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# REVIEW OF PROPULSION SYSTEMS IN SPACE AND FLIGHT LAUNCH

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## ABSTRACT
In the past few years scientist have published a series of new methods which promises the promises the revolution in the space propulsion systems, Space launches and flights these include the VASIMR ,NERVA, OPOC, NEXT ,MMEEV and PHOTON PROPULSION. some of these have the potential to decrease the launch casts thousands of times and other allows to reduce pollution by combustible gases in the atmosphere. while other change the speed and direction without spending the fuel. The author reviews and summaries some of the most revolutionary propulsion systems for scientists, engineers, mentors and public.

## General Terms
VASIMR; OPOC; NEXT; MMEEV; PROTON PROPULSION

## Keywords
NEW PROPULSION SYSTEMS, ROCKET PROPULSION, VASIMR, OPOC, NEXT, MMEEV and PROTON PROPULSION

## 1. INTRODUCTION
Brief history-people have long dreamed to reach the sky .The idea of building a tower high above the earth surface into heavens is very old. The Greek pyramid of Gaza constructed in 2570 BC it has a height of 146m.The writing of mosses about 1450 by in genesis chapter refers to an early civilization that is about 2100 by tried to build a tower to heaven out of brick and tar. This construction was called the tower of Babel and was reported in Mesopotamian Later this was located at similar location in the latter ages in 1943 production of v-2 rockets began in Germany with a operational range of 300 km and has a capacity to carry a 1000kg warhead with huge explosive charge. After World War 2 the missile system has achieved a great success but rocket system achieved greatest progress in late 90's. The research programmes were launched with the aim to decrease the launch cost, reduce pollution and have higher potential. Over recent years interference fit joining technology including the applications of space methods have been important in achieving of space propulsion. Parts results in the area of propulsion system and methods have been patented recently or are in patenting process. NASA made a significant contribution to the study of different types of propulsion systems in recent years. Some of such new innovation technologies are present in the given review.

## 2. VASIMR
Variable specific impulse magneto plasma rocket.

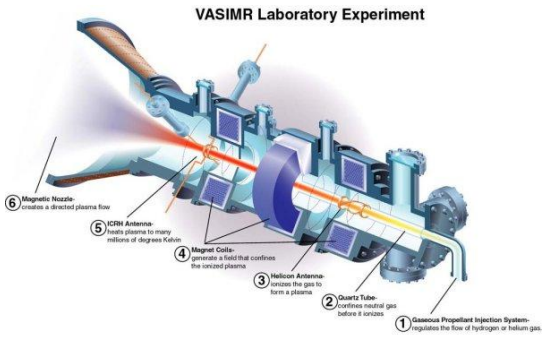
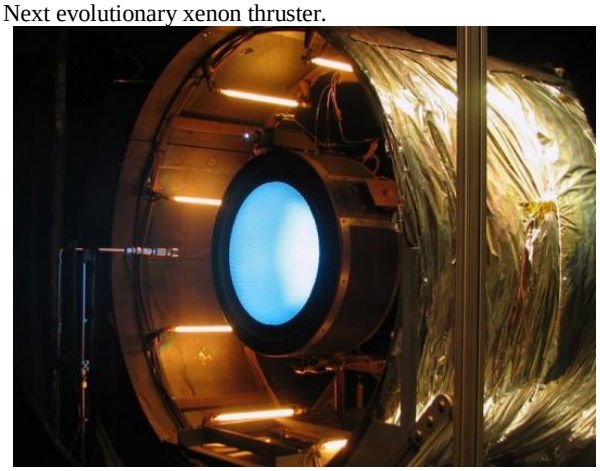



**Diagram of a VASIMR experimental engine at Johnson Space Flight Center. Image: NASA**

The first VASIMR experiment was conducted at MIT in 1983 on the magnetic mirror plasma device later on in 1995; it was brought to (ASPL). Its first experiment in Houston was conducted using a microwave plasma source. First experiment made a helicon discharge of 10 Kw and on later stages it was found with as much power as 250 kW. By 2013, 200kw vx-200 engine has executed more than 10,000 engine firings. While demonstrating greater than 70 % thruster effect relative to RF power input with argon propellant at full power. VASIMR is an electromagnetic thruster for space propellant. It uses radio waves to ionize and heat a propellant and magnetic field to accelerate the resulting plasma to generate thrust. It is one of the most advanced systems .VASIMR is intended to build a gap between high thrust low specific impulse propulsion systems and low thrust , high specific impulse systems. This system is capable in functioning in either mode.

## 3. NEXT
Next evolutionary xenon thruster.



**The next generation of ion engines have a fuel efficiency 10 to 12 times greater than traditional chemical thrusters. Credit: NASA**

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Next is one of the projects in the solar electric propulsion technology area. This project is one of the most powerful next generation ion engine technology and is managed by NASA Glenn research centre. Next is a propulsion system that could evolutionize the way we send science missions depends into the solar system. The thruster uses xenon gas and electrical power to drive future spacecrafts. The major feature of NEXT is a thruster that utilized design knowledge gained from ion thruster. That successfully propelled the deep space to fly by of asteroid Braille and the comet Borelli.

NEXT project is an integration of several elements which combines together Next gen ion thrusts, N star technologies which are having a cutting edge design to yield a thruster with unparalleled specific impulse, throttling range, specific capability and life capacity

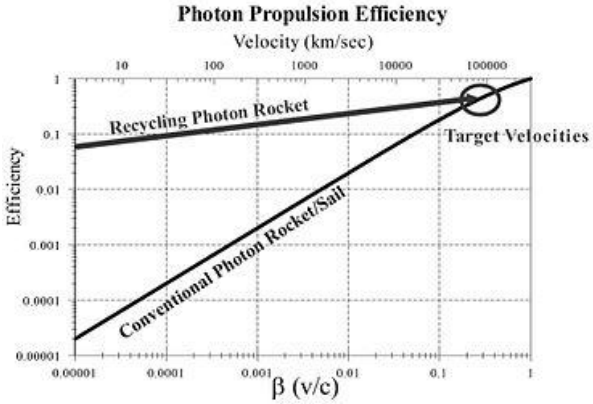
## 4. MMEEV

Multi mission earth entry vehicle

**Suitports on the outside of the Multi-Mission Space Exploration Vehicle (MMSEV).**

It is a flexible design concept which can be optimized or tailored by any sample return missions including lunar, asteroid, comet and planetary to mass sample return (MSR). EEV design, which due to planetary protection requirements is designed to be the most reliable space vehicle ever flown the MMEEW concept provides a logical foundation by which any sample return mission can build upon. In optimizing an EEV design which meets their specific needs by levering common design elements this approach could significantly reduce the risk and associated cost in development across all samples return missions while also providing significant feed forward risk reduction. For safe flights the MMEEV should possesses particular design attributes, the vehicle aerodynamics should be very well. understood first. Vehicle should quickly stabilize itself in a heat shield forward. Orientation of the release from the return vehicle a micrometeoroid impact or some other cause

## 5. PHOTON PROPULSION




**Energy transfer efficiency from the photon energy to the spacecraft kinetic energy as a function of β=v/c.**

Photon propulsion has been widely discussed for decades as a next generation propulsion that can make installer flight possible which requires the ability to propel spacecraft to speeds at least 10 % of the light speed v-0.1c=30,000 km/sec. It is considered as one of the best instiller technology. Compared with its theoretical progress, its actual demonstration at lab environment was very slow. It has been only very recent that a successful recycling photon thruster capable of amplifying thrust by order of magnitude was demonstrated in lab setting and that a successful space deployment of solar sail was achieved with such successes along with recent impressive development of high power laser and associated optics, which form necessary technological foundations for photon propulsion.

## 6. OPOC ENGINE

Opposed piston opposed cylinder engine tech.

It is an internal combustion engine that can be made to run on number of fuels. It operates on two cycle principle generating one power stroke per each crank revolution per cylinder. This OPOC has following features as compared with same power conventional engines.

- Smaller volumes for same power output.
- Less weight for same power
- Fewer fails count.
- Low emission controlled diesel efficient fuel consumption.
- Low noise/vibration.
- Low manufacturing cost.
- Uses conventional materials and processes

## 7. CONCLUSION

The main objective of the presented review paper is to show. That how newer propulsion technologies can overcome the backlogs of older technologies by using these above mentioned technologies we can reduce the production cost to very large extent and also helps in reducing pollution for flight purposes. It is proposed here that such new technologies reduce size and power input to very large scale and increase the efficiency of the system. It is projected that these development phases will result in systematic evolutionary applications such as satellite formation flying, NEO mining/mitigation and space solar power which will be a sufficient sustainable economic interest and return investment

to self sustain the development pathway, once fully developed these technologies would increase the horizon of the human economic and social interests in space from space exploration to space mining colonization and permanent habitation.

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[4] "International Space Station Mission". Ad Astra Rocket Company. 2011. Retrieved February 8, 2011. The VX-200 will provide the critical data set to build the VF-200-1, the first flight unit, to be tested in space aboard the International Space Station (ISS). The electrical energy will come from ISS at low power level, be stored in batteries and used to fire the engine at 200 kW.

[5] Lindsay, Clark S. (February 7, 2011). "Briefs: Japan & commercial crew; VASIMR on ISS update; Delta IV Heavy liftoff flames". HobbySpace.com. Archived from the original on November 2, 2011. Retrieved February 8, 2011.About 100 NASA people are now working with AAR on the project. AAR is negotiating with NASA for a launcher and the leading contender currently is Orbital Science's Taurus II. The VASIMR system will provide re-boost for the station plus it can also offer access to its 50 kWh batteries when not in operation. The thruster can fire for up to 15 minutes at 200 kW. The lab prototype has exceeded thruster output by a factor of two over the requirements set for the ISS version.

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