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SCIENTIFIC INNOVATION AND THE FUTURE ARMY

by

Mr. Charles W. Taylor

1 December 1980

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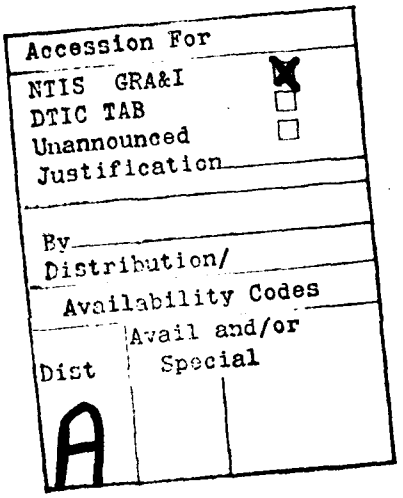
ABSTRACT

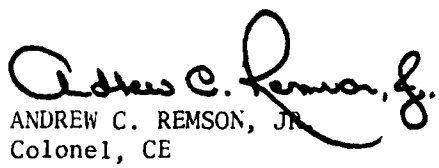
This paper lists a large number of scientific innovations which might come about by the year 2000 and which have potential military application. The description of the possible innovations are exceptionally brief summaries of scientific articles. They are presented to provide some scope to the breadth of possible scientific innovation and to provoke thought outside the scientific areas concerning possible military applications.



FOREWORD

This paper presents brief descriptions of possible scientific innovations which could have significant implications for the US Army in the future. The author, who has studied extensively scientific trends, describes a wide range of possible developments. They vary from the psychological to the physical, and expected to the unexpected. The list, far from being all-inclusive, is sufficiently inclusive to stimulate the imagination.

This paper was prepared as a contribution to the field of national security research and study. As such, it does not reflect the official view of the US Army War College, the Department of the Army, or the Department of Defense.



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SCIENTIFIC INNOVATION AND THE FUTURE ARMY

The innovations of American scientists can contribute significantly to the quality and combat capabilities of the US Army over the next two decades. The military applications of scientific achievements will increasingly become available if the Army keeps abreast with what scientists are doing. Military analysts and tacticians can determine possible future military applications by looking at all stages of innovations, particularly the early stages, across the broad sprectrum of the sciences. By cross relating scientific innovations with associated technologies, military strategists and planners can creatively adapt scientific discoveries to meet future needs for new equipment and weapons and to devise new concepts and strategies.

Scientific advances, although more often evolutionary than revolutionary, will offer the Army new dimensions for improving its capabilities in conflict. This paper identifies some of the scientific innovations which might come about by the year 2000 and which have potential military application. The source of the innovations is from the basic sciences and their related subordinate disciplines that have made significant contributions to military requirements in the past. The sciences that are most likely to continue to be highly innovative and contributory are shown below:

Life Sciences	Environmental Sciences
Biological sciences	Terrestrial sciences
Medical sciences	Oceanographic sciences
Behavioral sciences	Atmospheric sciences
Social sciences	Space sciences
Physical Sciences	**Engineering sciences**
Physics (including nuclear)	Electromagnetics
Chemistry	Materials sciences
Aerodynamics	Mechanical sciences
Mathematics	Energy conversion

The innovations of these sciences are listed in Tables 1 through 4. The listings are representative and are not meant to be all inclusive. They probably only touch the surface of the creativeness yet to come. They are listed here only to be thought provoking and to stimulate the imagination as to their possible military applications.

Innovation	Scientific Category
*Scientists have sufficient knowledge of the functioning of the human brain and sensory system to induce such specific responses as sleep, illusions, disorientation, speech impairment, and physical exhaustion through external and remote sensory stimulation by electromagnetic radiation, sound waves, and pulsed light as well as by exposure to new chemical compounds in solid or gaseous form.	Biological, medical, and behavioral sciences
Temporary change in the motivation and behavior of small groups of people or the sensory deprivation, feelings of depression, or physiological stress in an individual can be created when the vapors of a new chemical are inhaled.	Biological, medical, behavioral, and social sciences
*Artificial symptoms resembling natural disease symptoms caused by living organisms, having reduced time to onset of illness and no enduring effects, can be produced by deep inhalatin into the respiratory tract of specific minute chemical particles created by new methods of chemical synthesis.	Biological and medical sciences
Hospitalization and illness time are reduced and overall work output is increased by newly available long-life chemotherapeutic agents which are effective against a variety of disease-producing bacteria, viruses, and parasites.	Biological and medical sciences
Human susceptibility to vector-borne diseases endemic to specific areas of the world is attenuated or nullified by new oral, systemic insect repellants that concentrate in the outer layer of skin.	Biological and medical sciences
New drugs are used to increase muscular development and conditioning, overcome fatigue, increase mental alertness, induce rapid healing of tissues and accelerate recuperation, as well as greatly reduce radiation effects.	Biological and medical sciences

*This advance, in part or in total, might occur later than the year 2000

Table 1. Advances in the Life Sciences

Innovation	Scientific Category
Immunity or prophylaxis against a large number of disease-producing organisms that are endemic to broad areas of the world are induced by new chemical antigenic substances when administered in combination in humans.	Biological and medical sciences
New drugs arrest fears, anxiety, and apprehensions associated with the adjustment to various disturbing situations.	Biological, medical, and behavioral sciences
In addition to effective systems of preconditioning individuals to climatic extremes, artificial means (physical and chemical) are available to adapt people physiologically and psychologically to adverse climates and living conditions (i.e., desert, tropical, arctic, deep strata and ocean, and extraterrestrial).	Biological and medical
New computerized testing techniques and improved understanding of human behavior and the learning process permit rapid testing, selection, and training of individuals for specific occupations related to situations involving language, cultural values, politics, and economics; thereby, improving individual on-the-job effectiveness.	Biological, medical, behavioral, and social sciences
Cultural, sociological, economic, political, and military factors and attitudes of the various lesser nations have been codified, indexed, and computerized to enable cross-impact analysis of variables for forecasting popular and political unrest, potential change, or socio-economic needs well in advance of the occurrence of crisis situations.	Behavioral and social sciences
Individual response to a variety of climatic or unfamiliar conditions and stamina in stressful activities are improved by new nutritional supplements and dehydrated and irradiated foods.	Biological

Table 1. Advances in the Life Sciences (concluded)

Description	Subcategory
Computer capability exists for confident prediction of the performance of any land vehicle on any terrain at a given time from measurements of terrain characteristics and the knowledge of the mechanical characteristics and configuration of the vehicle.	Terrestrial
New soil stabilization techniques and vehicle design permit improved surface mobility and increase availability of landing surfaces.	Terrestrial
Diffusion devices use both electromagnetic and ultrasonic energy for high-speed penetration of rock and soils, and advanced plasma techniques for ceramic-like lining of tunnels and subterranean chambers.	Terrestrial
Land and sea portable water conversion plants purify and demineralize water from any source.	Terrestrial oceanographic
Aircraft or space vehicle-mounted electromagnetic energy sensing systems are used for observation, portrayal, and the forecasting of the state of the ground (trafficability) of any earth or extraterrestrial area.	Terrestrial, space
Seismic instruments developed for deep ocean installation and for airdropping to otherwise inaccessible locations allow continuous remote sensing, detection, and discrimination of underseas objects and underground and underseas disturbances.	Oceanography
Hydrographic surveys of large deep-ocean areas have provided sufficient data of ocean-bottom topography to establish the optimum location for submerged installations.	Oceanography
Tidal waves and other shoreline disturbances can be created or modified through the use of nuclear devices.	Oceanography
Offshore areas are being used for a variety of agricultural purposes.	Oceanography
Meteorologists can create or modify weather over small areas under specific conditions.	Atmospheric

Table 2. Advances in the Environmental Sciences

Description	Subcategory
Close-earth atmospheric pollution, particularly smog, can be controlled by meteorological processes.	Atmospheric
Satellite sensing devices linked with ground computer systems permit the identification of vegetation types and densities as well as penetrability by various types of land vehicles.	Space
Reader/printout systems are incorporated in geodetic satellites and are directly linked with land-based mobile computers which can rapidly produce full-color, three dimensional, real-time topographic maps.	Space

Table 2. Advances in the Environmental Sciences (concluded)

Description	Subcategory
Interactions of soil/saltwater and structural materials with increased static and dynamic load (pressure) limits permit underseas and expanded underground installations.	Physics
New high strength, transparent materials are resistant to heat, high impact, shock, and residual nuclear radiation and have laser reflecting features.	Physics, chemistry
*New lightweight metal and metal/nonmetal alloys and composites have wide extremes in operating temperatures (-100° to 5,000° F.) and strengths greater than 600,000 psi and are resistant to corrosion and abrasion; deterioration; fatigue; embrittlement; stress; and blast, heat, and radiation effects. Surfaces resist adherence of foreign matter.	Physics, aerodynamics
Methods of protecting sensitive metals and plastics from liquid-metal embrittlement and of circumventing such protective measures are developed.	Chemistry
Noncombustible, highly flexible, oil resistant, long-lasting plastic vehicle tires are available for land and air craft.	Chemistry
Especially treated clothing fabrics and equipment that rapidly change color to blend with any surroundings have been developed through organic and inorganic photoinduced transformation.	Chemistry
Lightweight, durable, disposable, foam-in-place clothing that is resistant to microbes and chemicals can be prepackaged by size, color, and style.	Chemistry
The hulls, propellers, or hydrofoils of ships and amphibians can be permanently coated with substances (polymers or polymer-like) to reduce drag and allow greater speeds in fresh or salt water.	Chemistry, hydrodynamics
Simple, lightweight, low cost, highspeed, reliable computers with interchangeable components are available for worldwide networks via satellite links.	Mathematics, physics
Advanced mathematical abstraction and computer techniques decreased problemsolving and analysis time and the need for full-scale simulations, thereby increasing the probability of more accurate and timely decisions.	Mathematics

Table 3. Advances in the Physical Sciences

Description	Subcategory
Means of acoustical sensing and accurately identifying objects by sound are available for land and underwater use.	Electromagnetics
*Nuclear detection instruments use electromagnetic wavelengths for sensing molecular mass and are capable of discriminating nuclear from nonnuclear material in space or on the ground movement of such material from orbiting satellites.	Electromagnetics
Hybrid explosives that provide energy release an order-of-magnitude above conventional high explosives, can be used for a variety of purposes including their use as a source of propellant energy.	Energy conversion
*High energy and greater efficiency for propulsion and common mobility are provided by long-life batteries, fuel cells, energy-conversion devices, nuclear energy, and, to an increasing extent, solar energy.	Energy conversion
*Low-cost and efficient production of nuclear material has permitted the development of mobile energy-supply depots.	Energy conversion
*New materials and scientific processes have allowed the development of a variety of effective and reliable energy conversion units which convert thermal energy directly to electrical energy. Units have high temperatures under conditions of vacuum and radiation.	Energy conversion, materials

Table 4. Advances in the Engineering Sciences

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