

## Full Paper

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## A plausible advanced propulsion device to go to Mars

### Abstract

Several propulsion techniques are currently available for traveling for long distances. Some of these involve propelling mass as a high-speed ejector to produce thrust such as rocket motors, ion and hall accelerators; others look at propellantless devices similar to Slepian and Woodward's Machian device and the microwave powered EmDrive. The obvious advantage of propellantless is that a spacecraft's weight can be more efficient in terms of more payload in lieu of including a large weight fraction involving fuels and/or oxidizers. A device was created and tested that resembled the Searle device modified similar to Godin and Roschin's device with some additional modifications. This electromagnetic propellantless device, when rotated, reduced 7% of its weight according to accurate experimental investigations. Several theories to explain this difference were created to include the Poynting field, a system employing DeBroglie's matter waves, on to dealing with magnetic dipoles, and these offer promises to provide a workable propulsion scheme, which is discussed for consideration. If modified further, this device may offer a capability that could provide an advanced propulsion system comparable representing a watershed event to go to Mars. This concept/system, if feasible, will represent an exotic and game-changing technology to create new thinking facilitating movements to support more serious space travel situations/missions.

### Keywords

Propellantless; Poynting conservation theorem; Mars; Electromagnetic; Fields.

## INTRODUCTION

There is a desire to go to Mars based upon recent rover findings as well as a change in the paradigm regarding the possible different view of Mars. In the past, Mars was considered as an ecological disaster that may have destroyed a previous civilization and these consequences represent the future of the Earth. Findings indicate that Mars may have been the consequences of fissile/fusion weaponry that exceeded any capability on the Earth. Such explosions could have blown away the Martian atmosphere reducing to the current low pressure as well as drive a civilization, if it exists, beneath the ground.

Finding these capabilities will help mankind understand its direction and offer options to make certain changes to enhance our survival. The question would appear to demonstrate such capabilities on a trip to

Mars. Obviously one would select to demonstrate Martian required technology to use this going to the Moon. There are significant differences between the Moon and Mars based upon temperature extremes where Mars' temperature range from day to night is similar to observed on the Earth; however, the extreme on the Moon without an atmosphere is significantly larger.

This would stress environmental conditions because space suit capabilities are also different. Space suits would be exposed to razor sharp rocks on the Moon whereas the surface on Mars has been eroded on the weather within the intrinsic atmosphere. These differences also raise the need to develop a propulsion scheme first under a less stressing situation to go to the Moon compared to the longer flight required on Mars.

A means to obtain shorter turn-around times to Mars

would require a relative high thrust level and continuous operation. The drawback is upon being close to the Martian surface, the thrust vector would have to be reversed. Discussions with propellant focused schemes is relatively easy in terms of discussing thrust. How do you measure thrust for a propellantless scheme? Moreover, how can you measure these quantities as well as loss of energy for a field controlled situation?

Some Propellantless drives exist such as the Slepian, Woodward and EmDrive. These systems use energy to provide a mechanism that creates momentum. This is problematic in terms of how thrust is provided. Fields are perturbed and this is because of energy being converted into momentum especially if superconductivity may be involved as well as operating with systems that use either an electric or a magnetic field independent of each other which will be discussed in further detail in the text.

There is a concern about separating these fields that may point to propulsion options. For example Sickel and Pice<sup>[1]</sup> examined electromechanical behavior of dielectric and ferroelectric thin films at high electric field. All dielectric materials undergo electrostriction and are strained proportionally to the square of the electric field that is applied. Piezoelectric materials have a large strain linearly proportional to electric field in addition to electrostriction. This project aims to measure the electrostriction in SrTiO<sub>3</sub> and then to use the same technique to probe piezoelectricity in BiFeO<sub>3</sub> at high electric fields to see if there is an electrostrictive contribution to the strain at high field. BiFeO<sub>3</sub> is a ferroelectric, antiferromagnetic material which is currently the object of intense study. It is widely believed that the ferroelectric and magnetic properties are coupled, but the exact mechanism is still poorly understood. The most promising applications lie in electrically controlling the magnetization direction in magnetic tunnel junctions or read/write heads in magnetic memories. These results are consistent with a combination of piezoelectricity and electrostriction. In other words, this a situation where an electric field could potentially operate independent of a magnetic field and vice versa. These notions have propulsion implications if these two fields could be identified as separate entities.

In terms of a purely electric propulsion device, Fralick and Niedra<sup>[2]</sup> performed an investigation to test the claims by Rex L. Schlicher, et al., (Patent 5,142,861) that a certain antenna geometry produces thrust greatly exceeding radiation reaction, when driven by repetitive, fast rise, and relatively slower decay current pulses. This is similar to the EmDrive. This pulsor was cap-

able of sustaining 1200 A pulses at a rate of 30 per second up to a minute. They concluded, in agreement with the momentum theorem of classical electromagnetic theory, that any thrust produced is far below practically useful levels. This was a failed attempt to look into an isolated electric field device that could be examined in the above equations but with more granularity to understand and investigate useful insights.

The device we propose is an electromagnetically propelled space vehicle that leaves the atmosphere into an orbit, then suddenly injects into higher energy orbits, the Moon, and possibly to Mars, which is an intriguing proposition. The task is considered as either a satellite or comparable with a portion of the ascent trajectory required for delivering a Single-Stage-To-Orbit (SSTO) vehicle or its payload at a cis-lunar or trans-lunar orbit. This proposed device may employ either an ascent or descent trajectory.

The rationale is to exploit the Earth's electric and magnetic field for a satellite or an SSTO. Unfortunately it is acknowledged that the Moon as well as Mars does not have a magnetic field. However, this would have no impact upon the portions of the trajectories involving both celestial bodies. It will also be assumed that if the magnetic field<sup>[26]</sup> on the Moon and Mars are low or inconsequential, subsequently such an electric field may also be low. By contrast, the Earth's dipole magnetic field creates the Van Allen belts that geometrically follow paths similar to the lines of force for a bar magnet with a distinct magnetic North and South Pole. The system would have to create fields that act opposed to the solar wind and magnetic field, found with the Pioneer 10 and Pioneer 11 spacecraft, generated from the sun.

The device would exploit these fields to create space propulsion. The spacecraft could take advantage of using a large magnetic field to create magnetic drag and change the satellite's trajectory to a lower energy orbit. This results when the satellite's magnetic field interacts directly with the Earth's magnetic field. With these rationales, a device is identified which is a propellant scheme that takes advantage of the Poynting field.

## DISCUSSION

The device proposes investigating a different scheme for generating electromagnetic propulsion to include increasing an orbit to a higher energy orbit, going to the Moon, and traversing to Mars. Although the idea of using electromagnetic propulsion is not new, this unique approach is a game-changing technology that examines using a Poynting Conservation Law.

The Morningstar Energy Box<sup>[3, 4]</sup> that uses a rotating electromagnetic field. Interestingly, the 190 pound electromagnetic Morningstar device showed nonlinear behavior that during several tests demonstrated a loss of 7% of the device's weight during steady-state operation<sup>[4]</sup>. These unusual events required examining a different scientific approach toward understanding electric and magnetic fields as well as gravitation. This resulted in a derivation of the Poynting Field Conservation Law which was recently derived in the Murad-Brandenburg (M-B) equation<sup>[5-7]</sup>. We are proposing to further examine our understanding of these scientific principles for creating an application, for example, to raise the orbit of a satellite or go to Mars.

A typical SSTO or large payload rocket booster to go into orbit in the atmosphere driven by energy sources created by either hydrocarbon propellants, a fission reactor, an aneutronic reactor or a hybrid reactor. This trajectory might follow by a spiral motion to find the right line of force and raise itself on the magnetic fields in a Van Allen belt before proceeding toward a cis- or trans-lunar and trans-Mars mission. Here, the energy produced on the spacecraft would generate high electric and magnetic fields.

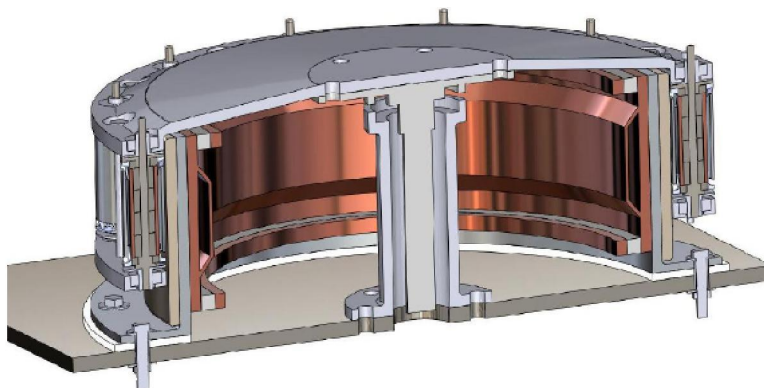
Using electromagnetic forces to accelerate a particle to generate thrust is not new. However, we propose an innovative theoretical approach. What we propose is to use a Poynting Field Conservation Law derived in the Murad-Brandenburg (M-B) equation<sup>[6, 7]</sup> after validation of this equation that was originally derived and used to develop a rationale for explaining unexpected phenomena. Moreover, this orbital craft will require considerable strengths of electric fields driven by electrical energy from an on-board nuclear reactor or solar panels. A possible result may include deriving a conservation equation based upon the Poynting field when the fields involve moving electromagnetic vortices due to the device's rotation. In the Murad-Brandenburg Equation, it is found that the equation

for the Poynting vector, which carries energy and momentum in EM fields, can be written as a wave equation with source terms involving steady-state Electromagnetic vorticity. This opens the possibility of creating a new EM propulsive force on spacecraft by exploiting this new way of generating EM momentum and energy.

### MORNINGSTAR ENERGY BOX<sup>[27]</sup>

This experimental device raised several interesting issue to explain<sup>[8]-[9]</sup> the loss of weight when this electromagnetic device operated. Some of these potential explanations involved:

- Conversion of angular momentum to linear momentum,
  - Poynting vector force/gravito-electro-magnetism (GEM) interaction,
  - Delayed mirror image of the magnetic/electric field,
  - Generation of gravitational waves,
  - Cogravitation per Jefimenko,
  - Matter wave per de Broglie,
  - D-dimensional transport, and
  - Suspending electromagnetic monopoles.
- Briefly for the most probable causes, our perspective involved:
- *Angular momentum*- The idea is to change Mother Nature by transferring angular momentum into linear momentum possibly similar to the Russian motives.
  - *Gravito-Electro-Magnetism (GEM)*- This notion uses a Poynting vector force induction based upon the roller design that act like magnetic dipoles, and
  - *Retarded Potentials*- The ring acts as a roller reflection plane on the ring. If the time is retarded or through magnetic hysteresis, it is possible that the image and subsequent forces from one roller can



**Figure 1 :** This is the morningstar energy box<sup>[3, 4]</sup> integrated assembly on a base support plate previously mentioned. The electromagnetic laminated rollers move on the exterior of a large laminated ring and the rollers revolve around the central-line spline to generate an electromagnetic force.

attract the adjacent roller to create self-acceleration.

### ANALYSIS

This force equation used in this effort that treats an electric field, magnetic field and the Poynting force is:

$$\bar{F} = e(\bar{E} + \bar{v} \times \bar{B}) + \alpha \bar{E} \times \bar{B}.$$

Capital letters will refer to vector quantities;  $E$  and  $B$  that are the electric and magnetic fields respectively,  $\bar{A}$  is spacecraft velocity,  $e$  is the electrical charge, and  $\alpha$  is a coupling factor for the Poynting vector momentum that corresponds to the particle response to radiation pressure through radiation absorption. The Poynting vector is defined as:

$$\bar{S} = \frac{1}{\mu_0} (\bar{E} \times \bar{B}), \text{ then : } \bar{F} = e(\bar{E} + \bar{v} \times \bar{B}) + \alpha \bar{S}$$

The Poynting vector is a components of the GEM or Gravitto-Electro-Magnetic Theory<sup>[5]</sup>. The premise for deriving a Poynting conservation field<sup>[6,7]</sup> is that both the electric and magnetic fields are wave equations. If so, the Poynting vector also must satisfy as a wave equation. Moreover, these terms are derived to include effects based upon the curl of the curl vector to show the impact of rotational effects demonstrated by the Morningstar Energy Box or why a spiral trajectory<sup>[10]</sup> for this effort may be of importance.

The conservation Law or M-B equation briefly is:

$$\begin{aligned} \mu_0 \left[ \frac{1}{c^2} \frac{\partial^2 \bar{S}}{\partial t^2} - \nabla^2 \bar{S} \right] = & \mu_0 \nabla \times \nabla \times \bar{S} - 2 \nabla \times \bar{B} \times \nabla \times \bar{E} \\ & - 4\pi \left[ -\frac{1}{c} \frac{\partial}{\partial t} (\rho_e \bar{E} + \rho_m \bar{B}) + \frac{1}{c} \frac{\partial}{\partial t} (\bar{J}_e \times \bar{B} + \bar{E} \times \bar{J}_m) - \nabla (\bar{J}_e \cdot \bar{E} + \bar{J}_m \cdot \bar{B}) \right]. \end{aligned}$$

Where  $\bar{S}$  is the Poynting vector,  $J$  values are current vectors and  $r$  values are source terms. Subscripts  $m$  and  $e$  imply magnetic and electric fields respectively. The term  $\mu$  is an electro-physical constant. Although it is not normally accepted about magnetic sources or currents, the view is that the Van Allen belts are predominantly due to the magnetic field and not the Earth's electric field. There is considerable motion in the Van Allen belt due strictly to the forces of the magnetic field, hence we are using an assumption that the magnetic current allows motion along the lines of force analogous to a bar magnet. Morningstar proposes to provide a more realistic view to consider magnetic sources and currents.

We intend to look at this problem with this equation considering conventional wisdom with:

$$\mu_0 \left[ \frac{1}{c^2} \frac{\partial^2 \bar{S}}{\partial t^2} - \nabla^2 \bar{S} \right] = \mu_0 \nabla \times \nabla \times \bar{S} - 2 \nabla \times \bar{B} \times \nabla \times \bar{E} - 4\pi \left[ -\frac{1}{c} \frac{\partial}{\partial t} (\rho_e \bar{E}) + \frac{1}{c} \frac{\partial}{\partial t} (\bar{J}_e \times \bar{B}) - \nabla (\bar{J}_e \cdot \bar{E}) \right]$$

During the development of this equations, a second equation was derived that looks like:

$$\begin{aligned} \frac{1}{c^2} \frac{\partial^2 \bar{V}}{\partial t^2} - \nabla^2 \bar{V} = & + \nabla \times \nabla \times \bar{S} + \frac{4\pi}{c} \frac{\partial}{\partial t} (\bar{J}_e \bar{E} + \bar{J}_m \bar{B}) \\ & - 4\pi \nabla \cdot \left[ (\bar{J}_e \times \bar{B} + \bar{E} \times \bar{J}_m) - (\rho_e \bar{E} + \rho_m \bar{B}) \right] - \frac{2}{c} \frac{\partial}{\partial t} \int_0^r [\nabla \times \bar{B} \times \nabla \times \bar{E}] \cdot d\bar{r}. \end{aligned}$$

This equation represents that a field is generated as a consequence during the derivations of the Poynting field conservation. This field could be a torsion field or possibly a local gravitational field. We would like to seriously investigate this possibility with this proposed effort. In both of these equations, the curl of the curl vectors imply that spiral-like rotation or local rotation can increase and impact the results of the wave equations. Again, it is obvious that there is needed more scientific basis for the consideration of these sources and currents because these have an impact on both the conservation law as well as this torsion field.

As in the Poynting Conservation Law, we will also look at this from the perspective of the conventional wisdom for this field with:

$$\frac{1}{c^2} \frac{\partial^2 \bar{V}}{\partial t^2} - \nabla^2 \bar{V} = + \nabla \times \nabla \times \bar{S} + \frac{4\pi}{c} \frac{\partial}{\partial t} \bar{J}_e \times \bar{E} - 4\pi \nabla \cdot [\bar{J}_e \times \bar{B} - \rho_e \bar{E}] - \frac{2}{c} \frac{\partial}{\partial t} \int_0^r [\nabla \times \bar{B} \times \nabla \times \bar{E}] \cdot d\bar{r}.$$

If in the course of this effort, we will look at the more expanded version of these equations.

## SOME THOUGHTS RELATED ABOUT RESULTS

The rationale is to use this for supporting a spacecraft or a satellite that will use a self-contained power supply with its own inherent electrical and magnetic field. The theoretical premise is to alter the Poynting field to raise the orbital energy to a higher level as well as go to Mars. Similarly, the scheme should also be used to reduce the trajectory energy as well using the attachment<sup>[11]</sup> as well as identify some potential ideas for a Poynting Motivator. Moreover, this would be considered as a simple trajectory model to assess these impacts and the requirements to raise or lower a satellites orbit. Morningstar has made a considerable effort in examining orbits<sup>[12-15]</sup>.

There are many terms in these equations involving sources, E-M fields and currents. These should be examined to direct the Poynting Field. For example, if we consider simple models that are independent of either the electric field from the magnetic field and vice versa as in:

$$\mu_0 \left[ \frac{1}{c^2} \frac{\partial^2 \bar{S}}{\partial t^2} - \nabla^2 \bar{S} \right] = \mu_0 \nabla \times \nabla \times \bar{S} - 4\pi \left[ -\frac{1}{c} \frac{\partial}{\partial t} (\rho_e \bar{E}) - \nabla (\bar{J}_e \cdot \bar{E}) \right].$$

Where there is a Poynting field representative of only an electric field and the Poynting field for only a pure magnetic field:

$$\mu_0 \left[ \frac{1}{c^2} \frac{\partial^2 \bar{S}}{\partial t^2} - \nabla^2 \bar{S} \right] = \mu_0 \nabla \times \nabla \times \bar{S} - 4\pi \left[ -\frac{1}{c} \frac{\partial}{\partial t} (\rho_m \bar{B}) - \nabla (\bar{J}_m \cdot \bar{B}) \right].$$

Note that the specific fields should be oriented in the same direction as the specific currents. Obviously if we ignore the magnetic current or source term, this becomes a wave equation as follows:

$$\mu_0 \left[ \frac{1}{c^2} \frac{\partial^2 \bar{S}}{\partial t^2} - \nabla^2 \bar{S} \right] = \mu_0 \nabla \times \nabla \times \bar{S}.$$

These equations may have propulsion implications. If these fields disappear, the definition for the Poynting vector should collapse and may yield another expression similar to Maxwell's equations for the RHS of these two equations. However, for the purposes of this discussion some other, albeit weak corresponding field will be used to allow the definition of the Poynting vector to be none zero.

Interestingly, this form of the equation suggests that it is possible to launch EM waves carrying energy and momentum thus creating a reaction force for space craft propulsion by creating a "smoke ring" pattern of Poynting vorticity. In other words, a new form of EM antenna may be feasible, with possible new propulsion phenomena. This would be due to the fact that, like the region far away from any antenna, the previous equation becomes simply the wave equation for the Poynting field, describing a 'normal' EM plane wave in free space.

$$\mu_0 \left[ \frac{1}{c^2} \frac{\partial^2 \bar{S}}{\partial t^2} - \nabla^2 \bar{S} \right] = 0.$$

It thus appears theoretically possible to create radiative EM momentum and energy, with the corresponding reactive propulsive forces on the spacecraft, by a Poynting vorticity ability.

There is a concern about separating these fields that may point to propulsion options. For example Sickel and Pice<sup>[1]</sup> examined electromechanical behavior of dielectric and ferroelectric thin films at high electric field previously mentioned. Likewise the use of a purely electric propulsion device, Fralick and Niedra<sup>[2]</sup> performed an investigation to test the claims by Rex L. Schlicher, et al., (Patent 5,142,861) that a certain antenna geometry produces thrust greatly exceeding radiation reaction. These issues nominally use at high field intensity levels. Alternatively, guided by the Murad-Brandenburg equation, this electromagnetic design for a spacecraft

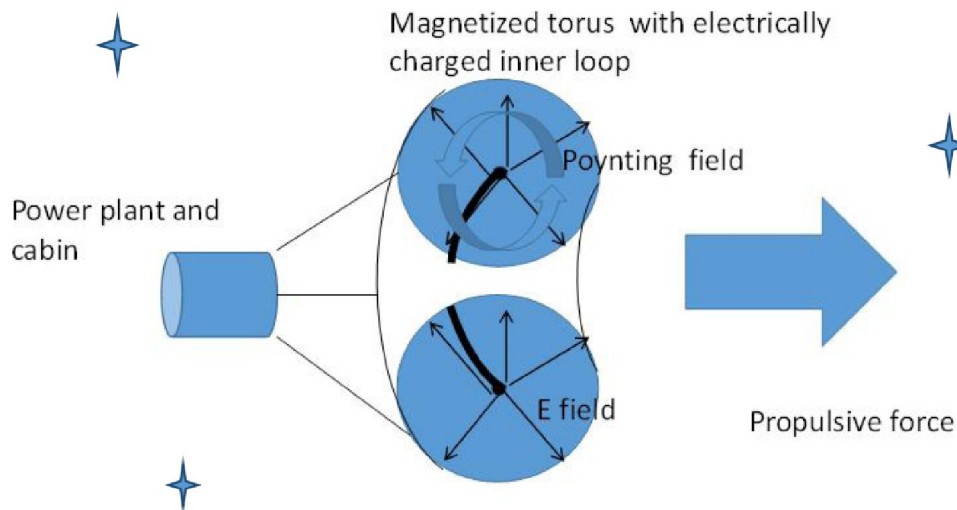


Figure 2 : A spacecraft propelled by a hypothetical poynting motivator

propelled by a “Poynting Motivator” to go to Mars should be feasible using a pattern of Poynting vorticity.

Similarly, we make the claim that by using this field, we can also produce a torsional or local gravitational field defined by  $V$ . This needs to further investigate this claim as well as identify experimental ideas to demonstrate feasibility. Examining the existence and creation of a localized gravitational field would definitely be a game-changing technology. This would support some of earlier efforts<sup>[16-23]</sup> as well.

An electromagnetic propellantless device is proposed. The first activity will be to determine an adequate measure to determine the strength of the Poynting field source term as a function of either the electric or magnetic fields. Moreover, once detectors are defined, they need to be assessed by variations such as alignment and distance locations from these fields. They will also be required to examine the primary electric and magnetic fields. An initial investigation needs to adequately determine parameters with the major concern for impacting the Poynting field. This would include individual currents as well as source terms.

## CONCLUDING THOUGHTS

The prime purpose is to validate these calculations and look into propulsion schemes that are identifiable and would support this rationale. The approach should look at linear or flat geometries, cylinder shapes objects and spherical geometries. Here, electric and magnetic fields need to be examined with specific alignments to minimize as well as maximize the strength of the Poynting field.

A second approach will look at hybrid geometric shapes where a field will have one geometric versus a different field with a specific different geometric shape.

These will also look at maximum and minimum values. Specific geometries such as toroids, half spherical, or other unique shapes should also be examined. In addition, we would also like to investigate Barrett’s  $SU(2)$  EM<sup>[24, 25]</sup> which is a new field that could couple with field associated with the measured mass of the Morningstar Energy Box whirling device. Barrett has shown the possibility of EM radiation fields with the same  $SU(2)$  gauge symmetry as the ion-attracting matter fields associated with ion-attracting, weak nuclear forces in nuclei. If so, ion-attracting  $SU(2)$  EM radiation fields could conceivably attract (rather than repel) ions to reduce the coulomb resistance and electrical compression energy needed.

For example, one could speculate that the gyrations of the magnets in the Morningstar Energy Box are causing some amount of  $SU(2)$  or  $SU(3)$  EM field generation that is interacting with the Higgs field (that is giving mass to the quarks and leptons and  $W$  and  $Z$  bosons that are inside every nucleon of the device) to modify the masses that the Higgs field is presumably handing out to all the matter particles inside the device. We also believe it is the action going on in these terms that cause the electro-gravitic or electro-Higgs interaction that is reducing the device’s mass. One might note that some of these added  $SU(2)$  terms involve vector products that slightly resemble the Poynting vector. But the  $SU(2)$  fields are tensor fields (not vector fields) and must be calculated with nonabelian algebra.

The final task potentially would focus to define specific propulsion devices that can impact a trajectory of a spacecraft using these Poynting momentum ideas as well as some of these  $SU(2)$  notions. This efforts would specifically require increasing the kinematic energy. This device represents an exotic and game-changing technology with high risk and high pay-off.

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