Nex-Gen-Jet

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Abstract

The need for a new form of aircraft engine has been clear for the past few decades. We developed one that is safer, lighter, and has many more capabilities than a normal jet engine. We removed the chance of fuel related fires and explosions, as well as the weight of modern jet engines. This new system is applicable to both jet powered aircraft and propeller powered aircraft. This proved crucial since it also eliminates air pollution from burning the fuel in previous engines. In our group, we split up different part of the project, the power fuel source for one team member and turbine to the other. With different research from hydrogen fuel cells to liquid nitrogen rocket engine it help to guide us to a design of a disk generator. The disk generator would work by using liquid nitrogen expansion causing the disk to spin and operating the generator needed to power the electromagnet turbine. After building it, we would test out the different speed to the energy production, record it. The results from the disk generator would help to identify if the next part of the turbine to see if it would potentially power it.The purpose of this potential project would be able to get rid of fuel such a diesel in airplane that can put people in risk when engine malfunction and explode or fuel goes to the environment in crashes. Also, this would help in the development of not just airplane but other models such as ships and automobile.

Introduction

With today's technology, everything is now becoming possible. Our project is specifically on how we can use this technology to develop an electric powered aircraft that does not rely on hazardous combustible fuel. An example would be the accident in December 1972, the Eastern Airlines Flight 401 crashed into an Everglades causing the death of where ninety four passengers and five flight crew members, fuel was spilled throughout the Everglades. This made it more dangerous for the people because any type of spark it would cause fire, killing the rest of the people. (NTSB,1973) One part of the project is to specifically develop the engines that can run on electricity and still provide the amount of power needed to propel a plane. I have focused on removing the combustion chambers and compressors, to create what I call a total-bypass engine. This means that all the air that enters the engine is bypassed, or pushed through the engine without going through a compressor or combustion chamber.

My design includes what I have come to call a magnetic rail turbine. This involves a complex process of boron magnets and electromagnets around a turbine disk. The system is arranged in a circular pattern, with the turbine in the middle. The boron magnets are arranged along the outside of the turbine all at a designated angle so that they are all pointing a single pole (north or south) towards one direction around the turbine. Around that system, is another circle with the inside of the circular part lined with electromagnets. These electromagnets are aligned with each other at the same angle as the boron magnets, but facing the opposite direction. Every electromagnet will be designed to point the same pole towards the boron magnets as they are pointing outwards. That way, the more power you put into the electromagnet, the stronger the repulsion between the two like-poles increases, and the turbine inside connected to the boron magnets will spin faster and faster.

Boron magnets are used since they are one of the most powerful stationary magnets that can be produced cheaply. That way the engine is both affordable and at the same time can achieve very high speeds of rotation. The magnets are also very polar, which allows one pole to face outwards without the other pole interfering with the repulsion. However, the design will have to be strong enough to withstand the magnets tendency to spin around and connect to the electromagnets in the event that the system becomes unparalleled. If it is kept as parallel as possible, then the magnets will all be able to stay in their location with ease and no tendency to spin around in it's socket. That way this design is one of the safest options, rather than a large electric motor.

This engine is a safer option than any other engine in current production for many reasons. Mainly being that it doesn't run on combustible fuel. This eliminates the risk of an uncontained engine failure due to fuel, and also virtually eliminated the risk of an uncontained engine fire. It's also safe due to the simple design. Since the number of parts and the complexity of parts are reduced, there are many less things that can go wrong.

The other part of the project is the power source such as the generator for the plane that replace fuel. From all the research, liquid nitrogen or LN_2 came closest to our requirement as how it would perform theoretically. Nitrogen is a colorless, odorless unreactive gas that forms about 78 percent of the earth's atmosphere. To form liquid nitrogen, nitrogen needs to be pressurized so that the temperature of the gas reaches a low enough temperature that the gas becomes much less energetic and becomes a gas.

However, in high altitude the temperature will be perfect to help to keep the nitrogen in liquid form. The benefit of using nitrogen is that when in contact with heat it expend leaving no trace of it by going back to the air. This would make it safer in case of a crash, there would be no explosion or fire because of fuel since it would vaporize completely. The nitrogen would be taken from the outside, go through a generator, then be stored in the wings on the aircraft based on the standard aircraft diagram. (Boeing, 2015) The liquid nitrogen can then be used to power the disk generator.

The design was influenced by a peer review journal by Epstein (2003) discussing MEMS Gas Turbine Engines and this particular piece from figure 2 could be used in bigger scale. Based on research, it can use liquid nitrogen to power it, a liquid nitrogen tank would have pipe connected to the center of the rotor dia radial inflow turbine letting the nitrogen expand causing to spin it, producing electricity. The other side of the turbine it would be connected to the generator, powering the airplane and all the rest of the nitrogen would be exit of the airplane.

These are the two different type of engine that can be used to generate power for the aircraft. They both meet the requirement of being environment friendly and also eliminated the complex motors. This part of the airplane overall would reduce the danger for aircraft after pilot error occur, leaving passengers in a safer area knowing that fuel would not be one of the components to put them in even more danger. This would not only help the commercial airline craft but also military aircraft in which would become safer in battles. It would benefit for the increase on aircraft that is only increasing in today's technology.

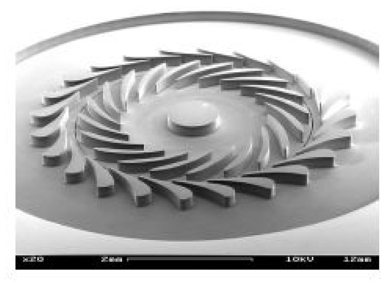

Figure 1: This is the original image of the disk that influenced the disk generator.

Proposed Methodology

Phase One: process: support system.
Build a support system that look like a huge table of 4 feet 5 inches high made of wood. The support system will help to keep the disk in place so it can spin without going out of control
Phase Two-1: Designing a 3D model on a computer with all the dimensions for the disk, sending to the 3D printer to create it.This step is necessary because it will help determine the size of the blades so we can build accurately. The overall look will help to determine if it is just like our theoretical estimates
Phase Two : Build Generator Disk ,the second step is to create the generator disk which will power the electromagnetic turbine, without it there will be no energy to power up the plane. Start of by creating the interior disk part.

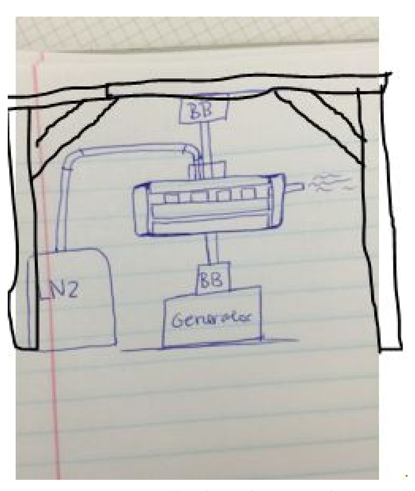

Figure 2: Rough sketch of Disk Generator Turbine prototype with support system

Phase Three: Testing- the process to test out the disk to see if the nitrogen does spin and produce the amount of energy needed for the magnetic rail turbine.
Data collection
Compare the amount of energy produce based on how fast the blades were able to spin. We would create a table chart based on the amount of liquid nitrogen put in the fan blades vs the speed that it would produce.
This way we would be able to analyze if it is enough energy for the magnetic rail turbine. If not, we would go back in the drawing board to make the fan blades with a different design or different dimensions to see if that has any effect on the production of energy.

Phase four Building: Magnetic Rail Turbine – will being built by adhering the turbine blades, magnets, axles, and outer shell together using adhesives and welding
Phase Five: It would be to test out the turbine without the disk generator just to see how it would perform. Also we would collect data on it by comparing its performing with the disk generator, and to see how fast it would go without disintegrating

Gantt chart

Second Semester — First week in days of February; Third week of March in days; Feb, Mar, Apr, May

Task	Description of Task	0.00%	Days/Weeks
Phase one	**Phase one of the building process: support system.**	0%	5 days
Sp1	Setting up the material to build	0%	2 days
Sp2	Build the support system	0%	2 days
Sp3	Test it out	0%	1 days
Phase two	**Building the Disk Generator**	0%	4-5 weeks
Sp1	Building: CAD design	0%	2 weeks
Sp2	Building: Interior disk	0%	2 weeks
Sp3	Building: Cover for disk, attaching to support system.	0%	1 weeks
Phase three	**Testing Disk Generator**	**0%**	**1 weeks**
Sp1	Test if LN2 spin the disk	0%	3 days
Sp2	Test if energy powers up the generator	0%	2 days
Sp3	Test & collect data: LN2 vs Electricity produced.	0%	2 days
Phase Four	**Magnetic Rail Turbine (goes directly alongside Phase 2)**	**0%**	**5-6 weeks**
Sp1	Assemble the electromagnets and engine exterior	0%	2 weeks
Sp2	Assemble the stators and rotors	0%	2 weeks
Sp3	Combine all the parts to create the engine	0%	1 weeks
Phase Five	**Test the jet engine alongside phase 3**	**0%**	**1 week**
Sp1	Attach batteries and disk generator to test rpm and thrust output	0%	7 days

Predicted Results

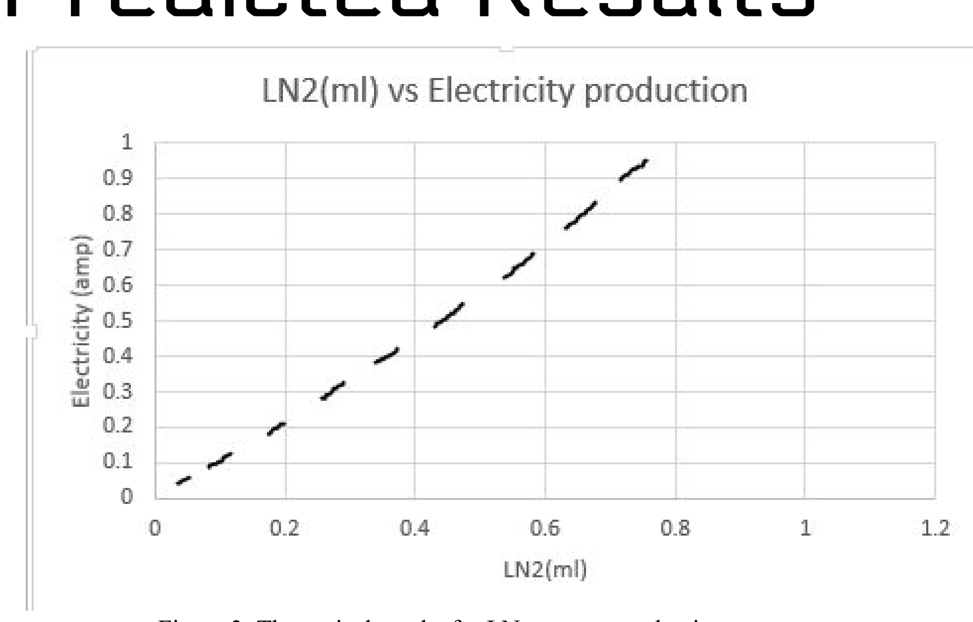

Figure 3: Theoretical results for LN_2 energy production.

Our proposal result is expected to have a high increase in energy production/electricity by the amount of liquid nitrogen is used in the disk generator. The data collection will have 3 trial to 5, to record the efficiency liquid nitrogen can produce compared to regular fuel. The data will be used to calculate a ratio between the amount the electromagnet turbine will need to be power by the amount of liquid nitrogen tanks used as input. Theoretically, liquid nitrogen should have enough heat to expand in rate that can be recorded by the rotational motion of disk. The production will be demonstrated through a graph such a figure 3.

That data will be used for the Magnetic Rail testing after it is tested alone.We predict that the Disk Generator and Magnetic Rail Turbine will be available to be used safely and efficiently by large commercial aircraft within the next two decades. The only reason the engine system should be delayed is if it does not produce sufficient thrust and the turbine blades need to be reevaluated, or if the engine proves to have safety concerns that need to be dealt with. However, these problems can be overcome and the engine will eventually enter commercial service. We also expect that the survival rate in commercial aircraft incidents will also be greatly increased due to the lack of combustible fuel aboard the aircraft. If the engine system is proven workable, then we will obtain a stronger patent on the system and begin developing a way to provide the system to large airlines and airline manufacturers such as Airbus.

The necessity of the analysis of the thrust data and electric output data from the two sections of the engine will be crucial to moving forward with the project. The thrust data from the turbine will describe the performance of the turbine and if it has enough thrust to propel an aircraft of a certain size, and the electric output data will describe if the generator has enough power to provide sufficient electricity to all the systems aboard the aircraft as well as continue powering the turbine.

Conclusion

Based off different sources there could be very positive outcome of the production of electricity based on the amount of liquid nitrogen expanding in the disk generator. If we were to replace fuel from a turbine with liquid nitrogen then not only will it be more efficient and environmentally friendly but the production of electricity will be use for the Magnetic Rail Turbine . If there is a large enough output of electricity from the Disk Generator, we could use it to power up the Magnetic Rail Turbine.

If the turbine functions as we predict, our future research would be to develop a smaller and more efficient engine that could be used for almost any type of transportation not just for aircraft. The energy production from the disk generator can be used in smaller scale or bigger scale it all depends on the results. We would be able to give a better alternative on how we can use clean energy and help to reduce our pollution on earth.

When we began this project we had the intention of building an electric powered aircraft. We had always had the same design for a Magnetic Rail Turbine, however there were a few slight revisions to the design through our research. This was due to finding out more aerodynamic options as well as finding new layouts of the magnets to achieve peak efficiency. We decided to lengthen the engine, as well as remove the compressor section of the engine to create a long, ultra-bypass turbofan engine. This allowed us to use the least electricity in the process of gaining the most power, as well as improving the safety of the engine by reducing any high pressure air from the engine and keeping the engine from requiring to manage strong forces from within the framework, which has proved catastrophic in the past with the Qantas "Titanic in the Sky" incident.

On the other hand, our generator proved much more difficult. We first looked into the use of a hydrogen fuel cell system, however it became apparent that it was an impossible generator as it required electricity to make electricity. We then looked into the use of other sources, first with the carbon fuel cell. This design was also disproved when we realized it used highly combustible solid carbon powder, similar to coal dust which can spontaneously detonate. We continued our search for other materials by looking into the use of liquid nitrogen. Since this gas could expand when heated, it proved to be a very beneficial solution. This added on top of the fact that it was unreactive, noncombustible, and could be extracted from the atmosphere met our perfect description of a possible fuel source.

We then began looking into ways of implementing this fuel source into our design. Eventually, we adapted a concept of a steam turbine design, where high pressured gas was injected in one side, then it passed through a turbine and spun the turbine generating power. We developed a rough idea of how the liquid nitrogen would be pumped into the first chamber of the steam turbine concept and it would warm up and expand, imitating what pressurized steam would do. We then discovered a higher-pressure system where hot water was injected with liquid nitrogen creating a very high pressure exhaust, and it was decided that we would then use this design primarily for our research since the high pressure nitrogen-H_2O mixture would provide the fastest spin on the turbine and in turn that would give us the largest electricity output.

When we were researching the design concepts for the Magnetic Rail Turbine, we stumbled upon an article describing a miniature generator using expansion to spin a turbine that was shaped roughly like a disk however the gas went parallel to the disk instead of through it like a conventional turbine. We then began to explore this option and discovered it was much more applicable in the limited space of an aircraft, and when we applied the idea of liquid nitrogen to it, it was discovered we did not need to use the high pressured water mixture. This also allowed us to make the engine safer, since we no longer needed to build a chamber to withstand hundreds of pounds of pressure. We also realized that the disk could be made larger and put into the center of the plane near the wings. Since it was so thin, on certain aircraft it could fit into the wing roots as well, creating a much larger generator than the cylindrical shape of the steam turbine concept, which was limited by the space beneath the floor of the plane and also took up much of the very valuable cargo space. Since the disk generator concept did not need a large area vertically, it was realized that we could include limited cargo area underneath the outer parts of the disk which optimized cargo room.

We refined the idea so that liquid nitrogen will be pumped into a box above the center of the disk, where the heat from the air conditioning system would warm up the liquid into a gas. It would then create moderately high pressure and move into the disk turbine directly. The energy from the expanding gas would then move outwards away from the center of the generator, pushing against the turbine blades found along the disk causing it to rotate. When the gas reached the exterior it would be recycled back into the wings and repressurized into liquid nitrogen to recycle the process. When the horizontal disk rotates, it would also rotate an axle which would be connected to ball bearings to maintain the smoothest rotation. Beneath the lower ball bearing underneath the disk generator we would put a conventional generator used in other generators like wind generators and steam turbines. This would allow us to harness the rotational energy of the spinning disk.

We then continued with the project and developed our methods and materials based off these two designs. We plan to build a prototype of each and test each section independent from each other. If it proves that the generator is capable of producing enough power, and the turbine produces enough thrust, we will begin trials of powering the turbine using the generator as we plan to have it inside of an aircraft. When we have refined our issues and increased the safety of the engine system, we will begin searching for ways of implementing it in an actual aircraft to begin arial tests and ultimately gain FAA certification. Once this point has been reached, we can proceed to begin forming a manufacturing company so that we may market and sell our engine system to large airlines such as Delta Airlines and also to sell our engines to aircraft manufacturers like Airbus and Boeing who can use them in new airliner designs.