GREEN: Test Drives, News and Video on Alt-Fuel Rides](#)

# Appendix J: Sun + Water = Fuel

## Special Reports

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November/December 2008

### Sun + Water = Fuel

With catalysts created by an MIT chemist, sunlight can turn water into hydrogen. If the process can scale up, it could make solar power a dominant source of energy.

By [Kevin Bullis](#)

Audio > Share > Favorite Print E-mail



**Leaf envy:** MIT chemist Daniel Nocera has mimicked the step in photosynthesis in which green plants split water. Credit: Christopher Harting

#### MULTIMEDIA

Daniel Nocera describes the challenges of artificial photosynthesis in a talk given before his recent advance.

"I'm going to show you something I haven't showed anybody yet," said Daniel Nocera, a professor of chemistry at MIT, speaking this May to an auditorium filled with scientists and U.S. government energy officials. He asked the house manager to lower the lights. Then he started a video. "Can you see that?" he asked excitedly, pointing to the bubbles rising from a strip of material immersed in water. "Oxygen is pouring off of this electrode." Then he added, somewhat cryptically, "This is the future. We've got the leaf."

What Nocera was demonstrating was a reaction that generates oxygen from water much as green plants do during photosynthesis--an achievement that could have profound implications for the energy debate. Carried out with the help of a catalyst he developed, the reaction is the first and most difficult step in splitting water to make hydrogen gas. And efficiently generating hydrogen from water, Nocera believes, will help surmount one of the main obstacles preventing solar power from becoming a dominant source of electricity: there's no cost-effective way to store the energy collected by solar panels so that it can be used at night or during cloudy days.

Solar power has a unique potential to generate vast amounts of clean energy that doesn't contribute to global warming. But without a cheap means to store this energy, solar power can't replace fossil fuels on a

large scale. In Nocera's scenario, sunlight would split water to produce versatile, easy-to-store hydrogen fuel that could later be burned in an internal-combustion generator or recombined with oxygen in a fuel cell. Even more ambitious, the reaction could be used to split seawater; in that case, running the hydrogen through a fuel cell would yield fresh water as well as electricity.

Storing energy from the sun by mimicking photosynthesis is something scientists have been trying to do since the early 1970s. In particular, they have tried to replicate the way green plants break down water. Chemists, of course, can already split water. But the process has required high temperatures, harsh alkaline solutions, or rare and expensive catalysts such as platinum. What Nocera has devised is an inexpensive catalyst that produces oxygen from water at room temperature and without caustic chemicals--the same benign conditions found in plants. Several other promising catalysts, including another that Nocera developed, could be used to complete the process and produce hydrogen gas.

Nocera sees two ways to take advantage of his breakthrough. In the first, a conventional solar panel would capture sunlight to produce electricity; in turn, that electricity would power a device called an electrolyzer, which would use his catalysts to split water. The second approach would employ a system that more closely mimics the structure of a leaf. The catalysts would be deployed side by side with special dye molecules designed to absorb sunlight; the energy captured by the dyes would drive the water-splitting reaction. Either way, solar energy would be converted into hydrogen fuel that could be easily stored and used at night--or whenever it's needed.

Nocera's audacious claims for the importance of his advance are the kind that academic chemists are usually loath to make in front of their peers. Indeed, a number of experts have questioned how well his system can be scaled up and how economical it will be. But Nocera shows no signs of backing down. "With this discovery, I totally change the dialogue," he told the audience in May. "All of the old arguments go out the window."

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## Appendix K:

### BREAKTHROUGHS IN PHYSICS KEY TO FUTURE ENERGY SECURITY

#### A BILLION DEGREES ON EARTH

Newsletter of INTEGRITY RESEARCH INSTITUTE [www.IntegrityResearchInstitute.org](http://www.IntegrityResearchInstitute.org) **Spring, 2003 VOL. 1 No. 4** <http://www.integrityresearchinstitute.org/IRINews.html>

Futurists agree that "Only a Technology Revolution Can Save the Earth" (C. Arthur, *The Independent*, 11/1/02) and that "A Quest for Clean Energy Must Begin Now" (A. Revkin, *NY Times*, 11/1/02). Answering the call is the astounding breakthrough made by a team led by Eric Lerner, with NASA JPL support. **For the first time temperatures above one billion degrees have been achieved in a dense plasma.** Using a compact and inexpensive device called the **plasma focus**, controlled fusion energy that generates no radioactivity and almost no neutrons ([www.focusfusion.org](http://www.focusfusion.org)) is very close.

Plasma focus technology is environmentally safe, cheap, and effectively an unlimited energy source using a hydrogen-boron reaction, instead of the usual deuterium-tritium mix for the tokamak. Mr. Lerner announced the achievement at the International Conference on Plasma Science on May 26, 2002 and at the Fifth Symposium on Current Trends in International Fusion Research on March 24, 2003. The other leaders of the research team are Dr. Bruce Freeman of **Texas A and M University**, where the experiments were performed in August, 2001 and Dr. Hank Oona of the **Los Alamos National Laboratory**. The results have been submitted to *Physica Scripta* and [available through Los Alamos](#).

The Fusion Program Manager, Dr. Richard Seimon, however, demanded that the results be repudiated or two staff engineers would be fired. Reaching a billion degrees, before the larger expensive tokamak did, was apparently unacceptable. Seimon therefore objected to their comparison to the 25-year-old tokamak in every report (E. Lerner, *Progressive Engineer*, Guest Editorial, July, 2002).

Eric Lerner, who directs **Lawrenceville Plasma Physics** (Lawrenceville, NJ), has projected decentralized 2 MW power plants, at a building cost of less than one million dollars each. He also has a [business plan](#) to develop and license the technology.

In a related story, the US DOE also insisted in 2002 that another report's negative assessment of federally-funded tokamak fusion research be withdrawn by Rand Corp.'s Robert Hirsch, who was then also fired. The independent report, "**Energy Technologies for 2050**" is now being sterilized by Rand for DOE review ("[Report Generates Negative Energy](#)" *Wash. Post*, 3/18/03, p.A27) reprinted below.

However, the DOE projects another 35 years before their commercially practical magnetic tokamak fusion demonstration plant is "fired up around 2037, with operations lasting until at least 2050" (*Platts Inside Energy*, 12/2/02, p.6).

## Nuclear Fusion: Power To The People? Or Just Political Hot Air?

By Charles Arthur • The Register UK, Posted in Science, 6th July 2005

[http://www.theregister.co.uk/2005/07/06/nuclear\\_fusion/](http://www.theregister.co.uk/2005/07/06/nuclear_fusion/)

### **Analysis**

It's G8 week, and climate change is high on the agenda. And now that even George Bush has acknowledged that climate change is (a) happening and (b) is at least partly due to humans but insisted it (c) should be tackled through technology, why not focus again on a technology that's (1) happening and (2) partly controlled by humans?

That is, nuclear fusion. Unlike fission, already used to produce most of France's electricity, fusion isn't commercial yet. Even its most positive advocates reckon it'll be more than 25 years before a fusion reactor could contribute usefully to the power grid ("useful" being defined as a steady output of 1 gigawatt; the UK has about 42 GW of installed electric plant).

But it does have one very important advocate, and another who is coming along for the ride, and they're both G8 leaders. The advocate: Tony Blair. The one along for the ride: George Bush. Plus it also involves two other G8 nations, France and Japan, directly, as they'll get tons of money from contracts to build the next stage in the long, long road to commercial fusion.

Last week France was chosen as the site for the International Thermonuclear Experimental Reactor (Iter) project, beating Japan's bid. If it works, ITER will take in 50 megawatts of power and put out between 500 and 1,000 MW. That's right - it could power itself.

Here's how. Fusion is what powers the stars. They burn by slamming two hydrogen nuclei (protons) together, to produce a helium nucleus (two protons) and some extra particles. (See the whole system here.)

On Earth, we cheat a little by fusing a nucleus of deuterium (hydrogen with a neutron aboard) with one of tritium (hydrogen with two neutrons), to produce a helium nucleus plus lots of energy in the form of a "fast" neutron. Simple on paper; fiendishly hard in practice. You have to heat the material to about 100 million Centigrade until it becomes "plasma", confine it using magnetic fields, and compress it so fiercely that you overcome the natural tendency of nuclei to repel each other as fiercely as Steve Ballmer encountering an iPod.

Deuterium is plentiful. There's enough in a bath to generate all the energy you'd need in your lifetime. Tritium is trickier, produced either from deuterium fusion, or other decay products. It's used in nuclear weapons, exit signs that work without power, and some illuminated watches.

If you can control the fusion reaction and keep it going, you produce huge amounts of "fast" neutrons which heat up the reactor vessel. That heat can produce steam which can turn turbines to generate electricity. Nuclear waste? Well, the reactor walls might be a little radioactive after you stop; but in 10 years' time you could reuse the parts in another reactor. Tritium is poisonous, but wouldn't get out. And the reaction can't run away like fission can; if the magnetic "bottle" fails, the reaction stops.

### **Big science**

The politics similarly involves bashing people's heads together at sufficient pressure to produce a solid project and a fast-moving schedule to make it happen. For years fusion was on the slow track. That's because it's big science, and thus big politics are involved to make it happen. Although the Joint European Torus project in Abingdon, Oxfordshire, managed to generate 80 per cent of the power put into it - falling just short of being self-sustaining - it demonstrated what could be done. In 1985 Ronald Reagan signed an agreement with Mikhail Gorbachev to work towards ITER, with the aim of producing a prototype commercial reactor this century.

But in 1998 Bill Clinton's administration withdrew from ITER, citing costs, and the US began going it alone with its own FIRE fusion project.

And ITER will cost. The budget is estimated at \$12bn - shared between Europe, the US, China, Korea, Japan and Russia - and a lifespan of about 30 years. Then again, that's only £6.6bn at present exchange rates. That would buy you a British national ID card scheme; in fact Britain's share is much less, and it could even generate £100m of revenues for British businesses annually.

But what's remarkable is how fusion has abruptly moved up the agenda. It's not for scientific reasons though, but politics. And it comes down to one person: Tony Blair.

He's come under pressure at home from Professor Sir David King, the government's chief scientific adviser, to do something on climate change. In 2001, he headed a European panel looking for a fast-track to fusion, and concluded (PDF) it was feasible. The problem is that renewables like wind, waves and solar can't cover the energy shortfall once the UK's nuclear power stations go offline around 2020; presently fission produces 25 per cent of the UK's electricity.

Building more nuclear fission stations looks the easy option, but Margaret Beckett, at the Department of Environment, Food and Rural Affairs, hates them and talks them down as fiercely as King talks them up. She sees them as vote-losers because nuclear waste disposal gives environmental groups a stick to beat Government with. By contrast, the only criticism (though it's a zinger) environmental groups like Greenpeace have of fusion is that it's a lot of money that could be spent subsidising or building renewables now.

That makes fusion the politically acceptable solution. Professor King likes it, Beckett doesn't dislike it, and the greens can't hang you for it. So two years ago at a Camp David summit Blair himself persuaded Bush to rejoin ITER and stop funding FIRE. (In such ways is political goodwill generated by supporting the US over Iraq recouped.)

So, note a key passage in Dubya's interview with ITN about how to get around climate change: "If people want to come together and share technologies and develop technologies and jointly spend - and spend money on research and development, just like the United States is, to help us diversify away from fossil fuels, [I am] more than willing to discuss it. I know we need more nuclear power in order - nuclear power, after all, is not dependent on fossil fuels and emits no greenhouse gases."

Note he doesn't specify what sort of nuclear power, and how he does emphasise coming together on R&D; though the US did oppose the siting of ITER in France, preferring the rival site, Japan, which would thus have got the guaranteed construction jobs and contracts. Why? Well, which country supported the US on its Iraq adventure, and which didn't? As we said - politics, not science, rules here.

But once the politicians have gone away, ITER's scientists can get on with the task. Which isn't trivial. But right now they're as happy as dogs with two tails, especially compared to a few years ago when it seemed the entire fusion project would run into the dirt. The arrival of climate change as a political hot potato has given their cause new fuel, and they're burning it as quickly as possible.

### **Big question**

The big question is, can it work? Can "hot" fusion ever be commercial? We'll deal with that in just a moment.

But first, some think that commercial fusion is much closer than grand projects like ITER make it seem. For them, cold fusion never went away, just went underground, much like its "hot" sibling. The publication in April of a letter in the science journal *Nature* by a team at UCLA who apparently achieved small-scale fusion in a laboratory has had some people agog.

The trouble is that it's not going to generate cheap electricity. It seems to work, but doesn't scale: you can't get more energy out than you put in. So this crystal-based technique could produce fast neutrons, for

radiotherapy or X-ray machines; but not a power generator. "It's very interesting, but it's not a power source," says Chris Carpenter, spokesman at JET. "These small-scale things aren't viable because they don't scale up."

For that, you need something like ITER - because hot fusion does scale, gloriously. ITER will only be twice the size of JET, yet should generate more than 75 times as much power.

And the potential? "You have an energy market that's worth about \$3 trillion worldwide annually, and electricity is one-third of that," says Carpenter. "If we invest big now in fusion, then it could pay off. OK, perhaps it won't work; in that case we've found out sooner, and we can try something else to generate the power we need. We aren't saying fusion is the only option. But it's probably the only non-polluting, large-scale option."

But what's changed since JET was built to make it any more likely that fusion won't remain forever 30 years in the future? The materials, says Carpenter, and the computers. From helium-cooled superconducting magnets to tungsten chamber walls to supercomputers that can calculate how the plasma will behave far more accurately and quickly than ever before, the pieces are all there, waiting for the politicians to sign off the cheques and shake hands.

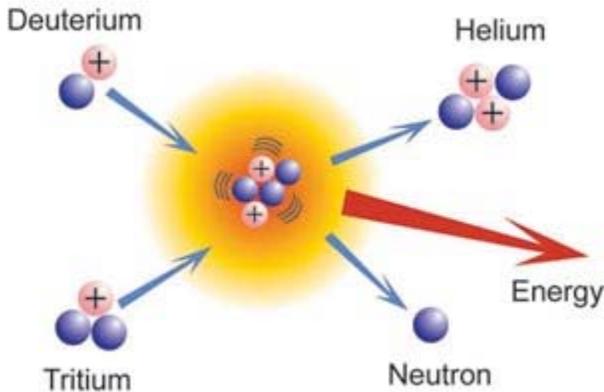
Sorry, by the way, if you thought that solving the world's energy problems was about something as trivial as science. As might be clear, it's really all politics.

And finally: fusion scientists have managed to get all this cash without enlisting Sir Bob Geldof or getting Pink Floyd to reform. Imagine if they had: we'd probably all have fusion-powered cars by now. ®

### ***Related stories***

#### **France Wins Billion Dollar Fusion Research Plant**

[UCLA demonstrates desktop nuclear fusion](#)



Appendix L:

## Planktos Is Back, and This Time It's Got Science!

Written by [Katie Fehrenbacher](#) Earth2Tech, <http://earth2tech.com/2008/07/07/planktos-is-back-and-this-time-its-got-science/>, [9 Comments](#) Posted July 7th, 2008 in [Startups](#)



Some of you might remember the beleaguered company [Planktos](#), which was looking to fertilize the world's oceans with iron in an attempt to stimulate phytoplankton blooms and reduce carbon emissions. Come on, you remember — its dreams went dead in the water [back in February](#) due to what it called a wave of “anti-offset crusaders” that waged a “highly effective disinformation campaign.” Critics on the other hand said the company flopped because of its lack of scientific practices. Well, like a bad horror movie sequel, it's baaack. And it's brought along a shiny new friend: “science.”

The newly named [Planktos Science](#) is based in San Francisco and consists of the original company's science team and its founder, Russ George. According to its [web site](#), Planktos Science has no business affiliation with the original Planktos Corp., which was publicly traded, nor its partner, Solar Energy ([hat tip GreenCarCongress](#)).

The launch post says that George was allowed to recover rights to the technology and use of the Planktos name, and that the company can now proceed with its work of seeding the oceans with iron. Planktos repeatedly describes that goal with the pleasant-sounding term “ecorestitution.” We're not sure what the “new” Planktos will do to reassure investors and the science community that it will proceed differently, but likely stamping its moniker and web site with “science” won't do the trick.

We appreciate the fact that ocean seeding has enough potential to merit scientific study. [Startup Climos is pursuing the same objective](#) — to investigate this technology's potential — and has managed to convince high profile investors Elon Musk and Braemer Energy Ventures to invest in its plan. [But as to whether or not](#) ocean seeding is effective in reducing global warming, the jury's still out.

It's the job of these companies to both base their actions on science and assure the public (and the media) that their actions are based on sound science. Because poor PR can ruin any plan, regardless of its merits. Of this Planktos Science is still guilty. [Check out this wild description](#) they put on their web site pointing fingers at “environmentalists” and the media that they say are fighting them:

They have chosen to engage in a classical 'strawman attack' demonizing their opposition through the publication and spreading of 'spin doctored' press releases replete with obvious lies and propaganda suggesting that there is no scientific basis and that there are no laws governing this field. It is all, in their words, like some sort of “wild west” arena.

Nothing could be farther from the truth but in this age of instant Internet blogging, gossip mongering, and mudslinging, truth is something that takes a little time and effort to learn. Sadly there is always some media outlet looking for a quick story conforming to media's central editorial premise - "if it bleeds, it leads." This provides fertile ground for these attacking organizations to harvest funds via their fear mongering "campaigns" but it comes at the expense of our dying oceans.

If Planktos Science wants to be a serious company, they should get some serious PR help.

We asked the CEO of Planktos' competitor Climos, Dan Whaley, what he thought about Planktos' relaunch. Whaley didn't seem too impressed by the new science spin:

New web site, same questions: Who are the credible oceanographers that are associated with this effort? Where are the studies, and the modeling for the projects he has proposed? Who will lead the cruise-Russ? **Where is the funding** and what is the business model? Russ George seems to be a curiosity— a distraction to the real science involved.

Also check out Popular Sciences' slam of Planktos ([here](#)).

## Related Posts

Email from Russ George, CEO of Planktos Science [http://www.planktos-science.com/ocean\\_science.html](http://www.planktos-science.com/ocean_science.html)

TO: Dennis Bushnell, NASA.gov

DATE: 12/28/07

Re: [global-energy] State of the Science: Beyond the Worst Case Climate Change Scenario AND Bjorn Lomborg's Copenhagen Consensus

Dennis,

Your comments on the "Worst Case Scenarios" are welcome. I think you've perhaps misunderstood the urgency of the crisis of anthropogenic CO<sub>2</sub> with regard to the oceans. While acidification proceeds apace the crisis is sadly under-reported and does not seem to have the attention it deserves. Impacts on large bodied carbonate life forms in the oceans like the corals and shell fish seem to capture the focus of organizations of science and the media on this topic. But the most critical detail these reports seem to miss is that life in the ocean which use calcium and silicon carbonates are in far more danger during their microscopic and larval stages. Ocean acidity and enhanced solubility of carbonates and the resulting difficulty of life to precipitate such carbonates out of solution is a question of surface chemistry and the surface to volume ratio of an organism defines its susceptibility to the CO<sub>2</sub> acidification enhanced solubility crisis. As the microscopic plankton which are comprised of both plants and animals, including larval carbonate loving organisms, face acidity challenges, already extant and destined to grow more serious based on the store of anthropogenic CO<sub>2</sub> already in the atmosphere, they cannot survive the critical period in their lives when their surface to volume ratio is enormously tilted toward surface dominance. Long before we notice the crisis of weakening coral reefs shells of shellfish, and conditions like lobster shell disease, the ocean plankton and larval crisis will be catastrophic. We may already be over this tipping point and with the lifetime of CO<sub>2</sub> already in the atmosphere even if anthropogenic CO<sub>2</sub> were stopped today it would be too late for microscopic life which is

not only the bottom of the food chain it is the vastly dominant form of life on this blue planet. There can be no doubt that we are near or even over the tipping point of impacts of anthropogenic CO<sub>2</sub> on ocean life and this demands the only solution which is to try to employ ocean life through eco-restoration to assist in resolving this planetary crisis.

Fortunately the utility and efficacy of iron micro-nutrient ocean eco-restoration is near to hand and has benefitted from 20 years and \$200 million in public research funds. Just a few weeks ago the Chief Scientist of the largest and best ocean iron micro-nutrient replenishment study performed aboard the German Alfred Wegner Institutes research ship Polarstern announced that in their experiment they observed the following results. Within 30 days of adding iron to enrich a patch of iron deplete Southern Ocean water to approximately 100 parts per trillion Fe a plankton bloom had fixed 50,000 tonnes of C for each tonne of Fe applied. Given that biomass C was derived from CO<sub>2</sub> that is a Fe:CO<sub>2</sub> ratio of ~1:186,000 fixation. Further that scientist reported that **50% of that fixed carbon had sunk to or below the permanent thermocline in the same 30-day time frame.** The permanent thermocline is an undisputed century to millennial sequestration depth for ocean biomass. NASA's satellites have shown us that ocean productivity declines have reached catastrophic levels in the past 30 years since we got the birds up and have been able to track these global changes. Extensive seaborne studies have mapped the iron deplete regions of the world's oceans and these are coincident with the regions showing the most dramatic productivity (NPP) declines. The math is as simple as John Martin proposed some 20 years ago... "give me a half a ship load of iron and I'll give you another ice age." However the real urgency is not to impose an 'ice age' but to save life in our oceans and we have the knowledge and ability to do so, we maybe have the time to do so, but that time element is very much uncertain, many fear we may already be too late.

We have an 8 billion tonne per year net surplus anthropogenic CO<sub>2</sub> build up in our atmosphere... Ocean acidity is racing toward the end point, not the tipping point, and will reach that end point before the end of this century and perhaps reach it by 2050. We must act now to begin direct removal of present CO<sub>2</sub> levels from our oceans or in our own lifetimes not those of our children and grandchildren we will witness the death of the oceans and the greatest mass extinction of life this planet has ever experienced. Do John Martin's math.... each billion tonnes of CO<sub>2</sub> requires 10,000 tonnes of iron to enhance ocean photosynthesis. The problem is not the amount of iron it is the distribution of it. Note that China alone is importing 600 million tonnes of iron each year for its steel mills. I urge you to take up this cause.

Russ George  
Planktos  
San Francisco

## Farewell to Planktos - August 22, 2008

[http://blogs.nature.com/news/thegreatbeyond/2008/08/farewell\\_to\\_planktos.html](http://blogs.nature.com/news/thegreatbeyond/2008/08/farewell_to_planktos.html)

Not that those who crow about the demise of Planktos Corp. care about facts. But had they bothered to read the SEC filings in this matter they would know that this report is on the demise of Planktos Corp. the public company, not the inspired work of the Planktos team who have reformed as the private company Planktos Science in accordance with the legal terms and conditions of the dissolution of thier relationship with the public company. But hey who cares about the facts and truth when you can simply take an equally effective, albeit ignorant, swipe at the work.

The Harvard Business publications group just took a similarly ignorant swipe at Planktos... Never having bothered to fact check with Planktos on thier swipe. With regard to the Harvard item this article is so fraught with spin and false statements it is hard to know where to begin.

The author Fryer talks about greener heads prevailing. Yes those are the 'greener head' that were engaged in **delivering threats to sink the Planktos vessel** which amount to death threats on the high seas, fomenting hate mail, and myriad other actions against the people and projects of Planktos.

Those same 'greener heads' added to that professional threats against the careers of scientists helping the project.

In classic smear tactic style those 'greener heads' created a 'strawman' Planktos and proceeded to attack that strawman rather than discuss the real project. This article and the Harvard business group sustains that 'strawman' smear campaign.

Yes these are the same "greener heads" that contested the research work Planktos proposed. The fact that 20 years and \$200 million dollars of international research had led to this step was ignored as if this was totally unknown and dangerous virgin territory. The fact that today the international science community is openly calling for almost an identical research effort to what Planktos was engaged in - ignored.

But far more seriously as this topic was turned into a '**Swift Boat**' style smear and political football the fact that the hundreds of gigatonnes of fossil CO<sub>2</sub>, that gigatonne carbon bomb airborne and impacting the ocean ecosystems now with dire acidifying effect is - ignored. And lets not forget the fact that the ocean eco-restoration work of Planktos and the hope that through such science and technology development a replenished and restored ocean ecology might just possibly be able to counter the deadly impact of the carbon bomb turning that deadly CO<sub>2</sub> into ocean life instead of acidifying ocean death - ignored.

The fact that the project **Planktos was running offered the worlds first totally dedicated full time plankton research vessel** equipped and staffed by the same scientific institutions that equip and staff the world meager but mainstream ocean research fleet - ignored.

The fact that the Planktos project aimed to deliver 50 tonnes, yes that is 50 tonnes of natural iron mineral micro-nutrient dust into an ocean that receives 500 million tonnes of mineral dust blown from North Africa each year - ignored. The fact that the project was openly transparent and working to be in compliance with the rules of the Kyoto Accord and countless international oversight programs - ignored.

So yes if one is to believe this author and the Harvard Business Group 'greener heads' did indeed prevail. Tragically those 'greener heads' are the ones who don't hesitate to employ hate crime methods to stop critical ocean scientific research. And those same 'greener heads' use their ruthless attack on Planktos to conduct massive fund raising and media dis-information campaigns. One must question just what sort of person would profess this as some kind of victory as opposed to the dastardly conspiracy it so clearly was.

Posted by: Russ George | August 25, 2008 07:57 PM

Email: [info@planktos.com](mailto:info@planktos.com)

## IRI Financial Report

### *Figures from IRS Form 990*

#### Revenue and Expenses: Fiscal Year Ending December 31, 2007

<b>Revenue</b>	
Contributions	\$6,000
Program Services	\$0
Investments	\$0
Special Events	\$0
Sales	\$24,965
Other	\$2,800
<b>Total Revenue</b>	<b>\$33,765</b>
<b>Total Expenditures</b>	<b>\$133,773</b>
<b>NET GAIN/LOSS</b>	<b>\$66,241</b>

#### Balance Sheet: Fiscal Year Ending December 31, 2007

<b>Assets</b>	<b>Jan 1, 2007</b>	<b>Dec 31, 2007</b>
Cash & Equivalent	\$181,163	\$51,264
Land and Buildings	\$0	\$0
Other	\$4,675	\$3,948
<b>Total Assets</b>	<b>\$191,909</b>	<b>\$66,801</b>

<b>Liabilities</b>	<b>Jan 1, 2007</b>	<b>Dec 31, 2007</b>
<b>Total Liabilities</b>	<b>\$3,060</b>	<b>\$560</b>

<b>FUND BALANCE</b>	<b>\$188,849</b>	<b>\$66,241</b>
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