

Did an A-36 Beechcraft Bonanza Aircraft encounter a Thunderstorm Analog of a Warp Drive Spacetime on 4 December 1970?

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Abstract

This paper critically reviews a private aircraft flight through an intense thunderstorm cell in 1970 described as being torus shaped by aircraft pilot Bruce Gernon, Jr. (Bermuda-Triangle.Org 2011). An earlier scientific analysis was conducted by David Pares who argued that the storm cell in question was capable of outputting a power of at least 1.585×10^{15} Watts through physical atmospheric processes categorized as a Mega Electric Thunderstorm (Pares 2010). Pares' analysis then went onto infer that the storm cell induced a "warp drive"-like means of travel for the aircraft causing it to be linearly displaced as a byproduct of the storm's intense electrical potentials and charge distributions. In this paper the events described by Gernon are reexamined and found to be more indicative of a wormhole-like spacetime obeying exponential flare out functions rather than a warp drive-like spacetime obeying horizon functions.

The deduced wormhole-like spacetime from analyzes within was reconstructed as having a non trivial geometry with a minimal throat radius proportional to the aircraft's wingspan. Further the wormhole-like spacetime is argued to be a higher-dimensional holographic projection resulting from the electrification of a cloud vortex coupling to a negative pressure hypothesized relativistically to induce a *phantom energy* condition which was dispersed along the cloud vortex causing it to behave as an analog wormhole. It is also argued that the storm cell's electrical mass densities acted as an effective low density gravitational fluid which allowed it to couple to a negative gravitational pressure of magnitude $P = -5.63 \times 10^{-16}$ Pascals hypothesized as emerging from two large extra spatial dimensions, acting as a *phantom energy* inductor. Strikingly the magnitude of the induced *phantom energy* in MKS units was found to be equivalent to the energy content of the Mega Electric Thunderstorm described by Pares in four-dimensional spacetime. While there are numerous questions which still remain to be resolved about the events documented by Gernon a "space warp" should not be ruled out as candidate explanation for the private aircraft's hypothesized linear displacement.

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Table of Contents

Introduction	2
The problem with atmospheric inductions of spacetime curvatures	2
Specifications of the A-36 Beechcraft Bonanza	3
Reported encounter with an electrified vortex at three thousand meters	3
A quick review of the storm dimensions	4
An overview of the Pares analysis	5
A meteorological analysis based on Weather Maps and Gernon's account	7
New interpretations	8
A mass cancelation hypothesis	8
On the spatial distortion hypothesis	9
Why not a warp drive?	10
If only there were a wormhole	10
Hypothesis for the source behind the alleged spatial distortion	13
Large extra dimensions?	14
Speculations resulting from string theory	15
An electronic fog?	16
Possible properties of a magnetized wormhole	17
Discussion and Summary	17
Bibliography	18

Introduction

There is a widely known urban legend regarding mysterious physical occurrences which have taken place near the Southeastern United States, known simply as the Bermuda Triangle. In this manuscript the author follows an earlier analysis conducted by David Pares regarding a meteorological occurrence which took place on December 4th, 1970 at 1000 UTC (3:00 PM EDT) as reported by pilot Bruce Gernon, Jr. (Pares 2010). The pilot conveyed the idea that he somehow made an instantaneous “jump” from Andros Island Airspace to Miami Airspace in a time frame inconsistent with the maximum possible cruising airspeed of his private A-36 Beechcraft Bonanza aircraft, after encountering a large storm wall, a vortex, and an “electronic fog” aloft approximate to the Intertropical Convergence Zone (ITCZ). Pares upon learning of Gernon's account conducted a preliminary reconstruction of the cloud electrification properties based on the reported meteorological conditions at the time. Pares conclusions strongly hinted that the electrical properties of the storm resembled the characteristics of an Alcubierre [warp drive] spacetime (Alcubierre 1994), that is if one exchanged electric potentials in place of the usual gravitational field potentials.

The present author is an independent researcher who has researched warp drive spacetimes in the past and is also a student of climate sciences, so the choice to investigate this topic was a natural one. This author feels that the limits of the possible cannot be known without venturing a little into the impossible from time to time and this topic certainly qualifies that criterion. If we naively assume that both Gernon's and Pares' descriptions are invalid then we gain no new scientific knowledge, rather than running with that assumption let us see where venturing into the impossible takes us.

The problem with atmospheric inductions of spacetime curvatures

The immediate problem this author has with the arguments of Pares is the claim that the metrological system in question was able to generate a spacetime distortion equivocal to the Alcubierre warp drive. It is practically universally known that the electrical energy potentials within thunderstorms are far, far below what is needed to induce any measurable spacetime curvature¹. Therefore in terms of General Relativity (GR) a gravitational based warp drive as the science is currently understood should in principle be ruled out altogether and an applicable alternative should be sought. As an example, electromagnetic analogs for black hole event horizons have been proposed within the past decade and have been demonstrated under laboratory conditions thereby prompting another route of inquiry outside of standard GR for gravitational physics. With this line of reasoning in mind the question that should be asked here is: could cloud electrification processes induce an electromagnetic analog of a warp drive spacetime? If so what would be the potential consequences of a thunderstorm analog of a warp drive spacetime, if any? Before we get too ahead of ourselves an overview of the thunderstorm encountered by Gernon is needed. Since the description of the events are tied to the dimensions and performances of an A-36 Beechcraft Bonanza aircraft those properties will be outlined first.

¹ For comparison the entire mass content of the Earth results in only a modest $\sim 10^{-9}$ m spacetime curvature on its surface which is much larger than the spacetime curvature allowed by the calculation of Pares' MET energy with a spacetime curvature of $\sim 10^{-31}$ m which is very near the theoretical spacetime quantization cut off known as the planck length $l_p = \sqrt{(G\hbar)/(c^3)} = 1.62 \times 10^{-35}$ m.

Specifications of the A-36 Beechcraft Bonanza

Knowing the performance, dimensions, and capabilities of the aircraft in question is crucial in reconstructing the events described by Gernon. This information is not exactly easy to get a hold of for the non aviator; the most reputable source found was published by Jane's ("Beechcraft Bonanza 36" 2010). From Jane's publication we can infer that the A-36 was quite a popular model as 3,103 aircraft of the 4-6 seat class were manufactured between the years 1968-1999. In fact the aircraft is still being manufactured today, but has been superseded by the G36 model whose specifications are listed below.

Specifications	Metric Unit	Imperial Unit
Wingspan	10.21 m	33 ft 6 in
Height	2.62 m	8 ft 7 in
Overall Length	8.38 m	27 ft 6 in
Empty Weight	1,148 kg	2,530 lbs
Operating Weight (single person)	1,224 kg	2,700 lbs
Max Fuel	201 kg	444 lbs
Cruising Speed	326 km/hr	202 mph
Normal Cruising Speed	306 km/hr	190 mph

Table 1: Jane's Specifications for G36 Beechcraft Bonanza

Jane's information on the Beechcraft Bonanza G36 is helpful for this study even although the model of the aircraft is technically incorrect; another less reliable online is the source Pilot Friend, gives some of the specifications of the A-36 model of the aircraft (Pilot Friend 2010).

Specifications	Metric Unit	Imperial Unit
Gross Weight	1,633 kg	3,600 lbs
Empty Weight	996 kg	2,195 lbs
Fuel Capacity	280 L	74.00 gal
Cruise Speed	311 km/hr	168 kts
Top Speed	331 km/hr	179 kts
Rate of Climb	314 m-pm	1,030 fpm
Ceiling	5.06 km	16,600 ft

Table 2: Pilot Friend Specifications for A-36 Beechcraft Bonanza

Comparisons of the two sources for the dimensions of the Beechcraft Bonanza aircraft reveal rather similar results with the marked exception that the G36 model appears to be lighter and have higher performance capabilities over the A-36 model. Given that the Jane's listings has the dimensions of most interest for this analysis the G36 model will be us as a substitute, here the A-36 data serves as reminder of the performance differences between the two models of the aircraft. It should be noted that there are also differences between the fuel capacities reported by Gernon and what is listed above, thus it should be assumed that Gernon's numbers are more accurate given the sources available to the author.

Reported encounter with an electrified vortex at three thousand meters

Gernon reports that he found himself caught unexpectedly in a torus shaped storm system with high lightning activity encountered shortly after takeoff from Andros Island some 337.96 km (210 mi)

from the Florida Coast². The pilot first described what looked to be a large lenticular cloud³ 48.28 km (30 mi) NW (135 degrees) from his position at an altitude of 152.4 m (500 ft) which was over flown for safety reasons. He then encountered a storm wall 16 minutes after the flyover of the lenticular cloud with very high electrical activity with a ceiling of 19.81 km (65,000 ft) that he could not fly over and which touched the sea surface, so he immediately set course towards a fair sky region located within the system. The system then enclosed, reminiscent of the interaction between cumulus-stratocumulus clouds (cf. figure 6.23 (Cotton, et al. 2011) pp. 214), leaving a small counter clockwise rotating cloud vortex 3.05 km (10,000 ft) in diameter at an altitude of 3.05 km which the pilot attempted to fly safely through. The vortex entrance was located approximately 128.7 km (80 mi) from the Florida coast⁴. Gernon speculates that the first lenticular cloud he encountered and the second storm wall was part of the system due the storm walls curved appearance, hence the argument for a torus shaped storm system.

Gernon then went on to state that the vortex he entered eventually collapsed down to the diameter of his aircraft's wingspan 10.21 m (33 ft 6 in), which he continued to fly through for another 20 seconds. Upon which his aircraft became surrounded by a dense fog, described as an "electric fog" which attached itself to his aircraft. The "electronic fog" was described as appearing bright gray with hints of a yellowish color that interfered with his flight instrumentation, save for his electrically shielded engine and radio. The electronic fog had dissipated after a period of three minutes, upon which Gernon found himself near Miami Airspace not Bimini Airspace, suggesting to him an instantaneous jump of 128.75 km (80 mi) took place somewhere along his journey through the storm system. It is also of note that Gernon reported that from outside the vortex its length appeared to be 16.09 km (10 mi) long but within it appeared only 1.61 km (1 mi) long, and that the diameter of the vortex shrank from 3.05 km to 60.96 m (200 ft) (Bermuda Triangle.Org 2011). The pilot also reported a sensation of deceleration for a period of 8 seconds when he initially entered the vortex and again when he left the vortex which lasted for a period of 5 seconds.

A quick review of the storm dimensions

With a navigation chart Gernon provided to Pares accompanied with hand written notes (Pares 2010) we can apply some dimensions to the storm system encountered. The notes from the navigation map provided by Gernon tell the story which follows (please note for the purposes of saving space in this paragraph that only the original imperial units of the source will be described, not the metric equivalents which can be calculated by the reader). The A-36 Aircraft took off at a speed of 180 mph for 10 minutes heading NW and reached an attitude of 10,000 ft covering a distance of 30 mi. After which the pilot encountered a large lenticular-like cloud while traveling at 105 mph for 10 minutes covering a distance of 17.5 mi while still ascending, at this point the pilot passes the first cloud formation. He then continued to travel at a speed of 135 mph for 6 minutes covering a distance of 13.5 mi reaching an altitude of 11,500 ft Gernon then encountered a second large storm system and changed course

² Note that the distances, heights, and travel times were all figured from a navigation map with notes provided by Gernon to Pares, for map see (Pares 2010).

³ The cloud form described was most likely in metrological terms a stratocumulus microcell.

⁴ It should also be noted that relative velocity and maneuvers described by Gernon he should not have travelled a distance greater than 111.31 km (69.17 mi), suggesting unaccountable distances were transverse along his journey.

towards the south at the same speed for 3 minutes covering a distance of 6.75 mi. He then spotted a clearing in the storm and changed course NW at a speed of 230 mph for 3 minutes covering a distance of 11.5 mi and then descended to an altitude of 10,000 ft. Next he entered a cloud vortex while travelling at 210 mph for 20 seconds covering a distance of 1.17 mi, after exiting the vortex he then encountered an “electronic fog” while travelling at 180 mph which attached itself to his craft for 3 minutes, covering a distance of 9 mi.

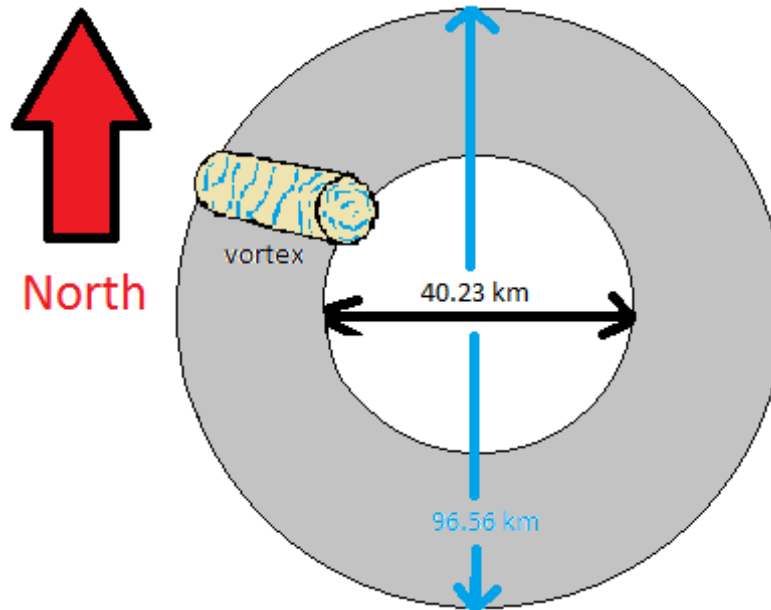


Figure 1: Simplified overhead schematic of the torus shaped MET with a 19.81 km ceiling for calculation purposes. The electrified vortex was located at the northwest quadrant (135 degrees) of the MET and was reported to be rotating in a counterclockwise direction, a reasonable hypothesis being that that the vortex was set into motion by the local geostrophic wind.

It is also here noted that the climb rate of the aircraft were shallow enough to have a negligible impact on distances calculated here, for example the distance travelled from takeoff to reaching the first cloud is found by the hypotenuse formula to be $\sqrt{(42.28 \text{ km})^2 - (3.05 \text{ km})^2} = 42.22 \text{ km}$ and is not likely to have a large impact on the derived storm characteristics. With all of that said we can estimate the dimensions of the storm system, assuming a torus shape, the storm cell had an outer diameter of 96.6 km (60 mi) and an inner diameter of 40.2 km (25 mi). Finally we have some reasonable numbers with which to deal with any meteorological or space warp phenomenon in later sections.

An overview of the Pares analysis

Pares essentially performed a meteorological analysis of the events described by Gernon, one first calculations carried out dealt with magnitude of the storm system’s power. A simplified model of weather processes suggest that the power output of a thunderstorm can be derived by multiplying cloud height by their assumed electric potentials and charge distributions. Pares described the storm system in which Gernon encountered as a Type 2 Mega Electric Thunderstorm which Pares defines as follows (Pares 2011b).

The Mega Electric Thunderstorms tends to form in Ocean regions where the wind speed and direction do not abruptly change with increasing height above the surface. These conditions usually consist of winds of a North Easterly component less than ten MPH, and less than 6 degrees F between ambient air and dew point. This scenario can usually be found just before a Cold front pushes through Northern Florida and out over the Ocean area. Additional evidence shows that Cumulus and Towering Cumulus clouds will form early in the morning in these areas coupled with increased Solar Sunspot activity and solar winds over 475 km/sec, to be a major contributing factors in setting off these special set of circumstances for Electronic Fog generation.

The Mega Electric Thunderstorms (MET) are said to have the properties such that the electric field is $E_{MS} = 4 \times 10^5 \text{ V/m}$ and the having a current of $I_{MS} = 2 \times 10^5 \text{ A}$ (Pares 2010) and therefore would be rather powerful, under simple assumptions for the storm in question this turns out to be

$$E_{MS}I_{MS}Z_{Cl} = 1.585 \times 10^{15} \text{ W}$$

where $Z_{Cl} = 19.81 \text{ km}$ is the cloud height reported by Gernon. Pares also calculated the electric field resultant of the surrounding storms to be $3.22282 \times 10^{15} \text{ W}$, without explaining how the storm vectors and magnitudes were calculated. To get the resultant from the flight path angle of 135 degrees (2.356 rad) one must assume electrification horizontally across the electrically active portion of the storm cell subtracting the fair weather center yield a horizontal “conducting” distance $d_c = 56.33 \text{ km}$ (35 mi)⁵ so the vectored strength of the field would be

$$E_{MS}I_{MS} \cdot d_c \sin(2.356) = 3.186 \times 10^{15} \text{ W}$$

which is close to Pares’ result suggesting that he used a similar reasoning. Before we can get into any dialog about “space warps” a review of the concept of a MET is in order.

In typical thunderstorms the electric field potential is traditionally derived to be $2.0 \times 10^6 \text{ V/m}$ and having a charge of 30 C per km (Mason and Mason 2003). For the dimensions of the storm system in question the charges involved translates to a current of $I = 594.3 \text{ Amps}$, thus under ordinary conditions the storm should have produced a power of $2.36 \times 10^{13} \text{ W}$. In reality however the electric potential within storms have been measured to be less than its theoretical value suggesting that cascade showers from cosmic rays may alter the electrical potential within clouds (Gurevich and Zybin 2005). So Pares’ high values for voltage are not too surprising if you consider that a MET is defined to be triggered by an increased flow of charged particles originating from the solar wind.

A brief review of space-weather is also need to fully grasp the arguments of Pares. It is generally known that the solar magnetic field acts to shield the Earth from Galactic Cosmic Rays (GCR), there is much ongoing debate about the GCR impact on weather and climate in the scientific literature. Typically when sunspot numbers are high the magnitude of the solar magnetic field increases, so under those conditions there are more pronounced blockings of GCR from interstellar space. The solar wind speed also has an influence of GCR reaching the Earth, i.e. a weak solar wind will result in more GCR reaching the Earth’s atmosphere. Furthermore the solar wind acts to distort the Earth’s geomagnetic field which helps to accelerate charged particles towards the poles producing the well known Northern Lights, thus

⁵ Here the conducting distance was not determined from the simplified torus model for the MET but rather the flight plan and notes provided by Gernon on a flight navigation map (Pares 2010).

variations in the geomagnetic field through either terrestrial or solar processes can result in large changes in GCR fluxes on the Earth's surface (Tinsley 2000). It is also generally well known that sunspots are generally found to be positively correlated with "geomagnetic storms".

Thus Pares' theory for the development of a MET favors high GCR counts and strong solar winds, which are somewhat contradictory, ideally solar winds are favored when sunspot activity is high. A high sunspot number implies a strong solar wind which can then disrupt the Earth's geomagnetic field, as well as a Corona Mass Ejections (CMEs). Pares cites NASA studies regarding magnetic reconnection events that are believed to cause an explosion of magnetic energy by directly connecting solar and geomagnetic [pseudo] lines of force (Pares 2011b). Thus what Pares refers to as a MET is already known in the literature by a different name, a *magnetospheric substorm* (Singh, et al. 2004).

A *magnetospheric substorm* results from the Earth's cross geomagnetic tails diving into the ionosphere and generating low density plasmas which induce enormous heat and energy flows. Pares' definition thus only varies from traditional literature from the stand point of defining: minimal solar wind speeds, electric potentials, electrical currents, and geographical locations for *magnetospheric substorms*. For the MET of interest the value for sunspot numbers was 84 and the solar wind velocity was recorded to be 706 km/sec (Pares 2010). The only nagging issue is how the E and I values were determined for a MET, are they from a working theory of Pares or from another source which was not cited?

The real issue with the Pares hypotheses is not the MET description, but rather the argument that the larger resultant electric vector pushed the aircraft forward by "crushing" the weaker electric fields ahead, thereby allegedly inducing a "space warp". Since electric vectors vary over all over, space warps should be generated at all times under this hypothesis, which does not appear to agree with observation. In one sense this is a reality as electrical energy can act to contract space, and electric vectors can alter energy states in a given given volume of spacetime, resulting in spacetime curvature. But one must bear in mind that the energy levels within a MET are much too small to induce observable spacetime curvatures according to GR.

A meteorological analysis based on Weather Maps and Gernon's account

The storm reported by Gernon was quite unusual, for example a vast majority of thunderstorms near Florida achieve altitudes of only 6 km (Vonnegut, et al. 1966; Bringi, et al. 1997) but a 20 km altitude for severe storms in the mid-latitudes are fairly common (MacGorman, et al. 2008). Even more surprising about a Floridian MET is that most storms have considerably lower ceilings during winter months due to cooler air temperatures and is reason why thunderstorms in wintery climates are almost unheard, so the MET described by Pares is some three times larger than one would expect under normal meteorological conditions.

Weather maps surrounding the day in question (NOAA 1970) do however reveal ideal conditions for the generation of a cyclonic storm. These storms are generated by cold air forcing warm air up and away, the 61 F (16.11 C) air temperature and dew point temperature data in the NOAA map (NOAA 1970) suggest that conditions necessary for the rise of unstable air masses as well as to spontaneously produce fog were present at the date in question. The NOAA data thus partially verifies that the storm system in question could have generated a fog capable of transforming into a rapidly towering cumulus cloud. In fact such maritime conditions are known to occur on occasion in the geophysical literature, they are classified as *cumulus-under-stratus* fogs and are the result of cool air flowing over warm marine environments (Cotton, et al. 2011).

So while the thunderstorm system described by Gernon may seem unlikely at first one cannot rule out the conditions described as being unheard of within the scientific literature. The only truly

puzzling description was the presence of a lenticular cloud as they are usually formed over rough mountainous terrain, not over relatively flat geographical regions such as Andros Island. On the other hand a stratocumulus cloud however in theory is capable of producing a cloud some 15 km wide which could give the appearance of lenticular cloud (cf. figure 6.24 (Cotton, et al. 2011) pp. 215).

The only remaining piece of information that can be easily meteorologically deduced is the rotational velocity of the cloud vortex described by Gernon. The earth's rotation generates pseudo force known as the Coriolis force, as seen from the surface of the planet this appears to generate a wind known as the geostrophic wind which is associated with the widely known trade winds. Since in region of Florida the geostrophic appears to move southwesterly this may be the cause for the counter clockwise rotation of the vortex. The velocity of the geostrophic wind at Andros Island is found to be

$$v_{gw} = \frac{1}{2\Omega_E \sin(\varphi)} \frac{p_{air}}{\rho_{air} d_{eq}} = 7.37 \text{ m/s}$$

where $\varphi = 0.443$ is the latitude of Andros Island in radians, Ω_E is the angular velocity of the earth, p_{air} is air pressure, ρ_{air} is air density and d_{eq} is the distance from the equator. It would now appear that we have exhausted the meteorological data we have been able to collect about the day in question and can now begin further analysis in regards to a potential "space warp". So assuming the conditions described by Gernon are accurate and the energy of the storm system as evaluated by Pares to be correct then what would be a reasonable hypothesis for the linear displacement deduced for the A-36 Aircraft?

New interpretations

Given the large amounts of mass-energy required to distort spacetime geometry in appreciable amounts in GR it would seem more reasonable to seek a solution less exotic than a "space warp" for the event in question. A starting point would be hypothesizing that the MET somehow altered electric fields within the storm system in such a way as to achieve an inertial mass cancelation like effect. Given that it is unlikely to modify an intense storm's electric potential a reasonable first hunch would be to test whether or not the magnetic properties of the storm system could have somehow concealed the mass of the aircraft and allowed it to travel along an electric potential, just as ions are capable of "riding" a lightning strike. This is most certainly a bizarre scenario to consider, but much less so than the presence of a massive spatial distortion induced by trivial amounts of terrestrial mass.

A mass cancelation hypothesis

Making use of elementary magnetic force laws one can approximate the magnetic strength of the MET along the aircraft's frame by assuming the cloud vortex tunnel to be a long wire with the mega storm current such that

$$B_{max} = \frac{\mu_0 I_{MS} \pi R_{vo}}{4\pi r_{a36}^3} = 3.882 \times 10^3 \text{ T}$$

where $R_{vo}=152.4$ m is the radius of the vortex entrance and $r_{a36}=5.11$ m is the approximate forward radius of the aircraft. The large charges generated by the storm would then be associated with a Lorentz Force proportional to the velocity of the aircraft $v_{a36}= 93.88$ m/s (210 mph) while it was within the vortex having a magnitude of order

$$F_{Lmax} = Q_{cc}[E_{MS} + (v_{a36}B_{max})] = 1.422 \times 10^8 N$$

where $Q_{cc}= 594.3 C$. It is assumed that the large outer vortex has an angular velocity corresponding to the geostrophic wind velocity having period $t_{vo} = 2\pi R_{vo}/v_{gw} = 129.92 \text{ sec}$.

We now introduce the concept of conserved magnetic moment obeying

$$\mu_{mc} = Q_{cc} \left[\frac{\pi(Z_{cl}/2)^2}{t_{vo}} \right] = Q_{cc} \left[\frac{\pi(r_{a36})^2}{t_{vi}} \right] = 7.119 \times 10^7 m^2 A$$

where

$$t_{vi} = \frac{Q_{cc}\pi r_{a36}^2}{\mu_{mc}} = 2.734 \times 10^{-3} s$$

is the rotational period of the vortex along the aircraft frame when it collapses to surround the aircraft. A possible counter balancing magnetic force along the aircraft frame theoretically may be produced with a magnitude of

$$\frac{m_{a36}}{t_{sl}^2 I_{lt} l_{a36}} \mu_{mc} = 1.040 \times 10^6 N$$

where $t_{sl}=100 \text{ sec}$ is the typical flash rate for sheet lightning and $I_{lt}= 1 \text{ Amp}$ is the typical current of a bolt of lightning, and $l_{a36}=8.38 \text{ m}$ is the length of the aircraft frame. The above does not appear to be a very likely scenario. Although one could argue the point with that with faster lightning flash rates or varying currents that the Lorentz Force could be hypothetically shielded resulting in a mass-cancellation like effect, but it would require moving at exactly the right velocities, having the right charges, lengths, et cetera making this a problematic argument at best. We can thus comfortably rule out an electrically induced mass cancellation like effect by a MET as a contender for the A-36's reported linear displacement.

On the spatial distortion hypothesis

The preliminary analyses thus far given by Gernon's account initially suggest that the electrified vortex in question would be more consistent with a Lorentzian wormhole than an Alcubierre warp drive⁶ given the dimensions of the described vortex. Gernon's description of a large rotating vortex can be likened to the mouth [entrance] of a wormhole, the vortex was also described as being narrower within, which in essence is analogous to a Lorentzian Einstein-Rosen bridge or "wormhole throat", not a bubble encased by a narrow region of expansion and contraction as would be the case with an Alcubierre warp drive, although there is some overlap with theories involving spacetime shortcuts (cf. Krasnikov 2003). The possibility addressed above raises a larger and perhaps more fundamental question, can thunderstorms be used as analogs to describe a wider class of otherwise purely theoretical gravitational phenomenon?

Pares speculates that Gernon's linear displacement occurred as a result of a gravitational spatial distortion since the aircraft's initial altitude entering and exiting the vortex were maintained suggesting

⁶ It is strongly noted that both interpretations within in the framework of GR are not possible without the physical destruction of our planet in the process.

that a geodesic or “free fall” path was taken by the aircraft. Pares then argued that the “electronic fog” may have therefore acted as an Alcubierre warp bubble spacetime, which theoretically allows for a gravitational propulsion system which conforms to natural geodesic paths. The problem with this suggestion is that an Alcubierre warp drive spacetime requires enormous amounts of exotic energy to induce, and moreover is intended more as a teaching tool for GR rather than as a practical method of achieving hyper-fast space flight. So an Alcubierre-like spacetime on the surface appears to be a unlikely solution to the perplexing problem of the A-36’s linear spatial displacement if we take Gernon’s report at face value.

Why not a warp drive?

A quick and easy determination for the mass of warp drive is $M_{WD} = -v^2 R^2 \sigma$ (Lobo 2007), where v is the velocity of the warp bubble, R is the radius of the warp bubble and σ the thickness of the bubble by convention. Assuming the velocity of the warp bubble from the deduced by an earlier distance estimate on the linear displacement $d_s = v_b = 1.1 \times 10^5 m/s$, the mass in SI units would be

$$M_b = - \left[\left(\frac{v_b}{c} \right)^2 r_{a36}^2 \sigma \right] \frac{c^2}{G} = 9.815 \times 10^{21} kg$$

which is a highly significant fraction of the Earth’s mass in the form of exotic energy, which can be easily ruled out.

There is another compelling reason to consider abandoning the idea of using the warp drive to explain away the spatial linear displacement as described by Gernon, maintained radio communication. Throughout his flight Gernon was able maintain radio contact with air traffic control, this would not be anticipated to be possible within a warp drive spacetime because the horizon of a warp bubble is expected to induce large Doppler shifts which would affect incoming and outgoing light rays. The horizon of a warp drive can be imagined as a “ringed” shaped black hole. Therefore a warp drive spacetime should have induced a large Doppler shift and shifted outgoing wavelengths by a factor $\lambda/\lambda_0 = (1 - r_s)^{-1/2}$, making radio communication virtually impossible as the frequency of the transmissions in both directions would be heavily distorted. Within warp drive spacetimes the complexities of GR are hidden within the cross terms, but the gist is that a warp bubble would consist of high density exotic energy and or matter capable of strongly bending light, thus inducing a gravitational horizon.

Quantum Mechanics also necessitates that the amount of exotic energy capable of existing within spacetime be limited by certain inequalities and as such a “warp bubble” should generate short lived particles whose mass closely approximate the planck mass at distances only slightly larger than the planck length (Lobo 2007). For the A-36 Aircraft-MET interaction to have generated a warp drive spacetime by quantum inequality restrictions would require a mass of $-4.42 \times 10^{47} kg = -3.83 \times 10^5 M_{MW}$, or some hundred thousand times the mass of the Milky Way. We may thus infer that the no Doppler shifts were induced as the radio transmissions continued unabated, implying that there were no high density gravitational fields of the warp drive variety present during Gernon’s flight.

If only there were a wormhole

What is more appealing from a gravitational standpoint is that wormhole throats essentially have a vortex-like behavior to them, a behavior also described by Gernon. Although wormholes are not a cure all as they still run into the mass-energy problems we briefly discussed earlier in regards to warp drive spacetimes. Gernon did provide enough detail for us to map out a wormhole-like geometry,

making it possible to backwards derive the topology of a hypothetical wormhole through simple logarithmic functions.

One might naively begin with a spherically symmetry static transversable wormhole known as a Morris-Thorne wormhole connected to Friedman-Robertson-Walker spacetime. With the large vortex radius $R_{vo} = 152.4$ m representing the mouth and the aircraft radius $r_{a36} = 5.11$ m being the throat radius, upon which we find the two regions to be separated by an exponential flare out function $R_{vo} = r_{a36} * \exp(r)$ where $r = \ln(R_{vo}/r_{a36}) = 3.406$ and modifying for Einsteinian spacetime⁷ one can deduce a flare out function of $2\exp(3.406)$. According to Gernon's report he travelled within the vortex for 20 seconds at $v_{a36} = 93.88$ m/s (210 mph), so we can now deduce the spatial ["linear"] displacement created by a mathematical wormhole.

$$d_s = 20 \text{ sec } v_{a36} 2e^{3.406} = 1.132 \times 10^5 \text{ m}$$

The above result is just a few kilometers short of what Gernon reported, but if we also take into account that after he exited the vortex he travelled with the "electronic fog" for an additional 3 minutes at 80.47 m/s (180 mph) so the travelled distance turns out to be 14.48 km (8.99 mi), and when these are added together they replicate the displacement reported by Gernon quite well. It would appear that the wormhole description "just works", or at least mathematically when known physics are neglected.

But the explanation for the linear displacement is not all that makes the wormhole idea attractive, Gernon also reported a few other anomalies that an ordinary person might have written off but which sound suspiciously like relativistic effects such as length contraction. He reported that the length of the cloud vortex appeared to extend 16.09 km (10 mi) but within only appeared to extend 1.61 km, in addition he also reported that the tunnel appeared shrink in radius from R_{vo} to $R_{vi} = 30.48$ m (100 ft) that was described as a "sucker hole", and that the clouds within the vortex appeared as alternating shades of brightness and darkness. Wormholes can also appear to brighten and darken light through microlensing effects (Abe 2010). Microlensing can be liken to the method by which modern astronomers use to detect extra solar planets, often illustrated as measuring the "wobbling" of light emitted from a parent star.

All of the above information can now be compiled to reconstructed a non-trivial wormhole geometry (see Figure 2 below), which may be classified as an Ellis wormhole or "drain hole" where one mouth is larger than the other. The smaller wormhole-like mouth would then have a flare out function defined by $r = \ln(R_{vi}/r_{a36}) = 1.797$ or in relativistic terms a flare out function of $2\exp(1.797)$.

⁷ This correction is needed because in GR spacetime distortions in geometric units have the form $2M$, the multiplication of by a factor of 2 helps to keep measures of spacetime "balanced".

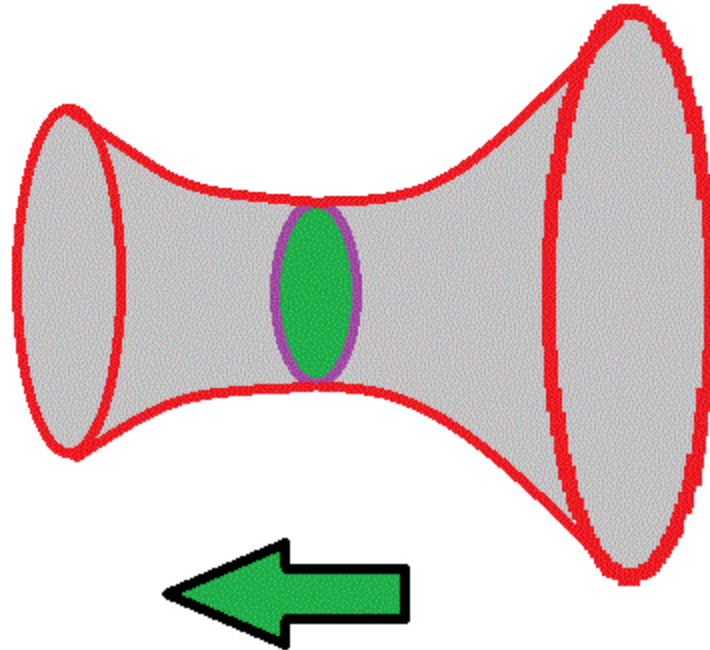


Figure 2: Non trivial wormhole geometry with differing mouth radii being larger than the minimum throat radius (green). Where the minimum throat radius corresponds to half of the A-36's total wing span, movement of direction within the "drain hole" is towards the smaller mouth in the negative x direction (left). Image is not drawn to scale.

What Gernon described thus would cause a wormhole tunnel that looked 16.09 km externally to appear to shrink down to 1.61 km internally due to its interaction with the second mouth. The apparent shrinking of the outer mouth down to 30.48 km was thus likely an optical effect induced by the smaller "drain hole" mouth. As a further illustration of the non-trivial wormhole-like geometry we will discuss how a 1.61 km tunnel would appear to be distorted to an outside observer with our earlier deduced flare out functions. There would appear to be a large expansion of space behind A-36 Aircraft with a relatively small contraction of space in front of it, as noted from the simple calculations below.

$$1.61 \text{ km } 2e^{3.406} = 97.03 \text{ km}$$

$$1.61 \text{ km } 2e^{1.797} = 19.41 \text{ km}$$

Travel through this Ellis-like wormhole results in a linear displacement of 116.4 km (72.35 mi), so this rather simplistic logarithmic analysis implies that the A-36 Aircraft could have travelled through a wormhole-like spacetime of the Ellis type which has energy properties not too dissimilar from a warp drive spacetime (Ellis 2004).

Gernon also made reference to experiencing a deceleration feeling shortly after entering and exiting the cloud vortex. The experience of deceleration is similar to free fall and can also be explained using the wormhole hypothesis. The two wormhole mouths interacting with the gravitational field of the earth would induce the gravitational acceleration rates seen below.

$$g2e^{-3.406} = 0.65 \text{ m/s}^2$$

$$g2e^{-1.797} = 3.25 \text{ m/s}^2$$

While the acceleration rates are less than one “gee”, they would certainly be discernible to an observer.

But a clear problem however now arises for anyone with a background in gravitational physics, the rate of gravitational acceleration at the surface of a black hole tends to be quite large for small mass black holes, mathematically expressed through the equation $|\vec{g}_{bh}| = c^4/4GM$. This fact strongly points to a problem with the weak gravitational acceleration deduced from Gernon’s report because when applying GR, the masses in question must be much, much larger than the mass of the Earth’s atmosphere. This is no little paradox which must be resolved. Solving backwards for the exp(-1.797) “gee” acceleration rate for the larger mouth one concludes that the proper mass for the larger mouth must be $M_{lm} = 9.31 \times 10^{42} kg$, in order to prevent devastating tidal forces, but this deduced mass is roughly eight times the mass of the entire Milky Way! Thus the math seems to suggest the presence of a wormhole but the physics seems require masses much larger than what were present.

Hypothesis for the source behind the alleged spatial distortion

It is quite surprising that a wormhole-like structure can explain the spatial short-cut described by Gernon, but the energy requirements for such typically require many times the mass of the Earth to be transversable by a human. So what is the source for gravitational-like distortion which was apparently achieved with arbitrarily small terrestrial masses? A start would be to compare the masses of the two mouths as interpreted through GR. The mass for a Schwarzschild body can be given in terms of its radius through the simple equation $M=Rc^2/2G$, for the large mouth $M_{vo}= 1.03 \times 10^{29}$ kg and for the throat region we find $M_t= 3.4 \times 10^{27}$ kg. The ratio of the two mass relationships can be equated to the difference in size between the throat and mouth regions

$$\frac{M_{vo}}{M_t} \approx \frac{R_{vo}}{r_{a36}} = 30.148$$

If we presuppose some kind of mass shielding effect, the energy supporting the wormhole from the large mouth side may be calculated as in joules as

$$\frac{R_{vo}}{r_{a36}} kg c^2 = 2.710 \times 10^{18} J$$

the result is a rather modest energy scale. A more surprising results is found when we consider the flare out function from the last section along with the flash rate of typical sheet lightning t_{sl} = 100 s and putting that into MKS units we find

$$\frac{R_{vo}}{r_{a36}} \frac{kg c^2}{t_{sl}} 2e^{-3.406} = 1.798 \times 10^{15} W$$

this result is very close to our earlier calculation for the power of the torus shaped MET encountered by Gernon and deduced by Pares (Pares 2010). It would seem that however unlikely that the storm was producing just the right amount of energy to generate the kind of wormhole-like topology introduced in the last section. From theory this would be best explained if the wormhole-like geometry was not sustained by normal matter but by small amounts of exotic energy of the same magnitude produced by the storm system.

A possible theoretical explanation for this would be result within GR would be *phantom energy* which has an equation of state $w < -1/3$, *phantom energy* is like the cosmological constant on steroids

and is a term which describes “big rip” cosmologies, where $w = p/(\rho c^2)$ is represented as a gravitational pressure over a gravitational density. So let us try and see if we can’t find some *phantom energy* in the wormhole-like equations, first gravitational pressure on the small scale can be written as

$$P = -G \int_{r_0}^R \frac{\rho(r)M(r)}{r_{a36}^2} d\hat{r} \approx 4.592 \times 10^{-17} Pa$$

where $M(r)=1.585 \times 10^{15} J/c^2 = 0.017 \text{ kg}$ and $\rho = 1.32 \times 10^{-4} \text{ kg/m}^3$ is the classical density of $M(r)$ at r_{a36} , if we use SI units we find that $w = p/(\rho c^2) = 3.9 \times 10^{-30}$ and at first appears no good since the result is positive. However there are two problems first we assumed P to be positive, if this is exotic matter it should be negative and further the relativistic formulations typically are written in units such that $G=c=1$ after these corrections we find that

$$w_c = -\frac{P}{\rho} = -5.229 \times 10^{-3} \text{ kg/m}$$

thus using “geometrodynamic” units and assuming a negative pressure we can model MET like wormhole using phantom energy since $w_c < -1/3$. Negative pressures in cosmological models obey the relationship $\rho + 3P/c^2 < 0$ for this case the terms in geometrodynamic units add up to $-10 \times 10^{-10} \text{ kg/m}^3$, so indeed the pressure appears to be negative. It should also be noted that typical non relativistic matter take on pressure values of $P=0$ in GR, but we are going around the $P=0$ constraint because the hypothetical wormhole in question would inherently be a relativistic object. It is also noted that there have been proposals suggesting that *phantom energy* present within a wormhole’s throat may be able to sustain the geometry (Sushkov 2005), moreover it has been argued that arbitrarily small amounts of *phantom energy* are sufficient to sustain a wormhole’s existence (Visser, et al. 2003).

Large extra dimensions?

The above result most certainly rules out the laws associated with GR as a possible solution to the linear displacement conundrum, but it doesn’t rule out competing theories on gravitation. String theory is all the rage in modern theoretical physics and in principle gravitation should act very strongly on small scales, specifically the planck scale. The problem however is that planck scale physics have not been obtainable in the universe beyond its initial birth, however there is an intriguing possibility which stems from the *hierarchy problem*. The *hierarchy problem* arises because the gravitational force at the planck scale is believed to be much stronger than all of the other known forces. One solution to the *hierarchy problem* is that large extra dimensions may act as bridge to gap the energy scales between superstring and Standard Model physics.

The motivation behind large extra dimension is that they would enlarge the planck scale and hence gravitational interactions would become stronger at lower more familiar energy ranges. For the case of one additional large extra spatial dimension the planck scale in the fifth dimension would be modified according to relationship

$$\left(l_{pl}^{(5)}\right)^3 = (l_{pl})^2 \frac{G^{(5)}}{G} = (l_{pl})^2 L_c$$

where L_c is the new “large” compactified spatial dimension (Zwiebach 2004). We can therefore imagine large extra spatial dimensions as having smaller magnitudes for Newton’s gravitational constant, i.e. having a limit approaching zero. With a large extra dimension in mind one can get a large mass for a wormhole mouth if the gravitational constant in the large extra dimension is vanishingly small, that is precisely the kind of thing we are looking for to solve our weak field, low mass wormhole problem!

Bearing in mind the above facts we may justify the absence of large mass for the MET wormhole mouth by means of a large extra spatial dimension with the magnitude found below.

$$L_c^{(n)} \approx \frac{M_{vo}}{M_{lm}} = 1.107 \times 10^{-14}$$

In the literature $L_c = l_{pl}^{(n)} = (l_{pl}^{(n)}/l_{pl})^{D-4}$, so a reasonable question now is how many extra dimensions are implied by the L_c ratio in string theory? One interesting proposal is that the large extra dimensions should be limited to pion fluctuations in the electro dynamic background and tied to cosmological constraints, so that the planck scale within a pion can be modified by string excitations (Hajdukovi 2007). Using Hajdukovi’s definition with the scale deduced above suggests that the number of extra dimensions should be between 3 and 4 since $l_{pl}^{(wh)} = 1.88 \times 10^{-23} m$, which corresponds to an energy range of $1.05 \times 10^4 \text{ TeV}/c^2$, current instrumentations are limited to observing energy events up to 5.4 TeV in theory (Zarneck 2008), thus ruling out an immediate laboratory test for this hypothesis.

This leaves only one other potential possibility, that the large extra dimension(s) planck length may be equal to the compactification scale of the large extra spatial dimensions. The problem with that interpretation though is that it does not lend itself to the standard string argument of gravitation being a strong force in a higher dimension. In fact with a $1.11 \times 10^{-14} m$ scale for a large extra dimension puts it at energy scale that is only 35 times that of an electron well within range of known particle physics. It is also somewhat curious that the L_c length scale is also suspiciously close to the Compton wavelength of an electron multiplied by the fine structure constant. If this realization was true then we might expect that modifications of the classical gravitational fields may be possible with present technologies but something seems amiss with this reasoning.

Speculations resulting from string theory

It is noteworthy to consider the similarities in forces between the gravitational force of electrons with the approximated storm mass and the deduced large mouth mass when observed at the Compton scale.

$$\frac{Gm_e M(r)}{(\lambda_c \alpha)^2} = 3.296 \times 10^{-15} N$$

$$\frac{Gm_e M_{vo}}{(R_{vo})^2} = 2.696 \times 10^{-16} N$$

The above gives the impression that the storm system mass may have been projected into a large extra dimension where it was amplified and then weakly interacted with the fourth dimension. Another striking feature is that when two extra spatial dimensions are added to Newton’s gravitational law at the Compton scale we find a pressure of a familiar pressure magnitude

$$P_{C\alpha} \equiv -\frac{Gm_e m_e}{(\lambda_c \alpha)^4} = -16G \left(\frac{c^2}{e^2}\right)^4 (m_e^2)^3 (\epsilon_0^2)^2 = -5.634 \times 10^{-16} \text{ Pa}$$

at the border between the extra dimensional interaction and the usual Newtonian gravitational field. Thus if Gernon's account is accurate, it would appear that nature is trying to tell us something very profound. If we neglect the fine structure constant planck's constant reenters the formulation and we find the pressure below

$$P_c \equiv -G(m_e^2)^3 \left(\frac{c^2}{h^2}\right)^2 = -1.598 \times 10^{-24} \text{ Pa}.$$

It would arguably seem that there exist two large extra spatial dimensions with sizes comparable to the Compton wavelength of an electron. Further that under the right conditions the large extra dimensional gravitational interactions may affect ordinary matter under the proper set of conditions, such as density, pressure and charge, or under general categorizations which black hole theorists have termed as "hair". This interpretation is reminiscent of AdS/CFT correspondence within string theory, that is to say the storm induced wormhole was likely the byproduct of a six-dimensional hologram fueled by the geometry of the MET electrostatic fields, thereby causing strong gravitational interactions to weakly enter into the classical world. It is also surprising that planck's constant disappeared in the equation above, causing the gravitational constant to effectively act as a running coupling constant resulting from a gravitation pressure leaking from extra dimensional space.

Returning back to the *phantom energy* argument from earlier section suggest that a pressure $P = -5.63 \times 10^{-16} \text{ Pa}$ and a density $\rho < 1.69 \times 10^{-15} \text{ kg/m}^3$ are the minimum requirements to obtain string excitations of standard electrons. If this is interpretation is correct then in order to reproduce this effect under *the phantom energy* condition with protons would require $P = -2.16 \times 10^4 \text{ Pa}$ and $\rho < 6.48 \times 10^4 \text{ kg/m}^3$, which presumably would have a stronger gravitational interaction. It is doubtful that just any minimum energy density will suffice with the pressures deduced; if that were the case then such interactions would already be widely known. Let us now close this section by noting another remarkable coincidence, the density of a planck particle across the large mouth radius is $\rho_{vo} = 6.15 \times 10^{-15} \text{ kg/m}^3$, which may imply that densities are constrained to planckian projection functions and that the range for protons may lie below 10^{-4} m , if an equivalent extra dimensional pressure exists for them.

An electronic fog?

Gernon and Pares have attributed the linear displacement of the A-36 Aircraft as an effect associated with the attachment of an "electronic fog" to the aircraft's frame. The present author feels that this association is incorrect and that the electronic fog was simply the byproduct of metrological conditions at the time. While the fog represents a clear aviation hazard, the fog likely had no bearing on the reported linear displacement of the A-36 Aircraft. Still the properties of the fog in question should be further studied as it is a potential flight threat which can cause avionics to fail and cause experienced pilots to become disoriented.

The association between the electronic fog and the linear displacement was attributed in part from the radio communication between West Palm Beach Airport and the A-36 Aircraft during the displacement event. This is because there was radio contact between the two parties even though the aircraft did not show up on West Palm Beach radar until it was over Miami air space when Gernon naturally assumed that he should have been over Bimini Airspace. Therefore suggesting to Pares and

Gernon that an apparent instantaneous acceleration of 128.75 km/s^2 (80 mi/sec^2) must have took place through presently unknown physical processes.

However it is entirely possible that the aircraft could have had radio contact while in a wormhole throat while simultaneously appearing invisible to radar, a similar process has been reported with meta material artificial wormholes acting as “invisibility cloaks” (Greenleaf, et al. 2007). It also cannot be ruled out that the electronic fog could have screened the aircraft from radar as well due to Compton scattering, but given the analysis thus far the wormhole-like analog for the cloud vortex is the most likely explanation for an induced spatial displacement. The wormhole-like effect upon retrospect may have even induced the “electronic fog”, but one should be careful to distinguish between the events and their correlations.

Possible properties of a magnetized wormhole

From a theoretical perspective wormholes in the past have been argued by individuals such as Throne and Visser to explain the properties of charged particles. If an electric field went through a wormhole it would appear as a point particle made up of electric charge, in the case of the MET it is possible that a magnetic field may have propagated through the vortex thus making the mouths appear to behave as magnetic monopoles. The smaller north mouth $R_{vi} = 30.48 \text{ m}$ could have acted as monopole with charge $+g$ attracting $-e$ charged ions resulting in the production of cloud condensation nuclei which speculatively may result in an unusually heavily charged fog, which has been coined by Gernon and Pares as an electronic fog.

The wormhole model can quite naturally explain most of the associated effects described by Gernon although it is still quite perplexing as to how a relativistically trivial amount of phantom energy on the order of a thunderstorm’s power was induced without a truly satisfying theoretical explanation. If one takes the point of view that the storm induced wormhole-like spacetime had mouths acting as oppositely charged magnetic monopoles, then perhaps opposing magnetic charges could have interacted through a bucking mechanism. The bucking of magnetic mouths could in principle allow them to couple to a complex scalar field which may have access to the mass-energy content of an external system. Interestingly a magnetic bucking mechanism was argued decades ago within an engineering review article where it was postulated that a fifth “energy-density” dimension might be able to modify Newtonian gravitational fields (Hathaway 1991).

This line of reasoning is of course highly speculative and is only brought up because of possible magnetic effects which can be induced through wormholes. Theoretical models of phantom energy also suggest that phantom energy may couple to ordinary gravitational fields by through scalar potentials. So it could be very well possible that magnetic charges of a low density gravitational fluid are necessary to couple with hypothetical negative pressures from extended dimensions. These speculations however would be more suitable for a future review article rather than a discussion here.

Discussion and Summary

Bruce Gernon most certainly encountered a very strange meteorological phenomenon which was associated with a reported “linear displacement”. The quality of Gernon’s reported data attracted the interest of David Pares which also attracted the interest of the present author. Assuming the testimony given by Bruce Gernon to be faithful, the present author agrees that a “space warp” is a possible albeit an unorthodox explanation for the encounter reported. Where this author divides with Gernon and Pares is that this author considers the cloud “vortex” event to be key to the spatial

displacement reported, not the described “electronic fog”. The present author’s speculation of how the linear spatial displacement of the A-36 Aircraft might have occurred is as follows.

Electric field potentials may be able to interact with extra dimensional gravitational fluids as long as gravitational mass densities lie in the following ranges $1.69 \times 10^{-15} \text{ kg/m}^3 \leq \rho_e \leq 6.15 \times 10^{-15} \text{ kg/m}^3$. This results from the simple fact that the addition of two extra spatial dimensions of size $1.77 \times 10^{-14} \text{ m}$ into Newtonian physics induces a gravitational pressure of $P = -5.63 \times 10^{-16} \text{ Pa}$ between the extra dimensional boundaries and by the fact that GR requires that *phantom energy* have an equation of state $w < -1/3$. Thus correspondingly the MET vortex was then able to act as a coupled electromagnetic scalar field for the electrons within the storm cell acting as a gravitational fluid. The coupling of the MET energy to the negative pressure gravitational fluid could be likened to the tuning of ordinary matter to a higher dimensional state, or as the coupling of an excited string boson. Thus the MET electro dynamic vortex was able to electro-gravitationally couple to higher dimensional space imparting to the electrons an excited string mass of M_{vo} , upon reflection the L_c scale of the two large extra dimensions then boosted the projected holographic mass back towards our dimension as M_{im} analogous to how a lens intensifies light. The hyper dimensionally induced wormhole then began to weakly leak a fraction of its energy content onto our lower dimensional spacetime, the result being the projection of a seemingly high mass wormhole with a relatively modest input energy.

It is acknowledged at this point that a top down approach starting with string theory will likely provide a more fruitful path for satisfactory resolutions regarding this perplexing issue, rather than the bottom up approach used here. In the end it is hoped that this venture into the impossible may help to enlarge the horizons of what is possible and spur further research into this and other important enigmas.

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