Chapter II
Tele - Transference Theory in Scientific View

هُوَ الَّذِي خَلَقَ لَكُمْ مَا فِي الأَرْضِ جَمِيعًا ث ... (٢٩)

"He it is who created for You, All that is on earth ..." (QS. Al-Baqarah: 29)

The verses above was clearly explained us that everything which is created by Allah SWT in the world was useful for all human kind, and it will be more useful when human also mixed up with it. Human used their brain doing some innovation; process all material and natural resource in the world supporting their life.

Al-Qur'an is Allah's book which is reveled to Prophet Muhammad PBUH. It was a perfect book and there is no comparison. It is *Shalih li Kulli Zaman wal Makan*. Suitable with the name and function of al-Qur'an which is as guide for human being and also guarantee a human to the right way in the world and here after, as long as human belief it. Finally, the whole universe is commemoration to whom that thought about it. Prophet Muhammad PBUH duty is explaining al-Qur'an contents to human, as mentioned in QS. An-Nahl: 44

بِالْبَيِّنَاتِ وَالزُّبُرِ وَأَنْزَلْنَا إِلَيْكَ الذِّكْرَ لِتُبَيِّنَ لِلنَّاسِ مَا نُزِّلَ إِلَيْهِمْ وَلَعَلَّهُمْ يَتَفَكَّرُونَ (٤٤)

"With clear signs and Books (We sent the Messengers). and we have also sent down unto You (O Muhammad) the Reminder and the advice (the Qur'ân), that You may explain clearly to men what is sent down to them, and that they may give thought.(44)"

Unfortunately, the infidel group did not believe it. They said it was impossible that al-Qur'an which has fifteen century divined is suitable with today condition. Because when it divined there is no computer, atom, nuclear energy, and outer-space craft like now. But do not forget that Allah had promise that al-Qur'an loaded enough explanation which is needed by human up to the judgment day. Unfortunately, all verses do not understandable yet, because maybe the explanation is just implied in al-Qur'an verses. And the implied explanation needs deep research.

As complete and perfect book, al-Qur'an also consists of some knowledge. It was a natural science, which is talked about some structure of object and its development, whereas physical science or physics talked about dead object. And in the Islamic world physics include to Islamic philosophy principles on behalf of Islamic Philosophy. The famous thinker is *Ibnu Sina* (Avicenna) who wrote science book *al-Syifa* (Medicine book) and *Fann* (scientific technical) and also there is al-Kindi, Nashir al-Din al-Thusi, Ali Riza, al-Biruni, al-Baghdadi, Mulla Sadra and Sabziwari[1].

They showed big attention on some matter of physics, such as time, space, matter, and movement, and then appeared debatable and different group of thinking (mazhab) which related to some principle of physics and nature philosophy. Mean about one group did research and experiment about nature power and another group tried to show pure symbolic science about natural world and also help people did contemplation to the world as personification of God name and feature, mean about realization the reality of the ones who hold the world or exceed nature[2].

Physics comes from Greek language φυσικός (physikos) "natural" dan φύσις (physis) "nature", it is science which talked about nature in wide meaning. Physics learn about dead and life of nature indication in range of space and time. Physicians learn the object act and feature begin from sub-microscopes particle which mold all matter (particle physics) until universe behavior as one cosmos[3].

Some feature which is learned in physics is a feature which is owned by all material system, like constancy energy law. This feature named as physics law. Physics also named as basic science because another science (like biology, chemistry, geology, etc) matter followed it rule. For example, chemistry is science about molecule and chem.-substance. And the feature of chem.-substance a given by

[1] Afzalur Rahman, *Ensiklopediana Ilmu dalam Al-Qur'an: Rujukan Terlengkap Isyarat-Isyarat Ilmiah dalam Al-Qur'an,* translated from *Quranic Science,* by Taufik Rahman, Bandung: PT. Mizan Pustaka, 2007, page. 92.

[2] Sayyed Hossein Nasr, *Islamic Science,* hh. 135-150

[3] http://id.wikipedia.org/fisika accessed 03 Februari 2010

molecule features which mold it. Moreover, the molecule explained with physics like mechanic quantum, thermodynamic and electromagnetic[4].

Physics is an experimental science and need observation as it practice. But it also talked in theoretical. And since twentieth century, the scientist differ it, they specialized. The result was excellent, it supported each other, could not be separated. Simply, theorist developed their theory which could be understandable by experiment and calculate the future result. Mean while experimentalist arrange and bring out the theory to be tested. Both could not be separated and interdependent. Progression in physics usually appeared when experimentalist made an innovation which could not be explained by theory and finally need new theory. Without an innovation theorist research usually could not be reach, walk to the wrong way. For example, M-theory which talked physics high energy, and because the experiment to test it never been arranged[5].

A. Tele - Transference in Physics Theory

Tele - Transference comes from word Tele mean "distance" and Transference mean "move". This theory discusses the way of transfering something to somewhere. The distance would be covered in range, to be short, and more efficiency. Moreover, people will be very helpful. Sciences now governs the world has revolutionized everything and worked wonders. It has carried sound waves for thousands of miles and even round the globe in less than twinkling. The science result that round the globe in less than twinkling are the light theory, wave theory and the electromagnetic wave theory. Those theories have helped people carrying the world through television, radio, telephone, internet, satellite, Tele-conference and another.

[4] http://id.wikipedia.org/fisika accessed 03 Februari 2010
[5] *Ibid*

A.1. Light Theory

A.1.1. Definition of Light

Light is kind of energy organized as electromagnetic wave which is could be seeing on eye.[6] Light is an important thing of human life. Sun is the prominent light for human and earth. Trees need light to make food through photosynthesis. Light characteristic is ranged straight all around. The evidence is a lamp, when people turned on the lamp he will see everything in lamp covered in dark space. But when the light was impaired made shadow, the shadow proves that light is straight. But light also could be turned.

Light is electromagnetic radiation, particularly radiation of a wavelength that is visible to the human eye (about 400–700 nm, or perhaps 380–750 nm)[7]. In physics, the term light sometimes refers to electromagnetic radiation of any wavelength, whether visible or not. Light also as form of meter size; one meter is distance which is trough by light in vacuum 1/299,792,458 second[8]. Light speed is 299,792,458 meter per second. Light, which exists in tiny "packets" called photons, exhibits properties of both waves and particles. This property is referred to as the wave–particle duality. The study of light, known as optics, is an important research area in modern physics.

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[5] Researcher begun this topic by quoting Feynman: "Newton thought that light was made up of particles, but then it was discovered that it behaves like a wave" taken from Ajoy Ghatak, *Optics*, New Delhi: Tata McGraw-Hill Publishing CO. LTD, 1982, page. 1. And according to Physics dictionary, light consist of electromagnetic wave with certain frequency and wave length and usually it mean ray. Corinne Stockley, Chris Oxlade and Jane Wertheim *"Kamus Fisika Bergambar"* Jakarta: Penerbit Erlangga, page. 46.

[7] www.en,wikipedia.org/light, accessed Friday, March 12, 2010. See more at Karen E. Kalumuck (2000). Human body explorations: hands-on investigates of what makes us tick. Kendall/Hunt Publishing Company. p. 74. ISBN 9780787261535. http://books.google.com/books?id=aPgCYd3ZBUgC&pg=PA74&dq=380+750+visible+wavelengths&as_brr=3&ei=L2N-Sq_bNZPelQSdjbykCg#v=onepage&q=380%20750%20visible%20wavelengths&f=false.

[8] There are a lot of explanation about speed of light, every scholar has their own perspective, even al-Qur'an also describe the speed of light, see more at Wisnu Arya Wardana, *Melacak Teori Einstein dalam al-Qur'an*, Yogyakarta: Pustaka Pelajar, 2006. Page 166-178.

A.1.2. Speed of Light

The speed of light in a vacuum is presently defined to be exactly 299,792,458 m/s (approximately 186,282 miles per second). The definition of light speed means that the meter is now defined in terms of the speed of light. Light always travels at a constant speed, even between particles of a substance through which it is shining. Photons excite the adjoining particles that in turn transfer the energy to the neighbor. This may appear to slow the beam down through its trajectory in real-time. The time lost between entry and exit accounts to the displacement of energy through the substance between each particle that is excited.

Different physicists have attempted to measure the speed of light throughout history. Galileo attempted to measure the speed of light in the seventeenth century. An early experiment to measure the speed of light was conducted by Ole Romer, a Danish physicist, in 1676[9]. Using a telescope, Ole observed the motions of Jupiter and one of its moons, Io. Noting discrepancies in the apparent period of Io's orbit, Romer calculated that light takes about 22 minutes to traverse the diameter of Earth's orbit. Unfortunately, its size was not known at that time. If Ole had known the diameter of the Earth's orbit, he would have calculated a speed of 227,000,000 m/s.

Léon Foucault used an experiment which used rotating mirrors to obtain a value of 298,000,000 m/s in 1862[10]. Albert A. Michelson conducted experiments on the speed of light from 1877 until his death in 1931. He refined Foucault's methods in 1926 using improved rotating mirrors to measure the time it took light to make a round trip from Mt. Wilson to Mt.

[9] Alan Isaac BSc, PhD. DIC, *Kamus Lengkap Fisika*, Jakarta: Erlangga, 1994, page. 241.

[10] Wisnu Arya Wardana, Melacak Teori Einstein dalam al-Qur'an, Yogyakarta: Pustaka Pelajar, 2006, page. 130-131.

San Antonio in California. The precise measurements yielded a speed of 299,796,000 m/s[11].

Two independent teams of physicists were able to bring light to a complete standstill by passing it through a Bose-Einstein Condensate of the element rubidium, one led by Dr. Lene Vestergaard Hau of Harvard University and the Rowland Institute for Science in Cambridge, Mass., and the other by Dr. Ronald L. Walsworth and Dr. Mikhail D. Lukin of the Harvard-Smithsonian Center for Astrophysics, also in Cambridge[12].

A.2. Wave Theory

A.2.1. Wave Definition

A wave is a disturbance that propagates through space and time, usually with transference of energy[13]. A mechanical wave is a wave that propagates or travels through a medium due to the restoring forces it produces upon deformation[14]. For example, when a sound wave is traveling through the air, air molecules slam into their neighbors, who push their neighbors into their neighbors (and so on); but when air molecules collide with their neighbors, they also bounce away from them back in the direction they came from. These collisions provide a restoring force that keeps the molecules from actually traveling with the wave.

Waves travel and transfer energy from one point to another, often with no permanent displacement of the particles of the medium—that is, with little or no associated mass transport; they consist instead of oscillations or vibrations around almost fixed locations[15]. In the picture of water waves, if we imagine a cork on the water, it would bob up and down staying in about the

[11] J. L. Heilbron, *Science History Encyclopedias,* New York: Oxford University Press, 2003, page. 467-468.

[12] www.en.wikipedia.org/light accessed Friday, 13 March, 2010

[13] Corinne Stockley, Chris Oxlade and Jane Wertheim, *Kamus Fisika Bergambar,* Jakarta: Penerbit Erlangga, page. 34.

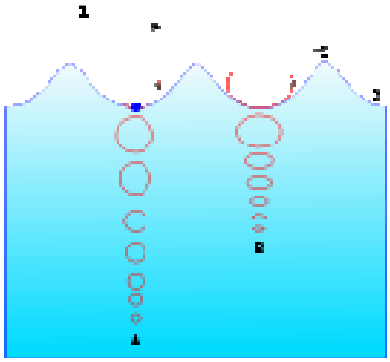
[14] *Ibid,* page. 34.

[15] *Ibid,* page. 34.

same place, although the wave itself is moving outward. When we say that a wave carries energy but not mass, we are referring to this fact that even as the wave travels outward from the center (carrying energy of motion), the medium itself does not flow with it.

A.2.2. Wave Characteristic

In physics wave term and vibration term closely related and interconnected. Vibration is the oscillation of a particle periodically around the equilibrium point. The example is the motion of a pendulum and a suspended object on a spring[16], or Ripples on the surface of a pond are actually a combination of transverse and longitudinal waves; therefore, the points on the surface follow orbital paths. See figures below[17];



A = In deep water.
B = In shallow water. The elliptical movement of a surface particle becomes flatter with decreasing depth.
1 = Progression of wave
2 = Crest
3 = Trough

Pict. 1 example of wave

Periodic waves are characterized by crests (highs) and troughs (lows), and may usually be categorized as either longitudinal or transverse. Transverse waves are those with vibrations perpendicular to the direction of the propagation of the wave; examples include waves on a string, and electromagnetic waves. Longitudinal waves are those with vibrations parallel

[16] Sunardi-Etsa Indra Irawan, *Fisika Bilingual SMA/Ma untuk Kelas XII*, Bandung: CV. Yrama Widya, 2007, page. 3.
[17] Neal J. Holmes-John B. Leake-Charles D. Ovian-Peter W. Nichols, *People Concepts Processes Science*, New York: McGraw-Hill Book Company, 1974, page 185.

to the direction of the propagation of the wave; examples include most sound waves[18].

All waves have common behavior under a number of standard situations. All waves can experience the following[19]:

- **Reflection** — change in wave direction after it strikes a reflective surface, causing the angle the wave makes with the reflective surface in relation to a normal line to the surface to equal the angle the reflected wave makes with the same normal line.
- **Refraction** — change in wave direction because of a change in the wave's speed from entering a new medium.
- **Diffraction** — bending of waves as they interact with obstacles in their path, which is more pronounced for wavelengths on the order of the diffracting object size.
- **Interference** — superposition of two waves that come into contact with each other (collide).
- **Dispersion** — wave splitting up by frequency.
- **Rectilinear Propagation** — the movement of light waves in a straight line also helpful for seismographs.

A.2.3. Kinds of Wave[20]

The waves conserved in this universe consist of many kinds, and one of these is the wave on water surface as illustrated above. Basically, a wave can be distinguished based on its propagation medium and on the direction of vibration to its propagation direction.

a. Mechanical Waves and Electromagnetic Waves

[18] www.en.wikipedia.org/light accessed Friday, March 12, 2010.
[19] *Op. cit,* Sunardi-Etsa Indra Irawan, page. 5
[20] *Op. cit,* Sunardi-Etsa Indra Irawan, page. 5. See also David Halliday-Robert Resnick-Jearl Walker, *Fundamental of Physics*,-Fifth Edition-Part 2, New York: John Willey & Sons Inc, 1997, page. 400-402.

According to the propagation medium, waves consist of mechanical waves and electromagnetic waves. Mechanical waves are the waves that require a propagation medium to transmit energy while electromagnetic waves are the waves that require no propagation medium to transmit energy. Waves on water surface, sound waves, waves on the string and slinky are example of mechanical waves, while the visible light, radio waves and television waves are example of electromagnetic waves[21].

b. Transverse Waves and Longitudinal Waves

Based on vibration direction to the propagation direction, waves are distinguished into transverse waves and longitudinal waves. A transverse waves is a wave which the vibration (the motion of particles in the medium) is in a direction perpendicular to the direction of the wave propagation (wave motion). For example, a string stretched horizontally and moved upward and downward will from wave patterns as shown in the following figure.

Beside transverse wave, there is also longitudinal wave that is wave of which the vibration (the motion of particles in the medium) is in a direction parallel to the direction of wave propagation. Besides waves on slinky, there are other example of longitudinal waves, those are waves on the spring and sound waves.

Longitudinal wave is always a mechanical wave because it is produced from the state maximum density and pressure (compression) and the state of minimum density and pressure (rarefaction) respectively[22].

[21] *Op. cit,* Sunardi-Etsa Indra Irawan, page. 5-7.
[22] *Op. cit,* Sunardi-Etsa Indra Irawan, page. 5-7.

A.2.4. Period, Frequency and Speed of Waves

In the study of wave, there are three important quantities; those are period, frequency and speed of wave.

Frequency of wave refers to how often the particles of medium vibrate when a wave passes through it. In brief, frequency is defined as the sum of waves occurring on a point per second, and mathematically it can be determined as follows[23];

$f = \frac{n}{t}$ Where,

f = frequency of wave ($^{1}/_{s}$)

n = the sum of wave

t = time (s)

The unit of frequency is ($^{1}/_{s}$) that is equal to hertz (abbreviated Hz). For example, if a slinky makes 3 vibrations in one second, then the frequency is 3 Hz and if it makes 8 oscillation in 4 seconds, them the frequency I 2 Hz.

Meanwhile, the quantity of wave period is the time for a particle to make one complete cycle of vibration, therefore period can be determined as follows;

$T = \frac{t}{n}$

Where

T = wave period (s)

Based on the above explanation, then the relationship between frequency and period can express as follows;

$F = \frac{1}{T}$ or $T = \frac{1}{f}$

[23] *Op. cit,* Sunardi-Etsa Indra Irawan, page. 11-13.

Because wave is a distribution that moves along medium from one end to the other end, then besides having frequency and period, it also has speed or velocity.[24]

Generally, an object's speed is relates to how fast it moves and it usually expressed as the distance travelled per unit of time. However in wave, the speed is defined as the distance travelled by a point on the wave (such as a crest) in a given time interval. The speed of wave can be expressed mathematically by the equation as follows[25];

$$V = \frac{distance}{time}$$

If related to period (T), frequency (f) and wavelength (λ), then the speed of wave can be determined by the following equation;

$$V = \frac{\lambda}{T} = \lambda f$$

Where, V = speed of wave

A.3. Electromagnetic Wave

A.3.1. Electromagnetic Wave Definition

In the history of electromagnetic wave is found by Maxwell. But, his result is just about electricity and magnetic. In half of 19th century, Faraday evolved basic concept of line of force, also magnetic field and electricity. He found electric motor and dynamo, and also found that magnetic field always produces electric field and changed electric field always produce magnetic field.

Magnetic field could be imagined as area where involve force had influence. For example, put stick of magnet under paper and put iron dust above, then shake paper slowly. The iron dust will follow magnetic radiation,

[24] *Op. cit,* Sunardi-Etsa Indra Irawan, page. 11-13

[25] *Loc. cit.* Corinne Stockley, Chris Oxlade and Jane Wertheim, page. 35. See also Alan Isaac BSc, Phd. DIC, page. 470.

and made circle of radiation, it is the field[26]. Then, what will happen when electric field crawls in room, which is caused by moving electron inside atom. When wave spread, every electric spot which is followed by will cause magnetic field. Finally, electric field caused magnetic wave which is walk together[27].

Electromagnetic wave is the propagation symptom of electric and magnetic fields which are perpendicular to each other and change periodically[28]. Electromagnetic wave is kind of transverse wave and has speed of $c = \frac{1}{\sqrt{\mu 0\ \varepsilon 0}} = 3 \times 10^8$ m/s in the air (vacuum)[29]. Electromagnetic wave has properties such as interference, diffraction, polarization, refraction and reflection. Electromagnetic wave energy is represented with pointing vector (s), which is energy per unit of area which is perpendicular to the direction of electromagnetic wave propagation[30].

Because electric field is produce by electric charges, then when the charges vibrate or accelerate, they will form fluctuating electric field and magnetic field simultaneously. The directions of the two fields are perpendicular to each other and one field is produced by the change of the other. These changing magnetic and electric fields can propagate at a speed equal to the speed of light and they called electromagnetic waves.

Based on the case, then Maxwell obtained a conclusion that the vibrating and accelerating electric charges will produce electromagnetic wave, and this wave can indicate symptom such as reflection, refraction, interference, diffraction and polarization.

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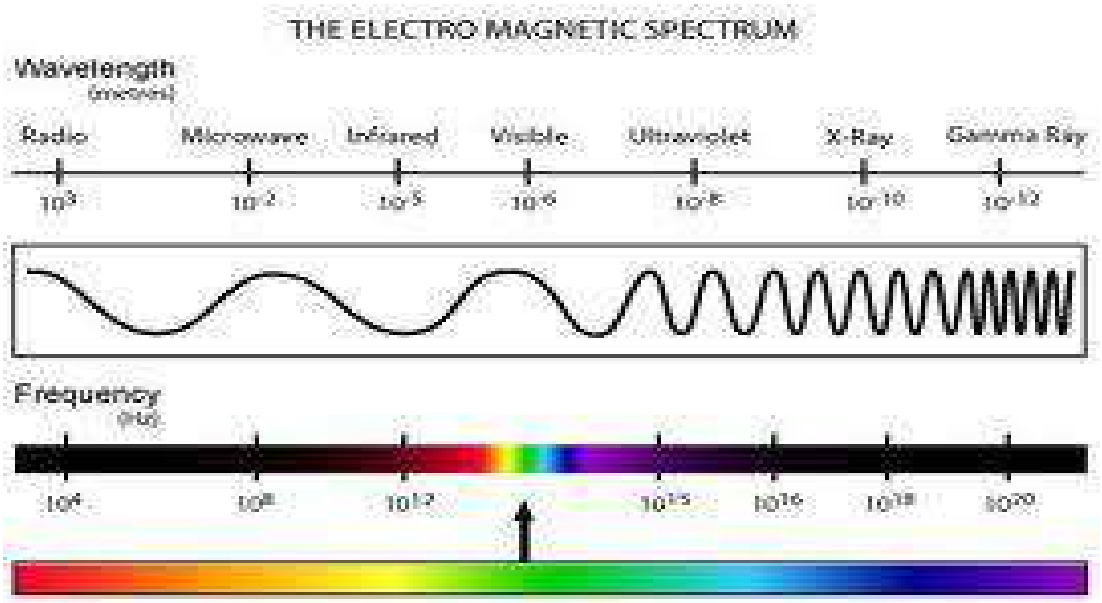
[26] John Gribbin, *Fisika Kuantum-panduan bagi pemula ke dunia subatomic*, Jakarta: Penerbit Erlangga, 2002, page. 9.
[27] *Ibid*, page. 10.
[28] *Loc. cit*. Corinne Stockley, Chris Oxlade and Jane Wertheim, page. 35.
[29] *Loc. cit*. David Halliday-Robert Resnick-Jearl Walker, Part 4, page. 842-845.
[30] *Loc. cit*, Sunardi-Etsa Indra Irawan, page. 83.

A.3.2. Electromagnetic Wave Spectrum

Inside of Maxwell electromagnetic wave theory, he assumed that there is another electromagnetic wave frequency except light frequency. And scientist has classified it below;



Pict.2 Electromagnetic wave spectrum from low frequency up to X-ray and so on.

A.3.3. Electromagnetic characteristic

Researcher begun this topic with note, electromagnetic wave has radiation and its radiation is energy. Then an object which abdicated ray is losing the energy. If it absorb energy mean strengthened. Both concepts above produce electromagnetic wave radiation. It found that radiation propagation in air as well as in deep water. Frequency is oscillation per second when radiation is turned out from a point to the air. Wavelength is space distance between minimum and maximum from wave in propagation course[31].

[31] http://www.elektro.undip.ac.id/sumardi/www/komponen/bab6non.pdf accessed Friday, March 12, 2010.

B. Some Example of Tele - Transference

B.1. Transportation

B.1.1. Concorde

B.1.1.1. Concorde Definition and History

The Aérospatiale-BAC Concorde aircraft is a turbojet-powered supersonic passenger airliner, a supersonic transport (SST), which flew from 1969 to 2003. It was a product of an Anglo-French government treaty, combining the manufacturing efforts of Aérospatiale and the British Aircraft Corporation. (The French word Concorde translates to the English concord as agreement, harmony, or union.) Concorde entered service with Air France and British Airways in 1976[32].

Concorde flew regular transatlantic flights from London Heathrow (British Airways) and Paris-Charles de Gaulle Airport (Air France) to New York JFK and Washington Dulles, flying these routes at record speeds, in less than half the time of other airliners.

B.1.1.2. Concorde General Characteristics

- **Crew:** 3 (pilot, co-pilot, and flight engineer)
- **Capacity:** 92–120 passengers
  (128 in high-density layout
- **Length:** 202 ft 4 in[173] (61.66 m)
- **Wingspan:** 84 ft 0 in (25.6 m)
- **Height:** 40 ft 0 in (12.2 m)
- **Fuselage internal length:** 129 feet 0 inches (39.32 m)
- **Fuselage width:** maximum of 9 feet 5 inches (2.87 m) external 8 feet 7 inches (2.62 m) internal

[32] www.en.wikipedia.org/concorde accessed Friday, March 12, 2010.

- **Fuselage height:** maximum of 10 feet 10 inches (3.30 m) external 6 feet 5 inches (1.96 m) internal)
- **Wing area:** 3,856 ft^2 (358.25 m^2)
- **Empty weight:** 173,500 lb (78,700 kg)
- **Useful load:** 245,000 lb (111,130 kg)
- **Powerplant:** 4× Rolls-Royce/SNECMA Olympus 593 Mk 610 afterburning turbojets
    - **Dry thrust:** 32,000 lbf (140 kN) each
    - **Thrust with afterburner:** 38,050 lbf (169 kN) each
- **Maximum fuel load:** 210,940 pounds (95,680 kg)
- **Maximum taxiing weight:** 412,000 pounds (187,000 kg)

B.1.1.3. Performance

- **Maximum speed:** Mach 2.2[174] (≈1,450 mph, 2,330 km/h[174])
- **Cruise speed:** Mach 2.02 (≈1,320 mph)
- **Range:** 3,900 nmi (4,500 mi, 7,250 km)
- **Service ceiling:** 60,000 ft (18,300 m)
- **Rate of climb:** 5,000 ft/min. (25.41 m/s)
- **lift-to-drag:** *Low speed*– 3.94, *Approach*– 4.35, *250 kn, 10,000 ft*– 9.27, *Mach 0.94*– 11.47, *Mach 2.04*– 7.14
- **Fuel consumption:** 46.85 lb/mi (13.2 kg/km) operating for maximum range
- **Thrust/weight:** 0.373
- **Maximum nose tip temperature:** 260 °F (127 °C)

B.1.2.1. Optic Cable

The development of wave theory produces some other theory and product result. Optic cable is real result of combination of wave and light. In last decades, communication tool is electromagnetic wave (radio), internet used telephone connection as modem, and another used modern cable such as VSAT, internet nirkabel and ADSL. But, west more modern than developed

country, they had fiber-to-the-home (FTTH) where the power was transferred through dense-wavelength-division-multiplexing (DWDM), bandwidth (information) in one cable.

Cable optic component consist of transmitter, cable channel and receiver. Transmitter consists of diode laser and LED, it used to change electric signal became light wave and put into cable optic. Cable fiber optic had more bandwidth than copper cable (1 terabit per second or 10^{12} bit/second), low material lost, no electromagnetic noise, and no electromagnetic interference[33].

Through bandwidth, fiber optic is more than copper cable or nirkabel/satellite. Receiver (photo detector system) used to change light signal became electronic material. Opto-electronic in cable optic made of semiconductor material, it is compound of class III (like Ga) and class V (like As). Those material produce a good matter of cable optic, facilitate electron transition from band conduction to band valence produce photon in process.

B.1.2.2. Cable Optic Definition

Fiber optic is thin pure long glass and its diameter is as big as human hairs. Cable optic composition is fiber optic which is used to bring digital data in light shape also in long way. Cable optic composition is[34];

a. Core is thin glass as kernel of fiber optic where light sent, this material diameter about 8-62,5μm.
b. Cladding is material which circum core and used to reflected light back to kernel (core). Cladding diameter is 125 μm.
c. Buffer coating is coating plastic which protected fiber from damage. Its material is hard or soft plastic like acrylic, nylon with diameter 250-900 μm.

[33] Drs. Murtono, M.Si and Nita Handayani, S.Si, *Optika*, Yogyakarta: UIN Sunan Kalijaga-Prodi Fisika dan Pendidikan Fisika, 2008, page 141-142. See also, Alan Isaac Bsc, page. 304.
[34] *Ibid*, page. 143.

B.1.2.3. Cable Optic Work

Its principle of working is about total internal reflection. When light pass surface to medium which has high index bias, so it is. Light will be reflected through critical angel θ_c mean light moved from high medium bias to lower medium bias then it will be reflected at 90˚ or through the surface. And critical angel could be count used Snell law, where angel bias is θ_2 as big as 90˚, with pattern[35];

n_1 Sin θ_1 = n_2 sin θ_2 and because θ_2 = 90˚ so *sin* θ_2 = 1,
and it conclusion pattern is; sin $\theta_1 = \frac{n1}{n_2}$.
Critical angel big: $\theta_c = \theta_1$ = arcsine$\frac{n1}{n_2}$.

For example when light moved from mirror in n_1 = 1,5 to the air (n_2 = 1), so critical corner big is arcsine (1/1,5) or 41,80˚. In fiber optic, kernel index bias is bigger that cladding index bias, until light reflected many times in the kernel.

B.2. Internet

The terms Internet and World Wide Web are often used in everyday speech without much distinction. However, the Internet and the World Wide Web are not one and the same. The Internet is a global data communications system. It is a hardware and software infrastructure that provides connectivity between computers. In contrast, the Web is one of the services communicated via the Internet. It is a collection of interconnected documents and other resources, linked by hyperlinks and URLs[36]. The term the Internet, when referring to the Internet has traditionally been treated as a proper noun and written with an initial capital letter. There is a trend to regard it as a generic term or common noun and thus write it as "the internet", without the capital.

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[35] *Ibid*, page. 144.

[36] Behrouz A. Forouzan, *Data Communications and Networking*-3rd Edition, McGraw-Hill Higher Education, page 15-18.

The Internet is a global system of interconnected computer networks that use the standard Internet Protocol Suite (TCP/IP)[37] to serve billions of users worldwide. It is a network of networks that consists of millions of private, public, academic, business, and government networks of local to global scope that are linked by a broad array of electronic and optical networking technologies. The Internet carries a vast array of information resources and services, most notably the inter-linked hypertext documents of the World Wide Web (WWW) and the infrastructure to support electronic mail[38].

Most traditional communications media, such as telephone and television services, are reshaped or redefined using the technologies of the Internet, giving rise to services such as Voice over Internet Protocol (VoIP) and IPTV. Newspaper publishing has been reshaped into Web sites, blogging, and web feeds. The Internet has enabled or accelerated the creation of new forms of human interactions through instant messaging, Internet forums, and social networking sites.

The origins of the Internet reach back to the 1960s when the United States funded research projects of its military agencies to build robust, fault-tolerant and distributed computer networks. This research and a period of civilian funding of a new U.S. backbone by the National Science Foundation spawned worldwide participation in the development of new networking technologies and led to the commercialization of an international network in the mid 1990s, and resulted in the following popularization of countless applications in virtually every aspect of modern human life. As of 2009, an estimated quarter of Earth's population uses the services of the Internet[39].

[37] *Ibid*, 4th Edition McGraw-Hill Higher Education, page 42-45.
[38] www.en.wikipedia.org/internet accessed Friday, March 12, 2010.
[39] *Ibid*

The Internet has no centralized governance in either technological implementation or policies for access and usage; each constituent network sets its own standards. Only the overreaching definitions of the two principal name spaces in the Internet, the Internet Protocol address space and the Domain Name System, are directed by a maintainer organization, the Internet Corporation for Assigned Names and Numbers (ICANN). The technical underpinning and standardization of the core protocols (IPv4 and IPv6) is an activity of the Internet Engineering Task Force (IETF), a non-profit organization of loosely-affiliated international participants that anyone may associate with by contributing technical expertise.

B.3. Communication

B.3.1. Radio

B.3.1.1. Radio in the History and Definition

Radio is the transmission of signals by modulation of electromagnetic waves with frequencies below those of visible light. Electromagnetic radiation travels by means of oscillating electromagnetic fields that pass through the air and the vacuum of space[40].

Originally, radio or radiotelegraphy was called "wireless telegraphy", which was shortened to "wireless" by the British. The prefix radio- in the sense of wireless transmission was first recorded in the word radio conductor, coined by the French physicist Édouard Branly in 1897 and based on the verb to radiate (in Latin "radius" means "spoke of a wheel, beam of light, ray"). "Radio" as a noun is said to have been coined by the advertising expert Waldo Warren (White 1944). This word also appears in a 1907 article by Lee De Forest, was adopted by the United States Navy in 1912 and became common

[40] *Loc. cit*. Alan Isaac BSc, page. 359-360.

by the time of the first commercial broadcasts in the United States in the 1920s[41].

B.3.1.2 Radio Processes

Radio systems used for communications will have the following elements. With more than 100 years of development, each process is implemented by a wide range of methods, specialized for different communications purposes. Each system contains a transmitter. This consists of a source of electrical energy, producing alternating current of a desired frequency of oscillation. The transmitter contains a system to modulate (change) some property of the energy produced to impress a signal on it. The transmitter sends the modulated electrical energy to a tuned resonant antenna; this structure converts the rapidly-changing alternating current into an electromagnetic wave that can move through free space (sometimes with a particular polarization (waves))[42].

Electromagnetic waves travel through space either directly, or have their path altered by reflection, refraction or diffraction. Noise will generally alter the desired signal; this electromagnetic interference comes from natural sources, as well as from artificial sources such as other transmitters and accidental radiators. The electromagnetic wave is intercepted by a tuned receiving antenna; this structure captures some of the energy of the wave and returns it to the form of oscillating electrical currents. At the receiver, these currents are demodulated, which is conversion to a usable signal form by a detector sub-system. The receiver is "tuned" to respond preferentially to the desired signals, and reject undesired signals[43].

Early radio systems relied entirely on the energy collected by an antenna to produce signals for the operator. Radio became more useful after

[41] www.en.wikipedia.org/radio accessed Friday, March 12, 2010.

[42] Read more about radio system working at RG. Carter, *Electromagnetism for Electronic Engineers*, London: Chapman & Hall publishing, page. 142-162.

[43] Drs. Maskoeri Jasin, *Ilmu Alamiah Dasar*, Jakarta: Grafindo Persada, 1995, page. 194.

the invention of electronic devices such as the vacuum tube and later the transistor, which made it possible to amplify weak signals. Today radio systems are used for applications from walkie-talkie children's toys to the control of space vehicles, as well as for broadcasting, and many other applications[44].

B.3.2. Television

B.3.2.1. Television Short History

Television (TV) is a widely used telecommunication medium for transmitting and receiving moving images, either monochromatic ("black and white") or color, usually accompanied by sound. "Television" may also refer specifically to a television set, television programming or television transmission. The word is derived from mixed Latin and Greek roots, meaning "far sight": Greek tele (τῆλε), far, and Latin visio, sight (from video, vies- to see or to view in the first person)[45].

Commercially available since the late 1930s, the television set has become a common communications receiver in homes, businesses and institutions, particularly as a source of entertainment and news. Since the 1970s the availability of video cassettes, laserdiscs, DVDs and now Blue-ray Discs, have resulted in the television set frequently being used for viewing recorded as well as broadcast material[46].

Although other forms such as closed-circuit television (CCTV) are in use, the most common usage of the medium is for broadcast television, which was modeled on the existing radio broadcasting systems developed in the 1920s, and uses high-powered radio-frequency transmitters to broadcast the television signal to individual TV receivers.

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[44] *Loc. cit.* Alan Isaac BSc, page. 363.
[45] *Loc. cit.* Alan Isaac BSc, page. 434.
[46] www.en.wikipedia.org/televison accessed Friday, March 12, 2010 and sees also *Op. cit.* Drs. Maskoeri Jasin, page 194-195.

Broadcast TV is typically disseminated via radio transmissions on designated channels in the 54–890 megahertz frequency band. Signals are now often transmitted with stereo and/or surround sound in many countries. Until the 2000s broadcast TV programs were generally recorded and transmitted as an analog signal, but in recent years public and commercial broadcasters have been progressively introducing digital television broadcasting technology.

A standard television set comprises multiple internal electronic circuits, including those for receiving and decoding broadcast signals. A visual display device which lacks a tuner is properly called a monitor, rather than a television. A television system may use different technical standards such as digital television (DTV) and high-definition television (HDTV). Television systems are also used for surveillance, industrial process control, and guiding of weapons, in places where direct observation is difficult or dangerous.

B.3.3. Telephone

B.3.3.1. Telephone Definition and History

The telephone (from the Greek: τῆλε, tēle, "far" and φωνή, phōnē, "voice") is a telecommunications device that transmits and receives sound, most commonly the human voice. It is one of the most common household appliances in the developed world, and has long been considered indispensable to business, industry and government. The word "telephone" has been adapted to many languages and is widely recognized around the world[47].

The device operates principally by converting sound waves into electrical signals, and electrical signals into sound waves. Such signals when conveyed through telephone networks — and often converted to electronic

[47] *Op. cit,* Drs. Makoeri Jasin, page. 194.

and/or optical signals — enable nearly every telephone user to communicate with nearly every other worldwide.

B.3.3.2. Telephone System

A traditional landline telephone system, also known as "plain old telephone service" (POTS), commonly handles both signaling and audio information on the same twisted pair of insulated wires: the telephone line. Although originally designed for voice communication, the system has been adapted for data communication such as Telex, Fax and Internet communication. The signaling equipment consists of a bell, beeper, light or other device to alert the user to incoming calls, and number buttons or a rotary dial to enter a telephone number for outgoing calls. A twisted pair line is preferred as it is more effective at rejecting electromagnetic interference (EMI) and crosstalk than an untwisted pair[48].

The phone's ringer is connected to the line through a capacitor, a device which blocks the flow of DC current but permits AC current. This constitutes a mechanism whereby the phone draws no current when it is on hook, but exchange circuitry can send an AC voltage down the line to activate the ringer for an incoming call. When a landline phone is inactive or "on hook", the circuitry at the telephone exchange detects the absence of DC current flow and therefore "knows" that the phone is on hook with only the alerting device electrically connected to the line. When a party initiates a call to this line, and the ringing signal is transmitted. When the called party picks up the handset, they actuate a double-circuit switch hook which simultaneously disconnects the alerting device and connects the audio circuitry to the line. This, in turn, draws DC current through the line, confirming that the called phone is now active. The exchange circuitry turns off the ring signal, and both phones are now active and connected through the

[48] www.en.wikipedia.org/telephone accessed Friday, March 12, 2010

exchange. The parties may now converse as long as both phones remain off hook. When a party "hangs up", placing the handset back on the cradle or hook, DC current ceases to flow in that line, signaling the exchange to disconnect the call[49].

Calls to parties beyond the local exchange are carried over "trunk" lines which establish connections between exchanges. In modern telephone networks, fiber-optic cable and digital technology are often employed in such connections. Satellite technology may be used for communication over very long distances.

In most telephones, the transmitter and receiver (microphone and speaker) are located in the handset, although in a speakerphone these components may be located in the base or in a separate enclosure. Powered by the line, the transmitter produces an electric current whose voltage varies in response to the sound waves arriving at its diaphragm. The resulting current is transmitted along the telephone line to the local exchange then on to the other phone (via the local exchange or a larger network), where it passes through the coil of the receiver. The varying voltage in the coil produces a corresponding movement of the receiver's diaphragm, reproducing the sound waves present at the transmitter.

C. Quantum Physics

Quantum physics is study about matter and radiation at atomic level. Today phenomena are about particle and wave debate. Particle was in some place at some time. Wave, for example sound wave, it spread around space. At atomic level, this difference is not valid. Electron known as particle could be like wave. As well as light known as wave, its half act just could be explained when it became particle, well known as photon. This wave-particle

[49] *Ibid*

characteristic or researcher say “duality” only could be explained through quantum physics.

Begin with Max Planck constant theory where he divided light become to be small particle named quanta[50]. Then he determined unit energy on symbol *E*, to each quantum which is related to its frequency, *f*. the pattern is $E = hf$ where *h* is new mathematic constant in nature. Max Planck theory explained that all things energy in the world distributed on each atom. And every atom could radiate electromagnetic radiation in quanta shape[51].

Max Planck theory disturbs Einstein. Then, he tried to pick Planck theory and applied it on his that light was spread as small particle. This is the basic theory of photoelectric effect, where electricity poured on electric combination when radiate light on metal plate and metal electron on it going to move and became electricity. This particle named as photon, then[52].

Before light theory was discovered by Einstein, scientist only knew that light is kind of wave. But, after Einstein, it is also mentioned as particle. In the beginning of 1920, France scientist, Louis de Broglie appeared with his theory of electron which is considered as particle also could be wave and particle. Mean, he said that all things considered as both wave and particle, even human and vas, although both wave characteristic is not visible because both had heavy mass[53].

The collaboration of those theories De Broglie with his electron theory, Einstein photon, Planck constant created Quantum, it is universal. This explained that on quantum reality wave and particle both were related and same[54].

[50] *Loc. cit*. Alan Isaacs BSc, page. 354.
[51] *Loc. cit*, John Gribbin, page. 15-16.
[52] *Loc. cit*, John Gribbin, page. 16-17.
[53] *Loc. cit*, John Gribbin, page. 26.
[54] *Loc. cit*, John Gribbin, page. 26.