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Electrokinetics as a Propellantless Propulsion Source

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Abstract

This is a review of the worthwhile, innovative theories and concepts in electrogravitics and electrokinetics that could yield tremendous technological and economic dividends in both investment dollars and potential applications for future generations. Electrogravitics is most commonly associated with the 1918 work by Professor Nipher followed by the 1928 British patent #300,311 of T. Townsend Brown, 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. An analysis of the 90-year old science of electrogravitics (or electrogravity) necessarily includes an analysis of electrokinetics. Electrokinetics, on the other hand, is more commonly associated with many 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 purported motion in the direction of 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 also suggests directions for further confirming measurements. This paper also reviews the published electrokinetic experiments by the Army Research Lab by Bahder and Fazi, California State University at Fullerton work by Woodward and Mahood, Erwin Saxl, and others.

Keywords: electrogravitic, electrogravity; electrokinetc; high voltage; asymmetric capacitor; gravitator; dielectrics; pulsed EMF.

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1. Electrokinetics versus Electrogravitics

Electrogravitics is most commonly associated with the 1928 British patent #300,311 of T. Townsend Brown, 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." Electrokinetics, on the other hand, is more commonly associated with many patents of T. Townsend Brown as well as Agnew Bahnson, starting with the 1960 US patent #2,949,550 entitled, "Electrokinetic Apparatus." Eleven years ago, *Electrogravitics Systems: A New Propulsion Methodology* "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,* both predates and postdates the first volume, thus giving a wider historical perspective. Volume II also contains further information on the Army Research Lab (ARL) and Honda Corporation experiments, as well as the electrokinetic equation discovery presented in this paper.[1] A short review of the history of electrogravitics has also recently been published by Theodore Loder.[2]

When asked, "What is electrogravitics?" a qualified answer is postulated to be "*electricity used to create a force that depends upon an object's mass, even as gravity does*." This definition may identify true electrogravitics, when the object's mass linearly affects the resultant force, in conjunction with a dielectric. This is also what the "Biefeld-Brown effect" of Brown's first patent (British #300,311) describes. However, as ARL's Tom Bahder emphasizes, subsequent T. Townsend Brown patents never mention electrogravitics.[3] Later on, Brown refers to "electrokinetics" (logically, a subset of electrogravitics), which also uses 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 includes electrokinetics*.

To put things in perspective, the article "How I Control Gravitation," published in 1929 by Brown,[4] presents an electrogravitics-validating discovery about very heavy metal objects (44 lbs. each) separated by a glass 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 seems to imply that the equation for his electrogravitic force might be $F \approx Vm_1m_2/r^2$. But electrokinetics and electrogravitics also seem to be governed by another equation (Eq.1).

2. Zinsser Effect Versus the Biefield-Brown Effect

There is another very similar 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.[5] For years afterwards, all of the scientists who knew of Zinsser's work, including this author, regarded his invention as a unique phenomenon, not able to be classified with any other discovery. However, upon reading 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.[6] 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.[7] Zinsser called this input "a kinetobaric driving impulse." Furthermore, he points out in the Specifications and Enumerations section, reprinted in my book, 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.[8] This figure is *twenty times* the force per energy input of the Inertial Impulse Engine of Roy Thornson, which has been estimated to produce 0.32 N/W.[9] By comparison, it is important to realize that any production of force today is extremely inefficient, as seen by the fact that a DC-9 jet engine produces 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."[10] 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.[11] 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.

3. 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.[12] Dr. Erwin Saxl used high voltage in the range of +/- 5000 volts on his very massive torque pendulum.[13] 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.[14] Most interesting were the "unexpected phenomena" which Saxl reported in his 1964 *Nature* article. The positively charge pendulum had the longest period of oscillation compared to the negatively charged or grounded pendulum. Diurnal 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.

3. Electrogravitic Woodward-Nordtvedt Effect[15]

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.[16] 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 2^{nd} time derivative of the energy."[17] 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.[18] 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.[19] 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.[20]

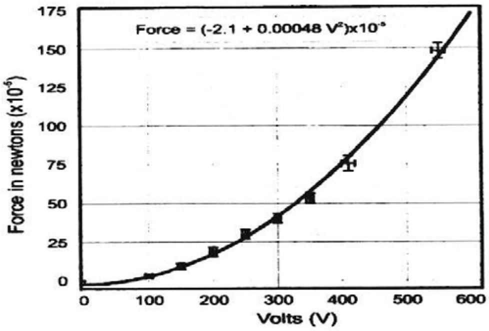

Fig 2. Force (10^{-5} N = dynes) output vs. capacitor voltage (V) input of a Woodward force transducer "flux capacitor".

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.[21] 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).[22] Zinsser had *activators* with masses between 200 g and 500 g and force production of "100 dynes to over one pound."[23] Recently, Woodward has been referring to his transducers as "flux capacitors" (like the movie, *Back to the Future*).[24]

4. 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.[25] 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.[26] 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.

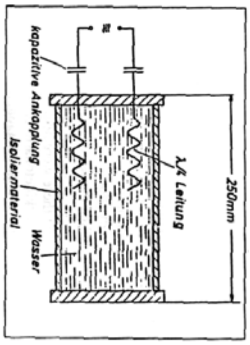

Fig. 2. Sample capacitor probe used by Zinsser. Notice the quarter λ/4 wavelength electrodes which indicate a resonant circuit design.

5. Electrokinetic Force Predicts Electrogravitic Direction

Can Jefimenko's electrokinetic force 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?

- Starting with Zinsser's probe diagram (Fig. 2) from Prof. Peschka's article, it is purposely put on its end for reasons that will become obvious. Compare it with an equivalent parallel plate capacitor (the plates are x distance apart) from Jefimenko's book:[27]

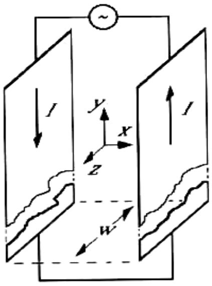

Fig. 3. Calculation of Jefimenko's electrokinetic force in the space between two current-carrying plates. X is the space between the plates. W is the width of the plates

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

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

where **j** is the unit vector for the y-axis direction seen in Fig. 3. 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.*

- Looking at Brown's electrogravitic force direction from the Fig. 1 in his 1929 article "How I Control Gravitation," we see that the positive lead is on the right side of the picture. Also, the

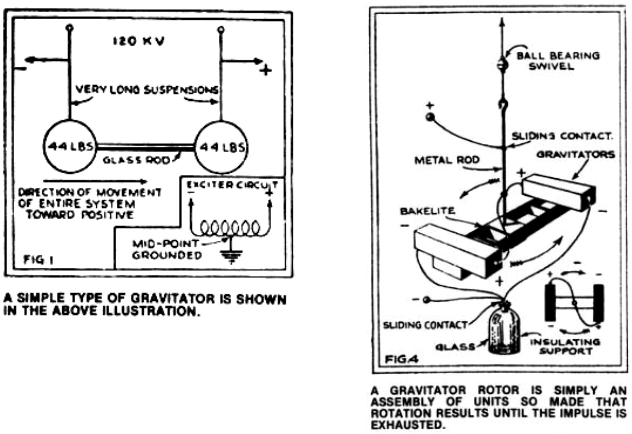

Fig. 3a. and Fig 3b. Courtesy of TT Brown from his article "How I Control Gravitation".

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*.[28] 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.*

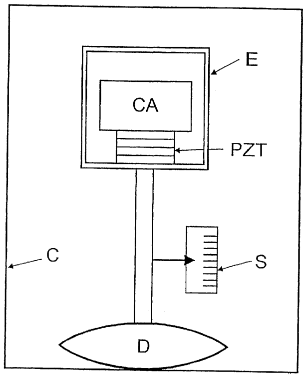

Fig. 4. Woodward's #6,098,924 patented impulse engine, also called a flux capacitor. The PZT provides nanometer-sized movements that are timed to an AC signal input. A torsion balance has been used with a pair of force transducers in other designs.

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 phenomena 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.

- 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.

- The Campbell and Serrano capacitor modules seen in their patented drawings in Figs. 5 and 6, as well as the Electrogravitic Craft Demonstration unit (Norton AFB, 1988),[29] can also be explained 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.

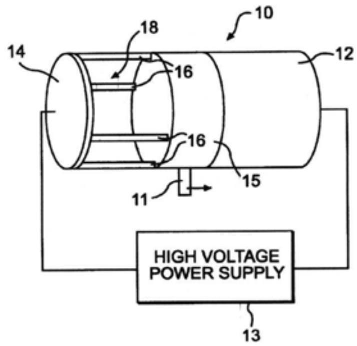

Fig.5 . Capacitor module from Campbell's NASA patent #6,317,310 which creates a thrust force. Disk 14 is copper; Struts 16 are dielectrics; Cylinder 15 is a dielectric; Cylinder 12 is an axial capacitor plate; Support post 11 is also dielectric.

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.

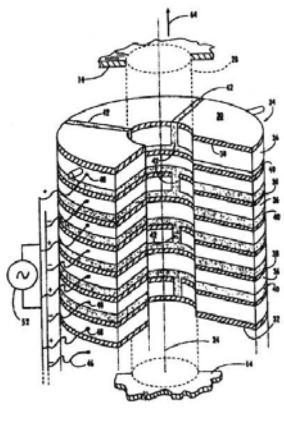

Fig. 6. Capacitor propulsion device with alternating metal and dielectric layers from Serrano's PCT patent WO 00/58623 with upward thrust direction indicated and + and – polarity designated on the side.

5. 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.[30]

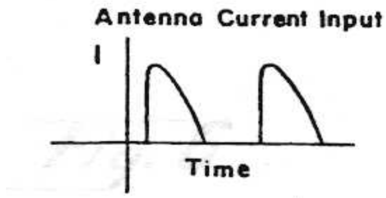

Fig. 7. An improved electrokinetic force current waveform is found in Schlicher propulsion patent #5,142,861

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.[31] 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. 7). 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.[32] 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*.[33]

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.[34] Secondly (2), there is the intriguing *spatial angular momentum discovery* by Graham and Lahoz.[35] 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.

6. 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[36] 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 told me that he believed the story was true. Since Dr. Puthoff used to work for the CIA for ten years as a director of Project Stargate, this was quite an endorsement.

In analyzing the Electrogravitic Craft Demonstration unit (Norton AFB 1988) diagrammed in Fig. 8, 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 footnote 26 for Mark's details.)

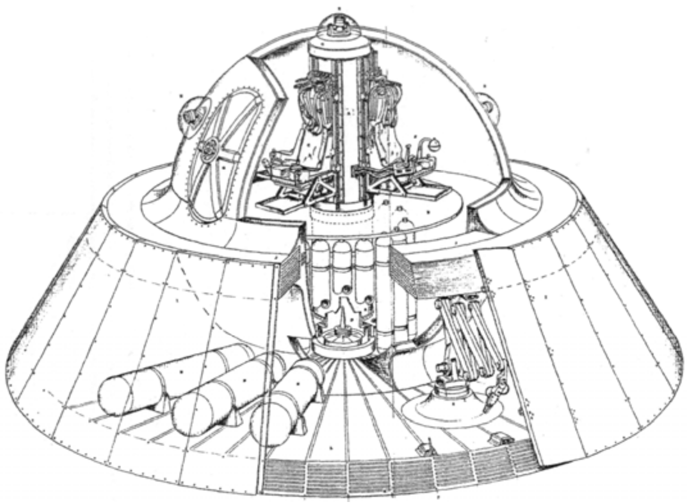

Fig.8. Electrogravitic Craft Demonstration unit (Norton AFB, 1988) – copyright © 2000, Mark McCandlish.

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

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[9] Valone, Thomas, "Inertial Propulsion: Concept and Experiment, Part 1" Proc. of Inter. Energy Conver. Eng. Conf., 1993, reprinted in IRI Report #608.
[10] See "Pulsed Electromagnetic Field Health Effects" IRI Report #418 and *Bioelectromagnetic Healing* book #414 by this author, which explain the beneficial therapy which PEMFs produce on biological cells.
[11] Mark McCandlish's Testimony (p. 131) 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.
[12] See Saxl patent #3,357,253 "Device and Method for Measuring Gravitational and Other Forces" which uses +/- 5000 volts.
[13] Saxl, E.J., "An Electrically Charged Torque Pendulum" *Nature*, July 11, 1964, p. 136
[14] Saxl & Allen, "Observations with a Massive Electrified Torsion Pendulum: Gravity Measurements During Eclipse," IRI Report #702.(Note: 2.2 lb = 1 kg)
[15] Graph of Fig. 1 from Woodward and Mahood, "Mach's Principle, Mass Fluctuations, and Rapid Spacetime Transport," California State University Fullerton, Fullerton CA 92634
[16] Woodward et al., "Method and Apparatus for Generating Propulsive Forces Without the Ejection of Propellant" US Patent #6,098,924 and #6,347,766 (same title)
[17] Cramer et al., "Tests of Mach's Principle with a Mechanical Oscillator" AIAA-2001-3908 email: cramer@phys.washington.edu
[18] 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
[19] Compare Fig. 1 graph to Brown's ONR graph on P.117 of Volume I
[20] Nordtvedt, K. *Inter. Journal of Theoretical Physics*, V. 27, 1988, p. 1395
[21] 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)
[22] For comparison, 1 Newton = 0.225 pounds
[23] Zinsser, FISONCET, Toronto, 1981, p. 298
[24] 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
[25] Jefimenko, Oleg *Causality, Electromagnetic Induction and Gravitation*, Electret Scientific Co., POB 4132, Star City, WV 26504, p. 29
[26] Jefimenko, p. 31
[27] Jefimenko, p. 47

[28] 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.
[29] McCandlish, Mark, "Testimony of Mr. Mark McCandlish, December 2000," *Electrogravitics II*, Integrity Research Institute, 2005, p. 131
[30] 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.
[31] 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.
[32] See the Taylor patent #5,197,279 and Schlicher patent #5,142,861.
[33] Ning Li was the Chair of the 2003 Gravitational Wave Conference. The CD Proceedings of the papers is available from Integrity Research Institute.
[34] Valone, Thomas, *The Homopolar Handbook: A Definitive Guide to Faraday Disk and N-Machine Technologies*, Integrity Research Institute, Third Edition, 2001
[35] Graham and Lahoz, "Observation of Static Electromagnetic Angular Momentum in vacuo" *Nature*, V. 285, May 15, 1980, p. 129
[36] 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.