Mechanical Impulse Drive

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Presented here is a robust electric In-Space impulse engine. The origin of three unusual propulsion technologies based on diverted reactions are reviewed and combined in harmony. Examined are mathematical data, acceleration charts, load cell graphs, and the mechanics of these dynamos: A multitude of slow-motion video demonstrations also provide positive test results. The emergence of this hybrid form of propulsion promises a durable drive that will safely propel us to distant objectives.

Nomenclature

A	=	intractance or augmentation of mass by its delayed reactance
a	=	acceleration
$\dot{a}$	=	surge
D	=	inertial delay, lag, or critical action time (CAT)
d	=	distance
f, g	=	generic functions
Hz	=	Hertz, frequency, or cycles per second
M	=	mass
N	=	newtons
RMO	=	rectified mechanical oscillator
t	=	time in seconds
W	=	watts or units of electrical work done
x	=	component of the unknown resultant

I. Introduction

Rectified mechanical oscillators, or RMO's, are special vibrators that have been modified so that the negative phase of the oscillation has been diverted, dampened, clamped, or negated in some way. This concept was originally considered a three-bodied problem in the 1960's until it became clear that the introduction of an outside force commands the direction the three bodies will take. Here, the author takes a brief tour through several RMO impulse engine concepts that include video experiments of the most promising types of impulse drives. Emphasis here is on In-Space impulse drive – not anti-gravity as such, which will likely require a different technical approach. But it must be emphasized that RMO drives are inertial and will only work in micro-g if they are attached to an inertial load.

In electronics, monostable multivibrators are oscillators that operate with part of the cycle in a stable state, and the remaining phase is unstable. The output is pulsating DC voltage. A trigger pulse to the circuit is needed for the circuit to enter such an unstable state. In a similar fashion, RMOs are monostable oscillators where a trigger, or shifter, causes the oscillation to be biased towards the positive direction. In some RMO drives, the trigger could be passive such as a spring or cushion that absorbs impact to transfer the resulting impulse onto the mainframe in a positive direction.

This paper is arranged in a series of examples and experiments: First, simple *Linear Impulse Drives* are reviewed after which *Rotary Impulse Drives* are discussed. Then the more complex *Roto-Linear Impulse Drives* are revealed along with a brief history of their origin. Next, *Linear RMO Drive Experiments* where linear drive modifications designed to improve performance are observed including test results. After which the author explores how gravity plays a part in *Multi-Cycle Linear RMO Drive Experiments*. Then a tour through *Single-Cycle Roto-Linear Drive Experiments.* Finally, the author discloses a fully rectified impulse drive, the *Multi-Cycle Roto-Linear Hybrid Drive Experiments*. For the latter, an additional function discovered by NASA and elaborated upon by Bruce DePalma was added to further stabilize this space drive. Near the end of this paper Fig. 20 displays all of the author's impulse engines with their controller power supplies. Such drives are possible because of the effect of inertial delay. [1]

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II. Inertial Lag and Virtual Energy

In electronics where current can lag voltage in an inductor circuit due to the inductor's magnetic reactance to a change in current, lag also applies to mechanical systems. In the case of a moving Billiard ball striking another ball, the response time of the reactionary ball is often overlooked, action and reaction are two separate events. More importantly, there is a temporal gap between each event.

A. Time in a Bottle

Inertial delay is a real phenomenon observable in everyday events but is generally considered insignificant. Not too unlike the suspended surprise of Yosemite Sam as he realizes he has just left the edge of a high cliff; this delay can be witnessed simply by observing the executive desk toy *Newton's Cradle Pendulum*. Note the impacting ball on one end of the chain of balls does not immediately affect the ball at the other end of the chain. This effect is more dramatically demonstrated in the author's YouTube video *Inertial Delay Demonstration with Repelling Magnets*.[2] Though these magnetic fields are compressing, so too are inertial fields but in a less overt fashion. [2]

This overlooked effect was analyzed in great detail and resulted in an additional Fourth Law [3] proposed to Newton's Three Laws of Motion. This information was reviewed in detail in the author's previous work. [4] In short, the physicist William O. Davis surmised: "The energy of a given system can only be changed in some finite length of time, depending on the system, and never in zero time." [5]

B. Freedom to Accel

This Fourth Law may also be applied to the field of thermodynamics and the notion of antigravity. However, inertial lag here implies a build-up of potential energy since momentum is temporarily suspended, although it may be for fractions of a second. This potential energy is expressed wherein inertial lag D occurs when accelerating mass Ma_1 imparts energy to Ma_2 along with its release of surplus energy $A\dot{a}$ from the impact itself as in Eq. (1) as:

$$D = \frac{Ma_1 + M_2}{t} = \frac{Ma_2}{t} = Ma_2(t^2) = Ma_2 + A\dot{a}$$

Equation 1

Where D is the inertial delay or "critical action time" (CAT) of the accelerating mass Ma_1 that transfers energy upon impact with, and to, stationary mass M_2 allowing time t to pass before mass M_2 can react. Mass M_2 now has the potential of its own momentum plus the energy from Ma_1. The result is an accelerated reactive mass inducing surge $A\dot{a}$ as a third, and also to lesser degrees a fourth and fifth, derivative force represented in Eq. (2):

$$Ma + DM\frac{da}{dt} = M\frac{d^2x}{dt^2} + DM\frac{d^3x}{dt^3}\ldots$$

Equation 2

When released, such suspended momentum often manifests as radiated or *virtual energy* [6] and, in most cases, a lost potential. This virtual energy, also known as surge, could manifest as external vibration, unusual consequences from an automobile accident or tornado, or even a gravitational wave. [7] Take for example Davis's conclusion of the energy wasted of a rocket during take-off where the initial displacement, velocity, and acceleration are all at zero and $t_0 = 0$. Ignoring the presence of Earth's gravity g in Eq. (3) below:

$$N = \frac{DM\dot{a}_0 t_1^3}{6}$$

Equation 3

> "The rocket will have acted as though it were heavier than its true weight! What happened to the energy that was lost?" [8]

Mass in motion appears to be more massive because to get the mass to move requires energy which becomes suspended as virtual until said mass changes direction or speed. While still obeying the Conservation Laws, this inertial potential may be released as a sustainable unidirectional force from the restorative cyclic configuration of surge in a mechanical system.

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[2] *Inertial Delay Demonstration with repelling magnets* 1:03 mins - https://www.youtube.com/watch?v=yWQcSEQalZc

III. A Nutshell History of RMOs

With the turn of the twentieth century and the production of the Henry Ford automobile, the age of profitable automation stirred up a blizzard of inventions, including inertial propulsion or impulse drive concepts. Many of these inventions do produce at least a marginal impulse force and some produce a respectable level of thrust to the point of warranting further research.

A. Categories

The more notable attempts at impulse drive were made with a variety of novel approaches: The general categories are *Piston Impact*, Rogers, U.S. patent 4,801,111; *Eccentric Weight*, Dean 2,886,976; *Barbell Half Circle*, Cook 3,683,707; *Eccentric Rotary Impact*, Thornson 4,631,971; *Variable Radius Mass*, Cuff 3,968,700; and the ever-popular *Gyroscopic Precession*, Kidd. [9]

B. Fundamental Types

However, the author has elaborated these six types of impulse drives into two basic mechanical actions – linear and rotary. *Linear* type motion is the simplest form of impulse action and in this case, is controlled at the beginning and end of each cycle. *Rotary* type motion, of course, is a bit more complex in that impulse is contained within a moving mass in a closed loop which is then influenced by an outside condition. Said conditions may temporarily separate the mass' centrifugal from the centripetal forces but must not detract from the impetus of the whole cycle. This is done by separating the two said forces with distance or by time, stretching action from reaction. Norman L. Dean discovered that the outside condition to best extract force from rotary motion is by adding a third force at the right time in the proper direction thus achieving a clean unidirectional motion of the overall system. This, in effect, is a hybrid of the two above-mentioned different basic types of impulse drives, a *Roto-Linear* drive.

IV. The Three Basic Types of RMO Drives

A. Linear Impulse Drives

The first and earliest documented impulse drive researched by the author was U.S. patent number 1,511,960 filed in July 1921 by Rudolf Goldschmidt shown in Fig. 1 below. This linear impulse device employed spinning eccentric rotors *W1* on a sleeve *R* surrounding the rod *S* holding a spring-loaded hammer *W* that impacts force-transferring buffer *N* allowing just the impulse of the massive hammer *W* to drive the plow.

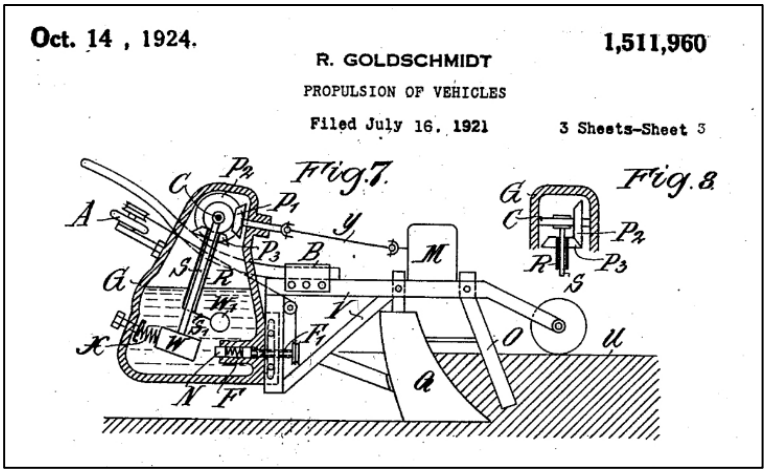


Figure 1 The Goldschmidt Plow - first known documented repetitive impulse drive.

In Fig. 2 below is a top view of the Goldschmidt drive where rotors *W1* are driven by gears *P* to power spring-buffered hammer *W*.

Goldschmidt's plow was the likely precursor to the 1935 Henry W. Bull drive. Though Bull filed only a few patents in 1937, none of his applications pertained to propulsion, so his drive was never developed. Bull may not have been able to find a way to circumvent Goldschmidt's patent or develop a way to cycle the system.

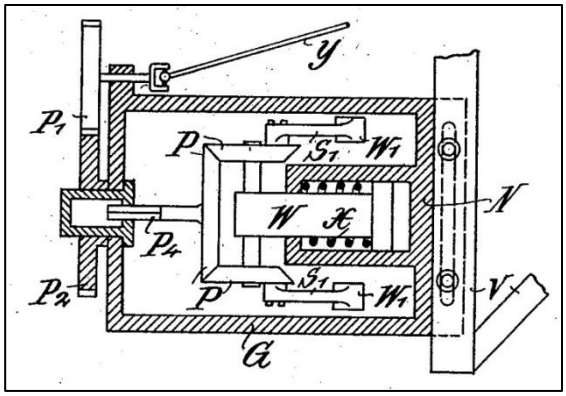


Figure 2 Top view of Goldschmidt's drive.

However, in a periodical interview of the time, Bull was quoted:

> "The theory is that a large weight with a low velocity (if stopped by springs) will yield more foot pounds of energy than a small weight with a high velocity being stopped by impact, even though both were given the same initial force. A simple illustration: Let us assume you are in the center of a room in space. One wall is elastic and the opposite one solid. In your hands are two balls, one heavy and the other light, and you throw them with the same force at the same time. The heavier one hits the elastic wall with an impulse, and a large amount of energy is given to the room in that direction. The lighter one having the same energy hits the solid wall, but its energy is dissipated in heat and distortion. If there could be found a method whereby the kinetic energy of the lighter ball could be effectively utilized the room would move in the other direction." (10)

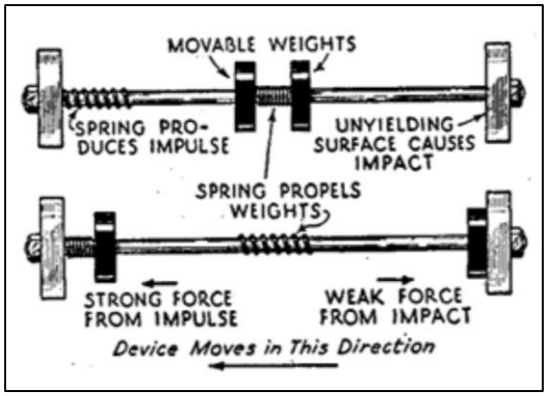


Figure 3 The Bull drive concept.

In Fig. 3 above[3] the Bull drive concept demonstrates that impact energy is absorbed as heat and distortion while a cushioned force passes on its energy as momentum. However, this case may not apply to certain cycling Bull drives working against gravity as the opposite reaction may occur as will be examined a bit later.

B. Rotary Impulse Drives

Rotary impulse type drives encompass a wide range of inventive ideas from the past such as gyroscopic drives and the variable radii drives like Cook, Thornson, Cuff drives, as well as the author's 1988 radial vectoring engine[4] E-3.

However, the genius of the Dean drive is that it was a completely new approach to rectifying mechanical motion. One of the three patents Dean cited in his first patent application 2,886,976 was what may loosely be classified as a precursor to the Dean drive was patent 2,350,248 by Aubrey Nowlin filed Nov. 1942 shown below in Fig. 4.

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[3] Henry W. Bull, *Mysterious New Aircraft Powered by Reaction Motor,* Popular Science Monthly, Jan. 1935, p. 27, courtesy RexResearch.com

[4] The author's *Inertial Propulsion Engines E-2 through E-9 - Vintage Videos: Part 1 of 3* – Observe at 8:00 mins. into the video. https://www.youtube.com/watch?v=tg4KP8qdtR4&t=504s

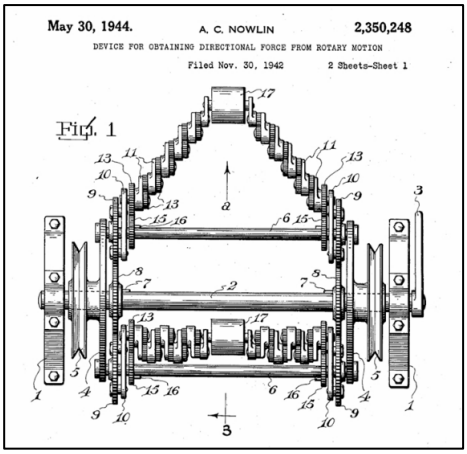


Figure 4 The Nowlin drive used many moving parts.

The idea behind this rotary impulse drive type shown in Fig. 4 above, was to use offset gear-links to throw a rotating eccentric mass off center creating an unbalanced force on one side of the machine. A set of planetary gears on either side of eccentric rotor *17* throw it out to the forward side of the machine and retract the eccentric at the rear. The main drawbacks to the Nolan Drive were a lot of moving links that would require constant lubrication with a likelihood of the links to kink and cause uneven motion and binding leading to unwanted side oscillations, and failure.

C. Roto-Linear Impulse Drives

Patented in 1959 by Norman L. Dean, his drive employed unique roto-linear motion. Not only are the eccentrics rotating, but they are also actively shifted to the forward side of the machine during part of the cycle. Though the Dean drive uses a substantial number of moving parts, their consolidation allows for minimal wear with no side wobble in single- or multiple-cycle operations.

D. Rugged and Reliable

The Dean drive can be configured to be quite durable: It must be noted that of all the later Dean engines the author has built over the past three decades with hundreds of hours of rigorous testing, not a single repair was needed. The mainframe of the E-13 series, reviewed later in this paper, was especially designed for minute flexibility caused by shifting loads without affecting the stroke of the carriages or causing perceptible wear.

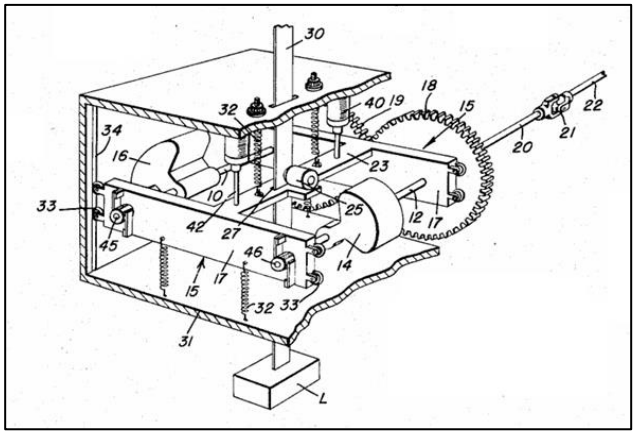
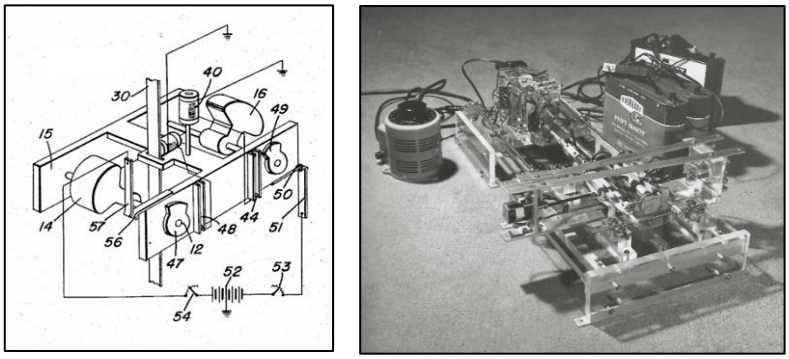


Figure 5 The controversial Dean drive. This is Fig. 5 from patent application 2,886,976.

For almost seven decades the Dean drive, depicted in Fig 5 above, has been neglected by Classical Mechanics so most researchers would risk neither time nor reputation to build one. This is somewhat due to the fact that no fully

functional Dean drive from Dean's time exists. Because of a lack of funding, Dean scavenged parts from operational machines to build better ones, though none were ever finished: No one had a Dean drive to copy. Unfortunately, Norman Dean died on an English operating table at the age of seventy and never saw his dream fulfilled of a space-faring economy.[5]

However, the Dean drive concept did change the way a few physicists viewed matter-in-motion, particularly on the nature of surge and its effect on surrounding frameworks. Devices such as the Dean drive appear to take advantage of the temporal gap within the Third Law. The author spent decades researching Deans' patents, building various Dean drives and experimenting for the best results, the culmination of which are later reviewed in this paper.



a) **b)**

Figure 6 The Dean drive scheme and one of the many drives he built.

Above in Fig. 6a is the Dean drive scheme where timing of the solenoid *40* shifter is critical. Figure 6b shows one of Dean's engines[6] built in the early 1960's. Note two separate power supplies are required: Here, a fixed voltage from a pair of batteries for system displacement and a *Variac* controller to adjust the rotors' speed. The motor and commutator assembly are at the back of the machine, the rotors at the lower front, and shifter at the sides.

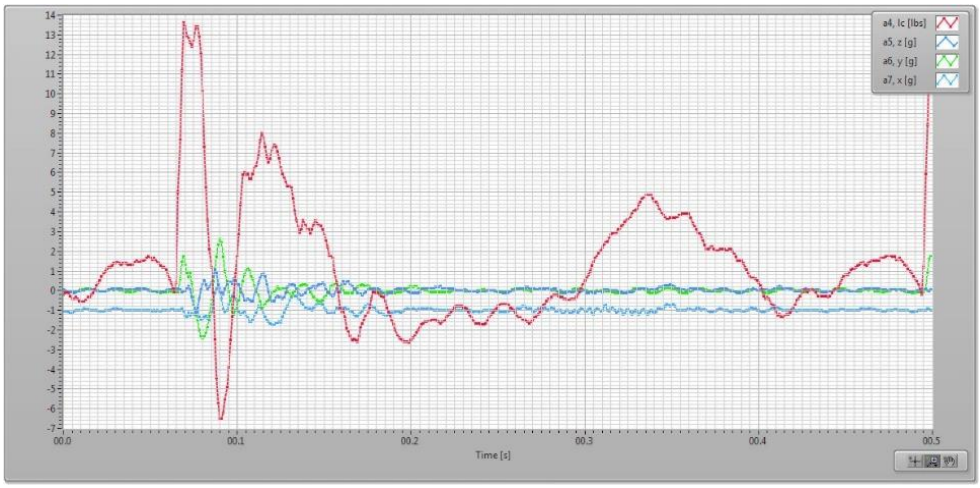


Figure 7 Load cell readout of E-13, a single cycle Dean drive.

In Fig. 7 above is the author's load cell readout of E-13A, a single-cycle Dean drive. Note third, fourth, and fifth derivative impulses believed to be the results of virtual energy.

[5] Courtesy of Bruce D. Dean, Norman L. Dean's grandson.
[6] Courtesy of Bruce D. Dean.

V. Linear RMO Drive Experiments

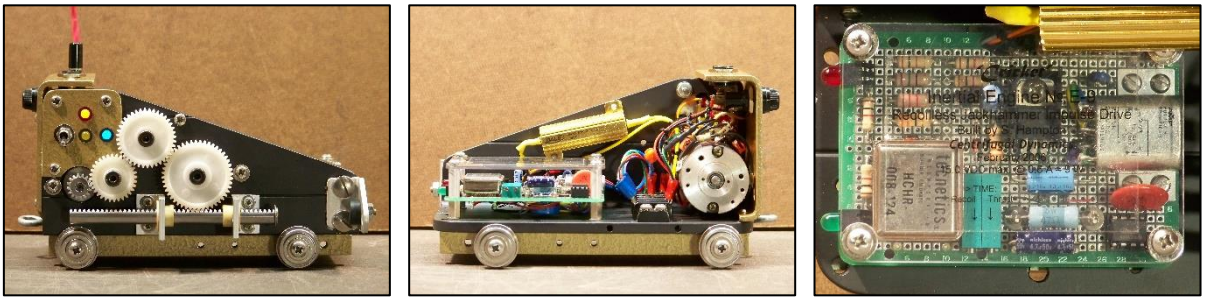
A. The Basic Linear Drive

Though roto-linear Dean drives have proven to have more impulse per watt, the linear Bull drive is still a plausible method of In-Space propulsion. The Henry Bull drive of 1935 is based on the principle that the impact energy is absorbed and converted to heat while the same force acting against a spring transfers that energy into momentum.

However, there appears to be confusion among researchers about how a Bull drive is supposed to work. The periodical that published the original piece on the machine appeared to have it backwards. [11] The two websites[7] sharing Bull drive research shows impulse force coming from what appears to be the wrong end of the device:[8] Force against a spring does provide impulse, *but* not when a backstroke is required which is how repetitive impulse machines have to work. The exception to that rule is the roto-linear Dean engine such as the E-13 series [12] which requires springs in both directions of the cycle. In this case, gravity is not intended to be a factor in the cycle as with the saucer-shaped E-9Lx reviewed later in this paper. Therefore originally, said engine E-9Lx had springs on the bottom of the solenoid plungers as Bull would predict, but no impulse could be attained from the E-9Lx drive. At that juncture, it became obvious that cushioning on the other end of the cycle is essential to manifest CAT and impulse against gravity.

B. The Jackhammer Bull Drive

Working upon the assumption that the Bull drive concept was sound, engine E-9Lx employed an electronic trigger system that was somewhat based on an earlier engine: Engine E-9 was built in 2006 and the author's first attempt to build a functioning Bull drive. Reminiscent of the Herman Munster-mobile, inertial engine E-9 is shown below in Figures 8a mechanical-side view; 8b electronic control-side view; and 8c circuit-board view. The drive weighs 1.36 kg. and is a recoilless jackhammer fired by an asymmetric electronic oscillator. It can propel itself on roller bearing wheels using just 9 watts. Nicknamed *Cricket* due to the sound it makes while running, it is a hybrid rotary-to-linear system. It is a fusion of the author's inertial engine E-8 shifters circa 1997, not reviewed here see Fig. 20, and what was believed to be the Henry Bull drive. It uses an asymmetrically fired ramrod to drive the rod fast-forward to a soft stop, then gradually recoil to repeat the cycle. Slight unidirectional force is achieved.



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

Figure 8 Inertial Engine E-9 circa 2006 is a recoilless jackhammer drive.

VI. Multi-Cycle Linear RMO Drive Experiments

A. Triple Phase Solenoid Drive

No one *invents* anti-gravity; one simply discovers ways to repel or outrun it. The approach presented here involves jumping up really fast and not coming down for a while. It must be stated up front that the purpose of this chapter is to demonstrate the possibility of overcoming gravity by means other than aerodynamics and reaction propulsion methods. This and the other machines discussed in this paper are not necessarily proposed end-result drives in themselves, though these principles could possibly be applied to future craft.

The next drive, though not a Henry Bull engine but a reversal of his principle, has been designated as the aforementioned E-9Lx, the fourteenth engine the author has built. It is a multi-cycle, triple-phase DC-operated impulse drive that employs solenoids and operates in reverse principle of the Bull drive. The E-9Lx acronym derives from "E" representing an inertial engine; "9" as a continuation series of inertial engine E-9; "L" refers to lift-off or loss-of-weight class; and "x" represents multiple cycle category – in this case, three-cycles. This engine takes advantage of inertial delays in three hops.

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[7] *The Impulse Drive Experiment* - IPD v1.0 - http://linas.org/mirrors/jnaudin.free.fr/2002.06.03/html/impdexp.htm

[8] *Harry W. Bull, Reaction Motor* - http://www.rexresearch.com/bull/1bull.htm

For example, imagine if one will, nine frogs tied together into three groups of three each, and each group of three were trained to jump upward, one-group-at-a-time, in sequence fast enough to keep all the frogs levitating. This is the operating principle of inertial engine E-9Lx. But instead of frogs, more easily trainable solenoids were used.

Getting up is one thing, staying up is whole another box of frogs. However, there is time to jump again before gravity can claim its due, as long as there is a rising platform to jump up against, in this case the machine framework. This is possible because impulse can be applied during one cycle while the other cycles are recovering from previous impulses. This all occurs during the inertial lag of each phase of the system.



a) **b)**

Figure 9 Inertial Engine E-9Lx.

Please refer to the above Fig. 9a. On the left is the engine, power drop, and remote frequency controller; and Fig. 9b is a close-up with pilot. Appropriately, the maximum operating frequency of each set of solenoids is 9 Hz. The experimental drive E-9Lx uses the upward impulse of a series of push solenoids, or *impellers*, in a properly arranged pattern fired in staged sequence at a frequency high enough to urge their mainframe upwards. The downstrokes of the solenoid plungers are dampened. The result is an overall upward motion of the device exhibiting a slight weight loss.

B. Lifting Force

Using a total of 13 watts of DC electrical power, engine E-9Lx drops its weight by 70.87 gm or 2.5 oz. from its 1.64 kg or 3.6 lb. total weight. This equates to 4.3 percent of the engines' total weight. Thus, to lift one kilogram of weight using this method, the power required in watts can simply be calculated in Eq (4) as:

$$1w = \frac{70.87}{13} = 5.45\ grams$$

$$1kg\ of\ Lift = \frac{1000}{5.45} = 183.48\ w$$

Equation 4

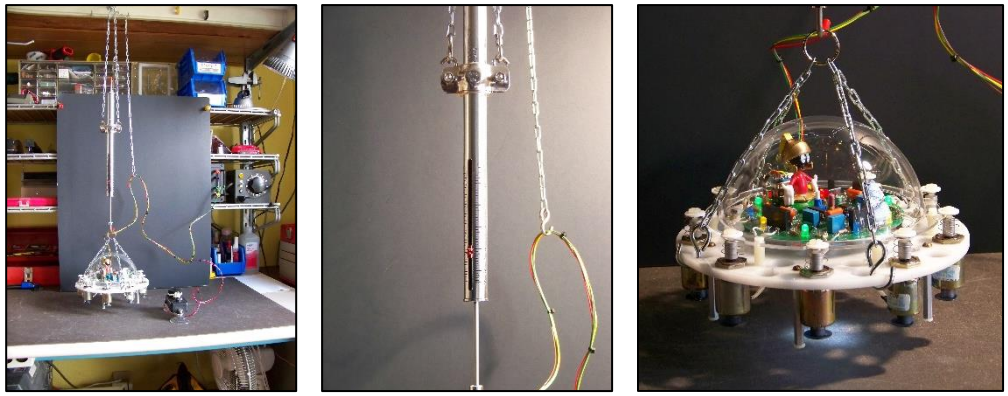
Or about 83 watts to lift one pound. However, the weight-to-power ratio of this particular configuration is too high for this device to be a direct example of a viable flying craft. Better efficiencies are possible with the invention of a lighter electrical impeller. Case-in-point: Just 7.25 VDC powered the electronics and 21.05 VDC was used to power the impeller coils. Because of the super-efficiency of such a system with lighter and more powerful electric impellers, it is conceivable that enough surge could induce an inertial radiation[9] of sorts that may play a part in the lifting force of future craft.

Figure 10a below displays how the experiment was set up. Figure 10b shows the 22 kg Chatillon scale with a modified clamp to suspend the scale by its body. The 5 lb. side of the scale was referenced in the video.[10] Figure 10c is a close-up view of inertial engine E-9Lx in idle mode.

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[9] *Tractor Beams - Inertial Radiation Demo* - https://www.youtube.com/watch?v=H3uP37vdQ4g

[10] *"Anti-Gravity" saucer achieves Schumann resonance…* https://youtu.be/jCgXDL7Nm6k



a) b) c)

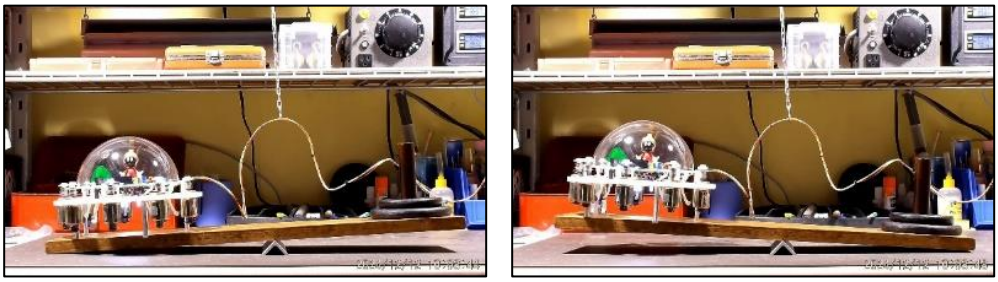
Figure 10 Weight Loss Experiment using analog scale.

It may be argued that the experiment in the video demonstration is invalid because the scales 5 lb. extension spring may shorten when vibrated. However, the scales needle did not display a gradient change in vibrational amplitude as the engine speed was increased, and the scale needle was stable at the lower speeds. As a side note: digital scales cannot respond to the subtle and rapid changes in weight which occur at Schumann resonance or 7.83 Hz. In a hovercraft, said resonance would simply be felt as a low frequency vibration.

It is also important to note here that many people have reported powerful subsonic vibrations of around 8 Hz during rocket launches. Norman L. Dean, famous for inventing the Dean drive and who was the actual inventor of the gyroscope used on modern space and aircraft,[11] also predicted the frequency needed for an inertial drive to overcome gravity at or near 8 Hz.[12]

C. Balance Beam Test

To further verify weight loss of inertial engine E-9Lx, a balance beam test was suggested[13] and conducted accordingly. See the video snapshots Fig. 11a at rest, and Fig. 11b upon start-up, below.



a) b)

Figure 11 E-9Lx Balance Beam Test

The counterweight consists of a 2.5 lb. and a 1.25 lb. plate equaling 3.75 lbs. equal to the weight of the engine along with the mounting screws to the balance beam itself. This test may be viewed at the YouTube site Balance Beam Test – lift-off.[14] Though it may also be argued that vibration is the cause of the upward force of this inertial engine toy, the engine is lifting from a dead standstill.

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[11] *The Prince of Space*, Norman R. Dean (son of Norman L. Dean), April 2010, pp. 107, 108 – which includes drawings and 1946 photographs of Norman L. Dean's Spatial Inertial Gyroscope: It is identical to what we use today on air and spacecraft.

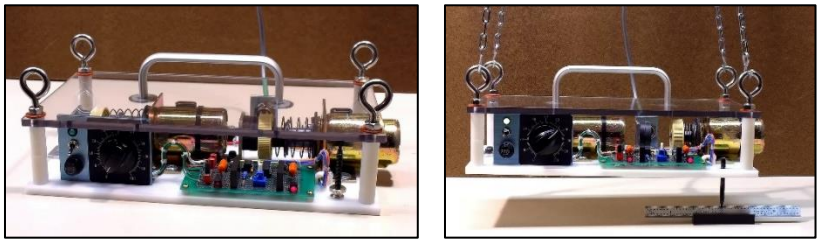
[12] Original and unpublished documentation from the private library of Norman L. Dean, *An Introduction to A System for Converting Rotary Motion into Unidirectional Motion,* page 15, 1964 Norman L. Dean, courtesy of his grandson Bruce D. Dean.

[13] Suggested by a YouTube viewer.

[14] *Balance Beam Test* - https://www.youtube.com/watch?v=HAMqmjheqZ0

D. Two Cycle Bull Drive

The next experiment is the fifteenth inertial drive built by the author, appropriately designated E-15, and was built under the assumption that Henry Bull had his principle of impulse reversed. As it turns out, with the *front-to-back* configuration Bull was correct. The author's previous drive, the E-9Lx saucer used solenoids *side-by-side* as impellers that forced the plungers upward in an attempt to induce impulse via impact. When said plungers were released, the springs slowed the plungers' return to rest. Since gravity plays a part in the cycle of each plunger E-9Lx would not work in space. However, the E-15 principle would be a self-contained in-space impulse drive system.



a) **b)**

Figure 12 Linear Impulse Drive E-15 under test

The inertial engine E-15 is a two-cycle Bull Drive where the impact is absorbed as heat when the solenoid plungers engage and the potential of the elastic energy from the compressed springs is transformed into kinetic impulse when the plungers are released. Figure 12a and Fig. 12b above are snapshots of the bench and pendulum tests. Please refer to the demonstration video on YouTube.[15] In the video and in Fig. 12b above, note the black stylus extending below the base of the drive indicates a steady positive impulse when the solenoids are engaged.



a) **b)**

Figure 13 Setting the spring rates for E-15

In Fig. 13a and Fig. 13b above shows how the proper spring-rates were determined for E-15. The force gauge is held firmly in a small vise so that the engine may engage the actuator while various solenoid springs were tested for the most reactive force and still able to compress when the solenoid is activated.

VII. Single-Cycle Roto-Linear Drive Experiments

Dean Drive with Bull Drive Assist

Two of the drives the author has recently built and experimented with showed promise of a fusion: The 1959 Norman Dean drive and the 1935 Henry Bull drive concepts. But strapping a Bull drive atop a Dean drive and cranking up both devices invite chaos. Such a marriage could inspire immediate divorce proceedings because the Bull drive depends upon reverse impetus, and the Dean drive depends upon a forward generated centrifugal force. However, it would be of great advantage to combine these linear and roto-linear types of drives: First, they both have unique features that prove efficiency at great power-to-weight ratios. Second, there is nothing impossible within the realm of propulsion according to Wile E. Coyote. But what complicates the merger is that if either engine is overdriven it runs backwards. Though separately, both engines do run backwards at higher speeds, they run with much less power, which gets a bit complicated when engineering for efficiency. Shown for scale in Fig. 14 below is a photo of the single-cycle

[15] *Henry Bull Impulse Engine* - https://www.youtube.com/watch?v=lMwk0zHG1ck&t=2s

E-13A with a pair of passive Bull drives on the left, and the two-cycle E-15 impulse Bull drive employing solenoid impellers.

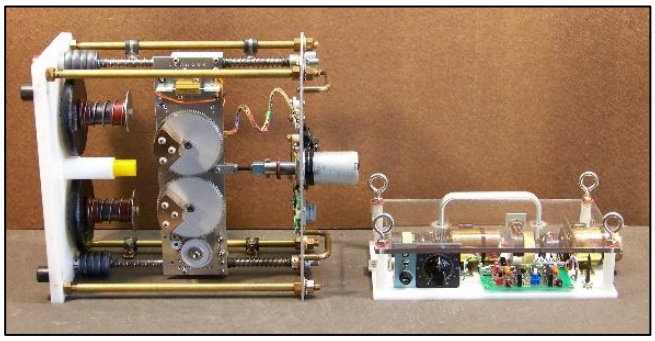


Figure 14 Merging two unique technologies - single-cycle Dean drive with a two-cycle Bull drive.

The success of a hybrid RMO hinges on working around the Dean Drive impulse function: Dean rotor cycle cannot be interrupted. So, the Bull drive had to be modified to work in harmony with the rotary function of the hybrid cycle.

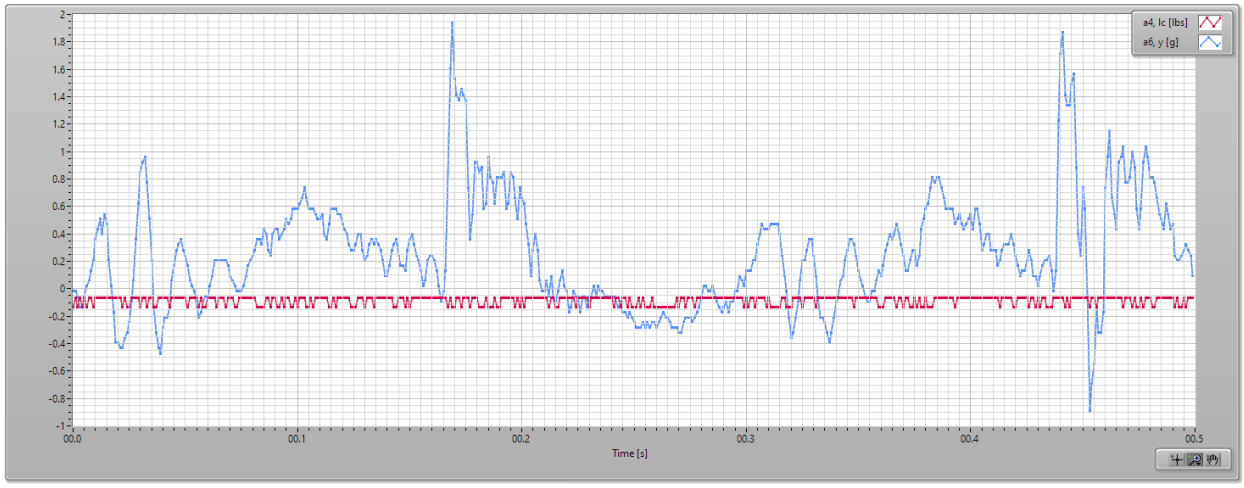


Figure 15 Accelerometer readout of E-13A, a single-cycle Dean drive.

Above in Fig. 15 is an accelerometer readout of E-13A, a single-cycle Dean drive peaking at nearly 2 g's. The red trace is the unmounted load cell used in later tests. The load cell was not in physical contact with the engine nor on the bench, but off to the side in the author's toolbox, but still in front of the operating inertial drive.

The first single-cycle hybrid experiment was a dual Bull drive attachment to the base of the Dean engine E-13A. Two Bull drives were added for better stability. This arrangement is now what is considered a *passive* Bull drive modification. See Fig 16 below which is a snapshot of a YouTube video[16] of the modified drive as it is surging forward. Notice in the video the black block at lower left which is a reference guide. In the video when the engine is resting at equilibrium, the black block aligns edge-to-edge with the white edge of the engine bottom plate. When operating, the engine pulsates from equilibrium to the right of equilibrium.

The problem with developing a two-cycle hybrid impulse drive is that while a Dean drive carriage swings towards the rear of the mainframe, it has already provided positive impulse forward upon the mainframe. The Bull drive however, provides impulse when its mass moves forward against the motion of the recovering carriage. This causes the mainframe to increase its overall impulse, but this also does not reduce the side-to-side wobbling in *two-cycle* Dean drives. For a *single-cycle* Dean drive like that shown in Fig. 16 below, this is not a problem. However, for *two-cycle* Dean drives, this problem can be best addressed in future designs where the Dean drive carriages are arranged

[16] *Dean engine with PASSIVE Bull Drive Assist* - https://www.youtube.com/watch?v=-bGX1470tVM

front-to-back, much like that of the two-cycle inertial engine E-8, not reviewed in this paper, see Fig. 20 at end of this paper.

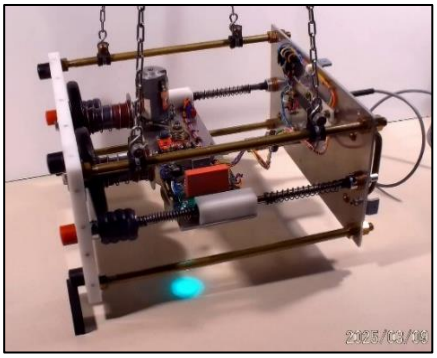


Figure 16 Passive Bull assisted Dean Drive E-13A as it courses forward to the right.

VIII. Multi-Cycle Roto-Linear Hybrid Drive Experiments

A. Von Braun's Mystery

In 1958 NASA launched one of its first missions, Explorer 1, on a rocket designed by Wernher Von Braun to explore the aurora borealis.[17] But something went wrong. NASA lost the rocket somewhere in space. As George Ludwig, power pack and radiation monitor designer of the Explorer 1 mission stated at the time:

> "... we all realized immediately that the rocket had provided a larger than expected thrust, resulting in a higher than planned orbit, and a longer orbital period. The orbit had been expected to have a perigee (lowest height above the Earth) of about 220 miles and an apogee (greatest height) of about 1000 miles. The perigee and apogee heights were actually 223 miles and, more significantly, 1592 miles, respectively, with an orbital period of 114.7 minutes rather than the 105 minutes that had been originally anticipated ...."[18]

This was a twenty-percent increase in performance; the rocket traveled an extra six hundred miles higher into orbit. The reason for the significantly higher than planned orbit was that the payload was set to a spin for better guidance. But mysteriously, that better guidance became an energy boosting momentum to the rocket's overall trajectory. In retrospect, this should not have been a surprise as rifled bullets not only travel straighter – but also farther.

B. The DePalma - Bull Assisted Dean Drive

In 1977 Bruce DePalma published a paper [13] on the effects of a spinning mass in linear motion with bouncing ball experiments. DePalma documented the experiment of two balls dropping from the same height, one spinning, and one not spinning. The results were dramatic; the spinning ball bounced upward by 20 percent higher and traveled about 10 percent further than the non-spinning ball.[19]

In the next experiment the passive Bull drive barbell plates were set to spin. The result was the plates rifled on the spring-loaded stalks when oscillated by the action of the Dean rotors' centrifugal force. This reduced plate intractance which empowered the plates with more energy that enhanced the Bull Drive performance. In effect, the inertial engine E-13CxBD is a Bull-DePalma mechanism assisted Dean drive. The result is a smoother two-cycle operation of the Dean drive with a noticeable boost of impulse power.[20] In the YouTube video, carefully observe the slow-motion portion of the video once the drive warms up: A steady displacement gain is usually not observable at typical operating frequencies of these impulse drives until the video is slowed down. Figure 17a below shows the two-cycle dual hybrid drive E-13CxBD employing DePalma booster-stabilizers. Figure 17b is a close-up of the DePalma pinch-roller driver.

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[17] *Von Braun's 50-Year-Old Secret,* Richard C. Hoagland - http://www.enterprisemission.com/Von_Braun.htm

[18] Ibid. page 16

[19] *Understanding the Dropping of the Spinning Ball Experiment* - Bruce E. DePalma's spinning ball experiment where a pair of bouncing balls, one spinning, shows the spinning ball going much higher than the non-spinning ball. http://rexresearch.com/depalma2/depalm.htm

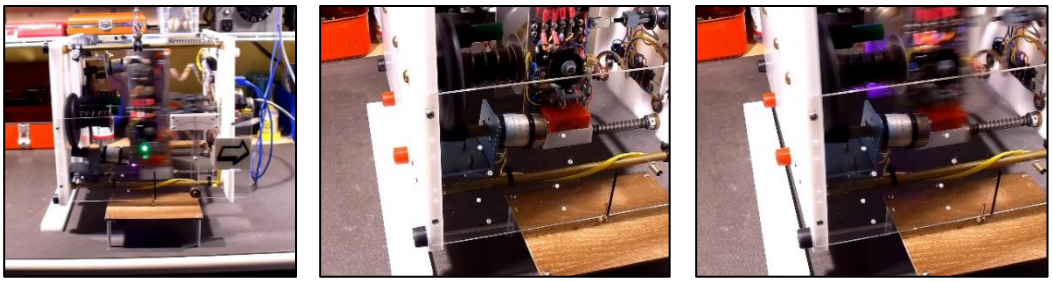
[20] *DePalma Assisted 2-Cycle Dean Drive* - https://www.youtube.com/watch?v=o_dfWpLRqLA



a) b)

Figure 17 The dual-cycle hybrid drive E-13CxBD employing DePalma boosters.

The two-cycle dual hybrid drive test shown in the YouTube video uses the playground pendulum that employs just two lines. There is justification for this kind of pendulum test: A two-line pendulum deflects from equilibrium with 30-percent less force than a Millis four-line *platform* pendulum which also forces the test drive to lift *upward* against gravity. [14] The two-line pendulum duplicates the micro-g-like condition of space.



a) b) c)

Figure 18 The dual-cycle hybrid drive E-13CxBD experiment.

Figure 18 above displays snapshots of the above-mentioned video test: In Fig. 18a the engine is running. Note the thin wood panel resting on the bench with brass reference needle that aligns with black curser line on the clear Plexiglas side panel of the engine. Figure 18b shows the drive at rest. Figure 18c shows a steady displacement from equilibrium.

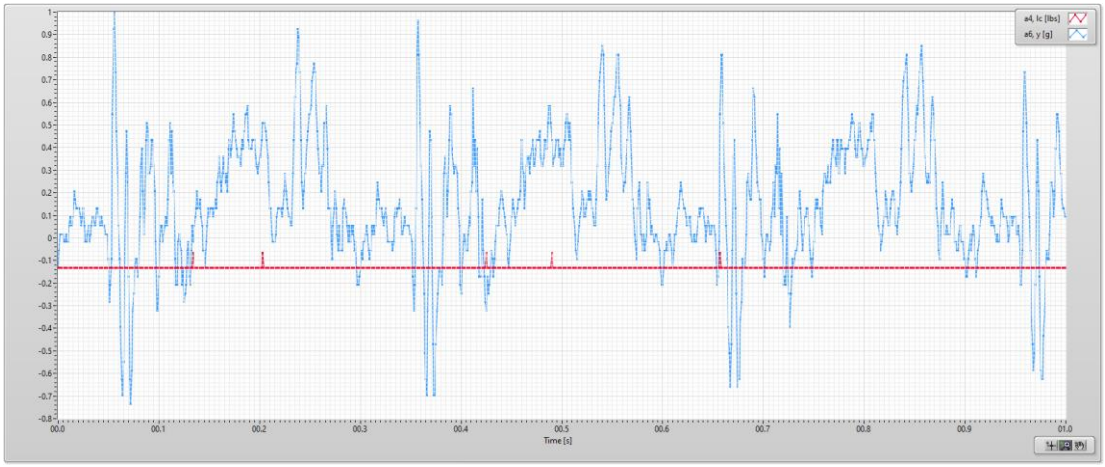


Figure 19 Accelerometer readout of dual-cycle Dean drive E-13Cx.

Figure 19 graph above displays the acceleration of the dual-cycle Dean drive E-13Cx. With the additional Bull and DePalma drives, this very same engine became designated E-13CxBD.

INERTIAL PROPULSION MACHINES
~ Built by the Author ~

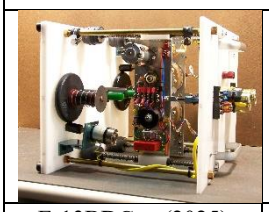
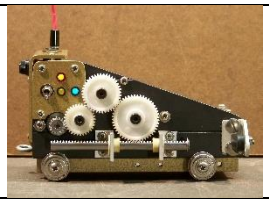
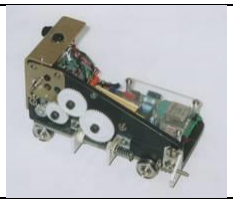
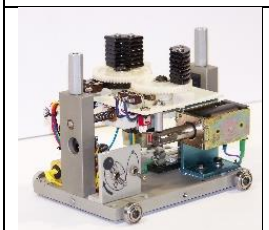
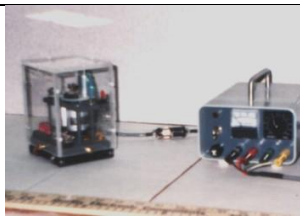
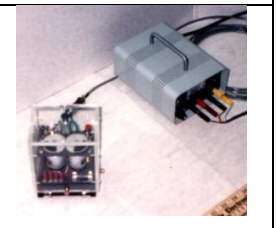
			
E-13BDCx (2025)	E-15 (2025)	E-9Lx (2024)	Controller PS-6 (2023)
			
E-13A, E-13B (2017)	Controller PS-5 (2019)	E-9 (2006)	E-9 (2006)
			
E-8 (1997)	Controller PS-4 (1994)	E-5 (1995, 2015)	E-5 (1995, 2015)
			
E-6A, E-6B (1995)	E-6 Cover (1995)	E-4 (1992)	E-4 (1992)
			
E-3 (1989)	Controller PS-3 (1989)	E-2 + PS-2 (1988)	E-2 + PS-2 (1988)

Figure 20 The Authors' empirical evidence.

Figure 20 above displays the author's hand-built mechanical impulse drives: Engines E-2 and E-6B were stolen from a storage unit in 2002, but an upgraded E-6A is still available. Engine E-1 was lost in a move in 1983.

Conclusion

It has been shown in this, and in previous works by the author, that Davis Mechanics does not contradict Newton's Laws. We have established a series of plausible and reliable tests. The successful test results of these rectified mechanical oscillator drives imply that *any* asymmetric oscillation; mechanical, electrical, electromagnetic, or electronic driven, may be used to produce unidirectional motion. It is entirely possible to create a solid-state inertial engine with the application of high voltage at an extremely high frequency on a dense material that can readily change quantum states. The electrons of this material must be able to jump orbits en masse rapidly and return passively.

However, such drives are inertial and will only work in micro-g if they are attached to an inertial load.
By combining Bull, DePalma and Dean Drive principles, it has also been shown that a relatively smooth, continuous impulse can be achieved from a closed system. Such a system can be made to eliminate all residual vibration with increased impulse force utilizing a durable, compact electric engine module that could be retrofitted into satellite designs and ganged for extended space flight.

*****

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And of course, thank you to the late Dr. William O. Davis for his brilliant work and insight into the nature of surge.

This paper is also a tribute to the work of the Wizard of Whirl – Norman L. Dean

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