FUTURE ENERGY
Annual
2010

featuring

Future Energy eNews

&

IRI Annual Report for 2009

Thomas Valone, Editor

CREDITS

Integrity Research Institute wishes to acknowledge the following sources for this IRI Member's Annual Report

Future Energy eNews

IAS-SPES

New Scientist

Journal of Renewable and Sustainable Energy

Michael Salla

MIT Technology Review

Raymond Sedwick

Integrity Research Institute
5020 Sunnyside Avenue, Suite 209
Beltsville MD 20705
301-220-0440
A nonprofit 501 (c) 3 corporation

www.IntegrityResearchInstitute.org

TABLE OF CONTENTS

IRI OFFICERS AND DIRECTORS - 2010

Officers

Thomas Valone
President

Wendy Nicholas
Director

Jacqueline Panting
Secretary
Treasurer

BOARD OF DIRECTORS

Thomas Valone, PhD **Wendy Nicholas, PE** **Jacqueline Panting, ND**

ADVISORS TO THE BOARD OF DIRECTORS

Scott Chubb, Ph.D
Elliot Maynard, Ph.D
Peter Hunt, MBA
John Powers, Ph.D
Beverly Rubik, Ph.D
Jeff Norris, MBA
Mitchell Swartz, MD, PhD
Ivan Kruglak
Phoebe Pfaheler
James Newburn

PRESIDENT'S LETTER

This past year is summarized along with the accomplishments of 2009. It is an honor to work on such important issues when the planet shows the initial signs of the accelerated warming trend that my colleague and mentor, James Hansen predicts will produce 2 to 3 degrees C in this century. Converting to Fahrenheit, we have a deep concern at IRI over the degree rise in temperature expected every twenty years, which needs to be addressed with radical energy technology introduced to the market quickly. As the "radical solution" expert, Vinod Khosla states (Scientific American, Jan., 2011), "The greatest energy payoffs will come from fundamentally reinventing mainstream technologies." When I saw Khosla speak in Houston TX he made the point that radical technologies can completely replace existing technologies in only five (5) years. This is the kind of revolution that IRI is advocating.

Therefore, in this special issue, we are not only giving you highlights of the Future Energy eNews from 2009 and accomplishments summaries, but also reprints of my two main journal articles proposing two practical energy and propulsion inventions that have a rich history of encouraging development and cooperation.

We hope this report will provide you with hope for the future, along with all of our other books, DVDs, and reports. I expect in another 18 months to be working for IRI full-time, if not sooner, since offers keep trickling in that seem to show a general interest from the public to accelerate the carbon-free future that we all dream about.

Please take the time to send us your feedback and how we can improve our quarterly communications with you. We have secured some great magazines for distribution throughout this coming year for IRI members and hope to improve the quality of our Future Energy report as time goes on.

Thank you for your continued support.

Sincerely,

Thomas Valone, PhD, PE
President

INTEGRITY RESEARCH INSTITUTE
HIGHLIGHTS 2009

Conferences & Presentations: Our Institute had a busy year in 2009. Chief among many conferences and events were the following:

1) ***Third International Conference on Future Energy, COFE3*** Our third conference following the theme of COFE 1 and COFE2 that took place at the Washington Hilton in Washington DC October 9 -10, 2009. Featured 14 speakers from all over the world, who are recognized as leaders in the field of emerging energy science. Also included an exhibit area, free to the public that featured publications, and demonstrations of emerging energy technology demos. A special taping of all our speakers by a Norwegian Filmmaker, New Paradigm Films, took place and footage will be used in a documentary entitled: "New Concepts of Reality" slated for publication in 2011. COFE3 benefited an audience of over 200+.

2) Presentation at the ***SPESIF Space and Propulsion Energy Technologies Applications Forum*** sponsored by the American Institute of Physics in 2010. The lecture by Dr. Valone was "Permanent Magnet Spiral Motor for Magnetic Gradient Energy Utilization: Axial Magnetic Field" benefiting the attendance of 500+. A copy is included in this issue. The highlight of this conference though was meeting with our longtime friend and colleague Col. Thomas Bearden (Ret.). We had a four hour long discussion on several topics, including emerging energy generation, longevity issues and magnetism.

3) Special invited presentation to the ***Naval Strategic Studies Institute,*** in Newport Rhode Island regarding "Thermal and Non-thermal Energy Harvesting with Zero Bias Diodes". Presented to about thirty Navy Commanders at their request.

4) Presentation at the ***"Tesla Society of PA"*** **Local Chapter Meeting in Philadelphia PA.** "Tesla's High Voltage Electrotherapy Devices" benefiting attendance of over 100+.

5) Presentation on "Empirical Analysis of Electrogravitics and Electrokinetics and its Potential for Space Travel" was given at the ***American Institute of Aeronautics and Astronautics*** meeting in February 2008 benefiting an attendance of 150+ and a copy of the paper is included in this issue, exclusively for IRI members.

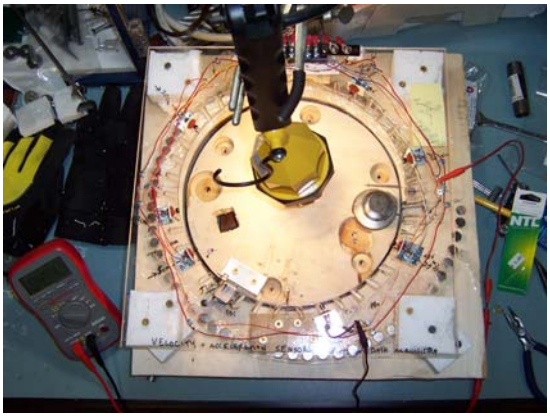
6) Two presentations in June, 2009 at the **Local Chapters of MUFON in Los Angeles and Orange County** on "*Energy Technologies of UFOs*" which was filmed by Los Angeles based Lightworks AV and turned into a commercial video called **"The World Needs New Energy"** now available from their website at http://www.lightworksav.com/theworldneedsnewenergyteslaufosclassifiedaerospacetechnologydvd.aspx .

7) Presentation at the **Secrets Conference** in Tempe Arizona, November 2009**,** sponsored by Dr Chet Snow on ***"Bioelectromagnetic Health Benefits"*** which included a workshop demonstration www.chetsnow.com .

8) Attendance at "Power MEMS Conference" at the AFI Silver Theater in Silver Spring on December 1, 2009 where Dr. Valone met an editor from Elsevier Publishers and has since submitted at least two book proposals on the IRI themes of energy, propulsion, and bioenergetics.

Future Energy News Program: We continue to research new emerging technologies and to report them in our free newsletters, brochures, and reports that include the latest news on energy developments, discoveries and research. Our ***"Future Energy eNews"*** is sent via email, monthly, to over 2000 recipients worldwide, free of charge. Also Quarterly mailings are sent for free to all our members. These include the latest papers and articles relating to emerging energy technologies as well as subscription gifts of important groundbreaking energy developments.

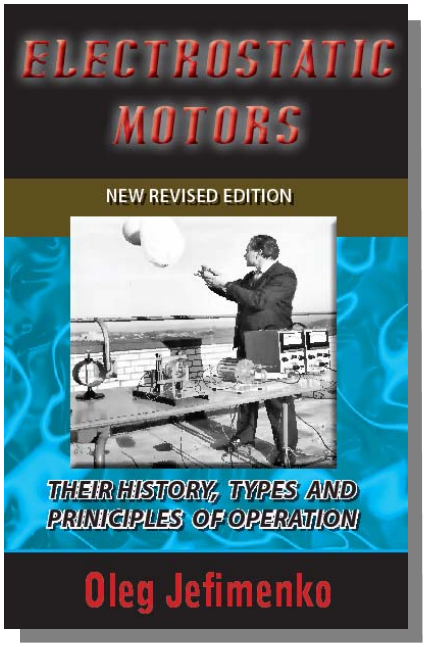
Spiral Magnetic Motor Program. This program is researching the capability of a totally permanent magnetic motor design for mechanical torque production. This year our lab researched several prototypes and models and built 5 different prototypes for testing and measuring. This research will continue for the next 4 years. Proposals for further funding have been sent to several groups that have shown an interest in developing a new way of producing clean energy for transportation and electricity generation.



Zero Point Energy Program. The research continues on the ambient heat and noise energy extraction through zero bias diodes. A spinoff is the theoretical prediction that they will also work out in space to harvest ZPE. In our lab, we are currently researching this ability and journal papers are being prepared for submission to several physics journals

including one for SPESIF and the AIP included in this issue which propose the use of zero bias diodes arrays as thermal electric noise rectifiers and nonthermal energy harvesters. 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, including research on equipment, therapy machines and providers of Bioenergy therapy. ***The Antioxidant Producing Clothing Project*** is very close to a prototype and a provisional patent has been applied for. Several investors have told us that they will be interested in funding this program further when ready. It will offer antioxidant protection and energizing to wearers through trickle current and will be especially helpful to use during heavy exercise or exertion. Our line of **PREMIER**s (Photonic Rejuvenator Energizing Machine & Immunizing Electrification Radiator) machines has become a bestseller and feedback from buyers is always positive. We have expanded this line to 4 different models, which can now be ordered with one, two, three or four noble gas tubes. Based on Tesla and Rife technologies and the Azure patent, these machines energize the body in a very short exposure. Uses the gas tube to deliver antioxidant electrons into the body tissues which studies show, directly neutralize free radicals. Invigorating and disinfecting, they help disease resistance. Currently an independent study on the clinical use of the Premier Jr. is being conducted with a Canadian Laboratory under the direction of Dr. Salansky. The study will continue through 2011.



IRI Publications: This year IRI published a new edition of the book "Electrostatic Motors, their history and principles of operation". Originally published by Dr Jefimenko, it had gone out of print. IRI approached Dr Jefimenko about reprinting the book and he agreed. Sadly, Dr Jefimenko passed away shortly after sending his approval but his assistant, David Walker wrote the introduction for this new edition. It contains all the original material plus many other articles that Jefimenko wrote about this subject as well as reprints of other articles discussing Electrostatic Motors. Note that ***"Future Energy Annual 2010"*** containing all the activities we did in 2010 has been exclusively published for distribution to members. We are happy that the book by Dr. Elizabeth Rauscher regarding Earthquake Prediction has been transferred back to Dr. Rauscher for publishing.

US Patent Issued For Extraction Of Zero Point Energy

Next Big Future, Press Release, February 3, 2009 – *reprint from Future Energy eNews, March '09*
http://nextbigfuture.com/2009/02/jovion-corporation-gets-patent-for-zero.html

DARPA Funds Zero Point Energy

As of Feb. 4, 2009, the company has gone through $200,000 in funding, partially from POCi, as well as from DARPA and some private investors.

The POCi funding covers the design, construction and testing of a practical and scalable energy harvesting system. The funding is contingent on the satisfactory achievement of certain scientific proof of principle milestones relating to a prototype Casimir cavity device as described in a current research grant to Dr. Garret Moddel, Professor in CU-Boulder's Department of Electrical and Computer Engineering and an inventor of the technology.

The patent is based primarily on papers published in the journal Physical Review by Hal Puthoff in 1987 and Timothy Boyer in 1975.

Bernard Haisch, who is a co-inventor, is quick to point out that this is all purely speculative at this point and that they have not yet been able to prove anything in the laboratory. The sporadic signals they have seen can't be ruled out as experimental error. That said, the model is still "well worth pursuing".

It is a "high risk / high gain" venture, he said, wanting to avoid the common mistake of overselling and under-delivering.

They are presently (as of Feb. 4, 2009) looking for major funding of around $10 million to carry out more sophisticated testing.

Patent Description

A system is disclosed for converting energy from the electromagnetic quantum vacuum available at any point in the universe to usable energy in the form of heat, electricity, mechanical energy or other forms of power. By suppressing electromagnetic quantum vacuum energy at appropriate frequencies a change may be effected in the electron energy levels which will result in the emission or release of energy. Mode suppression of electromagnetic quantum vacuum radiation is known to take place in Casimir cavities. A Casimir cavity refers to any region in which electromagnetic modes are suppressed or restricted. When atoms enter into suitable micro Casimir cavities a decrease in the orbital energies of electrons in atoms will thus occur. Such energy will be captured in the claimed devices. Upon emergence form such micro Casimir cavities the atoms will be re-energized by the ambient electromagnetic quantum vacuum. In this way energy is extracted locally and replenished globally from and by the electromagnetic quantum vacuum. This process may be repeated an unlimited number of times. This process is also consistent with the conservation of energy in that all usable energy does come at the expense of the energy content of the electromagnetic quantum vacuum. Similar effects may be produced by acting upon molecular bonds. Devices are described in which gas is recycled through a multiplicity of Casimir cavities. The disclosed devices are scalable in size and energy output for applications ranging from replacements for small batteries to power plant sized generators of electricity.

A 10cm X 10 cm parallel plates separated by 10 micron non-conducting strips aligned to form 5000 Casimir strips. Gas flow rate of 10 cm/second would generate 21-210 watts. A stacked set of 10 or

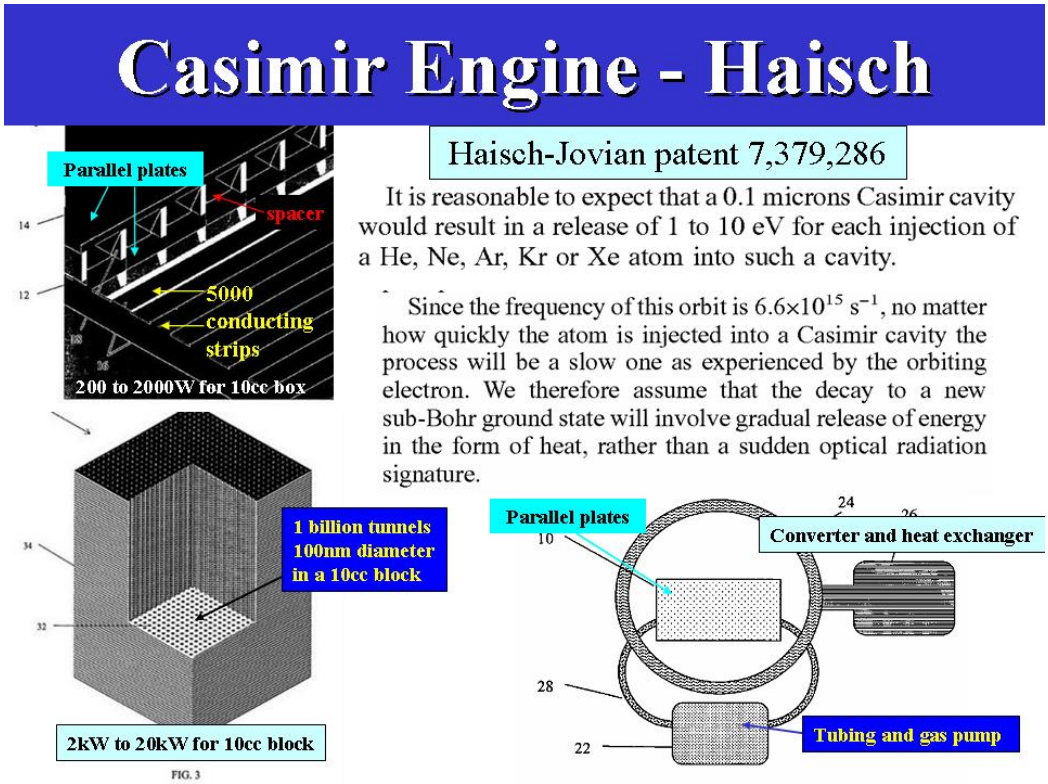
more layers could yield 210 to 2100 watts (thermal) for a 10X10X10 cm block.

A one cubic centimeter "sugar cube" size block with 1.3 billion tunnels would generate 2150 to 21500 watts (thermal). The 0.1 micron tunnels could be assembled a layer at a time using microchip lithography and then assembled into stacks. Other means of manufacturing the channels could be possible.

United States Patent 7,379,286 Haisch and Moddel
Quantum vacuum energy extraction Patent
The 21 page patent is available at www.google.com/patents
Jovion plans to use MEMS devices or polymer sheets to form the small Casimir cavities.

Francis seems to at least have read the work of Blacklight Power and the University of Colorado researcher at Jovion closely. They are both talking about reducing electron orbits using previously unknown means. The reasons being given about how these changes are occurring are very different. The University of Colorado reasoning is based on quantum mechanics while Blacklight Power applies a variation on classical mechanics.

The physical result of energy production can end up being the same even if only one of the explanations is right. The experiments could work even if both explanations are substantially wrong or incomplete. Haisch and Moddel explain the functioning of the invention as: “When the gas passes into a Casimir cavity the range of available modes is restricted and the gas sheds some of its electromagnetic energy such that this energy is available locally”…“When the gas once again flows out from the Casimir cavity, the gas’s atomic electronic orbital state energy is recharged from quantum mechanical vacuum fields. Thus energy is harvested globally and delivered locally”… “We are in effect extracting energy locally and replenishing it globally. Imagine extracting thimbles-full of water from the ocean. Yes, the ocean is being depleted thereby, but no practical consequences ensue.” (Below is an explanatory slide of patent images and text – Ed. Note)



Tiny Solar Cells Built to Power Microscopic Machines (AIP)

Published: November 10, 2008, *Journal of Renewable and Sustainable Energy*
Reprint from Future Energy eNews, April, 2009

Some of the tiniest solar cells ever built have been successfully tested as a power source for even tinier microscopic machines. An article in the inaugural issue of the Journal of Renewable and Sustainable Energy (JRSE), published by the American Institute of Physics (AIP), describes an inch-long array of 20 of these cells -- each one about a quarter the size of a lowercase "o" in a standard 12-point font.
The cells were made of an organic polymer and were joined together in an experiment aimed at proving their ability to power tiny devices that can be used to detect chemical leaks and for other applications, says Xiaomei Jiang, who led the research at the University of South Florida.

Traditional solar cells, such as the commercial type installed on rooftops, use a brittle backing made of silicon, the same sort of material upon which computer chips are built. By contrast, organic solar cells rely upon a polymer that has the same electrical properties of silicon wafers but can be dissolved and printed onto flexible material.

"I think these materials have a lot more potential than traditional silicon," says Jiang. "They could be sprayed on any surface that is exposed to sunlight -- a uniform, a car, a house."

Jiang and her colleagues fabricated their array of 20 tiny solar cells as a power source for running a microscopic sensor for detecting dangerous chemicals and toxins. The detector, known as a microeletromechanical system (MEMS) device, is built with carbon nanotubes and has already been tested using ordinary DC power supplied by batteries. When fully powered and hooked into a circuit, the carbon nanotubes can sensitively detect particular chemicals by measuring the electrical changes that occur when chemicals enter the tubes. The type of chemical can be distinguished by the exact change in the electrical signal.

The device needs a 15-volt power source to work, so far and Jiang's solar cell array can provide about half of that -- up to 7.8 volts in their laboratory tests. The next step, she says, is to optimize the device to increase the voltage and then combine the miniature solar array to the carbon nanotube chemical sensors. Jiang estimates they will be able to demonstrate this level of power with their next generation solar array by the end of the year.

Read the full text article "Fabrication of organic solar array for applications in microelectromechanical systems."

Source: www.aip.org/press_release/jrse.html

Listen to the co-editor of the journal, P. Craig Taylor, discuss the article and the new journal (www.NPR.org).

New Energy and Antigravity to be Promoted by General James Jones

Michael Salla, PhD, Baltimore Examiner, January 19, 2009 – reprinted from Future Energy eNews 5/09

http://www.examiner.com/x-2383-Honolulu-Exopolitics-Examiner~y2009m1d19-Obama-administration-first-100-days-to-promote-antigravity-technology

General James L. Jones, Jr., USMC (Ret.)The first 100 days of an Obama administration promise a number of bold initiatives aiming to reinvigorate the U.S. economy and restore America's international image. Key personnel in the Obama administration have been appointed to implement and ensure the success of such initiatives. Among these initiatives is the anticipated release of classified technologies based on antigravity propulsion principles that can revolutionize the energy and aerospace industries. Obama's National Security Advisor, retired Marine General James Jones, will feature prominently in the releases of antigravity technologies and associated initiatives.

Classified antigravity technologies have been kept from the public realm for over six decades while secretly developed by military-corporate entities. It was revealed in 1992, for example, that the B-2 Bomber used electrostatic charges on its leading wings and exhaust. According to aerospace experts, this was confirmation that the B-2 used electrogravitic principles based on the Biefeld-Brown Effect. The Biefeld-Brown Effect is based on the research of Thomas Townsend Brown who in 1928 gained a patent for his practical application of how high voltage electrostatic charges can reduce the weight of objects.

The Biefeld Brown Effect

The B-2 bomber employs sufficiently high voltages to significantly reduce its weight. This enables the B-2 and other classified antigravity vehicles to

display flight characteristics that appear to defy conventional laws of physics.

The key Obama appointee for introducing antigravity technology into the public sector is General Jones. After retiring from the Marines on February 1, 2007, General Jones served on the Board of Directors of the Boeing Corporation from June 21, 2007 to December 15, 2008. Boeing had been active at least since the early 1990's in studies to apply antigravity technology for commercial use.

In 2002, an internal Boeing project called "Gravity Research for Advanced Space Propulsion" (GRASP) had been disclosed to the aerospace industry. A GRASP briefing document obtained by Jane's Defense Weekly stated Boeing's position: "If gravity modification is real, it will alter the entire aerospace business."

According to a 2008 book by Dr Paul LaViolette, Secrets of Antigravity Technology, Boeing completed a separate classified study for the U.S. military of electrogravitic propulsion recently before October 2007. Boeing was rebuffed in its efforts to have such technology declassified and released into the public sector. As a Board Director and member of Boeing's Finance Committee at the time of the 2007 classified study, General Jones was privy to and supported Boeing's efforts in antigravity research and development.

At the same time that Boeing was actively seeking to develop antigravity technologies for a new generation of aircraft, Jones became President of the Institute for 21st Century Energy. The Institute was created by the U.S. Chamber of Commerce with the following mission:

To secure America's long-term energy security, America must reexamine outdated and entrenched

positions, become better informed about the sources of our fuel and power, and make judgments based on facts, sound science, and good American common sense.
As Obama's National Security Advisor, General Jones will be well placed to ensure that "new energy ideas" become integrated into a comprehensive national security policy by the Obama administration. He can be expected to encourage the development and release of new energy ideas that can truly lead the U.S. into the 21st Century. The first 100 days of the Obama administration will therefore witness significant progress towards practical commercial applications of antigravity technologies.

Antigravity Evolves from Electrogravitics and Subquantum Kinetics

*Book Review by Thomas Valone, PhD, PE - reprinted from **Infinite Energy** magazine, 2009*

Starting with a detailed review of electrogravitics and the life of T. Townsend Brown, Dr. Paul LaViolette's book, Secrets of Antigravity Propulsion (Bear & Company, 2008) offers a wonderfully informative description of the science of propulsion generators. Paul tends to use the terms "antigravity" and "electrogravitics" quite liberally, even when other terms might be more precise. However, the phenomena that is reviewed in his book, such as the 2200 newton per kilowatt thrust generated by T.T. Brown's best high voltage discs in his report, "Electrohydrodynamics" are quite impressive. Also interesting are the details about Brown's later life research into petrovoltaics that include graphs of the spontaneous voltage (about 300 mV) developed continuously over a nine-day period. Paul is careful to include corroboration when available, such as the Physical Review paper by Dr. Elmer Harrington from the National Bureau of Standards that confirms Brown's effects on gravitational acceleration and heat generation in rocks.

Paul also includes probably the most scientific review of the Philadelphia Experiment in print today along with the possibility that T.T. Brown participated in the event and how it might have been orchestrated. He includes, for example, a summary of Jim and Ken Corum's experiments with high-amperage coils around a steel torus that produced a fivefold reduction in radar reflection and a review of the Hutchison Effect. The evolution of antigravity research into the black world is given plausible reality with the evidence provided by several black ops interviews also in the book, as well as quotes from engineering articles.

While the book returns periodically to T.T. Brown and the asymmetric capacitors that gave the term "electrogravitics" its birth, the description of the Lafforgue patent developing longitudinal thrust is an added intrigue. Many readers may be familiar with Paul's article on the electrogravitics properties of the B-2 bomber that used to be in my book, Electrogravitics Systems, Reports on a New Propulsion Methodology, until it was recalled for its inclusion in his new book. However, in Secrets of Antigravity Propulsion a lot more detail is revealed making the B-2 electrification even more convincing. A French astrophysicist proposes the visible luminosity of the craft as proof that it was being excited by a high-voltage field. Even an online movie and color stills in possession of Northrop Grumman are documented that provide evidence of the high voltage glow. With information about an AC microwave excitation mode, LaViolette makes the case for a 40,000 newton per kilowatt thrust with a million volt potential for the B-2 thrusters, enough to explain the rumored no-fuel flight around the world.

Probably the most exciting chapter for me was the Chapter 6 description of the Podkletnov-Modanese electrogravitics impulse generator. It was reported in the Jane's Defense Weekly to knock over a set of books at one kilometer distance with a negligible power loss even hundreds of kilometers away. Paul predicted from his subquantum kinetic theory that the gravity impulse generator should have no recoil, which was then confirmed by Professor Podkletnov. His description of the increased punch from a faster rise time Marx generator seems quite credible from my research into the electrokinetic equation developed by Jefimenko, which has the same

feature and the same polarity toward the positive pole. However, Paul forgot to mention the most compelling civilian application for the Podkletnov gravity impulse generator, which is for planetary protection from killer near-earth-orbit (NEO) objects. Enough evidence is presented in the book to show that such a generator can maintain a collimated and coherent force beam for miles with enough pressure to perhaps nudge a large object away from a collision course.

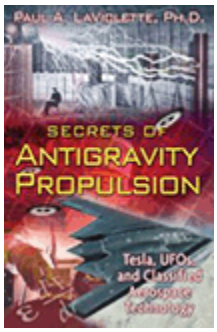
The book also includes a review of the historic Project Skyvault which is introduced by a black ops informant, as the first source of information that Paul received about it. It makes the case for an electrogravitics force developed from nonlinear materials exposed to microwaves, as well as an interesting description of phase conjugated mirror effects. One example given is the FASER research performed by Obolensky in the author's presence over a period of two years which also included a runaway experiment that exploded under resonant conditions.

Secrets of Antigravity Propulsion includes a brief review of the John Searl research as well as the recent Russian experiments attempting to reproduce his work. Paul also includes the gravity theories of Bob Lazar who reportedly worked at Area 51 S-4 for a few months and several UFO stories that help identify the expected effects from a downward-directed force beam.

With a large Appendix full of resource material, Secrets of Antigravity Propulsion is a compelling book that opens the world of scientific electrogravity research to the average reader. My hope is that the AIAA will offer a correction errata sheet in its new book, Frontiers of Propulsion Science by Eric Davis and Marc Millis which presently dismisses the years of electrogravitics covered in Paul's book with its own terse chapter containing a single, paultry negative experimental report of a "null effect." Inertial propulsion is also given similar treatment in the Davis-Millis book but omitted entirely from Paul's book, even though my non-profit institute publishes an Inertial Propulsion Patent Collection report with over 100 patents that the PTO says develop a force from a mechanical device. Sooner or later the truth will emerge, as much of it has in the latest masterful work on antigravity propulsion by Dr. Paul LaViolette.

For Further Information

See Dr. Paul LaViolette's new book***, Secrets of Antigravity Propulsion***, Inner Tradition, 2008, available online from www.IntegrityResearchInstitute.org or click on book below to order.
-- Ed note



Roll Up Solar Panels, *convenient portable power source*

By Prachi Patel, Technology Review, June 4, 2009
http://beta.technologyreview.com/business/22745/?nlid=2086

As opposed to conventional silicon solar panels, which are bulky and rigid, these lightweight, flexible sheets could easily be integrated into roofs and building facades or on vehicles. Such systems could be more attractive than conventional solar panels and be incorporated more easily into irregular roof designs. They could also be rolled up and carried in a backpack, says the company's cofounder and president, Xunming Deng. "You could take it with you and charge your laptop battery," he says.

Amorphous silicon thin-film solar cells can be cheaper than conventional crystalline cells because they use a fraction of the material: the cells are 1 micrometer thick, as opposed to the 150-to-200-micrometer-thick silicon layers in crystalline solar cells. But they're also notoriously inefficient. To boost their efficiency, Xunlight made triple-junction cells, which use three different materials--amorphous silicon, amorphous silicon germanium, and nanocrystalline silicon--each of which is tuned to capture the energy in different parts of the solar spectrum. (Conventional solar cells use one primary material, which only captures one part of the spectrum efficiently.)

Still, Xunlight's flexible PV modules are only about 8 percent efficient, while some crystalline silicon modules on the market are more than 20 percent efficient. As a result, Xunlight's large modules produce only 330 watts, whereas an array of crystalline silicon solar panels covering the same area would produce about 740 watts. United Solar Ovonic, based in Auburn Hills, MI, is already selling flexible PV modules. The company also uses triple-junction amorphous silicon cells, and its modules can be attached to roofing materials. But Xunlight's potential advantage is its high-volume roll-to-roll technique. "If their roll-to-roll process allows them to go to lower cost and larger area, that's the central advantage," says Johanna Schmidtke, an analyst with Lux Research, in Boston. "But they have to prove it with manufacturing."

Other companies, notably Heliovolt and Nanosolar, are in a race to make thin-film panels using copper indium gallium selenide (CIGS) cells. These have shown efficiencies on par with crystalline silicon and can be made on flexible substrates. In comparison with amorphous silicon, CIGS is a relatively difficult material to work with, and no one has been able to create low-cost products consistently in large quantities, says Ryan Boas, an analyst with Photon Consulting, in Boston.

Building integrated photovoltaics (BIPV), especially rooftop applications, would be the biggest market for flexible PV technology, Boas says. That's because flexible products are inherently very light, in addition to being quick and easy to install. "Imagine carrying a roll of flexible product on the roof and unrolling it," he says. "Workers are already used to unrolling roofing material."

But there are hidden risks and costs associated with BIPV, Schmidtke says. "BIPV is often touted as low cost," she says, "but in actuality, you've got greater risk in terms of a watertight system [for roofing materials] or fire risk, and that increases total installation cost." However, BIPV does have the advantage of being more aesthetically pleasing, which is important to consumers, she says. So far, Xunlight has raised $40 million from investors. In December, the state of Ohio gave the company a $7 million loan to speed up the construction of a 25-megawatt production line for its flexible solar modules. The company expects to have commercial products available in 2010.

Magnetic Core Multi-Grid Inertial Electrostatic Confinment Fusion

by **Ray Sedwick**, ***Aerospace Engineering Department of the Clark School of Engineering at the University of Maryland.*** Reprint from Future Energy eNews, July 2009

Inertial Electrostatic Confinement Fusion (IECF) uses a predominantly spherically symmetric electrostatic field to radially accelerate fuel to fusion energies in a central core. The main criticism of this approach is that it relies on a non-Maxwellian energy distribution to achieve significant focusing within the core. Because the fusion time scale is much longer than the thermalization time scale, this approach is often discounted out of hand. However, a new mechanism has been identified computationally and verified experimentally that could potentially confine the thermalization process to take place at the focal point within the core. The implication is that while thermalization will still result in a redistribution of ion energies and directions, the ions could remain on predominantly radial paths through the device and augmented focusing could still be achieved. To support a sufficiently high core density, a permanent magnet grid is considered as a mechanism for electron confinement. The performance of such a system using D-T is discussed.

Ray Sedwick is an ***Assistant Professor in the Aerospace Engineering Department of the Clark School of Engineering at the University of Maryland.*** Prior to this position he spent 15 years at the Massachusetts Institute of Technology, 5 in the pursuit of his S.M. (1994) and his Ph.D. (1997), and the remainder of the time as a researcher in the Space Systems Laboratory. At the University of Maryland he has established the Space Power and Propulsion Laboratory, where he leads graduate and undergraduate research in a variety of technology pursuits. He was a Fellow of the NASA Institute for Advanced Concepts (NIAC), recipient of the inaugural Bepi Colombo Prize, and recently awarded a National Science Foundation CAREER grant for research in compact helicon plasma sources.

For More Information

The Farnsworth Fusor
Shortly thereafter a preliminary test on the Farnsworth "Fusor" was performed in a small ITT basement laboratory. His first design for a hot fusion reactor ...
www.farnovision.com/chronicles/fusion/vassilatos.html - Cached - Similar

Philo Farnsworth: Fusor (Inertial Electrostatic Confinement)
Farnsworth, inertial electrostatic confinement fusion.
www.rexresearch.com/farnsworth/fusor.htm - Cached - Similar
[PDF] (Philo Farnsworth was also the genius inventor of television – Ed Note)

The Farnsworth/Hirsch Fusor
File Format: PDF/Adobe Acrobat - View
Farnsworth fusor is directly related to the failure of hot fusion over the forty odd years of massive public funding to produce real results. ...
www.belljar.net/634fusor.pdf - Similar

Brian McDermott's Fusion Story-How I made the Farnsworth Fusor
By May, I had made my first post to Fusor.net, and had ordered Richard's informational video tapes on the fusor. By that time, I had acquired a 30 year old ...
www.brian-mcdermott.com/brianfusor2.htm - Cached - Similar

The Farnsworth/Hirsch Fusor
The Fusor is a vaccum chamber device invented by Philo T. Farnsworth in the 1950's. An acceleration voltage (several kV) and the geometry of the electrodes ...
www.kronjaeger.com/hv-old/fusor/construction/ - Cached - Similar

American Institute of Aeronautics and Astronautics
Joint Propulsion Conference 2008, Hartford CT, paper # 092407

Empirical Analysis of Electrogravitics and Electrokinetics and its Potential for Space Travel

Thomas F. Valone*
Integrity Research Institute, Beltsville MD 20705
www.IntegrityResearchInstitute.org
e-mail: IRI@starpower.net

An analysis of the 90-year old science of electrogravitics (a.k.a. "gravitics" or "electrogravity") necessarily includes an analysis of electrokinetics. Electrogravitics is most commonly associated with the 1928 British patent #300,311 of T. Townsend Brown (his first one), the 1952 Special Inquiry File #24-185 of the Office of Naval Research into the "Electro-Gravity Device of Townsend Brown" and two widely circulated 1956 Aviation Studies Ltd. reports on "Electrogravitics Systems" and "The Gravitics Situation." By definition, electrogravitics historically has had a purported relationship to gravity or the object's mass, as well as the applied voltage. The Gravitics Situation report defined electrogravitics as "The application of modulating influences on electrostatic propulsion system." It also was tested recently by the Honda Corporation, which published experimental results and proposed theory of a correlation between electricity and gravity. Electrokinetics, on the other hand, is more commonly associated with many later patents of T. Townsend Brown as well as Agnew Bahnson, starting with the 1960 US patent #2,949,550 entitled, "Electrokinetic Apparatus." Electrokinetics, which often involves a capacitor and dielectric, has virtually no relationship that can be connected with mass or gravity. The Army Research Lab has recently issued a report on electrokinetics, analyzing the force on an asymmetric capacitor, while NASA has received three patents on the same design topic. To successfully describe and predict the reported motion toward the positive terminal of the capacitor, it is desirable to use the classical electrokinetic field and force equations for the specific geometry involved. This initial review and analysis also suggests directions for further confirming experiments and an empirically-based formulation of a working hypothesis for electrokinetics.

I. Nomenclature

$\boldsymbol{J}$	=	electric current density
I	=	electric current
$\boldsymbol{E}_K$	=	electrokinetic force vector
B	=	magnetic flux density
E	=	electric field
ρ	=	charge density

II. Introduction to Electrogravitics versus Electrokinetics

FOURTEEN years ago the first edited volume on the subject, *Electrogravitics Systems Volume I: A New Propulsion Methodology* or just "Volume I", introduced the subject by reprinting the Aviation Studies reports from 1956 as well as an in-depth analysis of the B-2 bomber by Paul LaViolette.[1] The second volume, *Electrogravitics II: Validating Reports on a New Propulsion Methodology* or "Volume II" expands the historical perspective of the first volume and brings it up to date. For example, Volume II contains further information on the Army Research Lab and Honda Corporation experiments, as well as the electrokinetic equation discovery presented in this paper. A short review of the history of electrogravitics has recently been published by Professor Theodore Loder.[2]

* President, Integrity Research Institute, 5020 Sunnyside Avenue, Suite 209, Beltsville MD 20705, AIAA Member.

A working definition, based on the T. Townsend Brown's first patent #300,311 and The Gravitics Situation report is "*electricity used to create a force that depends upon an object's mass, similar to gravity*." This is the answer that perhaps should still be used to identify true electrogravitics, which also involves the object's mass in the force, often with a dielectric. This is also what the "Biefeld-Brown effect" of describes. However, we have seen T. Townsend Brown and his patents evolve over time which Tom Bahder emphasizes. Later on, Brown refers to "electrokinetics" (that partly overlaps the field of electrogravitics), that requires asymmetric capacitors to amplify the force. Therefore, Bahder's article discusses the lightweight effects of "lifters" and the ion mobility theory found to explain them. Note: *electrogravitics (EG) and electrokinetics (EK) are related but different phenomona*.

To put things in perspective, the article "How I Control Gravitation," published in 1929 by Brown,[3] presents an electrogravitics-validating discovery about *very heavy metal objects* (44 lbs. each) separated by an insulator, charged up to high voltages. T.T. Brown also expresses an experimental formula in words which tell us what he found was directly contributing to the *unidirectional force* (UDF) which he discovered, moving the system of masses toward the positive charge. He describes the equation for his electrogravitic force to be $F \approx Vm_1m_2/r^2$. However, electrokinetics and electrogravitics also seem to be governed by another equation (Eq.1) when higher order pulsed voltages are utilized .

A. Zinsser Effect versus the Biefeld-Brown Effect

To expand and support the empirical evidence for electrokinetics, there is another invention which has comparable experiments that also involve electrogravity, called "gravitational anisotropy" by Rudolf G. Zinsser from Germany. Zinsser presented his experimental results at the Gravity Field Conference in Hanover in 1980, and also at the First International Symposium of Non-Conventional Energy Technology in Toronto in 1981.[4] For years afterwards, all of the scientists who knew of Zinsser's work, including myself, regarded his invention as a unique phenomenon, not able to be classified with any other discovery. However, upon comparing Zinsser to Brown's 1929 article on gravitation referred to above, there are striking similarities.

Zinsser's discovery is detailed in *The Zinsser Effect* book by this author.[5] To summarize his life's work, Zinsser discovered that if he connected his patented pulse generator to two conductive metal plates immersed in water, he could induce a sustained force that lasted even after the pulse generator was turned off. The pulses lasted for only a few nanoseconds each.[6] Zinsser called this input "a kinetobaric driving impulse." Furthermore, he points out in the Specifications and Enumerations section, that the high dielectric constant of water (about 80) is desirable and that a solid dielectric is possible. Dr. Peschka calculated that Zinsser's invention produced 6 Ns/Ws or 6 N/W.[7] This figure is *twenty times* the force per energy input of the Inertial Impulse Engine of Roy Thornson, (report available from IRI) which has been estimated to produce 0.32 N/W.[8] By comparison, it is important to realize that any production of force today is less efficient, as seen by the fact that a DC-9 jet engine produces *about 20 times less:* only 0.016 N/W or 3 lb/hp (fossil-fuel-powered land and air vehicles are even worse.)

Let's now compare the Zinsser Effect with the Biefeld-Brown Effect, looking at the details. Brown reports in his 1929 article that there are effects on plants and animals, as well as effects from the sun, moon and even slightly from some of the planetary positions. Zinsser also reports beneficial effects on plants and humans, including what he called "bacteriostasis and cytostasis."[9] Brown also refers to the "endogravitic" and "exogravitic" times that were representative of the charging and discharging times. Once the gravitator was charged, depending upon "its gravitic capacity" any further electrical input had no effect. *This is the same phenomenon that Zinsser witnessed* and both agree that the *pulsed voltage generation* was the main part of the electrogravitic effect.[10] Both Zinsser and Brown worked with dielectrics and capacitor plate transducers to produce the electrogravitic force. Both refer to a high dielectric constant material in between their capacitor plates as the preferred type to best insulate the charge. However, Zinsser never experimented with different dielectrics nor higher voltage to increase his force production. This was always a source of frustration for him but he wanted to keep working with water as his dielectric.

B. Electrically Charged Torque Pendulum of Erwin Saxl

Brown particularly worked with a torque (torsion) pendulum arrangement to measure the force production. He also refers the planetary effects being most pronounced *when aligned with the gravitator* instead of perpendicular to it. He compares these results to Saxl and Allen, who worked with an electrically charged torque pendulum.[11] Dr. Erwin Saxl used high voltage in the range of +/- 5000 volts on his very massive torque pendulum.[12] The changes in period of oscillation measurements with solar or lunar eclipses, showed great sensitivity to the shielding effects of

gravity during an alignment of astronomical bodies, helping to corroborate Brown's observation in his 1929 article. The pendulum Saxl used was over 100 kilograms in mass.[13] Most interesting were the "unexpected phenomena" which Saxl reported in his 1964 *Nature* article (see ref. 10). The positively charged pendulum had the longest period of oscillation compared to the negatively charged or grounded pendulum. Dirunal and seasonal variations were found in the effect of voltage on the pendulum, with the most pronounced occurring during a solar or lunar eclipse. In my opinion, this demonstrates the basic principles of electrogravitics: high voltage and mass together will cause unbalanced forces to occur. In this case, the electrogravitic interaction was measurable by oscillating the mass of a charged torque pendulum (producing current) whose period is normally proportional to its mass.

C. Electrogravitic Woodward-Nordtvedt Effect

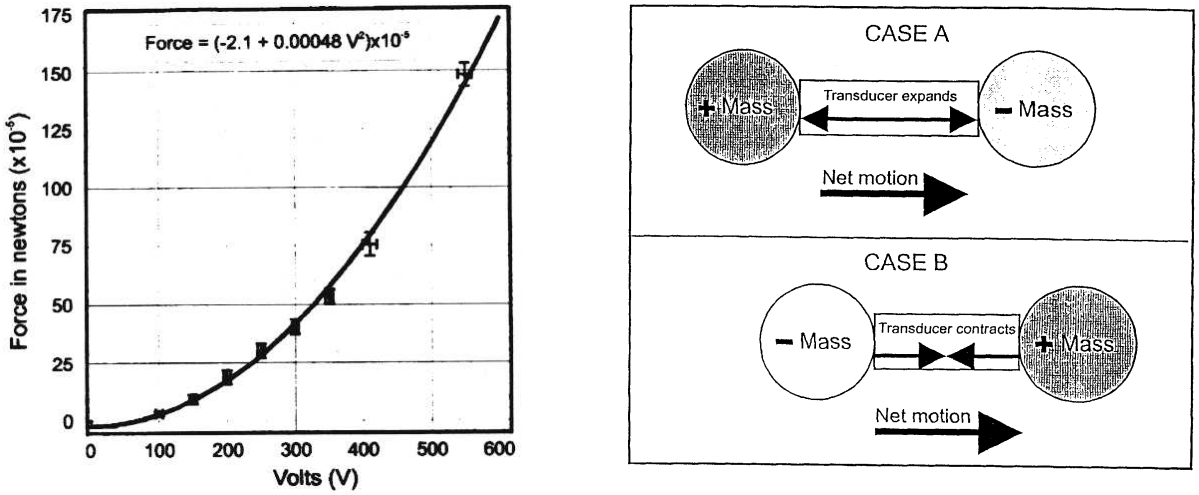


Figure 1. Force Output Vs. Capacitor Voltage Input of a Woodward Force Transducer (Mahood, 2000) and the Net Motion Direction of Cases A and B (Woodward, 2000). *Reported data graph of the Woodward-Nordtvedt effect. Note that the reported force is Newtons (×10^{-5}) which equals dynes)*

Referring to mass, it is sometimes not clear whether gravitational mass or inertial mass is being affected. The possibility of altering the equivalence principle (which equates the two), has been pursued diligently by Dr. James Woodward[14] (patent cover sheets in Volume II). His prediction, based on Sciama's formulation of Mach's Principle in the framework of general relativity, is that "in the presence of *energy flow*, the inertial mass of an object may undergo sizable variations, changing as the 2nd time derivative of the energy."[15] Woodward, however, indicates that it is the "active gravitational mass" which is being affected but the equivalence principle causes both "passive" inertial and gravitational masses to fluctuate.[16] With barium titanate dielectric between disk capacitors. a 3 kV signal was applied in the experiments of Woodward and Cramer resulting in symmetrical mass fluctuations on the order of centigrams.[17] Cramer actually uses the phrase "Woodward effect" in his AIAA paper, though it is well-known that Nordtvedt was the first to predict noticeable mass shifts in accelerated objects.[18]

The interesting observation which can be made, in light of previous sections, is that Woodward's experimental apparatus *resembles a combination of Saxl's torsion pendulum and Brown's electrogravitic dielectric capacitors.* The differences arise in the precise timing of the pulsed power generation and with input voltage. Recently, 0.01 μF capacitors (Model KD 1653) are being used, in the 50 kHz range (lower than Zinsser's 100 kHz) with the voltage still below 3 kV. Significantly, the thrust or unidirectional force (UDF) is exponential, depending on the square of the applied voltage.[19] However, the micronewton level of force that is produced *is actually the same order of magnitude which Zinsser produced,* who reported his results in dynes (1 dyne = 10^{-5} Newtons).[20] Zinsser had *activators* with masses between 200 g and 500 g and force production of "100 dynes to over one pound."[21] Recently, Woodward has been referring to his transducers as "flux capacitors" (like the movie, *Back to the Future*).[22]

III. Jefimenko's Electrokinetics Explains Electrogravitics

Known for his extensive work with atmospheric electricity, electrostatic motors and electrets, Dr. Oleg Jefimenko deserves significant credit for presenting a valuable theory of the *electrokinetic field*, as he calls it.[23] A W.V. University professor and physics purist at heart, he describes this field as the *dragging force* that electrons exert *on neighboring electric charges*, which is what he says Faraday noted in 1831, when experimenting with parallel wires: a momentary current in the same direction when the current is turned on and then a reverse current in the adjacent wire when the current is turned off.

He identifies the *electrokinetic field* by the vector $\mathbf{E}_k$ where

$$\mathbf{E}_k = -\frac{1}{4\pi\varepsilon_o c^2}\int \frac{1}{r}\left[\frac{\partial \mathbf{J}}{\partial t}\right] dv' \tag{1}$$

It is one of three terms for the electric field in terms of current and charge density. Equations like $\mathbf{F} = q\mathbf{E}$ also apply for calculating force. The significance of $\mathbf{E}_k$, as seen in Eq. 1, is that the electrokinetic field simply the third term of a classical solution for *the electric field* in Maxwell's equations:

$$\mathbf{E} = \frac{1}{4\pi\varepsilon_o}\int \left\{\frac{\rho}{r^2} + \frac{1}{rc}\frac{\partial \rho}{\partial t}\right\}\mathbf{r}\, dv' + \mathbf{E}_k \tag{2}$$

This three-term equation is a causal equation, according to Jefimenko, because it links the electric field **E** back the electric charge and its motion (current) which induces it. (He also proves that **E** cannot be a causal consequence of a time-variable magnetic field $\partial\mathbf{B}/\partial t$ but instead occurs simultaneously.) This is the essence of electromagnetic induction, *as Maxwell intended*, which is measured by, not caused by, a changing magnetic field. The third electric field term, designated as the electrokinetic field, *is directed along the current direction or parallel to it.* It also exists only as long as the current is changing in time. Lenz' Law is also built into the minus sign. Parallel conductors will produce the strongest induced current.

The significance of Eq. 3 is that the magnetic vector potential is seen to be created by the time integral which amounts to an *electrokinetic impulse* "produced by this current at that point *when the current is switched on"* according to Jefimenko.[24] Of course, a time-varying sinusoidal current will also qualify for production of an electrokinetic field and the vector potential. An important consequence of Eq. 1 is that *the faster the rates of change of current, the larger will be the electrokinetic force*. Therefore, high voltage pulsed inputs are favored.

However, its significance is much more general. "This field can exist anywhere in space and can *manifest itself as a pure force* by its action on free electric charges." All that is required for a measurable force *from a single conductor* is that the change in current density (time derivative) happens very fast (the c^2 in the denominator is also equal to $1/\mu_o\varepsilon_o$ unless the medium has non-vacuum permeability or permittivity).

The electrogravitics experiments of Brown and Zinsser involve a dielectric medium for greater efficacy and charge density. The electrokinetic force on the electric charges (electrons) of the dielectric, according to Eq. (1), is in the *opposite direction of the increasing positive current* (taking into account the minus sign). For parallel plate capacitors, Jefimenko explains that *the strongest induced field is produced between the plates* and so another equation evolves.

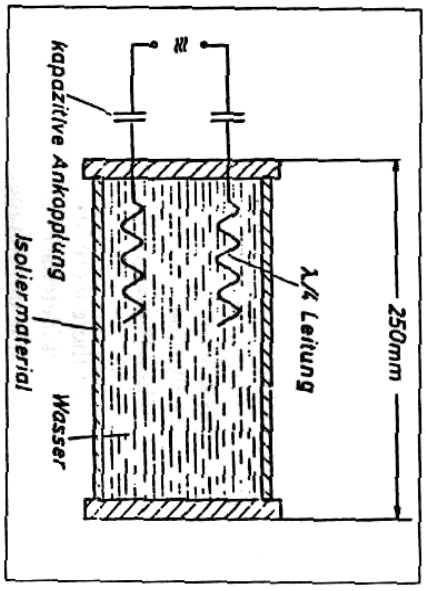


Figure 2. Sample capacitor probe used by Zinsser. *Note the quarter λ/4 wavelength electrodes that indicate an electrically resonant circuit design.*

IV. Electrokinetic Force Predicts Propulsion Direction

Can Jefimenko's electrokinetic force empirically and qualitatively predict the correct *direction* of the electrogravitic force seen in the Zinsser, Brown, Woodward as well as the yet-to-be-discussed Campbell, Serrano, and Norton AFB craft demonstrations? The following four sections offer empirical evidence for a "prediction" of a force production direction.

1) Starting with *Zinsser's probe diagram* (Fig. 2) from Prof. Peschka's article, it is purposely put on its end in order to compare it with an equivalent parallel plate capacitor (the plates are x distance apart) from Jefimenko's book:[25] Professor Jefimenko performs a calculation of the electrokinetic force in the space between two current-carrying capacitor plates powered by an alternating current. He designates X for the space between the plates where W is the width of each plate and the height is not labeled. His example matches the Zinsser force transducer quite closely.

We note that the current is presumed to be the same in each plate but in opposite directions because it is alternating. Using $E = - \partial A/\partial t$, Jefimenko calculates the electrokinetic field, for the AC parallel plate capacitor with current going in opposite directions, as

$$\mathrm{E}_k = -\mu_o \frac{\partial I}{\partial t}\frac{x}{w}\mathrm{j} \tag{3}$$

where **j** is the unit vector for the y-axis direction . It is clearly seen that the y-axis points upward in Fig. 3 and so with the minus sign of Eq. 3, the electrokinetic force for the AC parallel plate capacitor *will point downward.* Since Zinsser had his torsion balance on display in Toronto in 1981, I was privileged to verify the direction of the force that is created with his quarter-wave plates oriented as they are in Fig. 2. The torsion balance is built so that the capacitor probe can only be deflected *downward* from the horizontal. *The electrokinetic force is in the same direction*.

2) Looking at *Brown's electrogravitic force direction* from Fig. 3 in his 1929 article "How I Control Gravitation," we see that the positive lead is on the right side of the picture. Also, the arrow below *points to the right* with the caption, "Direction of movement of entire system toward positive." Examining the electrokinetic force of Eq. 1 in this article, we note that the increasing positive current comes in by convention in the positive lead and points to the left. Therefore, considering the minus sign, the direction of the electrokinetic force will be *to the right*. Checking with Fig. 4 of the 1929 Brown article, the same *confirmation of induced electrokinetic force direction*.[26] Thus, with Zinsser's and Brown's gravitators, *the electrokinetic theory provides a useful explanation and it is accurate for prediction of the resulting force direction*.

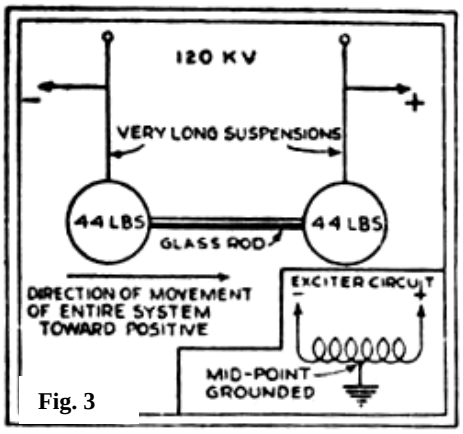


Fig. 3

A SIMPLE TYPE OF GRAVITATOR IS SHOWN IN THE ABOVE ILLUSTRATION.

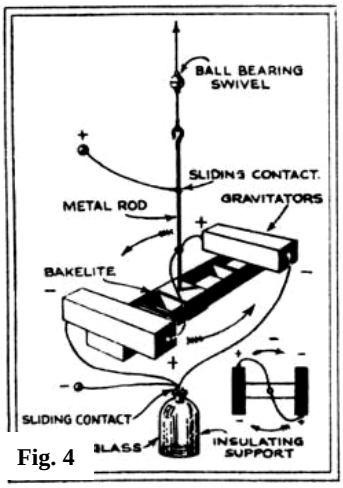


Fig. 4

A GRAVITATOR ROTOR IS SIMPLY AN ASSEMBLY OF UNITS SO MADE THAT ROTATION RESULTS UNTIL THE IMPULSE IS EXHAUSTED.

It is also worthwhile noting that T.T. Brown also indicates in that article,

> "when the direct current with high voltage (75 – 300 kilovolts) is applied, the gravitator swings up the arc … but it does not remain there. The pendulum then gradually returns to the vertical or starting position, even while the potential is maintained…Less than five seconds is required for the test pendulum to reach the maximum amplitude of the swing, but from thirty to eighty seconds are required for it to return to zero."

This phenomenon is *remarkably the same type of response that Zinsser recorded* with his experimental probes. Jefimenko's theory helps explain the rapid response, since the change of current happens in the beginning. However, the slow discharge in both experiments (which Zinsser called a "storage effect") needs more consideration. Considering the electrokinetic force of Eq. 3 and the +/- derivative, we know that the slow draining of a charged capacitor, most clearly seen in Fig. 1 of Brown's 1929 article, will produce a decreasing current out of the + terminal (to the right) and in Eq. 3, this means the derivative is negative. Therefore, *the slow draining of current will produce a weakening electrokinetic force* but *in the same direction as before*! The force will thus sustain itself to the right during discharge.

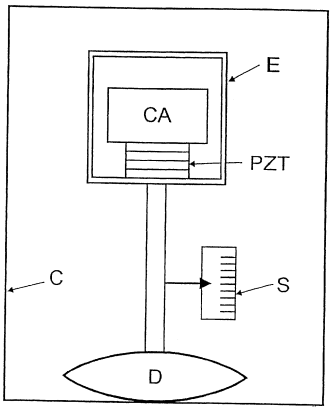


Figure 5. Woodward's #6,098,924 patented impulse engine, also called a "flux capacitor." *The PZT provides nanometer-sized movements that are timed to an AC signal input. A torsion balance has been used*

3) It is reasonable at this stage to also suggest that the electrokinetic theory will also predict the direction of *Woodward's UDF* but instantaneous analysis needs to be made to compare current direction into the commercial disk capacitors and the electrokinetic force on the dielectric charges. In every electrogravitics or electrokinetics case, it can be argued, the "neighboring charges" to a capacitor plate will necessarily be those in the dielectric material, which are polarized. The bound electron-lattice interaction *will drag the lattice material with them*, under the influence of the electrokinetic force. If the combination of physical electron acceleration (which also can be regarded as current flow) and the AC signal current flow can be resolved, it may be concluded that an instantaneous electrokinetic force, depending on dI/dt, contributes to the Woodward-Nordtvedt effect.

4) The *Campbell and Serrano capacitor modules* seen in their patented drawings in Figs. 6 and 7, as well as the *Electrogravitic Craft Demonstration unit (Norton AFB, 1988)*,[27] can also be analyzed with the electrokinetic force, in the same way that the Brown gravitator force was explained in paragraph (2) above. The current flows in one direction through the capacitor-dielectric and the force is produced in the opposite direction. The Norton AFB electrogravitic craft just has bigger plates with radial sections but the current flow still occurs at the center, *across the plates*. The Serrano patent diagram is also very similar in construction and operation. Campbell's NASA patents include #6,317,310, #6,411,493, and #6,775,123.

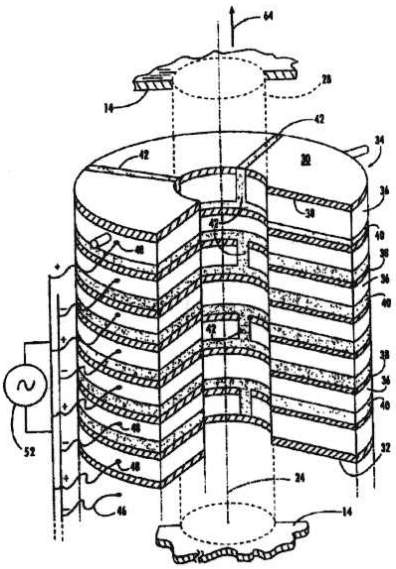


Figure 7. Capacitor propulsion device. *alternating metal and dielectric layers from Serrano's PCT patent WO 00/58623 with upward thrust direction indicated and + and – polarity designated on the side.*

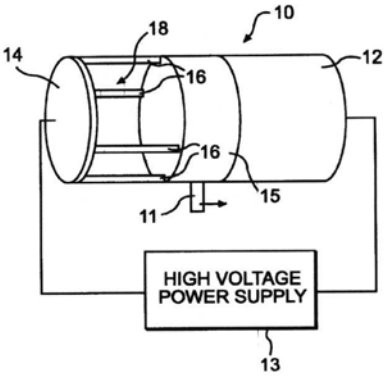


Figure 6. Capacitor module from Campbell's NASA patent #6,317,310 which creates a thrust force. Disk 14 is copper; Struts 16 are dielectrics; Cylinder 15 is a dielectric; Cylinder 12 is an axial capacitor plate; Support post 11 is also dielectric.

V. Electrokinetic Theory Observations

For parallel plate capacitor impulse probes, like Zinsser, Serrano, Campbell, the Norton AFB craft and both of Brown's models, the electrokinetic field of Eq. 3 provides a working model that seems to predict the *nature and direction of the force during charging and discharging phases*. More detailed information is needed for each example in order to actually calculate the theoretical electrokinetic force and compare it with experiment. We note that Eq. 3 also does not suffer the handicap of Eq. 1 since no c^2 term occurs in the denominator. Therefore, it can be concluded that AC fields operating on parallel plate capacitors should create *significantly larger* electrogravitic forces than other geometries with the same dI/dt. However, the current I is usually designated as $I_o\sin(\omega t)$ and its derivative is a sinusoid as well. Therefore, a detailed analysis is needed for each specific circuit and signal to determine the outcome.

Eq. 3 also seems to suggest a *possible enhancement* of the force *if a permeable dielectric (magnetizable) is used*. Then, the value for μ of the material would normally be substituted for μ_o.[28]

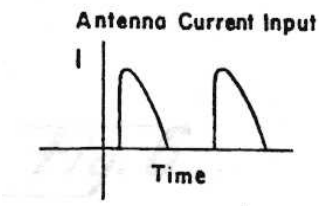


Figure 8. A possible electrokinetic force current waveform. *Schlicher propulsion patent #5,142,861*

A further observation of both Eq. 1 and Eq. 3 is that very fast changes in current, such as *a current surge or spark discharge* has to produce the most dynamic electrokinetic force, since dI/dt will be very large.[29] *The declining current surge,* or the negatively sloped dI/dt however, should create an opposing force until the current reverses direction. *Creative waveshaping seems to be the answer* to this obvious dilemma. Fortunately, a few similar inventions use pulse power electric current generators to create propulsion. The Taylor patent #5,197,279 "Electromagnetic Energy Propulsion Engine" uses huge currents to produce magnetic field repulsion. The Schlicher patent #5,142,861 "Nonlinear Electromagnetic Propulsion System and Method" predicts hundreds of pounds of thrust with tens of kiloamperes input. The Schlicher antenna current input is a rectified current surge produced with an SCR-triggered DC power source (see Fig. 8). The resulting waveform has a very steep leading edge but a *slowly declining trailing edge*, which should also be desirable for the electrokinetic force effect.[30] Furthermore, if this waveform is continued into the negative current direction below the horizontal axis, all of that region reinforces the electrokinetic force, with no opposite forces. Therefore, *a complete sinusoidal wave*, with Schlicher-style steep rise-times is recommended for a signal that contributes to a unidirectional force during 75% of its cycle.

Another observation that should be mentioned is that this electrokinetic force theory does not include the mass contribution to the electrogravitic force which Saxl, Woodward, and Brown's 1929 gravitator emphasize. A contributor to *Electrogravitics II*, Takaaki Musha offers a derived equation for electrogravitics *that does include a mass term* but not a derivative term. His model is based on the charge displacement or "deformation" of the atom under the influence of a capacitor's 18 kV high voltage field and his experimental results are encouraging. He also includes a reference to Ning Li and her *gravitoelectric theory*.[31]

A final concern, which may arise from the very nature of the electrokinetic force description, is the difficulty of conceptualizing or simply accepting the possibility of an *unbalanced force creation pushing against space*. This author has wrestled with this problem in other arenas for years. Three examples include (1) the homopolar generator which creates *back torque* that ironically, *pushes against space* to implement the Lorentz force to slow down the current-generating spinning disk.[32] Secondly (2), there is the intriguing *spatial angular momentum discovery* by Graham and Lahoz.[33] They have shown, reminiscent of Feynman's "disk paradox," that the vacuum is the seat of Newton's third law. A torsion balance is their chosen apparatus as well to demonstrate the pure reaction force with induction fields. Their reference to Einstein and Laub's papers cites the time derivative of the Poynting vector $\mathbf{S} = \mathbf{E} \times \mathbf{H}$ integrated over all space to preserve Newton's third law. Graham and Lahoz predict that *magnetic flywheels with electrets* will circulate energy to *push against space.* Lastly, for (3), the Taylor and Schlicher inventions push against space with an unbalanced force that is electromagnetic in origin.

A further confirmation of an electromagnetic explanation for the electrokinetic force empirically can be found in the semiconductor integrated circuit industry. Bothra's US patent #6,191,481 describes an electromigration impeding metallization lines and oxide slots that purposely cause "back-flow" (col. 6, line 25-30). The back-flow of electrons literally causes a force that not only stops electromigration, but if large enough, may perhaps be argued to cause a transfer of momentum to the lattice. This is a direction for high amperage pulsed current experiments to consider for a theoretical foundation for the propulsive force production.

At the Utah chapter meeting of the National Space Society in 2006, a military contractor also described his work with asymmetric capacitors which were summarized as "I levitated a hockey puck" with pulsed currents.

VI. Eye Witness Testimony of Advanced Electrogravitics

Sincere gratitude is given to Mark McCandlish, who has suffered personal trauma for publicizing this work, offers us one of the most conclusive rendition of a covert, flat-bottomed saucer hovercraft seen by dozens of invited eye-witnesses, including a Congressman, at Norton Air Force Base in 1988. When I spoke to Dr. Hal Puthoff about Mark's story, shortly after the famous Disclosure Event[34] at the National Press Club in 2001, he explained to me that he had already performed due diligence on it and checked on each individual to verify the details of the story. Hal explains,

> "All I was able to determine by my due diligence was: (1) to independently interview the source of the story and verify that, indeed he did tell the story to the individual who had passed it on to me, and (2) to independently interview yet another individual who had heard a similar story from a separate source. BUT, I was never able to verify that the story itself was true, only that there were two individuals who said it was true. I then corrected you with my statement (exact quote): '... the story remains in my 'gray basket' only as 'possibly' true.'"

Since Dr. Puthoff used to work for the CIA for ten years as a director of Project Stargate, this was quite an endorsement, even if only cautiously optimistic. In analyzing the Electrogravitic Craft Demonstration unit (Norton AFB 1988) diagrammed in Fig. 9, it can be compared to Campbell's and Serrano's patented design. A lot can be learned from studying the intricacies of this advanced design, including the use of a distributor cap style of pulse discharge and multiple symmetric, radial plates with dielectrics in between. (See reference 27 for Mark's details.) It also remains in my 'gray basket' as possibly true.

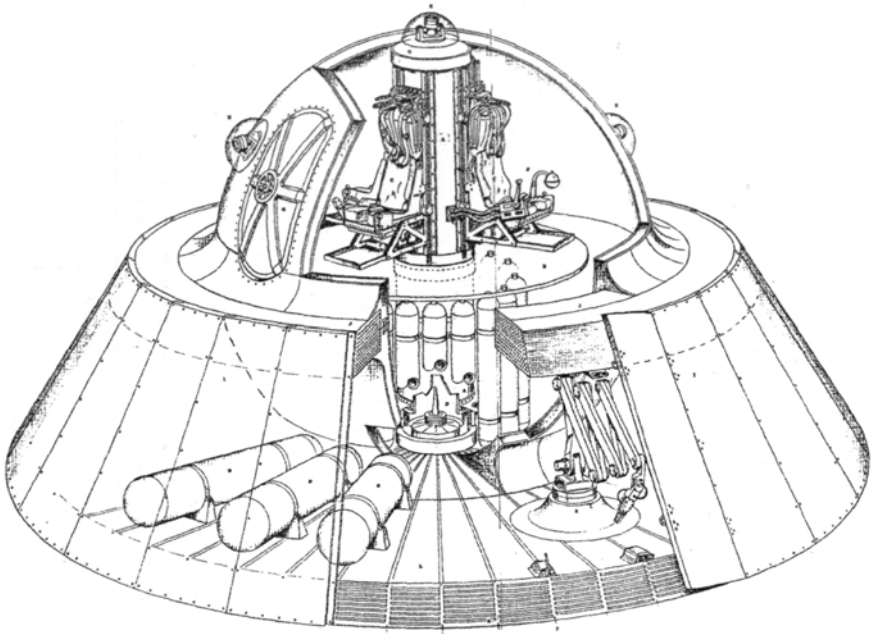


Figure 9. Electrogravitic Craft Demonstration Unit (Norton AFB, 1988) - courtesy of Mark McCandlish

Today, we still use World War II technology on land and in space. My sincere hope is that the validating science contained in *Electrogravitics II* will accelerate the civilian adaptation of this propulsion technology.

---

[1] Valone, Thomas, *Electrogravitics Systems Volume I: Reports on a New Propulsion Methodology*, 6th edition, Integrity Research Institute, Maryland, 2008, ISBN 978-0-9641070-0-7. http://www.integrityresearchinstitute.org/electrogravitics.html

[2] Loder, T., "Outside the Box Space Propulsion and Energy Technology for the 21st Century" AIAA-2002-1131

[3] Valone, Thomas, *Electrogravitics II: Validating Reports on a New Propulsion Methodology,* 3rd edition, 2008, p. 71. URL at http://www.amazon.com/s/ref=nb_ss_gw?url=search-alias%3Daps&field-keywords=electrogravitics+

[4] Zinsser, R.G. "Mechanical Energy from Anisotropic Gravitational Fields" First Int'l Symp. on Non-Conventional Energy Tech. (FISONCET), Toronto, 1981. Proceedings available from PACE, 100 Bronson Ave #1001, Ottawa, Ontario K1R 6G8

[5] Valone, Thomas *The Zinsser Effect: Cumulative Electrogravity Invention of Rudolf G. Zinsser*, Integrity Research Institute, 2005, 130 pages, ISBN 0-9641070-2-3

[6] Cravens, D.L. "Electric Propulsion/Antigravity" *Electric Spacecraft Journal*, Issue 13, 1994, p. 30 http://www.electricspacecraft.com/journal.htm

[7] Peschka, W., "Kinetobaric Effect as Possible Basis for a New Propulsion Principle," *Raumfahrt-Forschung*, Feb, 1974. Translated version appears in *Infinite Energy*, Issue 22, 1998, p. 52 http://www.infinite-energy.com and in *The Zinsser Effect* book.

[8] Valone, Thomas, "Inertial Propulsion: Concept and Experiment, Part 1" Proc. of Inter. Energy Conver. Eng. Conf., 1993, Available as IRI Report #608.

[9] See "Pulsed Electromagnetic Field Health Effects" IRI Report #418 and *Bioelectromagnetic Healing: A Rationale for Its Use* ISBN 978-0-9641070-5-2 book by this author, which explain the beneficial therapy which PEMFs produce on biological cells.

[10] Mark McCandlish's Testimony (p. 131 of *Electrogravitics II*) shows that the Air Force took note in that the electrogravitic demonstration craft shown at Norton AFB in 1988 had a rotating distributor for electrically pulsing sections of multiply-layered dielectric and metal plate pie-shaped sections with high voltage discharges.

[11] See Saxl patent #3,357,253 "Device and Method for Measuring Gravitational and Other Forces" which uses +/- 5000 volts.

[12] Saxl, E.J., "An Electrically Charged Torque Pendulum" *Nature*, July 11, 1964, p. 136

[13] Saxl & Allen, "Observations with a Massive Electrified Torsion Pendulum: Gravity Measurements During Eclipse," IRI Report #702.(Note: 2.2 lb = 1 kg)

[14] Graph of Fig. 1 from online report, Woodward and Mahood, "Mach's Principle, Mass Fluctuations, and Rapid Spacetime Transport," California State University Fullerton, Fullerton CA 92634

[15] Cramer et al., "Tests of Mach's Principle with a Mechanical Oscillator" AIAA-2001-3908 email: cramer@phys.washington.edu

[16] Woodward, James F. "A New Experimental Approach to Mach's Principle and Relativistic Gravitation, *Found. of Phys. Letters*, V. 3, No. 5, 1990, p. 497

[17] Compare Fig. 1 graph to Brown's ONR graph on P.117 of Volume I

[18] Nordtvedt, K. *Inter. Journal of Theoretical Physics*, V. 27, 1988, p. 1395

[19] Mahood, Thomas "Propellantless Propulsion: Recent Experimental Results Exploiting Transient Mass Modification" Proc. of STAIF, 1999, CP458, p. 1014 (Also see Mahood Master's Thesis www.serve.com/mahood/thesis.pdf)

[20] For comparison, 1 Newton = 0.225 pounds

[21] Zinsser, FISONCET, Toronto, 1981, p. 298

[22] Woodward, James "Flux Capacitors and the Origin of Inertia" *Foundations of Physics*, V. 34, 2004, p. 1475. Also see "Tweaking Flux Capacitors" *Proc. of STAIF*, 2005

[23] Jefimenko, Oleg *Causality, Electromagnetic Induction and Gravitation*, Electret Scientific Co., POB 4132, Star City, WV 26504, p. 29

[24] Jefimenko, p. 31

[25] Jefimenko, p. 47

[26] Brown's second patent #2,949,550 (see Patent Section: two electrokinetic saucers on a maypole) has movement toward the positive charge, so the same electrokinetic theory explained above works for both.

[27] McCandlish, Mark, "Testimony of Mr. Mark McCandlish, December 2000," *Electrogravitics II*, Integrity Research Institute, 2005, p. 131

[28] Einstein and Laub, *Annalen der Physik*, V. 26, 1908, p.533 and p. 541 – two articles on the subject of a moving capacitor with a "dielectric body of considerable permeability." Specific equations are derived predicting the resulting EM fields. Translated articles are reprinted in *The Homopolar Handbook* by this author (p. 122-136). Also see Clark's dielectric homopolar generator patent #6,051,905.

[29] Commentary to Eq. 2 states an electrokinetic impulse is produced when the "current is switched on," which implies a very steep leading edge of the current slope.

[30] See the Taylor and Schlicher patents in the Patent Section. – Ed note

[31] Ning Li was the Chair of the 2003 Gravitational Wave Conference. The *CD Proceedings* of the papers is available from http://www.IntegrityResearchInstitute.org

[32] Valone, Thomas, *The Homopolar Handbook: A Definitive Guide to Faraday Disk and N-Machine Technologies*, Integrity Research Institute, Third Edition, 2001. ISBN 0-9641070-1-5 http://www.amazon.com/s/ref=nb_ss_gw?url=search-alias%3Daps&field-keywords=homopolar+handbook

[33] Graham and Lahoz, "Observation of Static Electromagnetic Angular Momentum in vacuo" *Nature*, V. 285, May 15, 1980, p. 129

[34] See the authoritative book by Dr. Steven Greer, *Disclosure: Military and Government Witnesses Reveal the Greatest Secretes in Modern History*, Crossing Point, 2001. It provides the testimony of each witness who participated in the event, plus many more.

Presented to the Space, Propulsion & Energy Sciences International Forum (SPESIF), February 23-26, 2010,
Applied Physics Laboratory – Johns Hopkins University, sponsored by the American Institute of Physics

Permanent Magnet Spiral Motor for Magnetic Gradient Energy Utilization: Axial Magnetic Field

Thomas F. Valone

Integrity Research Institute
5020 Sunnyside Avenue, Suite 209
Beltsville, MD 20705
301-220-0440, IRI@starpower.net

Abstract. The Spiral Magnetic Motor, which can accelerate a magnetized rotor through 90% of its cycle with only permanent magnets, was an energy milestone for the 20th century patents by Kure Tekkosho in the 1970's. However, the Japanese company used old ferrite magnets which are relatively weak and an electrically-powered coil to jump start every cycle, which defeated the primary benefit of the permanent magnet motor design. The principle of applying an inhomogeneous, anisotropic magnetic field gradient force $F_z = \mu \cos \varphi \, dB/dz$, with permanent magnets is well-known in physics, e.g., Stern-Gerlach experiment, which exploits the interaction of a magnetic moment with the aligned electron spins of magnetic domains. In this case, it is applied to $dB/d\theta$ in polar coordinates, where the force F_θ depends equally on the magnetic moment, the cosine of the angle between the magnetic moment and the field gradient. The radial magnetic field increases in strength (in the attractive mode) or decreases in strength (in the repulsive mode) as the rotor turns through one complete cycle. An electromagnetic pulsed switching has been historically used to help the rotor traverse the gap (*detent*) between the end of the magnetic stator arc and the beginning (Kure Tekko, 1980). However, alternative magnetic pulse and switching designs have been developed, as well as strategic eddy current creation. This work focuses on the switching mechanism, novel magnetic pulse methods and advantageous angular momentum improvements. For example, a collaborative effort has begun with Toshiyuki Ueno (University of Tokyo) who has invented an extremely low power, combination magnetostrictive-piezoelectric (MS-PZT) device for generating low frequency magnetic fields and consumes "zero power" for static magnetic field production (Ueno, 2004 and 2007a). Utilizing a pickup coil such as an ultra-miniature millihenry inductor with a piezoelectric actuator or simply Wiegand wire geometry, it is shown that the necessary power for magnetic field switching device can be achieved in order to deflect the rotor magnet in transit. The Wiegand effect itself (bistable FeCoV wire called "Vicalloy") invented by John Wiegand (Switchable Magnetic Device, US Patent #4,247,601), utilizing Barkhausen jumps of magnetic domains, is also applied for a similar achievement (Dilatush, 1977). Conventional approaches for spiral magnetic gradient force production have not been adequate for magnetostatic motors to perform useful work. It is proposed that integrating a magnetic force control device with a spiral stator inhomogeneous axial magnetic field motor is a viable approach to add a sufficient nonlinear boundary shift to apply the angular momentum and potential energy gained in 315 degrees of the motor cycle.

Keywords: Magnetic Gradient, Spiral Magnet, Inhomogeneous Magnetic Field, Piezoelectric-Magnetostrictive, Magnetic Pulse Control, Magnetostatic Energy Density, Axial Magnetic Field
PACS: 75.50.Ww, 75.30.Gw, 77.65.-j

INTRODUCTION

Kure Tekkosho in the 1970's, Figure 1, secured a number of Japanese patents directed toward a spiral set of magnets, a Spiral Magnetic Motor (SMM) that can accelerate a magnetized rotor. However, the Japanese company used old ferrite magnets which possess a relatively weak coercive force and an additional electrically-powered coil which defeated the purpose of the motor design. Therefore, its Magnetic Wankel was not a successful attempt at a self-powered motor (Scott, 1980). The principle is a magnetic gradient that is analogous to the geographic gravity gradient where a steeper incline (higher gradient) provides a higher speed for vehicles going downhill. Such a magnetic field varying spatially is also found in a linear track (Arrott, 2006).

As with the Stern-Gerlach physics experiment to separate spinning protons, the magnetic field is stronger at one end of the track, whether it is linear or circular with an inhomogeneous magnetic field. The equation for the linear magnetic gradient force, equation (1), depends upon the cosine of the angle ϕ between the magnetic moment μ_s and the direction of the gradient of the magnetic field (Gautreau, 1978). As an aside, Gautreau gives the subscript s to the magnetic moment symbol used here since it is associated with the intrinsic angular momentum S of the electron.

$$F_z = \mu_s \cos\varphi \frac{dB}{dz} \tag{1}$$

An example of a linear magnetic gradient force is in Hartman's US patent #4,215,330 which moves a steel ball bearing up a 10 degree incline with permanent magnet gradient force, Figure 2. The applications for a successful completion of this proposed prime mover fall into two basic categories but others may be discovered at a later time: The first category is the production of electrical power, replacing fossil-fuel based generation, for a Magnetic Microturbine. The second category is the production of torque for automobile engines and basic transportation with a Magnetic Car. Both applications will free the countries of the world from dependence on oil and natural gas, thus raising the standard of living for everyone, especially in the third world, while being a clean energy source, once an efficient magnetic switching mechanism is achieved.

The Spiral Magnetic Motor invented by the Kure Tekkosho Co. (Ono Gunji, "Permanent Magnet Prime Mover," JP55144783) has remained an Electrically-Stimulated Linear Induction Motor (ESLIM) but also utilizing a little known physics principle called the permanent magnet "magnetic gradient force." Though there have been incremental improvements over the past thirty years, since this investigator became aware of the invention, no scientific investigation into the feasibility of a true magnetic motor (without electric assist) has been made until now. Permanent magnet motors that try to achieve unusual coefficients of performance with changes in magnetic geometry, switching reluctance schemes and various magnetic configurations generally have not been successful in developing an LIM that is driven solely by magnetic energy. There are some designs that should be regarded as conventional and others as promising in the search for a true magnetic motor that is entirely powered by the magnetic gradient force. It is proposed that a MAGnetic Linear Induction Motor (MAGLIM) is inevitable with the application of proper engineering principles, *since magnetic field switching is now easier than ever*.

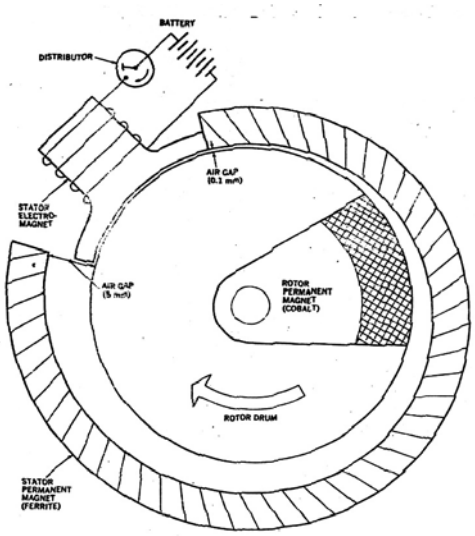


FIGURE 1. Kure Tekko "Magnetic Wankel" running in repulsive mode

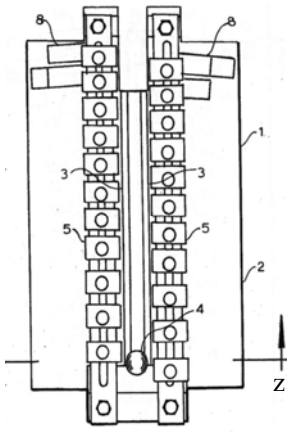


FIGURE 2. Magnetic gradient force in Hartman's US patent #4,215,330.

The generation of inhomogeneous magnetic fields in a linear direction forming a magnetic gradient is a crucial feature of the proposed MAGLIM. It also is well-known magnetostatics and a promising area of research as explained in the references to textbook physics principles.

The linear magnetic gradient force proportional to dB/dz displayed in Figure 2 (with z pointing to the top of the page) is converted to dB/dθ in the circular case, equation (2), utilized in this paper, where M is the macroscopic magnetic moment and φ is the angle between M and B. Taking the diagram of Figure 1, a radial magnetic field decreases its attraction as the rotor turns through one complete cycle. A large electromagnetic pulsed switching is usually needed, as was used in Figure 1 and in two of the recent patents awarded to H. Paul Sprain (Apparatus and Process for Generating Energy, US Patents #6,954,019, 2005 and #7,265,471) to help the rotor traverse the gap (detent) between the end of the magnetic spiral stator arc and the beginning of the arc.

$$F_\theta = M \cos\varphi \frac{dB}{d\theta} \tag{2}$$

SPIRAL MAGNET MOTOR CONSIDERATIONS

In this paper, *axial* magnetic field orientation is experimentally explored as a matter of convenience. Simulation with FEMM also indicated that a transverse field was of higher density with the axial magnet (parallel magnets of opposite poles) than the radial magnetic field design with opposite poles, perhaps because radial magnets in the attraction mode have a very strong radial field and low transverse (circumferential) field. A second part to this paper will be published by this author on *radial magnetic field* orientation SMM designs, which is more difficult to engineer but achieves a stronger coupling. As a design criterion, the moving magnetized rotor in the Spiral Magnetic Motor needs to be modeled as a *changing magnetic field* (*dB/dt*) with regard to the stator as well.

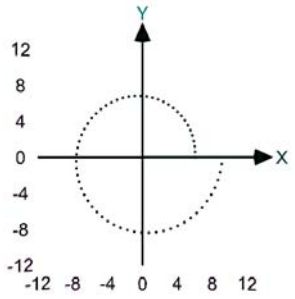


FIGURE 3. Example of Archimedean spiral for SMM stator magnets with $r = 6 + \theta/2$.

An example of one of the Archimedean spiral that was used in these experiments is in Figure 3. The equation of the stator spiral, in polar coordinates is $r = 6 + \theta/2$. A dotted plot with Reuniter Ver. 2.6, was used to facilitate precise cylindrical magnet placement for the axial stator magnets. Other spirals were also compared to maximize the circumferential force F_θ to achieve the highest revolution speed and in some cases (e.g., 1.25" and 3" rotor designs), for the rotor to completely counteract gravity when the plane of the wooden or acrylic stator was placed vertically, as in Figure 3, with the Y-axis upwards.

With the Archimedean spiral of Figure 3, the basic equation for the radial component of the linear magnetic field can be written in cylindrical coordinates as $B_r = r + n(\theta)$ where (theta) is in radians. Plotting such a *linear relationship*, the magnetic gradient (slope) is simply n, where $n = dB/d\theta$. It is conceivable that a parabolic $B_r = a(\theta)^2 + b(\theta)$ or even exponential relationship $B_r = ae^\theta$ may be theoretically simulated and experimentally tested in the future. These relationships would provide a higher magnetic gradient at the exit point where $\theta = 2\pi$ radians which could increase the peak kinetic energy of the rotor. Placing the stator magnets slightly closer together near the end of the spiral has also been found to speed the rotor up near the end of its cycle and increase its kinetic energy slightly, thus applying a nonlinear magnetic gradient.

Spiral Magnetic Motor Energy Balance

The idealized linear relationship of B and rotation angle was realized in the Sprain motor project (2-03-04 HPS data), for which this investigator was a consultant. The magnetic gradient, using ferrite magnets, was $dB/d\theta \cong 100$ Gauss/rad. Of course, the torque can be theoretically calculated from the classical equation $T = r \times F$ with the force related to the magnetic potential energy by $F = \nabla U$ where $U = M \cdot B$ and M equals the magnetic moment, also known as the magnetic dipole moment (Halliday, 1968). However, the force F is really a trigonometric vector sum of the tangential acceleration and the centripetal acceleration, made only more complicated by the surface magnetic field distribution and relative coupling between rotor and stator. In other words, the attempt to simplify the interaction to a simple dot product of the magnetic dipole and the magnetic flux density can only agree experimentally where there is a point dipole and a homogeneous magnetic field. Neither of these conditions exists in the ESLIM or MAGLIM configuration.

It is an educational exercise, however, to follow through with the standard energy balance of kinetic and potential energy. When taking the gradient of the dot product above to find the force *F*, the result is actually

$$F = \frac{M}{r}\frac{\partial B_r}{\partial \theta} + M\frac{\partial B_r}{\partial r} \tag{3}$$

The partial derivative $\partial B_r / \partial r$ can be argued to be equal to zero because the motion of the rotor is only in the circumferential direction (θ) and only uniform, permanent magnets are used in the stator. Torque applied to the rotor ($T = r \times F$) with *r* and *F* perpendicular ($\sin\theta = 1$), is simply

$$T = M\frac{\partial B_r}{\partial \theta} \tag{4}$$

A radial magnetic design is suggested by the term $\partial B_r/\partial\theta$ which *should be maximized for optimum torque production.* As we revisit the calculation for potential energy U, it is apparent that the dot product becomes

$$U = M_r B_r + M_\theta B_\theta \tag{5}$$

However, the magnetic moment of an axially or radially magnetized rotor should have a zero θ component that will make M_θ also zero. The conclusion of all of the preceding physics leads to the classical work-energy calculation $W = F \cdot dx$, which for rotation about a fixed axis becomes (Halliday, 1968)

$$W = \int T \cdot d\theta = \int M \; dB_r \tag{6}$$

Since M is a constant for a given magnet, the change of the magnetic field over a cycle from 0 to 2π is thus determined to be the only variable that contributes to the work done in the SMM. The experimental measurements for radial magnetic field variation will be included in the second part to this paper, since only axial magnetic field rotors and stators were used in this part.

The usual method is to set the work equal to the kinetic energy $\frac{1}{2}I\omega^2$ where the moment of inertia $I = \frac{1}{2}mr^2$ for a cylinder but in the case of ESLIM, it is circular reasoning. Though parameters can be calculated in this manner, no new fundamental information about the open system energy input is produced with this classical approach.

As an alternative insight into magnetic field energy, the maximum electrostatic field energy density can be compared to the magnetostatic field energy density for reasonable field intensities available today (Niarchos, 2003). The maximum electric field that can be applied in experimental circumstances in air is approximately 3 MV/m. Therefore, the maximum electrostatic energy density that can be expected to be available is

$$U_E = \tfrac{1}{2}\varepsilon_o E^2 \tag{7}$$

where ε_o is the permittivity of free space and E is the electric field (3 MV/m), giving an electric energy density on the order of 40 J/m^3. However, today NdFeB magnets, grade N52, have approached the maximum flux density that iron theoretically possesses: approximately 20 kG or 2 T which gives, using the permeability μ_o of free space, a magnetostatic potential energy density of

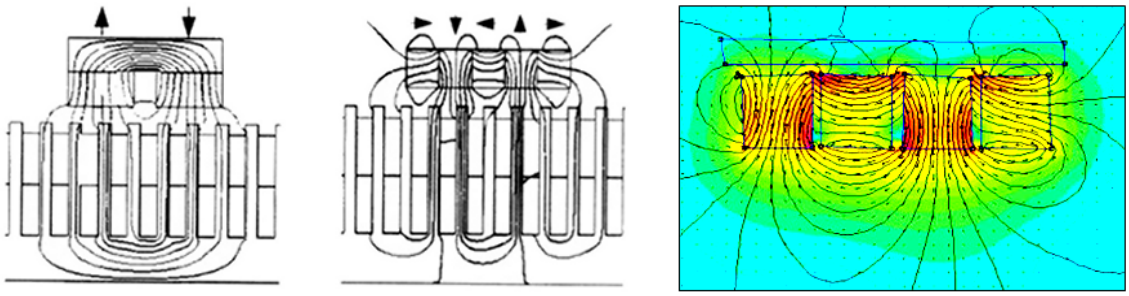
$$U_B = \tfrac{1}{2}B^2/\mu_o \tag{8}$$

which equals approximately 2 MJ/m^3 which is about *50,000 times* the available energy density of electric fields. This shows why magnetostatic interactions dominate for macro-world power production.

A separate paper is being co-authored on the theoretical quantum mechanical basis of magnetism in order to include the contribution from zero point energy, the Bohr magneton and the coupling of electron spin to the quantum vacuum. The orbital angular momentum of the electron contributes very little (less than 2%) to magnetism, while spin angular momentum is the primary source of microscopic magnetism (Chikazumi, 1964). The derivation of the total energy of a magnetic system given by the sum of the magnetostatic energy and the anisotropy energy due to the rotation of spins which is gained from the angular momentum of the vacuum is the basic thesis. Thus, the energy source of magnetic-powered devices will no longer be mysterious or elusive. Certainly energy physics has to be considered and evaluated in the operation of ESLIM or the proposed MAGLIM. Though classical physics does not provide a satisfactory explanation for the possibility of a self-sustained operation for either design, even with an open system, quantum physics offers a rigorous consideration of the angular momentum contribution from the quantum vacuum to electron spin, the main contributor to ferromagnetism (Valone, 2008).

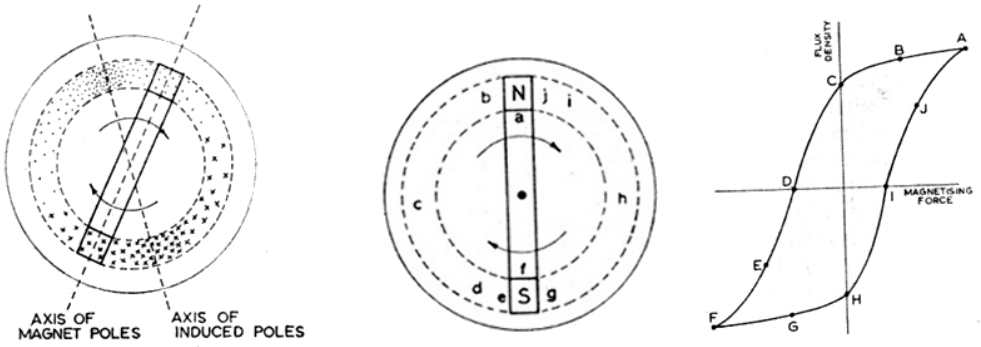
Halbach Magnet Arrays

Examining linear induction motors (LIMs), the Halbach array is used (rotating magnetic domains assembled (together) to provide a "superior magnetic flux property." Halbach arrays demonstrate the ability to create magnetic fields on only one side of the array (in this case, the downside). Seen in the diagram in Figure 4 the standard mover with (a) the vertical magnetization (up and down) is compared to the (b) Halbach array style which provides a *tighter coupling and stronger attraction* between the mover and stator. The Halbach array also induces a dB/dt term since the changing magnetic field direction appears as a time-dependent rotating magnetic field to the mover. This also allows a resonant frequency design to be implemented into the mechanical assembly of magnets as well. The science of linear motors has progressed significantly in the past few decades due to the heroic efforts of the late Professor Eric Laithwaite of Queens College, London who perfected magnetic levitation (MAGLEV) for commercial train applications (Laithwaite, 1970; Valone, 2002). Reviewing Figures 4 and 5, we see some of these LIM design techniques of Laithwaite's that are used to enhance the performance capability in the MAGLIM.



(a) **(b)** **(c)**

FIGURE 4. Typical (a) horseshoe magnet above a LIM stator, where arrows indicate the magnetic field direction, versus the (b) Halbach array above a LIM, showing the higher field intensity present, and (c) a FEMM simulation of a Halbach array, showing the asymmetry of flux lines.



(a) **(b)** **(c)**

FIGURE 5. Prof. Laithwaite's "Hysteresis Motor" creates delayed eddy currents based on the type of metal plate: (a) shows like poles formed below and behind bar magnet rotor; (b) and (c) show the points on the B-H curve corresponding to certain hysteresis points on the metal plate during the rotation cycle.

For the past ten years, modern high strength NdFeB magnets are providing a lightweight alternative to electromagnets for "on-board magnetic field sources" in a magnetic levitation vehicle. Therefore, the trend is toward more NdFeB Halbach arrays (Hoburg, 2004).

The magnetic fields in Halbach array "rotate" 90° from one magnet to the other, as it passes over the stator in Figure 4b, in order to accomplish two separate purposes:

a) to create fields that *vary periodically* with space in the direction of travel of the vehicle, with a dominant first Fourier component;

b) to put nearly all of the field either above or below the array, so as to *maximize the strength of the field* that interacts with the track (stator).

It is suggested that Halbach arrays can be an important addition to the rotor design of MAGLIM, where they can be added radially to the ends of the radially oriented magnet rotors. If Halbach arrays were used in the axial magnet orientation design, it is proposed that a few layers of soft iron shielding at the end of the spiral stator will produce a dramatically reduced detent and increased overshoot.

Hysteresis Magnetic Motor and Favorable Eddy Currents

Another fascinating technique that utilizes Lenz's Law which opposes any changing magnetic field is the magnetization effect on a metal plate with a particularly favorable permeability that improves and propels the magnetic rotor, which is of the same design as ESLIM (Laithwaite, 1970). Called the *Hysteresis Motor* (Figure 5), it

is designed to have a bar magnet parallel to the rotor with North and South pole radially oriented on the rotor. The important trick is to add a low permeability metal plate underneath the rotor that becomes momentarily magnetized due to Lenz's Law during the passage of the rotor over it. Favorable repulsive magnetic fields (like poles) form behind the rotor *as long as the eddy current formation time for that metal is of the same order of magnitude as the speed of the rotor.* As seen in the diagram, each of the induced poles in the steel "carries a high flux density" and pushes the rotor further away, "giving the effect of a pair of permanent magnet poles which are displaced from the position of the driving poles." Perhaps the conclusion to this design is the most compelling for MAGLIM: "This condition is therefore suitable for the production of continuous torque, without further relative motion between magnets and disc and the machine can run synchronously on the residual magnetism effect" (Laithwaite, 1970). The Hysteresis Motor may use axially magnetized poles (perpendicular to the disc) or radial magnets as in Figure 5(a), as well as custom L-shaped magnets in the MAGLIM to achieve a dual effect from the stator and the disc.

Seen in Figure 5 is the design effect of the rotor and disc with the typical hysteresis curve (B-H curve) which is now impressed onto the disc during dynamic motion. An interesting variation of the motor is the "Rack and Pinion" type of hysteresis motor that combines the teeth or slots of Figure 4 that make up the rack of a standard LIM with the magnetized rotor of Figure 5.

Since the rotor is moving, there is a delay in the Lenz' Law effect that creates like poles BEHIND the rotor pole, which normally tries to *oppose* the build-up of magnetic field intensity in the disc. The like magnetic pole then PUSHES the two away from each other but only if it has a delayed reaction. The governing equation, undisclosed by Laithwaite, but uncovered by this investigator, is due to a time lag for corresponding induction, derived from the same equation used in the theory of diffusion with $\rho/4\pi\mu$ as the diffusion constant. In series form, MacColl's equation for *a build-up of flux in sheets subjected to a sudden change of field* has a first term,

$$\frac{B}{\mu H} = 1 - \frac{8}{\pi^2} e^{-\beta t} \tag{9}$$

with t = time (sec) and

$$\beta = \pi\rho / (4\mu\delta^2) \tag{10}$$

where ρ = resistivity, μ = permeability, δ = thickness of plate, with a field H suddenly applied (Bozorth, 2003).

The SMM fits this equation fairly well since the angular velocity was estimated to be on the order of a revolution per second (1 RPS = 1 Hz) from five different spiral motors that were constructed and tested. Therefore, if the build-up of the opposing eddy current field is on the order of a tenth of a second, it is likely to be suitable for a delayed response of eddy currents that would be favorable. It has been found by this investigator that by choosing aluminum or copper for example, the permeability will be the same as free space ($\mu_o = 4\pi \times 10^{-7}$), which is very low and the resistivity is also low. Choosing an aluminum plate that is about a centimeter (1 cm) thick would also be a good choice since the thickness of the sheet "delta" is squared and also in the numerator. Altogether, the calculation shows a relatively *slow build-up over a tenth of a second* and only about 30% at a millisecond after the stator field magnet is applied to the rotating disk, which is in keeping with a delayed eddy current predicted by Laithwaite that will push the rotor along.

MAGNETOSTRICTIVE-PIEZOELECTRIC PULSER FOR DETENT NEUTRALIZATION

For years, an electromagnet has been the only detent neutralizer used for the ESLIM, Figure 1, for the purpose of producing a pulsed magnetic field that cancels the end field with an expenditure of 150 watts for 0.040 seconds (6 Joules of energy, 12-12-02 H.P. Sprain data). Such a process is also theoretically referred to as regauging or changing boundary conditions suddenly. Recently, new improvements to switching magnetic fields have become available for low frequency applications (Ueno, 2003). As seen in Figure 6, a new combination of a giant magnetostrictive (MS) rod with a piezoelectric (PZT) actuator invented only a couple of years ago creates a remarkably efficient effect for static or dynamic operation. The MS-PZT magnetic field generator *consumes no power* to maintain a static magnetic field and also demonstrates a 77% energy savings (0.27 W vs. 1.2 W) for dynamic pulsed magnetic field production up to about 10 Hz (600 RPM) and even higher for 1 Hz (60 RPM) or lower, in the range where ESLIM operates (Ueno, 2007b). This is the primary innovative concept of this investigator that the old-fashioned pulse coil for ESLIM be replaced with this MS-PZT device for a possible solution to the proposed MAGLIM.

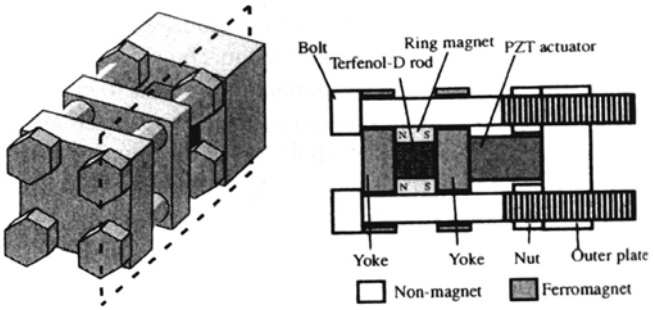


FIGURE 6. Magnetostrictive and piezoelectric (MS-PZT) combination in a vise creates pulsed magnetic fields with surprisingly little energy input.

COMPARISON OF POWER CONSUMPTION OF ELECTROMAGNET AND DEVICE IN STATIC AND DYNAMIC OPERATION

	E.M.	Device
Static operation		
Max input voltage [V]	2	200
Power consumption [W]	3.0	0.0
Dynamic operation (10Hz)		
Max input voltage	2	200
Power consumption	1.2	0.27
Dynamic operation (100Hz)		
Max input voltage	2	200
Power consumption	1.2	2.47

FIGURE 7. Energy consumption for the MS-PZT (Device) as compared to an electromagnet. Note the device has zero power consumption in the static case due to the charge storage capability of piezoelectric transducers.

Wiegand Pulse Generator

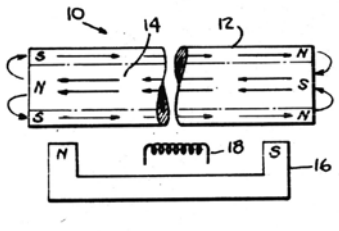


FIGURE 8. A two-layer Wiegand wire with pickup coil.

An additional discovery by this investigator that could regauge or recharge the rotor at the end of each cycle is the use of a Wiegand pulse generator to produce a magnetic pulse solely powered by Barkhausen effect caused by the passing magnetic field, *without recoil of any kind* (Figure 8). Naturally, the energy consideration of switching microscopic magnetic domains (0.1 mm) is an important part of such a treatment but beyond the scope of this paper. The *Barkhausen effect* is defined as the collective, sudden alignment of magnetic domains (Barkhausen, 1919) which can be heard by using a magnetic pickup coil speaker or microphone. This led to a surprisingly important effect that this investigation has uncovered: a Wiegand module with a coil surrounding it or even a bare ultra-miniature induction coil could power the MS-PZT without any external electricity input of any kind utilizing the changing magnetic field of the passing rotor. Barkhausen discovered that certain materials like Permalloy, if wound with a wire, create a voltage pulse, just like a coil exposed to a momentary magnetic field, as the magnetic domains shift together to align themselves with the field. In 1973, John Wiegand patented a breakerless ignition system (# 3,757,754) as seen in Figure 8. The improved wires called Vicalloy, subsequently made by Wiegand Electronics and now a host of other manufacturers, generate 12 V to 16 V (with a coil wound around the sire) without any electrical input and can easily conduct through 1000 feet of 24-gauge wire, producing several milliwatts of power. They are already used in keyless door opening locks in hotels and in a host of other applications worldwide, without batteries of any kind. In Figure 8, it is proposed that the rotor (16) can draw close to a bundle of Wiegand wires (14) or a larger, custom-designed Wiegand rod, at the end of the spiraled stator track and coil (18) necessary to trigger the MS-PZT pulsed magnetic field.

Wiegand designed the wire (10) in Figure 8 to have a low coercivity core (14) and high coercivity shell (12) for resetting the magnetic alignment for another pulse cycle from a passing magnet (16). Coil 18 can be added for a desired voltage output pulse if required.

Piezoelectric Actuators Lift Oranges

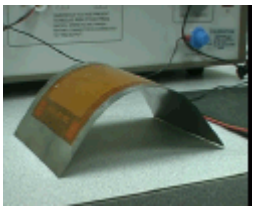


FIGURE 9. Piezo-Composite Actuator

Piezoelectric actuators called "piezo-composites" licensed by NASA are also available to quickly and effectively displace a stator magnet with a range of 1000 in-lb/in^3 using only voltage pulses and virtually no current (Smart Material Corp., Sarasota FL, www.smart-material.com, d31 type P2). The Macro Fiber Composite (MFC) is an innovative actuator that offers high performance and flexibility in a cost-competitive device. The MFC consists of rectangular piezo ceramic rods sandwiched between layers of adhesive and electroded polyimide film. This film contains interdigitated electrodes that transfer the applied voltage directly to and from the ribbon shaped rods. This assembly enables in-plane poling, actuation, and sensing in a sealed, durable, ready-to-use package. When embedded in a surface or attached to flexible structures, the MFC provides distributed solid-state deflection and vibration control or strain measurements. While on display at a SPESIF-2009 exhibit booth, a P1 type advanced piezo-composite such as in Figure 9 repeatedly lifted an average-sized, half-pound orange. Therefore, its capability to quickly move the last critical magnet away from a stator position during rotor overshoot is another method to reduce detent and disengage the rotor at the end of the SMM cycle.

EXPERIMENTAL TRIALS

One problem with the spiral magnetic motor MAGLIM is designing the magnet alignment properly to maximize the circumferential force while minimizing the radial force. The general design consideration of using axial magnetic orientation emerged from FEMM simulations (*e.g.*, Figure 4c) for improving acceleration due to the magnetic gradient force while reducing the radial attraction of rotor to stator magnets. As noted above, a second part to this paper will explore the radial magnetic orientation designs for similar sized rotors.

Work and Back Torque

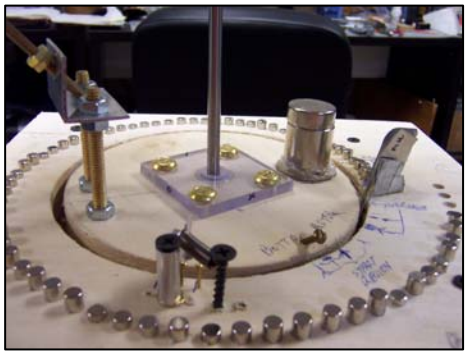


FIGURE 10. Photo of 6" rotor in the potential energy well at end of cycle.

The first series of MAGLIM models that were assembled and tested included NdFeB magnets (NdFeB 40, NdFeB 42 and NdFeB 50). The rotors and stators were constructed from hardwood with low permeable brass, stainless steel, acrylic and aluminum fittings. Figure 10 shows the six-inch rotor model at the equilibrium point at the end of a cycle at its lowest potential energy, with a 1" x 1.5" cylindrical rotor magnet. The spring latch at the bottom is designed to secure the *overshoot* which surprisingly, averaged about 45° or about $\pi/4$ radians. The assembly on the left is an experimental counterweight that was also used for impact with a mirror-image of the same SMM above it on the same shaft for momentum exchange experiments. Mu metal shielding strips are seen at the track end.

The range of SMM models that were built includes 1.25, 3, 4, 6 and 10-inch diameter (Figure 11). It was found that using inches is convenient for hole saws. The measurement of back torque was made for all of the various rotor models. Figure 12 shows the basic linear slide Newton scale that was used for measuring back torque (4 inch model shown), ensuring that the scale was perpendicular to the radius of the rotor. The initial, maximum force to begin disengagement was recorded as an approximate measure of the work required as in equation (6). However, as further measurements were made closer to the potential well, at the end of the cycle, a gradual change in back torque occurs.

For example, with the 10-inch rotor model, the 45° section of arc between the latched final stop (see bottom of Figure 10) and the top of the potential hill which starts another cycle (clockwise from latch) was split into four equidistant subsections, about 11° each, for the 10-inch rotor. The torque exerted by the rotor was then measured at each location. In addition, the 275° section of arc between the top of the potential hill, marking the beginning of

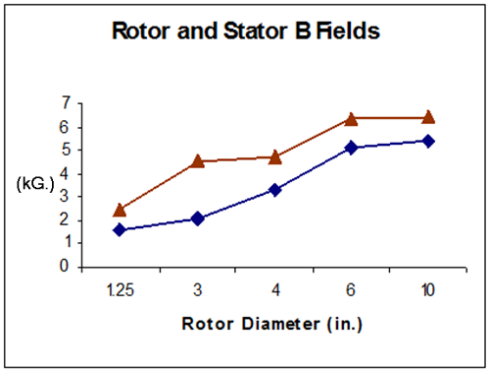


FIGURE 11. ▲ = rotor, ♦ = stator magnetic flux density.

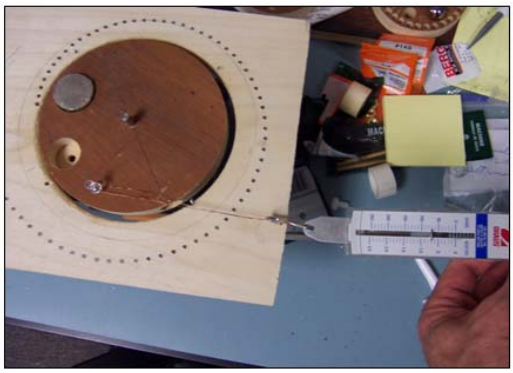
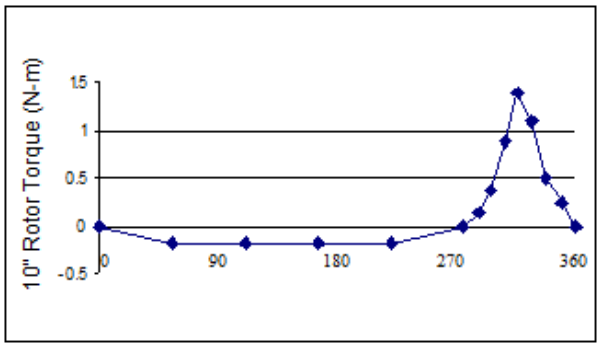
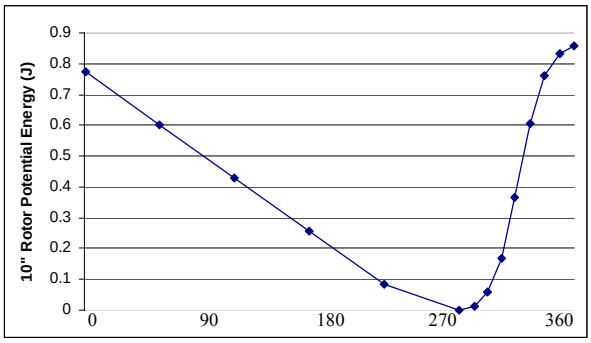


FIGURE 12. Measuring back torque, Ohaus scale.

another cycle, and the bottom of the potential well, was also split into five convenient equidistant subsections, 55° each, with torque measurements made at each subsection. Not surprisingly, the force/torque measurements at each of the subsections were the same for four out of the five points, indicating a *successful design of a linearly increasing magnetic flux gradient* and a uniform angular acceleration. The results of the torque measurement are seen in Figure 13(b). The graph clearly shows the creation of back torque (positive torque) from 275° to 360°, the uniform forward torque (negative work) is also apparent from 0° to 275°. This is the first time such information has ever been measured for an SMM.





(a) **(b)**

FIGURE 13. 10-inch rotor (a) torque and (b) potential energy versus angular displacement (degrees).

Furthermore, examining the values for the measured torque in Figure 13(a), it becomes apparent that they also represent the derivative at each point of the *potential energy curve* from equations (4) to (6). Such a potential energy curve, obtained by trapezoidal integration of the torque data points, is shown in Figure 13(b). Remarkably smooth, it decreases with a negative slope from 0° until reaching zero slope at the inflexion point of 275° which is an equilibrium point at the potential well. From 275° onwards, the potential energy U_B increases through overshoot region until reaching the maximum (steepest) derivative value at 315° where U_B continues to increase but with a decreasing slope (torque) until it levels out at the second inflexion point at 360° which corresponds to the maximum value for U_B. Further analysis on the energy balance can be done to determine the net work performed to move the rotor from the latched position of 315° to the top of the potential energy curve at 360°. Taking the force times distance, which for a rotating system is torque T integrated over the arc length dθ, or $W = \int T\, d\theta$ from equation (6), we find the amount of energy needed to overcome the last section of the SMM cycle.

The work done moving the 10-inch rotor from the latched point (315°) to the second inflexion point (360°), converting to 0.77 radians for the angular displacement θ region of interest, approximately equals 0.52 joules. This value compares favorably with the peak kinetic energy measured for the 10-inch rotor of approximately 0.80 joules (as seen in Figure 14) based on rotor mass and angular velocity.

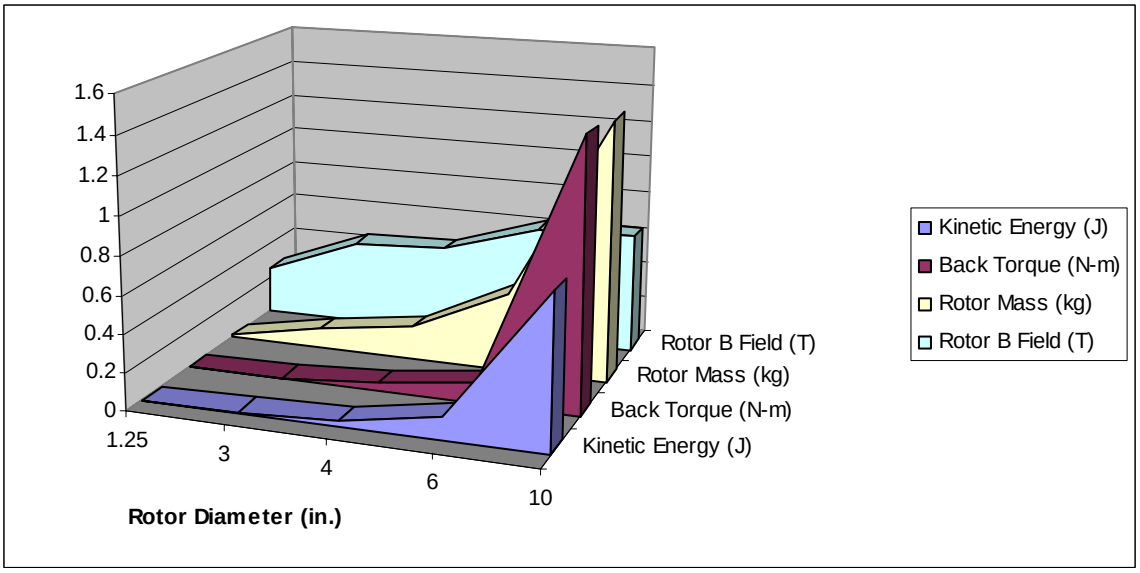


FIGURE 14. Comparison of the peak kinetic energy, peak back torque, rotor mass and rotor magnetic field for all of the five SMMs.

Rotor Mass, Angular Velocity, and Kinetic Energy

The peak kinetic energy measured for the 10-inch rotor is approximately 0.80 joules (Figure 14) based on rotor mass and angular velocity.

However, it is important to note that the 0.80 J of kinetic energy, which was calculated from the peak velocity, was consumed in climbing the potential hill from 275° to 315° where the rotor was latched into place, thus storing the accumulated kinetic energy before it is normally lost in the energy dissipative, oscillatory rebound which settles at the potential well. *Another 0.52 J of work energy is still needed*, according to the above calculation, for the rotor to pass from the 315° latch to the security of the 360° potential hill inflexion point in order to begin another cycle. The production of such an energy-equivalent in terms of the innovative suggestions from the previous section remains the focus of ongoing research in the SMM. Rotors with multiple magnets are also being tested as well as multiple rotors on the same shaft, in order to create a favorable energy production ratio.

More detailed information about the energy dynamics of the SMM in action was obtained by installing an interchangeable phototransistor harness above each of the SMMs and measuring the displacement versus time for one 5-cm and seven 10-cm intervals circumferentially around a 10-inch diameter circle, so as to accommodate every one of the SMMs. Each 10-cm circumferential displacement equals 0.787 radians or about 45°. Vishay BPW76B phototransistors with a TO-18 package were used with a transistor socket mounted horizontally at the appropriate positions. A centrally mounted light source was used to equally keep each PNP phototransistor in series with a 10K resistor in the on state and the output near ground. A thin, 1/16” thick brass rod, about the same thickness as the phototransistor window (Figure 15), was mounted securely on the perimeter of each rotor disk, rotating with the disk, to momentarily block the light and trigger a sharp pulse output of about 4 V which was sent into a computer programmed for data acquisition in BASIC. The program uses interval-halving to calculate the velocity for each interval and was originally applied to college physics student air track experiments for velocity and acceleration measurements. In this case, the circuitry was adapted to a circular arrangement around the periphery of the 10-inch harness with L-brackets made from aluminum screwed into acrylic with brass screw, all of which avoid disturbance of the magnetic fields due to their extremely low permeability.

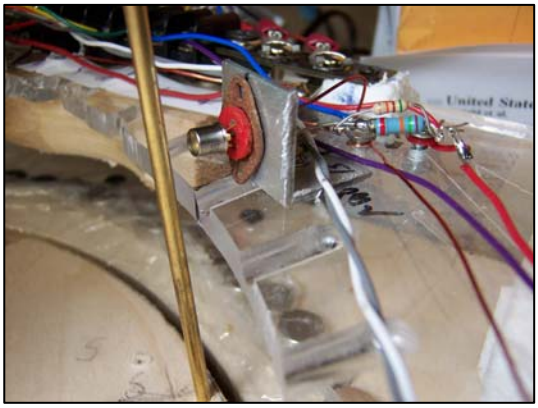


FIGURE 15. Phototransistor in place with vertical brass rod trigger passing by to block central light.

The multiple trials with each of the SMM 1.25, 3, 4, 6, and 10-inch rotor design models created repeatable but averaged data. As seen in Figure 14, the rotor magnetic flux density B varied from 0.25 T for the smallest rotor, to 0.45 T and 0. 47 T for the 3" and 4" models respectively, and 0.63 T and 0.64 T for the 6" and 10" models respectively. All magnetic field measurements were made with an Integrity Design & Research gaussmeter, Model IDR-329. The results of the timed interval sampling during a single cycle of all of the SMMs are shown in Figure 16, along with a polynomial trend curve added for the 4" rotor data. What emerges from the data is the observation that the 3" and the 4" rotor models are the fastest of all of the models, actually reaching the fastest response time of the computer acquisition system. It is likely that the 3-radian data point of the 3" rotor should be closer to 18 rad/sec since 200 cm/sec (16 rad/sec) is the maximum speed that can be measured with the program due to the eight-bit processor. Otherwise, all of the other data points are reliable and within a +/- 10% error tolerance. The small 1.25-inch (1" in the key for convenience) was the slowest rotor with the lowest B field and rotor mass as seen in Figure 14. However, interestingly, the 6" and the 10" rotors have almost identical angular velocity data, with the 10" rotor slowing down slightly as its potential well was well short of the end of the track (45° from the end vs. 25° from the end for the 6" rotor). If for no other reason, it is apparent from this insight that design efficiency and performance improvements can be achieved with the radial magnetic design for the next paper.

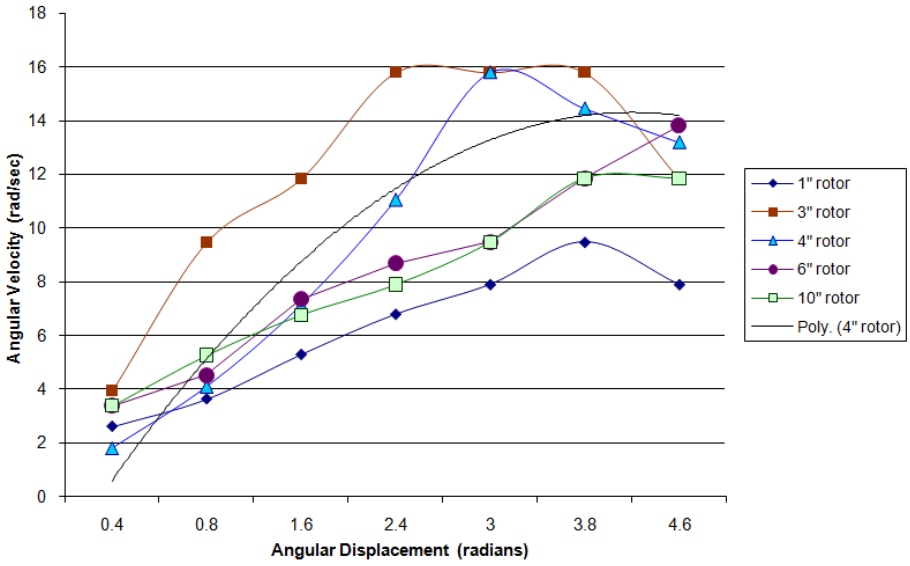


FIGURE 16. Computer acquired displacement data converted into angular velocity at each interval point for five different SMM designs with a polynomial trend line added for the 4-inch rotor.

Further observations made from a comparison of Figure 16 with Figure 14 yields the following correlation for future improvements. Figure 14 was designed as a composite graph in order to facilitate the comparison of parameters for each of the SMM designs. As seen above, the 6" and the 10" diameter rotor designs (Figure 16) performed most linearly with uniform acceleration, as well as the best trends toward a maximum velocity at the end of their cycle. Comparing them with Figure 14, it is noted that the rotor B fields are about the same. Furthermore, Figure 12 indicates the closest match between rotor and stator magnetic fields for the 6" and the 10" rotors as compared to the others. However, the rotor mass, back torque and kinetic energy are *maximized* with the 10" rotor, specifically where the rotor mass and back torque are on the same magnitude level. However, as seen from the in depth analysis of the 10" rotor, Figure 13, and the accompanying discussion, the rotor mass being so high for the 10" rotor, may well be

the single most important handicap preventing a more robust performance. Compared to the 10" rotor, the 6" rotor yielded 0.12 J of kinetic energy and about 0.11 N-m of back torque, which were on the same magnitude level, but its rotor mass was only 0.42 kg. Instead, the 10" rotor had its back torque of 1.4 N-m on the same magnitude level as the rotor mass (1.4 kg), with a much higher kinetic energy of 0.80 J. In other words, for about the same level of rotor B field (0.6 T), the 10" rotor achieved *6.7 times the maximum kinetic energy* with only 3.3 times the rotor mass as compared to the 6" rotor design, which shows an increase in efficiency, but it also suffered *13 times the maximum back torque* as the 6" rotor. This last statistic is perhaps due to the size of the rotor and stator magnets which were about twice the diameter as the 6" rotor and included a couple of one-inch NdFeB magnets sandwiched between two-inch by ½ inch NdFeB magnets, which are just about the largest and most powerful disk magnets commercially available. As a result, the magnetic coupling in the radial direction probably increased out of proportion to the circumferential improvement in angular velocity.

Horsepower

Any motor analysis is not complete until the horsepower rating is determined. The power developed by each of the SMM is known with the product of angular velocity ω and torque T to be (Granet, 1983),

$$P = T\,\omega \tag{11}$$

Therefore, for the 10" rotor SMM, we pick three sample data points from Figure 16 at 2.4, 3, and 3.8 radians for the calculation, each of which are increasing, though the torque (1.4 N-m) is known to be constant from Figure 13 (2π radians/360° conversion needed) in the region of interest.

$$P_{2.4} = 11\text{ W} \qquad P_{3.0} = 13\text{ W} \qquad P_{3.8} = 17\text{ W} \tag{12}$$

Using 1 hp = 746 W we can therefore find that the fractional horsepower rating varies for these three regions of performance to be from 0.015 hp, 0.017 hp, up to 0.023 hp (about 1/43 hp) for the maximum rating.

CONCLUSIONS

In conclusion, it has been demonstrated that the SMM can develop significant torque and horsepower, with about a half of a joule or 0.52 Watt-sec energy gap, in the case of the largest 10" rotor SMM that was tested. It is also encouraging that magnetostatic energy density is thousands of times larger than electrostatic energy density. However, to close the gap, several creative boundary-changing methods have been proposed, one or more of which are needed to turn the tide of energy loss to energy gain. Halbach magnet arrays offer one-sided magnetic fields so that no field lines are wasted. The Hysteresis Motor design offers an improvement and an increase in negative torque or negative work. The MS-PZT pulser, the Wiegand pulse generator or the piezoelectric actuator are three major game changers that will have the biggest impact on the performance of the SMM since they can input energy where it is needed (at the end of the cycle) without any significant drain on the SMM angular velocity. It has been shown by the work of Ueno, Wiegand and others that *the proportion of external energy input required by physics for a magnetic field output energy pulse has recently become insignificantly small*. Therefore, it is predicted that future work in this area alone will yield enormous improvements to the point where break-even or actual energy production for the SMM can be foreseen, since exactly this type of switching-on of a powerful energy addition, with very little trigger input, has been used in the past to achieve a thermodynamically sound, optically controlled vacuum energy transducer (Pinto, 1999). Therefore, the use of a magnetically-triggered Barkhausen avalanche of magnetic domains providing a significant magnetic pulse with Wiegand modules for example, is seen to be a strategic advantage, with a larger energy impact than it takes to create it. The same is true for the piezoelectric options explored with electric charge triggering from a pickup coil. The future work with Toshiyuki Ueno from the University of Tokyo will explore the magnetic pulse capability of an SMM rotor-triggered MS-PZT device for realization of the proposed MAGLIM. As Ueno and Wiegand have proven, the amount of energy required to produce a given magnetic pulse can be dramatically reduced until it is insignificant. Thus, the converse must also be true: with prudent energy harvesting of the SMM kinetic energy in motion, along with an optimum design of a multi-magnet rotor SMM, a productively significant magnetic pulse can assist with the regauging (switching) requirements.

NOMENCLATURE

β = MacColl's constant
δ = thickness of plate (m)
ε_o = 8.85×10^{-12} (farad/m)
m = mass (kg)
μ_s = electron magnetic moment (A-m^2)
M = magnetic moment (A-m^2)
ρ = resistivity (Ω-m)
μ = permeability (gauss/oersted)
μ_o = permeability of free space ($4\pi \times 10^{-7}$)
S = spin quantum number of electron
T = torque (N-m)
U = potential energy (J)
W = work (N-m or J)
ω = angular velocity (rad/sec)

φ = angle between magnetic moment and applied magnetic field
θ = circumferential angular displacement (degrees or radians)

ACRONYMS

ESLIM - Electrically Stimulated Linear Motor
hp - horsepower
kG - kilogauss
MAGLIM - Magnetically Stimulated Linear Motor
MFC - Macro Fiber Composite
MS - magnetostrictive
N-m - Newton-meters
NdFeB - Neodymium-Iron-Boron
PZT - piezoelectric
RPS - revolutions per second
SMM - spiral magnetic motor
SPESIF - Space, Propulsion & Energy Sciences International Forum
T - tesla
V - volt or volts
W - watts

ACKNOWLEDGMENTS

Acknowledgement is given to H. Paul Sprain for soliciting my assistance with his spiral magnetic motor, to Toshiyuki Ueno for discovery of the zero power magnetic field generator, to Tom Schum for his SMM prototype, to John Wiegand for his amazing magnetic pulse wires and to Professor Eric Laithwaite, the inventor of the magnetically levitated train and hysteresis motor, whose tireless enthusiasm, published legacy and fascination with magnetic motors of all types has inspired many.

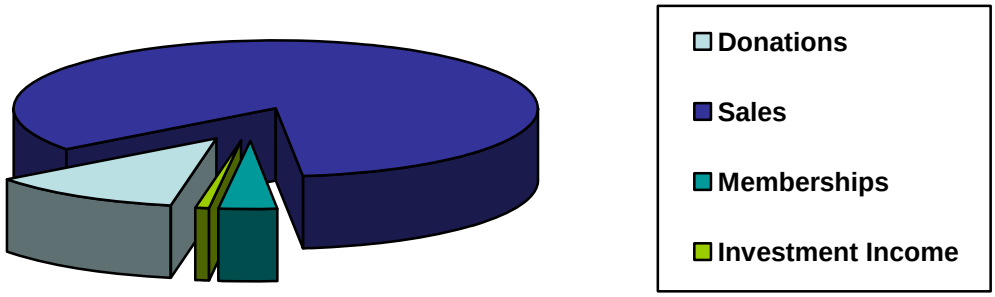
REFERENCES

Arrott, A. S., and Templeton, T. L., "Physical measurements in a permanent magnet field varying spatially," *J. App. Physics,* **99**, (20060, p. 08B507-1.
Barkhausen, *Phys. Z.*, **20**(401), (1919).
Bozorth, R. M., *Ferromagnetism*, J. Wiley & Sons, (2003), p. 786.
Chikazumi, *Physics of Magnetism*, J. Wiley, (1964).
Dilatush, Earle, "With No External Power Source, Clean Pulse-Generation Technique Creates Narrow, High-Level Outputs," EDN, Nov. 5, (1977), p. 19.
Fujii, N., Kayasugat, T., and Hoshi, T., "Simple End Effect Compensator for Linear Induction Motor," *IEEE Trans on Magnetics*, V. 38, No. 5, 2002, p. 3264
Gautreau, R. and Savin, W., *Modern Physics*, Schaum's Outline Series, McGraw-Hill Book Co., (1978), p. 120
Granet, Irving, *Technical Mechanics*, Holt, Rinehart and Winston, (1983), p.320.
Halliday, D. et al., *Physics,* John Wiley & Sons, Inc., (1962), p. 864.
Hoburg, "Modeling Maglev Passenger Compartment Static Magnetic Fields from Linear Halbach Permanent-Magnet Arrays," *IEEE Trans. On Magnetics*, **40**(1), Jan., (2004), p. 59.
Jang, S-M, Lee, S-H and Yoon, I-K, "Design Criteria for Detent Force Reduction of Permanent-Magnet Linear Synchronous Motors with Halbach Array," *IEEE Trans. On Magnetics*, **38**(5), (2002), p. 3261.
Laithwaite, Eric, *Propulsion Without Wheels,* English Univ. Press, 1970.

Niarchos, D., "Magnetic MEMS: key issues and some applications," *Sensors and Actuators A*, **109**, (2003), p. 166.
Pinto, F., "Engine cycle of an optically controlled vacuum energy transducer," *Physical Review B*, **60**(21), 14, 740, 1999
Scott, David, "Magnetic 'Wankel' for Electric Cars," *Popular Science,* June, (1979), p. 80.
Ueno, T., Jinhaq, Q. and Junji, T., "Magnetic Force Control with Composite of Giant Magnetostrictive and Piezoelectric Materials," *IEEE Trans. On Magnetics*, **39**(6), (2003), p. 3534.
Ueno, Toshiyuki, "Magnetic Force Control Based on the Inverse Magnetostrictive Effect," *IEEE Trans. Magnetics*, **40**(3), May, (2004), p. 1601.
Ueno, Toshiyuki and Higuchi, Toshiro, "Zero-Power Magnetic Levitation Using Composite of Magnetostrictive/Piezoelectric Materials," *IEEE Trans. Magnetics*, **43**(8), Aug., (2007), p. 3477.
Ueno et al., "Zero-Power Magnetic Levitation," *IEEE Trans. On Magnetics*, **43**(8), (2007), p. 3477.
Valone, Thomas, "Eric Laithwaite Report: Gyromagnetic Engineering Genius, Publications, Inventions & News Clips," Integrity Research Institute, (2002).
Valone, Thomas, "Is Permanent Magnetism Connected with Zero Point Energy?"*Zero Point Energy: The Fuel of the Future*, Integrity Research Institute, 1st edition, (2007), p. 200.

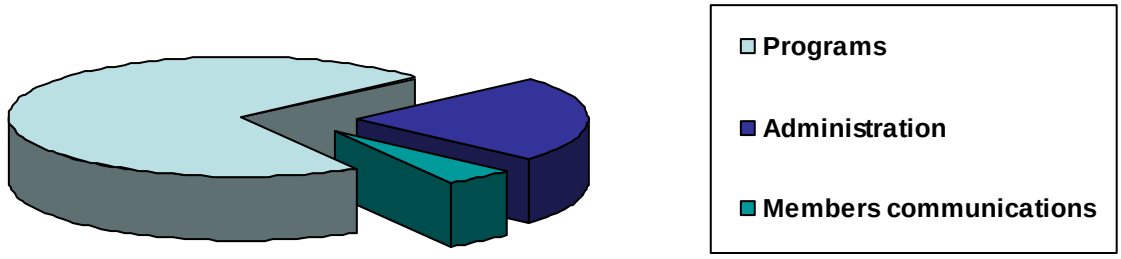
IRI FINANCIAL REPORT 2009

REVENUE



Donations:	**$ 7250.00**
Sales:	**$50902.00**
Memberships:	**$ 2351.00**
Investment:	**$ 433.00**

EXPENSES



Programs:	**$ 46875.00**
Administration:	**$ 15006.00**
Members:	**$ 3291.00**

BALANCE SHEET

	Beginning Year	End of Year
Cash, Savings, Investments	**$42,895**	**$20,361**
Other Assets	**$21,034**	**$14,818**
Total Assets	**$63,929**	**$35,179**
Total Liabilities	**$560**	**$560**
Net Assest or Fund Balances	**$63,369**	**$34,619**