Asymmetric Impulse Drive

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Presented here is a powerful electric In-Space engine. We glance at the origin of this propulsion technology. We examine the theory behind the mechanics, mathematical data, and how this dynamo is constructed. A number of positive digital test results are displayed. Two of these efficient engines have been built, upscaled from smaller prototypes. Further upscaling of this robust spacecraft engine will safely push us to distant objectives. We then demonstrate a 2-cycle Asymmetric Impulse Drive.

I. Nomenclature

A = intractance or augmentation of mass by its delayed reactance
$\dot{a}_c$ = centrifugal acceleration
$\dot{a}_c'''$ = surge acceleration third derivative displacement
$\dot{a}_c''''$ = jounce acceleration fourth derivative displacement
D = Inertial delay or "critical action time" (CAT)
E = electrical potential as Voltage
F = force (N)
f = frequency in cps or Hz
g = an acceleration equal to Earth's gravity
I = electric current flow in Amperes
λ = lambda or wavelength
m = eccentric mass x2 (kg)
M = vehicle's mass (kg)
P = power in Watts expressed as $I \times E$
r = radius
t = time (s)
v = velocity
W = watts or units of electrical work done
X = moving body
Z = multi-faceted impedance

II. Introduction

An electric In-Space engine will solve the problem of extended travel time between Earth, Moon, asteroids, and outer planets. All previously proposed electrical propulsion systems have fallen short to provide the force needed. Also, there is a general feeling in the physics community that a mechanical source of thrust or impulse is archaic and unrealistic. The author is going to address that misconception.

I, the author, have demonstrated that such an engine is quite real through the development of a dozen prototype machines and rigorous testing: Five positive testing methods will be disclosed. Acceleration and load cell charts will be reviewed. It is my intention to present unbiased results of these tests and to show how an electro-mechanical impulse engine can be engineered to produce a safe, dependable, and powerful source of in-space propulsion.

In Section III we look briefly at why Norman L. Dean's inertial propulsion (IP) patent has for decades, caused so much confusion. It is important for us to appreciate the origin of this propulsion system and why it took so long for it

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to come to fruition: Many of us are not aware that even today we depend heavily on another of Dean's brilliant inventions every time we fly in an airplane or send something into space.[2]

In Section IV we look at the peculiar mechanics of the Asymmetric Impulse Drive's operation and why it only *appears* to break some known physical laws. We provide a mathematical analysis and a logical theory. The concept of "Davis Mechanics" will be briefly reviewed and why it applies to this unusual mechanism. Because of the vigorous forces generated by this bizarre powerplant, it is also important to remember that *concepts* and *terminology* discussed in this, and the next section are needed *to clearly define the final analysis* of the test results.

In Section V we review the mechanical aspects of the drive and how it operates. It cannot be over-emphasized that the operation of a mechanical Dean oscillator is not as simple as it may first appear. It is not a vibrator. It cannot be analyzed as if it were a mass on springs: When there is an opportunity to properly shift this oscillator and cheat its cycle, far more force is realized than with precessing a gyroscope of much greater mass – and much easier to address.

Section VI uncovers the Asymmetrical Impulse Drive (AID) itself. I unveil the dynamics and parameters of this inertial engine and how it is constructed, and with what components are best suited for In-Space propulsion. The AID's electrical requirements and efficiency will be revealed.

In Section VII we review test results beginning with the over-rated, yet also ironically under-rated, pendulum test. We then reveal more definitive results using water, force gauges, digital accelerometers, and load cells.

Finally in Section VIII a two-cycle AID engine will be disclosed that promises to provide a smooth, powerful force that is safe, controllable, and extremely efficient.

III. Origin of the Asymmetric Impulse Drive

Many patents have been filed that propose a source of closed propulsion. The U.S. Patent and Trademark Office (USPTO) is flooded with such applications. There is an ancient, instinctive urge for us humans to propel ourselves using internal forces. This predates aeronautics, which is an attempt to do just that – escape the dominance of gravity – even in space. We humans cannot stop dreaming about it: There have been countless publications and papers on reactionless propulsion machines such as the Dean drive [1]. For example, recent papers that refer to the Dean drive by C. G. Provatidis [2] and M. Gamble [3] are both illuminating. However, we have brought the concept of the Dean drive to the physical plateau.

There is an exceptionally well-presented third-party animated video[3] debunking the theory of an independent centrifugal force from a Dean drive and tries to reconcile how this engine and Newton's Third Law of Motion can co-exist. Aside from the shifter timing being way off, the video did not entertain characteristics of how spinning eccentric rotors behave and how they actually *react* to sudden shifts in position.

The most thought-provoking publication illustrates what is termed "Davis Mechanics" [4]. Dr. Davis's work has been skimmed over as irrelevant by many physicists – but as it turns out, it is tantamount to understanding what is occurring in Dean drives (and other possible technologies.) Some of Davis's work will be reviewed in this paper. But first, let us look at the original problem – why the Dean drive looks good on paper, but will not fit in textbooks.

A. The Two-Fold Conundrum

Norman L. Dean (1902-1972) patented his first electro-mechanical inertial drive in 1956. [5] Dean has compelled hopeful inventors all around the world to twirl their fists around in basements, burning-up candles into the wee hours. The author was one of them. That perplexing machine has intrigued millions for almost 70 years. So why hasn't someone built a flying machine based on its design before now?

The problem is two-fold. The first problem as it turns out, was not infeasibility, but patent rights protection: Dean laid out his art so skillfully that without extensive research, even the most discerning engineer could not easily deduce all the variables.[6] Second, the Dean drive is not subject to a quick and dirty analysis.

Let us take a brief look at the first problem mentioned above: Why has it taken so long for the Dean drive to be seriously considered in the scientific community?

The following scenario represents problems many inventors still face: It is noteworthy that because Dean employed deflecting art and language in his patent and its claims, duplication of his drive has been elusive. This frustration was heightened in the early 1960's as such a drive would have placed the United States of America at a superior position in the "Space Race" that Russia was winning.

But like most inventors, Dean had his own problems, mainly the need to sell his invention so he could devote more time to research. Though a patriot, Dean's other major problem was his mistrust of large U.S. corporations and

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[2] *The Prince of Space*, Norman R. Dean (son of Norman L. Dean)
https://www.lulu.com/search?adult_audience_rating=00&page=1&pageSize=10&q=prince+of+space

[3] Why nobody can explain the Dean drive https://www.youtube.com/watch?v=XMNHUq8r6A4

especially the U.S. Government after forced appropriation of his Spatial Inertial Gyroscope. We are still using Dean's non-precessing gyroscope on air- and spacecraft – it got us to the Moon and back.[4]

Dean's skillful use of patent "stealth protection" and leaving out crucial information in his patent 2,886,976 made it quite difficult to duplicate his drive. See Fig. 1 below of one of many drives Dean built that did not resemble his patent drawings.[5]

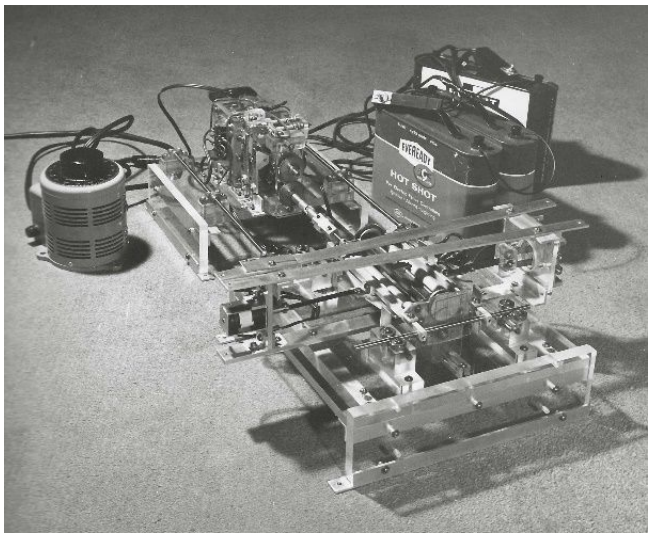


Fig. 1 One of many drives that Dean built. Note dual power supplies.

I have filed for patent [7] on the AID and at the risk of losing total financial control of the invention, I avoided use of stealth protection to bring this technology to the attention of the space industry.

The second problem, which we will examine shortly, is that the Dean drive just looks too simple to be true. Decades were spent building and experimenting to render our version of the Dean drive into a durable machine with a substantial driving force: It was not all that simple.

At this juncture, in order to fully understand what is occurring within and around a spinning eccentric mass that is continually changing its position in space and just how unidirectional force can be generated from it, a logical hypothesis is proposed here.

IV. Why Asymmetric Impulse Drives Work

William O. Davis, Ph.D. (1919 – 1974) was struck by the implication of a machine such as the Dean drive [8]. In the past, Davis's work on the effects of cyclic surge – as is with the case of the Dean drive – has been passed over because of the lack of evidence of a functional Dean drive at Davis's disposal. Now, Davis's work is even more compelling.[6] Davis reasoned that such a drive may obey Newton's Third Law of Motion and the Conservation Laws, but it appears that engines like AID are taking advantage of certain "loopholes" in the phenomenal world. [9]

Derivative displacements are of course, the result of actions that occur within a period of time when a mass in motion is forced to change its position. In everyday life when an automobile accident occurs most likely "surge" is involved. Surge is a "third derivative" displacement. Higher orders of derivative displacements are possible such as with very high-speed impact: "In most cases, higher derivatives will probably shed little light on the problem … of cyclic or oscillatory motion, it can be shown that a dynamic system can be completely described with not more than three derivatives." [10] Later, we will see positive evidence of a *fourth derivative* displacement also driving the AID.

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[4] *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 near identical to what we use today.

[5] Original and unpublished photograph from the private library of Norman L. Dean, *The Dean System Space Drive: Phasing,* 1963 Norman L. Dean, courtesy of his grandson Bruce D. Dean.

[6] Another physicist, Paul A. Crafton, Ph. D. submitted a 50-page paper to Norman L. Dean entitled *A Mathematical Analysis of a System for Converting a Rotary Motion into Unidirectional Motion,* Aug. 1958, with similar conclusions advocating that such a system will work. Original and unpublished documentation from the private library of Norman L. Dean.

A. Addressing Simultaneity

In close-order physics, interactions are usually considered instantaneous. But surge yields a seldom observed phenomenon: Like Dean drives, AID takes advantage of a loophole caused by matter already in motion then suddenly changing its position, also known as "rate of onset," which facilitates an "inertial delay" of sorts. In the field of thermodynamics, a similar type of time delay can be observed by anyone playing "Hot Potato." As Davis pointed out:

> "Einstein recognized that this condition (simultaneity) would not be met in the case of bodies separated by astronomical distances since the change in a gravitational field would have to be propagated at some finite velocity, presumably that of light, but he did not carry his investigation into the simpler field of everyday mechanics." [11]

Objects undergoing sudden changes in acceleration can produce unusual phenomena. For example, in the field of terminal ballistics, Davis and his associate G. Harry Stine, observed many odd characteristics of rate of onset:

> "Stress is not proportional to strain. The Classic law only holds under steady-state conditions in testing machines. Under conditions of high-rate loading, the stress-strain curves behave quite differently. Cables snap. Yokes break. The noses of armor-piercing shells hammer their way through armor plate while the backend of the same shell proceeds inexorably forward, not knowing that the front end is hammering away." [12]

Take for example a meter-long steel rod. With knuckles and thumb out of the way, if we were to smack this rod on one end with a hammer, we would find the instant the force is applied an elastic compression wave would traverse the length of the rod and return to the point of impact. This compressive wave travels at approximately 5,000 meters per second or 11,185 mph "…to the far end of the rod where it is reflected as a rarefaction and returns to the point of application of force at the same speed." [13]

The rod – as an object subjected to an unbalanced force – cannot move until this compressive wave has traversed its entire length and returned 4/10,000 of a second later. The force applied can be infinitely large but until this force has completed its "first round trip" the rod cannot obey $F = ma$. The rod appears to exhibit near infinite mass until its inertial delay time has passed. [14] This is the loophole that Norman Dean discovered when he built his first inertial engine and how AID functions – the utilization of inertial delay but on a repetitive and applicable time scale.

Inertial delay caused by cyclic surge can be expressed in Eq. (1) as:

$$F_{0cos}\, 2\pi f t = Ma + DM\frac{da}{dt} = M\frac{d^2x}{dt^2} + DM\frac{d^3x}{dt^3} \tag{1}$$

> "… where *D* is the delay time, or 'critical action time' of the body and $\frac{da}{dt}$ is the surge. *D* is assumed to be constant.
> "The equation has the solution:
>
> $$X = X_{0cos}(2\pi f t - \emptyset)$$
>
> "… where $\emptyset = 2fD$ and
>
> $$X_0 = \frac{-F_0}{4\pi^2 f^2 MZ}$$
>
> "… where *Z* is a sort of complex impedance and
>
> $$Z = \sqrt{1 + 4\pi^2 f^2 D^2}$$
>
> "The important feature to note in this solution is that the amplitude of the oscillation is less than predicted by the Newtonian equation and even more important, *there is a phase angle between the driving force and the displacement*, even in the absence of viscous dampening. This solution demonstrates the most significant characteristic of real bodies, to wit: not only is displacement somewhat less than Newton would predict for a given force, leading to an *increased apparent mass*, but *reaction is no longer opposite to the applied force*: there is a phase angle which will be larger the longer the critical action time of the system! *Action and reaction are not simultaneous!*" [15]

Over one-hundred-fifty years ago a similar problem on the nature of energy propagation occurred with the question of alternating current. It was thought by many that AC could not do work without violating the Conservation Laws, since the average current would logically be zero. Though current in the positive phase is balanced by an equal and opposite flow in the negative phase the current flow is not equal and opposite *simultaneously* so work can be done. As Davis puts it: "…when all else failed, radiation was invoked to preserve the Conservation of Momentum." [16]

Because of the way Asymmetrical Impulse Drives behave, under the assumption that a force proportional with surge, along with a force proportional to (or consistent with) the acceleration, the result must be additive. In this case, we are working with cyclic surge acceleration so the term $\dot{a}_c$ is an abbreviation for Eq. (2):

$$\dot{a}_c = \frac{d^3 s}{dt^3} \tag{2}$$

Thus, in our case, the equation of motion Eq. (3) would look like this:

$$F = Ma + A\dot{a}_c \tag{3}$$

The symbol "*A*" is the new term which Davis calls "intractance" and has units of mass-seconds. Since some of "…the solutions to this equation yield the ratio *A/M* as the *critical action time* (CAT) of the system." [17] This renders intractance as a product of the mass and the CAT in Eq. (4) as

$$A = DM \tag{4}$$

or an augmentation of mass by its delayed reactance.

The phase angle Davis refers to above can be observed on the AID engine while the rotors are spinning with their carriage in oscillation. The rotors take on the pattern of tilted ellipses: A not-so-subtle hint that eccentric rotors behave as if they have *more mass* when spinning on a movable platform. This phenomenon of "CAT" is observable and in *electrical* engineering are known as "starting transients." These inertial delays are seldom considered, except in the design and testing of dynamic rotary systems such as special electric motors that the author has worked with. But such often-overlooked mechanical lag anomalies may have positive implications for future energy generation from certain materials already in rotary or repetitive motion. For example, the repeated compression of certain materials so rapidly that the rarefaction cannot complete its cycle, may create an "infinite mass" generator of sorts.

However, Davis goes on to state "This conclusion is merely a logical consequence of the existence of a force proportional to the third derivative." [18] Dean drives, and AID are taking advantage of the temporal split between action and reaction. As such, Davis proposes a Fourth Law to Newton's list:

> *"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."* [19]

This Fourth Law may also be rightfully applied to the field of thermodynamics.

B. Virtual Energy

By exploiting matters' inability to respond immediately to a force, momentum may be amplified – a "virtual energy" as coined by Davis. Take for example Davis's analogy 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 gravity in Eq. (5) below, "The rocket will have acted as though it were heavier than its true weight! What happened to the energy that was lost?" [20]

$$N = \frac{DM\dot{a}_0 t_1^3}{6} \tag{5}$$

Davis proposed that the "lost" energy of a rocket launch may be radiated out into the immediate space as a form of "inertial radiation." However, the existence of this inertial radiation has little evidence – or we are not seeing and recognizing the evidence. No one has been able, so far, to detect such "waves." Davis speculated:

> "The concept of gravitational waves is not a new one, and in fact is implicit in the weak-field solutions of Einstein's General Field Equations, known for forty years (this was written in 1962). On the other hand, the type of gravitational-inertial radiation predicted by our theory is quite new since it is presumed to be a consequence of surge rather than simple acceleration. The magnitude of Einstein radiation is predicted to be too small as to defy detection, but the radiation described here should be clearly observable under the right conditions." [21] (supplemental information added)

Davis did not have direct access to a Dean drive but knew of its success and had worked with powerful mechanical oscillators. He also communicated with the people who viewed the Dean drive firsthand. Davis felt that a functioning Dean drive "would strongly tend to confirm the existence of the (inertial) radiation." [22] If this is so, then there must be a way to detect such radiation. Davis continues "… if radiation is generated it should be detectable and sooner or later a "Hertzian" experiment will have to be performed." [23]

The Dean drives the author has built do exhibit less carriage amplitude than predicted and while determining stroke length and the shift distance needed to move the rotor axles, or to shift the carriage, is often overestimated. This reduced amplitude is caused by the effect of "phasing" where instead of the spinning rotors forming a perfect ellipse as would be predicted by Newtonian assumption, the ellipse is thickened, warped or tilted, with reduced amplitude.

The author has demonstrated this phasing[7] between the driving force of the engine's rotors and the displacement of their carriages (axis) forming the tilted elliptical patterns while running. We can achieve as much as a 45-degree phase, depending on the load. This dimensional anomaly can be seen with the naked eye as "baby shoe patterns" while the rotors are spinning on a free-sliding carriage especially under florescent lighting or when viewed in "fast forward" on a video recording.

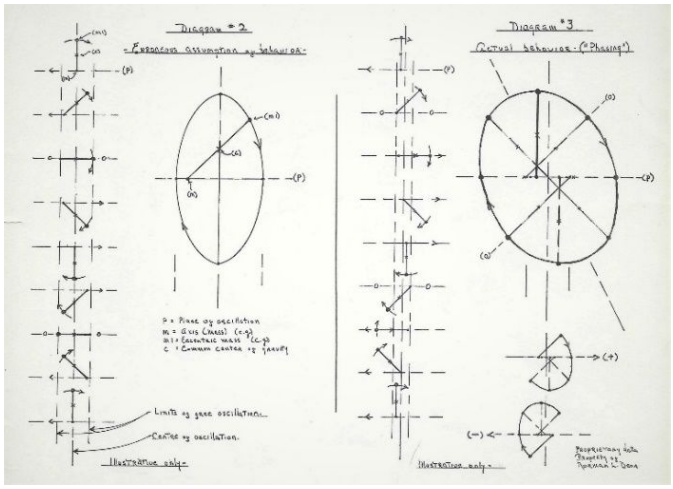


Fig. 2 Dean's observation of "Phasing" from his notebook of the same name.

Dean made note of a 45-degree rotor phasing in his journals[8] of which the author was just recently privy to. See Fig. 2 above, the plane of oscillation is horizontal. The author concurs with Dean who eloquently *insists* that this mechanical oscillator is not a "vibrator" in any sense of the word:

> "The resultant motion is not a "vibration" of the elements of the oscillator mass about or across their common center of gravity, but as a self-induced motion, of alternating directions, of the center of gravity (between the mass and the center of rotation) and the entirety across an exterior reference point which has no physical or dynamic relationship to

[7] https://www.youtube.com/watch?v=cTSrTDFGTN4 - see 1:08 minutes into video.

[8] Original and unpublished documentation from the private library of Norman L. Dean, *The Effect of Non-Simultaneity: The Phasing Phenomenon,* 1963 Norman L. Dean, courtesy of his grandson Bruce D. Dean.

the oscillator, *the force and motion being without exterior reaction to the oscillator."* [9] (supplemental information and emphasis added)

In other words, the basic Dean oscillator is producing motion without a mainframe reaction to that motion as would be the case with a so-called "vibrator." Thus, energy is not being wasted against the self-reaction of a typical vibrator but is being tied up in the delayed reaction of the spinning rotors while also in oscillation.

What can also be called an astonishing quality of the mechanical Dean oscillator is that within given parameters, the amplitude between the rotor axis from negative to positive phase remains constant despite the rotational speed of the eccentrics.[10] The "given parameters" would be the rotor mass and its radius which determines the stroke length of the oscillator. This quality, however, allows for variable speed control of the engine itself. In other words, the rotational speed of the eccentric rotors can be varied to change the impulse force of the AID without having to change the settings on the system such as stroke length, spring tensions, dampener stops, or shifter voltage.

Dean's conclusion: "The center of gravity tends to be alternately displaced in the plane of oscillation by force exerted in that plane and by *forces induced in the oscillator itself*."[11] (emphasis added). With the engine running in idle, Dean drive rotors are spinning and cyclically changing their trajectory – and phasing is the "footprint" of this unaccounted mechanical energy. In Dean drives, these phenomena are also indicative of a centrifugal force at work.

But most importantly, this abundance of excess energy is being tied up within the phasing of this mechanical oscillation – *until the rotors are shifted!*

Though Stine and Davis saw only a 3-degree phase shift on their "Dean drive" model, in their minds that 3-degrees proved to them there was CAT delay involved and unaccounted energy was being generated that was not otherwise detectable. [24] However, we can keep our tin-foil hats with neon bulbs in the closet as there appears to be a reasonable explanation for where this excess energy is manifesting in the AID.

V. The Dean Oscillator

A. Principle of Operation

Shortly after Dean published his inertial engine results in Popular Mechanics magazine in September 1961 [25], which created a snowstorm in the Kingdom of Nerdonia, Davis became interested in Deans' strange machine. So, after careful consideration Davis proposed a machine that may possibly work. Davis's calculations have not been taken seriously since a working Dean drive was not available at that time. But his work deserves another look.

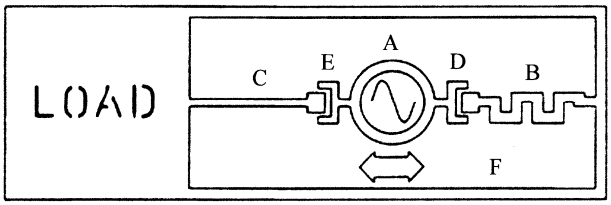


Fig. 3 Davis's model of a unidirectional mechanical oscillator drive.

All forms of propulsion create chaos in the backyard. However, there is no reason why some backyards cannot be fenced in. In the early 1960's Davis and Stine conceived a model [26] of how an inertial space drive might work as shown above in Fig. 3. The concept was intuitive: It is asymmetric where "A" is the oscillator, sine wave or saw-tooth – waveform may be critical; "B" is the long-time signal path; "C" is the short time signal path; "D" is a clutch; "E" is a clutch, timing is critical, and "F" is the frame/load. Impulse direction would be towards the left. (Actually "D" impedes operation.)

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[9] Original and unpublished documentation from the private library of Norman L. Dean, *Notes on the Behavior and Potential of a Mechanical Oscillator*, 1965, page 6, Norman L. Dean, courtesy of his grandson Bruce D. Dean.

[10] Original and unpublished documentation from the private library of Norman L. Dean, *Notes on the Behavior and Potential of a Mechanical Oscillator*, 1965, page 7, Norman L. Dean, courtesy of his grandson Bruce D. Dean.

[11] Original and unpublished documentation from the private library of Norman L. Dean, *The Dean System Space Drive: Phasing,* 1964, page 18, Norman L. Dean, courtesy of his grandson Bruce D. Dean.

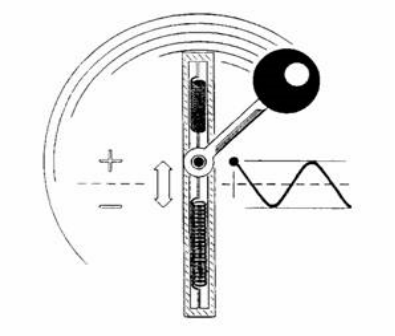


Fig. 4 Converting rotary motion into a powerful oscillation.

If the reader is clear on the subject of addition and cancellation forces in a Dean drive, please bear with me. From what the author has read, these forces are often overlooked or misunderstood by many researchers. First, the core operation of an AID engine itself is quite simple. The heart of the engine is an oscillator which operates by allowing eccentric rotors to pull their axles through a guided channel as shown above in Fig. 4 above. To do this we suspend the rotor axle. The channel is configured into a suspension system to confine the rotor axles into an oscillatory action.

Next, side forces must be cancelled otherwise vibration and wear will occur perpendicular to the line of travel. As Dean stated, "The use of "guides" to enforce a plane of oscillation is impractical."[12] The simplest way to cancel side forces is to add a counter-rotating eccentric rotor – both mounted on a common sub-frame or "carriage" (as shown below in Fig. 5a as outward conjunction and Fig. 5b inward conjunction.) This of course also doubles the force from the system, but most importantly, the added counter-rotating eccentric rotor stabilizes the system so that a powerful oscillatory motion is produced.

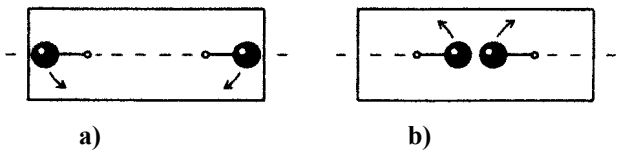


Fig. 5 Axial conjunctions in a Dean drive carriage system.

Forces generated by the eccentric rotors when their armatures are in-line with axial conjunction are cancelled out. Here, we convert rotary motion into a powerful bilinear oscillation so that forces can be isolated without stray vibrations or side wobble.

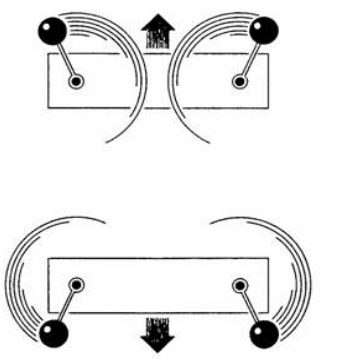


Fig. 6 A balanced mechanical oscillator that appears to violate the Third Law.

[12] Original and unpublished documentation from the private library of Norman L. Dean, *The Dean System Space Drive: Phasing,* page 14, 1964 Norman L. Dean, courtesy of his grandson Bruce D. Dean.

The resultant mechanical oscillator is a balanced one-frame system. It converts 360° rotary motion into a powerful 180° bi-directional force. But now, as we see above in Fig. 6, we have an anomaly. Even before we extract force from the system this basic oscillator is misbehaving: Why does the carriage swing *with* the rotors instead of *away* as would be predicted by Newton's Third Law of Motion? The reason: Since the rotors are counter-spinning side forces are cancelled out and the carriage swings towards the sum of the rotor's angular momentum – suggesting that a centrifugal force is being isolated from the centripetal. This hypothesis will be reviewed again in a moment.

When the rotors are at conjunction, they are not exerting a force on the carriage, the carriage is free to move in either direction along the plane of oscillation. We want to of course move the carriage in the direction we intend to go. This configuration of counter-spinning eccentrics mounted on a suspended carriage creates a convenient system that can be controlled in any number of ways.

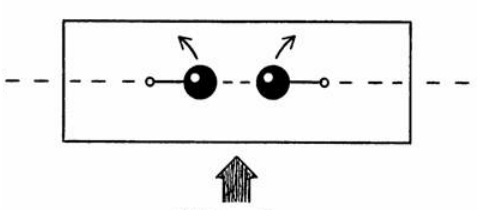


Fig. 7 Biasing the oscillator while rotors are conjunct.

This is a *balanced* mechanical oscillator. However, to rectify this balanced oscillator – to make an *unbalanced* mechanical oscillator – we must shift the carriage holding the eccentrics rotors. This occurs at a precise time in the cycle when the rotors have low inertia while approaching conjunction between negative and positive phase. An outside force may be employed to move the carriage in the desired positive direction as shown in Fig. 7 above. By leading the rotors ahead of the cycle during the balanced oscillation we save time in the cycle to allow for the release of angular momentum onto the mainframe. The *centripetal* force of the rotors is cyclically nullified by the shift resulting in a surge of *centrifugal* force. Because of the phenomena of *phasing*, and the shifting of the carriage, a centrifugal force and the Third Law can co-exist in such *three-frame inertial* systems.

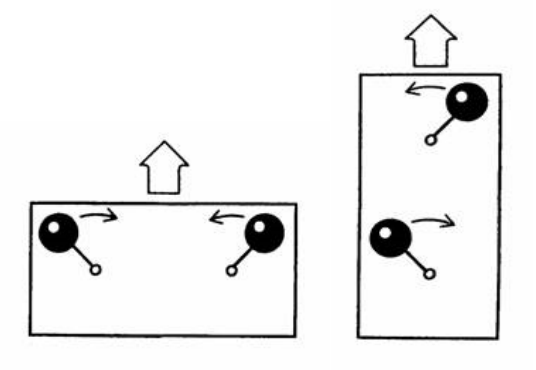


Fig. 8 Either carriage arrangement will produce unidirectional force.

Conveniently, cancellation and addition forces hold true for horizontal carriage systems as in Fig. 8a *and* vertical carriage systems as shown in Fig. 8b. Through actual experimentation we have determined that side-ways motion can be cancelled out even when we orientate the carriage and the rotors 90 degrees so that the engine can be configured into a narrower support system. The vertical arrangement in Fig. 8b would be useful when retrofitting rockets that may already employ reaction mass engines. Another advantage of this configuration is that pillow blocks that guide the carriage would experience less long-term wear as drive components can be easily centered on the carriage.

B. Rectifying A Mechanical Oscillator

Taking advantage of the rotors' reduced inertia when their armatures align at conjunction allows us to create an unbalanced oscillator. The rotor inertias are negligible because they are moving in the right direction making the system extremely efficient. In Fig. 9 below we see that the direction of the rotor rotation does not matter provided the

"shift" occurs while the rotors are approaching the forward side of the carriage at conjunction. It is recommended that the rotors conjunct up from the center of the carriage to reduce the chance of damage from loose parts or fingers being caught in the rotors and gears. It is also good form as the shifter linkage is in the center of the carriage.

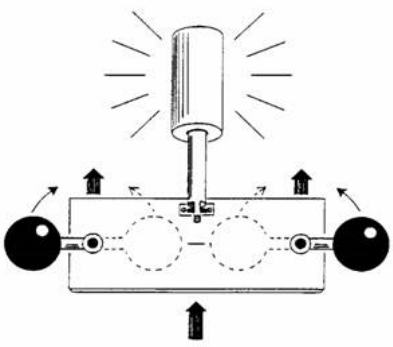


Fig. 9 Rectifying a mechanical oscillator by cheating the cycle.

Thus, rotary motion is converted into oscillations of a carriage then its momentum rectified: The carriage is shifted forward during low inertia, so momentum is conserved to be used later in the cycle. Reverse carriage oscillations are dampened. This creates a pulsed demand on the electric power supply thus too fulfilling the Conservation of Energy law. Newton's Third Law is not refuted because action and reaction are not simultaneous events so in this engine, inertial delay occurs at post carriage shift during part of the rotors' orbit when an unbalanced force emerges.

Furthermore, in shifting the rotors' axles we have *increased* the CAT of the system in positive phase to release repetitive centrifugal surge accelerations. These forces are then applied to the second inertial frame – the housing of the engine with its load to propel the system forward. This then becomes a three-frame system.

Three-frame systems do not behave Newtonian: The rotors, and the carriage that the rotors ride on with their elliptical orbits are *one inertial frame*. This elaborates into a temporal extortion of sorts when this complex is biased within a *second inertial frame* (the mainframe, load) which changes its position in space, the *third inertial frame*.

VI. The Asymmetric Impulse Drive Unveiled

A. Propulsion from Electricity

Of all the engines the author has built the engine Asymmetric Impulse Drive we present here shown below in Fig. 10a. and Fig. 10b., has the most impulse per engine weight. In Fig. 10b. AID is shown with its inertial dampeners mounted on spring-loaded stalks to the baseplate with digital and analog accelerometers mounted on the Plexiglas reference panel. The AID weighs 4.13 kg (9.1 lbs.) and can produce a consistent impulse of 21.7 N (4.88 lbs.) against a 100 N digital force gauge and has a peak force of over 78 N (17.5 lbs.) in our load cell tests. Average power consumption is a low 18 watts, and this engine has been duplicated (E-13A and E-13B). Note that the brass support rods may be replaced by aluminum rods saving another 1 lb. in engine weight without reducing engine power.



a) **b)**

Fig. 10 Asymmetric Impulse Drive E-13A

B. Efficiency

The power consumption of AID is low: Average power consumption for the shifter is 1.67 amperes times 24 VDC equals 40 watts times 25% pulsed duty cycle equals roughly 10 watts average as expressed in Eq. (6)

$$P_{avg} = IE \times .25 = 1.67 \times 24 \times 0.25 = 10.02\ W \tag{6}$$

The rotors use 0.9 amperes times 8.85 VDC or about 8 watts as shown in Eq. (7)

$$P = IE = 0.9 \times 8.85 = 7.97\ W \tag{7}$$

Total power consumption in watts added in Eq. (8) is

$$10.02 + 7.97 = 17.99\ W \tag{8}$$

To achieve an average force of 4.88 lbs. (21.707 N) it appears this engine requires a conservative 18 watts or 3.68 watts per pound of force (4.448 N) as we see in Eq. (9):

$$\frac{17.97}{4.88} = 3.68\ W \tag{9}$$



a) **b)**

Fig. 11 Dual power supply PS-5A controls impulse engine AID (E-13A)

However, this *does not* take into account initial peak force at the start of each and every cycle per second: In free space, the author estimates this engine could crank out an average of roughly 1 pound of force per watt.

The Asymmetric Impulse Drive impulse is determined by the rotors mass and radii as well as the velocity which can be finely controlled by varying the voltage to the rotors' drive motor. A dual power supply is required so I also built the 5th generation power supply PS-5A as shown above in Fig. 11a. The yellow and green terminals supply the fixed voltage for the shifter and the red and black terminals supply the variable voltage for the rotors to control speed. Above in Figure 11b. reveals the internal view of PS-5A.

C. Advantages

The Asymmetric Impulse Drive E-13 series requires minimal lubrication by use of sealed motor bearings, thermoplastic bushings, linear bushing housings or journals, lightweight and low-friction gears. We used the non-magnetic dry lubricant molybdenum disulfide (MoS_2) on the solenoid plunger for longer life. The closed glide journals have reservoirs to isolate a synthetic oil which will not react with the polyurethane dampeners. Teflon® or Polytetrafluoroethylene (PTFE) coating on the stainless-steel glide rods would greatly reduce wear and extend the life of the space drive. The glide rod springs ride on iglide® thermo-plastic bushings so are not in direct contact with the rods.

The open simplicity of the "erector-set" design of Asymmetric Impulse Drive E-13 series presented here is a self-contained unit which allows easy access to all parts. It also allows ease of replacement of parts and can be easily adjusted for stroke length should the need arise (though a set-gauge is required as the final settings took years to arrive at.) This modular spacecraft propulsion engine was designed for easy assembly and disassembly for adjustments, transport, and up-scalability. The system has a minimum of moving parts subject to friction and wear thus requiring minimal maintenance. Manufacturing is inexpensive and requires minimal machining.

D. Compliance

The Asymmetric Impulse Drive E-13 series is a compact power-plant measuring just 5" x 11" x 14" and is engineered with 4 brass support rods joining an aircraft-grade aluminum thrust plate to a tough, lightweight Delrin® (acetal) base plate. This frame also supports 2 stainless steel glide rods that journal the carriage plate. The thrust plate holds the solenoid shifter with associated electronic components, military grade power connector, terminal blocks, and brass handles.

The engine is held together with stainless-steel fasteners – some hardware is silicon-bronze for accent. A pair of solid bronze rotors are sandwiched on tough, lightweight aluminum gears journaled through the carriage plate also of aircraft-grade aluminum. All bushings are lightweight space-age iglide® thermo-plastic. Asymmetric Impulse Drive E-13 series is wired with tough, high temperature, military-grade color-coded low-friction Teflon® insulated strand wiring. Timing is governed by an optical encoder controlling a solid-state relay (SSR) and panel lighting is done with efficient LED's all mounted on the carriage plate. The electronics are protected with 4 different back-EMF surge cancellation components to help nullify solenoid backlash and possible EMP attack.

The author is military-trained in electronic troubleshooting and assembly: The AIDs are built under MIL-STD-454 soldering (hot solder-wicked joints with resin flux removed) and 2000A quality standards.

VII. Testing the Asymmetric Impulse Drive

A. Pendulum Tests

Since 1981 the author has designed fifteen different inertial propulsion systems of which eleven inertial engines were built. Pendulums are a poor substitute for zero *g* but the best we have here on Earth. There were a variety of ballistic pendulum configurations tested. Some pendulums were set-up as in-line arrangements with the hanging engine mounted on a single rail. Some had lines attached to the sides of the engine perpendicular to motion to allow the drives to stabilize while running. There were 2-point and 4-point ceiling terminations[13] some were even terminated from the ceiling on a sliding rail which proved to restrict motion because of line resonance or unwanted rocking of the engine. Many of these tests have been published online. Much feedback has been offered on these tests, some from physicists. So, the author would like to clear up a few misconceptions about testing inertial propulsion drives, in particular, impulse drives and how they respond to hanging from a pendulum.

First, it is important to note that the pendulum test was originally used to test cannons. [27] Therefore, the original ballistic pendulum test must be invoked to test impulse drives. Since the forces involved with this source of kinetic energy are generated in cyclic manner the test must be viewed like the earliest version as it was used to test cannons. So, each pulse from the drive will act as if a single cannon shot were fired upon it but happily in our case, there is no impact or mass ejected.

The purpose of the pendulum test for inertial propulsion is to show bias: The drive must work against gravity and recover after each impulse because it is hanging in a gravitational field swinging in an upward arc against gravity. Some of my YouTube viewers which include a few physicists forget we are still within a gravity field and insist that impulse engines should hover to one side of zenith. For impulse engines with significant force operating below 8.14 Hz (the frequency needed to neutralize Earth's gravity)[14] continuous deflection to one side of zenith is not possible.[15] If an impulse drive could cycle that fast then one *would not need a pendulum to test it* – it could levitate.

Another common misconception is the longer the pendulum lines the more deflection you get. The author has tested and has video proof[16] that the length of the lines has no effect on results. A functional impulse engine will displace itself the same distance whether the lines are 12 feet or 12 inches: The AID is a bootstrap engine that could care less about the length of pendulum lines because on Earth, *g* is relatively constant.

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[13] https://www.youtube.com/watch?v=Pw6Vkk0lXyw&t=33s

[14] 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.

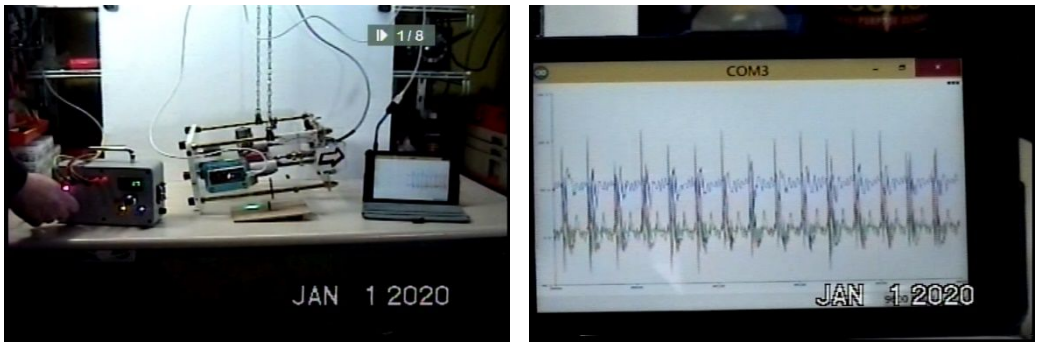
[15] https://www.youtube.com/watch?v=QJcbe8P5900&t=68s

[16] https://www.youtube.com/watch?v=Pw6Vkk0lXyw&t=33s See 5:45 mins. into video.

But *what* the lines are made of may affect the test: The heavier the lines the less stray oscillation, but lines that are too stiff and heavy will cause the drive under test to load down stunting deflection. If one is using the pendulum test the author advocates light-duty chains with a total load rate of no more than three times the calculated peak force of the drive. It is recommended a 25 lb. to 50 lb. test chain with 0.500" welded links if you can find it. In most of our successful experiments we used chains with 0.500" welded links and rated at 70 lbs. load each chain.

Some physicists advocate a 4-point pendulum test with the engine on a level platform where the lines terminate in front and behind at zenith *and* on the platform [28]. However, no disrespect intended to the author of previously referenced paper this forces the drive to have to lift itself to deflect horizontally which restricts lateral motion. That argument suggests that an oscillating mass within the engine will bias the test results simply by virtue of the shifting of the eccentric masses. We will see why that theory is not correct for operational IP machines. But first consider the following experiment: With engine AID in the OFF mode and hanging from a 4-point pendulum as suggested above using a 22 kg (5 lb.) Chatillon™ spring scale to push the engine, it took 1.00 lb. of force to deflect the engine 3.00". That same test with AID on a 2-point pendulum took only 0.700 lb. to deflect the engine 3.00". That means the 4-point pendulum test requires 30-percent more force to deflect it than the 2-point pendulum. Even at that AID passed with flying colors, no pun intended.[17] Why would we want to make this test more difficult for budding inventors?

Remember the rush of the playground swing? A 2-point side-by-side zenith termination (at the top of the swing set) allows for the least amount of resistance needed to get ourselves high in the air. But to really get up there we had to kick our legs up in a 10-degree arc. Kicking our legs out parallel to the ground as with the 4-point level pendulum test mentioned above dampens the swing.



a) **b)**

Fig. 12 AID 10-degree video pendulum test with Arduino accelerometer display.

When testing for impulse from an In-Space drive, the idea is to neutralize gravity as much as possible. Using the 2-point pendulum test as demonstrated[18] in Fig. 12a. above, we have discovered that by tilting the front of the engine 10-degrees upward while hanging on the pendulum, gives that needed arc to follow the swing of the lines with the least amount of gravitational impedance. This is because the engine wants to go linear, but the pendulum naturally restricts motion to an upward arc against gravity.

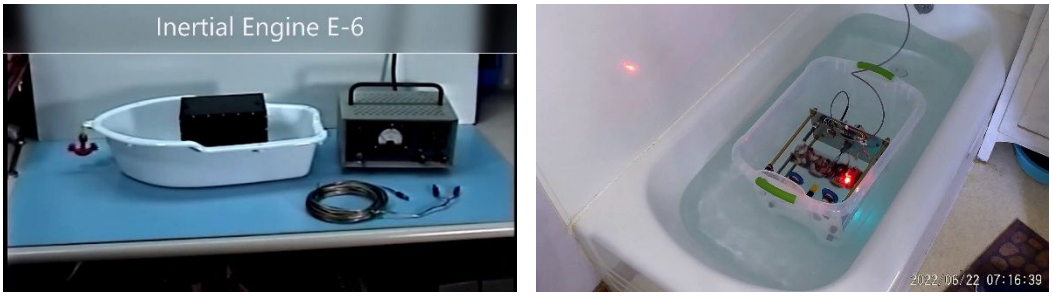
This 10-degree angle also reduces the likelihood of the chains (or lines) from going into resonance. Besides, this test *does* force the engine to propel slightly upward *against* gravity – but without the mechanical restraints of a poorly designed pendulum configuration. This 10-degree pendulum configuration also invalidates the shifting mass theory of the 4-point pendulum test hypothesis mentioned above. In Fig. 12b. we see a real-time close-up of the Arduino accelerometer display showing an average peak force of 1.93g from the AID using the 10-degree pendulum.

B. Marine Propulsion Test

One of the most frequent requests for authentication from my YouTube viewers is "Will it go across the water?" Though not a miracle in the biblical sense, AID *can* "tread" water. I could not find a canoe or boat-shaped container that would hold the AID but managed to find a storage tub that was the right size with a ridge on the inside bottom so that AID would not slide around inside the storage tub while running. In Fig. 13a. below is a snapshot from a video of an earlier prototype engine E-6 which we will discuss later. In Fig. 13b. we see a snapshot of E-13 as it navigates

[17] AID on a 4-point pendulum with FROG accelerometer: https://www.youtube.com/watch?v=Pw6Vkk0lXyw&t=33s
[18] https://www.youtube.com/watch?v=iqY1plld4o0

across the bathtub. And though AID glides effortlessly across the water, note that the storage tub in Fig. 13b. is not hydrodynamic.



a) **b)**

Fig. 13 Marine propulsion tests

Because any one swing set or rubber ducky test cannot be clearly defined as a standard for detecting force from impulse drives – and provokes so many emotional expectations and schoolyard brawls – there is only one true way to rule out vague test results: Digital sensors.

C. Force Gauge Tests

The Asymmetric Impulse Drives were run through a succession of rigid tests using a variety of accelerometers and force gauges. First, we will look at using force gauges to measure impulse from these engines.

In the experiment pictured below in Fig. 14 a pair of 100 N force-gauges were mounted on a secured platform and AID was suspended between them as an attempt to measure forward and reverse impulse forces in pounds.

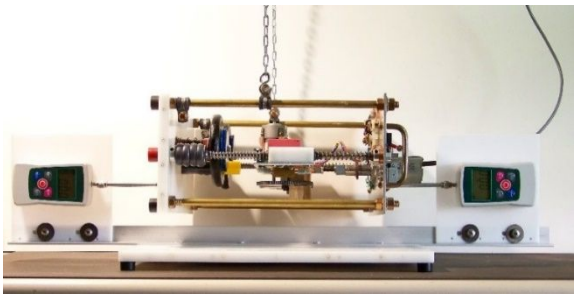


Fig. 14 Asymmetric Impulse Drive E-13A under force gauge "restraint."

There are dimensional limitations to this test. The engine is confined between the force gauge plungers on the forward and rear side of the engine: The engine wants to back-stop against the rear force gauge after being restrained against the forward force gauge because the engine mainframe is not free to cycle out as a three-frame system. This restriction would not occur in space. These tests were inconclusive.

However, if AID is laid horizontally on a level bench so that it can glide freely across a lubricated Mylar™ sheet it will produce an impulse of 21.7 N (4.88 lbs.) against a single 100 N digital force-gauge. Please keep in mind force gauges are typically too slow to respond to high spikes of acceleration and have a tendency to average out forces.

D. Digital Accelerometer Tests

Because of the limitations of the pendulum, marine, and the force-gauge tests and of possible transients involved in testing impulse drives in general only one type of testing method could give us the detailed results needed to prove a substantial positive driving force: Digital accelerometer and load cell sensor tests.

With the patient assistance of my associate[19], who painstakingly researched and solved the problem of testing[20], we set up the following experiments: First, we tried the digital Arduino™ sensor system (shown being used back in Fig. 12a. and Fig. 12b.) that proved we were getting positive results, but we could not get the sequencing and waveform detail needed to do an analysis of what was occurring while the AID was running.

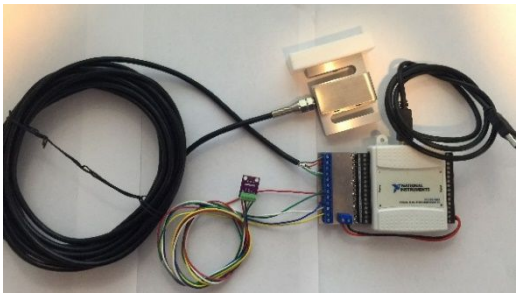


Fig. 15 National Instruments™ LabVIEW Data Acquisition (DAQ) device and sensors

We needed a more dependable set of data, so we set up the National Instruments™ LabVIEW Data Acquisition (DAQ) device shown above in Fig. 15 which is an accelerometer and load cell sensor assembly we used in our experiments. The DAQ in conjunction with Physics Lab Assistant (PLA) software[21] gave us precise, simultaneous data down to the millisecond with crisp waveform displays in X, Y, and Z dimensions as well as load cell data in pounds.

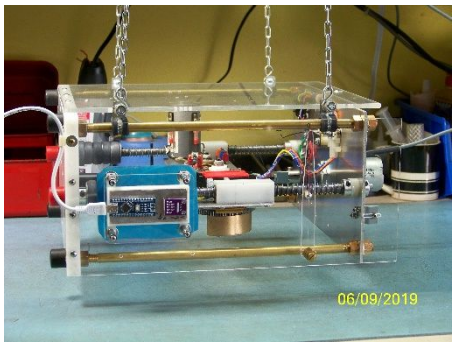


Fig. 16 Asymmetric Impulse Drive E-13A suspended by four light chains.

The Asymmetric Impulse Drive E-13A depicted in Fig. 16 above was suspended level by four light-duty chains 762 mm (30.00”) long each so that it could swing freely left to right – to left. Light chains offer the least reactance and in Fig. 16 terminate above at two points – one at the near side and one at the far side of the viewer. In this photograph the plexiglass panel on the near side of the engine holds the Arduino electronic accelerometer sensor on the left (mounted on a blue silicone pad), and an analog needle accelerometer on the right. (The actual DAQ accelerometer sensor used for the following test is shown above in Fig. 10b.) The analog accelerometer (plexiglas needle on the right) is useful for on-machine visual reference while reviewing video in slow motion.[22] Power cord and sensor cable drops are loose and allow free unrestrained movement of the engine. Impulse force is to the right.

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[19] Glen A. “Tony” Robertson is a Senior Aerospace Technologist at Kepler Aerospace (2019-present), tasked with the investigation of exotic propulsion methods.

[20] Mr. Robertson’s assistance does not necessarily imply his agreement with the viewpoint or analytical conclusions of the author of this paper.

[21] LabVIEW Applications: Physics Lab Assistant, © Doug Harper.

[22] https://www.youtube.com/watch?v=iqY1plld4o0 See 5:15 mins. into video.

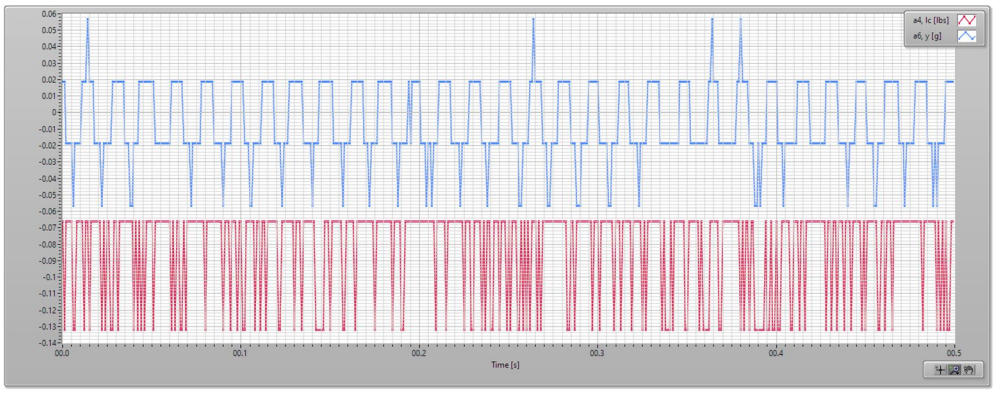


Fig. 17 Engine OFF null: Baseline – g force (blue trace) and load cell (red trace).

The final battery of tests was performed with PLA software using the DAQ, and the results were consistent over multiple trial runs. In the baseline test run with engine OFF shown in Fig. 17 above the bottom red trace is the load cell unattached to the free-hanging engine and is displaying random noise. It is used as a near zero-reference line here for the following test run. The top blue trace in Fig. 17 above is the accelerometer displaying its quiescent state in g-force. Note the random noise inherent in both the acceleration and load cell sensors.

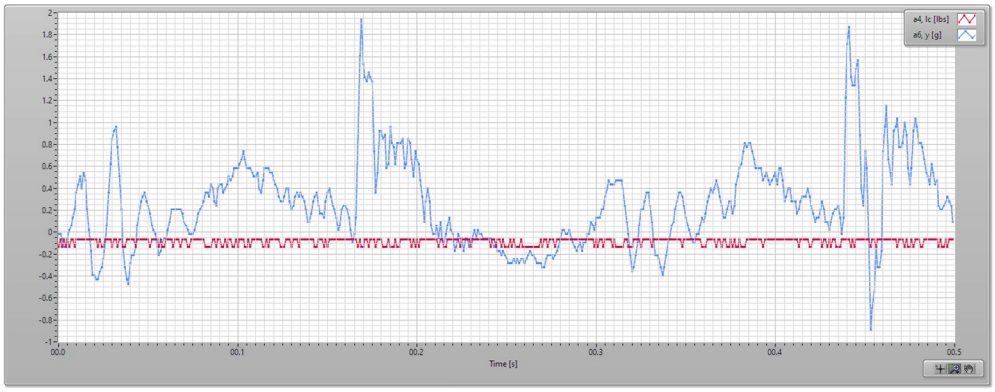


Fig. 18 AID waveform: Engine ON: g force (y axis, blue trace) at 3.33 Hz

In the graph Fig. 18 above, the free-hanging engine is running with the rotors set to 9.9 volts DC, or about 17 watts displayed for 500ms. The red trace displays the unattached load cell (which will be employed later) as a reference for near zero. The peak centrifugal acceleration in Eq. (10) would of course be defined in g-force as:

$$\dot{a}_c = 1.93 \times 9.81 \frac{m}{s^2} = 18.9 \frac{m}{s^2} = 1.93g \tag{10}$$

With 4 prominent peaks of centrifugal acceleration per pulse (13 peaks per second) the average g-force per pulse would be 4 peaks totaling 4.73 g's divided by 4 in Eq. (11) would roughly be

$$\dot{a}_c = \frac{4.73g}{4} = 1.18g_{avg} \tag{11}$$

Note the jagged modulation of the blue wave trace due to the hyper-sensitivity of the accelerometer sensor (as can be seen previously in Fig. 17 where the accelerometer sensor is resonating even when at null with the engine off) and minor deviations in the machining of the hand-built engine. Further dampening of the system will remove the negative spikes and variances in the waveform.

E. Load Cell Tests

A standard S-beam load cell rated at 15 lbs. connected to the DAQ was used to perform the following tests. The Asymmetric Impulse Drive was setup as shown in Robertson's experiment[23] below in Fig. 19. This test was also performed with Physics Lab Assistant software and DAQ – results were consistent over a multitude of trial runs.

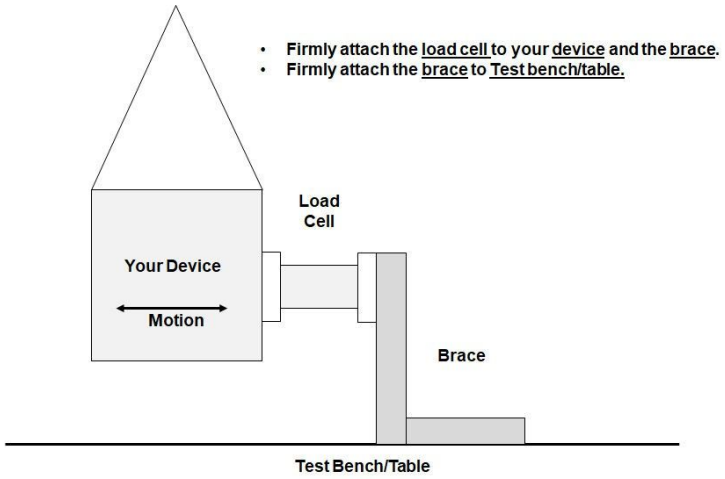


Fig. 19 The Robertson Load Cell Test for inertial propulsion.

The S-beam load cell (follow the black cable) in Fig. 20 below was securely bolted onto the front of the engine against the 9.52 mm (.375") thick aluminum plate which is anchored by a pony vise and clamped solid to the author's lab bench with a pair of vise-grip "C" clamps. The chain tethers suspend the mass of the engine to relieve its weight so that the load cell may accurately measure horizontal forces. Impulse force is to the right.

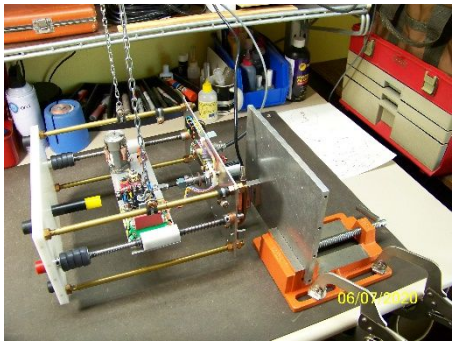


Fig. 20 Asymmetric Impulse Drive E-13A held in place by anchored load cell.

The following load cell trace for the Asymmetric Impulse Drive in Fig. 21 is for one cycle at .500 sec with positive force 50% of said cycle (rotor voltage set to 8.0 vdc for waveform clarity). The engine was reduced to about two-thirds speed at 2.27 Hz to better delineate the unusual forces involved here. Higher levels of force will be achieved.

F. Waveform Analysis

Refer to the load cell test chart of the AID in operation below in Fig. 21. Though the wave trace appears to be of four dampening cycles this display is for *one cycle* of 440ms or 2.27 Hz. It is important to note the unusual peaks in this waveform which look as if it had been generated by an electronic source. It is especially important to note the eerie echo – a repeated pattern in each positive peak. For a time, my associate and I were unsure of what we were

[23] Glen A. "Tony" Robertson is a Senior Aerospace Technologist at Kepler Aerospace (2019-present), tasked with the investigation of exotic propulsion methods.

looking at – until I reviewed my notes on Davis Mechanics. Though most physicists do not concur, Davis offered the best explanation for what was occurring in this type of engine. Referring to the chart below in Fig. 21, there appears to be two sizable, but unaccounted for, impulses caused by a third and fourth derivative of displacements which can only be attributed to surge. Let us look at what is happening in the AID:

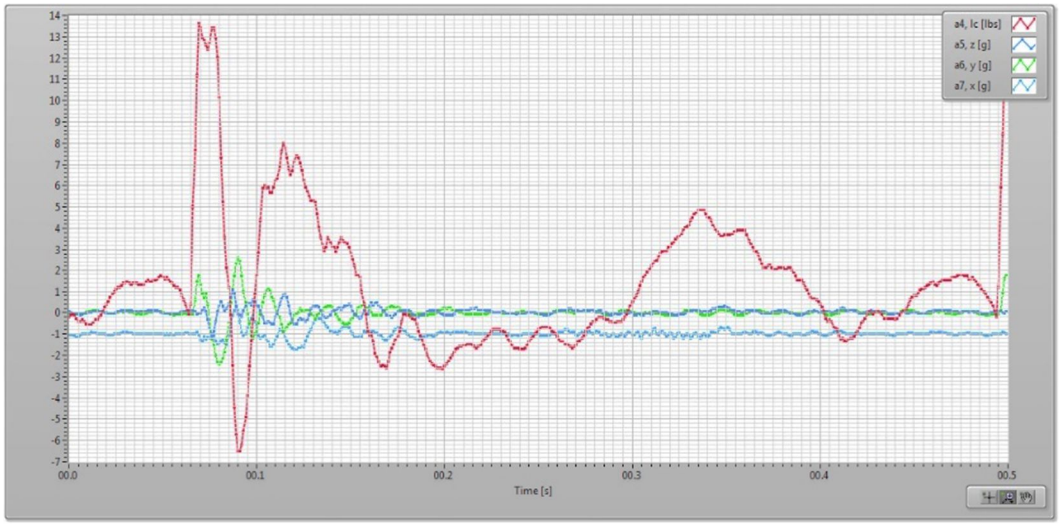


Fig. 21 AID waveform for one cycle: Pounds of force (red trace) at 2.27 Hz

The cycle starts at mark 65ms (.065 sec): The solenoid fires *with 13.8 lbs. peak force* pulling the carriage forward while the rotors are at conjunction. There is a short reactive 10ms negative spike down to -6.5 lbs. on the mainframe. Then at 100ms with the solenoid still activated the rotors drive the carriage forward – this advances the mainframe while the rotors gain CAT and impart their single pulse of acceleration to the mainframe for another 65ms *with 8 lbs. peak force.* The *energy that was tied up in phasing* has been released. This force manifests as traditionally described in Eq. (12):

$$F = \frac{mv^2}{r} = 35.58\ N \tag{12}$$

At mark 165ms: The solenoid releases, the rotors leave apogee – the carriage rapidly retreats to negative phase from the force of the front springs with a ringing for 130ms as the carriage dampens out against the rear springs and dampener pads.

Then at mark 300ms the mainframe is reacting to a phantom pulse of another 100ms duration *with 5 lbs. peak force* from the rotors' centrifugal force (Davis's virtual energy?) We can see the carriage dampening effect in this pulse *mirroring the pulse that occurred just before it*. This appears to be an unaccounted force caused by a third derivative displacement attributed to centrifugal surge acceleration as described in Eq. (13):

$$\dot{a}_c''' = \frac{d^3r}{dt^3} = 22.24\ N \tag{13}$$

At mark 400ms there is another period of ringing for 40ms then a *second residual phantom pulse* (jounce?) for 50ms or one-half wavelength (½ λ) of previous pulse, *with 2 lbs. peak force* which ends the cycle rendering Eq. (14):

$$\dot{a}_c'''' = \frac{d^4r}{dt^4} = 8.89\ N \tag{14}$$

Thus, the overall product of the pulses increases the resulting impulse force as expressed in Eq. (15):

$$F = Ma + A\dot{a}_c$$

(15)

These phantom pulses appear to be caused by derivative displacements of force that Newton was not inclined to investigate. The most complex machinery of Newton's time (other than the heavens) was the newly invented mechanical clock – as slow as they were. There were no volunteers to examine first-hand the derivative forces of carts spinning out of control around sharp bends.

However, in the AID these derivative forces distill into an exploitable energy which occur because of the accelerations between the rotor's angular momentum, carriage oscillations, and the mainframe's reaction. The Conservation Laws of Energy and Momentum are upheld because in the AID, the power demands are cyclic. As such, Davis proposed a change to the Conservation Laws as expressed for Momentum in Eq. (16):

$$\int_{x_0}^{x_1} F dx = \left[\frac{Mv^2}{2}\right]_{t_2}^{t_1} + D\left[\frac{d}{dt}\left(\frac{Mv^2}{2}\right)\right]_{t_0}^{t_1} - DM\int_{t_0}^{t_1} a^2\, dt$$

(16)

A body of mass M with a constant inertial delay time D moves in one dimension. A force is applied over the distance between two positions, x_0 and x_1, during the time interval, t_0 to t_1. Velocity is v and acceleration a is in the x direction. Davis pointed out that the first term on the right side of the above equation is Newtonian:

> "The second two terms represent the portion of energy that has not been converted to kinetic energy because of third derivative effects. This portion of energy, in keeping with the terminology applied to modern nuclear physics to particles which exist in the nucleus for too short of time to violate the Law of Conservation of Energy, we have called 'virtual energy'. Thus, this equation expresses an amendment to the Energy Conservation Law by a new 'Principle of Virtual Energy'. If a force proportional to surge exists, then a logical consequence is the existence of such 'virtual energy'." [29]

Virtual energy has unusual effects as DePalma discovered with his spinning ball experiment: Spinning objects actually create their own excess energy apparently from free space[24] – a torsional amplification of sorts.

However, in the AID this three-frame system is amplifying a "virtual energy" of some kind. The above phantom pulses suggest that while running this engine is either extraordinarily efficient or according to Dean, Davis, Stine and Crafton, is generating excess energy to accentuate its propulsive force.

Upscaling, Duplicating, and Multi-Cycling

As we increase frequency of the AID system, we also see an increase in force. In Fig. 22 below we see the peak force has exceeded the range of the load cell, but we can protract the peak force as expressed in Eq. (17) to:

$$F_{peak} = 4.13kg \times 18.9\frac{m}{s^2} = 78.0N\ (17.5\ lbs)$$

(17)

where the weight of the AID engine is 4.13kg using a peak acceleration of 1.93g as modestly displayed back at Fig. 18. As mentioned earlier this engine can be reduced in weight by 1 lb. with lighter support rods without reducing power output.

[24] https://depalma.pairsite.com/SpinningBall%28Understanding%29.html

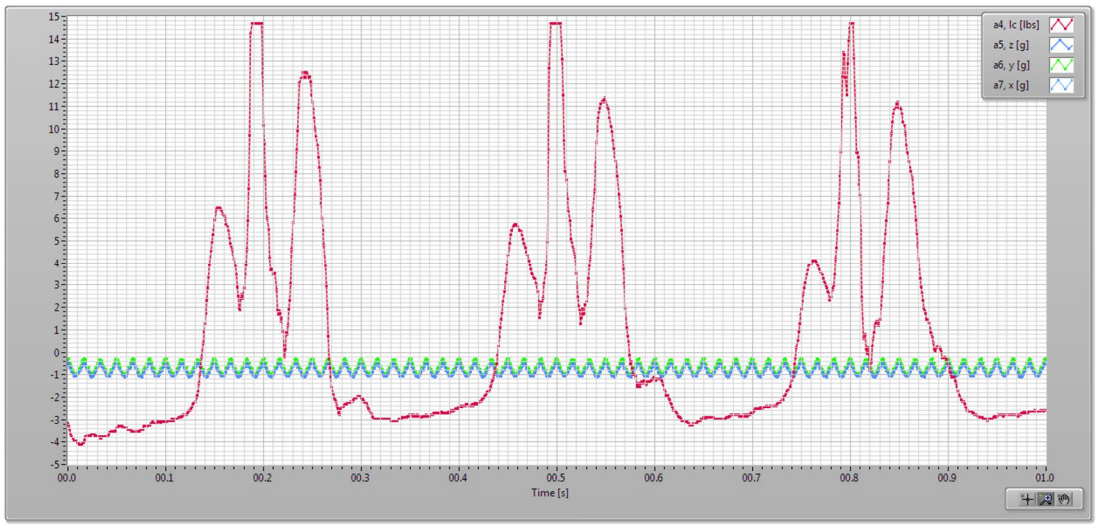
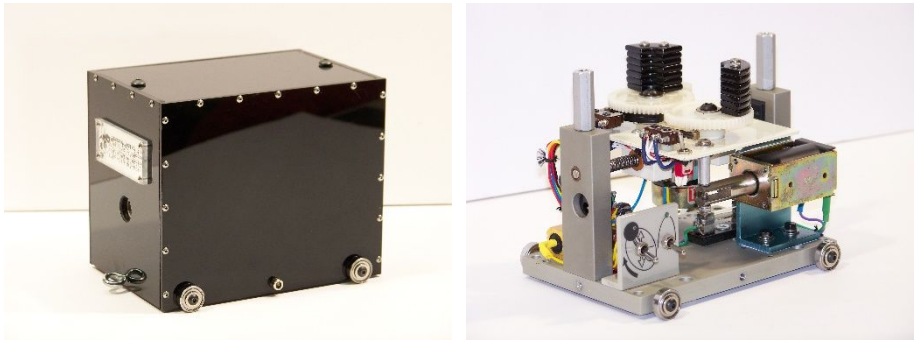


Fig. 22 AID waveform: Pounds of force (red trace) at three-quarters power (3.1 Hz)

However, this type of engine has speed and force limitations. There is a ceiling where diminishing returns occur beyond 4 Hz. Higher frequencies reduce impulse force considerably. This is a natural limitation due to the rotor radius, mass, and carriage stroke-length relationship. Fortunately, upscaling will not reduce the optimal frequency of operation if proportional references are observed.

A. AID is Up Scalable

As good practice with any prototype endeavor, when possible, I build two engines of the same design in tandem. In this way if I make a change in one engine and it proves negative, I have the other engine as reference to fall back upon. If the change is positive, then I incorporate it into the other engine – and the machine evolves.



a) **b)**

Fig. 23 University Physics Lab model impulse engine E-6A built 1995

The prototype precursor to the AID series were the engine E-6 series in Fig. 23a. with its black box cover and Fig. 23b. exposed above, of which I also built two back in 1995. It was the second Dean drive I built and measured 6” x 6” x 4.25” and weighed 2.6 lb. Though E-6 was a simple low powered drive, this junk-box jalopy was the primary steppingstone to the heavily modified AID. Inertial engine E-6, however, lacks the positive stroke enhancement and the negative dampening features of the inertial engine E-13 series. This is partly due to inertial engine E-6 using just a single source power supply which allowed only one speed: E-6 was designed as a university physics lab demonstration model that can drag a 4.5 lb. load (about twice its weight) at over 0.500” per second using just 11 watts. It never made it to market for various reasons outside my control.

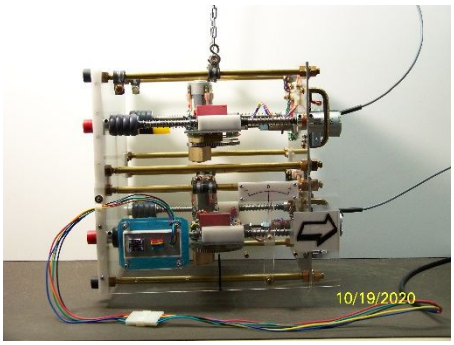


Fig. 24 AID impulse engines E13A and E-13B ganged together.

B. AID Has Been Duplicated

The individual propulsion data from the Asymmetric Impulse Drive series, E-13A and E-13B, demonstrates them to be virtually identical twins.

Next, I ganged both AID impulse engines together as shown in Fig. 24 above to produce a 2-cycle propulsion system and the load cell tests will be reviewed shortly. Synchronizing two separate Asymmetric Impulse Drive carriages on one engine mainframe to reciprocate will produce a practical two-cycle impulse engine.

C. Multi-Cycling

Norman L. Dean built a 6-cycle engine and phased the rotors sequentially 60-degrees apart to achieve a smooth source of propulsion. He did this by linking all six carriages together using "high speed flexible shafting" to drive the system without self-cancelling feedback to the other carriages. See Fig. 25 below.[25] Stepper motors synchronized by a precisely timed electronic multivibrator circuit may be the modern way to achieve this end.

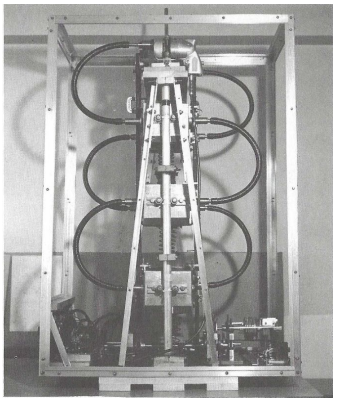


Fig. 25 Dean's 6-cycle inertial engine

Since the author has just two of these drives, we could only gang them together to produce a drive that resembles a reciprocating engine. The following two-cycle engine experiments utilized two separate dual power supplies (PS-5A and PS-5B). Fine-tuning the power supplies to facilitate reciprocation between the AID's E-13A and E-13B proved to be tricky because of the idiosyncrasies between motors and various components, some of which are surplus parts from the 1990's.[26] However, our video presentation shows that it can be done. These experiments suggest that a smooth operating two-cycle impulse engine is possible.

Because of the forces involved to perform the load cell tests in the next experiment the two-cycle impulse engine arrangement required considerable preparation as shown in Fig. 26 below. The S-beam load cell is bolted securely to the front of E-13A (with E-13B attached above to E-13A) and the other end of the load cell was bolted to a 9.52 mm

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[25] Original and unpublished photograph from the private library of Norman L. Dean, *An Introduction to A System for Converting Rotary Motion into Unidirectional Motion,* page 10, 1964 Norman L. Dean, courtesy of his grandson Bruce D. Dean.

[26] Recognition and appreciation to Gary French, ex-owner of J.B. Saunders Co. Surplus Electronics

(.375”) aluminum plate that was anchored to the work bench with a pony vise and two vise-grip “C” clamps (as was shown back in Fig. 19.) The engine was suspended by two 31.75 kg (70 lb.) test chains 762mm (30.0”) long and stabilized by a pair of 6.8 kg (15 lb.) dumbbells at the rear of the assembly. The dumbbells *did not* bias the load cell null but merely kept the engine from wobbling.

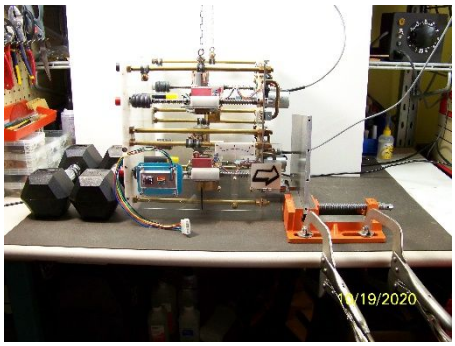


Fig. 26 Securing the two-cycle Asymmetric Impulse Drive.

Without using servos or stepper motors it was a bit touch-and-go to get these two engines to reciprocate due to subtle differences in surplus components. After few attempts to chart the two-cycle engine while it was operating, we managed to produce results that hint such a drive as a two-cycle impulse engine is possible.

The results can be seen in Fig. 27 below where the two carriages were phased as close to 180 degrees apart as was possible with top engine (E13B) at 9.97 vdc and bottom engine (E-13A) at 9.73 vdc. We lose some peak force but gain in uniformity.

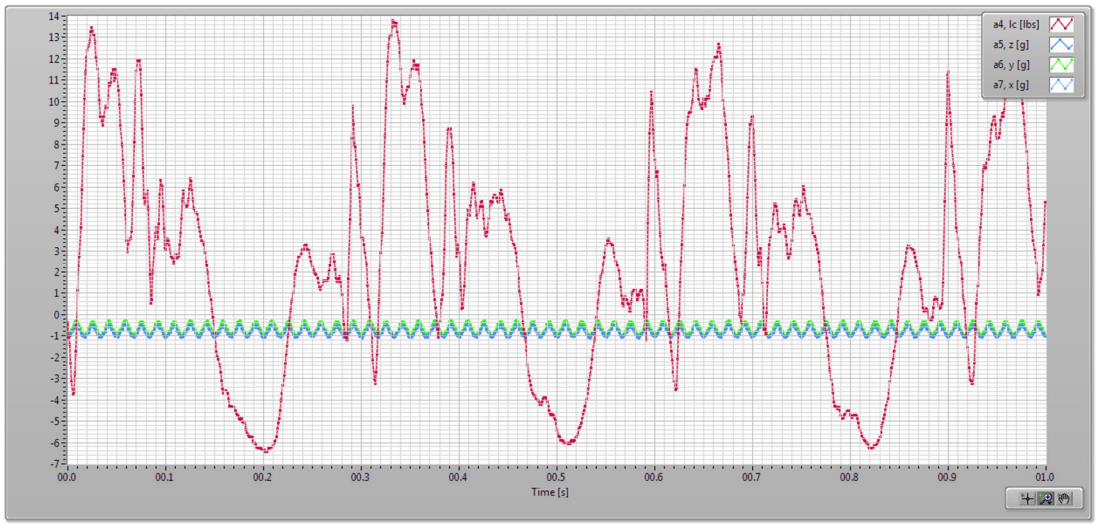


Fig. 27 Waveform: Asymmetric Impulse Drive E-13A, E-13B ganged at 3.7 Hz.

The system is producing positive motion 84-percent of the time with an average positive force of 35.052 N (7.88 lbs.) nearly the weight of one engine. The overall average gain as expressed in Eq. (18) would be 29.447 N (6.62 lbs.):

$$F = 0.84\ x\ 35.052\ \text{N} = 29.447\ \text{N} \tag{18}$$

Or 7.739N (1.74 lbs.) over the gain of a single engine, but the impulses are more consistent.

Please note in Fig. 27 the eerie menagerie of third and fourth derivative ghost pulses ganged together to render an overall relatively coherent impulse.

The author proposes that collectively the "virtual energy" generated by this mechanical complex is adding to the coherent pulse of force that would make for a smooth source for space drive or a practical "Impulse Drive" as it were.

Conclusion

It has been shown that a mechanical Dean oscillator will not behave as Newtonian thought would predict. The mechanical Dean oscillator was also shown to produce acceleration from an eccentric rotor in rotor-linear motion and we describe how this "inertial engine" can propel us efficiently and safely through space. We established a series of plausible and reliable means to test inertial propulsion drives. It was shown that some kinetic systems such as AID have extra potential energy tied-up within their own intractance that can be released under the right conditions. Furthermore, it is the authors' conclusion that because of the inherent inertial lag in all matter, it may be possible to release pent-up forces from certain materials in rotary or repetitive motion as a source of energy.

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My wife Delores E. Hampton has always believed in me and was my inspiration to finally move the Asymmetric Impulse Drive beyond the years of testing into actuality.

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A thank you to my brother David J. Hampton for his support and help in attaining the patent for the AID.

I would also like to thank Kent Hanna for machine-turning and slicing of the bronze rotors for the AID so that I could quarter-cut and balance them. Kent and his brother Steve have also done machining for E-3 and E-4 gratis.

A thank you to Gary French, owner of J.B. Saunders Co. for resourcing some of the parts for the AID.

A warm thank you to Bruce D. Dean, grandson of Norman L. Dean, for his encouragement, background information, unpublished resource materials from Norman L. Dean himself, along with photos of Dean's original Spatial Inertial Gyroscope and IP engines.

The author must note here that after I had built the AIDs, I was blessed with access to some of Norman L. Dean's original notes and documents which confirms my belief that Dean was of genius caliber who created a phenomenal form of propulsion. Though none of his complete IP machines survived his untimely death in 1972, it is my hope that his name will be written across the stars of human history.

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[22] ibid.
[23] ibid.

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