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Interceptor Technology for Intercontinental Ballistic Missiles by Stretching Time

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Abstract Time is a relative dimension varies from a frame of reference to another according to the required mission and the given geometry. Thus, the consideration of the same interval of time is relatively different from a frame of reference to another. Such different consideration for the same duration of normal time (T_n) is expressed by the relativity of the time. Stretching Time (T_{st}) means to achieve more rate of execution than the usual rates in same period of time using more kinetic energy (KE) where the more kinetic energy the more the normal time is stretched. Thus, each frame of reference is characterized by its own relative time which should be assayed according to the capability of the permitted execution within the boarders of the frame of reference. The utmost necessity to stretch the duration of all stages of the Intercontinental Ballistic Missile (ICBM) trip reveals the importance of the ST concept which is expressed mathematically by: $T_{st} = T_n \times \sqrt{\frac{KE_{Greater}}{KE_{Smaller}}}$ to provide a new vision to the interception technique for the ICBM using satellite-interception technique (SIT) to be used instead of the Grounded Defensible Technique (GDT). SIT enables to compare the capability of execution for the interceptor satellites in different orbits of different altitudes to choose the proper satellite interceptor for the ICBM in each phase of its trip according to the required mission and the given geometry. SIT will be more effective in intercepting the ICBM than the current techniques, where such efficiency (ef) at any moment can be calculated by knowing the ratio of velocities of the SIT and that of the ICBM as follows: $ef = \left(\frac{V_m - V_i}{V_i} - 1 \right) \times 100\%$, where V_m , V_i are velocities of the ICBM and the SIT respectively. SIT would be a guard for the sky from the ICBMs, without geographical difficulties, with too much less budget as it decreases the fixed, operating and damage costs of applying GDT.

Keywords Stretching out the Time, Satellite Interceptor Technique, Chemical Oxygen Iodine Laser, Efficiency of the Antimissile Defensible Technique

1. Introduction

Sometimes man is in bad need to stretch out the time to achieve more rates than usual in the same period or less. Currently, thousands of satellites have been launched into orbits around the Earth for a large number of purposes. Common types include military (spy) and civilian earth observation satellites as communication satellites, navigation satellites, weather satellites, and research satellites. Space stations and human spacecraft in orbit are also satellites. Each satellite form a system with earth has its own total mechanical energy (E) which is the sum of Kinetic and Potential Energies of such system. Satellite orbits vary greatly, depending on the purpose of the satellite, and are classified in a number of ways. Well-known (overlapping) classes include low earth orbit, polar orbit, and geostationary orbit. Their orbital speed and consequently capability of execution varies as orbital altitude change which can be simply explained by considering the following example: If an object regularly passes by a station once per two hours, then by doubling its velocity it will pass by the station once per an hour. Then it can be said that what had been done during two hours by the regular rates of energy consumption was done also within one hour only. Then one can say either of “a normal time (T_n) of one hour is stretched out to contain the events of two hours of another normal time”. “Or the events of normal time of length two hours have been accelerated to be done in normal time of one hour only. I.e. stretching a period of time (T_{st}) occurs by accelerating the events of this period.

Thus, if a body moves by uniform velocity V_2 through time t_2 for the same distance [execution] instead of V_1 through time t_1 where $t_2 < t_1$, then in the frame of reference of this body only $\frac{d(\text{execution})}{dt} \propto T_{st}$

$$\frac{T_{st}}{T_n} = \frac{t_1}{t_2} = \frac{V_2}{V_1} \quad (1.1) \ \& \ T_{st} = T_n \times \sqrt{\frac{KE}{KE_{regular}}} \quad (1.2)$$

While if two bodies (S & M) move by the same velocity in the same direction then their relative velocity will be zero and the distance between them will be constant. Exactly likes as if those bodies are at rest or in a freezing state simultaneously with respect to each other and the normal time of their frame of reference is stopped. Such freezing state can be expressed by other words as "Time of this frame of reference is infinitely stretched out until any relative change of the velocities of these bodies". Once those bodies move by different velocities for the same interval of time by the same acceleration [a] where $v_m > v_s$ then, the value of the stretched time of their frame of reference (S & M) can be calculated as follows:

$$T_{s\&m.st} = T_n \times \frac{v_m}{v_m - v_s} \quad (1.3)$$

where $T_{s\&m.st}$ is the stretched time seemed to [S] in the frame of reference of both bodies [S&M]or the stretched time measured by the clock of [S] due to its motion with respect to the motion of [M] .i.e. As (Vs) changes from zero (rest state) to v_m (freezing state), as $t_{s\&m.st}$ changes from T_n to ∞ . This consideration for time according to capability of execution is the concept of theory of Stretching out the time (ST) which states that "Time should be considered according to the execution done within it and such execution is relatively different from a frame of reference to another. Consequently consideration of the same interval of time is relatively different from a frame of reference to another, and such different considerations for the same duration of normal time are expressed by the relativity of the time. If these considerations are longer than the normal time T_n, then such duration would be considered stretched and is denoted by T_{st} ".The importance of such time consideration has been revealed after using satellites in military defensible systems, where nowadays the danger of the ballistic missiles increases as many countries has reached its technology which has been developed through new generations that produced the intercontinental ones ICBM[3]whose range reached to thousands of miles by passing through three stages. The first is the Boost Phase in which the missile penetrates the atmospheric field to the outer space during at most three minutes. The second is the Midcourse Phase in which the missile moves in the outer space for a while extending to at most of thirty minutes by a velocity which should be less than the orbital velocity to re-enter the atmospheric field again. While the third stage is the Terminal Phase in which the missile penetrates the atmospheric field from the outer space with velocity equivalent to its velocity by the end of the first Phase on entering the outer space. Or in other words, velocity of entering the space is equivalent to that of re-entering the atmosphere [4]. Then the missile is supposed to complete its trip towards its target in few seconds according to its velocity except if it is intercepted by a successful antimissile defensible system which would be in struggle with time to launch its anti-missile missile. So the previous introduction has revealed the utmost necessity to "Stretch" the available time for the defensible system according to the vision of theory of Stretching Time (ST). Then this theory introduces a different technique that should be used instead of the current grounded defensible systems by using a satellite interceptor technique SIT as a space shuttle satellite (S). This new technology will be more effective in intercepting the ICBM than the grounded defensible techniques, where such efficiency expresses the increase in abilities compared with the standstill defensible techniques. The next is a practical proof for theory of ST followed by its applications on satellites motion and its defensible uses during the three stages of ICBM trip.

2. Proofs of Theory of Stretching Time

2.1. Practical proof

As the planets and their motions are responsible for the time calculation, then it will be convenient to let planets and their motions detect the theory of stretching out the time practically which expresses the relativity in considering time with respect to their frames of reference.

Planets of the solar system are orbiting around the sun in elliptical paths by different uniform velocities which can be calculated by knowing the lengths of these orbits as well as the intervals of time measured from Earth that needed to complete one revolution around the sun. This interval of time is denoted by a one year in the frame of reference of the Earth. Also the radius of each planet and the average distance between each planet and the sun during the whole cycle were measured and calculated accurately.

For example these characteristics for Earth & Mercury are illustrated in the following table [1]:

Table 1. illustrates useful planetary data for Mercury & Earth

Planet	Mean Radius (m)	Period of revolution (sec)	Mean distance from the Sun (m)
Mercury	2.43×10^{6}	7.6×10^{6}	5.79×10^{10}
Earth	6.37×10^{6}	3.156×10^{7}	1.496×10^{11}

Reference: Physics for scientists and engineers with modern physics seventh edition page 370 by: JEWETT/SERWAY

From the above table it's obvious that the period of revolution of Mercury around the sun is shorter than the same revolution of the Earth where both periods were measured in the frame of reference of Earth.

But we can't consider the normal time for Mercury to complete one revolution $t_{Mercury} = 7.6\times10^6$ Seconds as measured in the frame of reference of Earth is stretched to be equivalent to $t_{Earth} = 3.156\times10^7$ seconds in the frame of reference of Mercury as both planets haven't performed the same execution. Both planets haven't covered equal distances through those revolutions due to the difference in the lengths of their orbits which is the necessary condition to apply theory of ST.

Thus according to the concept of ST, the duration of normal time for Mercury to move a distance equivalent to the length of the orbit of Earth as measured in the frame of reference of Earth is stretched out to be equivalent to 3.156×10^7 seconds in the frame of reference of Mercury. Then from data shown in table 2.1, the length of one revolution of Earth around the Sun (S_{Earth}), regarding the elliptical path is nearly circular whose radius is the average distance from Earth to Sun can be calculated as follows:

$$S_{Earth} = 2\pi[r_{Earth} + d_{Earth\to Sun}] = 2\pi[6.37\times10^6 + 1.496\times10^{11}] = 9.400045458\times10^{11} m \quad (2.1.1)$$

By the same way from data shown in table 2.1, the length of one revolution of Mercury around the Sun ($S_{Mercury}$) is as follows:

$$S_{Mercury} = 2\pi[r_{Mercury} + d_{Mercury\to Sun}] = 2\pi[2.43\times10^6 + 5.79\times10^{10}] = 3.638116974\times10^{11} m \quad (2.1.2)$$

So the normal time T_n needed for Mercury to move a distance equivalent to S_{Earth} is as follows:

$$T_n = \frac{S_{Earth}}{S_{Mercury}} \square_{Mercury} = \frac{9.400045458\times10^{11} m}{3.638116974\times10^{11} m}\times 7.6\times10^6 \sec = 19636626.86 \sec \quad (2.1.3)$$

This means that in the frame of reference of Mercury an interval of normal time (T_n) equivalent to 19636626.86 sec is stretched (T_{st}) to 3.156×10^7 sec

Thus, $\frac{T_{st}}{T_n} = \frac{3.156?\ \ 0^7}{19636626.86} = 1.607200678$ (2.1.4), which means that one year of normal time on Mercury is equivalent to 1.607200678 years of normal time on Earth.

While the ratio of their uniform velocities was as follows:

$$V_{Mercury} = \frac{2\pi[r_{Mercury} + d_{Mercury\to Sun}]}{t_{Mercury}} = \frac{2\pi[2.43\times10^6 + 5.79\times10^{10}]}{7.6\times10^6} = 47869.96019 \frac{m}{\sec} \quad (2.1.5)$$

$$V_{Earth} = \frac{2\pi[r_{Earth} + d_{Earth\to Sun}]}{t_{Earth}} = \frac{2\pi[6.37\times10^6 + 1.496\times10^{11}]}{3.156\times10^7} = 29784.68143 \frac{m}{\sec} \quad (2.1.6)$$

$$\frac{V_{Mercury}}{V_{Earth}} = \frac{47869.96019}{29784.68143} = 1.607200678 \quad (2.1.7)$$

From (2.1.4) & (2.1.7)

$$\frac{V_{Mercury}}{V_{Earth}} = \frac{t_{st}}{t_n} = 1.607200678 \quad (2.1.8)$$

This proves theory of ST practically as described in (1.1).

2.2. Mechanical Proof

From the satellite motion, it is possible to prove the concept of ST which described mathematically above in equations (1.1) & (1.2) as shown in the following proof.

Consider a satellite of mass (m) revolving in a circular orbit of radius (r) around the earth , the total mechanical energy (E) of the system of the satellite and the earth will be the sum of the kinetic energy (KE) of the satellite and the potential energy(PE) of the system .

i.e.; E = KE + PE (2.2.1). Then $E = \frac{1}{2}mV^2 + \frac{-GM_{earth}m}{r}$ [1] (2.2.2), where G is the universal gravitational constant equivalent to $6.67 \times 10^{-11} Nm^2/Kg^2$, M_{Earth} is the mass of the earth [1].

Applying Newton's second law, then the gravitational force: $F_g = \frac{GM_{earth}m}{r^2} = ma = \frac{mv^2}{r}$ [1]

Then

$$mv^2 = \frac{GM_{earth}m}{r} \qquad (2.2.3)$$

From (2.2.3) in (2.2.2) $E = \frac{1}{2}\frac{GM_{earth}m}{r} - \frac{GM_{earth}m}{r} = -\frac{1}{2}\frac{GM_{earth}m}{r}$ i.e.

$$KE = -E = \frac{GM_{earth}m}{2r} \qquad (2.2.4)$$

Then if there are two satellites of same mass (m) orbiting around the earth in two different orbits of radii $r_1 \& r_2$ where $r_1 < r_2$

Then from (2.2.4) $\frac{KE_1}{KE_2} = \frac{-E_1}{-E_2} = \frac{GMm}{2r_1} \times \frac{2r_2}{GMm} = \frac{r_2}{r_1}$

Thus,

$$\frac{KE_1}{KE_2} = \frac{E_1}{E_2} = \frac{r_2}{r_1} \qquad (2.2.5)$$

from (2.2.3) $v_1^2 = \frac{GM}{r_1} \& v_2^2 = \frac{GM}{r_2}$

$$v_1 = \sqrt{\frac{GM}{r_1}} \& v_2 = \sqrt{\frac{GM}{r_2}} \qquad (2.2.6)$$

Also t_2 is the time needed for the second satellite to complete one cycle where

$$t_2 = \frac{S}{v_2} = \frac{2\pi r_2}{\sqrt{\frac{GM}{r_2}}} = \frac{2\pi r_2\sqrt{r_2}}{\sqrt{GM}} \qquad (2.2.7).$$

Then to apply theory of stretching the time, both satellites should do the same execution. Then in case of constant velocity, same execution means that both satellites should cover the same distance. The last step shows the time needed for the first satellite to cover a distance equivalent to ($S = 2\pi r_2$). Then the time needed t_1 for the first satellite to cover the same distance

$$S = 2\pi r_2 \text{ is } t_1 = \frac{S}{v_1} \qquad (2.2.8)$$

$$\text{from (2.2.8) \& (2.2.6) } t_1 = \frac{2\pi r_2\sqrt{r_1}}{\sqrt{GM}} \qquad (2.2.9)$$

Then as $v_1 > v_2 \& t_1 < t_2$.It is considered that the first satellite has stretched the normal time (t_1) to be equivalent to (t_2)

as both durations contain the same execution to fulfill the condition for applying theory of stretching the time.

Or $T_n = t_1$ & $T_{st} = t_2$ (2.2.10) & from (2.2.7) & (2.2.8) & (2.2.10)

$$\frac{t_2}{t_1} = \frac{T_{st}}{T_n} = \frac{S}{v_2} ? \frac{v_1}{S} \quad \frac{v_1}{v_2} = \frac{v_{faster}}{v_{slower}} \text{ i.e.; } \frac{T_{st}}{T_n} = \frac{v_{faster}}{v_{slower}} \qquad (2.2.11)$$

This is the same concept of theory of ST previously mentioned in (1.1) and proved practically in (2.1.8).

Also from (2.2.7) & (2.2.9)

$$\frac{t_{st}}{t_n} = \frac{2\pi r_2 \sqrt{r_2}}{\sqrt{GM}} \times \frac{\sqrt{GM}}{2\pi r_2 \sqrt{r_1}} \text{ . Then } \frac{T_{st}}{T_n} = \sqrt{\frac{r_2}{r_1}} \qquad (2.2.12)$$

From (2.2.5) & (2.2.12)

$$\frac{T_{st}}{T_n} = \sqrt{\frac{KE_1}{KE_2}} \text{ i.e. } \frac{T_{st}}{T_n} = \sqrt{\frac{KE_{greater}}{KE_{smaller}}} \qquad (2.2.13)$$

This is the same concept of theory of ST previously mentioned in (1.2).

Accordingly, the practical and mechanical proofs provide a clear cut criterion to accept the concept of theory of ST described in equations (1.1) and (1.2).

2.3. Numerical Proof

Two satellites A & B of same mass 470 kg, A is orbiting in an orbit 280 Km above the surface of earth and the other B is a geosynchronous satellite [6] or in other words is to remain over a fixed position above the earth. Thus the capability of execution of satellites A & B orbiting in those orbits can be compared according to the concept of theory of ST to choose the proper satellite orbit as follows:

1st for satellite B: As B is a geosynchronous satellite then:

Its orbital period $t_B = 24 hours = 86400 \sec$ [1, 6]

By applying Kepler's third law, Radius of its orbit r_B

$$r_B = \sqrt[3]{\frac{GMt_B^2}{4\pi^2}} = \sqrt[3]{\frac{6.67\times10^{-11}\times5.98\times10^{24}\times(86400)^2}{4\pi^2}} \Rightarrow r_B = 4.23\times10^7 m$$

Then $v_B = \sqrt{\frac{GM}{r_B}} = \sqrt{\frac{GM}{4.23\times10^7}}$, Also $KE_B = \frac{GM(470)}{2\times4.23\times10^7} J$

2nd for satellite A: From table 2.1.1 the mean radius of earth is 6.37×10^6 m, then the radius of its orbit $r_A = 280\times10^3 + 6.37\times10^6 = 6.65\times10^6 m$

Then $v_A = \sqrt{\frac{GM}{r_A}} = \sqrt{\frac{GM}{6.65\times10^6}} m/\sec$, Time needed for A to cover a distance equivalent to $S = 2\pi r_B$ = $2\pi\times4.23\times10^7$ m is:

$$t_A = \frac{2\pi r_B}{v_A} = \frac{2\pi\times4.23\times10^7}{\sqrt{\frac{GM}{6.65\times10^6}}} = 34317.6507 \sec \text{, Also } KE_A = \frac{GM(470)}{2\times6.65\times10^6} J$$

Then according to the concept of theory of ST, satellite A has stretched out the normal time t_A to be equivalent to t_B as both durations contain the same execution. Then $t_A = T_n$ & $t_B = T_{st}$

$$\frac{T_{st}}{T_n} = \frac{86400}{34317.6507} = 2.5 \text{, And } \frac{v_{faster(A)}}{v_{slower(B)}} = \sqrt{\frac{GM}{6.65\times10^6}} \times \sqrt{\frac{4.23\times10^7}{GM}} = 2.5$$

Then $\frac{T_{st}}{T_n} = \frac{v_{faster}}{v_{slower}}$ =2.5

$$\sqrt{\frac{KE_{greater(A)}}{KE_{smaller(B)}}} = \sqrt{\frac{GM(470)}{2\times6.65\times10^6}\times\frac{2\times4.23\times10^7}{GM(470)}} = 2.5 \text{, Then } \frac{T_{st}}{T_n} = \sqrt{\frac{KE_{greater}}{KE_{smaller}}} = 2.5$$

Accordingly, Satellite A can do two and a half times as much as what Satellite B can do within the same interval of a normal time which has been measured by a stand still observer. Then it can be concluded that, by knowing the levels of total mechanical energy E of the orbits it will be possible to compare the capability of execution of the satellites orbiting in those orbits according to the concept of theory of ST to choose the proper satellite orbit. This is considered a numerical proof for the concept of ST described in (1.1) and (1.2) which has been proved practically and mechanically to strengthen the confidence of the approach.

3. Efficiency of the Anti ballistic missiles defensible techniques

In the frame of reference of the ICBM and its interceptor only, the ideal model for the interceptor can be achieved through the concept of theory of ST if the interceptor has the ability to move with equal velocity and in same direction of the ICBM i.e. $v_i = v_m$, and the given geography(geometry) allows intercepting. In such ideal interception the normal time would be stretched to infinity ($T_{st} \rightarrow \infty$) as shown in equation (1.3) and the state of frame of reference of the ICBM and its interceptor would be in the freezing state as previously described. But in case of $v_i \neq v_m$, $v_m >>> v_i$ a non ideal model occurs for the interceptor due to the great difference in velocities. The efficiency (ef) of this air defensible technique can be calculated by knowing the ratio of $v_i : v_m$ where the moment efficiency of the used or the detected defensible technique is $ef = \left(\frac{V_m - V_i}{V_i} - 1\right) \times 100\%$, then if $\frac{v_i}{v_m} = \frac{x}{1}$ at any moment & $0 < x < 1$ then the efficiency of the defensible technique will be : $ef = \left[\frac{1}{1-x} - 1\right] \times 100\%$ as illustrated graphically by the following figure.

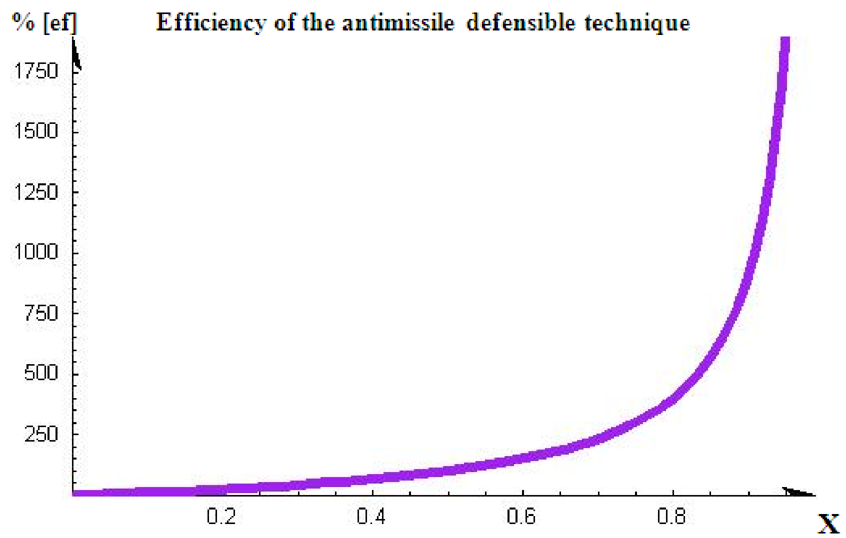

Figure 3.1 shows the moment efficiency of the defensible techniques by knowing the ratio $\frac{v_i}{v_m} = \frac{x}{1}$

The graph of Figure 3.1 has vertical asymptote at X =1 or $\lim_{x\to1}[ef] = \lim_{x\to1}\left[\frac{1}{1-x} - 1\right] \times 100\% = \infty$.

This means that by increasing the square of the ratio of speed of the Interceptor (v_i) to speed of Missile (v_m) the moment efficiency (ef) of the defensible techniques increases and vice versa.
The following is a table illustrates some calculations for [ef] by knowing X.

Table 3.1. shows different values for [ef] corresponding to some values for X

X	[ef]
0.1	11.1%
0.4	66.67%
0.5	100%
0.9	900%

Hint

Efficiency of 100% means that the moving defensible technique has double the chance of the rested ones.

4. Stretching Time of the Boost Phase

The 1st stage of the ICBM trip is called the boost phase after which the missile penetrates the atmospheric field to the outer space during at most of three minutes. The altitude at the end of this phase is typically 150 to 400 km [altitude B Fig-4.1] depending on the trajectory chosen, where the typical burnout speed is 7 km/s[2]. Due to the short time of this phase the aim is to stretch it as much as possible, consequently the ICBM & the Satellite Interceptor should fulfill the following to reach the freezing state of their frame of reference: (1st) they should move in the same direction, (2nd) their velocities should be as much close to each other. Then due to the above conditions and the nature of the boost phase of the ICBM which lasts to altitude of approximately 300 km above the earth, the interceptor should be a satellite in the low earth orbit [5] [LEO] [altitude A Fig-4.1] which has altitude of about 100 km above earth, each interceptor will guard a circular distance θ of the 360 degree of the orbital circular distance. As the ICBM is launched then an engine on the proper interceptor that lies in the circular segment θ of the location of the launched ICBM should be boosted to let the interceptor acquire a velocity equal to that of the ICBM to achieve the freezing state for the boost phase. The range of the perpendicular distance to the launching direction between the interceptor and the ICBM will be from 100 km to 1133km which can be decreased by decreasing θ i.e. increasing number of interceptors at [LEO] orbit.

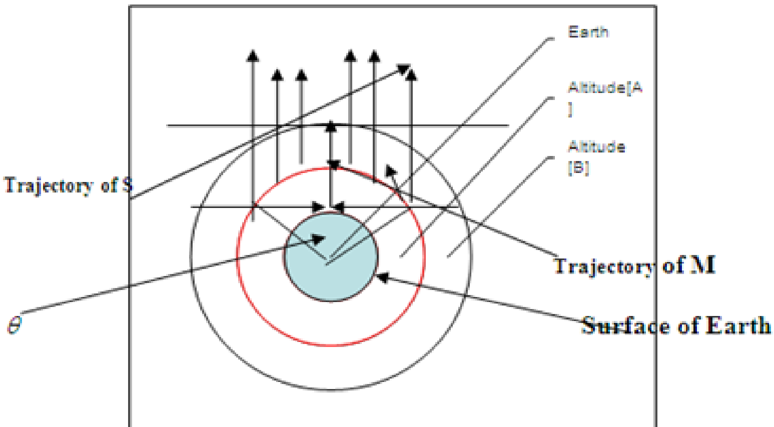

Fig-4.1 Altitude [A] is the [LEO] for SIT
Altitude [B] is the end of the Boost Phase

Numerical example: If an ICBM (M) is launched from point X on the earth of latitude Y & longitude Z by velocity v_m =7 km/s, then due to its infrared sensors the interceptor satellite (I) that lies in the circular segment of central angle of 10 degrees on [LEO] of altitude 100 km[5] above the earth , parallel to the latitude Y or to the longitude Z and has the missile trajectory as their axis of symmetry, will boost an engine to acquire the same velocity which is v_i =7 km/s. Then if the net mass of the interceptor after burning the fuel of boosting the engine is ranged from 470 kg to 3000 kg as it may contain a unit for a Patriot missile which is known by PDB-6 or a unit for a chemical oxygen iodine laser [COIL] which is effective in destroying the ICBMs for a range up to 600 km. Then it will need to burn energy ranging from:

$$\Delta E = \frac{1}{2} m V^2 = \frac{1}{2} X[470 \rightarrow 3000] X (7000)^2 = 1.19 X 10^{10} J \rightarrow 7.35 X 10^{10} J$$

This is equivalent to burn from 89 gal to 550 gal of gasoline. And it will be away from the ICBM by a distance ranging from 100 to 550 km. Thus, the ICBM will be within the influential range of the COIL, and as shown from (3.) when $V_i \rightarrow V_m \;\&\; T_{st} \rightarrow \infty$. This is the ideal model for the ICBM interceptor achieves the freezing state by stretching the boost stage duration to infinity with respect to their frame of reference without geographical difficulties whose geometrical paths allow the required intercepting mission. After destroying the ICBM by the proper satellite interceptor, the proper satellite interceptor can change its orbit to a higher one [1]. Then no loss damage will be expected. This air defensible technique overcomes the geographical difficulties that may arise when depending on the distribution of flocks of planes carrying the COILs [2] around the location X as it may be a vast country of territories longer than twice the range of the COIL. Also it will need a larger budget to surround all the locations of all enemies in case of a world war. Further more, these carrying planes will be easy targets for enemy's defenses. On the contrary when depending on the satellite interceptor technique [SIT], it will be as a guard for the sky from the ICBMS along a whole altitude or longitude around the earth not only a certain country, without geographical difficulties, with too much less budget as it decreases the fixed, the operating and the damage costs.

5. Catching up the ICBM during its Mid-Course phase trip

The 2nd stage of the ICBM trip is called the Mid-Course phase in which the missile moves in a suborbital path in the outer space for a while extending to at most thirty minutes. During this phase the Missile moves by a velocity which should be less than the orbital velocity to re-enter the atmospheric field again. Thus the concepts of the orbital mechanics and theory of ST which introduced in sections 2.2 and 2.3 can be applied on the orbital motion of the ICBM during the Mid-Course phase. By knowing the levels of total mechanical energy (E) of the orbits it will be possible to compare the capability of execution of the satellites orbiting in those orbits according to the concept of theory of stretching the time which has been proved mathematically by: $T_{st}=T_n \times \sqrt{\frac{KE_{greater}}{KE_{smaller}}}$ in (2.2.13).

Application

Let us consider an ICBM penetrating the atmosphere to the outer space during its 2nd phase of its flight in a suborbital elliptical path [3]. This phase may last up to 25 minutes of normal time depending on the maximum height that the ICBM may reach above the surface of earth, while its velocity should be less than the required one to complete one cycle around the earth. If this ICBM reached a height of 1200 km above the sea level, then the required velocity to orbit the earth is

$$V=\sqrt{\frac{GM_{EARTH}}{H_{ICBM}+R_{EARTH}}}=\sqrt{\frac{6.67\times10^{-11}\times5.98\times10^{24}}{1200\times10^{3}+6.37\times10^{6}}}=7258.812346\, m/\text{sec}$$

Then, velocity of the ICBM should be less than V (V_{ICBM} < 7258.812346 m/sec) to follow the suborbital elliptical path [1]. If the ICBM in its 2nd phase trip with velocity $V_{ICBM}=7\, km/\text{sec}$ in a sub orbit of altitude 1200 km above sea level, and in the mean time there are two interceptor satellites or space shuttle satellites A & B orbiting around the earth in two different orbits of altitudes 800 km & 1600 km above sea level ready to intercept the ICBM that lies in the same influential range of their PDB-6 or COIL then;

The velocity of each of them would be

$$V_A=\sqrt{\frac{6.67\times10^{-11}\times5.98\times10^{24}}{800\times10^{3}+6.37\times10^{6}}}=7458.541854\, m/\text{sec}$$

& $V_B=\sqrt{\frac{6.67\times10^{-11}\times5.98\times10^{24}}{1600\times10^{3}+6.37\times10^{6}}}=7074.314257\, m/\text{sec}$. Then $V_A > V_B$ but satellite B was moving by velocity closer to that of the ICBM than that of satellite A.

The relative positions of the grounded defensible technique (GDT), interceptors A and B with respect to the ICBM are shown in figure 5.1

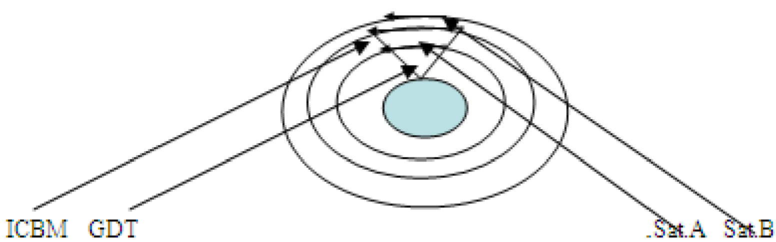

Fig 5.1 shows the relative positions of GDT, Sat A, Sat B with respect to the ICBM

Then in the frame of reference of [ICBM & B], from (1.3) the normal time T_n for the GDT to intercept the ICBM in its influential range would be stretched to $T_{st_{B.ICBM}}$ during the interception by satellite B where:

$$T_{st_{B.ICBM}}=T_n\times\frac{V_B}{V_B\text{-}V_{ICBM}}=T_n\times\frac{(7074.314257)}{(7074.314257)\text{-}(7000)}=95.195T_n$$

Similarly in the frame of reference of [ICBM & A], T_n would be stretched to $T_{st_{A.ICBM}}$ during the interception by satellite A where:

$$T_{st.A\&ICBM}=T_n\times\frac{V_A}{V_A-V_{ICBM}}=T_n\times\frac{7458.541854}{(7458.541854)-(7000)}=16.266T_n$$

Thus it can be concluded that:

(I)Both satellites are more efficient than the grounded stand still defensible techniques (GDT) where the efficiency of satellite A is $[ef]_A=\left[\frac{T_{stA.ICBM}}{T_n}-1\right]\times100\%=[\frac{16.266T_n}{T_n}-1]\times100\%=1526.6\%$ compared to the stand still defensible techniques, while the efficiency of satellite B is $[ef]_B=\left[\frac{T_{stB.ICBM}}{T_n}-1\right]\times100\%=[\frac{95.195T_n}{T_n}-1]\times100\%=9419.5\%$ compared to the grounded stand still defensible techniques. I.e. $[ef]_B>[ef]_A$

This reflects the utmost needs for this new vision for considering the time, as the normal time T_n has different considerations (T_{st}) with respect to the three observers, [Grounded defensible techniques (GDT)], [Satellite A], [Satellite B] which can be tabulated as follows:

Frame of reference	Normal time	Stretched time
(1) GDT , ICBM	T_n	T_n (no stretching)
(2) A , ICBM	T_n	16.266 T_n
(3) B , ICBM	T_n	95.195 T_n

Table (5.1) shows the different considerations (T_{st}) for the same duration of the normal time T_n which were measured by three different observers having different velocities. And such different considerations for the same duration of normal time are expressed by the relativity of the time.

(II) Despite A is faster than B ($V_A>V_B$), stretching the time in the frame of reference of [ICBM & B] is longer than the corresponding value for the same normal time in the frame of reference of [ICBM & A] as the velocities of the ICBM , satellite B are closer to each other than the velocities of the ICBM ,satellite A.

(III)The last point indicates that stretching time in the frame of reference of two bodies depends only on how close are the velocities of the moving bodies regardless of their values. Thereby, if there is a possibility to intercept ICBM in its Mid-Course phase by two interceptors one higher and the other is lower than the ICBM, then it will be more efficacy to catch the ICBM up by the higher orbital satellite than the lower one as its velocity will be closer to the velocity of the ICBM which will cause longer stretching for the available normal time.

6. The interception for ICBM during its Terminal Phase trip

The 3rd stage of the ICBM trip is called the Terminal Phase, in which the ICBM penetrates the atmospheric field once again from the outer space, with velocity equivalent to its velocity by the end of the 1st stage on entering the outer space. Or in other words, the velocity of entering the space is equivalent to that of re-entering the atmosphere [4]. Then the missile is supposed to complete its trip towards its target in few seconds according to its velocity except if it is intercepted by a successful antimissile defensible system which would be in struggle with time, which is necessary for such interception. The thesis of theory of ST provides a different technique that should be used instead of the current grounded defensible systems by using the proper space shuttle or satellite interceptor (I) which the ICBM lies within the influential range of its PDB-6 or COIL.

This technique will be more effective in intercepting the ICBM (M) than the grounded defensible techniques (GDT) where such efficiency is illustrated and proved as follows:

After re-entering the atmosphere from the outer space the M and the third possible interceptor-space shuttle (I) - moves both downwards, as shown in figure 6.1. After a normal time T_n the missile has a velocity v_m while the interceptor shuttle has a velocity v_i .

From (1.3): $T_{im.st}=T_n\times\frac{v_m}{v_m-v_i}$, where $T_{im.st}$ is the relative stretched time that seemed to (I) with respect to the M due to their relative motion in the frame of reference that gathers the missile and the interceptor(I & M). Also the percentage of the increase of $T_{im.st}$ than the normal time T_n is considered the measure of the efficiency of the defensible anti-missile technique [ef], which can be calculated as before:

$$[ef]=\left[\frac{T_{im.st}}{T_n}-1\right]\times100\%$$

Therefore as v_i approaches v_m as

$$\lim_{v_i\to v_m}[\frac{v_m}{v_m-v_i}-1]=\infty .$$

This means that increasing the ratio of $v_i:v_m$ is more effective than increasing v_i only.

Numerical example

If an ICBM on its suborbital course of altitude H $\geq 100km$ by velocity v_m is re-entering the atmosphere, then due to its infrared sensors the interceptor satellite(I) - that lies in the circular segment of central angle of 10 degrees on [LEO] of altitude 100 km [5] above the earth, parallel or perpendicular to the ICBM suborbital course, and has the ICBM trajectory as their axis of symmetry, will intercept the ICBM while moving downwards by a velocity v_i. Then if the two bodies [I&M] start vertical motions downwards by initial velocities [5Km/s & 10Km/s] respectively under gravity $\left[g = 10m/s^2\right]$ for an interval of normal time (T_n) equal to $\frac{2}{\sqrt{5}}$sec as measured by a stationary observer.

Then the time measured by the clock of [I] according to the frame of reference of [I&M] would be stretched to $t_{im.st}$ during the interception in the terminal phase which can be calculated as follows:

$$v_i = 5000 + \frac{2}{\sqrt{5}} \times 10 = 5000 + 4\sqrt{5}\text{m/s}$$ [1]

$$v_m = 10000 + \frac{2}{\sqrt{5}} \times 10 = 10000 + 4\sqrt{5}\text{m/s}$$ [1] &

From (1.3) the stretched time seemed to the interceptor relative to the ICBM ($t_{im.st}$) would be as follows:

$$t_{im.st} = \frac{\frac{2}{\sqrt{5}} \times \left[10000 + 4\sqrt{5}\right]}{\left[10000 + 4\sqrt{5}\right] - \left[5000 + 4\sqrt{5}\right]} = 1.79\text{sec}$$

While the efficiency of this SIT is calculated as follows:

For $v_i : v_m \simeq 1:2$ $\Rightarrow$

$$\left[ef\right] = \left[\frac{1.79}{\frac{2}{\sqrt{5}}} - 1\right] \times 100\% \approx 100\%$$

which means that the chance of interception by the GDT is doubled by the SIT.

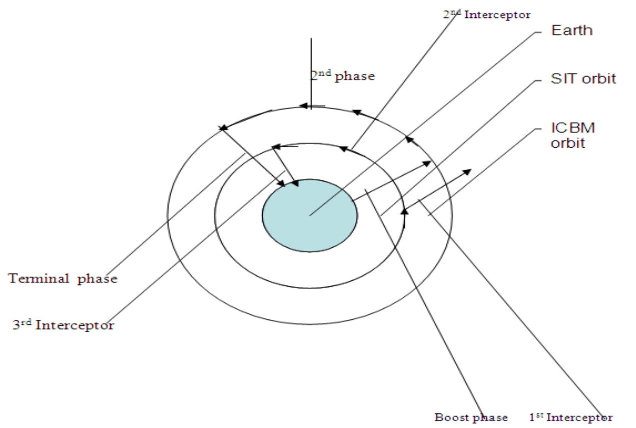

Figure 6.1. shows the interception to the ICBM during the three phases of the whole trip of the ICBM

7. Discussion

This paper aims to improve the efficiency of the interception technique to the ICBM using the available means of technology depending on the concept of stretching time (ST). Concept of ST posits that time should be considered according to the execution rate that had been done within it compared to the normal rate. As rate of execution is relatively different from a frame of reference to another, accordingly the consideration of the same interval of time is relatively different from a frame of reference to another. The special theory of relativity has considered the frame of reference to be the universe itself and has related the time dilation of the clock of the moving body to its speed compared to the speed of light as it is the highest speed in the universe [1]. While the theory of ST has considered the frame of reference to be the moving body itself whether moving alone by any kind of motion or even moving along with other bodies where in such a case this theory has related the time dilation of the clock of each of the moving bodies to its speed compared to the speed of the fastest one. i.e.; Relativity of the time is not only for moving bodies by high speed but for all moving bodies according to the frame of reference of the moving bodies, or in other words time should be measured by the capability of execution.

Concept of ST is considered a new vision for measuring the time where; The meaning of ST is more execution than regular within the same interval of normal time by using more kinetic energy, where the more we use kinetic energy the more the normal time is stretched out. This has been expressed as proved mathematically before in (2.2.13) by $T_{st} = T_n \times \sqrt{\frac{KE_{greater}}{KE_{smaller}}}$. Thus, if a body moves by a uniform velocity V_2 through time t_2 for the same distance [execution] instead of V_1 through time t_1 where $t_2 < t_1$ then in the frame of reference of this body only

$\frac{T_{st}}{T_n} = \frac{t_1}{t_2} = \frac{V_2}{V_1}$ which express the increase in the rate of execution of this body by the increase of its kinetic energy. While if two bodies move together with different velocities in the same interval of normal time then in the frame of reference of both bodies T_n is seemed to the slower body to be stretched out to $T_{st.slower} = T_n \times \frac{v_{faster}}{v_{faster} - v_{slower}}$ .The word seemed means that the slower body could do more in the normal time T_n as if its length numerically is equivalent to $T_{st.slower}$ or in other words the clock of the slower body will record $T_{st.slower}$ instead of T_n .

This concept of ST was presented in a case deserves to be frozen until the survival; the utmost necessity to "Stretch" the durations of all phases of ICBM trip urges to apply a new technique instead of the current systems which is the SIT. The ideal model for the ICBM interceptor achieves the freezing state by stretching the duration of the interception to infinity with respect to the frame of reference of the ICBM and the interceptor whenever their geometrical paths allow the required intercepting mission without geographical obstacles. Applying the concept of ST allows choosing the proper satellite orbit according to the required mission and the given geometry by comparing the capability of execution for satellites in different orbits of different altitudes as shown in the provided presentation. For instance, the presented interception to the ICBM during the Mid-Course phase shows three different considerations for the same interval of time during which the ICBM covered its orbital path before re-entering the atmospheric field. As each of these considerations is longer than the normal time T_n , then such consideration for time is expressed by the stretched time T_{st} . Such different considerations for the same duration of normal time in the different frames of reference are expressed by the relativity of the time.

This new technology will be more effective in intercepting the ICBM than the current techniques, where such efficiency can be calculated by knowing the ratio of velocities of the SIT and the ICBM (Vi / Vm) as follows:

[ef] = [1/ (1- Vi / Vm)-1] x100%, where increasing this ratio (Vi / Vm) is more efficient than increasing Vi only regardless to Vm. i.e. as the ratio of the speed of SIT to that of the ICBM increases, the moment efficiency of the defensible techniques increases and vice versa. Or in other words efficiency depends on how close are the velocities of the SIT and the ICBM.

Moreover, the SIT overcomes the geographical obstacles that may arise when depending on the GDT as shown in the presented interception to ICBM during its boost phase. SIT would be a guard for the sky from the ICBMs along a whole altitude or longitude around the earth not only a certain country, without geographical difficulties, with too much less budget as it decreases the fixed, operating and damage costs of applying GDT.

8. Conclusion

Time is a relative dimension varies from a frame of reference to another according to the required mission and the given geometry. Satellite interceptor technique plays a major role in targeted ICBM interception through the concept of stretching time. It provides the possibility to stretch the available normal time of all phases of the ICBM trip, according to the concept of stretching time which is expressed mathematically by: $T_{st} = T_n \times \frac{V_{ICBM}}{V_{ICBM} - V_{SIT}}$ .With promising efficacy, lower risk, and a lower relatively affordable cost of satellite interceptor technique, this approach assessed the defending significance of this new technology in targeted ICBM interception with a unit for Patriot missile which is known by PDB-6 or a unit for chemical oxygen iodine laser[COIL].

Conflict of Interest

The author declares that there is no conflict of interest concerning this paper.

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