Atmospheric Power Cycle

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High altitude flight may be powered by an "Atmospheric Power Cycle" that uses the natural temperature decrease from a low elevation to a high altitude in the same manner that ocean thermal energy conversion (OTEC) technology generates power from the Delta T of warm shallow sea water that contains stored solar energy and cold deep water for heat rejection. The high temperature reservoir for the Atmospheric Power Cycle harnesses the thermal energy contained in ambient higher temperature air (solar energy stored in the air) at low altitude to provide the power source and the cooler air at a higher altitude forms the low temperature reservoir, which acts as the heat sink for the Atmospheric Power Cycle. Upward gliding flight is initiated by aerostatic lift provided by a low-boiling-point-liquid working fluid that is vaporized, using the ambient temperature heat of low altitude air, into a lighter-than-air lifting gas that allows altitude to be gained. Lighter-than-air water vapor at below atmospheric pressure is proposed as a condensable working fluid. Alternately a mixture of water vapor with a low concentration of gaseous ammonia may be used as a working fluid to provide greater pressure as the vapor partial pressure of the ammonia is much higher. Both of these low density gases are lighter-than-air and the ammonia acts as a pressure equalizing gas to evaporate the water into vapor at a much lower temperature with the approximate lift of a hot air balloon at low altitude and much greater lift than a hot air balloon at high altitude as the pressure decreases. The temperature dramatically falls via the Lapse Rate within the Troposphere as high altitude is attained. Heat rejection to the cold air allows phase change condensation of the lifting gas or gases to the dense liquid state that causes the loss of lift as cold air fills the area that was previously occupied by expanded lifting gas and gliding downward flight is achieved. The working fluid is insulated from the ambient temperature of the surrounding atmosphere during the climb to high altitude and during the decent to prevent unwanted premature condensation or vaporization until the desired altitude is reached. Phase change of the working fluid is performed by heat exchangers that take in heat or reject heat to the atmosphere. A chart presenting the Carnot thermal efficiency of the Atmospheric Power Cycle based on the Lapse Rates of the Troposphere, Stratosphere, and Mesosphere is presented that extends from sea level upward through the Mesosphere to 88 kilometers (288,640 feet) that clearly demonstrates that high altitude flight can efficiently be powered by an Atmospheric Power Cycle.

Nomenclature

T_H	=	highest temperature of a heat driven power cycle
T_C	=	coldest temperature of a heat driven power cycle
K	=	the Kelvin temperature scale
C	=	the Celsius temperature scale
F	=	the Fahrenheit temperature scale
p.s.i	=	pounds per square inch of pressure
BTU	=	British Thermal Units
km	=	kilometers
ft.	=	feet
meter	=	defined as 3.28 feet

I. Introduction

This document describes an *Atmospheric Thermal Energy Conversion* (ATEC) power generating cycle that employs the natural temperature decrease from low elevation to high altitude. The high temperature reservoir of the power cycle uses the thermal energy contained in ambient higher temperature air at low altitude and heat rejection to complete the power cycle is provided by cooler air at a higher altitude that serves as the low temperature reservoir for the power cycle. The following data substantiates that the ATEC power cycle is capable of efficiently supporting fuel-less flight powered by the thermal energy within the atmosphere.

High altitude flight can be efficiently powered without the use of fossil fuels using stored thermal energy (solar heat) contained in our lower atmosphere as the energy source by an atmospheric power cycle that uses the natural temperature drop from low elevation to high altitude to produce power for flight in the same manner that ocean thermal energy conversion (OTEC) technology generates electrical power from the Delta T of warm solar heated surface sea water to cold, deep sea water for heat rejection. The high temperature reservoir for the atmospheric thermal energy conversion (ATEC) power cycle disclosed herein harnesses the thermal energy contained in ambient higher temperature air at low altitude to provide the power source and cooler, higher altitude air forms the low temperature reservoir (heat sink) for the ATEC process.

The temperature at which water boils is a function of pressure. For example, from the Steam Tables we can ascertain the following thermodynamic conditions: At a reduced pressure of .025 Bar (.36292 p.s.i.), water will boil (vaporize) at 21.1° C. (70° F. or 294 K) using heat energy of 1092.1 BTUs per minute. We, therefore, can readily regulate the vaporization temperature of the water (or another low-boiling-point liquid) by changing the internal pressure of the sealed system. Further, water is readily available (even from the lower atmosphere), inexpensive, non-toxic, non-flammable, non-explosive, has excellent heat exchange characteristics, and is environmentally benign.

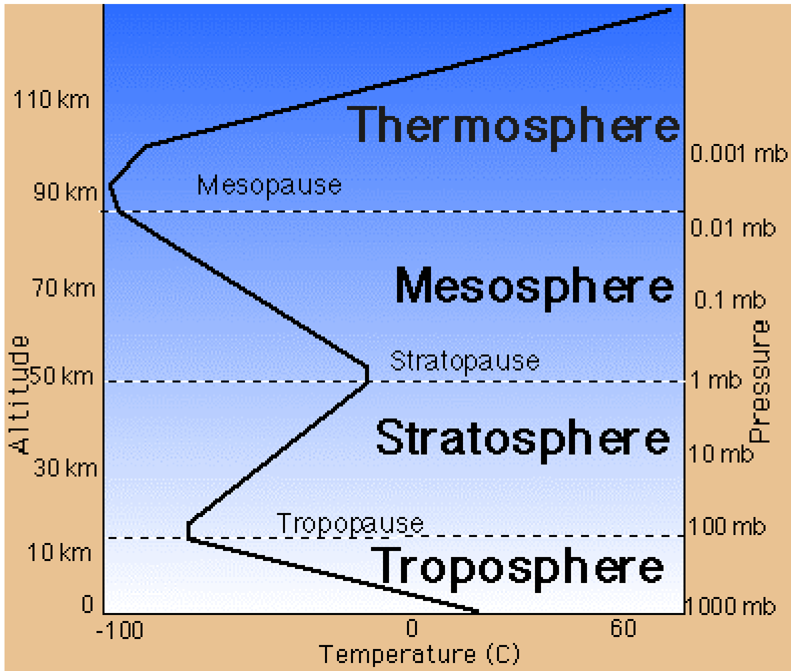
Aerostatic lift is provided by a low-boiling-point-liquid that is vaporized into a lighter-than-air gas by heat from low altitude warm air that allows altitude to be gained. Water vapor at below atmospheric pressure or a mixture of water vapor with a low concentration of gaseous ammonia that provides higher vapor pressure is proposed as a condensable lifting gas as both low density gases are lighter-than-air. The ammonia acts as a pressure equalizing gas to evaporate the water into vapor at a much lower temperature.

ATEC (which is shown herein as having a Carnot thermal efficiency being 21.0 % efficient at an elevation of 10 km or 32,800 feet) is much more efficient than OTEC, which has a maximum Carnot thermal efficiency of 7.33 % based on warm water in regions near the Equator having a surface temperature of 26.7° C. (80° F.) with deep water temperature at 941.5 meters (3,000 feet) of depth of 4.44° C. (40° F.) providing a Delta T of only 22.6° C. (40° F.), due to the greater temperature difference between the warm air at the earth's surface and cold air at high altitude. The temperature dramatically falls within the Troposphere as altitude is gained known as the "Lapse Rate". Heat rejected to cold air that can be as cold as -51.1° C. (-60° F.) in the upper Troposphere condenses the gas into dense liquid having reduced volume that causes the loss of lift. Cold air fills space that was previously occupied by expanded gas, increasing the overall density of the aircraft and downward gliding flight is achieved. The aircraft's density can be changed by physically changing its size or by the use of collapsible balloon like structures within a fixed volume outer enclosure.

The lifting gas is insulated from the cold surrounding atmosphere while upward gliding to prevent condensation until the desired height is reached; and, the liquid is insulated from the warmer surrounding air during downward gliding to prevent premature vaporization. Phase change is performed by heat exchange that takes in heat or rejects heat to the atmosphere. At low altitude, the liquid may be boiled into a lifting gas to again gain altitude. To land heavier-than-air like a conventional airplane, the liquid may be kept cooled or held under pressure in a sealed container. A chart presenting the Carnot thermal efficiency of the ATEC power cycle based on the Lapse Rates of the Troposphere, Stratosphere, and Mesosphere is presented, extending from sea level upward through the Mesosphere to 88 kilometers (288,640 feet), that clearly demonstrates that high altitude flight that includes the production and storage of additional power can efficiently be powered by an ATEC atmospheric power cycle.

II. Atmospheric Lapse Rate

In an assessment of the dynamics of the atmosphere in regard to the *Lapse Rate* (the decrease in temperature with altitude within the Troposphere) within the Troposphere that ranges to near 11 km (36,000 feet) on the average (it can go as high as 18 km or 59,040 over the Equator) and then the temperature begins to increase (inversion) in the Stratosphere. In regards to a power cycle using the lower altitude as the heat source and the upper altitude as the low temperature heat sink, the amount of power as calculated by the Carnot thermal efficiency reaches it first peak at the top of the Troposphere and begins to decline in efficiency through the Stratosphere.



A. Troposphere - lowest layer of the atmosphere where weather occurs. Temperature falls 3.5°F per 1000 feet (6.38°C per kilometer). Top lies at about 6-7 miles (11 kilometers average). Temperature varies from an average of 15.6°C (298K) at the surface to -60°C (213K) at the top of the troposphere. Tropopause - top of the troposphere.

B. Stratosphere - top of the Tropopause to about 30 miles. Temperature is constant to about 20 miles then increases to the Stratopause. The temperature rise is due to the presence of an ozone layer. The ozone absorbs incoming UV radiation increasing the heat content of the gas. At about 18 miles the ozone reaches its maximum concentration, about 5ppm. Without the ozone layer the Earth's surface would be warmer and the UV level much higher.

C. Mesosphere - extends from 30 miles to about 50 miles. Temperature falls to -84° C (189K) at the Mesopause.

D. Thermosphere - extends above the mesosphere more than 100 miles. Zone of increasing temperature, but this is meaningless since there is in effect no atmosphere present.

The data regarding the lapse rate varies substantially between references reviewed from a high of 5.5° F. drop per 1,000 feet down to 3° F. drop per 1000 feet. Using 36, 000 feet (11km) as the average top of the troposphere and using its temperature at a -60° F. (-51.1° C. or 222 K) that is shown on some charts as low as -57° C. (-70° F.) , the average drop from 60° F. (15.6° C. or 289 K) to -60° F. (-51.1° C. or 222 K) equals 120° F. temperature Delta over 36,000 feet of height gained which calculates to 3.33° F. average drop per 1000 feet of altitude gained up to 36,000 feet, which is the top of the Troposphere. The temperature then begins to rise after the Tropopause. We will use the lapse rate of negative 3.33° F. per 1,000 feet (-6.064° C. per kilometer) to 36,000 feet (11 kilometers) for calculation purposes in this paper.

Interpreting from the above Atmospheric Chart, the temperature increase going from the top of the Troposphere into the Stratosphere from 11 kilometers of altitude having a temperature of -51.1° C. (-60° F. or 222 K) to the top of the Stratosphere at 50 kilometers of height having a temperature of -21° C. (-5.8° F.) provides a lapse rate of positive $0.77°$ C. per kilometer. There is a temperature decrease from the Stratosphere going to 88 kilometers of height through the Mesosphere of -21° C. (-5.8° F.) to -84°.5 C. (-120° F.), providing a lapse rate of negative -1.61° C., realizing that this is an estimate of average conditions that may change significantly by location.

III. Carnot Thermal Efficiency of the Atmospheric Power Cycle

The Carnot thermal efficiency is the maximum possible efficiency of a heat driven power cycle, such as the Rankine Power Cycle or the Carnot Power Cycle. The highest temperature (T_H) is subtracted by the lowest or coldest temperature (T_C), which is divided by the highest temperature and multiplied by 100% to give the Carnot efficiency as a percentage.

$$\frac{T_H - T_C}{T_H} \cdot 100\% = \text{Carnot Thermal Efficiency}$$

The temperatures in the Carnot efficiency formula must be expressed in the Kelvin temperature scale.

The Carnot thermal efficiency of the lapse rate from sea level to one kilometer of altitude from sea level is:

$$T_H = 15.6° \text{ (60.1° F.)} = 289 \text{ K}$$

$$T_C = 9.536° \text{ C. (49.2° F.)} = 283 \text{ K}$$

$$\frac{289 - 283}{289} \cdot 100\% = 2.076\%$$

Calculated as the Carnot efficiency, 2.076% is the maximum possible thermal efficiency for a vapor cycle such as the Rankine cycle having a high temperature reservoir of 15.6° C. (60° F. or 289 K) at sea level and a low temperature reservoir of 9.536° C. (49.2° F. or 283 K) at 1 km (3,280 ft.) of height.

As the altitude increases within the Troposphere, the temperature decreases and the Carnot efficiency also increases as the Delta T becomes larger with height. As the Stratosphere is reached the temperature begins to decrease and so does the Carnot thermal efficiency.

IV. Efficiency of the Formation of Potential Energy of Position at Height

Assuming that water is vaporized at sea level and the vapor is then condensed back to liquid water at height then the liquid forms a Potential Energy of Position (at high altitude) that may be added to the power output of the cycle as the positive energy gained during downward gliding due to the positive weight of the aircraft being greater than the density of the air (positive mass of the aircraft after condensing the gas to the liquid phase to form Potential Energy of Position at a given height above sea level):

Potential Energy = mass (m) times the acceleration of gravity (g) times height (h).

P. E. = m (mass in kg) times g (acceleration due to gravity of 9.81 m/s/s) times h (height in meters) = Joules per second. One Joule per second = 1 Watt. The answer therefore can be expressed as Watts.

If we calculate the potential energy of the liquid water at an altitude of 1,000 meters (3,280 ft), which is the minimal altitude to obtain a 6.064° C. (10.9° F.) temperature drop to facilitate condensation, the result is:

The accepted value to vaporize 1 gram of water is 2261 Joules. Therefore, it takes 2.261E06 Joules to vaporize 1 kg of water.

The Potential Energy of 1 kg of water at 1000m is:

$P.E. = 1\ kg \cdot 9.81g \cdot 1000m = 9.81E03$

The efficiency of the potential energy of 1 kg of water at 1000m is:

Energy obtainable from Energy of Position / Energy used to vaporize water mass

$Efficiency = 9.81E03J / 2.261E06J \cdot 100\% = 0.434\%$

The total theoretical maximum efficiency of this new combined power cycle is:

The Potential Energy via the position (at altitude) at which high density liquid mass is formed is calculated as 0.434% and is added to the 2.076% maximum efficiency calculated as the Carnot efficiency from a vapor power cycle via the gas turbine, such as the Rankine cycle, which is a total combined efficiency of 2.5%.

Increased efficiency due to Potential Energy formation:

$Efficiency\ \ Increase = 0.434\% / 2.076\% \cdot 100\% = 20.91\%$

This is a 21% increase in power output generated by adding power output from creating Potential Energy via the location at which high density mass is formed at high altitude via condensation of low density lifting gas to high density liquid.

V. Atmospheric Combined Carnot Thermal Efficiency and the Efficiency of the Creation of Potential Energy via Condensation at Height Chart

Height in Kilometers	Height in Feet	Temperature Via Lapse Rate Celsius (F.)	Carnot Thermal Efficiency	Potential Energy Efficiency	Total Combined Efficiency	Increase Via Potential Energy
Troposphere Lapse Rate of $-6.064°$ C. (-10.92 F.) per km with Decreasing Temp. Regime						
0	0	15.6 (60.1)	0.00%	0.00%	0.00%	0.00%
1	3280	9.54 (49.2)	2.08%	0.43%	2.51%	20.67%
2	6560	3.47 (38.2)	4.15%	0.87%	5.02%	20.96%
3	9840	-2.59 (27.3)	6.22%	1.30%	7.52%	20.90%
4	13120	-8.66 (16.4)	8.65%	1.74%	10.39%	20.11%
5	16400	-14.72 (5.5)	10.72%	2.17%	12.89%	20.24%
6	19680	-20.78 (-5.4)	12.80%	2.60%	15.40%	20.31%
7	22960	-26.85 (-16.3)	14.88%	3.04%	17.92%	20.43%
8	26240	-32.91 (-27.2)	16.96%	3.47%	20.43%	20.46%
9	29520	-39.98 (-40)	19.38%	3.90%	23.28%	20.12%
10	32800	-45.04 (-49.1)	21.11%	4.34%	25.45%	20.56%
11	36080	-51.1 (-60)	23.18%	4.77%	27.95%	20.56%
Stratosphere Lapse Rate of Positive $0.77°$ C. ($1.36°$ F.) per km with Increasing Temp. Regime						
12	39360	-50.33 (-40.3)	22.84%	5.21%	28.05%	22.81%
15	49200	-48.02 (-54.4)	21.03%	6.51%	27.54%	30.96%
20	65600	-44.17 (-47.5)	20.69%	8.68%	29.37%	41.95%
25	82000	-40.32 (-40.6)	19.35%	10.85%	30.20%	56.07%
30	98400	-36.47 (-33.6)	18.01%	13.02%	31.03%	72.29%
35	114800	-32.62 (-26.7)	16.67%	15.19%	31.86%	91.12%
40	131200	-28.77 (-19.8)	15.33%	17.36%	32.69%	113.24%
45	147600	-24.92 (-12.9)	14.18%	19.52%	33.70%	137.66%

50	164000	-21.07 (-5.3)	12.80%	21.69%	34.49%	169.00%
Mesosphere Lapse Rate of -1.61° C. (-2.9° F.) per km with Decreasing Temp. Regime						
51	167280	-23.31 (-9.96)	13.29%	22.13%	35.42%	166.52%
55	180400	-31.37 (-24.5)	16.26%	23.86%	40.12%	146.74%
60	196800	-39.42 (-39)	19.03%	26.03%	45.06%	136.78%
65	213200	-47.47 (-53.4)	21.80%	28.20%	50.00%	129.36%
70	229600	-55.52 (-67.9)	24.57%	30.37%	54.94%	123.61%
75	246000	-63.57 (-82.4)	27.34%	32.54%	59.88%	119.02%
80	262400	-71.62 (-96.9)	30.10%	34.71%	64.81%	115.32%
85	278800	-79.67 (-111)	33.22%	36.88%	70.10%	111.08%
88	288640	-84.5 (-120)	34.60%	38.18%	72.78%	110.35%

VI. Comparison to Typical Fossil Fuel Burning Heat Engine Efficiencies

Product	Size (kW)	Efficiency	Installed Cost $/kW	Status
IC Engines	10-5,000	28-45%	$300-$600 $1,000-$1,500 CHP	Now
Microturbines	30-100 today 100-400 future	24-32%	$1,000-$1,500 $1,500-$2,000 CHP	Now
Small Fuel Cells	3-10 Lab Units 10-50 future	30-35%	Play the Lottery	2010?
Large Fuel Cells	200-1,000	40-50%	$4,000 - $5,000	?
Small Turbines	30-10,000	25-40%	$600-$1,000	Now
PV	0.1-10	N/A	$8,000 +	Now

The efficiency of the ATEC Atmospheric Power Cycle compares favorably with the efficiencies of typical fossil fuel burning heat engines that are in common use today.

VII. Simplified Flight System Design Known as the "GravityPlane"

The "GravityPlane" performs upward gliding flight powered by the thermal energy in the lower atmosphere that boils a low-boiling-point liquid into a lifting gas to create aerostatic lift; and, thereby, does not require fossil fuels in order to fly. The glider alternately performs downward gliding flight via the Acceleration of Gravity by forming Potential Energy, which is accomplished by increasing the overall density of the aircraft that makes the aircraft heavier-than-air by condensing the lighter-than-air gas or gases into dense liquid that is much heavier-than-air and occupies a much smaller volume. Denser ambient air fills the space previously occupied by the expanded lifting gas. The Potential Energy that is formed is immediately converted to Kinetic Energy of Motion by the effect of the Acceleration of Gravity that causes downward motion, resulting in downward gliding flight.

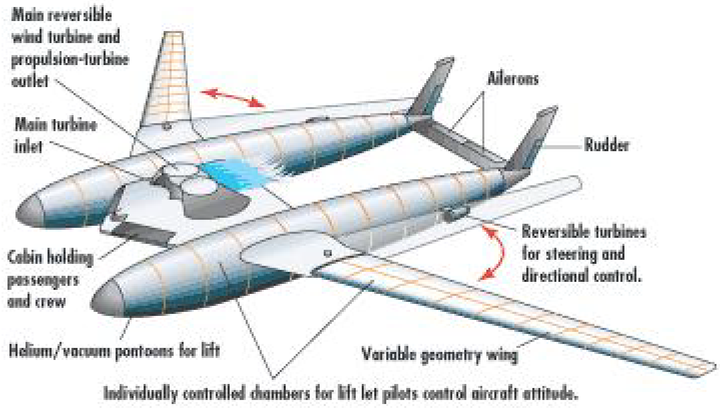
Buoyancy is also a function of gravity as the gravitation pull exerted on the atmosphere is greater than the gravitation pull exerted on lighter-than-air lifting gases, causing the lifting gas to rise within the atmosphere in accordance with Archimedes' Principal. Buoyancy is generated in response to heat energy from the lower atmosphere that vaporizes a low-boiling-point-liquid, such as a combination of water and ammonia, into a lifting gas in order to create aerostatic lift to gain altitude.

Altitude is gained because the aircraft becomes lighter-than-air. A portion of the upward momentum of the aircraft that is caused by buoyancy is deflected into forward motion in order to create upward gliding flight. During this climb to high altitude, specially designed ram air turbines (RATs) produce on-board power using a portion of the upward and forward momentum generated by the force of buoyancy. Upward gliding flight in response the upward momentum caused by buoyancy works in the same manner as downward gliding flight via gravity acceleration works by defecting air via airfoils into forward motion. Likewise, on-board power is generated by RATs during downward gliding flight descent.

Video of Vertical Axis Wind Turbine (VAWT) or Ram Air Turbine (RAT) in Actual Operation that May be Viewed at the www.fuellessflight.com Website

The wind turbine or ram air turbine design employees Delta drag, having a positive output high drag side, and an opposing negative output low drag side, and also uses lift with reduced overall drag as compared to conventional wind turbines or ram air turbines. The present invention that uses Delta drag is a fundamentally new approach to harnessing the power or the wind or the indicated wind produced during flight and was developed to produce power during gliding flight with minimal and controllable disturbance to the drag characteristics of gliding flight as the resistance to the force of the wind may readily be adjusted by changing the amount of resistance applied to the output shaft of the device that changes the amount of drag produced by the VAWT or RAT.

GravityPlane Schematic

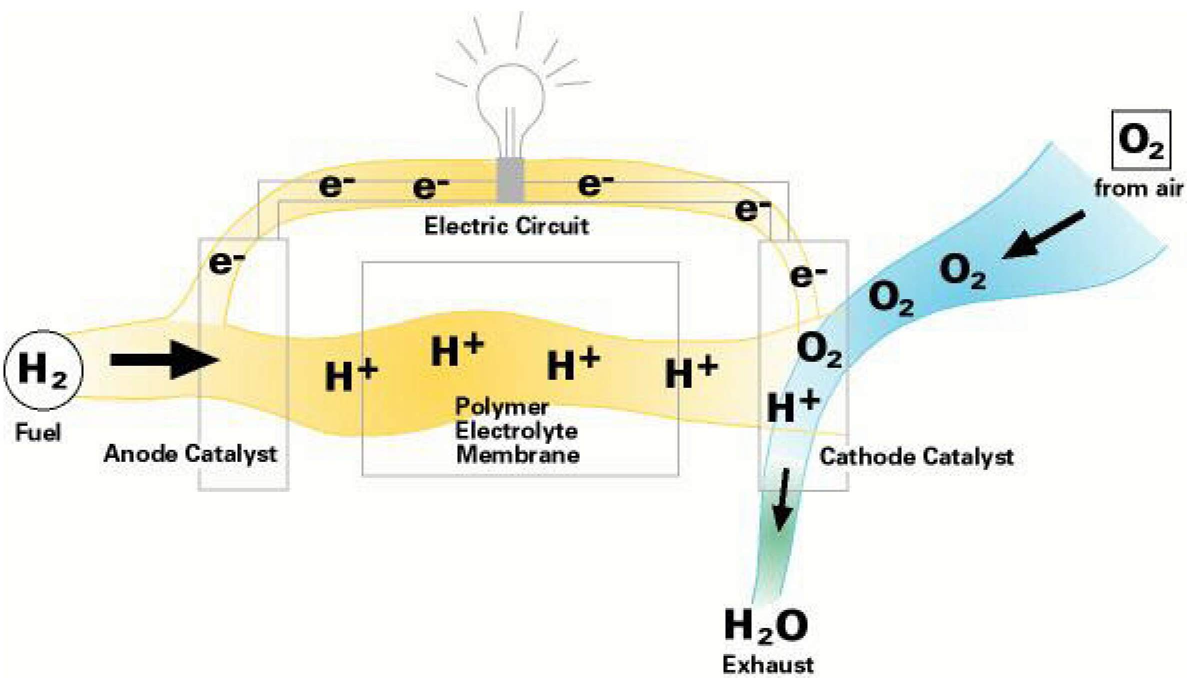


The two fuselages of the gravityplane are actually aerostatic lift pontoons that provide lighter-than-air lift for the aircraft. The passengers and crew are within a cabin area at the leading edge of the aircraft. The Rat would logically be located underneath the aircraft as not to disturb the laminar flow of air over the aircraft but is shown on top for illustration purposes only.

The fuselages are insulated vessels that maintain the internal temperature of the working fluid that is retained in elongated collapsible gas bags that run the length of the pontoons. During periods of heat exchange the fronts and rears of the fuselages are opened in order to allow air to flow linearly through them in order to perform heat exchange during gliding flight.

The controls of the hybrid aircraft are like those of a conventional airplane.

VIII. A Fuel Cell Driven Steam-Lift Aircraft



A fuel cell during its operation will produce superheated steam that can be used as a lifting gas that is held with the hybrid airship's envelope in order to accomplish aerostatic lift. The expanded steam that is much lighter-than-air would have sufficient vapor pressure to displace heavier ambient air from the bottom of the envelope and would therefore form a steam bubble contained within the vessel to create steam-lift in the same manner as hot air of a hot air balloon displaces heavier cold air from the envelope. Alternatively, drawing a partial vacuum within the envelope would allow water to vaporize at a much lower temperature and the amount of lift would be greater due to the lower density of the water vapor being very low density, low temperature steam.

The use of steam as a lifting gas is known to have been proposed as long ago as 1926 via the use of a boiler to produce steam and / or the use of a steam engine to provide propulsion and steam for aerostatic lift, but these concepts required bringing heavy water mass along on the aerostat that must be boiled to steam during the flight and thus dramatically reduced the lifting capacity of the aerostat, especially during take-off with a full load of water. The efficiency of this prior art steam engine process is known to be as low a five percent.

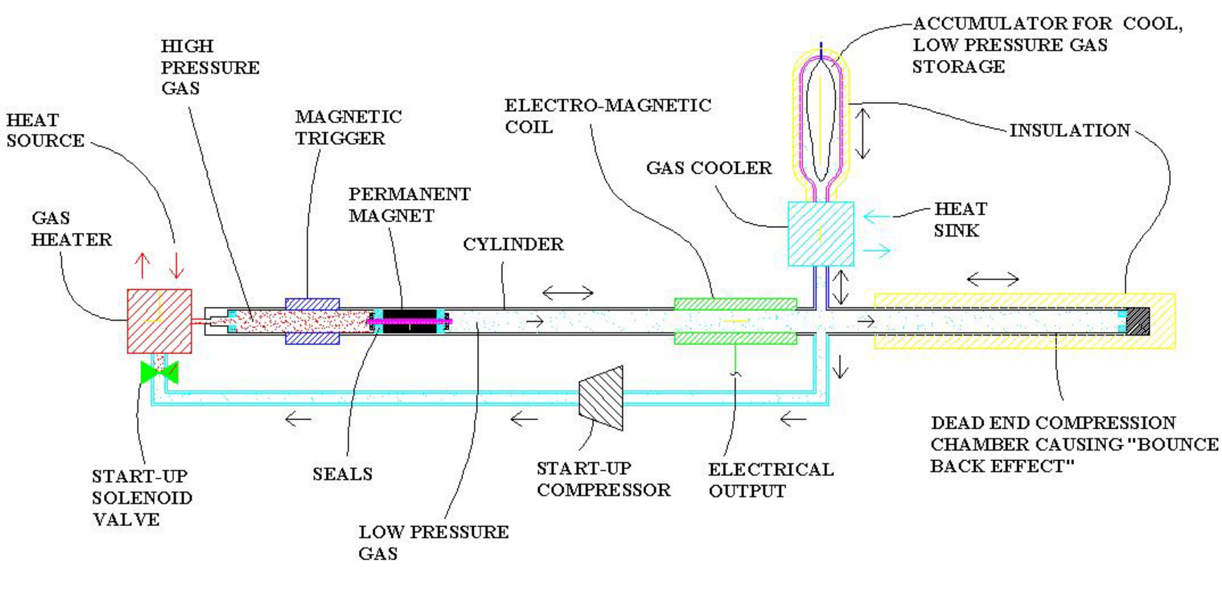
In dramatic contrast to this prior art steam engine, a fuel cell makes its own steam by combining hydrogen molecules with oxygen molecules from the air. Therefore, water does have to be carried aboard. Fuel cells may be fueled directly by hydrogen gas or may be fueled by conventional fossil fuels using a reformer that provides hydrogen molecules to the fuel cell or by the use of solid oxide fuel cells (SOFC's) that do not need a reformer to use conventional fuels.

Fuel cells can be operated in reverse mode to perform electrolysis of water into hydrogen and oxygen with an input of electricity. The RAT of this hybrid airship can power an electrical generator to produce electricity during downward gliding flight in order to regenerate the supply of hydrogen for use by the fuel cell in the same manner as regenerative breaking generates electricity for use by the motor that is operated in reverse as a generator to recharge the batteries of a hybrid vehicle as an energy recovery means.

IX. The Accelerated Magnetic Pellet (Piston) Generator that is a form of "Thermodynamic Fuel Cell" having a Direct Output of Electricity as a more Versatile and Less Costly Fuel Cell Alternative

The Magnetic Pellet (Piston) Generator (MPG) is capable of being powered by a fuel like a fuel cell, but the MPG can also be powered by a temperature differential or by a pressure differential to drive a permanent magnet back-and-forth linearly through an electro-magnetic coil in order to create a direct output of electricity like a fuel cell. Therefore, the MPG can be used to boil (to provide cooling via the latent heat of vaporization for the MPG) and /or to condense (to provide the latent heat of condensation as a heat source for the MPG) the working fluid of a hybrid airship and can generate power in the process.

Accelerated Magnetic Pellet (Piston) Linear Alternator (Patent Pending)



The MPG provides high power density because of the high rate of speed of the permanent magnet being greater than the velocity of a bullet.

X. Conclusion

Fuel-less flight can be powered by an Atmospheric Thermal Energy Conversion (ATEC) atmospheric power cycle without the need for combusting fossil fuels in an efficient manner as is mathematically proven herein by the Carnot thermal efficiency. The source of energy to power the ATEC atmospheric power cycle is the thermal energy in the air, which is stored solar energy from the sun retained in the lower atmosphere that surrounds us.

References

Patents by the Author

U.S. Patent Application Number 60/572,933 titled, "Phase Change Airship, using low Pressure Steam as a Lifting Gas" dated May 20, 2004.

U.S. Patent Application Number 60/439,514 titled, "Methods and Apparatus to Generate useful Power, Refrigeration, and Heating from Harnessing the Potential Energies of Position Via the Continuous Placement or Formation of Bodies of Mass to Create Mass Differentials, Caused by the Gravitational Pull of the Earth, that Are Immediately Converted to Kinetic Energies of Motion in a Cycle" dated January 13, 2003.

U.S. Patent Application Number 60/467,525 titled, "Airship Powered by Gravity Acceleration for Transport and for the Generation of Useful Power" dated May 5, 2003.

U.S. Patent Application Number 60/484,903 titled, "Gravity Powered Aircraft via the Use of Vacuum-Lift Contained within a Cellular Matrix Airfoil" dated July 7, 2003.

U.S. Patent Application Number 60/491,108 titled, "Energy Generation via the Forces of Buoyancy and Gravity Acceleration" dated July 29, 2003.

U.S. Patent Application Number 60/491,852 titled, "Flight Can be Sustained Using the Forces of Gravity – Buoyancy and Gravity Acceleration" dated August 1, 2003.

U.S. Patent Application Number 60/532,550 titled, "Gravity Powered, Fuel-Less Glider Useful in the Air, on the Surface of the Water, or as an Underwater Sea Glider" dated December 26, 2003.

U.S. Patent Application Number 60/532,535 titled, "Gravity Powered Flight and Gravity Powered Energy Generation via a Phase Change Process" dated December 26, 2003.

International Patent Application PCT/US2004/001164 titled, "Potential Energy of Position Power Generation System and Method" dated January 13, 2004.

International Patent Application PCT/US2004/007369 titled, "Hybrid Wind and Solar Powered Turbine; Hydro-Turbine; Air Compressor; Hydraulic Pump; Air or Hydro-Propeller, Having Pivotable Shutters on a Rotating disk" dated March 6, 2004, that claim priority to U.S. Patent 60/452,119 and U.S. Patent 60/500,362.

International Patent Application Number PCT/US/2004/015307 titled, "Air Glider or Sea Glider Alternately being Lighter than Air or Water to being Heavier than Air or Water, Having a Gas Turbine or Hydro-Turbine to Harness the Kinetic Energy of Motion Through the Air or Water and Method" dated May 5, 2004.

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