

**Discussion on report of referee on article on new inventions of electric airplanes , solar powered planes , drones etc. in view Newton's third law of motion**

Ajay Sharma

Fundamental Physics Society. His Mercy Enclave, Post Box 107 GPO Shimla 171001 HP India

Email: [ajoy.plus@gmail.com](mailto:ajoy.plus@gmail.com) Mobile 0091 94184-50899

Discussion or reply on Reports of referee ( A Modgil , DDHU Shimla , India )

**The report dated 8<sup>th</sup> June 2021**

**“ The motion of rockets is understood on the basics of Newton's third law of motion. The rockets work precisely . Also electric airplanes , solar powered planes , drones etc. are new inventions comparatively. These are required to be studied .**

**It will be interesting to determine the precision to which Newton's laws have been verified by examining the precision to which the operation of thruster rockets / propeller design and operation have been taken, to permit the precise manoeuvres that enabled Osiris-Rex to land on the asteroid Bennu and the drone Ingenuity to take off and fly in the thin atmosphere of Mars. “**

=====

Ajay Sharma responds, replying sentence by sentence

**“ The motion of rockets is understood on the basics of Newton's third law of motion. The rockets work precisely . Also electric airplanes , solar powered planes , drones etc. are new inventions comparatively. These are required to be studied .**

**1<sup>st</sup> sentence of report dated 8.6.2021 on paper**

Your goodself have written that

**Part I**

**Author Comments :** Please see that just comparison or contrast is not the theme of article . Theme of article is that Newton's law is not quantitatively confirmed in motion of aircrafts. The motion violates Archimedes Principle.

The third application of Newton's third law of motion also leads to law of conservation of momentum which is used in rocket motion by Tsiolkovsky. The law of conservation of momentum as in eq.(1)

$$mU_{\text{initial}} + MV_{\text{initial}} = MV_{\text{final}} + mU_{\text{final}} \quad (1)$$

Initial momentum of system ( projectile and target) = Final momentum of system (projectile and target) (1).

**General daily life applications.**

Whether universally applicable Newton's law is quantitatively and specifically obeyed in various cases or not. The quantitative verification is first and foremost conditions of validity of equation.

(i) Freely falling bodies ( different natures , types etc.)

$$\text{Action} = \text{Force} = \text{Weight} = mg = 1\text{kg} \times 9.8\text{m/s}^2 = 9.8 \text{ newtons} \quad (2)$$

$$\text{Reaction} = - \text{Action} = -9.8 \text{ newtons} \quad (3)$$

This issue is not discussed here ; it is just passing reference in the discussion about diverse applications of Newton's third law of motion. Thus all bodies must rebound in similar way (as action and reaction are same) after striking the surface. These need to be quantitatively confirmed. The similar conclusion is drawn from rocket motion.

(ii) Various applications of the Law : recoil of gun, swimmer swims in water, birds fly in air, backward motion boat when a person jumps from it towards the shore etc. etc.

### **The third law of motion in rockets and airplanes**

(iii) Newton's third law of motion in terms of force or in terms of conservation of momentum (velocity) is applied in case of various aircrafts etc.

(a) **Launching of rockets** : Newton's third law of motion is used or law of conservation of momentum.

(i) Exhaust moves backward as action

(ii) Rocket moves forward reaction

Thus third law ( understood in terms of force) is obeyed as we teach right from Middle School students.

The other form of third law of motion is law of conservation of momentum , it was applied by Tsiolkovsky [1] in 1903 ( 217 years after publication of Newton's third law, 671 years after use of rockets in battle) and obtained velocity of rocket as

$$V = V_e \ln M_0/M \quad (4)$$

It is known as ideal rocket equation. This equation is theoretically improved ( as Tsiolkovsky's equation has limitations) as

$$V = V_e \ln M_0/M - gt \quad (5)$$

$$V = V_e \ln M_0/M = I_{sp} g V_e \ln M_0/M \quad (6)$$

None of the eqs.(4-6) are quantitatively justified experimentally, as there are no specific experimental evidences ( measurement value of V, corresponding to M). Many other factors are responsible for rocket movement.

### **Zero emission aircrafts or no exhaust (smoke , fire, gases and sparks)**

(b) motion of electric airplanes planes where no exhaust is emitted

(c) motion of Solar powered planes where no exhaust is emitted

(d) motion of drones etc. where no exhaust is emitted.

It simply means , there is no action and should be no reaction. Thus electric planes , Solar powered planes etc should not move from ground. In terms of other form of third law of motion (law of conservation of momentum), the same result is obtained when  $M_0 = M$ , velocity  $V=0$ .

$$V = V_e \ln M_0/M = V_e \ln 1 = 0 \quad (7)$$

Thus Newton's law fail here. These planes should not move from ground , flying is separate issue. Also their motion is contradictory to Archimedes Principle. We should discuss and accept it honestly. Some new theory is needed for explanation which would affect other moving bodies as well.

### **Negligible emission of exhaust (smoke , fire, gases and sparks)**

Is Newton's third law of motion ever experimentally confirmed quantitatively in case of  
airplanes  
fighter planes

helicopters

drones

exhaust is negligible in these cases? Thus to calculate the value of  $V$ , the mass of rocket ( $M$ ) at any time need to be measured and applied in eq.(4) .

**Why these issues are not discussed in report? These issues are part of paper.**

## Part II

**Invention and developments of rockets is independent of Newton' Third law**

**Significant historical developments are not ordinarily part of textbooks for students.**

Rockets were used in 1232 in Chinese-Mangol battle of Kai-fung-fu i.e. about 454 years before Newton's third law in the *Principia* (1686). In these years rockets were developed in Asia and Europe, and became more destructive in warfare with time scientists improved them.

These sensitive issues are not discussed in the report.

In 1686 Newton gave third law of motion, in *Principia* but did not mention about rocket motion [2] in this regard.

In 1813, William Moore ( British Military scientists) published book Treatise On the Motion of Rockets [3] did not mention Newton's third law in rocket motion. Or did not use Newton's third law of motion.

In 1903, Russian scientist Tsiolkovsky (217 years after publication of the *Principia*) , applied Newton's third law of motion ( in form of conservation of momentum) in rockets motion theoretically for first time. Thus he derived eq.(4) i.e. ideal rocket equation. This equation has some limitations so it was re-structured as eqs.(5-6).

In brief , Newton's law was applied to rocket motion by Tsiolkovsky in 1903 i.e. 217 years after discovery of Newton's law ; and 671 years after use of rockets in Chinese-Mongol battle. Thus we need quantitative confirmation of eqs.(4-6).

### Comparison of swimming and rocket launching in your report dated 6.6.2021

You have written that when a rocket moves forward, its mass varies .

But how you can say that when swimmer swims then there is change in its mass. These may be different phenomena.

### Specific confirmation of eqs.(4-6)

I have contacted ( regarding specific confirmations of eqs.(4-6) ISRO , NASA, ESA and Roscosmos in this regard but none replied.

So how can I assume that eqs.( 4-6) are experimentally justified. If your goodself know any scientific source these are quantitatively justified please let me know .

**Conclusions :** In case of electric plane, solar powered air plane and drones Newton's law fail completely.

They also disobey Archimedes Principle.

In case of airplanes, fighter planes, helicopters & drones ( all low emission planes) Newton's law is not justified quantitatively as eqs. (4-6)

Are there quantitative experimental evidences for confirmation of eqs.(4-6).

-----

## 2<sup>nd</sup> sentence of report dated 6.6.2022

In the last sentence you have written that

*“It will be interesting to determine the precision to which Newton’s laws have been verified by examining the precision to which the operation of thruster rockets / propeller design and operation have been taken, to permit the precise manoeuvres that enabled Osiris-Rex to land on the asteroid Bennu and the drone Ingenuity to take off and fly in the thin atmosphere of Mars.”*

These are recent successful examples about space exploration. These are excellent example of practical engineering and computer algorithms. The space crafts are controlled by scientists from the laboratory as children control and maneuver drones from the street. The motion of rocket is not as simple as it looks like that exhaust moves backward and rocket reaches the desired point, as Newton has given three laws of motion.

The motion of rockets is controlled and maintained by super computers by number of scientists, based on experience of numerous preceding scientists.

If it is not so then rockets will fall down anywhere on the earth like fireworks , when its fuel is consumed or even earlier losing its direction. Here Newton’s third law is just used, as exhaust moves backwards the rocket moves forwards ; it is simply like when an air-filled balloon is deflated by child it moves upwards Newton’s third law also work here.

As you have mentioned about Newton’s law, I hope you will allow to quote them.

### **Newton’s First Law of Motion.**

The law is given in the Principia [2] at page 19 as

*“Everybody perseveres in its state of rest, or of uniform motion in a right line, unless it is compelled to change that state by forces impressed thereon”.*

Its first part was initially stated by Aristotle (250BC) and Second part by Galileo ( known as Galileo’s law of inertia) in the book *Dialogue Concerning Two New Sciences* [4] at page 195 as

*Imagine any particle projected along a horizontal plane without friction; then we know, from what has been more fully explained in the preceding pages, that this particle will move along this same plane with a motion which is uniform and perpetual, provided the plane has no limits.*

This law was further used by Descartes [5] in 1644 and Christiaan Huygens [6] .

### **Newton’s second law.**

*“The alteration of motion is ever proportional to the motive force impressed; and is made in the direction of the right line in which that force is impressed.”*

Newton did not give any equation for the law .

$F = ma$

was given by Euler [7] in 1775 in his paper available at The Euler Archive <http://eulerarchive.maa.org/> Index Numbers E479

### **Newton’s Third Law of Motion.**

Its qualitative applications of already critically considered with details. Further please refer to page 2 explanation to First Sentence :

### **Invention and developments of rockets is independent of Newton’ Third law**

Rockets and satellites are excellent examples of research in engineering and computer software of numerous scientists in past. We should use these for confirm Newton’s third law or law of conservation of momentum to quantitatively.

---

### **Request**

I also request in advance that you will allow me to quote this communication ( along with reviewed paper ..... ) paper, in my forth coming book

### Improved form of Newton's Third Law of Motion .

Ten Chapters , about 160 pages words may be about 80,000

This paper and communication will constitute separate chapter. Science be benefited with interactions; it has happened in science in past. This issue needs to be certainly critically discussed.

An early reply solicited. Thanking you for your interest and time on the work. I am indebted to you for your comments.

Yours faithfully

Ajay Sharma

Email [ajoy.plus@gmail.com](mailto:ajoy.plus@gmail.com) Mobiles & Whats App. 94184 50899, 94183 09989

### References

- [1] Blagonravov, A A (1954 ) Editor Collected Works of K E Tsiolkovskiy ( translation of KE Tsiolkovskiy Sobraniye Sochineniy Tom II Reaktivnyye Letatel'nyye Apparaty" Izatel' stvo Akademii Nauk SSSR, Moscow 1954 . pp. 7-11. National Aeronautics and Space Administration, NASA TT F-237.
- [2] Newton , I. *Mathematical Principles of Natural Philosophy* (printed for Benjamin Motte, Middle Temple Gate, London) pp.2, 8,9,10-11,19-20, 1727 , translated by Andrew Motte from the *Latin*.  
[http://books.google.co.in/books?id=Tm0FAAAAQAAJ&pg=PA1&redir\\_esc=y#v=onepage&q&f=false](http://books.google.co.in/books?id=Tm0FAAAAQAAJ&pg=PA1&redir_esc=y#v=onepage&q&f=false)
- [3] [Moore , William \(1813\) , Treatise On the Motion of Rockets](#) Printed for G. and S. Robinson , Paternoster-Row , England  
pp. 24-44  
<https://play.google.com/books/reader?id=nrVgAAAACAAJ&printsec=frontcover&pg=GBS.PR1>
- [4] Galileo G (1638) *Dialogues Concerning Two New Sciences* ( [Lodewijk Elzevir Leiden](#), [South Holland](#)) p.195
- [5] Descartes (1644), R. *Principles of Philosophy* apud Ludovicum Elzevirium 1 January 1644
- [6] Huygen's C (1673) apud F. Muguet, regis & illustrissimi archiepiscopi typographum, viâ Citharæ, ad insigne trium Regum
- [7] Euler Leonhard (1775) The Euler Archive <http://eulerarchive.maa.org/> Index Numbers E479