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தகவல் தொழிநுட்பத்திற்கான ஒரு வழிகாட்டி

A GUIDE TO INFORMATION TECHNOLOGY

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THE EVOLUTION OF THE ELECTRONIC COMPUTER

Dr. N.W.N. Jayasiri, Director MIS, National Institute of Business Management.

The present day electronic computer has an important characteristic which differentiates if from other machines.

While most machines are designed for specific tasks, for instance the motor car for travel on land, and the air craft for air travel, the computer can perform variety of tasks. It can help businessmen to keep accounts, scientists to model complex phenomena, architects to design buildings, engineers to design machinery, artists to draw pictures, children to learn school subjects, and even musicians to compose music.

Another characteristic which places the electronic computer above other machines is its phenomenal progress since its invention in 1946.Its speed and capacity have risen to awesome levels during its brief history while its size and price have declined in manner unprecedented in any other known product.

Mankind owes much to many individuals, among them mathematicians, scientists, and engineers who have contributed to its's development and businessmen who have made it an affordable commercial product.

Early History

It is interesting to look back at the machines that were the predecessors of the electronic computer. One of the first known is the " adding machine" developed in 1642 by French scientist and philosopher Blaise Pascal.

In the early 1800's, Charles Babbage, professor of mathematics at Cambridge University, England, developed the "difference engine" for the preparation of mathematical tables, such as log tables, to replace the error-prone human "computers" who did such work in his time. Babbage later designed in great detail the " analytical engine" which was a general purpose machine but could not complete it's construction . The "analytical engine" had many of the features of the present - day computer . It had the processing unit, called the "mill" separate from the storage unit.

The analytical engine could perform limitless types of computation. Its designer did not have a specific computation in mind. It would use punched cards as instructions, and it was "programmable". That is, it could be made to do a different computation by changing the punched cards. It was thus a general purpose machine.

The idea of punched cards was borrowed from the textile industry. A French silk weaver, Joseph M.Jacquard in 1801 used a sequence of chained steel punched cards to control the loom. The holes in the cards controlled the position of steel rods which in turn determined whcih weft threads should be lifted above the warp and which remained below. A different sequence of cards would produce a different weave pattern. The holes in the cards made yes/ no selections.

The next major step came in the early 1930's . In Berlin, Germany, a young engineering student Konrad Zuse used electric relays, which were widely used in the telephone industry, as the elements, of his computing machine. The relay resembles an electric bell. When a current is passed through its coil, magnetism is created and an arm is pulled towards the coil. The movement of the arm is made to open or close an electric switch. Zuse's machine used binary arithmetic and his program was punched on rolls of discarded movie film.

The Electronic Computer

Zuse's machine was relatively fast, taking just 5 seconds for a multiplication. At this time, the electronic valve, or vacuum tube as it is called, was widely used as a component in radio receivers. It was invented by Fleming in 1904 as a diode or 'valve' and developed by DeForest in 1906 into a triode which could increase or decrease a current between two electrodes by the application of a small control voltage to a third electrode.

The vacuum tube acts as a switch by the movement of electrons whose mass is almost zero. It was more than 1000 times faster than the best relays which depended on th physical movement of a metal arm.

Although Zuse was convinced that the vacuum tube was the only a availabel way for a higher speed computer, he could not build such a machine becaus the two years it would take was considered far too long by the military.

In America, computing machines were required for aiming of cannons in the battlefield. The cannon was set at a particular angle to aim at a distant target. The angle for the required distance was ready by soldiers from "Firing Tables" on the basis of wind force and direction, air temperature, air density and other factors.

The Firing Table itself was prepared by women "computers" from data collected in test firings. Preparation of a single table involved thousands of computations and took 4 woman years . Each new type of gun required a new table. It was indeed the work for a computing machine that used vacuum tubes.

The first electronic computer was built for this purpose by John W Mauchly a physicist, and Jay Presper Eckert an engineer, at the Moore School of Engineerig, Pennsylvania University. This machine was named Electronic Numerical Integrator and Calculator. ENIAC. It occupied a 50 foot by 30 foot room and used 18000 valves.

Vacuum tubes were notoriously unreliable-they burn out - and a lot of redundancy was built into ENIAC to ensure that it would work even if many components had failed. Because isolation of one defective valve out of 1800 was tedious, section' or boards were constructed each with 20 to 30 valves. A defective section could be unplugged and replaced to reduce repair time, instead of isolating the particular faulty valve.

ENIAC was quite fast, it could do 5000 additions per second, but it had a major disadvantage. In order to get a computer to do a different computation, the program must be changed. The people who gave instructions to ENIAC, the programmers, had to know the wiring diagram of each section.

They had to turn 6000 switches and replug hundreds of wires to change the program, and it took many hours. The problem was that in ENIAC data was fed into the processor, but instructions were outside and lay on the switches and plugged wires.

In 1945 the great mathematician John von Neumann wrote a report proposing the stored program computer. He made a brilliant, yet simple suggestion - instructions are also a form of data: put the instructions into the computer just like data. In this report Neumann set down the main features of the digital computer, which remains the principal model to this day.

Mauchly and Eckert thereafter started the Electronic Discrete Variable Computer, EDVAC in 1946. However professor Maurics Wilkes fo Cambridge University, England, who started the Electronic Delay Storage Automatic Calculator EDSAC in 1947, completed the first stored program computer in 1949, ahead of the EDVAC.

Mauchly and Eckert formed the first computer company, the Eckert-Mauchly Computer Corporation, in 1947 to manufacture the Universal Automatic Computer UNIVAC for the US Bureau of the Census, UNIVAC served the Bureau for twelve years but had taken longer to build than expected and was financial failure for the inventors because numerous items had to be developed for the purpose. Eckert and Mauchly had greatly underestimated the job.

The new electronic computers were powerful, large and very costly. Analysts observed that the entire needs of Britain could be served by three such machines and that of the USA by six.

Commercial production of electronic computers became a success later when IBM which was selling punch card tabulating machines commenced marketing of computers.

Theoretical Work

In addition to the design of von Neumann, important theoretical work that contributed to the development of computers came from the mathematicians Geroge. Boole, 1854, and Alan Turing 1936, both of UK. Boole's work in 1854 on the mathematics of symbolic logic, largely ignored during his time, was to become the tool for analysis and design of complex digital circuits..

Turing who was engaged in code breaking for the war effort, held the view that a computer could be made to imitate the logical thinking of a human being. His code breaking work using machines, manipulated alphabetic characters rather than numbers, and he foresaw that " computing machines" could manipulate any type of symbols and learn from experience just like human beings. The computer could remember and use methods that were successful in the past and avoid those that had failed.

The term computer is now used to refer to a machine rather than a human as in the early days, and conveys a meaning of manipulating numbers. This is because computers were first made for number crunching but computers could as well have started with the manipulation of letters or any other symbols.

The Problem of Software

Although a few companies began to advertise and sell computers, many businesses that installed computers found that their machines were idling for a long time until the necessary programs were developed.

Programs were written as a series of 0's and 1's. Programming required talent in mathematics as well as knowledge of the functioning of complex electronic circuits. Such skills were very rare.

The cost of programming at the time was two to three times the price of the hardware. There was thus much doubt whether the new machine could ever become a popular tool. Who would want such a large and costly machine, and even if someone got it, what could he do with it ?

It became evident that programming should become simpler and programs should be English-like in order to be written and understood easily.

The first high level programming language FORTRAN, Formula Translator, was introduced by IBM. A program written in FORTRAN for a particular computation was first fed as data to another program called the FORTRAN compiler, which converted it into instructions in the form of a series of 0's and 1's.The latter was then executed by the computer to perform the required computaton.

Business companies realized that although FORTRAN was suitable for scientific computations, it was difficult to use for business accounting. The Common Business Oriented Language COBOL was developed to fill this need and became the most widely used language for commercial applications. Many languages have been developed since then for a variety of purposes.

Semiconductors and Integrated Circuits

Silicon material was first used as a semiconductor diode in the crystal- detector radio of Pickard in 1906. It was abandonced because of unreliability.

The Germanium semiconductor transistor invented by Shockley, Brattain and Bardeen in 1947 in the USA was the next major development for the progress of the computer. The transistor was many times smaller, consumed less electricity and was far more reliable than the vacuum tube.Transistors were produced commercially in 1951. Used initially in radio receivers, the term transistor became synonymous with the portable radio . It replaced the vacuum tube as the main element of the electronic computer. As a result,computers became smaller, and more reliable.

The computer that used vacuum tubes came to be referred to as the first generation, and those that used transistors, the second generation. Germanium was soon replaced by silicon as the base material for semiconductors.

An important event that led to rapid expansion of the use of semiconductors was the decision by American Telephone and Telegraph AT & T to share the knowledge of semiconductors with other companies, rather than keep it secret.

The invention by Kilby at Texas Instruments in1958, of the integrated circuit IC, which contained several transistors on one tiny - less than half inch square- chip of silicon started the microelectronics era.

The higher density Metal Oxide Semiconductor Field Effect Transistor MOSFET IC's came to compete with the earlier developed Junction Transistor IC 's in the 1960's

The IC was remarkable.As more and more transistors were packed on an IC, the speed of operation increased and the cost decreased progressively.

Since 1959 through to the present time the number of active devices on a chip has doubled each year. Modern Very Large Scale Integration VLSI memory chips contain over a million transistors.

Space travel and man's landing on the moon would not have been possible without the miniature on- board computers that were manufactured using IC'S.

Microcomputers

High level integration made it possible to place the components of a complete processing unit on a single IC. The first such microprocessor was developed by Intel Corporation in 1970. A computer built around a microprocessor is known as a microcomputer.

The popularity of microcomputers spread when the company Altair of USA marketed computer kits for $ 500. People bought it just for the sake of having one's own computer. This led to a rapid growth in the development of programs by enthusiasts and electronic hobbyists, and the use of computers for a variety of purposes.

Two youngsters who made their own computers with purchased parts then revolutionized the computer industry Stephen Wozniak and Steve Jobs. They set out to make a computer that was cheap and easy to use a computer for every man. Inventing a piece of equipment is one matter, but making it a commercially successful product is another, as witnessed earlier by Eckert and Mauchly. Wozniak and Jobs got the assistance of seasoned businessmen for manufacture and marketing of their new computer. Their Apple Computer introduced in 1977 was a roaring success.

In Britain, Clive Sinclair offered the ZX80 microcomputers for £100 in 1980. IBM introduced its Personal Computer, the PC, based on the Intel 8088 microprocessor in 1983, and later the PC-XT and the Intel 80286 based PC -AT which established the microcomputer as a tool for business as well as home. The design of the IBM PC was available to anyone, and as a result a large number of businesses grew around it, manufacturing components, circuit boards, compatible microcomputers, peripheral equipment, and a variety of ingenious software.

Earlier the XEROX Corporation of USA, known for the development of the photocopiers, saw the potential of the electronic computer and set up a research team at their Pao Alto Research Center PARC to develop easy-to-use computers. Much of the inventions of XEROX lay dormant because of high production costs until Steve Jobs went there looking for simple methods of computer use for his second generation Apple Computer. He made use of the developments of XEROX and the 'mouse' pointing device of Doug Engelbart in his new computer, the Apple Macintosh. The Macintosh was a major innovation. A user could operate it without command words simply by moving the pointer to symbols of the screen, known as icons, and clicking a button on the mouse. The operation of a computer had become child's play.

The microcomputer industry grew into a multi-billion dollar business in a few years and many entrepreneurs became millionaires almost overnight. There were also numerous others who set up businesses that collapsed equally fast.

Computer industry giants such as Digital Equipment Corporation, Wang, Control Data Corporation, and even IBM itself came to be seriously threatened by the pervasive dominance of the PC.

Communications and Networking

Telecommunication services move information and computers manipulate information, and there is thus a close relationship between telecomunications technology and computer technology. Telecommunication facilities began to be used in the early days of electronic computers for the connection of remote terminals, and later for communication between computers or what is called networking of computers. Communication facilities have become available for data transmission purposes within countries as well between countries.

In many business establishments microcomputers within a room or building are connected together to form a Local Area Network in order to share resources. Networking is becoming increasingly popular and it is expected that most computers will be networked in some way or other.

The Computer and the Human Brain

Ever since its invention, journalists and dramatists have compared the electronic computer to the human brain and beyond.

Research that probes the possible imitation of human reasoning by computers is known as Artificial Intelligence, AI. Two particular lines of study in AI are the translation of text from one natural language to another, and the development of "expert systems" to imitate doctors and other specialists. Although the later has been somewhat successful and expert systems are available for several tasks, efforts towards natural language translation have been faced with formidable problems.

It appears that the processes by which one human being understands the verbal or written communication of another have been largely under rated. We attach different meanings to a word or phrase depending on the context.We also make use of a very large store of background knowledge to understand what someone else tells us.

Recognition of handwriting , sounds and speech, and recognition of objects through vision, have likewise proved to be highly complex and require very powerful computing resources.

Artificial Intelligence is the next frontier for rcomputer scientists. Advances in electronics and optics indicate that many of the limitations of hardware will be overcome in the near future. It may be recalled that Turing himself considered the manufacture of a human-like computer to be well within our reach.

SATELLITE COMMUNICATIONS FOR THE 21ST CENTURY

Communications have been evolving with the advent of mankind. Various techniques have been discovered and adopted in the past for communications. With the technical and scientific innovations, the communication skills also have developed further. Whilst peering through the pages of our ancient history it was distinctly proved that people used drums, birds, poems, hooting and other methods as modes of communications in Sri Lanka. The drums are being used in villages for communication purposes even at present. The book, "Selalihini Sandesaya" is an example where the services of birds have been obtained for communication purposes.

With the invention of electricity and the radio waves by Marconi 95 years ago, the scientists and engineers have invented modern communication technologies such as telephone, radio, television, telex, etc.

With new developments the inter-continental usage of radio telephones and television has been a problem as the systems proposed at that time were very costly. Also the methods adopted to have these services were subjected to natural disasters such as earthquakes, cyclones, floods, etc. Therefore, scientists and engineers were looking for alternative methods for communication between continents.

In 1945, Dr. Arthur C Clarke had written an article to the "WIRELESS WORLD" expressing his opinion on usage of geo-stationary orbit which is 35,786 km. away from the earth's surface for communication purposes. (fig. 1) He has further said using 3 positions in the geo-stationary orbit the entire globe could be covered for communication purposes. In the same article he has further elaborated his views on usage of 3 orbits viz. geo - stationary orbit, polar orbit and elliptical orbit for the use of communication satellites. (fig. 2)

With the invention of transistor the hardware used for telecommunication purposes has developed rapidly. During the Second World War period microwaves were invented and used on radar applications. The rocketry was invented by the Germans. These inventions have led to the development of satellite technology.

As a result of extension research and development work in 1957, the Soviet Union launched a satellite named SPUTNIK 1 into space. Subsequently, in 1958, the United States also launched a satellite into space.

The first geo-stationary orbit satellite was launched in 1961 and this was a great achievement in the field of communications. The international organisation called INTELSAT (International Telecommunications Satellite Consortium) was formed to improve the communication techniques in the world. In 1965, the first geo-stationary satellite was launched by INTELSAT and used for television broadcasts and for communication purposes. (fig. 3) Subsequently, INTELSAT has launched a few more satellites with the introduction of new superior technological advances.

In Sri Lanka first earth station for satellite communication was established at Padukka by the Department of Telecommunications in 1975. Two more earth stations belong to Sri Lanka Telecom and few private earth stations have been added since then.

The main features of a satellite are the receiving antennas, transmitting antennas, solar panels and the transponders. The standard life-span of a satellite is considered as 10 to 12 years, but the manufacturers' recommended life-span would be 3 to 5 years. The source of energy to the satellites are from batteries made out of nickel cadmium or nickel hydrogen. In the space, the temperature can vary from 100^0 c to 256^0 c and new materials have been developed to protect the eletronics inside the satellites.

For the television broadcast using satellite only one earth station is required on the earth surface but for telecommunication purposes a minimum of 2 earth stations are required. When transmitting television broadcasts, the transponder is capable of sending spot beams for specific locations which requires high-powered signals. This technique has been developed to concentrate the signals only to thickly populated areas and also to avoid covering the sea surface. (fig. 4)

The power of the signal is defined by a unit called decibel. The fig. 4 shows the spot beam pattern for ASIASAT II on the earth's surface.

When a satellite transmits a beam it is considered that the signal comes from an infinite range. Hence the signals are received through a parabolic dish antenna. The signals that are falling on to the parabolic dish reflects and concentrate at the focal point of the dish. Another accessory named feed horn collects concentrated signal and sends it through a low-noise blockdown converter to reduce the frequency to a lower range through a coaxial cable. This signal is transmitted to the receiver which converts the signal into a television signal. The following frequencies are being commonly used in the satellite broadcast systems:-

1.	Ku band	12	-	14 Ghz
2.	C-band	3.4	-	4.7 Ghz
3.	S.band	1.545	-	2.69 Ghz

Due to rain attenuation there is an energy loss in using Ku-band signals in tropical countries. Therefore in the tropical countries C-band and S-band are commonly used in satellite communications.

In the US and Japan certain institutions have already developed antennas with flat surfaces. These antennas have already been fitted on airplane surfaces for communication purposes while in the air. Portable Satellite Communication kits are now available with IDD facilities.

DATA TRANSFER USING SATELLITES

There are many applications in the usage of satellites for communication purposes. Very Small Aperture Terminal technology is quite popular in large countries such as USA, India and in the Soviet Union. India has 600 V-SAT terminals all over India connecting main information centres of the country and these information centres have been connected to the main hub in New Delhi where the communication is done through their own satellite named INSAT. The V-SAT technology is heavily used in commercial applications such as banking and trading, as the information from various places could be obtained through the computers using this technology. With the development of fibre optics and advanced satellite technology, a new concept called "Communications Highways" has been put forward by technologists and researchers.

LOW EARTH-ORBITING SATELLITES

This article has so far concerned geo-stationary satellites and their applications for telecommunication but it has certain drawbacks as the message takes about a 1/4 second to travel to the satellite and to return to the earth station. Because this time delay it is difficult to converse with another user who has access to the earth station in another country. Therefore the new concept of using low earth-orbiting satellites for telecommunication purposes has now been introduced. Under this system satellites will be kept about 600 miles away from the earth's surface. (fig. 5)

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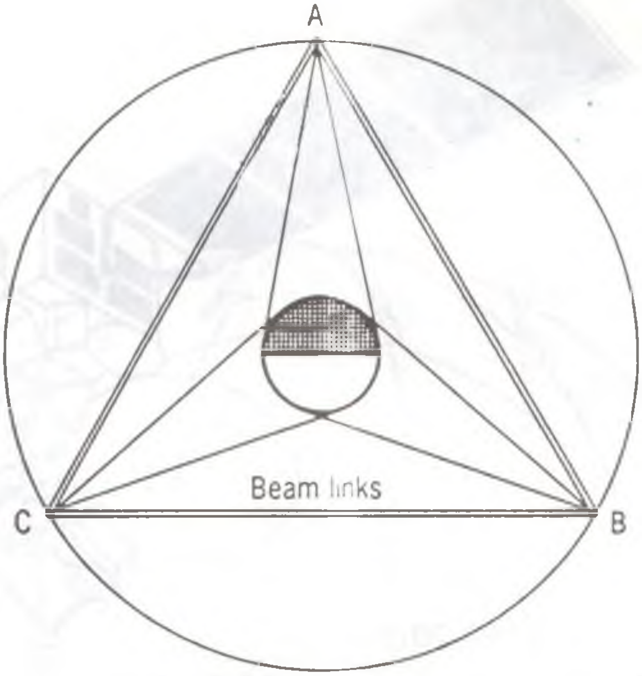


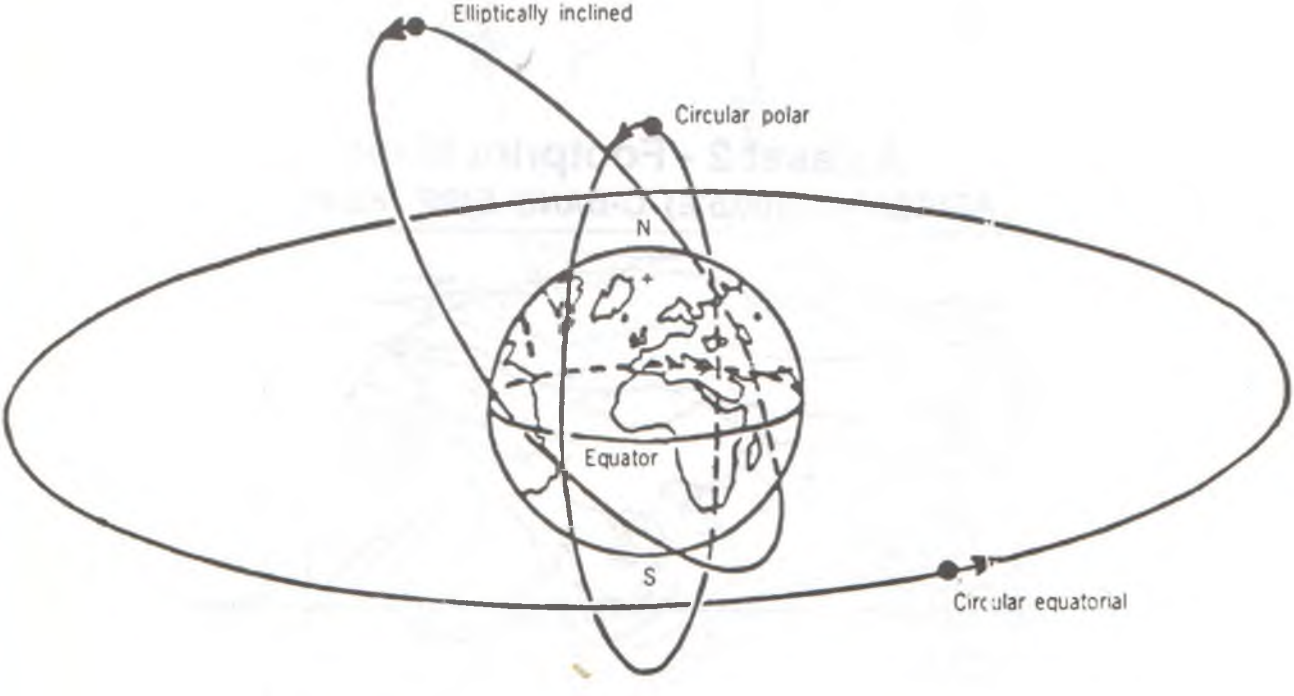
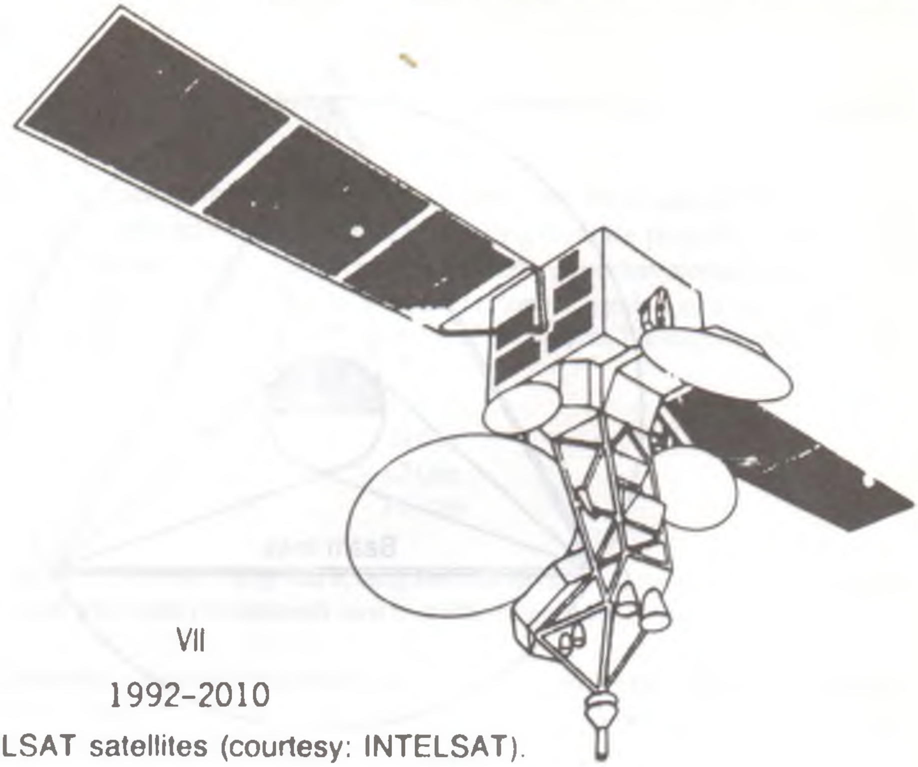


Figure .2. Arthur Clarke's three basic orbits.



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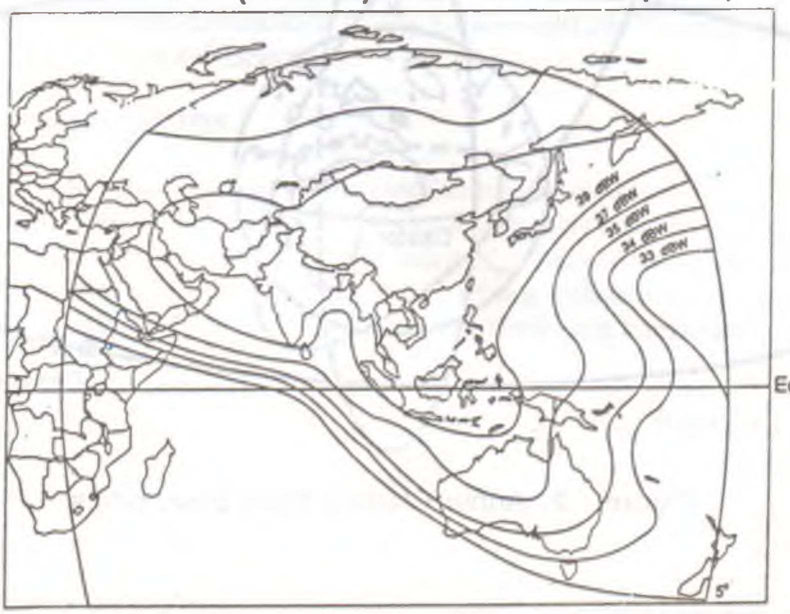
1992–2010

INTELSAT satellites (courtesy: INTELSAT).

Asiasat 2 - Footprint Maps

ASIASAT-2 (100.5°E) - C-BAND EIRP (dBW)



21 වන සියවස - චන්ද්‍රිකා සන්නිවේදනය

සන්නිවේදනය මිනිස් ඉතිහාසය තරම්ම පැරණිය. කාලයත් සමඟම සන්නිවේදන ක්‍රමද දියුණු වෙමින් පවතී. මනුෂ්‍ය වර්ගයාගේ තාක්ෂණ පිළිබඳ නව සොයා ගැනීම් සමගම රටවල් අතර සන්නිවේදනය වඩාත් ප්‍රගුණ කිරීමට විටින් විට සන්නිවේදනයේ නව සොයා ගැනීම් සිදුවිය.

අතීතයේදී අප පැරණි රාජ්‍ය තාන්ත්‍රිකයන් බෙර, පක්ෂීන්, සංදේශ, විරිදු, හූ හඬ, කැමුර ගැසීම් සහ වෙනත් නොයෙකුත් ක්‍රම භාවිතා කළ බව මේ පිළිබඳව කරනු ලබන විමර්ශනයකදී පෙනී යයි. බෙර වයා පණිවුඩ දීම තවමත් අප රටේ ගම්බද ප්‍රදේශවල භාවිතා වේ. සැළලිහිණි සංදේශය පක්ෂීන් භාවිතය පිළිබඳ නිදර්ශණයක් වේ. තවද විපතකදී හෝ හදිසි උවමනාවකදී අදත් අපේ ගැමියා හූවකින් එම අවශ්‍යතාවය ඉටු කර ගනී.

මිනිසාගේ නව සොයාගැනීමක් වන විදුලිය භාවිතය නිසා නව සන්නිවේදන ක්‍රම සඳහා දුරකථනය, ගුවන්විදුලිය, රූපවාහිණිය, ටෙලෙක්ස් සහ ඉලෙක්ට්‍රොනික් මේල් ක්‍රම සොයා ගන්නා ලදී. වසර 95කට පෙර මාර්කෝර්නි විසින් රේඩියෝ තරංග සොයා ගැනීමත් සමඟ ගුවන් විදුලිය නව සන්නිවේදන ක්‍රමයන්ට ඉමහත් රුකුලක් විය. දුරකථනයද සන්නිවේදනයේ ලා තවත් ප්‍රබල උපකරණයක් විය. මෙම සොයාගැනීමත් සමග කම්බි මාර්ගයෙන්ද, ගුවන් විදුලි තරංග මඟින්ද නවීන සෙලියුලර් දුරකථන සඳහා මයික්‍රෝ (MICRO) තරංග භාවිතයෙන්ද දුරකථනයට නවීන ක්‍රම යොදා ගැනුනි.

එහෙත් දුරකථන සේවා, රූපවාහිණි සේවා අන්තර් ජාතික ලෙස භාවිතයට ගැනීම ඉතාම වියදම් අධික ක්‍රියාවක් විය. එසේම මෙම සේවා නොයෙකුත් ස්වාභාවික හේතූන් නිසා (සුළි සුළං, භූමිකම්පා, ජලගැලීම්) සමහර අවස්ථාවන් හිදී අඩපණ වීමට අවස්ථාද ඇත. මේ නිසා විද්‍යාඥයින් මුළු පෘතුවියටම සන්නිවේදන ක්‍රම ලබාදීමට සුදුසු ක්‍රම සෙවීමට යුහුසුළු වූහ.

1945 දී ආතර් සී ක්ලාක් මහතා විසින් වයර්ලස් වර්ල්ඩ් යන සඟරාවට ලියූ ලිපියක් මඟින් භූ ස්ථායි (GEOSTATIONERY) කක්ෂයක (කි.මී. 35,786 පෘතුවි පෘෂ්ඨයේ සිට) ස්ථාන තුනක අභ්‍යාවකාශ ස්ථාන තුනක් මඟින් මුළු පෘතුවි ගෝලයම සන්නිවේදන මාධ්‍ය සඳහා යොදා ගත හැකි බව ප්‍රථමයෙන් ප්‍රකාශ කලේය. (රූප අංක 1 බලන්න) එහෙත් එවකට ඉලෙක්ට්‍රොනික විද්‍යාව නොදියුණුව තිබූ බැවින් ඒ මහතා මිනිසුන් මඟින් ක්‍රියා කරවන අභ්‍යාවකාශ මධ්‍යස්ථාන තුනක් මේ පිළිබඳ යොද ගැනීම සුදුසු යැයි සිතීය. එමෙන්ම එම ලිපිය මඟින් ඔහු චන්ද්‍රිකා සඳහා යොදා ගත හැකි ප්‍රධාන කක්ෂ තුනක් පිළිබඳව අදහස් තවදුරටත් පළකලේය. (රූප අංක 2 බලන්න) පසුව ඉලෙක්ට්‍රොනික තාක්ෂණයේ ට්‍රාන්සිස්ටරය සොයාගැනීමත් සමඟම තාක්ෂණ ක්‍රම වෙනස්ව නව මඟකට පිවිසුණි. මෙම වැදගත් අදහස ක්‍රියාත්මක කිරීමට විද්‍යාඥයින්ට වසර ගණනාවක් ගතවිය.

මේ අනුව චන්ද්‍රිකා අභ්‍යාවකාශ ගතකිරීම 1957 දී සෝවියට් දේශය අභ්‍යාවකාශ ගත කළ ස්පුට්නික් 1 "SPUTNIK 1" යන චන්ද්‍රිකාවෙන් ආරම්භ කලේය. 1961 දී පළමු භූ ස්ථායි චන්ද්‍රිකාව අභ්‍යාවකාශගතකිරීමත් සමඟම තවත් පියවරක් ඉදිරියට තැබීය. ආතර් සී ක්ලාක් මහතාගේ අදහස මත පර්යේෂණ කළ ඇමෙරිකානු ඉංජිනේරුවන් සහ විද්‍යාඥයන් 1965 පළමුවන භූ ස්ථායි (GEOSTATIONERY) සන්නිවේදන චන්ද්‍රිකාව අභ්‍යවකාශගතකොට රූපවාහිණී විකාශනය සඳහා භාවිතා කරන ලදී.

මෙම අභ්‍යවකාශගතකිරීම් කරන ලද්දේ INTELSAT (INTERNATIONAL TELECOMMUNICATIONS SATELLITE CONSORTIUM) සමාගම මගිනි. ඉන්පසු 1967 - 1975 දක්වා කාලය තුළ චන්ද්‍රිකා 5ක් කක්ෂගත කොට තිබුණි. (රූප අංක 3 බලන්න) ලංකාවේ ඉන්ටෙල්සැට් චන්ද්‍රිකා මඟින් පණිවුඩ හුවමාරුව සඳහා පළමු චන්ද්‍රිකා පණිවුඩ හුවමාරු මධ්‍යස්ථානය 1975 දී පාදුක්කෝ පිහිටුවන ලදී. මීට පසුව තවත් පෘතුවි පණිවුඩ හුවමාරු මධ්‍යස්ථාන කීපයක් පණිවුඩ ජාලයට එක් වුනි.

සන්නිවේදන චන්ද්‍රිකාවක ඇති ප්‍රධාන අංගෝපාංග ලෙස පණිවුඩ ලබා ගැනීමට ඇති ඇන්ටෙනාත්, සූර්යතාපයෙන් ශක්තිය ලබන විද්‍යුත් කෝෂ, පණිවුඩ විසුරුවා හැරීමට ගන්නා TRANSPONDER නම් උපකරණ කැමරා සහ කක්ෂය වෙනස් කිරීමට භාවිතා කරන අධිපීඩන උපකරණ සැලකිය හැක. පෘතුවියෙන් මතුපිට මධ්‍යස්ථානයෙන් (EARTH STATION) ලැබෙන පණිවිඩ ඇන්ටෙනා මගින් ලබාගෙන සම්ප්‍රේෂණය කිරීමට ට්‍රාන්ස් ෆොන්ඩරය (TRANSPONDER) භාවිතා කරයි. පෘතුවියෙන් 2/3 ක් පමණ ජලයෙන් වැසී තිබීම නිසා සෑම ප්‍රදේශයටම සම්ප්‍රේෂණය කිරීමත් අත්‍යවශ්‍ය වේ. මේ නිසා සම්ප්‍රේෂණ කටයුතු කිරීම සඳහා වෙනත් බලයක් යොදාගනු ලබයි. මෙය හඳුන්වනුයේ ඩෙසිබෙල් (dB) යන ඒකකයෙනි. මෙම පණිවිඩ හෝ රූවාහිණි දර්ශණ සම්ප්‍රේෂණය කරනුයේ මයික්‍රෝවේ තරංග භාවිතා කොටය.

මෙම සම්ප්‍රේෂණ පෘතුවිය මත පතිත කරවීමේදී වැඩි බලයක් අවශ්‍ය ස්ථානවලට ඒ අවශ්‍ය ප්‍රමාණය ලබා දිය හැක. මේ නිසා චන්ද්‍රිකාවේ බලශක්තිය ඉතිරි කිරීමත් ඒ සමඟ චන්ද්‍රිකාවේ පැවැත්වීමේ කාල සීමාව දීර්ඝ වීමත් සිදුවේ. අප හට බීබීසී, ස්ටාර් යන රූපවාහණී සේවාවන් ලැබෙන ඒෂියා සැට් (AISA-SAT) චන්ද්‍රිකාවේ සම්ප්‍රේෂණ තරංග සීමාවන් 4 වන රූපයෙන් දැක්වේ. (රූප අංක 4 බලන්න)

ඒවා නැවත පෘතුවි මතුපිටදී රැස් කිරීමට පාරාවලයක හැඩය සහිතව දීසි ඇන්ටෙනාවන් (DISH ANTENNA) භාවිතා කරනු ලබයි.

රූපවාහිණී මාධ්‍ය සම්ප්‍රේෂණයේදී මයික්‍රෝ තරංග වර්ග 3 ක් භාවිතා කරයි.

Ku Band	12	-	14	GHZ
C Band	34	-	47	GHZ
S Band	1. 545	-	2.69	GHZ

මෙම වර්ග තුනෙන් Ku Band ඇති තරංගවල ශක්තියට වැසි සහිත කාලගුණය වඩාත් බලපායි. මේ නිසා සම්ප්‍රේෂණය දුර්වල විය හැක. මෙම කාණ්ඩයට අයත් තරංග ඝර්මකලාපික (TROPICAL) රටවල් සඳහා යෝග්‍ය නොවේ. ලංකාව ආශ්‍රිත රටවල් සඳහා වඩා යෝග්‍ය වන්නේ C සහ S Band මයික්‍රෝතරංග භාවිතයයි.

දීසි ඇන්ටෙනාවට (DISH ANTENNA) මෙසේ ලැබෙන තරංග, නාභිය මත ඒක රාශිවේ. එහි නාභියේ තබා ඇති LOW NOISE AMPLIFIER නැමැති උපකරණයෙන් එය අඩු සංඛ්‍යාත තරංග වලට පරිවර්තනය කරයි. ඉන්පසු රිසීවරය මගින් රූපවාහිනී තරංග වලට හරවයි.

ඉදිරි අනාගතයේදී දීසි ඇන්ටෙනා වෙනුවට සමතලා මතුපිටක් සහිත (FLAT SURFACE) ඇන්ටෙනා භාවිතා කිරීමට විද්‍යාඥයින් කටයුතු කරයි. මෙම ඇන්ටෙනා වර්ග දැනටමත් ගුවන් යානා මතුපිට සවිකොට ඇත. තවත් ඇන්ටෙනා වර්ග සූට්කේසයක මතුපිට හැඩයට තනා ඇත. ඒවා කෙතරම් කුඩාද කිවහොත් අතේ ගෙන යන කුඩා බෑගයක් සේ තමන්ට රිසි තැනකට රැගෙන ගිය හැක.

චන්ද්‍රිකා මගින් දත්ත හුවමාරුව සහ පණිවුඩ හුවමාරුව

මේ සඳහා පෘතුවි ස්ථාන (EARTH STATION) 2ක් ස්ථාන දෙකක පිහිටි චන්ද්‍රිකාව හරහා පණිවුඩ හුවමාරු කරගනී. මෙම පණිවුඩ රටක ඇති දුරකථන පද්ධතියට යා කළ හැක. එමෙන්ම ෆැක්ස් යන්ත්‍ර පණිවුඩ, ඉලෙක්ට්‍රොනික් මේල් ක්‍රම , කොම්පියුටර් දත්ත හුවමාරුව පහසු වේ.

දැනට විශාල රටවල් වල දත්ත හුවමාරුව (DATA TRANSFER) සඳහා භාවිතා කරණ එක් ක්‍රමයකි. (VSAT) තාක්ෂණය. මෙය (VERY SMALL APPERTURE TERMINAL) යනුවෙන් හඳුන්වයි. චන්ද්‍රිකාව ඇසුරෙන් රට පුරා ඇති මධ්‍යස්ථාන මගින් කෘෂිකර්මාන්ත, ජනගහණය, නිෂ්පාදනය යනාදී අංශ පිළිබඳව එක් එක් මධ්‍යස්ථාන එකතු කොට ඇති තොරතුරු සහ දත්ත හුවමාරු කිරීමට අවකාශ ලැබේ. මෙම ක්‍රමය දියුණු රටවල වාණිජ බැංකු ක්‍රමවත් කිරීමටත් රටේ ඇති සම්පත්වල දත්ත ඒකරාශි කිරීමටත් ඉතා යෝග්‍යමත් වේ.

මෙවැනි තාක්ෂණික ක්‍රම භාවිතයෙන් අනාගතය සඳහා ඉදිරිපත් කර ඇති සන්නිවේදන මහාමාර්ග (COMMUNICATION HIGHWAYS) යන මතය යථාර්තයක් බවට පත්වීමේ සාධක මතුවෙමින් පවතී.

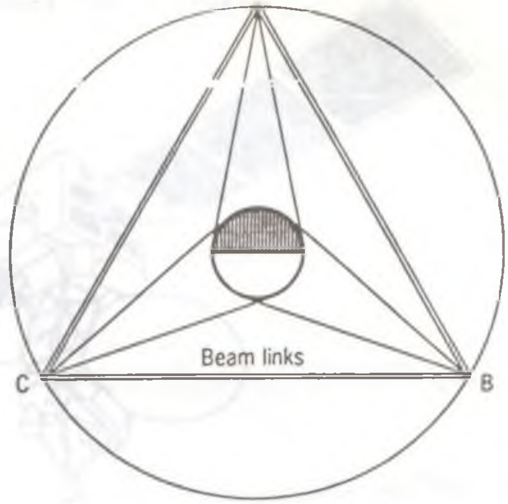
LOW EARTH ORBIT චන්ද්‍රිකා මගින් සැලසුම් කර ඇති MOBILE දුරකථන සේවා

මීට පෙර ඉදිරිපත් කරන ලද්දේ භූ ස්ථායි චන්ද්‍රිකා මගින් අපට ලබාගත හැකි සේවා පිළිබඳ විස්තරයකි. ඉදිරියේදී සැලසුම් කර ඇති අති පුළුල් දුරකථන සේවා පද්ධති දෙකක් පිළිබඳ සුළු වශයෙන් හෝ සඳහන් කිරීම අත්‍යවශ්‍ය යැයි හැගේ.

චන්ද්‍රිකාවක් පෘතුවි භූ ස්ථායි (GEOSTATIONARY) කක්ෂය වටා භ්‍රමණය කොට පණිවුඩ හුවමාරුවක යෙදවීමේදී, මයික්‍රෝවේව් තරංග පෘතුවි පෘෂ්ඨයේ සිට චන්ද්‍රිකාව වෙත යෑමට තත්පර 1/4 ක වේලාවක් ගතවේ. ඒ නිසා දුරකථන භාවිතයේදී දුර්වල කරුණක් ලෙස මෙය පෙනී යයි. මේ නිසා විද්‍යාඥයින් තවත් කක්ෂයක ගමන් ගන්නා LOW EARTH ORBITING චන්ද්‍රිකා පිළිබඳව අදහස් ඉදිරිපත් කළහ. මෙහිදී චන්ද්‍රිකා ගමන් ගනුයේ සැතපුම් 600ක් පමණ පෘතුවි පෘෂ්ඨයට ඇතිනි.

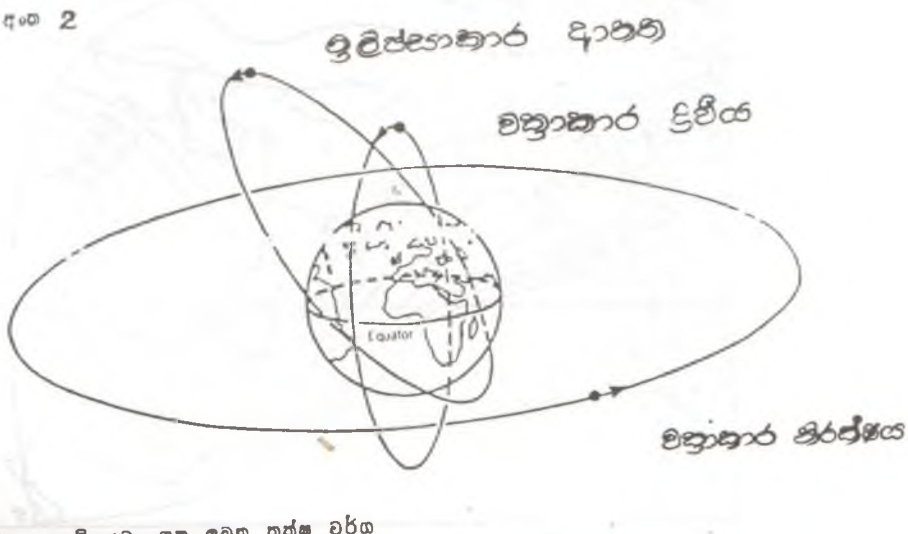
එමෙන්ම සෑම රටක්ම ආවරණය කිරීම සඳහා රූපයේ පෙනෙන අයුරින් (රූප අංක 5 බලන්න) චන්ද්‍රිකා විශාල ප්‍රමාණයක් අභ්‍යාවකාශගතකිරීමට සැලසුම් කොට ඇත. එක් සමාගමක් මගින් චන්ද්‍රිකා 77 ක් මේ සඳහා භාවිතා කිරීම නිසා ආවර්තිතා චක්‍රයේ ඇති මූලද්‍රව්‍ය ප්‍රමාණයට සම වීමෙන් එයට IRRIDIUM යන නම භාවිතා කරනු ලබයි. මෙම ක්‍රම දෙක මගින්ම මුහුදේ හෝ ගොඩබිමේ ඕනෑම ස්ථානයක සිට උපකරණ කට්ටල ඇති ඕනෑම අයකුට කථා කළ හැක. ෆැක්ස් පණිවුඩ හෝ ඉලෙක්ට්‍රොනික මේල් ක්‍රමයක් පිළිබඳ පහසුකම් මෙම චන්ද්‍රිකා මාර්ගයෙන්ම ලබාගත හැක.

පද්මසිරි ද අල්විස්
නියෝජ්‍ය අධ්‍යක්ෂක
ආතර් සී ක්ලාක් මධ්‍යස්ථානය.



ආතර් සී ක්ලාක් මහතාගේ අනාවැකිය

රූප අංක 2

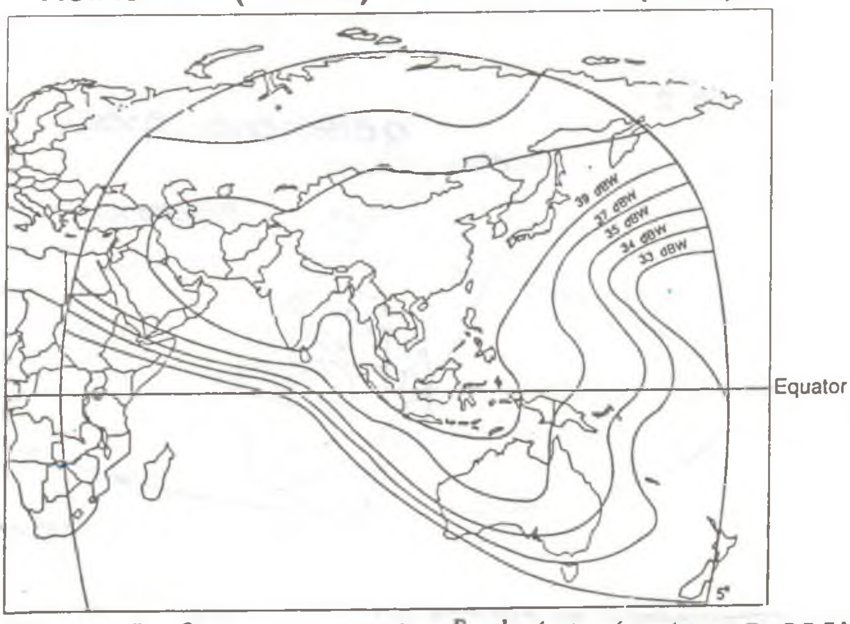


චන්ද්‍රිකා භාවිතයට ගනු ලබන කක්ෂ වර්ග

ඉන්ටෙල් IV සැටි චන්ද්‍රිකාවේ රූප සටහන

රූප අංක 03

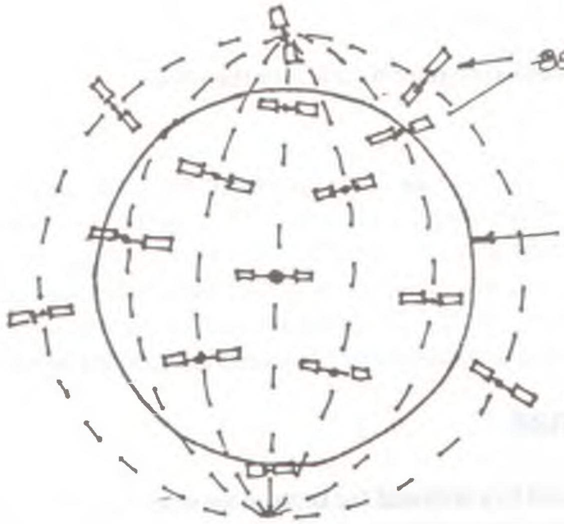
ASIASAT-2 (100.5°E) C-BAND EIRP (dBW)



ඒෂියා සැටි 2 (ASIA-SAT) සම්ප්‍රේෂණ මුද්‍රණය (FOOT PRINT)

රූප අංක. 4

රූප අංක 5



LEO චන්ද්‍රිකා මගින් සන්නිවේදනය සඳහා සැලසුම් කර ඇති චන්ද්‍රිකා පද්ධතිය

The Text book of the 21st Century

Imagine a student inserting a Credit card-like piese of plastic in to a high-resolution, flat-screen holder the size of a paperback book. He selects the size, face and color of the type he wishes to read and pushes a button to turn the "pages." with just a touch he can obtain a definition or explanation of any word or phrase on the screen, or he can rotate a crystalline structure or the spiral helix of DNA to predict the outcomes of physics experiments or to see the airflow patterns created by an eagle's wings.

This is not a fantasy. It could well be a glimpse inti the textbook of the future. More than just an electronic or Multimedia tool, the textbook of the 21st Century will be process-oriented, with volatile, man, manipulable contents, and a knowledge base that cAn be endlessly updated and customized. Definitely not a textbook for the passive learner.

Today, of course the, the basic instructional tool is still the traditional paper textbook-sometimes accompanied by a computer diskette containing exercises for examples. Often these ancillaries computerize a task that might be done just as easily with paper and pencil. They don't begin to take advantage of some of the most exciting possibilities of electronic textbooks: simulation, multimedia construction and collaboration.

Certainly print has its limitations. It is static, it is linear, and has a knowledge base, it is very thin: if you want to know more about a particular subject, you can't get hold of further explations or illustrations without leaving the book and going to another source. Thats why it is so important to add electronic media to the tools used in the classroom, although admittedly the process isn't always as fast or smooth as we might like. The technology is always many steps ahead of the ability of educational intitutes to absorb and exploit it.

> ***" In the Information age, a diverse educational experience will be the critical foundation for success. What tomorrows students will need is not just mastery of subject matter, but mastery of learnig. Education will not be simply a prelude to a career, but a lifelong endeavor."***
> ***John Scully - Ex - CEO Apple Computer Inc.***

New Learning Strategies

Simulation, or "situated cognition," as it is sometimes called, is a way of putting learning into a context. Multimedia construction can best be described with the example of a project that is part of a long-term research effort called Apple Classrooms of Tomorrow. The project, called "Sun of Heaven," consits of a deep-content database about the history of china. It enables high school kids who are studying China to prepare multimediaconstructions on a topic of special interest instead of traditional term papers.

The projects database contains not only the complete contentsof a textbook on Chinese history, but also a collection of videos and still shots of Chinese artifacts that span more than two thousand years. Stiudents used the Macintosh to search this rich database for words, images and sounds that would be relevant to their topic. Ultimately, the students combined all of these resources into a multimedia presentation. The results were impresive, but more importantly, the process was both engaging and instructive.

The thired learning strategy that tomorrow's textbooks will encourage is collaboration. Electronic networks have already changed the ways that students and scholars work and interact. Collective authorship of scientific papers is now the rule, as the researchers in farflung laboratories share data and ideas on a daily or even hourly basis. These electronic messages constitute a continuous dialog that may eventually take the place of scholarly journals.

In the same way, textbook authors (as well as adopters of textbooks) may go on-line to update, revise, and improve their own and others books on a continuous basis, adding new perspectives and enhancing documentation.

Smaller, Cheaper and Smarter

To realize the textbooks of tomorrow, we will need to make our computers smaller, cheaper and smater. Miniaturization is vital to educational computing, precisely because we need a mix of technologies in our classrooms.

Miniaturization gives us a CD-ROM Atlas without sacrificing the globe, and it gives us a multimedia lesson on Beethoven without sacrificing the piano in the corner of the room. As the hardware shrinks, so-over time-will the price.

But making the machines smaller and cheaper won't get us far if we don't also make them smater. As long as instructional technologies remain delivery vehicles, learners will remain passive. We mustn't get so caught up in the glitz of these entertaining delivary systems that we become satisfied with a passive envirinment.

Janaka Perera, Manager Training,
Wijeya Graphics (Pvt) Ltd.