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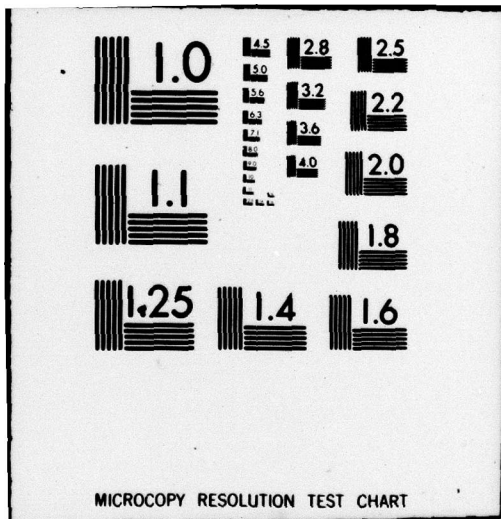
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THE IMPORTANT FUNCTIONS OF ELECTRONIC
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By

Chang Li-ch'ien



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THE IMPORTANT FUNCTIONS OF ELECTRONIC
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Discussing Science
with Young People



The Important Functions of Electronic
Technology in Aviation and Space
Technology

Chang Li-ch'ien

The electronic technology is a branch of scientific technology that is strongly active, rapidly developing, and is widely used in our time. This technology penetrates deeply into various domains of natural sciences, and touches different aspects of the national economy, production, and our living activities. When the advanced electronic technology is applied to the modernized industries, agriculture, transportation, defense, and science, impressive changes will appear. As early as 1956, our great leader and teacher Chairman Mao pointed out that, the level of a nation's electronic technology is an important indicator of its modernization. Our beloved Premier Chou also indicated emphatically that, this is an Electronic Age, rather than an Atomic Age. The working wave lengths of modern electronic technology range from sound waves, shortwaves, microwaves, millimeter waves, to infra red and visible light, and further expand to ultraviolet light, X rays, and gamma radiation. Integrated circuits are now being developed from large scales to super large scales. A super large-scale integrated circuit can make over ten thousand gate circuits in one square millimeter of a silicon chip. It is estimated that the degree of integration will exceed several hundred millions. The automatic control systems that are constructed from small-volume, low-cost microprocessors and microcomputers, can be used in many areas of the national economy, to promote auto-

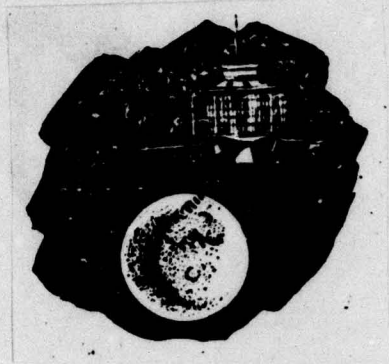
mation of production and management. The application of electronic computers can partially free us from the heavy labor of our brains. We expect that, when communication is automated in the 21 st century, we will be able to store all the knowledge of mankind in the storage systems of electronic computers, and we can assure that the communication data that we need will be retrievable in a few seconds. Using a high-efficiency laser as an energetic-bundles weapon to shoot down targets in air has been reported abroad. The possible use of lasers to control the ignition devices for nuclear fusion has been explored, and significant progress has been achieved. The future space solar-powered electric stations will employ microwave technology to transmit electricity to the large, modern industrialized cities on earth. The modern electronic technology is continuously being developed. Its applications will bring about great changes in our social activities. It will lead to another technological revolution in industry in the 20th century, similar to the steam engine, electricity, and atomic energy in our history.

The aviation and space technology is one of the modern and advanced scientific technologies. This technology requires a relatively high level of theoretical understanding and experiential know-how, as well as a relatively high level of industrialization. Its accomplishments are the result of consolidating the latest techniques in many disciplines. In this age, the development of any branch of science and technology is not an isolated event, but is supplemented and complemented by one another. Many of the early achievements in electronic technology have promoted the development of aviation and space technology. Likewise, the development of aviation and space technology has brought about new demands for electronic techniques, and thus stimulated the advancement of electronic technology. The historical facts are the strong explanations: During the

second world war, a large number of airplanes were used in the battles. This induced the birth of radar for controlling firing. On the other hand, as the airplanes were equipped with electronic devices for radar, guided flights, and communications, the functioning of the airplanes was greatly improved.



Since the fifties, precision long-range single-pulse radars and multi-function video-control field radars were introduced as a result of the demands from trajectory guided missiles and space flights. A modern single-pulse radar can measure an angle to the accuracy of 10 seconds, and can track down a signaling device at a distance as far as several hundred thousand meters. A video-control field radar can track and process, in the proper moments, several hundred targets in the sky; its effective distance reaches several thousand meters. In the area of aviation technology, precision electronic devices are used to launch and retrieve satellites accurately. Satellites of various applications have appeared one after another, and seem to have a broad future. Because aviation and space technology widely uses electronic technology and has its unique requirements, a discipline of aviation electronics has branched out from the field of electronics. Electronic technology and aviation-space technology are thus closely related.



The theories, systems, equipment, and components in the modern electronic technology provide many devices of various applications and numerous terminologies for the aviation and space technology: In the aviation area, airplanes are now equipped with a large number of electronic instruments and meters for guiding flights, communications, landing, battle-ground surveillance, target aiming, guiding missiles and bombs, anti submarines, anti tanks, land surveys, exploration of mineral deposits, locating schools of fish, and protection of forests. At present, the cost of the electronic equipment in a relatively modern bomber is 30 - 40% of the total value of the entire plane. A modern air flight control center is a fast automatic system made up of a radar network, a communications network, electronic computers, and control display devices. It is really a system of electronic technology. In the area of space technology, the control and survey of satellites and space ships, the transmission and processing of signals, and certain remote sensing jobs all require electronic devices to perform. With the aid of an electronic system, a satellite can perform the jobs of military surveillance, defense early warning, global communications broadcasting, exploration of the earth's resources, land survey, and meteorological observations. Furthermore, it can establish, on the satellite orbit, a high-altitude scientific experiment station, an orbit

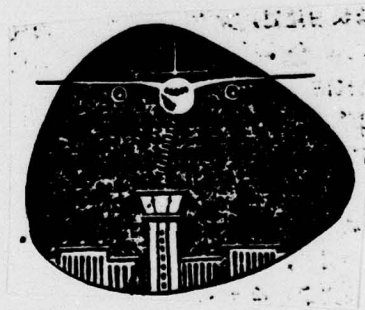
factory, and a high-efficiency solar powered electron station. In the area of rockets and missiles, the guiding and control systems of multiple-head and cruise missiles utilize many precision electronic devices. The electronic system in a rocket is an important component in guiding and controlling its return flight. In the anti-missile weapons for strategic defense, the latest developments in the electronic technology are put to use. The most advanced radars and electronic computers are used in the computer control to search, track, identify, and block the enemy's missile heads. In the research, production, and developmental works of the aviation and space technology, using electronic computers not only can perform a large number of complex mathematical calculations, but can also lead to the best plan and design, and to the research and production of a self-adopting system. The study of the transmission characteristics of electromagnetic waves can be applied to designing the outline of an airplane which has a relatively small area to reflect radar, and to finding the electronic counter measures in a surprise-defense weapon. From the brief examples of a few areas mentioned above, we can see that the electronic technology has extremely important functions in the aviation and space technology. Electronic technology is a strong pillar in the development of aviation and space technology.

The modern electronic technology uses the relatively high levels of knowledge in mathematics and physics. To possess electronic techniques requires a good foundation of mathematics and physics. Mathematics is an indispensable, important tool in the scientific research, design, and experiments in electronic technology. For example, to calculate a simple alternating circuitry, it is necessary to use the knowledge in trigonometric functions, vectors, and calculus. The analysis of a pulse circuitry requires the use of differential equations and Fourier

transformation. As for the problems of transmitting and processing electromagnetic waves and signals, the required level of mathematics is even higher. Mathematics can also greatly help us to raise our power of logical thinking and inference judgment. Electronic technology is derived from physics; much of its contents are based on electromagnetism, and are closely related to atomic physics, optics, acoustics, mechanics, and thermodynamics. For instance, frequently encountered in electronic technology are the basic principles of electromagnetism, such as the Ohm's law and electromagnetic induction, whether it is in the elementary level or the sophisticated level of the electronic devices. The mutual space energetics exchange in physics is also commonly involved. Learning physics well can broaden our knowledge and improve our intelligence, and is beneficial to the use of electronic technology. We must firmly build a good foundation of mathematics and physics, and must establish an interest in mathematics and physics while we are young. With the mathematics and physics background, we can easily master the modern electronic technology. We must also learn a foreign language, so that we can absorb directly the advanced techniques from abroad, and become independent in our works. Now our Chairman Hua, as the leader of the Party Central, has issued the order of marching toward the four modernizations. Comrades of various ranks and young people in the nation are determined, with great enthusiasm and high spirits, to reach the peak of science and technology, and to contribute their efforts to building a modern and strong country. We believe that our aviation electronic technology will, in the near future, catch up and even overpass the international advanced level.

Note: What is a gate circuit? The calculating process in an electronic computer is actually a process in which the two numbers, 0 and 1, or two states, undergo checks and exchanges

according to a certain logics. Hence, it requires the logic function of a single-component circuit. The circuit that possesses the logic function is called a logic circuit. Because it is a binary system, using two electrical states to represent numbers, either open or closed, similar to a gate, this basic logic circuit is also called a gate circuit.



Inserts by Chang Chen-yeh

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