AIR UNIVERSITY review

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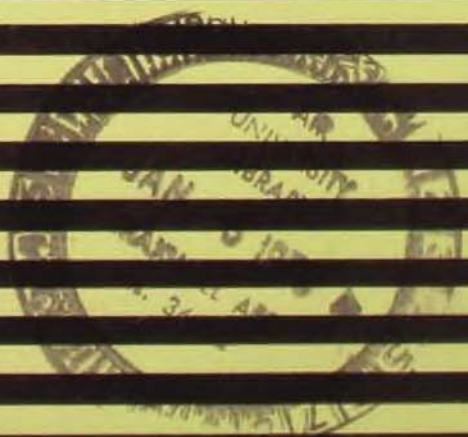

AIR UNIVERSITY
review

from the editor's aerie

Krafft Ehricke, an émigré from the German scientific community in the tradition of Wernher von Braun, Hubertus Strughold, etc., pulls aside the curtain for a futuristic look at space in our lead article. Perhaps we need to be reminded occasionally that our present energy crisis is not the first experienced by civilized man. The English had somewhat denuded their country of firewood in the sixteenth century when somebody discovered that a soft black rock would burn even better, and coal eventually fueled the Industrial Revolution. Early in the last century, the decreasing availability of whale oil threatened to dim our lamps until it was determined that petroleum would burn as well and was much more abundant and less expensive. Ehricke suggests that still greater sources of energy abound, awaiting man's ingenuity to unlock their secrets.

Colonel Herman Gilster provided the well-received lead article for our May-June 1977 issue, which concluded that air interdiction as an element of tactical doctrine is far from dead but that its effectiveness depends greatly on the kind of war being fought. His follow-on article here, "The Commando Hunt V Interdiction Campaign: A Case Study in Constrained Optimization," is another contribution to our continuing effort to stimulate dialogue on doctrine, strategy, and tactics.

The *Review*'s charter also includes the charge to stimulate discussion on matters concerning leadership and management. The Hegelian way is to present the thesis and the antithesis so that a synthesis emerges as an improvement over the original contending ideas. This issue presents two articles that will perhaps serve as theses: "Assertiveness Training for the Military Woman?" by Nancy Dughi and Major Michael Richardson's "Navigators in Command—A Naval Perspective." Dughi argues that it is both desirable and fair that military women receive special training to make them equally competitive in this man's world—or formerly man's world. Richardson holds that removal of the legal constraint against navigators being assigned to command flying units is not enough; he would have us establish a quota system that would reserve certain command spots for navigators alone. One of our editors volunteered to write an antithesis: "Prejudice or Fact? A Perspective from the PPPA" as Devil's Advocate. This antithesis argues that the perceptions expressed by Richardson are exaggerations of the degree to which the PPPA (Prejudiced Pilots' Protective Association) is biased and narrow-minded—and, consequently, those perceptions are themselves prejudices. Though our Devil's Advocate makes no attempt to criticize the Navy's more formal method of selecting unit commanders, he does suggest that the use of any quota system in this exercise would be just as unfair as the old USAF methods. Hopefully, this is only the beginning.

Having given some attention to technology, doctrine, and management, this issue closes with a review-article on international relations: "Why Is There Still a Cold War?" by Lieutenant Colonel Alan Gropman. We hope the package is balanced enough to give some food for thought to everyone, and provocative enough to sustain a healthy flow of new ideas.

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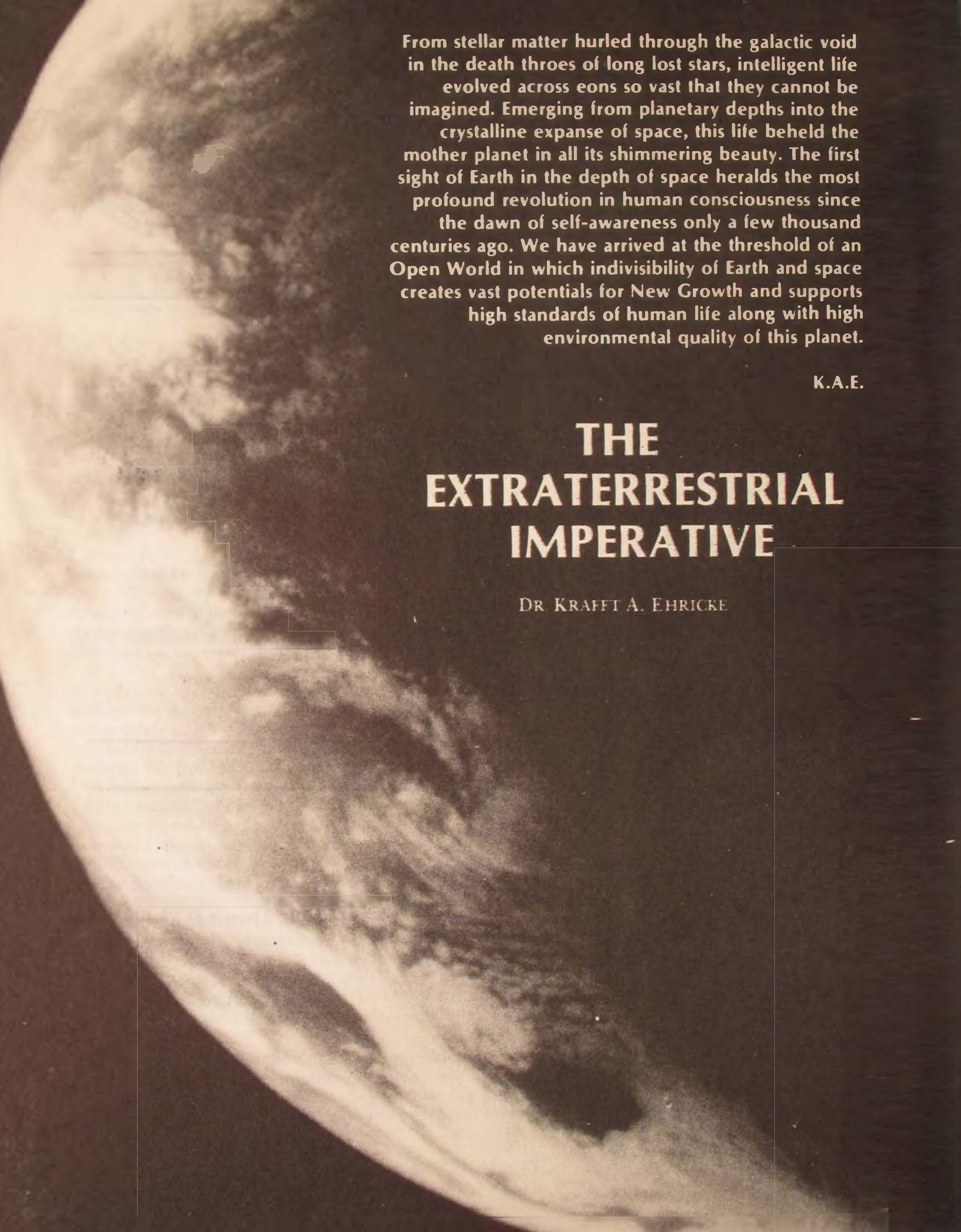
articles

departments



From stellar matter hurled through the galactic void in the death throes of long lost stars, intelligent life evolved across eons so vast that they cannot be imagined. Emerging from planetary depths into the crystalline expanse of space, this life beheld the mother planet in all its shimmering beauty. The first sight of Earth in the depth of space heralds the most profound revolution in human consciousness since the dawn of self-awareness only a few thousand centuries ago. We have arrived at the threshold of an Open World in which indivisibility of Earth and space creates vast potentials for New Growth and supports high standards of human life along with high environmental quality of this planet.

K.A.E.

THE EXTRATERRESTRIAL IMPERATIVE

DR. KRAFFT A. EHRICKE

Advocates of the notion that mankind has reached or is approaching the limits to its growth might reflect on the following analogy. Consider a fetus in the seventh month with a strong predilection for statistics and extrapolation. Based on data of past growth, consumption rates, and waste output, based further on the assumption that the rate changes will continue, and, finally, based on the supposition that the existing environment is all that will ever be available, the fetus concludes that it must stop growing in order to survive. It does not yet understand that its advancing metabolic (i.e., technological) capabilities will soon permit it to operate outside the womb. Thus, the fetus lacks awareness of the larger cycles that stimulate and control its growth and would condemn it (and the "womb") to destruction were it indeed permitted to implement its conclusion.

FAR FROM being isolated in space, Earth is a spaceship with external supplies. The most fundamental commodity, energy, comes from an external source. Terrestrial environment and the biosphere run on the 1.5 billion billion kilowatt-hours of solar energy intercepted annually.

Earth and space are indivisible. Only a few centuries ago did man begin to understand this indivisibility in terms of natural laws. Now we experience it by going into space and returning at will and by conversing with our automated scouts all over the solar system. In a few years this indivisibility will express itself in the productive industrial use of extraterrestrial environments.

There was a time when man was slow to accept the mounting evidence that Earth is not flat. Today it is necessary to understand that we do not live in a limited, isolated, closed world. Our world is open to the cosmos and contains all the future and growth potential the human mind can envision. But ours is not, and probably never will be, a problem-free world.

Humanity faces the most complex task of its history so far. Stated in a solution-oriented way, it is necessary gradually to reorganize this planet at two levels. One must deal with the competing necessities of biosphere and mankind with all their environmental and climatic consequences. On the other level, it is necessary to resolve the demands of competing nations and worlds within mankind's hierarchy of socioeconomic developmental levels and the "Christmas tree" of sociopolitical, ideological, and military consequences.

The way to solve a problem is to forge concepts that permit one to look beyond the problem. Even today's conflicts between humankind and the environment, so seemingly insolvable to catastrophists and antitechnologists, can be turned from conflict to juxtaposition of interests in the crucible of higher concepts. Such a concept is the realization that we can enhance the "supplies" to spaceship Earth, beyond energy, to include materials and information acquisition/transfer for the mainstream of human civilization.

We have not yet exhausted outright any needed resource. There are vast land areas, such as the Sudan and others, that could feed all mankind once developed. Minerals and energy abound on Earth and beyond if we have the resolve to develop them rather than retreat into stagnating stupor that would hurt our environment more than the advance of a benign industrial revolution taking into account terrestrial and extraterrestrial environments. Technology will not be the cause of our demise, but lack of willingness to advance it beyond the early, transitional state may be. Technology is the source of our options. Options are the basis of a future that keeps us above the level of pawns. Those who condemn technology, properly applied, eliminate our options. They commit the worst of all pollutions—the pollution of our future.

To find the approaches to solutions that can properly safeguard the future of our civilization with its unparalleled contributions to the human factor of life, we need a better understanding of what we face. We need insight into the long past that shaped us and set our course—back to life's silent and successful struggle for survival and growth on a primordial planet.

The Extraterrestrial Imperative is a manifestation of larger evolutionary cycles—an integral part of life's commitment to expansion and growth. The reality of the biosphere testifies to this fact. This splendid system assures our planet's unique position as a colony of life for the duration of our star, unless the climatic or genetic foundations are destroyed. When the planet's accessible (organic but abiotic) energy sources became exhausted some three billion years ago, life's response was a vigorous struggle for survival through growth. Certain organisms developed the enzymes needed to utilize solar energy. This shift to an extraterrestrial source was the first great industrial revolution on our planet. Driven by solar energy, the evolving chlorophyll molecule became the technical instrument by which to turn primordial energy and matter into chemical energy in biotic organic compounds. Mass production of the basic staples of life was initiated. The by-product, free oxygen, began to pollute the chemically nonaggressive environment of Earth and became a self-induced growth driver by which life stimulated itself into a giant evolutionary advance—a global biosphere—catapulting intelligent life into existence.

The point is that technology is as old as life. Technological advances and enlargement of the resource base beyond the limits of this planet became the bridge for survival and

growth. A system evolved, so stable that it could tolerate the ascent of a new, intelligent life form able, in turn, to interact with primordial matter through its own technology. This is the basis for the new thrust of the Extraterrestrial Imperative. For small planets, such as Earth, the extraplanetary imperative is a necessity to ensure long-term survival. In return, this imperative offers a higher, virtually unlimited, evolutionary ceiling than appears available to much larger, exclusively planetogenic bioworlds as might have arisen on Jupiter.

The fact that neither technology nor reaching beyond Earth is exactly new, but natural growth options exercised before, puts the human reality of our time into perspective. The reality has two anchor points: (1) That the chlorophyll molecule and the human brain are the only true superpowers on this planet. They must find a way to coexist, and, not being intrinsically incompatible, they can. (2) That humanity does not live as a mankind but is "organized" as an aggregate of some 140 nations. Most of these nations strive to improve their standard of life or safeguard social standards achieved and extend them to the less advantaged. Without the means to grow—and, like it or not, these means include material resources and the ability to process them—general stagnation will create a shrinking-water-droplet world in which competition for growth turns into a grim struggle for survival.

In an industrial civilization, all nations tend to profit from technoscientific advances made by some. In a shrinking-water-droplet world, this humane symbiosis cannot last. When it breaks down, it will pull all into a maelstrom of regression, burdening both the biosphere and the hard-won standards of our civilization—possibly to the breaking point.

Space industrialization as a phenomenon of human development presents the systematic breakthrough into a new Open World at a time when many formerly open world characteristics on Earth (resource abundance, waste sink capacity) fade, and the terrestrial environment begins to assume the appearance of a closed world in relation to human activities. This has two important consequences: To man, the cause of the devolves the burden of preserving the terrestrial environment. Without projecting his productive capabilities beyond the terrestrial environment, man will not be able to carry the burden in the long run without severely stunting the human growth potential.

We cross into the new Open World through a multitude of environmental frontiers—subatomic, atomic, molecular, the cosmos of the human mind, and the cosmos of the universe. In pragmatic terms, in the Open World new environments are what it is all about; they are the source of all national wealth, the basis for all new options. Through their exploration and productive use (industrialization) both the spiritual and the material causes of mankind are advanced.

This concept permits us to see beyond what seems to be an irreconcilable confrontation of man and environment, unless humankind backs down into a no-growth mode. Our technology supports both of our main strategic options—a benign industrial revolution on Earth and an extension of our industrial capabilities beyond Earth. We can see more clearly that we are not stonewalled; we have choices. Therewith the buck stops again right here, with us. It leaves us a choice between two ways of life of either organizing scarcity or creating wealth.

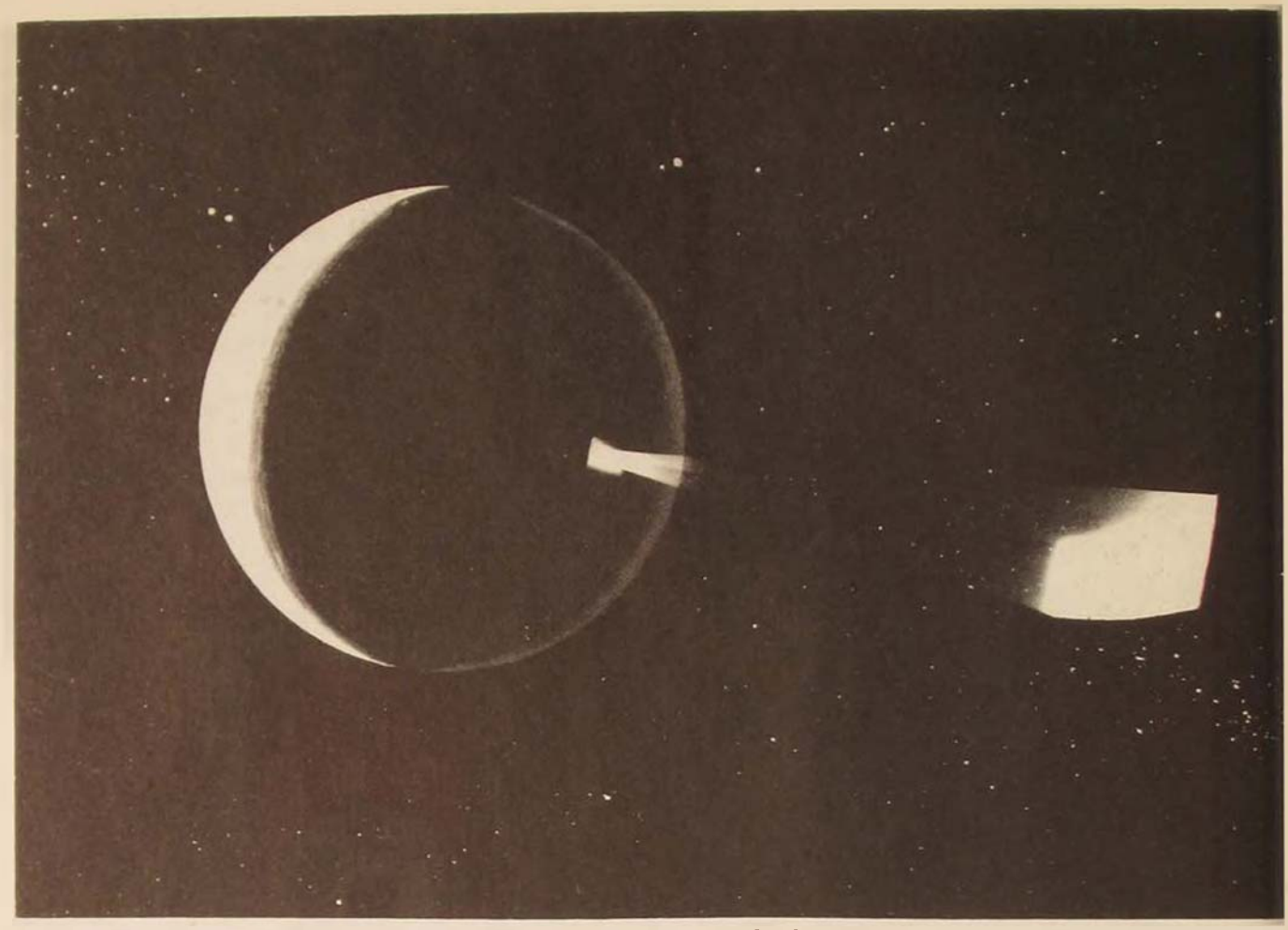
Organizing scarcity reveals the resolve of a viable society to meet and overcome a state of need. The emphasis is on overcoming, because a healthy society will reject the notion of managing scarcity (not to be confused with prudence) as a way of life. Creating wealth is the natural state of life, and mature men and women understand that this is not synonymous with ever increasing consumptive affluence but is equally the basis

for safeguarding and developing human values. Current criticisms of industrial lifestyles, which in fashionable zeal tend to exceed the bounds of justifiable cause, should not blind us to the fact that success in creating wealth underwrites a degree of human freedom and a level of social services unmatched by any other lifestyle or civilization, past or present. The quality of these industrial lifestyles sparks the incentives and sets the goals in many developing societies equally determined to set their own shade of life within industrialization. Greater productivity leaves more time to services and human development. Industrial progress without increased burden on the human environment prevents increases in productivity from becoming self-defeating.

The three initial space industrial product areas are information, materials, and energy. Once set up properly, space industrial systems in each of these areas are exceedingly productive. This has clearly been demonstrated by satellites for information transmission and sensory information acquisition. It is equally true for the energy and the material processing sectors. Through the development of space-related industries in the sectors of electronic (information-related) services, products, and energy, new jobs are created. The industrial resource base is broadened. The economies of industrialized and industrializing countries are strengthened. Public health and social services will benefit. The industrial use of space in the information services sector is already a reality, although the potential is far from exhausted. Beyond 1980 the Space Shuttle-based Space Transportation System (STS) will form the economic basis for broadening the commercial applications in the information sector as well as for developing the energy and product sectors.

Information transmission satellites have made great progress in the past decade in global communications, from Intelsat I (1965), with a capacity for 240 telephone circuits, a design lifetime of 1.5 years, and an

The Space Shuttle Transportation System is as much key to the industrial opening of space as the railroad was to the opening of the West. The manipulator arm of the orbiter has just released the orbit transfer vehicle for payload delivery into more distant orbit.



For space power generation (Powersoletta) and photosynthetic food production enhancement (Biosoletta), large reflectors must be able to focus the light beam into its minimum focal area so as to achieve intensities in the order of one solar constant. Thus reflector units may be equipped with adjustable facets either in a pre-formed structure (as shown) or in a flat circular mode with concentric arrangement.

investment cost $32,500 per circuit-year, to Intelsat IV-A (1975), with 6000 circuits, a lifetime of 7 years, and $1100 per circuit-year. Between 1965 and 1972, the typical Intelsat user fee per circuit-year had dropped from $32,000 to $9375. In 1979, Intelsat V (with ten years lifetime) will come on line, doubling the number of circuits at a possible cost reduction to $500 per circuit-year. Of growing importance is the field of domestic communications satellites, using channels leased from Intelsat spacecraft (as have Algeria and Norway) or dedicated satellites (U.S., Canada, Indonesia). Data exchange satellites, designed for the transfer of wideband, high-rate data blocks rather than voice or TV circuits, are under development for the business market in the U. S. and Japan. These will be the first to use rooftop terminals.

The increase in satellite antenna size, channel numbers, and radiated power, made possible by the STS, will accelerate the trend

toward increasingly smaller Earth terminals. Direct-broadcast satellite systems and communication satellites to mobile terminals down to personal communication via handheld or wristwatch tranceivers will then become realities in the 1980–90 decade. The latter group, in particular, has no competition from hardware links on Earth and only marginal competition from high-frequency radio. A first step in this field has already been taken. Marisat, stationed over the Pacific, Indian, and Atlantic Oceans, provides shipboard and mobile offshore telephone circuits.

Behind these technological advances lies a momentous contribution to modern society. In the nineteenth century, economic growth rested on mass transfer, the transfer of goods from one location to another. In the first half of the twentieth century, the economic foundations shifted to the transfer of energy. Now, as society is based increasingly on services, information transfer will continue to rise in importance well into the twenty-first century. Beginning in the 1980s, growing numbers of people will telecommute rather than commute to work. If, by 2000, the expected mileage traveled in this country is reduced by 18 percent, the annual fuel savings correspond to some 700 million barrels of oil (at an average of 27 mi/gal) and at least $28 billion (at 60¢/gal and 5¢/mi).

There are more than 200,000 doctors' offices in this country today (general practitioners, specialists, and federal offices). Interconnection by office-to-office communication links permits such advances as ready consultation with specialists anywhere, instant updating on diseases, treatments, and medications, and expanded use of paramedics in mobile units. Eventually a global medisat system will make "home type" medical services available in the remotest areas, based on signals or even pictures defining the patient's state to supervising doctors. In developing countries, public health services can be improved much faster and at a far lower investment than could be hoped for without satellites.

Similarly expanded opportunities are provided in education, including special services to the handicapped and televised instructional courses for general education. To increase adult living competence is a much-needed service in our fast-changing time. Televised instructional courses with massive "enrollments" of tens to hundreds of thousands would reduce cost from hundreds to a few dollars per participant. Public order and safety, electronic mail directly to our homes, teletraveling, teleshopping, new ways of contacts between peoples all over the world, the expanded opportunities to tune into major scientific and cultural events anywhere in the world—including, eventually, activities in orbit, on the Moon and beyond—are other promises of the emerging era of space-based information transmission.

But the explosive growth in the capacity to transmit information also means an equal growth in the capacity to transmit misinformation. The potential for manipulating people's minds will increase accordingly. Again, the buck stops on the human desk, since technology itself is neutral. However, these dangers are a blessing in disguise. How else can we improve unless we face the dangers we pose to ourselves? It is the way of nature to immunize through infection, not to protect by creating a sterile environment.

The other branch of information services, namely, sensory information acquisition, is rapidly becoming integrated into the mainstream of economic and environmental activities worldwide. The well-known services from weather forecasting to crop measurement already are worth billions of dollars in agriculture and forestry, pollution control and public health, tourism and leisure time industries. As population, industrialization, and urbanization increase, reliance on

information acquisition from space for the management of food, water, and land and ocean resources will become indispensable. Our sensitivity to climatic variations will grow. Therefore, beyond weather forecasting lies the challenge of understanding the mechanisms and dynamics of regional and global climatic variations. NASA's plans for a large, eventually manned, Solar-Terrestrial Observatory in the late 1980s are of crucial importance. Certainly, by the turn of the millenium, the ability to assess man's impact on climatic changes and the ability to forecast regional or global climatic variations will have become critical to the survival of civilization.

To educate without offering prospects for utilizing the improved human resources through meaningful employment can have destabilizing social effects. In industrialized countries, and even more so in developing countries, education must go hand in hand with economic growth to ensure adequate job markets in the production and services sectors. Here the key is energy.

Our present energy world is shrinking rapidly as continued global industrialization demands its expansion. To reverse this process, the development of coal, fission, solar, and fusion sources must be pursued. The age of cheap, abundant energy need not be over; but it is not only vital to our time, it is the most important heritage we can bestow on succeeding generations to ensure their quality of life on a planet from which we skimmed the richest and most readily accessible resources. In the energy sector, more than in any other, the future depends on *our* problem-solving capacity, for, as our bodies cannot exist long without breathing, our industrial civilization cannot last through a prolonged period of lack of available energy. Therefore, we cannot leave this problem to posterity. Our problem-solving capacity, in turn, is enhanced by adding a new industrial option bank in space.

In the space energy sector, one must distinguish between using energy in space for material processing and production, in order to reduce energy consumption within the biosphere, and utilizing space as a source of energy for use on Earth.

Photovoltaic systems are a natural for supplying energy to orbiting information and manufacturing systems. Here, NASA-planned power units from 50 to perhaps 1000 kwe size will be adequate, at least for the 1980s. For example, a very advanced person-to-person comsat with 1.2 million channels requires about 600 kwe.

Most anticipated space manufacturing processes indicate power requirements within 500 kwe. Due to the strength of the gravitational pull of Earth and the associated transportation costs, only items of relatively low mass but high quality and product value are economically competitive. In the lunar-industrial product sector, on the other hand, larger masses and cost-effective extraction of desired elements from lunar minerals and oxides are the key to economic viability. Here much higher power levels are involved. Unavailability of solar energy during lunar night and the desirability of underground extraction render fusion power particularly attractive.

Controlled fusion power is the key to the ultimate economy and versatility of space industrial productivity. Consequently, plasma research and experiments toward fusion reactors should be given high priority early in space industrial research and development planning. Fusion reactors are complex, with complex auxiliary systems for plasma heating and fueling, complicated blanket and shield structures, energy storage and tritium recovery, and handling. Nevertheless, it appears that operation in space can reduce many of the most difficult engineering problems. A magnetically confined fusion plasma requires a surrounding vacuum of 10^{-6} torr (1.3 billionth of an atmosphere). At lesser vacuum, the plasma pressure becomes impractically high. Space offers a vacuum of 10^{-8} torr or less, greatly

reducing plasma and required pressures.

Terrestrial vacuum chambers are relatively small because of the difficulties and cost of maintaining such high vacuum on the ground. Since 80 percent of the energy released by a deuterium-tritium reaction resides in neutrons that cannot be confined magnetically, the inner chamber walls are exposed to savage neutron flux densities, creating an environment that is comparable only to that close to a detonating hydrogen bomb. The resulting material problems are correspondingly severe. Moreover, wall particles are released as impurities into the vacuum. When these impurities get into the plasma, their presence raises the energy transfer by radiation out of the reaction zone, cooling the plasma, causing plasma instabilities, and possibly killing the reaction.

In large vacuum chambers, whose construction poses no basic problems in space, the neutron flux density to the wall is reduced, among other advantages. Thermal stresses, blistering, embrittlement, and other damage are reduced. Maintenance problems are facilitated, and the useful life of the material structure is prolonged. With more internal volume available and with the high external vacuum, conditions are greatly improved for overcoming the impurity problem. Additional advantages (also for terrestrial fusion plants) may be derived from space-manufactured stronger (more homogeneous) refractory metals or other alloys suitable as inner wall material.

For use on Earth, a transmission system must be added to the energy unit. Through space, energy can be transmitted at any wavelength of the electromagnetic spectrum. But for transmission through the atmosphere, only selected wavelength regimes are suitable—primarily in the visible and the 10 to 15 cm wavelength microwave region. Transmission in the visible requires the redirection of sunlight by reflectors (space light). Microwave transmission must use large antenna arrays generating a coherent (i.e., laserlike, nonspreading) beam. Much smaller antennas are required if laser frequencies are used (for example, CO_2 laser light in the infrared). But they appear practical only for energy transmission into the upper atmosphere (e.g., to power aircraft at high-altitude level flight) but not to ground stations.

For Earth, the solar option is particularly enhanced by space light beaming to Earth the most versatile and ecologically best integrated energy source. The reflector size and number are tailored to their functional requirements—night illumination (Lunetta), power generation (Powersoletta), and photosynthetic food production enhancement (Biosoletta). Typically, Lunetta and Powersoletta circle Earth at 4200 km once every three hours, continuously in sunshine (sun-synchronous orbit). The large Biosoletta system preferably orbits in a slightly elliptic, 24-hour orbit, highly inclined to cause minimum, if any, interference with communication satellites in equatorial geostationary orbit.

Lunettas can serve urban areas, remote industrial activities, rural areas in developing countries to facilitate night work where needed, and disaster areas. Controlled light is provided to specific targets for specified periods without cables and fuel consumption. It can be delivered quickly, removed without a trace, or furnish reliable, high-quality urban lighting even at cloudly skies or in fog, without danger of blackout.

Present city lighting, averaged over the urban area, equals about that provided by two full moons high in a clear sky. Most outdoor lighting requirements correspond to an illumination equivalent to between 100 and 1000 moons, in farm areas 50 to 300 moons. A Lunetta system with clear-sky illuminance of 700 moons (over 100 moons even at strong overcast) needs some 3.6 sq km of reflecting area, divided into 15 to 20 reflectors. Since they move across the sky, additional reflectors must be installed, raising the total to 27 sq km, but

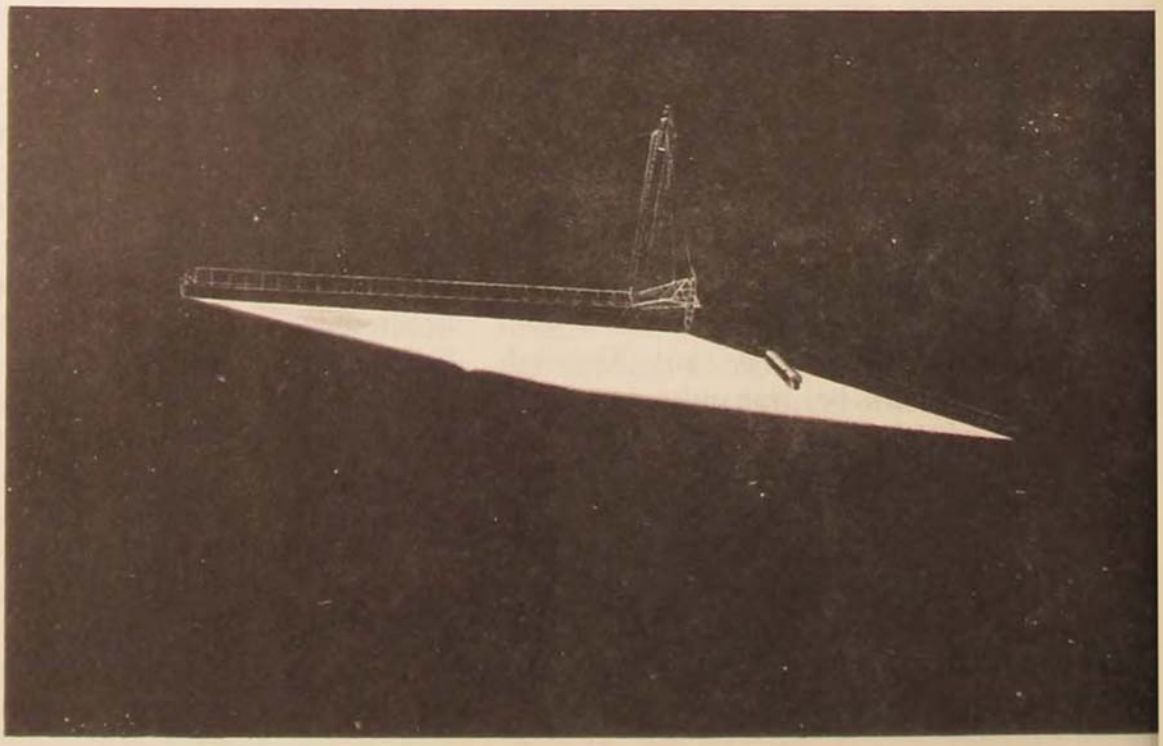
more than one city may be served. Individual reflectors appear as stars some 1500 times as bright as Venus—a beautiful sight, illuminating the city gently but distinctly from several directions.

Powersoletta enhances solar energy supplies to earthbound solar-electric central power stations. Reflectors (10 to 50 sq km) with a cumulative area of 1530 sq km beam one solar constant to a 1200 sq km ground area. Because of their motion, 11,500 sq km reflecting area must be installed. But at least three ground stations can be served in a latitude belt between 30 and 50 degrees. Powersoletta removes geographic constraints on solar central power siting. Latitude becomes comparatively less important than low-average overcast.

A ground station, at 1000 sq km of solar cell banks and 15 percent conversion efficiency, operates around the clock, yielding a net annual output of 45 to 65 million kilowatt-years, depending on local atmospheric conditions. Energy storage for baseload power is minimized. The output is of great economic and environmental significance. Over a three-year period, a 55-million kw-year annual output consumes 339 or 552 million tons of oil or coal, respectively; or requires a loading of 1807 metric tons of uranium in light water reactors, generating 63.2 tons of assorted fission products, 16.1 tons of plutonium isotopes, and 9.5 tons of long-lived waste.

People living within at least 50 km of the

Protolunetta is a reflector for testing and special missions. At 550-km (300 n mi) altitude the shuttle-lifted and orbiter-controlled 10,000-ft² reflector in 98° sun-synchronous orbit can beam for 2.5 hours (37.5°) sideways into Earth's night side. Intensity of illumination ranges from a theoretical maximum of 45 moon-equivalents (no clouds, vertical beaming) to values of 5 to 20 moons (side beaming and cloudiness).

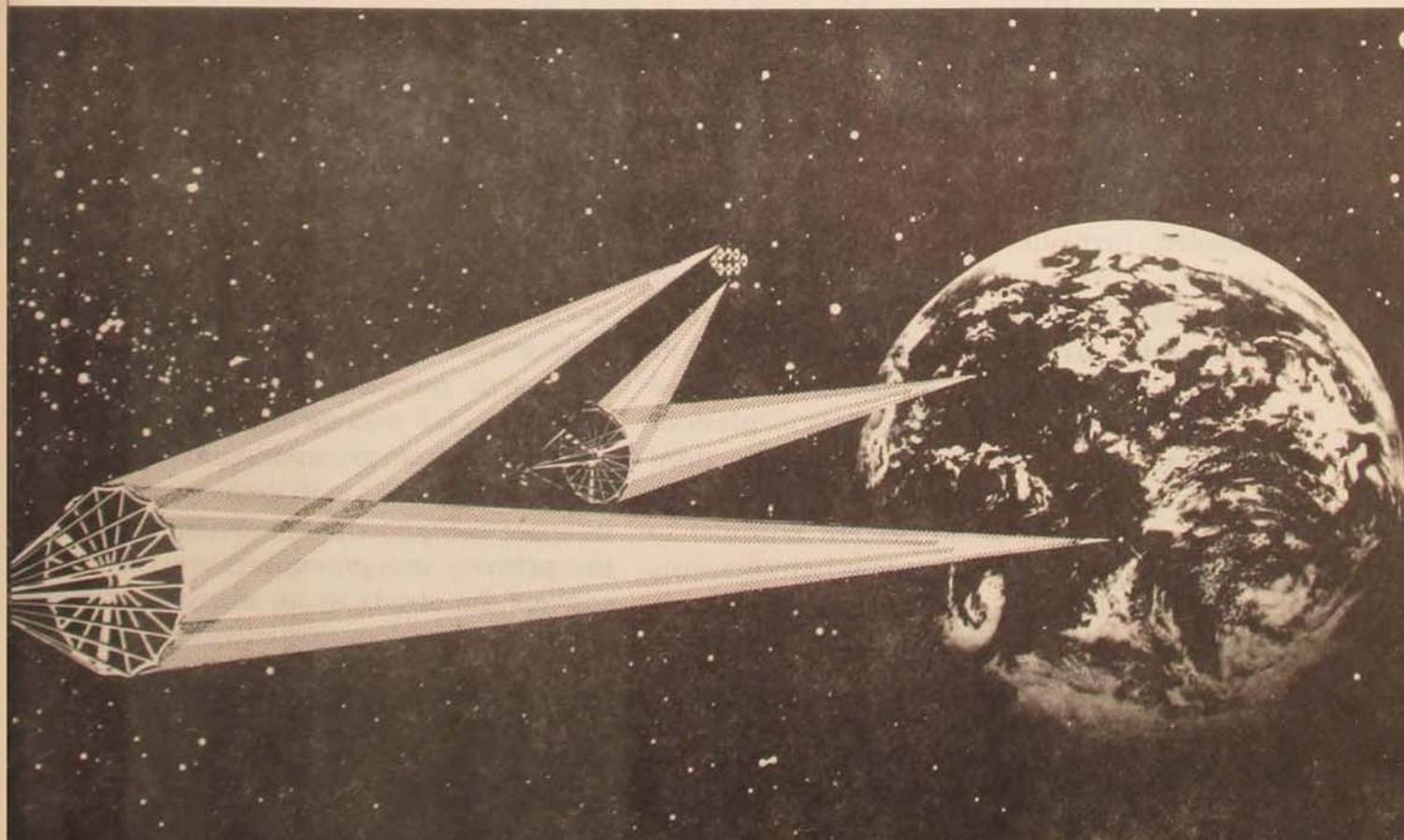


power station will experience night light intensity between midnight sun and bright aurora, due to light spillover. This could be avoided by operating Powersoletta at daytime. Certain reflectors are turned around to the Sun, beaming at those reflectors best positioned at the time to service the power station. The retroreflection technique may cut the reflecting area by some 30 percent. This technique requires extensive energy storage but no enlargement of the receiver area (the most expensive addition) because of double irradiation.

For the night Powersoletta, a cost at the bus bar of electricity (in 1977 dollars) of about 50 mils/kwhe is indicated during a 30-year amortization period, about 20 mils/kwhe thereafter. For the daylight system, 35 to 40 mils/kwhe and 15 mils/kwhe, respectively, are indicated. These numbers include a ground station cost of over $1000/kwe, twice the Energy Research and Development Administration (now Department of Energy) 1985 goal of $500/kwe.

The reflectors with adjustable facets use structures of carbon epoxy and fibers and membranes of kapton. All parts are coated in space with the optically best material, sodium. Recoated and serviced at about ten-year intervals, the reflectors should last 60 to 100 years. At a resulting sodium consumption of 1500 tons annually, a service station may be established at libration point L-4 or L-5 in lunar orbit, supplied with sodium mined on

A small space power satellite in geostationary orbit focuses two small power beams (100–500 MW, 3 GH_z) onto large electromagnetic reflectors (also in geostationary orbit) which, due to their size (5 to 10 km^2), can beam the power safely into small ground receiver areas (22 to 11 km^2, respectively). The power levels can well be integrated into utility systems. Accuracy of reflector surface is more readily controlled at the low pressure of the low-power beams. Beam coherence is controlled from the transmitter to compensate for slight inaccuracies in reflector contour and to prevent scattering of the microwave beam beyond the receiver area. Higher frequencies reduce dimensions but reduce efficiencies and increase atmospheric lossses.



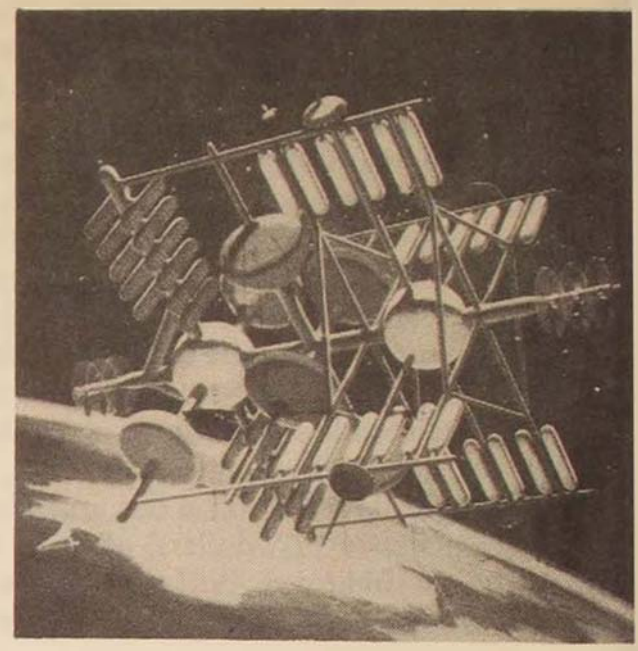
the Moon (measured abundance in lunar samples 0.2 to 0.5 percent). The reflectors can commute to lunar orbit by a combination of solar pressure and electric thrust—in 300 days or less transfer time at a reflector weight of 75 tons/sq km.

To prevent night frost damage, Powersoletta excess reflectors can beam temporarily at the cold area to raise local temperatures and thereafter be reoriented to the power stations.

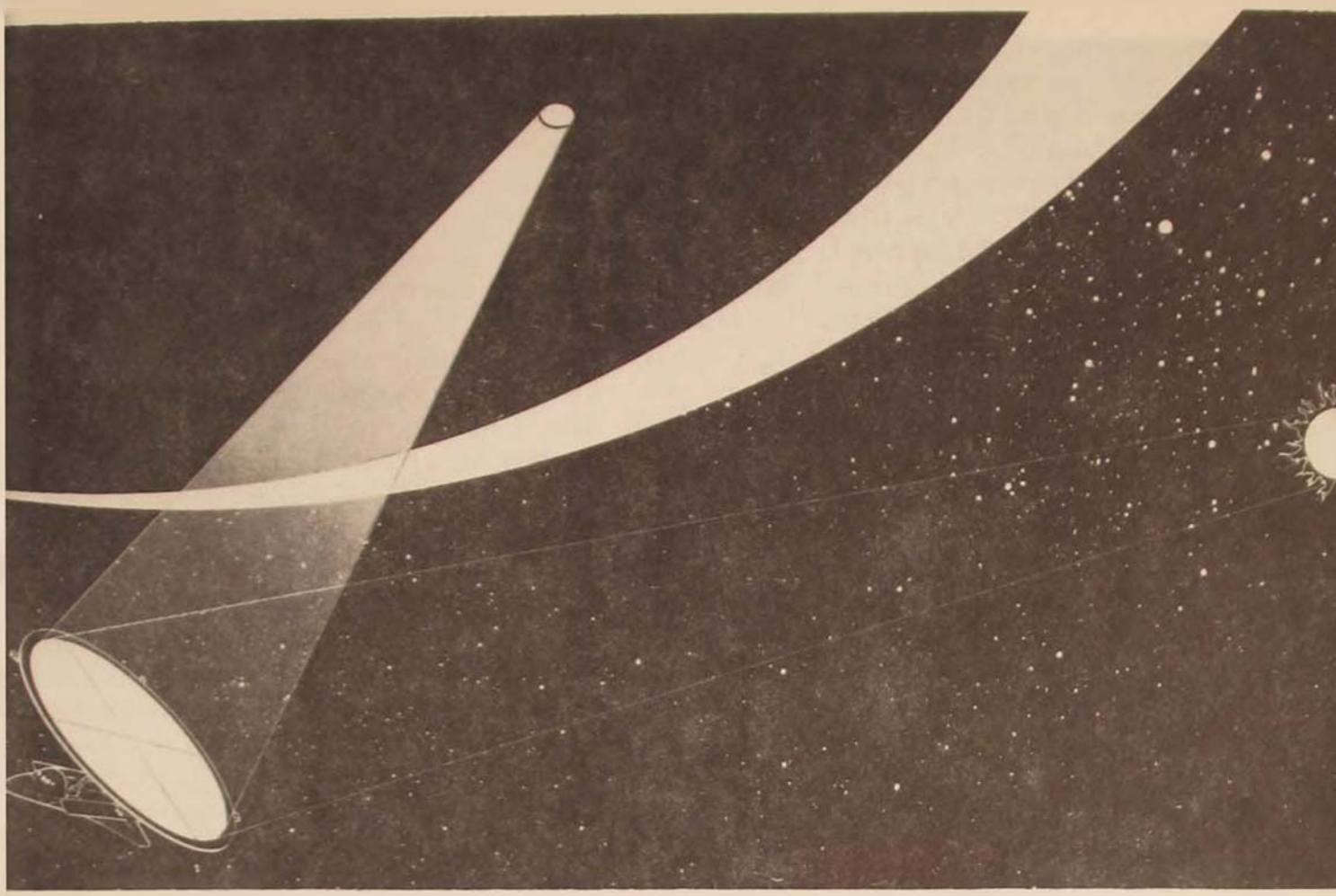
Biosoletta is applied most effectively to fertile ocean regions lacking sunlight for achieving full productive potential; that is, to circumpolar upwell areas. At some 100,000 sq km, the irradiated area should be ecologically self-contained. Seafood is a vital protein supplement. Based on Antarctic production figures and a 40 percent utilization factor of seafood produced, a Biosoletta alternating in 12-hour intervals between a 100,000 sq km "macropond" each in Arctic and Antarctic waters (50 to 70 degrees latitude) could generate an annual Antarctic yield alone of the daily protein supply (36 grams in about 220 grams of seafood) for 180 million people. Again, the Biosoletta reflectors can be serviced at a libration point to which they solar-sail in ten days to three weeks.

Even Biosoletta's energy influx constitutes barely 0.08 percent of the Sun's energy influx and, therefore, cannot affect the global climate. Locally, cold winds and strong currents dissipate the thermal energy rapidly. Biosoletta furnishes make-up radiation energy to power carbon assimilation. Solar radiation in polar regions delivers 0.7 trillion kilocalories per sq km per year, compared to between 1.2 and 1.6 trillion kg-cal/sq km year in tropical waters. Biosoletta "photon-fertilizes" two tiny but bioproduction-intensive "macroponds" (each about 1 percent of a 5-degree belt at 60 percent latitude) to approach the solar level at low latitudes.

Compared to Powersoletta, the microwave-type Space Power Satellite (SPS) alternative has a number of advantages and disadvantages. The advantages are reduced atmospheric losses, especially due to overcast, and the ability to shape the beam, thereby being able to irradiate relatively small areas from geostationary orbit; whereas a reflector's focal area increases with distance (barring costly special arrangements) and is about 100,000 km^2 from geostationary orbit. For this, however, SPS pays with greater complexity of its space component. The system must accept the primary energy, convert it to electricity, convert the electricity to microwave energy, and shape the microwave energy into a beam of required specifications. If the primary energy



Astropolis—a fully developed space city of about A.D. 2000—contains apartment complexes for inhabitants and tourists (outer radial cylinders); large zero-g or low-g space for manufacturing, medical, and recreational facilities (cylindrical axis of rotation and large spherical enclosures); agricultural and recycling facilities at different g-levels (semispherical enclosures); and parks, avenues with greenery, shopping centers, and theaters (outer cylinders, parallel to axis of rotation with saucer-shaped enclosures). An outgrowth of earlier space station developments, Astropolis may trailblaze the way to permanent human abodes beyond Earth.



The small reflector (0.1–0.2 km²/1.07–2.14 million sq ft) is a typical unit for a Lunetta illumination system (shown in trampoline-type design). A sodium-coated (in space) kapton membrane is kept under controlled tension by a cable system leading over the end points of the cross-shaped beam structure to an electromotor-powered control system atop the rigging tower vertical to the reflector plane. Sides of the reflector membrane are attached to catenary cables attached to controllable (flexible) end points of the cross-structure. The structural material is primarily graphite-fiber reinforced composites, giving high strength/stiffness, low weight, high thermal stability, and good vibration damping. Structural members are coated for protection against solar ultraviolet.

is solar, the low-radiation density determines the system's size (80–120 km² for delivery of 10 million kilowatt at ground outlet) and its weight (50,000 to 75,000 tons for 10 million kilowatt), independent of the conversion system (photovoltaic or solar-thermal). For fusion as primary power, the waste heat radiator becomes the primary driver of system size and structural mass, depending on the conversion system. Generally, smaller sizes and weights are indicated. Powersoletta's thermal input, while far from critical, is higher, but a large number of microwave beams, each carrying millions of kilowatt power, may not be the publicly preferred option.

The disadvantages of the SPS are rooted primarily in the fact that microwave radiation at significant power densities is not part of the solar radiation input into the terrestrial

environment. One consequence of this concerns ionospheric radio frequency interference, which causes power loss and can cause ionospheric heating. Through the limitation of maximum power intensity in the beam to about 17 percent of the Sun's radiation energy flux in the ionosphere (1.35 kw/sq m), this effect can be kept within acceptable limits. However, safety limits force the density at the beam's periphery to much lower values so that, including a safety zone around the receiver system, the required land area corresponds to an energy influx of about 2.5 percent of a solar constant on the ground (1 kw/sq m). For Powersoletta, the output per unit land area is about twice as large. Thus, SPS requires much more receiver land area than Powersoletta, even though the microwave beam can be shaped.

Space manufacturing looks commercially promising for a wide range of products. These lie primarily, but not exclusively, in the pharmaceutical, electronic, and optical sectors. In the pharmaceutical sector, it becomes increasingly desirable to separate and concentrate living cells capable of producing medically important substances. Under zero-gravity conditions in space, living cells, whose mass/charge ratios differ, can be separated efficiently and accurately by applying weak electric fields (electrophoresis). The effectiveness of this method is strongly impeded in the presence of a sizable gravitational force.

Electrophoresis has a wide range of medical and biological applications. An early promising use is the isolation of human kidney cells that produce the enzyme urokinase, a substance with the potential of effectively preventing and dissolving blood clots. Even at a present cost of $1200 per dose, the 500,000 doses currently needed annually in the U.S. alone cannot be produced by the present method that extracts one dose of urokinase from more than one ton of urine. The electrophoretic method can also be applied to separate other kidney cells that produce erythropoietin (an antianemia hormone stimulating the production of red blood cells in bone marrow); to a host of enzymes (blood proteins) controlling a wide variety of metabolic functions (and malfunctions); to white blood cells and antibodies (affecting tumor growth, transplant rejections, etc.); to chromosomes (X-, Y-types, affecting composition of cattle population through artificial insemination); and, possibly, to nerve cells (neurology). Even this list is not exhaustive. The consequences to medical and biological science and practice—from preventive, even predictive, medicine to agriculture—cannot even be estimated today.

In the electric/electronic product, value lies in the growth of mono-crystalline semiconductors of highest perfection and purity for a wide variety of applications. The same space features of null-gravity (eliminating convection currents in melts) and

The manmade mobile planetella Androcell, first discussed by the author in 1971, is an extension of the Astropolis design. Wings extend radially from a large cylindrical axis which serves as zero-g space (except during powered maneuvers), accepts, processes, and stores outside raw materials, serves as thrust frame, and houses fusion power plants at each end to energize magnetic shielding, fusion drives, laser systems, material processing, all utilities, agricultures, and two light-emitting helioids that replace the Sun in the outer solar system. Residential sections, complete with peripheral axiparallel cylindrical public spaces, form the outer part of each wing in the 0.6 to 0.2 g regime. Large cylindrical enclosures utilize lower g-levels, housing waste treatment, agricultural installations, low-g recreation and medical/laboratory/production facilities. Androcell, capable of replacing its own modules and adapted to the sociopsychological requirements of life in a mobile multi-g neocosm, is depicted here in the Jovian system, examining cosmic debris remotely by laser and a landing party. (Painting courtesy of Rockwell International Corporation)

ease of levitation melting (no contamination through wall contacts) also permit the production of glasses of very high purity and optical quality as needed for high-power laser systems, fiber-optic transmission lines, and high-resolution optics.

The list of already recognized potential products is much longer. All meet requirements of high value and low mass that give them commercial viability and could favorably affect the balance of payments of the United States and other industrialized nations vis-à-vis the rising costs of raw materials from developing countries. From there, other product lines lead to larger mass items and special products for larger space systems. In the larger mass items category, for example, is the production of new metal alloys and near-perfect, friction-free bearings and pistons by alloying metals of widely differing specific gravity (which causes them to separate at surface gravity), such as aluminum and lead alloys for bearings and pistons. Automobile manufacturers have long attempted at great expenditure to create such alloys that could give many automotive parts a capability of at least 500,000 miles. Two items exemplify the products-for-large-space-systems category: the aforementioned use of sodium for coating space reflectors and the production of ultra-light (for operation in a low-*g* environment) high-quality solar cells.

Lunar material contains industrially valuable materials. The world reserves of some of these appear limited at present. But several factors militate against major imports to Earth of zinc, copper, nickel, manganese, or titanium from the Moon (or from translunar sources, such as asteroids). In some cases, technological advancements will lead to the commercial exploitation of progressively poorer grades, thereby enlarging terrestrial land reserves currently not counted. Large mineral deposits become accessible on the ocean floor. Recycling and substitutions offer additional options for stretching terrestrial metal supplies. Job considerations in the primary (extractive) and secondary (refinement to semifinished products) metal industries are an additional factor since it takes a long time to phase out such industries, especially in developing countries, prior to relying on large-scale extraterrestrial imports. This leaves as a comparatively closer prospect the advantages of the lunar environment (vacuum, low-*g* conditions at the surface, zero-*g* in an orbiting lunar factory) for generating superior products of comparatively high market value but larger masses than those that are most suitable for Earth-orbiting factories. Access to low-gravity supplies can also be important for large space constructions as are typically involved in the energy sector. For these, however, the most attractive construction materials (graphite composites, graphite fibers, epoxies, poly-imides) are not available on the Moon. Therefore, the opportunities of taking advantage of lunar gravity to obtain construction materials for large space systems appear limited.

However, associated with the large masses of these systems are significant transportation requirements from Earth. If oxygen-hydrogen orbital transfer vehicles (OTVs) are used to lift these masses from near-Earth orbit (NEO) to outer, especially geosynchronous orbits (GSO), then, for each 100,000 metric tons of construction material delivered to GSO, the launch system must deliver also about 290,000 tons of oxygen to NEO for the OTV (plus 60,000 tons of hydrogen). For each ton of payload delivered to NEO, an advanced launch vehicle burns 11 to 15 tons of propellant in the atmosphere, releasing 8 to 11 tons of water vapor and 37,000 to 47,000 thermal kilowatt-hours. Whether the oxygen must be supplied from Earth, therefore, makes a difference of some 3.7 million tons of propellant burned in the atmosphere per 100,000 tons of cargo to GSO.

Lunar oxygen, therefore, can be an attractive substitute, especially since it ranks second in abundance behind silicon, and it can be

extracted in large quantities by means of fusion power and requires no further processing. Of course, the need for oxygen can be eliminated by employing electric or advanced nuclear propulsion. But each of these alternatives has its own set of disadvantages and problems that keep the use of lunar oxygen a competitive option, especially since a lunar oxygen industry opens up a lunar industrial capability whose implications are not restricted to transportation. Another potentially attractive early option is a lunar service industry with selective resource utilization, taking advantage of low gravity availability as well as vacuum conditions on the surface. A case in point is the libration-point service station for Soletta reflectors with sodium and other selective resources supplied from the Moon.

Thus, the industrialization of space offers a new dimension of technology and productivity with a vast scope of opportunities in terms of electronic services, solar energy for Earth for illumination, electric power and food production enhancement, space factories, space fusion, and lunar industrial potentials. However, a great deal of hard-nosed research and development and of pragmatic, balanced in-depth assessment is necessary of the many opportunities as they come up. There will be disappointments as well as pleasant surprises.

More profound and inspiring than the technology, however, are human and socioeconomic implications. Understood in the perspective of the Extraterrestrial Imperative, space industrialization is the crucible in which the seemingly irreconcilable problems that cause such profound pessimism in the outlook of many can be resolved. Earth and space become one through the intelligence and the creativity of man.

In conclusion, let us take a brief look beyond. In the perspective of the evolutionary thrust of the Open World of Earth-space, exoindustrial productivity may be regarded as the first phase of extraterrestrialization, that is, the process of living in more than one world. The industrial facilities of this phase are Earth-related, directly or indirectly, as they should be. The people who make up the industrial teams in orbit or on the Moon are and remain terrestrials.

The people on Earth benefit from space industries. They are not asked to foot the bill for huge autarkical, colony-type factories housing thousands who, in turn, deprive terrestrials of even larger numbers of jobs.

The economic function of space industrialization is to generate jobs on Earth, not in space. Its most important international function is to assist in reducing the gap in the economic development of our global "North" and "South," *not* by lowering the standards of the North but by raising those of the South. This implies continued global industrialization. But as the world keeps industrializing, global competition for our country will increase and continue to erode the job base. Thus, for domestic as well as international reasons we need to open up a new industrial territory and make it work for people right here on Earth.

As the space industrial capability level and the skill of productive space utilization advance, the number of people living in space for a major fraction of their life span will grow. These people will develop new preferences as to g-levels and lifestyles no longer necessarily related to terrestrial physical or social conditions. They will "urbanize" their new worlds. Space stations and lunar abodes will become their primary home—Earth a place to visit or perhaps just to "experience" holographically, in the comfort of their gravity environment. The more antiseptic surroundings in space settlements could reduce resistance to diseases of those who live in them from birth. They may find the hygiene

of Earth just as hazardous as we would find the hygiene of medieval cities or ancient Rome. Still, some space-born offspring may migrate back. Those who stay will continue to diverge sociopsychologically from the ways of terrestrial mankind, as Americans have diverged from their ancestral countries. They will become the new *Homo Extraterrestris* who no longer needs Earth, hence does not wish to simulate its environment slavishly.

Their readiness to achieve sociopolitical and resource independence will grow with the psychology of their extraterrestrial motivations and their technological ability to create new worlds in their totality. This will lead to Androcell, not a colony of Earth, but a *sovereign, mobile neocosm*. Androcell is the new beginning, while back on Earth open-world conditions move toward a demographic and industrial equilibrium.

The Androcell phase is likely to follow the intermediate phase, exourbanization. Oversimplifying somewhat, one may say that exoindustrialization puts the machines and productive techniques into space; exourbanization introduces the human and biological elements; and extraterrestrialization integrates the two components into complete neocosms.

Each of the three evolutionary phases is justifiable by clearly identifiable prime objectives as well as by their impact in changing the consequence world. Each phase contributes to the capability *and* motivation to progress to the subsequent phase. In the third phase, we leave the harbor and emerge into the open sea of space, psychologically and socially speaking. Human history henceforth will pulse through many world-arteries that lose themselves beyond the horizons of our present perception in the trackless infinity of space and time.

The civilization of the Androcell is truly three-dimensional, not only because the design of Androcell utilizes purposefully all gravity levels between axis and periphery of the rotating systems; but, more important, because living awareness between worlds, and between surfaces and Androcells, plays itself out in three-dimensional space. Through exoindustrialization (production facilities), exourbanization (Astropolis, Selenopolis) and neocosms (Androcells), the human life form may be regarded as returning to the three-dimensional origin of all terrestrial life. The two-dimensional existence of Earth's land surface becomes an evolutionary benchmark wedge between the three-dimensionality of the finite oceanic womb from which life rose to the brightness of consciousness and the infinite cosmic womb in which it can rise to a level beyond our understanding.

La Jolla, California

THE COMMANDO HUNT V INTERDICTION CAMPAIGN

a case study in constrained optimization

COLONEL HERMAN L. GILSTER

Military problems are, in one important aspect, economic problems in the efficient allocation and use of resources.

WITH these words Charles J. Hitch and Roland N. McKean began their classic text, *The Economics of Defense in the Nuclear Age*, which stimulated

decision-making based on the principles of economic analysis within the Department of Defense in the early 1960s.[1] Military problems are indeed economic problems in the efficient allocation and use of resources, and this truth became ever more apparent during the long war in Southeast Asia.

Military resource allocation decisions are made in a sequence of steps starting with gross allocations to satisfy national objectives at the highest level and proceeding to specific allocations to satisfy tactical objectives at the lowest. At each step, the decision must be based on the objectives, resources, and limitations specified at the higher level. The lower decisions thus become ones of constrained optimization—maximizing output subject to a given level and use of resources or minimizing the cost of ataining a given level of output.

This was characteristic of the air interdiction operations in Southeast Asia.[2] With a specified level of air resources, U.S. airmen were asked to reduce the flow of enemy troops and materiel into South Vietnam to the lowest possible level. During most of the war, strikes against the source of supplies in North Vietnam were prohibited, and a relatively inactive enemy in South Vietnam required only a minimal flow of supplies. From the air, U.S. aircrews had to hunt, find, and destroy those supplies along heavily canopied roads through the jungles of Laos. These limitations, among others, made it a difficult, almost impossible mission. To a greater extent than in most previous wars, these men faced a traditional problem in constrained optimization.

This article provides an assessment of how well they met the challenge. Basic tools and principles of economic analysis are used to evaluate the allocation and effectiveness of air resources employed during one of the major air campaigns—code named Commando Hunt V—waged against the North Vietnamese logistics network in southern Laos from 10 October 1970 to 30 June 1971.*

The Objective Variable

Correctly specifying the product or objective in an analysis is the most important yet perhaps the most difficult task of all. Quantifying that objective only adds to the difficulty. In Southeast Asia, it led to the specifying of a wide spectrum of objectives for air power, at one time or another, often with no clear distinction between input and output. For example, at certain times the total number of sorties flown, a number easily calculated, was taken as the output measure of air power. But sorties are an input, not an output, and maximizing their number can only lead to gross inefficiencies unless constant or increasing returns to scale are experienced.

Another output measure often advocated was target destruction. Although target destruction may be the objective of individual aircraft, it cannot be the final measure of air power. Destruction is a means toward an end not an end in itself. It is an intermediate product between sorties and the true objective. Therefore, reported target destruction did not play a part in the ensuing evaluation; rather the stated objectives of the Commando Hunt V interdiction campaign were used. The primary objective of that campaign was to "reduce the flow of personnel and materiel into the Republic of Vietnam and Cambodia to the lowest possible level." A secondary objective was to "make the enemy pay an increasingly greater cost for his efforts to dominate Southeast Asia." In a limited sense, the second objective is subsumed by the first. The amount of supplies destroyed along the trail network in southern Laos both added to the enemy's cost and resulted in the delivery of fewer supplies to enemy forces in South Vietnam and Cambodia. *There can be no question, though*

* The evaluation follows the traditional outline of a microeconomic analysis. First, the product, or interdiction objective, and the inputs that influence that product are defined.[3] Then a discussion of the production function, which relates the inputs to the product, is presented. Following this the variable cost of applying these inputs based on cost factors derived from our Southeast Asian experience is outlined. And finally, the criterion of attaining the given product at minimum cost is applied to determine optimum air resource allocations. These results are used as a bench mark for measuring the efficiency of the actual Commando Hunt V strike allocations.[4]

that the central purpose of the interdiction force was to reduce the amount of supplies, either by destruction or through forced enemy logistics expenditure, to a level below that at which a sustained enemy offensive in the south could be maintained. This study, therefore, took the reduction of enemy supplies that reached the borders of South Vietnam and Cambodia as the basis from which to measure effectiveness of air power in the interdiction role.

The quantitative measure of supplies reaching the borders of South Vietnam and Cambodia was called "throughput." Throughput was calculated by intelligence analysts who combined the number of southbound sensor-detected truck movements, aircraft visual truck observations, and road and river watch team observations along the Laos exit routes. Duplicate counts were then eliminated to obtain an estimate of the actual number of truckloads of southbound supplies that exited the system.

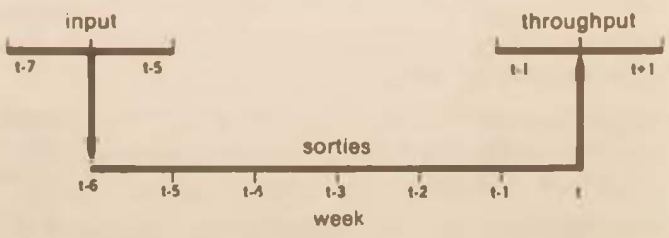
To determine whether a reduction of supplies took place in Laos, one must compare throughput with input, or the amount of supplies the enemy put into the system. The estimated number of trucks that entered Laos through the passes from North Vietnam was calculated in the same manner as throughput. To this figure was added an estimate of equivalent truckloads of supplies that also entered Laos through enemy pipelines and natural waterways.

A reasonable measure of the impact of interdiction forces on an enemy logistics system, whether through destruction of supplies or forced expenditure of resources to maintain and defend the system, would be the difference between input and throughput lagged by an appropriate period to account for the length of time supplies are in transit.[5] A lagged structure of the system then becomes important, not because one needs to pinpoint exact transit times but because it is necessary to determine a reasonable time over which the supplies that entered the system during any time period were subject to air attack.

Logistics intelligence indicated that it normally took the North Vietnamese about six weeks from the start of the dry season in November to fill the Laos supply pipeline and that their shuttle system was probably geared to that time span. A correlation analysis incorporating throughput during a given week and input during previous weeks provided additional support for the six-week estimate as did an area-by-area analysis of sensor-detected truck movements. These same analyses, however, also implied some variation around the predominant six-week transit time. For this reason, a three-week average, rather than a single week's estimate, was used for input and throughput at each end of the six-week period in the construction of the objective variable. This construction is illustrated in Figure 1.

Assuming the creation of no permanent stockpiles within the system—and there was no indication of such—one can attribute the primary difference between input and throughput to the interdiction forces. In a reasonable time period some volume of supplies put into the system did not leave it. In this study, it matters not whether the supplies were destroyed or expended in the maintenance and defense of the system. In

Figure 1. The objective variable, $IP_{t-6}-TP_t$



either case, those supplies were not available to support enemy offensives in the south.

The Inputs

Next come the inputs to the production function—the resources with which the air commander may influence the objective. Of primary interest in this study are the strike sorties, not only because they delivered ordnance and directly interfaced with the enemy logistics system but also because they comprised 86 percent of the total variable cost of the interdiction effort. The evaluation, therefore, concentrated on those sorties, which are listed by major aircraft type and target category in Table I.[6] Sorties that did not expend ordnance were not considered strike sorties and are not included.

Throughout the conflict in Southeast Asia, enemy trucks proved to be the most lucrative interdiction target. In fact, there existed a strong statistical relationship between a reduction in throughput (the objective variable) and the number of trucks reported destroyed or damaged, a relationship that could not be found with other target categories.[7] The vital role played by the enemy truck force was recognized in Commando Hunt V, and a concerted effort was made to position the strike force to destroy this critical element. In particular, this applied to the AC-130 and AC-119K gunships, which were transport aircraft that had been modified with sophisticated night detection equipment and 20 and 40 millimeter cannons to destroy trucks moving down the trails of Laos at night.[8] These aircraft had been developed in previous campaigns and were by far the most effective truck-killing systems in the U.S. arsenal.

Because of their slower speed and vulnerability, each AC-130 and AC-119 gunship was normally assigned three F-4 escort aircraft to cover its operations over heavily defended areas of the Ho Chi Minh Trail. The primary purpose of these escorts was to suppress enemy antiaircraft artillery activity so that the gunship could continue pursuit and attack of enemy targets.[9] Consequently, the escorts played a major role in gunship results by making possible the operation of this highly effective weapon system in high threat environments in which it could not normally survive.[10] Since it was statistically impossible to isolate the individual contribution of the escorts from that of the gunship, a gunship team sortie variable was established to act as a proxy for both the gunship and its three escorts. Accordingly, the integrity of the team, or total

Table I. Commando Hunt V strike sorties

Sortie Type	Target Category	Weekly Average
gunship team (AC-130, AC-119K—with 3 F-4 escorts)	trucks	65
fighter-attack (F-4, F-100, A-1, A-4, A-6, A-7, B-57G)	trucks and storage areas	579
	lines of communication	695
	direct air support	404
bomber (B-52)	area targets	220

system concept, was maintained in the subsequent evaluation of weapon system effectiveness.

The fighter-attack aircraft, which with the exception of the A-1 were jet-propelled, were employed against the full spectrum of interdiction targets both day and night.[11] The A-4s, A-6s, A-7s, and some of the F-4s were U.S. Navy aircraft that operated off carriers in the Gulf of Tonkin. The remainder, or about 60 percent, were U.S. Air Force aircraft operating out of land bases in Thailand and South Vietnam. The targets struck by these aircraft fell into three main categories: trucks and storage areas, lines of communication, and direct air support.

In the first category, trucks received primary emphasis since storage areas were extremely difficult to locate and attack. Storage areas were kept small, widely dispersed, and heavily concealed; and seldom did an attack provide significant visible results. Sorties against these two targets were treated together because of the command process by which they were allocated. Most sorties were assigned to the Airborne Battlefield Command and Control Center (an orbiting command post) and forward air controllers over the trail to be directed against either trucks or storage areas, whichever appeared more lucrative at the time. This control feature indicated that these sorties should be viewed as an entity.[12] Actually, strikes against both target categories can be classified as attacks of supply destruction as compared to attacks of delay, which are associated with lines of communication (LOC) sorties.

LOC attacks are attacks against the road network itself. These attacks traditionally ranged from simple road-busting strikes, in which roads were pocked with bomb craters, to much more sophisticated efforts, in which roads were first cratered and then overlaid with magnetic mines to damage road repair equipment and antipersonnel munitions to harass the clearance and repair crews. These strikes had proved to be the most questionable of all, for unless transport capacity can be rendered and maintained grossly inadequate, attacks of delay may harass an enemy, but they will not seriously restrict his action. The absence of ideal interdiction points in southern Laos and a vast network of interlinking routes and by-passes provided the North Vietnamese numerous options for the movement of supplies. Road busting and mining operations did little to constrain their actions. They quickly by-passed the interdiction points or repaired the roads and continued operations.[13]

LOC sorties, however, were given a new dimension during the initial entry interdiction program of Commando Hunt V. For the first time both fighter-attack and B-52 aircraft were employed in coordinated, sustained, around-the-clock attacks against the input routes from North Vietnam into Laos. A primary purpose of these attacks was to impede and delay traffic flow until the full complement of AC-130 gunships, which had been in the continental U.S. for modification, could be returned and their new crews acclimated to operations along the trail.

The final strike category, direct air support, was unique to Commando Hunt V. Strikes against enemy troops and equipment in the vicinity of friendly forces are normally viewed as a function of the close air support mission, not air interdiction. During Commando Hunt V, however, the South Vietnamese army staged a major ground incursion against the North Vietnamese logistics network in Laos west of the demilitarized zone between North and South Vietnam. This operation, code named Lam Son 719, along with several other minor ground operations in Laos, played a vital role in the interdiction campaign, for the purpose of these incursions was not to gain and hold enemy territory but to disrupt the enemy's lines of communication and destroy his supplies. As such, sorties flown in support of these operations contributed to the interdiction

objective—the reduction in supplies reaching South Vietnam and Cambodia—and their inclusion as a vital part of the interdiction effort seemed appropriate. They are termed "direct air support" sorties in this study in order to differentiate them from sorties normally associated with the close air support mission.

The impact of the B-52 aircraft, used in Southeast Asia primarily in a tactical as opposed to the traditional strategic role, could not be evaluated in the subsequent analysis because of the aggregate nature of the sortie data and the small variation in the total number of B-52s flown over the trail each week.[14] Evidence of the B-52's contribution to the campaign, however, could be gleaned from other intelligence information, and it might well be that the use of B-52s in conjunction with other tactical air sorties contributed to the positive products noted later.

In summary, the four tactical air sortie sets established as basic input for the production function and subsequent analysis are (1) gunship team sorties; and fighter-attack sorties striking (2) trucks and storage areas, (3) lines of communication, and (4) direct air support targets. To these inputs, it is necessary to add one additional explanatory variable that also influenced the volume of throughput: the enemy intent to push a volume of supplies through during a particular time period. Since actual intent was unknown, one requires a proxy variable to approximate this effect. The variable most highly related to throughput was the number of southbound sensor-detected truck movements, for if the enemy intended to increase throughput during a particular period, this could be accomplished only through an increase in southbound supply movements. Southbound sensor-detected truck movements were, therefore, used to proxy enemy intent and serve further as a normalizing influence so that the effectiveness of the various sortie sets could be more accurately evaluated.

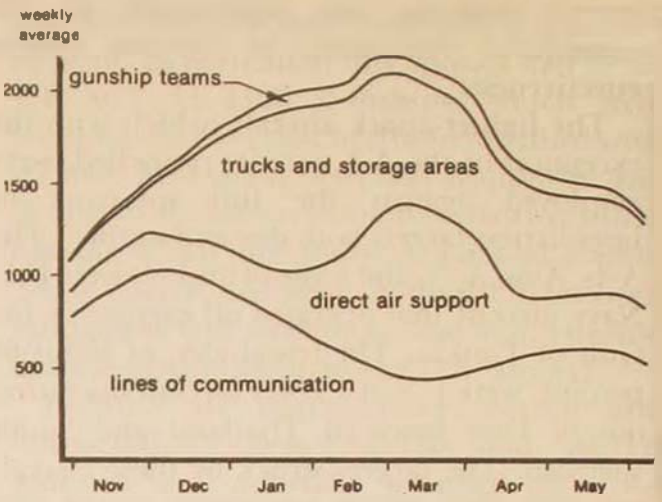


Figure 2. Tactical air strike sorties flown in southern Laos, October 1970–June 1971

To conform with the lagged structure described in the previous section and the assumption that six weeks was a reasonable period over which air strikes might affect a volume of supplies in transit, moving weekly averages from week t–6 through week t (see Figure 1) were calculated for each sortie set. For consistency, a similar moving average was also calculated for the proxy variable, southbound sensor-detected truck movements.

Figure 2 provides a plot of the sortie variables with the horizontal time scale entered at the midpoint of the moving averages. The dynamics of the campaign become quite evident in such a plot. First was the allocation of a major portion of the sorties to the entry interdiction campaign in November and December; then the rather dramatic shift to support the Lam Son 719 ground incursion in February and March. Overlaying these two operations was the increasing level of effort directed against trucks and storage areas as enemy traffic began to surge in December and the gunships were returned to the theater.

Figure 3 presents a similar plot for southbound sensor-detected truck movements,

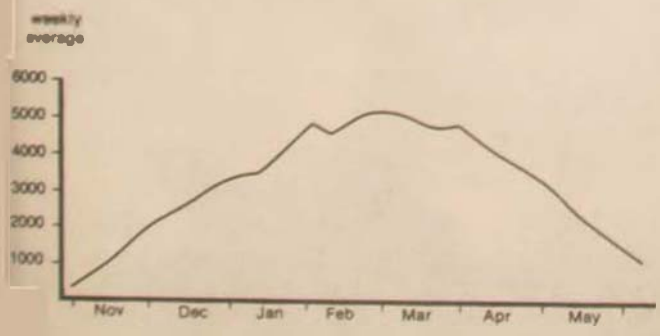
derived from the activations of seismic sensors delivered by U. S. aircraft in strings of six to eight beside known enemy routes. This profile provides a good representation of the trend of enemy activity over a dry season campaign in southern Laos. The weekly values, however, include duplicate counts of individual trucks that passed through more than one sensor string in a single night. Therefore, sensor-detected movements should not be viewed in an absolute sense but rather as a relative measure or index of variations in enemy activity over a span of time. As can be seen, during Commando Hunt V enemy activity increased from a wet season low in October, reached a maximum during February and March, and then declined again as the next wet season approached.

The Production Function

At the heart of an economic analysis is the production function, which describes how inputs can be combined to produce the output or objective. In other words, it defines the alternate ways the objective may be attained. The production function that provided the most significant and realistic results was the modified version of the Cobb-Douglas model:

$$Q = X_1^{.131} \quad X_2^{.57} \quad X_3^{.33} \quad X_4^{.28} \quad X_5^{.85}$$

Figure 3. Southbound sensor-detected truck movements, October 1970–June 1971



Where: Q = The objective variable, $IP_{t-6} - IP_t$ per week

X_1 = Gunship team sorties against trucks per week

X_2 = Fighter-attack sorties against trucks and storage areas per week

X_3 = Fighter-attack sorties against lines of communication per week

X_4 = Fighter-attack sorties in direct air support per week

X_5 = Southbound sensor-detected movements per week

The Xs are weekly moving averages week t-6 through week t.[15]

All exponents for the sortie sets are positive and indicate diminishing returns except that for the gunship teams. The exponent of 1.31 on the gunship team variable is greater than one and requires some explanation: it indicates that as more gunship sorties were flown, effectiveness increased at a progressive rate (i.e., a one percent increase in gunship sorties resulted in a more than one percent increase in the objective variable). Two explanations seem plausible. First, when the campaign began, few gunships were available and the crews were inexperienced. As the campaign progressed, more gunships were delivered to Southeast Asia at the same time the crews were gaining valuable experience. The exponent may, therefore, incorporate a crew learning curve that was impossible to isolate statistically. Crew learning curves were normally experienced during each dry season campaign, since tour lengths were confined to one year.

The second explanation may be that as a gunship force increased, alternate routes the enemy previously used could be covered. This is analogous to the example used to explain increasing returns to the last few radars that close a gap in an early warning line. As long as a gap remains through which the enemy may strike, the radar line is partially ineffective. But as the gap is closed, the whole system becomes

A truck destroyed by an A-1

effective. Consequently, we receive high returns to the last few radars that secure the system. The extent to which these returns would be experienced further in the gunship case, however, is subject to question. The largest number of weekly gunship sorties flown against trucks during the campaign was approximately 100. To extend the analysis beyond the data base may be inappropriate because beyond some point we could experience diminishing returns as the force is increased, especially if air space limitations become critical.[16]

Of the fighter-attack sorties, the highest exponent was attributed to those that struck trucks and storage areas. This seems reasonable, especially in the case of trucks that had traditionally proved to be the most lucrative Southeast Asian interdiction target. In addition, several rare but spectacular strikes, with numerous secondary explosions reported, were experienced in storage area attacks during Commando Hunt V. Lines of communication sorties appeared to be productive but at a lower level than the first two sets. Previous evaluations of this set of sorties had seriously questioned their effectiveness. It may well be that the complementary use of B-52s for sustained bombing during the initial entry interdiction program resulted in the positive contribution of LOC sorties that was not evident in analyses of previous campaigns. Finally, the productivity of the direct air support sorties probably resulted from their contribution to the joint Lam Son 719 operation, in which the combined air and ground forces destroyed large volumes of supplies and forced the enemy to expend valuable resources in his defense. Consequently, these supplies were not available as throughput in subsequent weeks, and the difference between input and throughput, the objective, was increased.

The last variable in the model, southbound sensor-detected truck movements, acts as a proxy for enemy intent. The exponent is negative, which indicates that if sortie levels are not increased when enemy activity increases, throughput for any given amount of input will increase. As stated above, the main purpose for including this variable was to statistically isolate and account for the effect of changes in the level of enemy activity, thereby making possible a more accurate comparison of the effectiveness of the U.S. air resources.

Variable Input Costs

In examining the conduct of a tactical air operation to determine the most efficient allocation of air resources, one should look only at the variable cost experience and limit analysis to those resources consumed in the actual performance of the mission. Omitted, then, are those costs that cannot be directly related to the operation or to any particular weapon system. These costs are generally defined as fixed costs because they do not vary with the level of combat activity and they are not a direct consequence of flying the mission. Even so, identification of appropriate wartime variable costs is no simple matter. A wide range of alternative assumptions had to be considered, but the choices made in this study suggest that the approximate variable cost of nearly 9 months of interdiction operations in fiscal year 1971 dollars was $1.1 billion, or about $4.2 million a day.[17] These costs are summarized in Table II.

The cost per sortie for fighter-attack aircraft of $8900 is an average weighted by the number of sorties flown by all fighter-attack aircraft during the campaign.[18] It does not include the F-4 aircraft that escorted gunships since these aircraft were considered an integral part of the gunship team, another weapon system category.

The gunship sortie cost is also an average weighted by the number of sorties flown by the AC-130 and AC-119K aircraft. The escort sortie cost was higher than the fighter-attack aircraft average since the F-4 was more expensive to

Aircraft	Total Sorties	Cost Per Sortie ($)	Total Variable Cost ($ millions)
fighter-attack	62,100	8,900	552.7
gunship team		52,300	125.5
gunship	2,400	(11,500)	
F-4 escort	7,200	(13,600)	
B-52	8,100	32,500	263.3
total strike	79,800	11,800	941.5 (86%)
total support	49,200	3,100	152.5 (14%)
campaign total	129,000		1,094.0 (100%)

Table II. Total variable cost of the interdiction campaign, 10 October 1970–30 June 1971 (FY 1971 dollars)

operate than the average and the escorts carried large ordnance loads consisting primarily of high-cost flak suppression munitions. In addition, two escorts were shot down during the campaign, giving an attrition cost per sortie that was twice that of other F-4 strike missions. The total variable cost of the gunship team sortie, including the three escorts, therefore, totaled $52,300.

Economic Evaluation

Four of the basic elements of an economic analysis have thus far been examined: The product and inputs have been defined, the production function that relates the inputs to the product has been estimated, and the cost of applying the inputs have been calculated. To complete the analysis and compute an optimal allocation of tactical air resources in terms of the Commando Hunt V experience, a criterion must be established to determine which, out of all possible sortie combinations defined by the production function, is the most cost-effective.

Since sorties and the objective are not expressed in the same units, the concept of constrained optimization must be employed. It is impossible to both maximize output and minimize cost: maximizing output would call for a prohibitively large force while minimizing cost would call for no force at all. These dual criteria are, therefore, incompatible. As a proper criterion, we may either minimize the cost of attaining a given output or, conversely, maximize output for a given resource or cost level. Because of U.S. interest in the cost aspect of operations in Southeast Asia, the former will form the basis of the economic analysis that follows. An example of maximizing output for a given resource level is also provided.

The optimal allocation of sorties to various target types, therefore, will be predicated on minimizing the cost of the sorties flown per week subject to the constraint that the same average weekly reduction in throughput, $IP_{t-6} - TP_t$ = 436 truckloads, reported during the period of October 1970 through June 1971 is maintained.[19] In other words, we require to:

Minimize: The cost of sorties flown per week

Subject to: $IP_{t-6} - TP_t$ = 436 truckloads per week.

Because of the high productivity of the gunship teams, the mathematical solution called for more gunship team sorties than were available to strike trucks at night during the time period under consideration. For this reason a second constraint was employed to

arrive at a realistic solution. Optimum 2 was thus obtained by using the following specification:

Minimize: The cost of sorties flown per week

Subject to: (1) $IP_{t-6} - TP_t$ = 436 truckloads per week.
(2) Gunship team sorties = 65 per week (October '70-June '71 average).

The numerical solutions to the cost minimization problems being addressed are given in Table III.[20] Also given, in the column entitled "Flown Per Week," are the weekly average number of sorties that flew and expended ordnance during the period October 1970 through June 1971. The total variable cost for this combination of sorties, based on the cost factors cited above, was approximately $18.3 million per week.

The next column gives the optimal solution in which the number of gunship team sorties was not constrained. This sortie combination would have cost about $13.3 million per week and would have attained, according to the production function, the same reduction in throughput as the combination flown. It matters not whether the true reduction was less or more than 436 truckloads; the actual reduction would be identical for the two combinations with the optimum costing some $5 million a week less. The cost of attaining an additional reduction in throughput by one truckload at the optimum with this allocation would be $12,300.

This solution, however, called for a weekly average of 134 gunship team sorties to be flown at night against trucks in southern Laos. Because of the small number of gunships available at the start of the campaign and commitments to other operating areas and targets in Southeast Asia, a weekly average this high was infeasible. It should also be kept in mind that this large number calls for an extension of the gunship team relationship to a point beyond the data base range used in estimating the production model, so the relationship may or may not be valid at this point.

The second solution provides a more realistic optimum by constraining the number of gunship team sorties to 65, the weekly average flown during the period covered by this study. This solution requires 1581 fighter-attack sorties and is invariant with respect to their cost. In general, about 100 sorties are saved by shifting some sorties from LOC

Table III. Cost minimization sortie allocations

Sortie Type	Flown Per Week	Optimum 1	Optimum 2
gunship team	65	134	65
fighter-attack			
trucks and storage areas	579	344	765
lines of communication	695	201	445
direct air support	404	167	371
total	1678	712	1581
cost per week	$18,333,700	$13,345,000	$17,470,400
saving per week		4,988,700	863,300
marginal cost to reduce throughput		12,300	27,300
marginal value of a gunship team sortie			187,000

strikes to the more productive strikes against trucks and storage areas. The cost of the Optimum 2 combination of sorties is about $17.5 million, implying a possible saving of somewhat less than $1 million.

The critical role of the gunship team is highlighted in the second solution by the increased marginal cost of obtaining a reduction in throughput by one truckload. As less effective weapon systems are substituted for the gunship team, the marginal cost more than doubles. The dollar value of an additional gunship team sortie in the second solution is $187,000. Thus, total cost could be reduced by $187,000 if an additional gunship team sortie above the 65 were made available. Although this marginal value decreases as more gunship team sorties are added and the first optimum is approached, these results are indicative of the high opportunity cost of using gunship teams in functions other than striking trucks at night in their primary interdiction role.

This does not imply, however, that the gunship team alone should perform the interdiction mission. Critics who advocated the sole use of gunship teams on an average output per dollar cost basis neglected a fundamental facet of marginal cost analysis. This is illustrated in the Optimum 1 solution of Table III, where the number of gunship team sorties was not limited. Seven hundred twelve fighter-attack sorties, or 5.4 fighter-attac sorties per each gunship team sortie, were stil required for other interdiction functions. Eve if the cost of a fighter-attack sortie were 10 percent greater than that used in this study, th optimal distribution would still call for 2. fighter-attack sorties for each gunship tean sortie. The estimated results, therefore conform to traditional theory which assert that the marginal product of one input i predicated in part on the number of othe inputs with which it is combined. Th gunship team's marginal product wa enhanced by the use of other fighter-attac aircraft, as was the marginal product of th fighter-attack aircraft by the gunship teams Both were an integral part of the interdictio effort.

A second way of looking at an optima allocation scheme is to determine th maximum reduction in throughput that coul be expected from the sorties actually flown. I other words, we now require to:

Maximize: The reduction in throughpu $(IP_{t-6} - TP_t)$.

Subject to: (1) Gunship team sorties = 65 p week.

(2) Fighter-attack sorties = 167 per week.

The solution to this output maximizatio problem is given in Table IV. As can be seen

Table IV. Output maximization sortie allocations

Sortie Type	Flown Per Week	Optimum
gunship team	65	65
fighter-attack		
trucks and storage areas	579	810
lines of communication	695	465
direct air support	404	403
total	1678	1678
reduction in throughput	436 truckloads	467 truckloads

the potential reduction in throughput is 467 truckloads, 31 truckloads more than was actually attained.

The increase in output would result from a 33 percent shift of fighter-attack sorties out of the lines of communication target category to the trucks and storage area category. In the cost minimization problem cited previously, a similar shift would permit a saving of about 100 sorties with the reduction in throughput held constant at the campaign average. In either case, the indication is that fewer lines of communication sorties were required. A reallocation out of this category to trucks and storage areas would have resulted in either an increase in output for the same number of sorties or a saving of sorties for the same output.

In the context of constrained optimization, this is the one fault that can be found with sortie allocations during Commando Hunt V. It was a fault that permeated all of the interdiction campaigns in Southeast Asia—too many attacks of delay in an environment in which time meant little to the enemy. The fact that this sortie set's marginal product was positive, however, indicates a contribution to the interdiction effort that had not been evidenced in other campaigns. If anything, the credit must go to the entry interdiction program, which delayed the enemy's logistics surge and gained time for the build-up and training of the gunship truck-killing force. An earlier termination of this program, however, after first evidence that the enemy's by-pass route structure had been completed, might possibly have resulted in the savings outlined above.

A final aspect of this campaign, one unique to Commando Hunt V, was the Lam Son 719 ground incursion into Laos and its contribution to the overall objective. Although the incursion did not meet with full expectations, South Vietnamese ground troops remained in Laos for about six weeks and at one point penetrated as far as Tchepone, a main logistics transshipment hub. The intense enemy reaction to the incursion is indicative of the threat he perceived to his South Vietnamese and Cambodian logistics life lines and his further need to maintain military credibility. Nevertheless, the combined allied air and ground forces destroyed large volumes of supplies and forced the enemy to expend valuable resources in his defense. The productivity of the direct air support sorties resulted from their contribution to this joint operation.

Beyond this immediate effect, Lam Son 719 also played an important role in enhancing the effectiveness of other interdiction sorties. The increased logistics requirements forced the enemy to move and concentrate supplies that might otherwise have been delayed or concealed from air strikes. As a result, the productivity of the entire interdiction force was increased and there was a decided upward shift in enemy truck and supply destruction—indicating once again that when the enemy is forced into a main front confrontation and the timing and volume of replacement men and materiel become critical, the strike effectiveness of an interdiction force is considerably enhanced.

Graphical Review

The problem-solving methodology employed in this case study can be illustrated graphically in a two-dimensional diagram if we group all fighter-attack aircraft sorties into one category and assume they have been efficiently allocated, according to the interdiction model, to trucks and storage areas, lines of communication, and direct air support. We then have only two inputs to consider, the combined fighter-attack sorties and the gunship team sorties, and we seek the least-cost combination of these two inputs to attain the given output—a reduction in throughput of 436 truckloads per week. This is illustrated in the isoquant-isocost diagram of

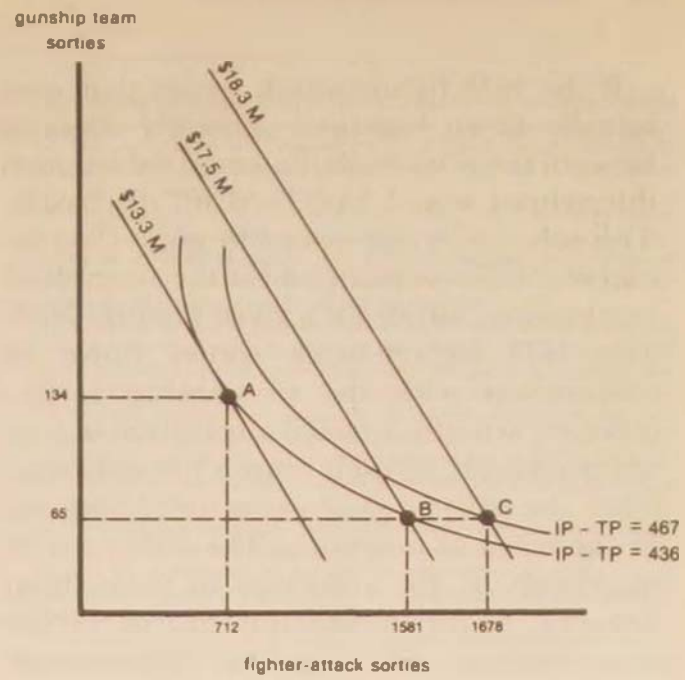


Figure 4. Isoquant-isocost presentation

Figure 4. The diagram is for illustrative purposes only and should not be taken as an exact reproduction of the cost and output functions. It has also been scaled to better depict the various constrained solutions.

The least-cost combination of sorties is depicted by point A on the diagram where the given "436" isoquant is tangent to the lowest cost line of $13.3 million—the Optimum 1 solution. This solution, however, called for 134 gunship team sorties, more than were available to strike trucks during the campaign. We must, therefore, move down along the isoquant or equal-output line away from the least-cost solution to point B which is constrained at 65 gunship team sorties—the Optimum 2 solution. As can be seen in the diagram, this solution is achievable only at a higher cost than the first.

An enemy line of communication winding through bomb craters

If the 1678 fighter-attack sorties that were actually flown had been optimally allocated between target types, the potential reduction in throughput would have been 467 truckloads. This solution is represented by point C on the higher "467" isoquant and is the example of maximizing output for a given resource level. The 1678 fighter-attack sorties flown in conjunction with the 65 gunship sorties, however, actually attained a reduction of only 436 truckloads, so their output lies somewhat below the efficient production surface defined by the series of isoquants. The difference, 31 truckloads, is the reduction in throughput foregone, or the opportunity cost of the less than optimal allocation of fighter-attack aircraft.

On a dollar-cost basis, the potential saving available at the Optimum 1 and 2 solutions are the differences between the actual cost line of $18.3 million and the $13.3 million and $17.5 million lines, respectively. If sufficient gunship team sorties had been available, a cost saving of about $5 million per week might have been attained. With the strike resources available, however, a cost saving of less than $1 million per week was possible. This is a rather impressive result. *Compared to the $17.5 million optimal cost, the overrun was only five percent.*

MANY OBSERVERS still question the viability and overall impact of the air interdiction effort in Southeast Asia. Historically, it has been difficult to show a consistent payoff for the supply denial objective in terms of its impact on the outcome of a campaign, especially a protracted one. What is observed is merely the ability of the enemy to fight at the current operating level, a level which he may or may not have selected as a result of the burden imposed on him by air interdiction. Without knowledge of the enemy's precise intentions, one finds it virtually impossible to determine whether the interdiction effort seriously limited his capability to operate at the preferred level of activity. Indeed, some insight into the impact of interdiction during World War II has been gained through the media of German records and interviews, but barring a similar exchange, it is unlikely we will ever be able to assess with certainty the true impact during the Southeast Asian conflict.[21]

Nevertheless, this uncertainty should not be allowed to detract from the results already described. U. S. armed forces were deployed by political decree to Southeast Asia, and given this circumstance, a primary task of military leaders was to conduct the assigned operations as efficiently as possible. Within the context of constrained optimization, the phenomenon faced at the tactical level, the final result was as good as could possibly be expected.

Department of Defense

Notes

1. Charles J. Hitch and Roland N. McKean, *The Economics of Defense in the Nuclear Age* (Cambridge: Harvard University Press, 1960).

2. For background material on these campaigns see: Herman L. Gilster, "Air Interdiction in Protracted War: An Economic Evaluation," *Air University Review*, May-June 1977, pp. 2-18.

3. The data used in this study are probably as accurate as could be obtained in a wartime environment. The data consisted mainly of sortie counts, which should be highly accurate, and input throughput, and truck movement estimates calculated by intelligence analysts from electronic sensor activations. Reported target destruction data, often criticized as unreliable, are used only in an auxiliary sense. All data used were first screened for consistency and significant deviations from expected values. In addition, the final economic evaluation was predicated on regression parameters, which are functions of the relationships between variations about data means and not on the absolute values of the means. Therefore, certain absolute data values, such as estimated throughput, might be high or low, but this is of little consequence in a marginal analysis as long as the values were consistently calculated. Since the time span of the study covered only nine months and there were no methodological changes in calculating logistics estimates during that period, a consistency assumption would appear reasonable.

4. These results were originally reported in a classified study, *An Econometric Study of Aerial Interdiction in Southern Laos, 10 October 1970–30 June 1971*, published by Headquarters Seventh Air Force in November 1971. The study was subsequently declassified and reprinted under the same title as U.S.A.F. Academy Technical Report 77-1, May 1977.

5. Some expenditure of resources, of course, would take place in the absence of interdiction, but most logisticians feel this amount would be negligible in the total.

6. Sortie data were extracted on a weekly basis from the official Southeast Asia Data Base and classified by the first target type struck. During the course

of a mission a few sorties did strike other targets, but in general most expended their ordnance on the same target type. Sorties coded against enemy defenses were primarily gunship escorts and Lam Son 719 flak suppression sorties and were included in the gunship team and direct air support categories, respectively.

7. In a regression equation similar to the type described later, approximately 76 percent of the variation in the objective variable was explained by the number of trucks reported destroyed or damaged.

8. Later, 105-mm cannons were installed on some gunships.

9. Since it was extremely difficult to locate and destroy the well-concealed gun positions, area munitions were delivered in the general vicinity of defense activity to temporarily silence the guns until a strike was completed.

10. On the average, two of the three escorts expended ordnance against enemy defenses in their flak suppression role, and the third principally attacked trucks under direction of the gunship.

11. The B-57G, a small, modified tactical bomber with characteristics similar to those of the fighter-attack aircraft, was also included in this group.

12. The numbers of sorties striking trucks and storage areas were also highly correlated over time. During the beginning and end of the dry season campaign, when the enemy resupply surge occurred, more sorties were normally directed against the enemy's road network or LOCs. During mid-campaign, when the enemy resupply surge occurred, more sorties were allocated to strikes against both trucks and storage areas. The resulting high correlation between sorties attacking trucks and storage areas, which for Commando Hunt V was .94, made it difficult to break out their individual influence with any degree of confidence.

13. In the few cases when it was possible to measure road closure time, delays in the range of 0 to 49 hours were recorded with a median of only 15 hours.

14. The weekly mean was 220 sorties with a standard deviation of only 11 sorties. With such a small variation, the marginal contribution of B-52 sorties to the objective could not be estimated.

15. The parameters of the model were estimated, using 32 data points or weekly average observations to cover the period of the campaign. The equation accounts for 86 percent ($R^2 = .86$) of the variation in the objective variable, $TP_{t-6} - TP_t$, and the T ratios for the exponents of the explanatory variables are all significant at the 95 percent confidence level.

16. It should be noted that the production function of this study was estimated using Commando Hunt V data and is unique to that campaign. As with the gunship team case, caution should be exercised in extrapolating any results beyond the range of events that prevailed during Commando Hunt V.

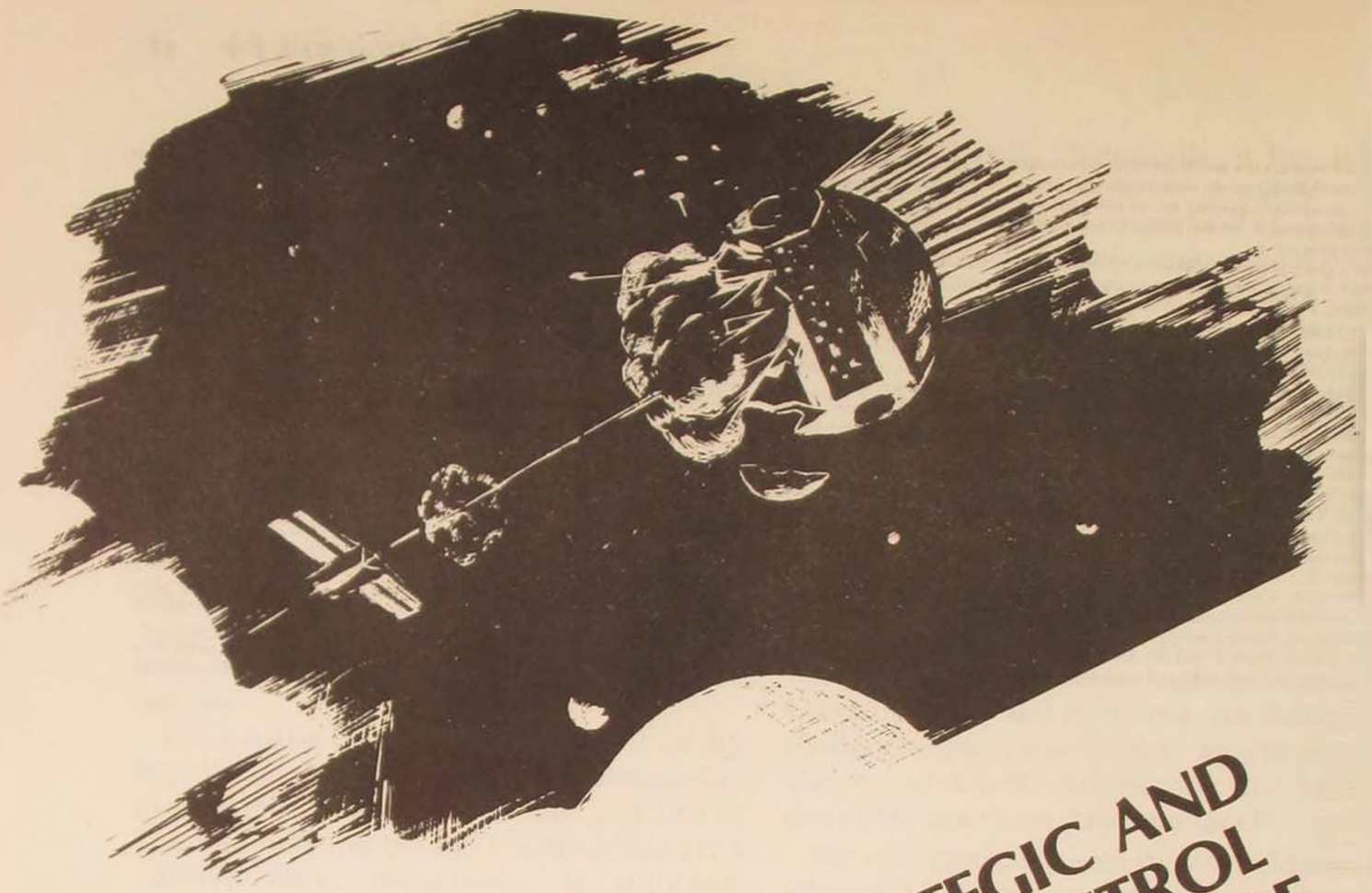
17. Variable input costs included combat aircraft and aircrew attrition, ordnance, and aircraft operating and support costs.

18. These sortie costs ranged from $4300 for the F-100 to $15,700 for the B-57G. The cost for the F-4, which flew approximately half the fighter-attack sorties, was $10,800.

19. To isolate the sortie contributions, southbound sensor-detected truck movements were also held constant at the campaign weekly average of 3312.

20. For an explanation of the mathematical technique used to solve problems in constrained optimization, see the *Econometric Study* cited in footnote #4 or any mathematical economics text.

21. For more on this subject see Gilster, "Air Interdiction in Protracted War: An Economic Evaluation," *Air University Review*, May-June 1977, pp. 2-18.



STRATEGIC AND ARMS CONTROL IMPLICATIONS OF LASER WEAPONS

a preliminary assessment

DR. BARRY J. SMERNOFF

THERE SHOULD be little doubt in the minds of most thoughtful individuals that laser weapon technology has the potential to revolutionize the art of warfare during the next quarter-century or two. Recently, various television shows and movies, such as "Star Trek" (with its main phasers delivering lethal photon torpedoes) and *Star Wars*, have popularized the image of death rays. Prior to the advent of high-energy laser technology, this image of target destruction through intense laser irradiation seemed much too exotic to be more than suggestive of twenty-first century possibilities. The purpose of this article is to separate technological reality from emotional imagery in an initial attempt to understand better the feasibility, desirability, and complex implications of future laser weapons.[1]

Donald Brennan has related the revealing anecdote about a distinguished physicist who,

in 1956, stated that the development of a coherent source of light would never be possible:

> The laser, which is exactly such a source, was invented in 1958, and the first operating model was achieved in 1960. By 1962, people were modulating laser beams for communications and bouncing laser beams off the moon. The laser provides a uniquely concentrated source of radiant energy; . . .
>
> Fifteen years ago, or possibly even ten, one might have asked a representative scientist just which of the technical devices appearing in the Buck Rogers comic strip was *least* likely to be achieved in the near future. If I am not mistaken, most [such respondents] (certainly I myself) would have pointed to the disintegrator ray gun. It would have been a bad choice, as the invention of the laser in 1958 made apparent. . . .[2]

This passage was published before Edward Gerry announced his invention of the gas-dynamic laser, which opened the door for high-energy laser (HEL) technology. Public disclosures about rapidly advancing HEL technology, which now includes electric-discharge lasers and chemical lasers, suggest that the U.S.-Soviet competition to weaponize these technologies is well under way.

Following the advent of gas-dynamic laser technology in the late 1960s, various news reports have been published regarding the military potential of high-energy laser weapons. For example, in 1973 an Associated Press story stated that:

> The British government is exchanging information with the United States on a laser "death ray" both nations are developing to destroy aircraft and missiles at long range, the Defense Ministry said today. A spokesman said work on a powerful, long-range laser gun has been going on for some time.[3]

More recently, an article appearing in the *New York Times* boasted a headline implying that high-energy laser weapons would become part of American and Soviet arsenals in the not-too-distant future.[4] What formerly had been considered an exotic weapon possibility has now become a conventional topic of popularized articles appearing in news stories and in science-oriented magazines.[5]

How much money is being spent to develop laser weapons (i.e., to weaponize high-energy laser technology)? Rumor has it that the Soviet Union may be spending as much as $1 billion each year on laser weapon research and development (R&D).[6] American expenditures, according to publicly released figures, were $187 million in FY 1977 and are estimated to be $150 million in FY 1978. Table I provides a historical breakdown of these funding levels for the three services and for the Defense Advanced Research Projects Agency (DARPA), while Figure 1 indicates the

Table I. DOD high-energy laser funding ($ millions)

	FY 1975	*FY 1976*	*FY 1977*	*FY 1978*
Army	*24.8*	*28.5*	*26.5*	13.7
Navy	*38.6*	*45.3*	*46.3*	33.2
Air Force	*56.2*	*63.1*	*88.9*	78.2
DARPA	*21.1*	*20.9*	*25.4*	*24.9*
	140.7	157.8	187.1	150.0

Source: Dr. Malcolm R. Currie, Director of Defense Research and Engineering, *The DoD Program of RDT&E, FY 1977*, Statement to the Congress, 3 February 1976 and Office of the Assistant Director (Space and Advanced Systems), ODDR&E.

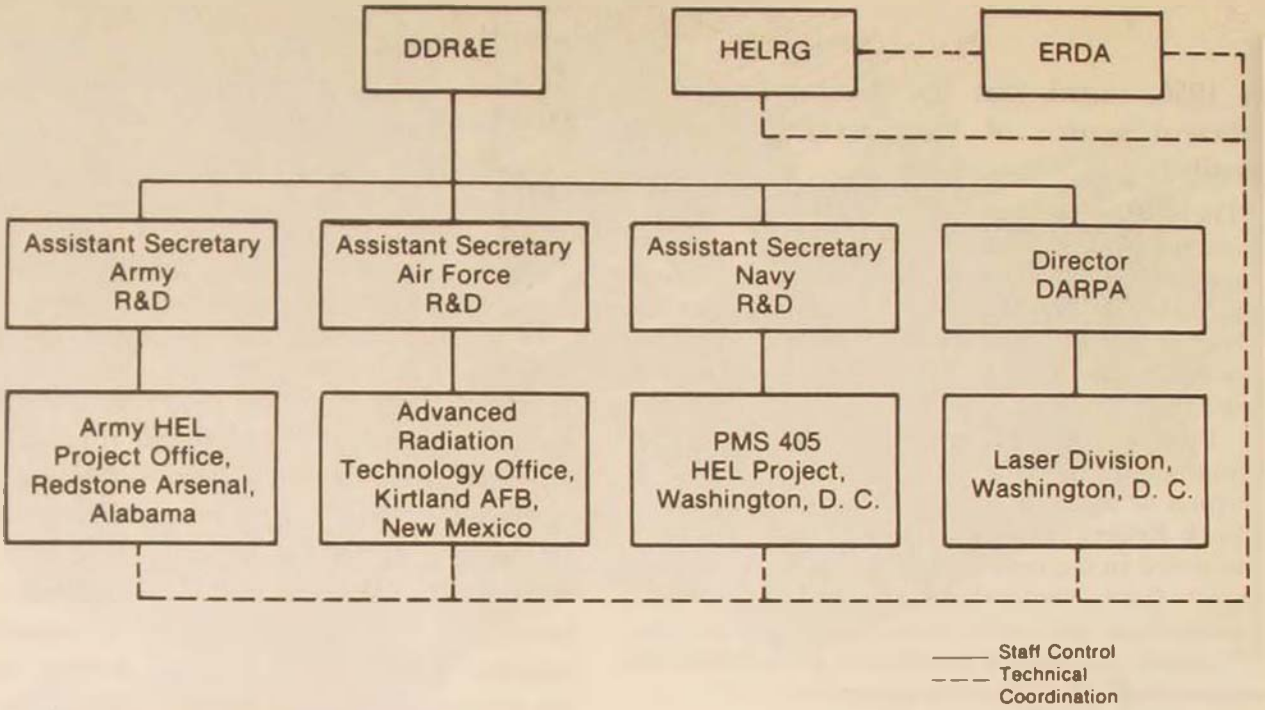


Figure 1. High-energy laser R&D program management

management structure for the DOD's high-energy laser program.

The objective of the DOD-wide HEL program is to develop laser weapons that are capable of engaging and destroying selected military targets.[7] The HEL technology program is structured to provide the necessary feasibility tests to support full-scale engineering development decisions for laser weapons in the early 1980s. If prototype laser weapons are successfully demonstrated by the mid-1980s, operational weapon systems might become available in the late 1980s for selected tactical applications emphasizing the defense of aircraft, ships, and ground-based assets.

Hypothetical laser weapon systems consist of three basic components. The *laser device* (beam generator) generates the high-energy beam of electromagnetic radiation. The *fire-control subsystem* acquires the target, selects the aimpoint, and aims the weapon. Finally, the *beam-control* (optical) *subsystem* expands the beam and projects it to the target.

In view of the central requirement to prepare for prototype decisions in the early 1980s, the three services are engaged in a series of technology demonstrations involving the broad spectrum of HEL issues as illustrated in Figure 2. The Army testbed is the Mobile Test Unit, consisting of an electric laser mounted on a USMC LVTP-7 tracked vehicle, which was retired recently after accomplishing its remaining milestones. The Navy is conducting a unified field test program at the San Juan Capistrano facility near Camp Pendleton, California, which places emphasis on integration of an advanced beam-control system with chemical lasers. Finally, the testbed for the Air Force HEL program is the Airborne Laser Laboratory (ALL), a highly instrumented NKC-135 aircraft.

One of the best unclassified summaries of the DOD high-energy laser program is given in a three-part series of articles by Philip J. Klass. Among the important HEL development programs discussed by Klass, the Airborne Laser Laboratory is probably the most significant for USAF applications:

To investigate high-altitude propagation problems and the inherent difficulties of installing a high-energy laser and its aiming-tracking system in an airborne platform, USAF has outfitted a Boeing KC-135. The aircraft, called the Airborne Laser Laboratory (ALL), has been outfitted with a gas-dynamic laser, using carbon dioxide, which radiates at 10.6 micron, supplied by United Technologies Corp. The beam aiming/tracking system is supplied by Hughes Aircraft Co.

The Airborne Laser Laboratory is the most advanced of the three planned service testbed facilities, and experience gained with the USAF aircraft is expected to be of value for surface-based applications.[8]

selected strategic implications

Potential applications of air-based laser weapons include bomber self-defense, air superiority, satellite destruction, and antisubmarine launched ballistic missile (ASLBM) missions. The first two applications might be feasible, if not especially cost-effective, during the next decade. The last two applications are the ones with significant strategic (and arms control) implications since they could constitute unique long-range capabilities for which there would be few competing technological alternatives.

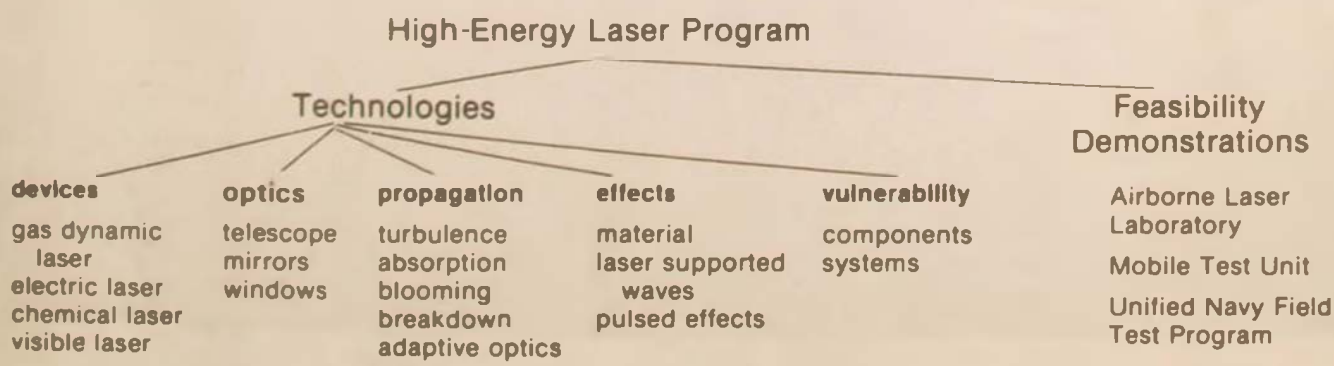
An air-based laser antisatellite (ASAT) capability would have some interesting advantages and disadvantages. First, *any* American antisatellite capability would tend to symmetrize the current unsettling situation in which the Soviet Union has developed and tested a nonnuclear hunter-killer ASAT system.[9] On the other hand, the U.S. at best has no more than a primitive nuclear antisatellite capability whose use is not very credible, short of all-out warfare. The Soviet ASAT capability has triggered a U.S. budget request for $108 million to be dedicated to "space defense" R&D:

> Soviet development and testing of a potential antisatellite capability clearly threatens the survivability of our space system and raises the spector of space warfare as a new dimension of conflict. We are responding to this Soviet initiative in space by expanding those RDT&E programs which will provide a capability for protecting U.S. satellite systems.[10]

Given the large and growing space assets of the United States, which include important early warning and communication satellities,[11] continued neglect of the U.S.-Soviet ASAT asymmetry might increasingly imperil the American strategic posture. A symmetrizing response, which may be both technologically elegant and politically discreet, corresponds to air-based laser ASAT weapons.

The second point is much more subtle. If effective laser antisatellite weapons were deployed on large aircraft by both superpowers, the temptation to strike first might grow. Both sides might perceive that

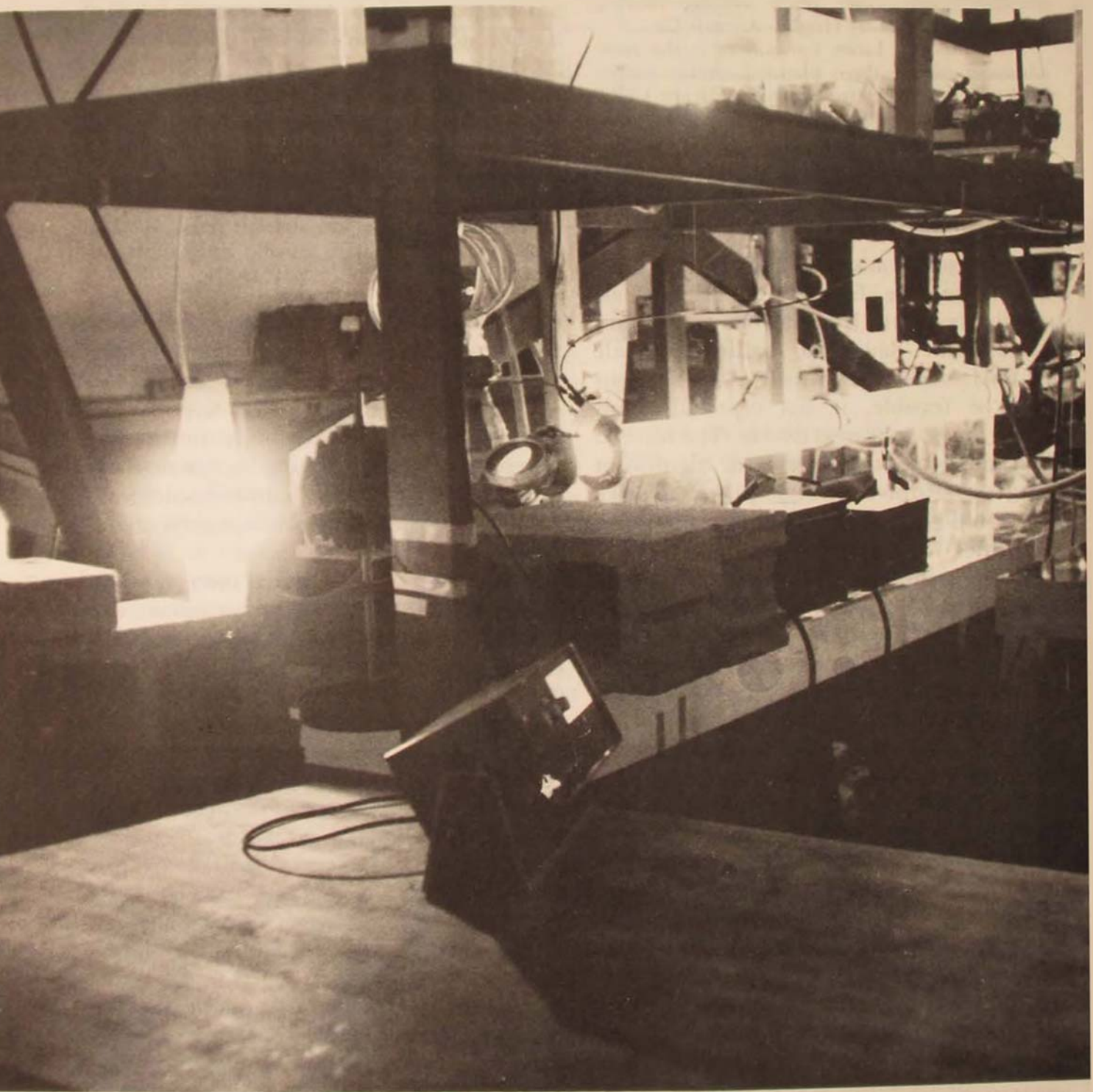
Figure 2. High-energy laser program

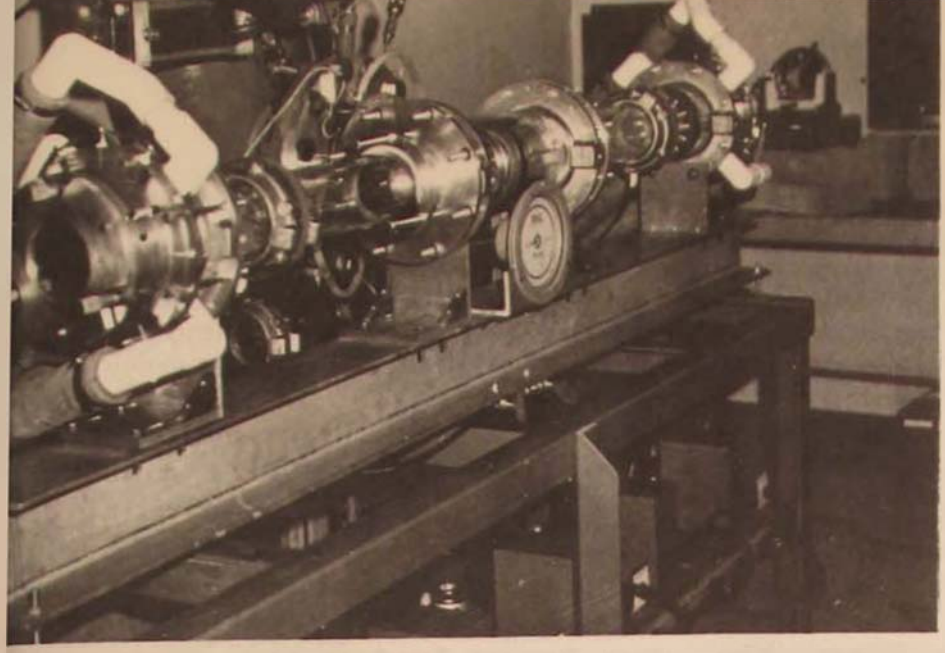


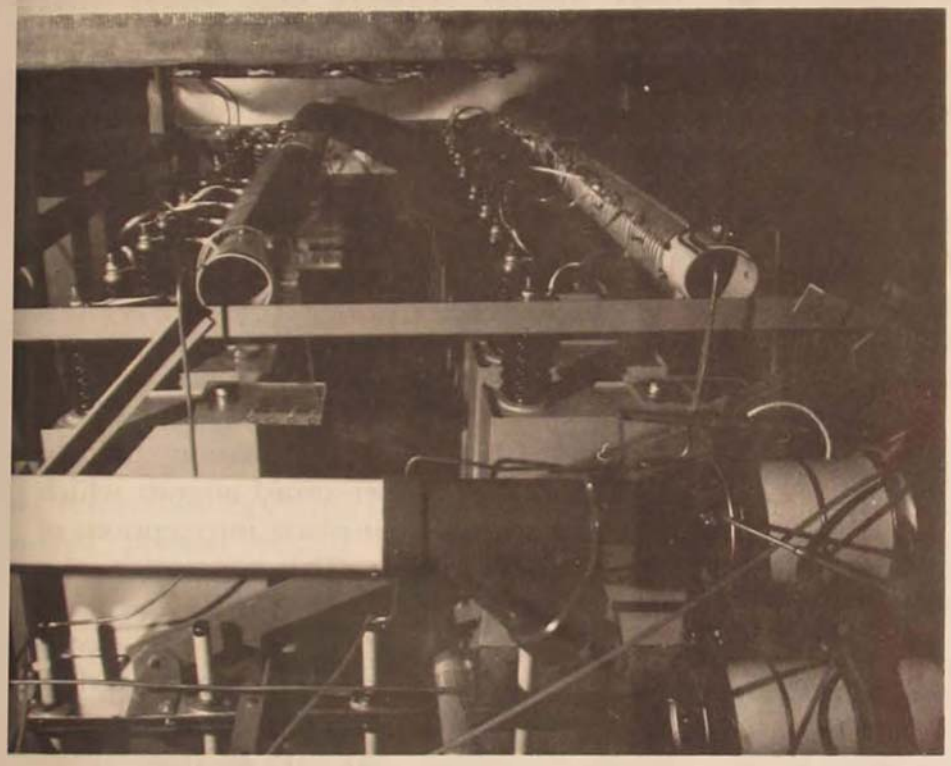
Continued on Page 44

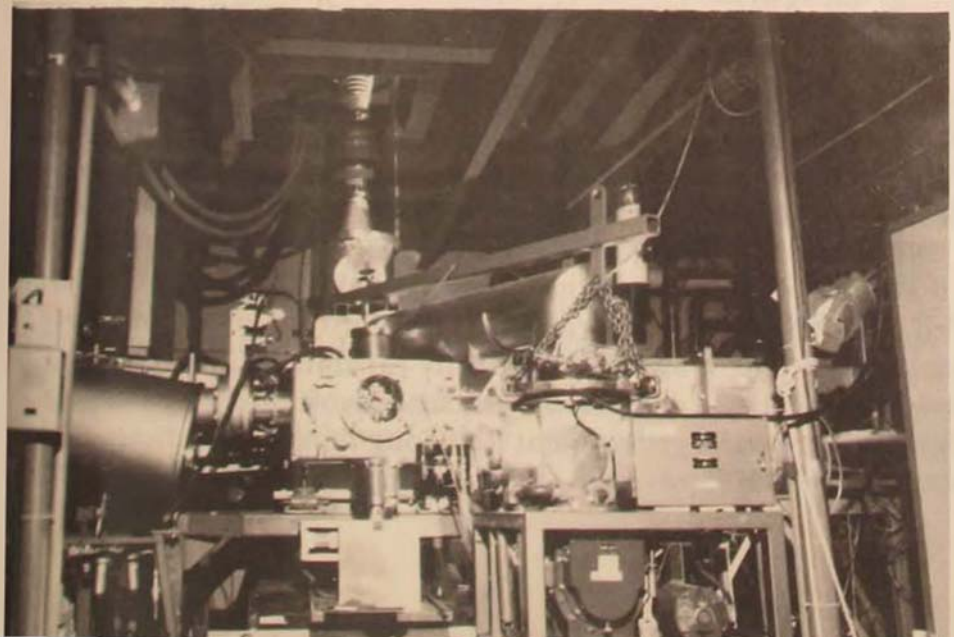
Air Force Laser Research

The laser, a product of only the last twenty years, is being intently researched here and abroad in both civil and military laboratories for potential applications. At the time of its development in the Air Force Weapons Laboratory, the pulsed CO_2 laser (below) was a completely new concept in CO_2 lasers; its laser beam represented a 2 to 3 orders of magnitude increase in pulsed CO_2 power levels while maintaining high average power because of continuous and rapid pulse repetition capability. . . . Other Air Force laser research projects (opposite) include the electric discharge convection laser (top), which is used for laser effect and vulnerability testing; the CO_2 electric discharge laser (EDL) charge modulator; the CO_2 electric discharge laser electron gun.









important advantages could be gained by preempting the opposition during a developing crisis. Space might be viewed as an attractive arena for early hostilities that demonstrate resolve during such a crisis without being too provocative. Moreover, once long-range laser ASAT weapons enter the strategic scene, laser antiballistic missile (ABM) concepts (which may or may not be space-based) cannot be far behind.[12]

We may have more to lose in this type of HEL arms competition than the Soviets, not simply because the U.S. is more dependent on satellites than the Soviet Union. Elite opposition to ABM weapon systems is much stronger in the U.S. than in the Soviet Union. Russian leaders have always had a strong interest in strategic defense, as demonstrated by the contemporary American puzzlement regarding the strategic significance of large Soviet civil defense capabilities. In this regard, former Defense Secretary Donald H. Rumsfeld made an extremely interesting point in his last report to Congress:

> In theorizing about strategic nuclear stability, some analysts have postulated that mutual vulnerability is a condition of stability—in other words, if each side offered its vulnerable population and industry as hostages to the other, neither side would dare to attack. These same analysts saw acceptance by the Soviets of this premise in their signature of the ABM Treaty of 1972. It has become *equally plausible* to believe that the Soviets have never really agreed to this assumption, and that they entered the ABM Treaty either because of severe resource constraints or because they feared that, without an agreement, U.S. technology over the near term would give us a continuing and even growing advantage in this form of defense.[13]

Some students of strategic affairs may disagree with Rumsfeld that "it has become equally plausible" to believe that the Soviet Union is not irrevocably wedded to the ABM Treaty by virtue of its being a collective "MADvocate."[14] In any case, Soviet interpretation of the ABM Treaty of 1972 may leave open the possibility that the development of ABM systems "based on other physical principles"[15] is not foreclosed by Article V which states that:

> Each Party undertakes not to develop, test, or deploy ABM systems or components which are sea-based, air-based, space-based, or mobile land-based.

Some American officials interpret this article to apply only to those ABM systems or components currently consisting of interceptor missiles, radars, etc., and *not* to "exotic" ABM possibilities that might utilize laser or particle beams. Hence, to the extent that Soviet leaders may share this interpretation and have not foreclosed the exotic-ABM option, the advent of American laser ASAT weapon systems could provide additional incentive for Soviet development of air- or space-based laser ABM systems.

The ASLBM application is an example of another long-range HEL possibility that bears directly on the ABM Treaty of 1972. To the degree that overhead surveillance systems can provide early warning and launch location information for submarine-launched ballistic missiles (SLBMs), this information could be utilized to vector laser-armed aircraft which would carry out boost-phase interceptions of relatively soft SLBMs. This conception of a possible air-based laser ASLBM weapon system might prove to be much more cost-effective than strategic antisubmarine warfare (ASW) systems. Its feasibility, of course, would depend on further advances in high-energy laser technology as well as on the future durability of the ABM Treaty, for which a review conference will be convened in 1978.

It is my belief that laser ABM systems constitute the most interesting possible application of high-energy laser technology. It is true that laser guns (having large fields of fire and great agility) mounted on various aircraft may lead to highly effective self-defense and air superiority capabilities in the coming decades. But the real payoff is in laser weapon systems that have long ranges (e.g., thousands of miles) and adequate power/propagation/

pointing characteristics to produce the timely destruction of strategic targets such as satellites and ballistic missiles. The contemporary strategic balance is based on nuclear weapons, which, in the event of war, would be delivered to their designated targets by bombers, ICBMs, and SLBMs (and probably strategic cruise missiles in the mid-term future). Effective interception of these nuclear delivery systems constitutes the most important generic function of strategic defensive weapon systems and may prove to be highly feasible by the use of advanced laser weapons.

space as an arena for laser weaponry

With the possible exception of the ASLBM application, aircraft are *not* the most appropriate platforms for basing high-energy laser weapons designed to destroy strategic ballistic missiles. Given its unique vantage point and lack of propagation problems, space is the best arena from which to launch potent "photon torpedoes" toward strategic missiles in the vulnerable boost-phase. Missile cases and engines would appear to have important laser vulnerabilities during the highly stressed powered portion of the flight trajectory. Satellites, of course, would tend to be even more vulnerable to space-based lasers.

The Defense Advanced Research Projects Agency has been concentrating its strategic technology efforts in chemical laser R&D with various space-based applications in mind. In his posture statement for FY 1977, under the priority heading of "Space Applications," DARPA Director George H. Heilmeier stated:

> The US continues to increase its reliance on strategic offensive and defensive systems which totally or partially involve space as the environment. It is in this environment that one of the most significant properties of a high energy laser may be exploited most fully—the ability to precisely transmit energy over very long distances at the speed of light.
>
> The laser device is the heart of the system and for space-based applications, where system weight is a critical factor, laser efficiency is a driving parameter. The DARPA laser program is investigating two candidate device classes—an infrared (2.7μm) hydrogen-fluoride laser whose energy is produced by either chemical or electrical excitation. . . .
>
> Recent DARPA studies have revealed the significant advantages to be gained by implementing very large optical apertures in space. In infrared surveillance systems, this would provide the capability to accomplish continuous surveillance. This year DARPA has initiated studies to define the technical risk and direction associated with the development of this technology. We feel that large erectable space optics will significantly influence the future direction of space laser and surveillance system development.[16]

More recently, Dr. Heilmeier has testified that DARPA's space-based laser program is motivated partly by a belief that the achievement of high-energy lasers for possible use against hostile satellites "could represent a Sputnik-like event" in its geopolitical impact.[17] His important testimony before the Senate Armed Services Subcommittee on R&D goes directly to the heart of the potential strategic implications of high-energy laser technology:

> When I appeared before this committee last year, I outlined an investment strategy which focused on some key questions whose answers are deeply rooted in advanced technology. There is little doubt in my mind that these questions could become the national security issues of the 1980s. Let me review them briefly:
>
> - Are there technologies on the horizon that could make possible a space-related use of high energy lasers and could such a laser system in the hands of the Soviets threaten our vital satellite network and strategic deterrent capability? Conversely, could such a laser serve the United States in some defensive way? . . .
>
> Even two years ago some of these questions would have seemed like something out of a modern day Jules Verne novel. However, as a result of DARPA initiatives, while difficult technical problems remain, the technologies to answer each of these questions in the affirmative are on the horizon *today* and require little in the way of major unknown, conceptual breakthroughs to make visionary answers to these questions a reality. But what are the implications to our security assuming that we or the Soviets are successful?

For a moment, I'd like you to consider:

- *Space Defense*—Both the United States and Russia depend heavily on space assets. Ponder the consequences of a space associated system that could protect our own satellite resources while possessing the capability to destroy enemy satellites in a surgical and timely manner. . . .
- *Ballistic Missile Defense*—Ballistic missile defense based on missile interceptors can be saturated by large numbers of warheads. Ponder the consequences of a leak-proof ballistic missile defense—one that could not be overcome by projected numbers of missiles. . . .

Sometime in the future, the foregoing initiatives can be ours instead of the Soviets'. While difficult technical problems remain, the technology is on the horizon and amenable to an investment in well structured, focused programs . . . .

Almost from the inception of the high energy laser, people have speculated on the possibility of deployment of them in space. This was simply unrealizable using the gas dynamic laser (the first high energy laser) or the electrically excited laser because of their size and weight. Our recently completed analysis indicates that laser systems incorporating much more efficient future chemical lasers may be feasible.

The high energy laser in space is a potential system to defend our own satellites against antisatellite threats. The technical problems are formidable, requiring major advances in chemical laser devices; precision pointing and tracking; and large, high-power optics. Nevertheless, space is a favorable environment for chemical lasers. The pressure recovery problem that terrestrial and airborne applications must face does not exist in the vacuum of space, nor are there propagation problems due to the atmosphere which can distort the beam and lessen its effectiveness.

The DARPA program is attacking important aspects of the space-based high energy laser problem. It is my belief that the high energy laser in space could represent a Sputnik-like event . . . a technical achievement which could influence the perceptions of foreign countries as to who is the leader in defense-related technology. Such perceptions could have serious political implications in view of more obvious trends in other areas.[18]

According to a recent report on HEL weapon possibilities, the question of space applications comes up again and again:

Not only do all laser wavelengths travel better in space—losing energy density only throu unavoidable beam spreading—but sor particularly destructive wavelengths, such those in the ultraviolet, can only propagate ir vacuum. Chemical lasers, which may one day very light and efficient, work best in space. A satellites make very tempting targets, since their nature, they must be lightweight and th relatively fragile.

The number of strategically important sat lites is constantly increasing. . . . Treaties a incidents aside, [former DDR&E] Currie admi "The question of warfare in space or space a sanctuary inevitably will arise."[19]

This line of thinking has produced a revival interest in the possibility of space warfa involving high-energy laser weapons.[20]

At a Harvard seminar in 1974, Richard Garwin reportedly delivered a "devastati critique" of the emerging laser weapo program.[21] After ruling out various las weapon possibilities (e.g., ground-based ABM airborne antiaircraft, and shipborne anticrui missile systems) as either cost-ineffective vulnerable to countermeasures, Garwin mad a quite provocative statement about the like American response to a hypothetical Sovi deployment of a space-based laser weapo system:

A space-based laser ABM . . . fails as a practic candidate for deployment if only because neith the United States and the Soviet Union wou tolerate the other's gradual deployment of su capability. Rather, nuclear-armed intercepto would be used to attack the imagined lase bearing satellites as they were being readied orbit over a period of months.[22]

Garwin's statement and Heilmeier testimony provide important evidence th Soviet development and testing of space-base high-energy lasers would generally be take *very* seriously by the United States. This wou be true even if such Soviet activities were beir performed with nondestructive purposes mind (such as radar tracking, high-resolutio imaging, or power transmission).[23] Indee any large-scale Soviet experimentation wi space-based high-energy lasers that occurre before similar American experimentatio could well constitute a Heilmeierian "Spu

nik-like" technological surprise with enormous political and military impact.[21] The possibility of this type of technological surprise and its concomitant implications for national security and arms control must be taken into account by strategic and arms control policy planners.

elected arms control implication

The political evolution of an appropriate American response to such a possible Soviet surprise is one of the most uncertain components of the current strategic situation. The Soviets are well aware of the legacy of Sputnik/1957: the aggressive American response pushed the Soviet Union deeper into a posture of strategic inferiority which lasted for more than a decade. Would Soviet leaders tend to be more cautious about triggering a similar American response in the future? Or would they calculate that the contemporary arms control environment might provide adequate political cover for important technological developments in the area of strategic defense which could ultimately contribute to clear-cut Soviet superiority?

After all, the ABM Treaty of 1972 is the bedrock of the SALT process on which rests everything that has followed, including President Carter's expectations that a SALT II agreement is feasible in the very near future. Hence the Soviet leadership might believe that some combination of (1) arms control ambience; (2) American permissiveness regarding technical violations of the existing SALT agreements; and (3) vocal MADvocates in American elites (who would never permit the construction of serious ABM systems for population defense) could suffice to protect Soviet HEL (or particle-beam) initiatives from inducing coherent mobilization of American military technology and resources in the form of a serious commitment to, say, a space-based laser ABM weapon development program.

One of the primary considerations regarding the continuing viability of the ABM Treaty of 1972 is whether the Soviet Union and United States both have sufficient political will to resolve the rather "small and grubby" issues that are likely to arise. The first ABM Treaty review conference during 1978 will provide an important forum for testing the political will of both parties to this treaty when the issues of tactical ABM and SAM-upgrade possibilities may be placed on the conference agenda. Difficulty in resolving smaller arms control issues would portend extreme problems in resolving much larger issues relating to exotic-ABM possibilities in the future (e.g., during the ABM Treaty review conference of 1983 and 1988—it should be noted that this treaty is of *unlimited* duration).

How interested will the Soviet Union and the United States be in propping up the ABM Treaty during the 1980s if and when HEL (or particle-beam) technology advances to the point at which serious ABM applications appear to be feasible and may become increasingly desirable? To the extent that both American and Soviet leaders invest significant political capital in détente and bilateral strategic arms control objectives, they will tend to equivocate with their domestic constituencies and even deceive themselves about what the other's intentions and possible capabilities may be.[25] The fundamental issue of political will may become subsidiary to that of the grudging toleration by one side (probably the American) for ABM research or advanced development initiatives by the other side (probably the Soviet) which do not per se violate Article V of the ABM Treaty, liberally interpreted.

The key point is the existence of broad gray zones between those HEL applications that may involve real threats to the viability of the strategic nuclear-deterrent forces and those that do not. Few sharp boundaries can be drawn between future HEL systems designed to track and image satellites and those having marginal capabilities for delivering lethal bolts of laser energy to relatively fragile

Airborne Laser Laboratory

The USAF Airborne Laser Laboratory (ALL) is the most advanced and probably the most significant for USAF applications in the high-energy laser development programs. In flight (above) out of Kirtland AFB, New Mexico, the Airborne Laser Laboratory is an NKC-135A aircraft testbed facility. . . . Shown close-up (below) is the Airborne Laser Laboratory aircraft's pod.

satellites or eventually to strategic nuclear aircraft and missiles. As HEL technology advances, this gray zone expands, and marginal weapon capabilities against vulnerable targets tend to blur into increasingly broad-based capabilities against a wider spectrum of "interesting" targets. This blurring process is likely to produce severe and unprecedented difficulties for the arms control task of channeling HEL technology into directions which have minimal destabilizing implications for international security over the long haul.

On the other hand, considering the inherent instability of nuclear deterrence as a means for reducing the risk of destructive war over the very-long-term future, one could argue that a strategic transition from nuclear offensive weapons to nonnuclear (photon and/or particle-beam) defensive weapons might be eminently desirable. In this regard, President Carter's ultimate objective of the elimination of nuclear weapons from national arsenals should be noted. The primary task of long-term arms control may be to channel HEL technology so as not to destabilize the delicate balance of nuclear deterrence but rather to guarantee a *smooth transition* from such "offensive" balances to a more stable regime of defensive emphasis.

This line of thinking brings us to a central arms control issue: should the ABM Treaty of 1972 be interpreted as banning all space-based HEL systems, including those not dedicated to the ABM mission as well as those that are? All military systems have growth potential (e.g., note the persistence of the SAM upgrade issue), and HEL weapon systems may have much more than their fair share. Could nonlethal HEL systems be secretly upgraded to have lethal capabilities in such a manner that detectability would remain highly uncertain? Or could non-ABM laser weapons be upgraded to have significant ABM capabilities? If so, the ABM Treaty review conference of 1983 or 1988 may be forced to consider the feasibility of arms control verification for emerging HEL technology. This technology is an increasingly important gray area, with enormous strategic potential, in which straightforward arms control negotiating and verification approaches are totally lacking. Disposition of these complex issues through conceptual nuclear attacks on "imagined" laser ABM satellite systems, as Garwin suggested, comes nowhere near the heart of the laser weapon arms control problem.

Given new statutory requirements for arms control impact statements (ACIS),[26] as well as the Carter administration's clear-cut arms control orientation, it seems questionable whether Garwin's type of summary judgment against space-based HEL weapon systems will eliminate future academic and congressional interest in the implications of possible laser weapon developments for both American and international security. This should prove to be a fertile field for creative policy-relevant research, especially since adequate technical verification of HEL-related arms control agreements may prove to be an extremely elusive goal:

> The SALT agreements did include a specific prohibition of the testing of certain kinds of ABM components of satellite-based ABM development. Less than complete confidence in verification was accepted in these agreements, which seem to have set a precedent for other possible limitations without insistence on verification. That verification is as much a political as a technical matter, that perfect verification is impossible, and that it is also unnecessary if there is some measure of political trust are also increasingly accepted ideas.[27]

In essence, inadequate technical verification of hypothetical laser weapon arms control agreements would force the United States to rely upon Soviet good will. Few Americans, however, would be willing to accept this type of arrangement.

The bottom line for laser weapons is that they are slowly moving toward engineering reality from the domain of science fiction.

When HEL prototypes become available in the mid-1980s for various military applications, the policy implications of laser weapons for strategic force structure and doctrine will require careful investigation. The impact of this new family of directed-energy weaponry on strategic arms control will become increasingly important and could help determine the long-term evolution of the shape of SALT during the future.

Hudson Institute, Inc.

Notes

1. A more comprehensive analysis of the possible impact of laser weapons on strategic posture and doctrine and on arms control will be published in a forthcoming issue of the Harvard quarterly, *International Security*.

2. D. G. Brennan, "Weaponry," *Toward the Year 2018* (New York: Foreign Policy Association, 1968), pp. 9–15.

3. Associated Press wire, May 22, 1973.

4. Drew Middleton, "Powerful Lasers Reported Bound for American and Soviet Arsenals," *New York Times*, February 16, 1977, p. 2.

5. For example, see John H. Douglas, "High-Energy Laser Weapons," *Science News*, July 3, 1976; Jeff Hecht, "Laser Weapons," *Analog Science Fiction Science Fact*, October 1977; and Edgar Ulsamer, "Exotic New Weapons: Reality or Myth?" *Air Force Magazine*, September 1977.

6. James W. Canan, *The Superwarriors* (New York: Weybright & Talley, 1975), p. 273. Recently, American military intelligence officials were reported to have compared the Soviet particle-beam ABM development program in size to the huge Manhattan Project (see David Binder, "U.S. and Soviet Reported Trying to Perfect an Anti-Missile Beam," *New York Times*, February 5, 1977). Obviously, such estimates reflect many qualitative factors which are judgmental in nature.

7. See the prepared statement by Dr. Robert A. Greenberg, Assistant Director for Space and Advanced Systems (ODDR&E), in *Fiscal Year 1978 Authorization . . . Hearings* before the Committee on Armed Services, U.S. Senate, 95th Congress, March 29, 1977, pp. 6173–76.

8. Philip J. Klass, "Advanced Weaponry Research Intensifies," *Aviation Week & Space Technology*, August 18, 1975, p. 34.

9. Bernard Weinraub, "Brown Says Soviets Can Fell Satellites," *New York Times*, October 5, 1977 and "Soviet Union Outpaces U.S. in Preparing for Possible War in Space, Brown Says," *Wall Street Journal*, October 5, 1977. According to the principal Deputy Director of Defense Research and Engineering: "We cannot let the U.S.S.R. obtain a military advantage in space through antisatellite weapons, because the consequences to the future balance of military power could be no less than catastrophic." Statement by Robert N. Parker before the Subcommittee on Science and Space of the Senate Committee on Commerce, Science and Transportation, 95th Congress, March 9, 1977, p. II-2.

10. *Report of Secretary of Defense Donald H. Rumsfeld to the Congress on the FY 1978 Budget, FY 1979 Authorization Request and FY 1978–1982 Defense Programs*, January 14, 1977, pp. 198–99.

11. According to Genera George S. Brown, Chairman of the Joint Chiefs of Staff, *U.S. Military Posture Statement for FY 1977* (p. 46):

> The United States' primary system for warning of ICBM and SLBM launches is a system which consists of 3 satellites (2 located in the Western Hemisphere and 1 in the Eastern Hemisphere). The satellites are in synchronous orbit and operate on a full time basis. The Western satellites are deployed to provide coverage of the SLBM launch areas and the Eastern satellite is deployed to provide coverage of the ICBM threat.

12. An interesting, but far from comprehensive, discussion of the possible impact of laser ABM weapons is given by P. J. Nahin, "The Laser Ballistic Missile Defense," *IEEE Transactions on Aerospace and Electronic Systems*, vol. AES-13, March 1977.

13. Rumsfeld, p. 67. Emphasis added.

14. See Donald G. Brennan's definition of MAD = mutual assured destruction in "Strategic Alternatives," *New York Times*, May 24 and 25, 1971 (a two-part Op Ed article).

15. See Paragraph E of the Agreed Interpretations to the SALT I agreements, *Arms Control and disarmament Agreements*, U.S. Arms Control and Disarmament Agency, June 1977 (second edition), p. 141.

16. *Hearings Before the Committee on Armed Services, United States Senate*, 94th Congress, Second Session, pp. 5762–66, Part 11, Research and Development (1976).

17. Philip J. Klass, "Progress Made on High-Energy Laser," *Aviation Week & Space Technology*, March 7, 1977, p. 16.

18. George H. Heilmeier, Statement on DARPA FY 1978 R&D Program in *Fiscal Year 1978 Authorization . . . Hearings*, pp. 6177–83.

19. Douglas, pp. 11–12.

20. "War's Fourth Dimension," *Newsweek*, November 29, 1976. Also see three articles in *New York Times*: "2 Magazines Say Soviet Lasers Destroyed a U.S. Space Satellite," November 23, 1976; "Pentagon Fearful of Soviet Effort to Develop Hunter-Killer Satellites," November 24, 1976; and "Warfare in Space?" editorial, November 26, 1976.

21. Douglas, p. 11.

22. Richard L. Garwin, "Effective Military Technology for the 1980s," *International Security*, Fall 1976, p. 73.

23. For example, see Edgar Ulsamer, "Laser-Powered Rockets and Dark Satellites," *Air Force Magazine*, April 1976; Robert H. Kingston and Leon J. Sullivan, "Coherent Laser Radar," *Optical Design Problems in Laser Systems*, vol. 69, Society of Photo-Optical Instrumentation Engineers (1975); and Kenneth Billings, "Laser Energy Conversion," *Astronautics and Aeronautics*, June 1975.

24. Herbert York, in *Race to Oblivion: A Participant's View of the Arms Race* (New York: Simon and Schuster, 1970), discusses at length the crucial psychological impact that Sputnik had on American society and government. Another excellent description of the strategic and political impact of Sputnik is given by Philip J. Klass in *Secret Sentries in Space* (New York: Random House, 1971).

25. As always, the subjective interpretation of ambiguous intentions is an ultrahazardous occupation.

26. Public Law 94-141, Section 146, amending the Arms Control and Disarmament Act (22 U.S.C. 2571-75).

27. Harvey Brooks, "The Military Innovation System and the Qualitative Arms Race," *Daedalus*, Summer 1975, p. 82.

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The Editor

ASSERTIVENESS TRAINING FOR THE MILITARY WOMAN?

NANCY DUGHI

Case 1: The bus shelter stands in front of the women's dormitory. It is deep; the bench inside is protected on three sides from wind and rain. The interviewer cites it as a convenience for the women. One of the group makes an angry grimace; another laughs self-consciously.

"Sure it is," she says, "if you don't look at the walls."

"Walls?"

The angry woman answers, "Yeah! Inside they are covered with insults. Not just in writing, but carved in the wood. After they painted the shelter, you could still read the words. WAFs are this . . . WAFs are that . . ."

"Have you reported it?"

"No. Who would care? We're just two-stripers. Or they'd say we're women, always complaining."

A younger woman shrugs off the discussion. "It isn't that serious. I know those things aren't true, so I don't let them bother me. I just look away."

Case 2: Sergeant McC has her uniforms made in the tailor shop. She is tall and fine-boned. On duty she wears her long blonde hair in a bun. The other women regard her as an example of what a woman should look like in uniform. But it is her attitude as much as her appearance that impresses people; she is career-minded. She feels she must prove that women can succeed in "male" jobs. When she is assigned to work behind the desk (actually a high counter) in the security station, she must climb onto the desk to raise the heavy door above it. The men do not have to do this, for they are taller or stronger than she. However, she has "sworn" that she will never ask any of the men to do anything for her.

Case 3: A/1C laughs when she hears Sergeant McC. She says that she herself is just the opposite. She will let the men do her whole job if they want to. There is much she pretends not to be able to handle, just to get out of work. She goes on to explain what she does, or says, to elicit help. The rest of the women laugh, agree, add comments. Sgt. McC presses her lips together and says nothing more. It is obvious she is a minority in this group.

Case 4: Senior Airman R is very happy in the Air Force. She works in supply; her supervisor praises her for her quickness to do the menial parts of her job cheerfully. In this, he says, she is superior to the young men of the same age and training who work for him. She is the enlistee par excellence: her morale is high; she takes advantage of recreation facilities; she is a conscientious, even enthusiastic, participant in the Extension Course Institute program. However, she wears her hair in such a strange fashion that even the base commander has commented on it. Since she violates no rules, she cannot be reprimanded for the odd style. Her superior, a male, is at a loss as to what to do. He fears tears and suggests that the interviewer speak to her about it. A male officer comments, "She must have been sick the day they gave them hair styling in Basic."

SUCH SMALL incidents and attitudes are the drops that make up tides, tides which are reflected on personnel charts in re-enlistment numbers, efficiency quotas, and career progression graphs. Even though all four cases concern women, they are not uniquely "feminine" situations. The problems transcend sex, and vast programs in all divisions of the Human Resources Branch are geared to deal with the discrimination, malingering, and lack of team spirit illustrated. Only in Case 4, where those with the real problem of adjustment were male officers or NCOs, is there no obvious organizational way of handling what they feel is a problem.

What is unusual about these cases is the way in which the women have acted or reacted. Young males, black or white, would have handled the situations very differently and, for the Air Force's purposes, in more desirable ways. They would have complained to Social Actions, demanded help from a crew mate, argued with a malingerer, or have been available for a frank discussion about a personal idiosyncrasy. In brief, they would have been assertive. No inhibitions because of their sex would have kept them quiet.

But since male assertiveness is based more on the good self-image that most young men have[1] than on natural aggressiveness; and since female nonassertiveness stems more from social conditioning than from their admitted nonaggressiveness,[2] it would seem logical that the Air Force should make an attempt to counteract the women's conditioning by trying to raise their self-image and by giving

them courses in how to be assertive. Hours spent teaching young female recruits about make-up or hair styles could be better used to help them raise their self-estimates and develop interpersonal skills so that they can start their Air Force careers with the same degree of confidence that young male recruits face new situations.

It must be remembered that assertiveness is not aggressiveness. Hand-to-hand combat or guerrilla warfare may call for aggressive behavior, but otherwise, strongly aggressive people are a handicap, even to an organization designed to make war. It is important to point out this distinction before continuing the argument for Assertiveness Training for military women, partly because aggressiveness in women is considered an undesirable characteristic by both men and women and partly because the two words are often incorrectly interchanged. When *aggressive* is used as a complimentary term for a man, the speaker usually means *assertive*. An assertive salesman, for example, interests and wins clients; an aggressive salesman antagonizes them.

One of the leading exponents of Assertiveness Training defines the characteristics in this way:

> *Nonassertive behavior* is that type of interpersonal behavior which enables the person's rights to be violated in one of two ways: (a) the person violates his/her own rights . . . by . . . ignoring them or (b) . . . permits others to infringe on his/her rights . . .
> *Assertive behavior* is that type of interpersonal behavior in which a person stands up for his/her legitimate rights in such a way that the rights of others are not violated . . .
> *Aggressive behavior* . . . is behavior in which a person stands up for his/her rights in such a way that the rights of others are violated. . . .[3]

These definitions were developed by Ms. Jakubowski-Spector while preparing a monograph on assertiveness for the American Personnel and Guidance Association. Her scholarly work has become a reference for writers of the best-selling paperback books that have made Assertiveness Training a subject of discussion for anyone who is interested in human relations. Psychologists and career counselors have developed assertive training workshops appropriate for businesses, and the educators and clergy who are familiar with this literature use it to enliven their classes or sermons.

The danger here is that this very popularity makes many women, to whom such books are especially addressed,[4] feel they already know enough about assertiveness to make training in the subject unnecessary. Military women, by enlisting, have made a giant step, they feel, into the world dominated by men. Anything more would smack of Women's Liberation, and though uniformed women feel strongly about having equal rights, they also feel strongly about not being "libbers" or extremists.

Air Force surveys and civilian polls[5] reveal that women are decidedly more conservative than men. They know far less about the women's movement or their own rights than blacks or other minorities, or even whites, know about black history or the civil rights laws.[6]

However, since women usually have a lower image of women in general than they have of themselves as individuals,[7] it is necessary to raise their opinion of their entire gender, as well as their personal self-confidence. A miniconsciousness raising session should precede Assertiveness Training and is, in fact, included in the most comprehensive of the paperback books, *The New Assertive Woman*. This work aims to convince women of the stark necessity as well as the advantages of being assertive, and, through a questionnaire, it helps them spot areas where they are aggressive or nonassertive.

Body language; voice pitch, timbre, and expression; posture, grooming and choice of clothes—all reveal a person's self-estimate. These qualities are dealt with during Assertiveness Training so that changes come from the inside and are not merely adjustments made to the outer appearance.

Visible changes, in fact, are often noticed after Assertiveness Training. Weight-loss is an example. Obesity is more common among women than men, and studies indicate that it is often caused by conflict about sex stereotypes.[8] Fat women do not rate passivity, docility, and modesty high as their own major interpersonal traits. Yet they have been conditioned to believe that strength and responsibility (which they rate high) are not socially desirable for women. They compensate by gaining weight. When such women start to behave assertively, they no longer need extra flesh, and they are able to lose and control their weight.

THE AIR FORCE is already providing its women with confidence on the job, which comes from knowing that they have been competently trained. Now, a combination of Assertiveness Training with at least a minimum of consciousness raising and women's history is needed to prepare them to move in larger numbers into positions of responsibility and command, which will soon be theirs by right of rank or grade. Their technical training is not faulted. It is time special attention was paid to developing the force of character and the interpersonal skills they will need as senior NCOs and officers.

Notes

1. Martha T. S. Mednick et al., editors, *Women and Achievement* (New York: Halsted Press, 1975), pp. 38–41; Inge K. Broverman et al., "Sex Role Stereotypes and Judgment of Mental Health" in Mednick.

2. Corinne Hunt, *Male and Female* (Middlesex, England: Penguin Books, 1972), pp. 108–9.

3. Patricia Jakubowski-Spector, "An Introduction to Assertive Training Procedures for Women" (Washington, D.C.: American Personnel and Guidance Association, 1973).

4. This is because women seem to buy this sort of book more frequently. The subject is as apropos to men as to women, as noted in cases cited in *When I Say No, I Feel Guilty* by Manuel J. Smith (New York: Bantam Books, 1975) and *Don't Say Yes When You Want to Say No* by Herbert Fensterheim and Joan Baer (New York: Dell Books, 1975). A young man at an Army post in Europe came to an Assertiveness Training session given by the author. He was not dismayed that the course was geared for women; he took notes and said he felt he had gotten what he had come for: tips on how to enforce discipline in his new extra-duty job as barracks sergeant.

5. Air Force Survey to help evaluate effectiveness of Social Actions programs, prepared in 1976 by Captain David L. Payne, USAF, Program Analysis Branch, Department of Social Actions Training. The Virginia Slims American Woman's Opinion Poll, vol. III, conducted by the Roper Organization. Gallup Polls, Princeton, New Jersey, 1955–1977.

6. For five weeks, different groups present in Social Actions sessions at one base were asked this question: "Name two women who worked for women's suffrage." Only two names were ever offered, and these, in seriousness, were Jane Fonda and Margaret Mead. The groups totaled 125 people of both sexes, all ranks and grades, civilian and military. All groups could name three, sometimes five, black or minority civil rights leaders. Later, a group of fifteen college women knew the last name only of one suffrage worker and the first name of another. All white, they knew the full names of three black civil rights workers.

7. Mednick, pp. 38 and 44.

8. Angela Barron McBride, *A Married Feminist* (New York: Harper and Row, 1975), cites in her chapter, "The Body," numerous studies on women's obesity and overeating.

NAVIGATORS IN COMMAND

a naval perspective

MAJOR MICHAEL E. RICHARDSON

IN LATE January 1975, the Commander in Chief, Strategic Air Command (SAC) General Russell E. Dougherty, selected and the Air Force Chief of Staff, General David C. Jones, approved the assignment of Colonel Eugene D. Scott as commander of the USAF's 47th Air Division.[1] Normally, selection of a SAC air division commander would generate only limited, mostly local, attention, but this assignment had repercussions far beyond the two northwestern U.S. bases that comprise the 47th Air Division. The assignment was exceptional because Colonel Scott (then a brigadier general selectee) is a navigator, the first navigator to assume command of an Air Force combat flying organization.

Colonel Scott's assignment culminated more than a year's effort by the Department of the Air Force to eliminate an outdated and discriminatory provision of the U.S. Code that limited command of Air Force flying units to rated pilots.[2] Section 8577, Title 10, was originally designed to protect a fledgling Army Air Service from exploitation by the parochial interest of competitive branches of the Army. However, in more recent years the Title 10 restriction had become a severe limiting factor in the progression of many career-motivated nonpilot officers. Navigators in particular were affected. Excluded by legislation from command opportunities within their area of specialty, air operations, navigators were thus provided with only limited access to the professional development opportunities (e.g., responsible jobs, service schools, advanced education, etc.) that are so necessary for promotion and preparation for higher level positions.[3]

Those navigators who wished to assume the additional responsibilities of command were forced to transfer to other career fields where, though penalized initially by a lack of technical expertise, they were eventually able to progress on individual merit. Even then their horizons were limited; few advanced as far as general,[4] and the position of Air Force Chief of Staff has never been held by a navigator. Obviously, then, Colonel Scott's assignment takes on particular significance, for it may well mark the beginning of a new era in Air Force leadership.

However, it is far too early to assume that the pilot's overwhelming domination of the Air

Force command structure will change significantly. This author finds it difficult to believe that the Air Force program designed to bring navigators into command positions will, *as currently structured*, effect much significant or lasting change on the leadership composition of the Air Force. Mere identification of a problem and elimination of administrative barriers do not equate to change in a large, complex bureaucratic organization like the Air Force. Historical precedence lends some credence to such pessimism. Captain Chris L. Jefferies cites the experiences of the Royal Air Force (RAF) in the post-World War II era. Of particular significance to the USAF is that:

> . . . RAF articulation of the policy [equal career prospects for navigators] was insufficient. Because of lead times insisted upon to allow navigators adequate preparation for command assignments, together with a hesitancy to move in a new direction, the system continues much as before, . . . even though equal opportunity was the policy, pilots were still receiving a disproportionate share of promotions and command assignments.[5]

As any student of organizational behavior would have forecast, without a strongly enforced implementation plan the bureaucratic inertia and the pilots' vested interests in the existing structure effectively countered the stated policy objective. Jefferies thus concluded:

> In effect, an "affirmative action" policy was [eventually] necessary; that is, a conscious effort to identify flying units that navigators could command, "reserving" them for navigators. Unless the USAF undertakes a similar approach, the same problem is likely to affect the USAF navigator.[6]

The U.S. Navy provides a more recent and positive perspective on the subject. The naval flight officer (NFO) is the naval aviation equivalent of the Air Force navigator—a rated, nonpilot officer variously responsible for navigation, bombing, reconnaissance, radar intercepts, electronic warfare, antisubmarine warfare, etc. Prior to 1970, NFOs suffered under similar Title 10 restrictions concerning command of flying organizations—although in theory, if not in practice, they were eligible for command of all surface vessels, including aircraft carriers.

In 1969 the Navy petitioned Congress for relief from the Title 10 restrictions, and in February 1970 they received the implementing legislation.[7] The first NFO commanding officer, a marine, assumed command of an F-4 squadron in October of that year.[8] Since then, more than 40 NFOs have completed command assignments, approximately 20 more are currently serving in command billets, and 100 more have been identified, by the Navy's command screening board, for future command positions.[9]

It would appear that the Navy's program for integrating NFOs into the command structure is operating successfully.[10] As important, the NFOs also believe it is working.[11] The obvious question, in light of the RAF experience, becomes, "Why?" What is different about the Navy's approach to the problem that has made it succeed? Or, do the differences lie not in the program but within the structure of the Navy itself? The answers to these questions may be of great significance to the Air Force. For if it is possible to identify those elements or combination of elements, which have contributed to the success of the NFO program, it may be possible to incorporate those factors as the core of a progressive Air Force program to expand navigator command opportunity.

The NFO Experience

Before we identify positive elements of the Navy's program, it will be desirable to review some background concerning the role of the NFO and his position in the naval aviation community. An excerpt from the House Armed Services Committee report on NFO command provides some historical perspective:

> The requirement for a non-pilot aviation officer in naval aviation dates back to 1922 when a formal training program for such officers was first initiated. These officers were called Naval Aviation Observers (NAO). Their function was to relieve the pilot of aeronautical duties related to the mission of the aircraft other than the actual manipulation of the aircraft. This basic function remains unchanged and is the function of the Naval Flight Officer today.
> Since the Naval Aviation Observers of that era were unrestricted *surface* line officers temporarily assigned to aviation duties, it was considered fitting that they be considered competitive for command of aircraft carriers and aircraft tenders but not aviation units organized for flight tactical purposes, aviation schools, or air stations. The Observers were so afforded these privileges and restrictions under 10 U.S. Code 5942 which was enacted into law in 1926. . . .
> The immediate post World War II era saw a rapid technological advance in aircraft design and electronic sophistication. This was further accelerated by the Korean conflict. By the 1950s the Navy was developing various multiplaced aircraft with an increasing emphasis on the total mission concept. Such aircraft placed a heavy reliance on electronic sensors for the accomplishment of their particular mission. Aircraft such as the A3B and WV-2 (now EC 121) required from one to four nonpilot officers to operate the various types of electronic equipment.
> As the number of aircraft which relied on electronics to accomplish their mission grew, the NAO program also expanded to nine different types of airborne specialists who were being recruited, trained, and who flew as unrestricted line reserve officers. . . .
> As the need for these nonpilot, aviation-oriented officers increased, it became obvious that a program to procure and retain highly skilled officers on active naval service in these specialties was urgently needed. As a result, in 1959 the development of a full-term unrestricted line NAO career pattern similar to that of the naval aviator was promulgated and in 1960, the opening of regular commission status . . . was afforded the NAO. In 1964, the career advantages of this program were enhanced by instituting a permanent flight pay status . . . and the . . . title [was] changed . . . to naval flight officer (NFO). . . .[12]

In the late 1960s, as increasing numbers of NFOs approached eligibility for the rank of commander (0-5), it became evident that the Title 10, U.S. Code restrictions would prevent them from obtaining the normal sequence of aviation commands that the Navy requires for a flyer to be competitive for the rank of captain (0-6) and above. The importance of command in Navy career progression cannot be overstated. This is dramatically highlighted by the fact that less than 5 percent of the rated officers selected for 0-6 have not held a command billet.[13] Hence, if the NFO career field was to remain viable and attractive, the Navy felt that it must obtain immediate relief from the Title 10 restrictions.

In a 1969 House Armed Services Committee report, the Navy indicated, "The Title 10 legislation is *urgently* needed this year."[14] This sense of immediacy is further noted in a letter (dated 30 September 1969) from Admiral T. H. Moorer, Chief of Naval Operations, to Representative L. Mendel Rivers, Chairman, House Committee on Armed Services:

> . . . [The Legislation] to permit Naval Flight Officers to be eligible to command certain naval activities is of vital interest to the Navy.
>
> Early consideration of this legislation would assist greatly in the retention of those Naval Flight Officers already on active service, whose continued service is vital. Your assistance in scheduling an early hearing on this bill would be sincerely appreciated.[15]

The resulting legislation was passed by both houses of the Congress and signed into law by President Richard M. Nixon on 26 February 1970. Since that time equal competition for command billets and equal career opportunity appear to have become fact for the NFO.

timely Navy action

The willingness of the Department of the Navy to take the prompt action necessary to resolve the conflict between NFO career development and the Title 10 restrictions is probably the one singular factor that contributed most to the smooth transition of the NFO into the command structure.

The timeliness of the Navy's action is

manifested in two aspects: First, the action was taken before significant numbers of NFOs reached a point in their career where the Title 10 restriction was a serious limiting factor. Thus, wholesale alienation of a large group of officers was avoided. Second, the Navy action was taken before the organizational bureaucracy had developed and institutionalized a system to cope with the apparent inconsistencies in the existing policies. Thus, the Navy was able to avoid the necessity of overcoming deeply ingrained, nonproductive behavioral patterns during the implementation of its NFO command program. "A stitch in time saves nine" seems particularly appropriate in this instance.

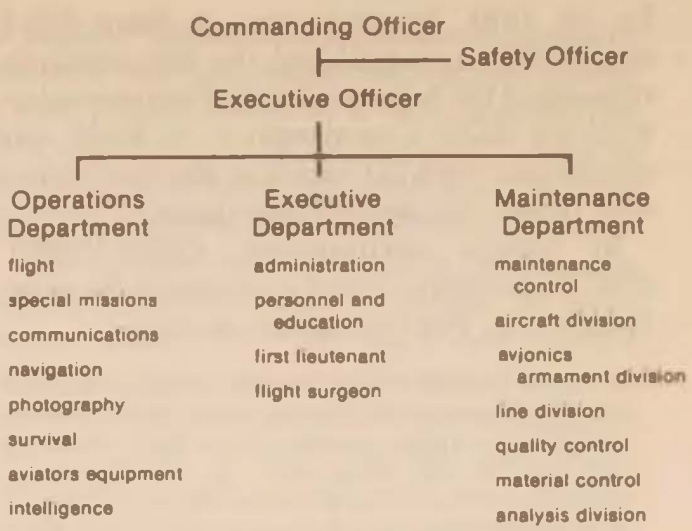


Figure 1. Simplified Navy flying squadron organization[18]

background experience

A second factor that has greatly aided the NFOs in their transition into command billets lies in the broad background of squadron-level duties they accumulate prior to assuming command. Aviators simply do not have an experience advantage in the Navy. Even prior to 1970 squadron duty assignments were made largely without distinction to rating, and now the NFO competes equally among all his contemporaries for the available jobs.[16] The editor of *Naval Aviation News* comments:

> A pilot/NFO comparison isn't even applicable anymore since their jobs (except in the aircraft) are completely interchangeable. Other than landing signal officer, there are virtually no billets within a squadron, or non-squadron sea or shore duty assignments, which cannot be filled by pilots or NFOs.[17]

Equal opportunity also exists at the department head level. A typical Navy flying squadron is organized like that illustrated in Figure 1. Headed by a commanding officer (CO) and his vice commander, the executive officer (XO), the squadron is divided functionally into several operating departments. Assignment as department head carries large responsibilities and is vital in the command and career progression of any advancing officer. It has consistently been Navy policy to appoint the best qualified individuals, regardless of rating, as department heads.

mission commanders

As valuable as a background of squadron duties was to an NFO, it was no substitute for the real-time command experience that accrued to an aviator by virtue of being an aircraft commander. Major A. G. Bartel, USMC, writing in the *Marine Corps Gazette*, addressed this issue:

> Command of aviation operational missions has long been the basic stepping stone for aviator pilots to aviation squadron command. In the interest of improved mission performance, officer manpower utilization and retention, the stepping stones to command must be equally available to both naval aviators and naval flight officers.[19]

Lieutenant Commander Peter T. Smith, writing in a similar vein, stated:

> Until an NFO has successfully demonstrated proficiency as an aircraft commander he will not even be considered by a command selection board, no matter what Title 10 says.[20]

Navy precedent for use of nonpilot officers as aircraft/mission commanders dates back as

far as 1919. In that year, a Navy NC-4 successfully accomplished the first airborne crossing of the Atlantic Ocean. The commander of the NC-4, Commander A. C. Read, was not the man with his hands on the controls but was, rather, the aircraft's navigator.[21]

In today's environment, OPNAVINST 3710.7G provides current guidance in this area. Specifically, this instruction states:

> A naval aircraft or formation of naval aircraft shall be flown under the command of the pilot in command, mission commander or flight leader as appropriate, so designated by the reporting custodian or authorized representative. The status of each individual participating in the flight shall be clearly understood prior to flight. . . . When a flight schedule is published the pilot in command, mission commander or flight leader as appropriate, shall be specifically designated thereon for each aircraft and flight respectively.[22]

Given this discretion, the commanding officer is able to select the best qualified officer on a crew or within a formation to function as the mission commander. The instruction further elaborates on the mission commander's responsibilities:

> The mission commander shall be a properly qualified naval aviator or naval flight officer designated by appropriate authority. He shall be responsible for all phases of the assigned mission except those aspects of safety of flight which are related to the physical control of the aircraft and are considered beyond the qualification of the mission commander's designator/MOS [Equivalent of AF Specialty Code]. . . . The mission commander shall direct a coordinated plan of action and shall be responsible for effectiveness of the flight.[23]

While the mission commander must be respecified for each recruiting flight, in some areas of the aviation community—primarily the Antisubmarine Warfare (ASW) Force—it is not unusual for the best senior qualified officer to be designated on a recurring basis. In these cases, he also assumes the duties of a "crew commander," generally directing the crew activity on the ground (or on-board ship) as well as in the air.[24]

It is in the role of mission commander that the NFO gains the background and skills that truly allow him to compete with aviators on an equal basis. The experience is instrumental in forming the sound judgment and leadership skills that are prerequisites for higher level command billets. Without doubt, the policy that provides for NFO mission commanders is one of the major elements enabling NFOs to assume successfully the demands of higher level command duties.

command screening board

The Navy process that selects officers for command opportunity is formalized and centers around a command screening board which meets annually in November. Chaired by an admiral, the board reviews the records of eligible lieutenant commanders (0-4) and commanders (0-5) and identifies the best qualified individuals for subsequent assignment to command billets. The board considers all unrestricted line officers from the various Navy communities—submarine, surface, aviation (both aviators and NFOs) and special (UDT, SEALS, etc.). An officer normally receives four screenings (one year below the zone, two years in the primary zone, and one year above the zone) before being rejected for command. Overall, approximately 40 percent of rated officers are selected for command within their period of eligibility.[25] This process has provided two distinct advantages to the NFOs in their transition to equal command opportunity.

First, because board selection is a consensus, arrived at in a logical, systematic fashion, it is difficult for one or two biased individuals to influence the command opportunities of any given group. Thus, NFOs have been ensured an honest, unprejudiced appraisal of their individual potential as Navy commanding officers.

Second, although board results are not formally published—as are promotion board selections—the information is widely available to the officer corps. Selected officers are notified officially by letter, and statistics

concerning the performance of a particular specialty group are as close as a phone call to the appropriate "detailer" in the bureau of Naval Personnel. It is not difficult for the NFO to ensure that his opportunity for command equals that of his pilot contemporaries.

command policy

Once selected for a command assignment, the naval officer is initially assigned to the unit as the executive officer for a period of 12–15 months. This duty allows him to become familiar with the organization and its operations before assuming command. His tour as commander is similarly limited to 12–15 months. At that point, the successful commander may receive a higher level "bonus" command within the aviation community, or he may be assigned to a surface vessel to begin his progression toward command of an aircraft carrier.

Current Navy policy limits NFO squadron commander assignments to those units with aircraft that carry NFOs as part of the integral crew.[26] In these squadrons, the Navy attempts to alternate aviators and NFOs as commanders, although crew manning ratios sometimes preclude a one-for-one rotation cycle. The envisioned ideal situation is one which would ensure that when an aviator is serving as the squadron commander, he would have an NFO functioning as his executive officer. Then, when the NFO moves up to the CO's position, the Navy would assign a command-screened aviator to serve as his XO. This rotation of the aircrew specialties through the squadron's management positions has ensured an equal command opportunity for all selected officers.

The career progression path for a naval officer is highly structured and strongly relates promotional opportunity and career continuity to successful performance as a command is the keystone to continued career advancement. Consequently, each naval officer is literally "groomed" for command through a series of duty assignments as a junior officer. Those officers identified as best qualified and formally identified by the command screening board for subsequent assignments in executive and commanding officer positions.

The relative ease with which NFOs were able to enter this structure hinges on three major points: First, the Navy took prompt action to bring them formally into the system before large numbers of disenfranchised officers were created. Second, the Navy "grooming" process ensured that eligible NFOs were well prepared to assume their roles as commanders. And finally, the naval officer corps was already structured to accept nonpilot officers as commanders—aviators are, in fact, a minority group in the Navy. While NFO commanders met some initial resistance within the aviation community, the Navy, as a whole, was willing to accept their legitimacy.

Lessons for the Air Force

What, if any, of this can be applied to the Air Force navigator? It must be initially recognized that the Air Force and the Navy aviation community, while similar in many aspects, are not duplicate organizations. It would be folly to assume that policies which have been successful for the Navy will be equally successful when applied to the Air Force navigator. However, there is merit in the Navy program, and it should receive careful consideration.

The Air Force problem of integrating the navigator into the command structure is far more complex and difficult to deal with than that which faced the Navy. The time for early problem identification and prompt corrective action has long since passed. Any program that the Air Force undertakes will have to overcome long-standing prejudice and deeply entrenched bureaucratic procedures, both formal and informal, to achieve success.

Initial Air Force efforts are concentrating on a review of rated staff and supervisory positions with an eye to redesignating those which can be held by both pilots and navigators. If navigators are to succeed as unit commanders, they must be provided the same broad background of experience in squadron and wing level jobs that is currently available to the pilot. The traditional steppingstone jobs—flight commander, chief of standardization and evaluation, operations officer, etc.—cannot continue to be reserved for the pilot force.

More important, and an issue that is currently being ignored, is the implementation of a mission/crew commander concept which includes the navigator. This function will be critical to the overall success of the navigator command program. For it is only in the day-to-day arena of crew interface and mission responsibility that a future commander gains the experience and credibility required of a leader. In all instances, the senior mission qualified officer assigned to a crew (pilot or navigator) should ultimately be responsible for the activity of the crew and its efforts toward mission accomplishment.

Several of the major air commands, particularly SAC and MAC, are in a unique position to provide such an opportunity; but to date, they have not chosen to do so. These commands are already structured around the concept of the integral crew, with its attendant assignment of a "crew commander." It would appear to be a logical extension of Air Force policy to widen the eligibility for this position to include the assigned navigators. However, more than a year and a half after the rescinding of the Title 10 limitations, this position continues to be reserved for the senior pilot on the crew.

In the face of this continuing discriminatory behavior, the Air Force needs to find some highly visible vehicle to assure the navigator force that it is truly making progress toward the promised equality. In the Navy, the command screening process accomplishes a large portion of this function.

The Air Force process for selecting commanders is far less structured and much more informal. In all cases, the senior commander in the chain of command has the prerogative to designate his subordinate commanders. However, the process that identifies eligible officers varies widely. The Ad Hoc Committee on Removal of the Title 10 Restriction to Command comments:

> Although MAJCOM [Major Air Command] procedures for selection of flying unit commanders vary in degree of formality, all have the objective of assigning the best available officers to the jobs. Some commands publish the selection criteria, but in most cases there are no major efforts to publicize the selection procedures to their officer force. Most commands have a "list" containing the names of the selected commander candidates, but in no case is the list published for dissemination.[27]

Given the closeness with which the command selection process is held and the long perceived tendency on the part of the "Pilot's Protective Society" to perpetuate itself, is it really surprising that navigators are skeptical that equal command opportunity will become fact?

THE NAVY has provided an example that the Air Force would do well to emulate. The individual elements may be adapted or discarded as necessary, but the background of a formal, highly visible program that receives consistent top-level review is essential. Until we no longer judge a man's leadership potential by the wings that he wears, equal command opportunity for navigators will continue to be a concept, not a reality. The Chinese philosopher Lao-tzu commented, "A journey of a thousand miles must begin with a single step." Rescinding the Title 10 restrictions was but the first step; the difficult journey is yet to follow.

Bergstrom AFB, Texas

Notes

1. "Navigator to Head Combat Flying Unit," *Air Force Times*, 12 February 1975, p. 2.
2. Section 8577 of Title 10, U.S. Code, stipulated that: "Flying units shall be commanded by commissioned officers of the Air Force who have received aeronautical ratings as pilots of service types of aircraft."
3. William J. Richardson, "Command Opportunities for Navigators," Unpublished Research Report, USAF Air War College, Maxwell AFB, Alabama, n.d.
4. Chris L. Jefferies, "The Navigator: An End to Professional Discrimination?" *Air University Review*, September-October 1974, pp. 87-92.
5. Ibid., p. 90.
6. Ibid.
7. Robert P. Lukeman, "Navigator Command of Flying Units: Perspectives and Prospects," *The Navigator*, Summer 1975, pp. 11-22.
8. A. G. Bartel, "NFO: Equal or Second Class," *Marine Corps Gazette*, May 1973, pp. 72-73.
9. Letter from J. R. McGuire, Bureau of Naval Personnel, to Michael E. Richardson, 22 February 1976.
10. In December 1973, in response to a House Armed Services Committee request for data, the Navy concluded, "Unified command opportunity for pilots and NFOs is viable, credible, and (what's more) really works."
11. The results of a survey conducted at the Naval War College concerning the NFO and his command and career opportunities strongly support the contention stated here. See Appendix, especially entries 4, 5, 8, 9, and 15.
12. U.S. Congress, House, Committee on Armed Services, *House Report 91-576: Pertaining Naval Flight Officers To Be Eligible To Command Certain Naval Activities, And For Other Purposes*, 91st Congress, 1st sess., 16 October 1969.
13. U.S. Air Force, "Repeal of Title 10, U.S. Code 8577 Restriction to Command of Flying Units," Ad Hoc Committee Report, Randolph AFB, Texas: Air Force Military Personnel Center, 29 July-9 August 1974, p. 8.
14. U.S. Congress, House Report No. 91-576, p. 3. Emphasis added.
15. U.S. Congress, House Armed Services Subcommittee No. 4, Hearings on H. R. 11548, 91st Congress, 1st sess., 10 October 1969.
16. The survey conducted at the Naval War College also reflected on this point. Additional comments of both aviators and NFOs were strong in this regard. See Appendix, entries 9 and 10.
17. Paul N. Mullane, "Naval Flight Officer," *The Navigator*, vol. 2, 1973, pp. 11-15.
18. Malcolm W. Cagle, *The Naval Aviation Guide* (Annapolis: Naval Institute Press, 1972), p. 182.
19. Bartel, p. 73.
20. Peter T. Smith, "The NFO and Squadron Command," U.S. Naval Institution Proceedings, April 1970, pp. 40-45.
21. William A. Cohen, "The Military Navigator in Aerospace Warfare," *Air University Review*, March-April 1967, p. 102.
22. "NATOPS General Flight and Operating Instructions Manual," OPNAVINST 3710.7G, Washington: U.S. Office of Naval Operations, 1 January 1973, pp. 2-7.
23. Ibid., pp. 2-8.
24. Interview with Commander David S. Thompson, Instructor, Naval Staff Course, Naval War College, Newport, Rhode Island, 7 November 1975.
25. U.S. Air Force, Ad Hoc Committee Report, pp. 7-8.
26. See Appendix, question 6, for aircrew reaction to this policy.
27. U.S. Air Force, Ad Hoc Committee Report, p. 16.

Author's note: As the article was originally written in the fall of 1975 while I was a student at the Naval Command and Staff course, some of the data may no longer be current. Certainly the NFO statistics have changed since my last update in February 1976. Similarly, the MAJCOM positions concerning navigator mission/crew commanders may have changed in the ensuing two and one-half years.

M.E.R.

APPENDIX:
Summary of survey results

	Disagree Strongly	Disagree	Neutral	Agree	Strongly Agree	
1. The Naval Aviator and NFO programs attract equally talented officers.	5.8%	25.5%	15.7%	41.2%	11.8%	aviator
	5.3%	10.5%	0	73.7%	10.5%	NFO
2. Aviator training is more demanding and more rigorous than NFO training.	6.0%	6.0%	8.0%	46.0%	34.0%	aviator
	11.1%	33.3%	11.1%	33.3%	11.1%	NFO
3. Elimination of the U.S. Code restrictions has *significantly* affected aviator's chances of being selected for command.	12.0%	28.0%	14.0%	40.0%	6.0%	aviator
	0	21.1%	21.1%	52.6%	5.3%	NFO
4. NFOs currently have an equal opportunity to compete for:						
a. Command of flying squadrons.	0	43.4%	3.8%	43.4%	9.4%	aviator
	0	11.1%	5.6%	38.9%	44.4%	NFO
b. "Bonus" Commands (CAG, RAG, Air Wing, etc.).	18.0%	44.0%	30.0%	8.0%	0	aviator
	10.5%	26.3%	15.8%	47.4%	0	NFO
c. Non-flying units or vessels.	2.0%	14.0%	26.0%	46.0%	12.0%	aviator
	5.3%	15.8%	15.8%	21.1%	42.1%	NFO
d. Professional military schools (Command & Staff, War College, etc.).	0	0	11.8%	49.0%	39.2%	aviator
	0	4.8%	4.8%	42.9%	47.6%	NFO
e. Advanced academic education.	0	0	9.6%	38.5%	51.9%	aviator
	0	0	0	40.0%	60.0%	NFO

5. When seniority allows, NFOs will have equal flag rank promotion opportunities as aviators.	4.0% 0	34.0% 21.1%	18.0% 21.1%	38.0% 31.6%	6.0% 26.3%	aviator NFO
6. NFO commands should be limited to those organizations assigned aircraft which carry NFOs as crew members.	10.4% 10.0%	8.3% 10.0%	2.1% 5.0%	25.0% 40.0%	54.2% 35.0%	aviator NFO
7. Utilizing NFOs in command billets allows the Navy to achieve maximum utilization of its manpower resources.	2.0% 0	2.0% 0	21.6% 5.3%	49.0% 26.3%	25.5% 68.4%	aviator NFO
8. NFOs currently receive a fair share of the available command billets.	2.0% 0	26.0% 20.0%	22.0% 15.0%	42.0% 50.0%	8.0% 15.0%	aviator NFO
9. Current assignment policies insure that NFOs have sufficient background and experience prior to command screening and selection.	2.1% 0	6.3% 0	25.0% 17.6%	50.0% 52.9%	16.7% 29.4%	aviator NFO
10. Assignment of squadron duties (Ops Officer, Maintenance Officer, etc.) provides aviators better preparation for command selection.	6.3% 38.9%	27.1% 38.9%	18.8% 5.6%	29.2% 5.6%	18.8% 11.1%	aviator NFO
11. NFOs should be allowed to command a composite unit which includes single seat aircraft as long as he can maintain proficiency in at least one of the unit's aircraft/missions.	14.3% 0	22.4% 0	8.2% 16.7%	44.9% 55.6%	10.2% 27.8%	aviator NFO
12. The best qualified officer on the crew—regardless of rating—should function as that aircraft's mission commander.	16.7% 0	20.8% 16.7%	0 5.6%	37.5% 5.6%	25.0% 72.2%	aviator NFO
13. Assuming currency in unit aircraft and mission, NFOs are as qualified as aviators to command a flying organization.	4.2% 0	20.8% 0	4.2% 0	41.7% 5.6%	29.2% 94.4%	aviator NFO
14. Unit morale and mission effectiveness can suffer in units having NFO commanders because he is forced to ask subordinates to accomplish jobs that he cannot nor will ever be able to do.	25.0% 88.9%	39.6% 11.1%	12.5% 0	18.8% 0	4.2% 0	aviator NFO
15. Flying safety would be expected to suffer in a unit commanded by an NFO.	43.8% 88.9%	45.8% 11.1%	4.2% 0	6.3% 0	0 0	aviator NFO
16. Aircrew members are generally reluctant to serve in units commanded by NFOs.	14.6% 77.8%	43.8% 16.7%	29.2% 5.6%	10.4% 0	2.1% 0	aviator NFO

Sample size: 53 aviators
20 NFOs

PREJUDICE OR FACT?

a perspective from the PPPA*

THE DEVIL'S ADVOCATE

AS A WASP, field grade pilot, I grow weary of being a member of the tiniest of all the minorities and the one that is the target of all the rest—the one that is the cause of all our troubles from *A*ntinavigatorism to Zero Defects shortfalls. Will I never hear a word in our defense? Is it really possible that *all* of our decisions arise from prejudice? Is it really possible that the pilot force is merely a collection of trained apes with no redeeming qualities of intellect and taste? With all the fanfare about the ladies entering the academies, will not one of us dare mention that their ratio among the maintenance troops is quietly being reduced—because of a fact that was obvious from the start: their physical strength is *not* equal to that of the male crew chiefs?

I know that views like that are most illiberal and go against the "wave of the future," but does not the rational approach suggest that some, perhaps only a very few, of the old ideas are sound? History is an amalgam of change and continuity. *Some* of the ideas that we have acquired through trial and error are bound to remain valid.

Through the millennia, the male has been more assertive, stronger physically, and has been the hunter; since time immemorial, the female, possessing a superior grasp of psychology and a more delicate touch,has been charged with the most important of all tasks: the physical and *moral* rearing of our young. These generalizations are not even limited to *Homo sapiens* but apply as well to the greater part of the animal kingdom. He who would deny them denies the most fundamental cornerstones of our civilization. Perhaps it is not too much to suggest, incidentally, that there is some connection between our departure from the traditional roles and the rising crime rate, drug abuse, and what some would describe as an ever-worsening lack of will on the part of the American people as a whole. If one of the so-called prejudices of the "male chauvinist pigs"—that the women of the maintenance force are not as physically strong as the men—is true, is it possible that some, or at least one, of the "prejudices" of the PPPA has some basis in fact? At the risk of appearing to be a hopeless reactionary, I should like to go against the "wave of the future" and explore that possibility.

As this article was written in part to

*Prejudiced Pilots' Protective Association

accompany Major Michael Richardson's "Navigators in Command—A Naval Perspective," the first thing that needs to be said is that the Navy is not the Air Force. One of the principal reasons that naval aviation was not given to the Air Force in 1947 was that flyers could not be expected to understand the sea and naval warfare. Naval aviation *is* auxiliary to the surface forces. Army aviation *is* auxiliary to the ground forces. Marine Corps aviation *is* subordinate to the marine ground combat forces. It is absolutely central to the theory of Billy Mitchell that air power must be a striking arm in its own right, that it is an independent force that can and should fight battles with the enemy which are not associated with the conflict on the ground—not directly, at least. Thus, Air Force aviation is not, and should not be, auxiliary to any other kind of military force.

The corollaries to this are:

(1) A naval officer must be a specialist in naval warfare first and an aviator only in an incidental way and only insofar as aviation will enhance his ability to fight a war on the sea.

(2) An Army officer must be an expert in warfare on the ground and an aviator in only an incidental way—only in a way that helps him prosecute the battle *on the ground.* Many Army aviators have come to grief, they say, with promotion boards for failing to understand this: they have spent too much time with airplanes and too little with the infantry.

(3) The essence of Air Force generalship is *war in the air.* Thus, being an aviator is *not* incidental to command in the Air Force; it is absolutely vital. Nonflyers have risen to the top spot in the Navy, but nonline officers have not—and justifiably so. The essence of command in the Navy is the understanding of seamanship and warfare at sea. Some Army chiefs of staff have been aviators, but that is not a necessary qualification. No recent Army chief of staff has come from other than the combat arms—and this is justifiable since the essence of the profession is war on land. Thus, I maintain that it would make no more sense to put a nonflyer in charge of the Air Force than it would to make a quartermaster the Chief of Staff of the Army or a member of the Navy's Civil Engineering Corps CNO. What is good for the Navy, therefore, is not necessarily good for the Air Force.

Of course, a navigator is a flyer, and I do not propose that he be denied the chance to command the Air Force. I propose only to try to elevate the opinions that our navigators hold on the logic and fair-mindedness of their brother officers—who happen to be pilots. I will attempt to do this by convincing them that some of their *own* views are but prejudices and that *some* of the so-called "prejudices" of the PPPA may be based on fact.

There were some logical bases in the old system. It all grew out of the storms of the twenties when the air arm was dominated by artillery officers and the like. The original passage of the law that eliminated such officers from the command of flying units was a vital step on the road to the independent Air Force and to the understanding that air power can be used alone to achieve some of the ends of national policy. Presumably no navigator will argue with the sentiments behind the initial passage of the law. The rub is that the navigator rating did not exist at the time. The law was not intended to discriminate against navigators, only against nonflyers.

The navigator rating was not created until World War II was upon us. When I entered navigator school, a common lament among my colleagues was that there were no navigator generals. *True.* This was taken to be proof positive that institutional prejudice condemned us forever to second-class citizenship. *Untrue.* At the time, and for quite a while afterward, there was not a navigator in the Air Force with enough time in the service to seriously aspire to the rank of general, no

matter how far below-the-zone. The present Chief of Staff, General David C. Jones, is the first ever to start his commissioned service *after* the creation of the navigator rating. Thus, it is not at all remarkable that no navigator has been Chief of Staff since none has had the length of service to be competitive.

Now on to a more touchy subject. Many, if not all, of our navigators believe that the pilot "prejudice" holds that their career area is not as well qualified for command as are the pilots. Is it possible that, when considered as a group *(on the average),* that the "prejudice" has *some* basis in fact? Dare we say it? The Air Force believes in the "whole man" concept—no matter that few of us in either group approach that ideal. Our ideal "whole man" possesses a full measure of three qualities: morality, intellect, and good health and physical condition.

Morality is a very dangerous subject, and one would be well advised to stay away from it at cocktail parties. But here it is vital. For the most part, there is no moral difference between navigators and pilots. Aggressiveness, however, is a moral quality and one that is certainly to be desired in a commander. At the outset of navigator training, there was a portion of every group that was physically eligible, or later became eligible, for pilot training. Would it be valid to suggest, on the average, that the most aggressive of them did not rest until they gained admission to pilot school? Further, one considerable prejudice of the navigator group is that all pilots are wholly prejudiced against navigators. This has given many of the observers a feeling of second-class citizenship, and perhaps it is not too much to assume that many of the most aggressive physically disqualified observers have refused to live with that feeling and have left the service. Can it be said, then, that these things have tended to lower the *average* aggressiveness of the remaining group? Maybe the difference between the two groups is microscopic, but since the reverse argument on the part of the navigators cannot be logically maintained, perhaps there is *some* factual basis to the PPPA's prejudice.

A less dangerous subject is the discussion of the intellectual aspects of the problem. One World War II legend had to do with the classification process for flying schools:

I. Gregarious, athletic, and aggressive persons----------To pilot school
II. Intellectual (anyone caught reading a book)----------To navigator school
III. Reclusive, no redeeming social qualities----------Bombardiers

There can be no doubt that navigation is more of an intellectual challenge than is driving an airplane. Moreover, Major Richardson's point that many successful navigators have made their marks outside their rated career field—very often in sophisticated aspects of engineering and missilery—is valid. These things have probably contributed to the observers' prejudice to the effect that pilots are dumb. Let us take a closer look at it.

Dr. Monte D. Wright's *Most Probable Position* is a splendid work that should be known to every navigator.* His research proves beyond question that almost all of the fundamentals of aerial navigation were well established *before* World War II. They were actually established, then, *before* the navigator rating was invented. Established by whom? In *Mission with LeMay* the general tells us how in the thirties he established a long-range navigation school in Hawaii and how he served as the navigator of the force of the B-17s that intercepted the *Rex* 700 miles at sea. In short, navigation is an essential part of the pilot rating from the outset. But can the reverse argument be made? Of course, many navigators are also aeronautical engineers, but

*Dr. Wright, now NASA Historian, was himself an Air Force navigator.

is a knowledge of aeronautics common to all navigators? There is no question that the observer force has as good or better grasp of avionics than do the drivers, but can the same be said about propulsion? How many of our navigators understand engines and the associated maintenance problems? Is it fair to say that observers tend to be more specialized than pilots? The very term "general" suggests that the commander should be a generalist not a specialist. *On the average,* then, perhaps it is fair to maintain that neither specialty group has reached an intellectual level superior to that of the other. Yet there is some slight tendency for navigators to acquire specialized knowledge as compared to more generalized learning on the part of pilots.

Any number of authorities from Marshal de Saxe onward have cited health and good physical condition as an important quality for commanders. Who can deny it? One of the excuses that Napoleon used for his defeat at Waterloo was that he was too ill to provide the kind of leadership he had used at Austerlitz and at all the other great battlefields. Good physical condition is important not only for the sake of strength and endurance but also because the commander's condition and even athletic prowess have an impact on the psychology of the troops. How do the two groups stack up in this regard?

Many from the observer group were originally disqualified from pilot school because of physical or health defects. None of the pilots were so disqualified from navigation training. That most common defect, less-than-perfect eyesight, is not an earthshaking handicap for a commander. But, all the same, it could hardly be argued that *any* physical defect enhances an individual's ability to command. A minor point, no doubt.

Hardly more serious is the fact that a considerable minority of the navigators were eliminated from pilot training before going to observer school; none of the pilots was eliminated from navigator training. Usually, this elimination was caused by physical things: a want of coordination or an inability to judge relative motion. Of course, that is no disgrace—some great athletes have "washed out" of pilot school—but it does not improve one's qualification for command. Sometimes, elimination is caused by factors of a moral nature: the inability to retain one's composure under pressure or, on rare occasions, the lack of determination to see a difficult task through to the finish. Is it too much to say that, *on the average,* navigators are not quite as able as pilots in the physical sense?

Over the years, the attrition rate—especially the forced attrition rate—of the pilot school has been substantial; that of the navigator training programs has been minimal. If we grant credibility to the evaluation programs of the Air Training Command, can this have had any other effect than to cause the average capability of the pilot group to be a bit higher than that of the navigators? In short, is the "prejudice" really *all* prejudice, or is it based on fact to *some* extent?

It is to be noted that the above treatment has emphasized the words "on the average." Certainly, no reasonable man would argue against the idea that the *above average* navigator should be given the chance to prove himself as a commander—even at the cost of denying that chance to another highly competent man—for command slots do not grow on trees. But do we really want to go so far as Major Richardson and Captain Jefferies (September-October 1974, *Air University Review)* suggest? Do we really want to reserve slots for navigators only? Do we want to make a man a commander because he is a competent leader or because he is a navigator?

Some educational institutions have been struggling with a similar problem. Because of Health, Education, and Welfare Department regulations, they were forced to maintain a certain proportion of the faculty composed of blacks and another composed of females. The result sometimes was that the best qualified

teacher did not get the job *because* a competitor was female or black.

If you would not have me deny you command *because* you are a navigator, then you could hardly expect me to appoint you to command *because* you are a navigator—that would be reverse discrimination just as bad as the original. Your pride should *demand* that the decision be made based on *merit* alone—if that is possible. So let us appoint the above average leaders among our navigators to command positions—be they black, or female, or whatever. As for the remainder, now that Congress and the Air Force have taken a giant step toward the satisfaction of your claims, perhaps you should, in turn, ask yourselves some hard questions—some questions *not* designed to produce answers that would prove that the rest of the world is *prejudiced* and that navigators, alone being privy to the truth, must inherit the earth—all of it.

Among these questions might be:

Am I myself so prejudiced as to deny every pilot the quality of being able to think logically?

Am I as aggressive as I might be? Have I troubled myself to learn anything about the engines so that I can understand and help with maintenance problems? Have I ever been guilty of taking a "nit-picking" approach to flying and advised the pilot against flying a difficult—but possible—mission? Am I a positive thinker? Do I like to fly? Do I *ever* take the establishment side of a discussion? Do I like the Air Force? Do I show the same enthusiasm for pilot proficiency training as I do for night celestial? Have I helped the pilot and the squadron commander with their leadership problems regarding the enlisted crew members?

Do I take care of myself physically? Are Air Force officers fatter than those in the Army? Am I one of the fat ones? Have I made a serious effort to quit smoking? Are my excuses valid—really valid? Do I schedule my physicals before I am notified to do so by CBPO? Is my shot record up to date at this moment?

What was the last book I read? When was the last time I read a book on strategy? When was the last time I read a serious book of any kind? Do I subscribe to *any* periodicals on military and international affairs?

Do I really know what my profession is all about, or am I just another specialist, competent for day-to-day navigation but certainly not fit to hold the fate of nations in my hands?

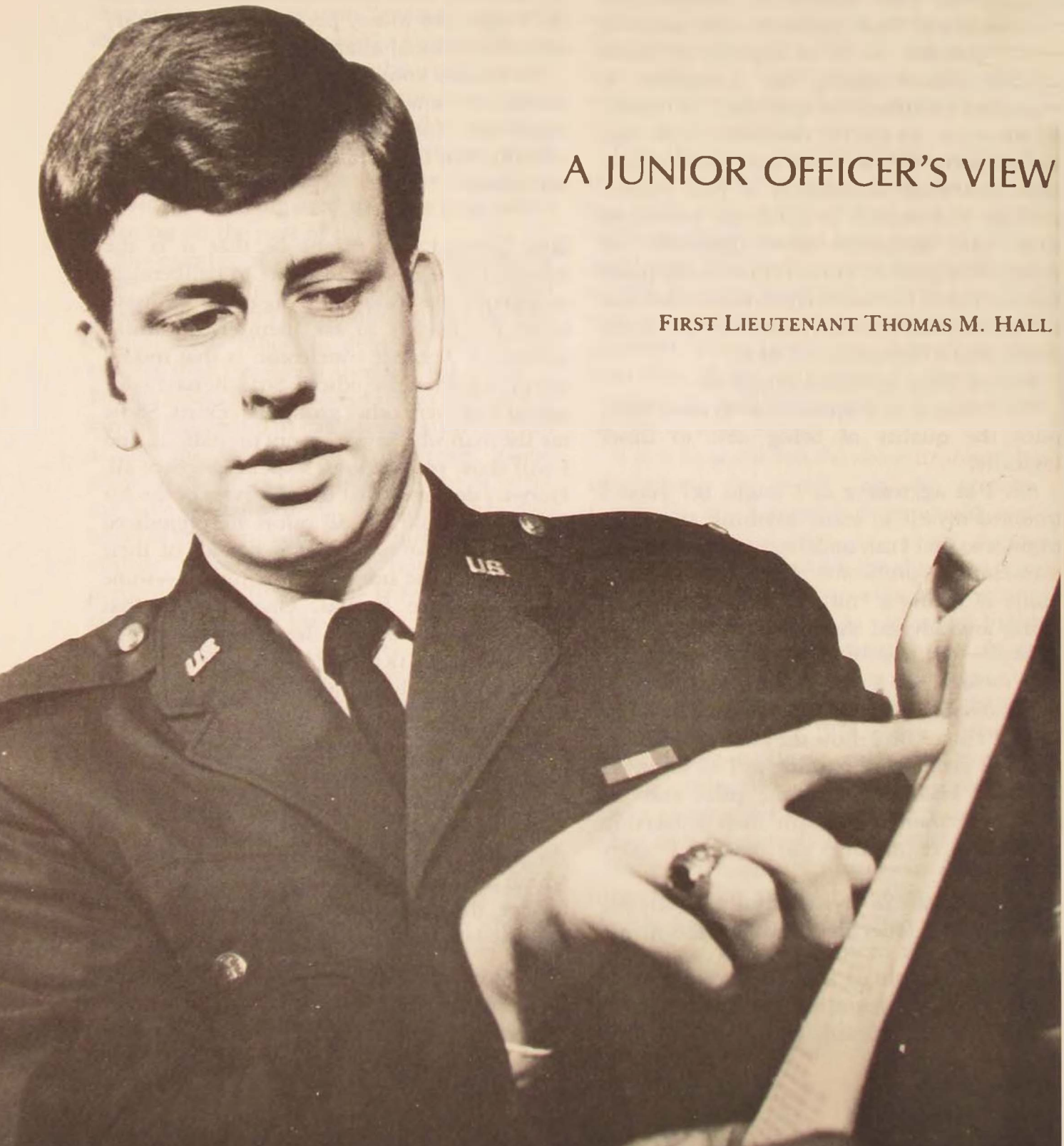
ONE CONCLUSION might be that it is the function of a devil's advocate to deliberately exaggerate the case—to exaggerate so as to cause his readers to ask themselves painful questions. Another conclusion is that indeed the pilot force is prejudiced. So is the navigator group and every other group that exists. Show me the man who says he is not prejudiced, and I will show you the most hopeless bigot of all. Honesty demands that the observers of the Air Force grant that not all pilots are prejudiced against navigators, and that not all of their attitudes on the subject are prejudices—some might well be factual. One step in that direction might be that the observers cease to use terms like "Pilots' Protective Association"—that kind of term does nothing for the cause. Again, now that the Congress has gone part way toward the satisfaction of the grievances of the navigators, maybe the time has come for some introspection. Perhaps it is time to take a hard look to discover which of the pilots' clichés are based on prejudice and which are based on fact—and to eliminate the former through demonstrated performance, and the latter by the same method.

DRM

in my opinion

A JUNIOR OFFICER'S VIEW

FIRST LIEUTENANT THOMAS M. HALL



IN THE COURSE of a brief Air Force career, I have had the opportunity to read the works of many successful men, among them statesmen and general officers, as they reflected on their careers and passed along the wisdom of their experiences. I recall that in each case, no matter how valuable I thought the advice to be, I envied that individual. I simply envied his position of being important enough to be asked for his opinion. Now I do not pretend to be important enough (yet) to have my advice sought after. Rather, having the opportunity to reflect on his or her own experiences is something any junior officer would relish. I hope no one will object if I take pleasure in assuming a role usually filled by senior officers.

Basic to this discussion, and basic to the first five commissioned years, is the decision by the junior officer to make the Air Force his career. Many factors bear on that decision. The newcomer to any career area is going to do a lot of thinking about the opportunities and drawbacks to devoting his life to that line of work, and it is certainly no less true of a junior officer in the Air Force. It is a time when the individual and the system are sizing each other up. Obviously the junior officer is concerned with much more than this one decision; many have already made it. Yet everything about the Air Force lifestyle has a bearing on it.

salary and benefits

Perhaps the most tangible aspects of a career with the Air Force are salary and benefits. We know we will never get rich, but we have enough to be fairly comfortable. I think nearly all of us feel that way, regardless of rank. But we also realize that the peacetime military is one of the few organizations in society where benefits are decreasing. Although benefits are not a big issue now, the *lack* of them will be. Air Force officers have a common concern for the future, concerned not so much for future raises as for the erosion of the benefits we already have.

Another tangible aspect of military life is geographical location, especially as it relates to one's family. In general, however, location is not that big an issue, but it will get bigger as the number of PCS moves decreases.

risk of failure

Another, less tangible aspect in deciding whether to stay in the Air Force is the risk of failure. One has to look at it from both a practical and an idealistic standpoint, but I really cannot say which is the more important. Practically speaking, none of us wants to fail. (But more than that, I think we want to do the best job we possibly can, especially the young officer just starting out.) But there is a risk of failure in any profession we might choose. In the Air Force, failure can result in getting passed over for promotion and involuntary separation. The early years of a career are a trial period where an individual is rated a few times and gets a feel for his or her own chance of success. It is a time when an individual must learn the type and amount of work needed to achieve success. But there are no assurances, even for the hardest worker. This is a competitive business from the start, where there is simply no room at the top for all those who want to be there. It is an organization in which the price of continued membership is continual advancement.

Theoretically, though there are many living examples to deny this, the Air Force is an organization where you cannot reach your own level of incompetency. It is either up or out. But if you put the fear of failure aside for a minute, I think this knowledge also has a profound effect on job satisfaction. Take, for example, a young copilot who has probably wanted to fly since he was a young boy. To him being a copilot is probably a good job in itself. But he knows that to progress he must upgrade to the pilot seat, then to instructor pilot, then to evaluator. The system has a built-in dissatisfier; you know that if you stay in the same job for very long, your career will not

progress. It is a problem, especially if the avenues of progress are blocked. For the co-pilot, there may already be an overage of pilots, making it difficult to upgrade.

In talking with my contemporaries I find that the heart of the matter lies in *how* people are selected for advancement. We realize there is a chance of failing in any endeavor. Indeed, it is a basic part of any challenging career. But it is certainly easier to assume the risk of failing if you know you will be judged fairly and on your own merits. But other, intangible factors get in the way—politics, charisma, who you know. There are also a number of less subtle ways of saying that our advancement system is somewhat less than perfectly objective. I think that this is one of the hardest things for an idealistic newcomer to understand.

One of the men I admire most is a major who has spent eighteen years in the Air Force. He received his master's degree through AFIT, is personable, frank, does his job well, and looks after his men, yet he has been passed over three times for lieutenant colonel. He is being allowed to complete his twenty years for retirement because of his regular commission. But to me there is real irony in the way he became regular. One day years ago, the members of his class at navigator training were told they could have regular commissions, but they would have to remain after class that afternoon to fill out the paperwork. He stayed. Now that story is not exactly motivating to a young officer, but to him his career has not been all that bad. The opportunity to live all over the world, his education, and his job have been compensation.

I do not intend to discuss the OER system at great length. Junior officers certainly have no monopoly on complaints about the OER system. Personally, being rated fairly is the most important aspect of job satisfaction. I hear constantly that pilots will be rated better than I because I am a navigator, but being an Academy graduate makes up for it. It is more than just a matter of being recognized for one's efforts because the OER is the crucial factor in promotions and, therefore, success.

There is also some risk in succeeding. I have been told by a number of senior officers to enjoy my years on a flight crew because they offer the most time off and the fewest responsibilities. I am hard pressed to believe them, for most of us crew members seem very busy to me, but it does point up something interesting. Most of us look to the job of wing commander as an example of success. The prestige and responsibility are tremendous, but so is the sacrifice. To say it is a 24-hour-a-day job is no exaggeration. PCS moves are frequent, and I would guess that their disrupting effects on home life are temendous. It is up to each individual to decide whether the prestige, and pressure, are for him.

information, intelligence, and integrity

These three "I's" are the things most junior officers would like to change. I am also grouping them because they are really three nebulous concepts and hard ones to substantiate.

Keeping informed is one of the biggest problems in any organization. This is especially true for the junior officer because of his place in the organization—at the bottom. I think it is safe to say that we rarely get the same information as the senior officers, and, therefore, it is harder for us to see things the way they do. I think we see considerably less. Remember the experiment in which a particular story is passed around the room in whispers from one person to another? The version told by the last person is somewhat different from the original. One at the scene of a breaking news story often finds the version in the next day's newspaper rather different from what "happened." Really, the system and human nature are at fault, but on the other hand, I do not see many people going out of their way to keep us informed either. What this means to a junior officer at his place in the system is misunderstanding and a bit of

demotivation. A leader's decisions are no better than the information he has to base them on. We are leaders, too, and in today's Air Force, information and reason, not blind obedience, are the basis for much of what we know as leadership.

In looking back to the story-telling experiment, we realize that the reason the story changed so much was that different words mean different things to different people. Even if all the factors bearing on a commander's decision are known to a particular junior officer, he still might not understand it. He is an individual; he is newer and less experienced. It is that simple. His perspective is inherently different.

Junior officers will admit this, but they do not view it as a disadvantage. On the contrary, they are eager and willing to apply their own outlook and intelligence to any situation. Yet I have never talked to a junior officer who felt that his intelligence and abilities were being fully utilized. It is partly our fault—and I realized that from talking to a number of junior officers who admitted it. As one of them put it, we have "tunnel vision." All we really know of the Air Force, or at least all of the firsthand information we have, is what we have experienced in our initial assignments. It is difficult for me, in my first operational assignment, to realize that what I am doing now is not necessarily what I will be doing four years from now, and so on. I am speaking from the standpoint of a young crew member, and not from the standpoint, say, of a young systems project officer. With this bias in mind, then, let me continue. Just as many junior officers perceive that their information is limited, likewise they feel that their opportunity to send information back up the system is also limited. It seems to me that I hear the expression "just another warm body" all the time. Another expression I hear frequently is "crewdog." It is an old one, but it is still applied to us, for junior officers make up a large part of the "crewdog" force. The point is, the expressions persist and for a reason. For example, crew members are given the responsibility of flying the airplanes, but most of us feel we have little input into deciding *how* they are to be flown.

I tried very hard to nail down some good, specific examples but with little success. Many junior officers seem to find the forum for expressing their ideas very limited, which can reduce the job of crew member to a mechanical one. The problem is two-sided: on the one hand we feel our opinions are not solicited; on the other we feel we are being "led by the hand."

There is a definite relationship between being left out of the decision-making process and my next topic, integrity, which is a sensitive subject to say the least. In using the word, I do not mean to indict anyone's character. Rather it is a convenient label under which to group a number of intangibles. Let me start with the "my door is always open" syndrome. That is a phrase uttered by many sincere men, at all levels of command, who are truly interested in the welfare and ideas of their men. But, unfortunately, some insincere types use it, too, and it is this latter group that gives the phrase its bad name. I cannot really say why this is true, but many junior officers I have talked with felt they could not go to their commander or operations officer with problems or suggestions. Maybe it was a fear of reprimand, or maybe they did not want to jump the chain of command. Maybe there is a feeling of distrust. I will not pretend to be able to explain it any further, but it is a problem of integrity that even the most sincere commander must overcome.

A number of junior officers I have talked with mentioned this second example. It has to do with the apparent hypocrisy generated by the energy crisis. We are all familiar with the tremendous amounts of fuel burned by our aircraft, yet how many times do those same aircraft orbit in the holding pattern because they are not allowed to land early or because of

constraints on flying time that quarter? It is the same Air Force that asks us to turn our thermostats down to a chilly 68°.

In researching this study I solicited a wide range of opinions. Much of what I heard was "Such and such is all screwed up," or "That's just not right." But when I asked for specific examples, all I got was a shrug of the shoulders. Politics and hypocrisy abound in our organization. Of course, it is not just in the Air Force, but in government, business, everywhere. I do not know how to get rid of it except to try to rid it from my own actions. But it is something junior officers are very sensitive to.

other risks

It occurred to me that I have devised this whole article without mentioning war or the possibility of getting killed. It is something no one talks about, I suppose, because it is something each of us must face on his own. I fervently hope that my contemporaries and I can spend our careers flying only training missions. But on the other hand, each of us knew what the military was all about when we joined. I hope that if I am ever called, I will be ready, and that the cause for which I am being asked to risk everything is a worthy one.

a sense of humor

One has to have a special sense of humor to work for the Air Force. We are really pretty good at laughing at ourselves, too, as evidenced by the popularity of the television show "MASH" among service members. It is a parody of the things that go on around us everyday. Many say it *is* what goes on. Moreover, I think a sense of humor is essential for preserving one's sanity amid the endless stream of directives and policies that come down to us. I do not think there is anyone who could make it through basic training, for example, without a sense of humor. I do not know what happens as one gets older or has been in the Air Force a few years—maybe it is a thing called responsibility— but often the only ones I see smiling are the junior officers. This may be interpreted as bad attitude, but it is not. Injecting some humor into a serious situation can help relieve the pressure; taking the edge off a situation may be more important to a junior officer, but all too often it is equated with not caring. There may be junior officers with a bad attitude who take everything lightly, but the majority probably use humor for what it is worth: a valuable tool for keeping things in perspective.

on opting out or in

Another inconsistency concerns those junior officers who decide not to make a career of the Air Force. The first few years are a trial period, and many are going to decide against the Air Force. This does not necessarily make them villains, and it does not necessarily mean they do not care about doing their job. Some of them joined because they wanted to serve their country; they leave because they feel their obligation has been fulfilled, and their talents can be better used elsewhere. The Air Force may be guilty of not properly using the talents of these individuals once they have announced their intention to leave. Commanders are less willing—and this is understandable—to give them a high rating on their performance report. I do not know how often this happens, but I think some unfortunate alienation occurs.

But on balance, there must be a number of things that keep junior officers in the service long enough to become middle managers (at least). I would guess that the man who likes the Air Force the most could list a lot more of its faults than its positive aspects. Maybe we take the good things for granted until the need arises. At Loring AFB, Maine, it is popular to complain about the weather, the black flies, and the lack of stores, but many enjoy themselves there nevertheless. We draw satisfaction from our work in different ways, but there are a few important aspects most

junior officers have in common.

To begin with, most junior officers agree that the initial five-year commitment is a good opportunity. It affords a decent paying job and a comfortable lifestyle from the start. I do not know the exact figures, but few of today's college graduates find jobs in the field they majored in. For that matter, how many graduates know exactly what they want to do? The Air Force, then, provides excellent direction for the recent graduate. A commission can make the transition years useful and productive as well. If a college student can get over the fear of committing five years of his life, he will realize that he is not giving up or losing those five years at all. The Air Force commitment is an opportunity to experience the military and other aspects of society as well.

opportunities

One of these aspects is people. Almost without exception people make the assignment, because of the close-knit nature of the Air Force community. Some contend that we in. the military are brainwashed, but we certainly do not come from the same mold. More than in the usual college experience, one associates with people from all parts of the country. It does something positive for one's outlook to live, work, and socialize with such a diversity of individuals. Certainly that opportunity alone would broaden the outlook of a college graduate.

But the experiences, like the people, are also diverse. Even the newest crew member at Loring has already lived in two or three different parts of the country he might never have seen otherwise. I have been skiing, scuba diving, parachuting, and done other things I never would have done had I not joined the Air Force. I learned to fly, and now I am getting my master's degree—free—to say nothing of other educational opportunities. There is even something positive to be found in the unpleasant experiences, like basic training and survival. Although one would not care to go through them again, he learns some invaluable lessons there about human nature and himself.

on idealism

I would introduce a third consideration which one hears little or no mention of these days maybe because it smacks of patriotism, a theme no longer fashionable in our society; I feel there is some sort of higher calling associated with a military career. (I asked two friends if they agree. One said "Hell no"; the other "Yes, definitely.") It is easy to be cynical about it; after you have been pushing paperwork all day, it may be the last thing on your mind, but I think that it is important to remember that each of us is responsible in some way for the nation's defense. It is not something you write home about or get misty-eyed about, but it is an aspect of our job that places military service on a level with other prestigious professions such as medicine and law. It is a part of job satisfaction that executives in business and industry may never know.

working in the system

The last area has to do with change and with a junior officer's attitude toward his superiors. We are all taught early in life that the best way to effect change is to work within the system. It is not until much later we learn that to effect change we must be in a position of influence in the system. To achieve that position is a long process that involves hard work, sacrifice, and compromise. Although I have not been there yet myself, I would guess there are many successful, influential men at the top wondering just what they were trying to do in the first place. What effect does the system of which we are a part, have on the individual?

Hardly a day goes by that I do not hear someone imply of a superior that if he were in so and so's position he would have done things differently. I feel that way, too, yet when I do occasionally find myself in so and so's

position, my brilliant, clear-cut, and logical thinking escapes me. I realize that so and so has a tough job. The middle manager finds himself in so and so's position more and more often, and there he is intensely evaluated, not only from above but also from below by a group of intelligent, eager young people, the junior officers.

From what I have seen of middle management in the Air Force, it is strong and getting stronger. And well it should be, with the many new management tools being developed and put into use today. No smugness is intended here. By and large we junior officers are receiving good management, and probably middle management would rather hear it from a subordinate, one of the resources being managed, than from superiors. It is well to remember that both groups are sensitive to the opinions of the other. I remember very well at navigator training the offhand remark a captain made about "those stupid young lieutenants." Those of us who overheard him had a low opinion of that man from then on; he remains irrevocably despised by us to this day. Moreover, we are sensitive to such remarks even when they are made in fun, which that one was not. We lieutenants are very conscious of the fact that we are lieutenants. But on the other hand, we are not always impartial judges either. Often one mistake by a superior tends to wipe out all the good he may have done, especially when it is a mistake in human relations.

My point is twofold. One is that our relationship to superiors is a two-way street. Unfortunately, junior officers are not always fair in their judgment of superiors. We tend to be somewhat emotional and idealistic—at least we show it more—and we are quick to criticize. The second point is the suggestion that middle managers (and their superiors) remember their own ideals, those things they used to get emotional about; they are probably still around, still waiting for somebody to do something about them.

Loring AFB, Maine

books and ideas

WHY IS THERE STILL A COLD WAR?

LIEUTENANT COLONEL ALAN GROPMAN

Berlin airlift—Winter 1948-49

ONE OBSERVES among colleagues a growing sense of uneasiness regarding the burgeoning offensive strength of the Soviet Union and its Warsaw Pact. This fear is also seen in the press and heard from commentators on the radio. Americans might expect that they had purchased security by spending an enormous share of their national wealth on defense, deferring spending on urgent social needs, and losing tens of thousands in the swamps, seas, and air over, in, and around Vietnam and Korea. Yet Americans are told that they are becoming less secure and that the Soviets changed directions in the 1960s and are now no longer defensively oriented. Americans are told that NATO is outnumbered and outgunned in every major category of land and air weaponry. We are warned that the Soviets do not seek parity with the West; rather, they are trying to gain numerical and firepower superiority. That is cause enough for concern, but why is this problem still here? Why does the United States continue to need to spend so much of its national budget on defense? Why is there still a cold war?

Has the United States erred in its foreign policy since 1945 in its dealings with the Soviet Union? Three recently published books argue that America has made fundamental mistakes in its approach to the Soviets, but the authors do not agree on the nature of the error. Richard J. Walton argues that America, and more specifically Harry Truman, provoked the Russians into permanently challenging the United States in the Cold War. James A. Nathan and James K. Oliver as co-authors assert that both sides are to be blamed for the continuance of the Cold War, but the evidence they marshal puts them in Walton's revisionist camp. All three authors see the United States as being too tough and forcing the Russians to try to be tougher yet. Alexander Solzhenitsyn, however, does not believe that America has been staunch enough in dealing with the Russians and has invited Soviet expansion through its weakness. He fears for the survival of Western civilization. All three books are valuable for one's professional reading, but all have faults, some of which are not minor.

Harry Truman and the Cold War

Richard Walton writes† that Truman must have known in 1945 that the Soviet Union was no threat to America and should have acted more moderately. Convincingly he argues that "given America's enormous strength when World War II ended, given Russia's terrible devastation . . . and its need to devote itself to reconstruction, and given Russia's fear and suspicion of the West . . . the major responsibility for a peaceful world rested with the United States." Walton believes that Henry Wallace, former Secretary of Agriculture and Vice President, understood the correct path but was tragically ignored.

While Wallace was still in Truman's cabinet, he asked the President to look objectively at America's actions since 1945: "I mean by actions," he wrote, "the concrete things like $13 billion for the War and Navy Deparments, the Bikini tests of the Atomic Bomb and continued production of bombs . . . production of B-29s and planned production of B-36s, and the effort to secure air bases spread over half the globe from which the other half of the globe can be bombed." Wallace asked: "How would it look if Russia had 10,000 mile bombers and air bases within a thousand miles of our coast lines, and we did not?" Wallace saw clearly that our "interest in establishing democracy in Eastern Europe, where democracy has by and large never existed," seems to Russia to be an "attempt to re-establish the encirclement of unfriendly

†Richard J. Walton, *Henry Wallace, Harry Truman, and the Cold War* (New York: Viking, 1976, $12.95), 387 pages.

neighbors which was created" after World War I and which could "serve as a springboard of still another effort to destroy her."[1] Wallace understood that the Soviet Union had legitimate security interests in Eastern Europe, something formally unrecognized until President Gerald Ford did so in Helsinki in 1975.

Wallace realized that compromise was not surrender, that an adversary could be viewed as a nation seeking to serve its national interests rather than as a mortal foe, and that problems with the Russians could be solved without sacrifice of American vital interests. Wallace realized the need for détente. Walton loses few opportunities to show that much Wallace called for in the late 1940s is policy today, and he outlines Wallace's foresight:

> Henry Wallace said . . . that the United States would end up supporting corrupt, incompetent and repressive dictators all over the world. . . . He said that the effort to contain communism would be costly in American blood and treasure. He said that a crusade against communism would lead to the repression of civil liberties at home. He said that American foreign policy would lead to militarism. . . . Henry Wallace was right. . . . Henry Wallace has been vindicated by history.

That last point is certainly debatable, but Walton's point is well taken. Truman had an opportunity, before the Russians developed the atom bomb, to give peace a chance and stop the arms race before it began. Instead he confronted the Russians with an "iron fist and strong language,"[2] and helped provoke the Cold War.

The difficulty with Walton's thesis is that it presumes that the Soviets were not expansionist (a dangerous assumption if wrong), and it lacks balance. Very little mention is given of the Soviet rhetoric or actions that might have caused Truman's bellicose actions. Lenin had warned that the two systems could not live in harmony side by side, and Stalin believed and said the same; and yet Walton gives no weight to such statements. He also fails to acknowledge the effect of the Russian military conquest and occupation of Eastern Europe. It is all well and good to point out that the Russians had security interests in the area, but objectivity requires comment on the effect on the President and his advisers of the communizing of an unwilling Poland, Bulgaria, Hungary, and the rest of the satellites. Walton is also ungenerous when he compares Truman's "intervention" in the Italian election of 1948 with the Soviet take-over of Czechoslovakia that same year. All he can dredge up is Truman's campaign to have Italian-Americans write to relatives in Italy and George Marshall's unsubtle threat that American aid was tied to a non-Communist electoral victory. Even Walton admits that the Russian army conquered Czechoslovakia in 1948. He also chokes over the death of Czech leader Jan Masaryk. Writing in 1976, Walton says that the type of death—murder or suicide—"is still in dispute. . . ." There was no dispute in 1976 because the Czech government in 1968 released indisputable evidence from witnesses that Masaryk was thrown out of a window and murdered.[3] Walton's book, therefore, lacks balance. Other defects are its political hyperbole and naivete.

Walton states more than once that "it seems that everyone you meet now (except Republicans) who was old enough to vote in 1948 says he voted for Wallace." (p. 180) Walton must confine himself to select circles. He also has difficulty trying to justify to himself Wallace's acceptance of American Communist Party (ACP) indorsement in 1948. In that election year the ACP did not run its own candidate, as was customary, but indorsed and campaigned ardently for Wallace, the Progressive Party candidate. Wallace permitted key ACP leaders to be his most important advisers, e.g., John Abt as number two man in the campaign and Lee Pressman as secretary of the platform committee. Walton admits Abt's and Pressman's critical positions and says that there were Communists "at various levels at Progressive national headquarters and in the field," (pp. 249-50) but sees nothing wrong

with this because Communists have rights, too. Walton, however, is mystified and angered by the hostility Communists provoked in the voting public and the weak vote Wallace received because of this Communist support. Yet Walton acknowledges that there is "no doubt that many Communists had a deep and abiding, often blind, loyalty to the Soviet Union." But he asks: "Does this mean that they were disloyal to the United States? I do not know." (p. 266) Walton knows that the American Communists were always trying to "ape Russian communism," and "they closed their eyes to the ugly repression within the Soviet Union and were guilty of a mental agility that would have done credit to medieval theologians, as they sought to justify each twist and turn of the Soviet line even when yesterday's truth became today's heresy." (p. 251) Who might Walton expect to support a Henry Wallace with Communist support: American-Poles, Czechs, Germans, or Lithuanians with relatives behind the Iron Curtain? American farmers who had seen the ACP justify the murderous farm collectivization in Russia in the 1920s and '30s? American Jews who observed constant Russian anti-Semitism? American Christians and Jews who agonized over official state atheism? The ACP had tried to justify the Stalin purges in the 1930s and also the Hitler-Stalin nonaggression pact of 1939, and yet Walton is unable to understand the antipathy American voters had for Wallace with Communist support. Walton really expected a great deal from voters in 1948.

Foreign Policy and Domestic Institutions

Walton's arguments about the causes of the Cold War are expanded on by professors Nathan and Oliver, who manufacture a whole cloth out of foreign policy thread.† The authors see American domestic and international politics corrupted by foreign policy. Their book sees a connection between the Cold War and Watergate, believing that the Nixon excesses, the defeat in Vietnam, the imperial presidency, and the decline of Congress in foreign policy matters are all consequences of the manner in which presidents from Truman to Ford have viewed international politics. These presidents, the authors assert, identified foreign policy with security policy: "Foreign policy is to protect national interests against the dangerous and hostile forces at loose in a world where there are no international police and no courts with binding authority. . . ." In this society, force is the "common medium of exchange; and power is the only means of gaining interest." The diplomacy of violence, they write, "has been one of the dominant instrumentalities of American foreign policy for the last three decades."

All presidents since World War II, they claim, have seen the world as anarchic and the Soviet Union as the major threat to world order. Presidents from Truman to Ford reacted to this perceived threat with activism and interventionism. Although all these presidents saw the value of negotiations, they insisted (taking a page from Munich in 1938) that they must negotiate from a position of strength. No one seems to have asked how the Soviets might be expected to react to what they perceived as a hostile, capitalist West that always insisted on negotiating from a position of strength.

This presidential view of a permanently threatening, anarchic world society profoundly affected domestic institutions. It led to presidential demands for enormous discretionary powers and allocation of a third to more than half of the national budget to the tools of war rather than domestic needs.

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†James A. Nathan and James K. Oliver, *United States Foreign Policy and World Order* (Boston: Little Brown and Company, 1976, $10.95), 598 pages.

Nathan and Oliver believe—and given the example of Watergate, it would be difficult to debate them—that this domination of domestic politics by foreign policy has had "dismal domestic repercussions."

Nathan and Oliver also provide the intellectual underpinnings of American foreign policy. They cite George Kennan's alarmist telegram to the President in 1946 in which Kennan described the Russian leadership as a "political force committed to the belief that with the US there can be no permanent modus vivendi, that it is desirable and necessary that the internal harmony of our society be disrupted, our traditional way of life be destroyed, the international authority of our state be broken if Soviet power is to be secure." Kennan also wrote that the Soviets were "highly sensitive to the logic of force."[4] Although Kennan repudiated these ideas 25 years later, these views were critical to the Truman approach. This advice, which was similar to most that Truman received, resulted in a get tough policy with the Russians when the United States could have afforded to appear moderate. A year later Kennan wrote his famous "X" article in *Foreign Affairs*, which suggested that the Soviet leadership will fall from power because of internal weaknesses, but until then, "it is clear that the main element in any United States policy toward the Soviet Union must be that of long-term vigilant containment of Russian expansive tendencies."[5]

Three years after containment became the policy, Paul Nitze directed a staff of foreign and defense policy experts in the development of the landmark National Security Council Policy Paper 68 (NSC 68) titled "United States Objectives and Programs for National Security." Nitze's staff, writing in January 1950, described a bipolar world in which "conflict had become endemic." They believed that the Soviet Union desired the "complete abolition or forcible destruction" of power centers opposed to Soviet hegemony. NSC 68 called on the United States to organize its energies and those of the free world to "frustrate the Kremlin design for world domination." They believed the Soviets would be able, by the end of 1950, to overrun Western Europe and bomb America with atomic weapons. They called for a rapid buildup of American and Western power, and the "reduction of federal expenditures for purposes other than defense or foreign assistance. . . ."[6] This program was not accepted without debate in January 1950, but the outbreak of hostilities in Korea six months later ended the discussion.

Nathan and Oliver describe the Korean War as the "seminal event of the Cold War." It expanded containment to Asia, increased military spending (it was 67 percent of the 1952 budget), unbalanced budgets, fueled inflation, released a whirlwind of domestic tensions, and provoked a civil-military crisis. Nathan and Oliver write that the "decision to go into Korea was predicated on the perception that American will was being tested. Although the arena was peripheral, the United States . . . must respond . . . to establish a reputation for action and to deter probes at the center." Once taking up the gauntlet in Korea, the authors draw a straight line to Vietnam. President Eisenhower, they assert, had no argument with NSC 68 and piled on commitments by forging alliances all over the world. Eisenhower had the strength, the authors declare, to negotiate the Cold War, but he failed to do so and institutionalized the Cold War and the military-industrial complex.

When Eisenhower passed the torch to John Kennedy, he yielded office to a man who advocated negotiating from strength and who had no qualms about post-World War II security policy. Kennedy's advisers saw the need for a flexible response to Soviet threats across the whole war spectrum so Kennedy built missiles at one end of the line and counterinsurgency schools at the other. In a year he produced a missile gap overwhelmingly favorable to the United States, and to

counter Khrushchev's publicly announced support of wars of national liberation, Kennedy offered "nation-building," with the help of Green Berets. The authors say that Kennedy activism predisposed the administration to interventionism and sent it down the slippery slope to Vietnam. And everybody knows how that turned out.

Nathan and Oliver argue that the overwhelming concentration of the executive and his key advisers on the pursuit of world order undermined domestic institutions. The authors point out that the State Department was fatally weakened by Johnson and Nixon and was essentially replaced by a bloated extraconstitutional White House security apparatus. More significant, Nathan and Oliver believe that the Congress has been all but frozen out of foreign-policy making. Many key presidential appointments do not require Senate advice and consent. Presidents since Franklin Roosevelt have turned more and more to executive agreements rather than treaties because the latter require Senate approval, and even the control of the purse has been effectively subverted. This last point is carefully drawn and studded with examples. Presidents from Truman to Ford through impoundment, budgetary discretion, transfer authority, reprogramming, diverting pipeline goods, selling excess stocks, and pure budgetary legerdemain have been able to spend unappropriated money for purposes the Congress has sometimes specifically forbidden. The bombing toward the end of the war in Southeast Asia is a case in point.

How did the constitutional subversion come about? By relentless bipartisanism. Presidents since Truman have argued that the external threat to the country is so all-pervasive that dissent is an unaffordable luxury. Bipartisanship has become a way of political life in America, stifling debate and letting the President alone fix the course. By cataloguing the excesses of the Nixon administration, all of which were made in the name of national security, Nathan and Oliver have provided food for thought.

Some of the nourishment, however, is indigestible. While the authors are critical of presidential foreign policy, they offer no reasonable alternative. They realize that interventionism and global containment have not been successful and have undermined the home front, but they offer a scenario that would be unacceptable to most Americans:

> Even if the Soviets did have ambitions in Europe the worst that is normally forecast is a kind of "Finlandization." . . . Even if the Soviets moved on Europe and colonized the Common Market in the fashion that Stalin worked his will on Eastern Europe . . .it is not clear that it would present a *security* threat to the United States. . . . Even if the Soviets could gain such an empire by force, it is doubtful they could hold it.[7]

Given the 30-year record of the Soviets in Eastern Europe, it is doubtful that anything short of full-scale war could dislodge them once in power.

A greater problem than the authors' unacceptable alternative is the technical weakness of their manuscript: they do not footnote properly. This is more than a pedantic gripe. The book has more than a thousand footnotes, but many necessary footnotes are missing from controversial material. Space will not permit a full listing, but two examples should suffice. Nathan and Oliver suggest that Eisenhower advisers closely connected to United Fruit sent the CIA into Guatemala to upset a leftist regime. What follows from their book is completely unsubstantiated:

> As a lawyer, John Foster Dulles had drawn up contracts between United Fruit and the Guatemalan Government by which whole provinces were turned over to the company; the Assistant Secretary of State for Inter-American Affairs at the time of the coup held a significant block of United Fruit stock; Allen Dulles, the head of the CIA had been President of the company; and Walter Bedell Smith, the Undersecretary of State, would join the board of directors of United Fruit upon leaving the State Department.[8]

The authors allege that President Johnson "gave thinly disguised approval to the 1968 invasion by Russia of Czechoslovakia." (p. 443) Perhaps, but Nathan and Oliver should cite their sources. Beyond the lack of footnotes in critical places, many footnotes do not present all the information they should. The authors depend too heavily on secondary sources and never tell readers how the secondary source may have arrived at the information they cite.

Regardless of these criticisms, the book has worth. It shows clearly the price Americans have paid for always talking tough and never considering its effect on adversaries and of desiring to negotiate only from strength. Nathan and Oliver also demonstrate how the domination of foreign over domestic affairs has weakened American institutions and threatened its democracy.

Warning to the West

Alexander Solzhenitsyn, however, would not agree with Nathan, Oliver, and Walton.† He believes the United States has not talked or acted firmly enough, and that American weakness has invited Soviet expansionism. He warns that detente is one-sided because the Russians are abusing the West. He claims that detente is " a respite before destruction" and warns that the Russians are preparing weapons that could kill America with "one single blow."

Solzhenitsyn condemns the West for its lack of courage and is especially upset over the moral failure to condemn Russian and leftist repression while always vilifying rightist injustices. (He spoke and wrote before Jimmy Carter took office.) He openly asks how anyone could trust a Soviet government that has cost its own country tens of millions of lives between 1917 and 1959 and murders dissenters in insane asylums. Solzhenitsyn is pessimistically prophetic: The Soviet Union is a "concentration of world evil . . . full of hatred for humanity. It is fully determined to destroy your society. Must you wait until it comes to smash through your borders, until the young men of America have to fall defending the borders of their continent?" He sees defeat everywhere—from Portugal, to Africa, to India, to Southeast Asia—and fears for the future: "The West is on the verge of a collapse created by its own hands."

If the West is to survive, it must deal firmly with the Soviet Union. "The Communist leaders respect only firmness and they have contempt for persons who continually give in to them." Only "firmness makes it possible to withstand the assaults of communist totalitarianism." He also claims that the Soviets are aiming at total arms superiority. Solzhenitsyn roundly condemns Western capitalists for trading with the Russians, believing that the Soviet regime would collapse or moderate if it were not able to purchase necessities from the West. He even condemns Western diplomatic recognition of the Soviet Union.

It is difficult to fault Solzhenitsyn's description of internal Russia. He describes the country as a despicable totalitarian system that feeds on its own, has monumental faults, a past bloody with repression, and a future not any better. One might argue, however, with Solzhenitsyn's interpretation of external events. Not all would agree that Portugal has been lost to the West or that it will soon be a member of the "Warsaw Pact." (p. 69) Some would disagree when he states that "freedom has been lost in Laos, China, Angola," and many other places he mentions, because freedom was not there in the first place. Solzhenitsyn accuses the United States of cowardice for leaving Vietnam

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†Alexander Solzhenitsyn, *Warning to the West* (New York: Farrar, Straus and Giroux, 1976, $7.95), 145 pages. This is a collection of several speeches given to American and British audiences.

with "three thousand Americans in captivity," (pp. 31–32) but that is not true. Yet these are not major points.

Solzhenitsyn's small volume should be read by all those who are unconcerned with the Russian threat, or by anybody who believes that detente has made the Soviets mellow, or by anyone who wishes to combat intellectually those who hold such beliefs. One wishes it would be possible to bring Walton and Solzhenitsyn together.

ONE CANNOT combat a vicious ideology, however, by ignoring it or the regime it controls, as Solzhenitsyn suggests, and one cannot advance the cause of peace by hyperbole. Solzhenitsyn's warning, however, at its lowest level should be sufficient to cause America to keep its powder dry and bayonets sharpened. The message of the other two books is different. America's eyes must be focused on the goal of peace because war is insane and the burden of armaments is too severe to be continued indefinitely given domestic problems. The United States must also always regard the reaction of its adversaries to its rhetoric and must never again permit national security matters and foreign policy to corrupt internal politics.

Ramstein AFB, Germany

Notes

1. Letter, 23 July 1946, cited in Walton, pp. 88–89.
2. Memo, Truman to James Byrnes, 5 January 1946, cited in Walton, p.72.
3. See *New York Times*, 7, 8, 16, 17 April 1968 for the then newly released material. The *Times* articles pointed out that feces were found on the window ledge and floor beneath the window Masaryk fell from, indicating violence. Eyewitness accounts were also offered.
4. Message, Kennan to State Department, 22 February 1966, cited in Nathan and Oliver, pp. 66–67.
5. From July 1947, *U.S. Foreign Affairs*, cited in Nathan and Oliver, pp. 89–90.
6. Cited in Nathan and Oliver, pp. 126–32.
7. Ibid., pp. 433–34, emphasis in original.
8. Ibid., p. 219

POTPOURRI

Germany: A Short History by Donald S. Detwiler. Carbondale: Southern Illinois University Press, 1976, 273 pages, $10.00 hardback, $4.95 paper.

Works on German history have a tendency to expand into several volumes, no matter how restricted the topic. Donald Detwiler has produced a notable exception, all the more remarkable since he covers approximately 2000 years of history in only 273 pages. Yet this survey traces the major political events of the Germans from the Roman occupation to the present. With no attempt at being comprehensive, the book is both readable and worthwhile. It bears looking at.

The intended audience is the general reader or the beginning student of German history; for them, the book is right on the mark. It reveals an obvious mastery of the material and an ability to present a concise account without lapsing into a recitation of names and dates. The author summarizes the events and introduces thoughtful analyses of many complex issues. He is too brief at times (e.g., when he blazes through the entire Napoleonic era in little more than a paragraph), but this is generally the exception.

Detwiler concentrates on the modern era—half of the book deals with the last 100 years—and probably his best work is in the sections about this century. He carefully explains the confusion and disillusionment at the end of World War I, the deep divisions of the Weimar period, and the dramatic events of Hitler's Germany. These topics are all superbly thought out and presented. Detwiler's analysis vividly displays his skill at portraying the spirit of the times, despite the concise nature of the book.

There are several valuable additions to the text, including a twelve-page chronology and a series of maps depicting the borders and internal divisions of Germany throughout the time period of the book. The maps are rather difficult to understand, but so is their subject; the lengthy captions are a great help. Most important is an extensive bibliographic essay, a valuable aid for further study of issues raised by the history.

Modern German history abounds with issues that are popularly perceived but need to be better understood: the militarism of the officer corps, the shallow democratic experience, the stab-in-the-back theory of the First World War, the attraction to authoritarian government. For all of these, this book provides an excellent background. For an understanding of the two Germanies and their place in Europe and world affairs, there is no briefer, more readable, or more authoritative account.

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The Great Anglo-Boer War by Byron Farwell. New York: Harper & Row, 1976, 454 pages, $16.95.

At a time of yet another realignment of political power in southern Africa, it is useful to recall the great events at the turn of the century which cast their shadow on that continent and continue to influence strongly the actions there today. Thus the publication of Byron Farwell's book is, if nothing else, timely. To those interested in this area of turmoil, the Boer War offers insights for today's problems. It has been too often overlooked as an insignificant colonial episode of the past.

The oversight is understandable. This "little" war was quickly overshadowed by the vastness of World War I. Yet while the British Empire subdued a disorganized band of Dutch farmers after many embarrassing losses, the goals of the farmers, independence and a white-dominated society, were achieved in the end. The war proved that the Afrikaners were, and are today, a hearty breed who brook little outside interference and adapt to change in their own good time.

Farwell's book is long on ambition, trying to describe the "great human drama" of the entire era, with only a cursory glance at antecedents of the war: acquisition by the British Empire of former holdings of the Dutch East Africa Company in South Africa, inept colonial policies that alienated the inhabitants, and the first Anglo-Boer War ending in British defeat at Majuba Hill. Some interesting human sidelights are also expressed through the thoughts of soldiers and loved ones on both sides. However, the book is a tedious re-creation of the battles and skirmishes which, of course, did compose the war. Rather than apologize for the fact, the author should state the scope of his work and proceed without announcing it as something it will not be.

The battle scenes are a dismal reminder of the ineptitude of British generalship there. Against stiff competition, General Sir Redvers Buller won the prize for incompetence. Frontal attacks by massed troops against the accurate rapid-firing Mausers of the Boers led to the inevitable losses that characterized most of the battles in the first half of the war.

After Field Marshal Roberts had reorganized the British effort and brought the materiel superiority

of his side to bear, the tide of the war changed. The Boers shifted to guerrilla tactics; fought in 300-man commandos and appointed, rather than elected their officers. These decisions allowed them to continue the fight for at least another year, even though it was obvious that they could never win on the field of battle. Unfortunately, the author gives this momentous shift in strategy about as little notice as did the British. Roberts returned home to a hero's welcome, assuming the war was over. His chief of staff, Lord Kitchener, took command and directed the escalating brutality of the guerrilla phase of the war. The author fails to emphasize the real importance of the Boer decision, the tenacity and single-mindedness of the Afrikaners. Their simple faith in God and devotion to cause may now seem incomprehensible. Yet these farmers were the forebears of today's leaders in the Republic of South Africa.

Farwell's book is lengthy but not a momentous work. It is a reminder of an era when the British Empire was beginning to descend from the heights of Victorian grandeur, and the political and social institutions of the African subcontinent were being shaped for good or ill.

Major William R. Griffiths, USA
Hq TRADOC, Fort Monroe, Virginia

The Lusitania Disaster: An Episode in Modern Warfare and Diplomacy by Thomas A. Bailey and Paul B. Ryan. New York: The Free Press, 1975, 340 pages + bibliography, notes, and index, $10.95.

The ship moved slowly forward off the Irish coast. It was 1:40 in the afternoon: the sea was calm, the day sunny, and the passengers, though probably nervous because of the submarine-infested waters, went about their business without undue alarm. Then it happened: the starboard bow lookout shouted an alarm and disappeared to warn his brother, sleeping below deck. The bridge did not hear this first warning and took no evasive action. A second warning from the crow's-nest came too late. The torpedo from U-boat 20 struck the massive ship, and 18 minutes later it sank to the bottom of the ocean. The time: May 1915. The incident: the sinking of the *Lusitania!*

The single torpedo (at least most survivors say there was only one) wreaked incredible havoc. But it was subsequent explosions that ripped the huge ship apart, accounting for its rapid disappearance from the face of the ocean and the extreme loss of life (1198 of 1959 people on board died). The rapidity with which the ship sank and the later explosions—attributed to everything from bursting boilers to the discharge of a surreptitious cargo of munitions destined for Britain's wartime effort—set off a controversy that has lasted these many years.

Was this a plot by Great Britain to lure the United States into war on the side of the Allies? Would the Admiralty deliberately decoy the huge Cunard liner into the path of a U-boat to get the United States to abandon its neutrality (if indeed it ever existed when one considers that the Anglophile Woodrow Wilson was at the helm of government)? While this was the major theme that preyed on most minds, there were innumerable questions raised. Why was the ship moving at less than top speed? Why had the captain deliberately (or apparently deliberately) ignored his orders and repeated warnings?

As if the diplomatic and humanitarian questions were not enough to muddle the mind, there were others. Did the *Lusitania* have secret orders to ram any U-boat that surfaced? And was the vessel really armed when she left the port of New York? Why, too, did the ship sink so quickly? Why couldn't the lifeboats be readied and launched?

For years, the sinking of the *Lusitania* ranked along with the destruction of the *Maine* in the Havana harbor as causes célèbres, but the *Lusitania* disaster has remained shrouded in mystery. Various books have appeared offering a variety of explanations, but the most sensational was written by British author Colin Simpson in 1972. Simpson claimed that the *Lusitania* carried 6-inch guns, and he did nothing to dispel the idea that the ship was trapped and ambushed.

In his effort to set the record straight, Thomas Bailey, a competent historian, solicited help from a man with a wealth of naval experience and the added professional qualifications of a historian—Paul B. Ryan (a retired Navy captain)—to co-author a work that examines each hypothesis and myth. The book is a model of historical sleuthing, reflecting the merger of two diverse but mutally supporting talents. Almost without exception, the authors unravel the riddles and hold up to the cold light of historical perspective the events leading to the *Lusitania's* sinking.

The authors found that Cunard Captain William T. Turner used less than adequate judgment in interpreting somewhat unclear Admiralty instructions of the danger of submarines. Moreover, while the ship sailed under Cunard's instructions at less than top speed and failed to follow a zigzag course, it was by sheerest luck that the U-boat, commanded by Kapitanleutnant Walther Schweiger, and the liner crossed paths. (Schweiger was to lose his life while commanding another U-boat in 1917.)

Bailey and Ryan note also that the sinking was not the single event carrying the U.S. into war but was an episode in a long list of such events. For Germany, they concluded that the torpedoing might have been both morally and legally justified (although the findings of somewhat impartial tribunes never found it so), but it ultimately led to defeat.

The volume is both informative and entertaining, factual and lucid—history as it should be written. There are very few errors (e.g., Field Marshal Alfred Jodl rather than Colonel General Alfred Jodl on page 340). In all, the book is a model of scholarly research and probably a definitive effort.

Lloyd H. Cornett, Jr., Chief
Albert F. Simpson Historical Research Center
Air University

THE G.I.'s: The Americans in Britain, 1942–1945 by Norman Longmate. New York: Charles Scribner's Sons, 1975. 416 pages. $12.50.

That titanic struggle of nations we remember as World War II is being reshaped daily with new revelations, such as the existence of Enigma and Intrepid. Those brave men who shouldered the grave responsibilities inherent in directing nations at war are rapidly fading from recent memory and taking their places in the pages of history with those great and near-great leaders who preceded them.

Norman Longmate, a BBC journalist who experienced the arrival of American troops in Britain firsthand, has given us neither a terse exposé of some previously close-guarded information nor an epic canvas like many we have been seeing for the past several years in print. It is, however, a good glimpse into one of those peripheral areas of the European war and will bring vivid memories to those readers who were part of that experience. *The G.I.'s* is written in an anecdotal manner which amalgamates interviews and commentary into the narrative. Aside from a minor preoccupation with the sexual mores of Yanks and "Brits," Longmate manages to capture two cultures in collision.

Occasionally a tidbit, such as Ike's irritation with less than totally professional, dedicated subordinates and General Raymond E. Lee's observation that the British could defeat Germany only with ". . . the help of God or Uncle Sam . . . Perhaps it will take both," spices the narrative. Ambassador Joseph P. Kennedy draws some stiff criticism for his supposed "defeatist line" in the years prior to American entry into global war. Ambassador John G. Winant fares better.

The G.I.'s is light, easy reading which attempts "to illuminate, through the experience of ordinary people of both nations, one brief but significant episode in Anglo-American history." He quotes "a Birmingham schoolboy" who observed in 1942, "They [the Americans] were never merely 'them' and they rapidly became 'us.' " This is the story of a patient Great Britain, waiting for the American cousins to awaken to the reality of war, which then finds that the arrival of the Yanks creates a curious blending of cultures and a mutual correction of misconceptions. This is an entertaining book for an evening's reading.

Lieutenant Colonel John F. Votaw, USA
11th Armored Cavalry Regiment

Unchosen Presidents: The Vice President and Other Frustrations of Presidential Succession by Allan P. Sindler. Berkeley: University of California Press, 1976. 118 pages, $5.95.

Allan Sindler, Dean of Public Policy at the University of California, Berkeley, argues that our nation's system of selecting vice presidents has frequently resulted in candidates with mediocre talent. Regrettably, presidential nominees often choose running mates for political reasons, not for their potential to serve as president. Since 1789, the United States has adopted sixteen amendments to the Constitution; two of these, the twelfth in 1804 and the twenty-fifth in 1967, altered the procedure for selecting vice presidents. In spite of these amendments, however, a major shortcoming continues—quality candidates find little attraction in the office of vice president.

The author examines two possible changes to the present system of selecting presidential successors—changes that could provide well-qualified candidates for the nation's highest office. He considers elevating the stature and importance of the vice president by expanding his role and responsibilities, thereby attracting men of high caliber. After a lengthy discussion, however, Sindler concludes that this approach would raise too many conflicts with the president and would probably fail. Therefore, he recommends electing a new president whenever a vacancy occurs, with the vice president acting as an interim president. This approach would produce a president of higher quality than does the present

system of vice-presidential selection and also eliminate the possibility of ever having another appointed president.

Dean Sindler has written a convincing, well-organized, and compact work, yet the reader completes his book with a sense of frustration. Since 1973, Watergate and other scandals have given the nation two appointed vice presidents and one appointed president. Little support, however, has emerged for changing the selection procedures specified by the twenty-fifth amendment. It is difficult and painful to imagine future events severe enough to bring about the special election process that the author argues for so strongly. Until such events do occur, Sindler's work will remain only a topic of interest to political scientists.

Captain Harry R. Borowski, USAF
Department of History, USAF Academy

Human Relations in the Military, Problems and Programs edited by George Henderson. Chicago: Nelson-Hall, Inc., 1975, 291 pages, $14.00.

It is unfortunate that George Henderson gave his book the wrong name. To the casual eye, the title *Human Relations in the Military* has an instantaneous appeal. However, for the serious reader the appeal is quickly diminished. It is *not* an exposition of current human relations issues in the military environment. The book does not address the management of human resources in the broadest sense. It does not attempt to deal with such human relations subjects as motivation, job enrichment, managerial style, management by objectives, etc. For that reason, it fails to fulfill the title's promise.

It *is* an interesting collection of personal examples and histories of *some* of the social actions problems and solutions faced by military leaders and managers in the past decade. The topics covered range from counseling to confrontation, from drugs to discipline, and from drinking to discrimination. As in many books that cover such a broad area, the treatment is somewhat shallow. This superficiality is offset to great degree by the depth in which each individual case study is portrayed. The cases are largely based on personal experiences of low-level military managers and their civilian counterparts. As a result, they come alive, graphically portraying the difficulties inherent in trying to solve human problems. The contributors are of course biased—biased because they care. That makes the book worthwhile if used as the author intended, as a text for students in military training programs for people concerned with techniques and programs for improving human relations.

The bibliography alone makes it a valuable reference tool. However, to prevent any confusion, the title should be covered with a label that says "Social Actions Cases and Problems."

Major Paul F. Murphy, USAF
Springfield, Virginia

Economists at Bay: Why the Experts Will Never Solve Your Problems by Robert Lekachman. New York: McGraw-Hill, 1976, index, xii + 291 pages, $8.95.

Economists at Bay will convince only true believers. Its basic arguments are: (1) the state of the economy is deplorable; (2) the state of economic theory (and the economic profession) is reprehensible; (3) those "respectable economists" who have guided past economic policy are major contributors to current economic difficulties; and, (4) a revitalized economic theory relevant to current economic problems is urgently needed.

The primary focus of the author's discontent is the stagflation of the seventies and economists' failure to cope with it. This failure, Dr. Lekachman contends, is the result of contemporary economic theory's ignoring the relevant economic institutions. The radical economic movement is viewed as the potential savior, possibly developing a greatly expanded normative economics based on modern radical philosophy. The author follows his own prescription. *Economists at Bay* is broad in scope and ambitious in aim, with relevance to current problems being the primary objective.

The book gets some points on content: the failure of any theory to control, predict, or explain observed events is a powerful impetus toward new theories. The Great Depression, for example, was a major factor in the inception and growth of Keynesian macroeconomics. Undoubtedly an amended and strengthened economic theory will also emerge from the present season of discontent.

The author's sense of the factors shaping economic thought strengthens his book: his preoccupation with political causes detracts from it. The various political discourses obscure—and finally destroy—its sense of purpose. Dr. Lekachman looks at everything but ends up seeing very little.

The more prosaic details are ignored in pursuit of the larger aims. The author criticizes an international economic order that confines industrial activity to developed nations yet deplores multinational corporations' transferring industrial operations to the Third World. Most readers would expect a more consistent viewpoint. Skeptics would conclude that the unifying theme is an overwhelming need to be critical.

Political imperatives detract from more than mere consistency. Basing wide-ranging conclusions on heroic assumptions allows confident statements, but it does not preclude troublesome objections which, in fact, come readily to mind. The author notes, among present-day evils, that the heaviest burden of unemployment falls on minorities. Yet Milton Friedman, the book's arch villain, has repeatedly predicted this as a consequence of minimum wage laws. One could just as well conclude that current problems are at least partly the result of ignoring, rather than following, the guidance of "respectable economists."

The same political preoccupations becloud the author's view of economic theory. He is concerned that conservatives frequently advance better economic arguments for their policies than do liberals or radicals. The fault is seen in "limitations of contemporary economics." This seems analogous to a losing coach's concern with poor manufacturing of modern footballs. Beyond this, one suspects that the real reason for wanting to change economic theory is to allow radicals to win debates. Lekachman trusts that radical economists will aid radical politicians. However, even if the radical economic movement does produce a great theorist, the author's expectations may yet go unfulfilled.

Adam Smith, a radical economist of 1776, advocated an antibusiness doctrine called laissez faire. This same laissez faire became the chief ideological support for the probusiness politics of Victorian England. Similarly, it does not follow that today's radical economics will support tomorrow's radical politics.

In short, Dr. Lekachman seeks relevance at the expense of most other considerations. Relevance, however, is a highly perishable commodity. Secular stagnation was relevant to the thirties; the age of affluence was highly relevant in the sixties. They are not nearly as pertinent today. The ideas in *Economists at Bay* will depreciate much more rapidly.

Captain Raymond E. Franck, Jr., USAF
Department of Economics, Geography, and Management, USAF Academy

The Joint Chiefs of Staff, the First Twenty-five Years by Lawrence J. Korb. Bloomington: Indiana University Press, 1976, 210 pages, $10.95.

Lawrence J. Korb, in *The Joint Chiefs of Staff, the First Twenty-five Years,* reviews the organizational history, provides biographical sketches on the past and present members, analyzes the activities, and projects the future of the Joint Chiefs. The book is solidly based on facts from official documents and interviews with nine former chiefs of staff and other high officials within the Department of Defense. The author skillfully weaves personal knowledge of military sociology with historical facts and expert opinion to form a straightforward, interesting narrative.

The narrative is divided into four parts. First, the author analyzes the responsibilities and prerogatives of the chiefs, outlines their decision-making processes, and discusses the relationships between the JCS and other high-level structures within the American political system. He then reviews the careers of the 28 officers who have served on the JCS. An analysis of the sometimes controversial involvement of the chiefs in the defense budget process follows, and effects of the individual prestige, personality, and biases of various chiefs are also discussed. The role of the JCS in American foreign policy is examined in the fourth chapter. Korb describes the part played by the chiefs in various foreign policy crises, with emphasis on the Korean and Vietnam wars. In concluding, the author looks at the present Chiefs of Staff and predicts their future role in the post-Vietnam era. As a whole, the narrative represents a successful effort by the author to fit the JCS, as an entity, into the larger framework of the American political system.

The narrative also represents an intensive research effort. Essentially, however, the author uses Department of Defense sources relating to the JCS; the book, therefore, lacks vivacity; the narrative can be compared to a synthesis of family discussions about a fellow family member. There is no penetrating, fresh insight into the personalities, politics, and controversies associated with the JCS. The book would benefit from outside views for counterpoint, especially in the chapters dealing with the JCS political and policy-making activities.

Lawrence J. Korb gives us a scholarly insider's view of the Joint Chiefs. A number of other authors, Carl W. Borklund, Samuel P. Huntington, and Stuart H. Loory, for example, have dealt with the Department of Defense or the American military as a whole; their books treat the JCS peripherally or as a

subsystem within the larger military establishment. Korb's *The Joint Chiefs of Staff, the First Twenty-five Years* is the first to deal exclusively with the JCS as an entity.

Captain Franklin L. Gertcher, USAF
1843d Electronics Engineering Squadron (AFSC)

The Dragon's Wings by William M. Leary, Jr. Athens: The University of Georgia Press, 1976. xiii + 279 pages, appendix, bibliography, index, $12.00.

Consider China in the 1920s and '30s: near economic collapse, famine, factionalism, warlords, revolution, foreign meddling—a China once described as a "geographic expression" and not really a country at all. Out of this setting author William M. Leary, Jr., selects his subject, the building of an airline. To many students of the Chinese scene, Leary's topic may seem unimportant. But as presented in *The Dragon's Wings*, it becomes an exciting, well-researched, and informative account of an American business attempt to build an airline for the Chinese.

Using the China National Aviation Corporation (CNAC) as the case study, Leary recounts the early efforts and many false starts in beginning such a venture. Help arrived in the early 1930s from Juan Trippe's Pan American Airways. Pan Am provided both management and financial assistance to CNAC, and the ledger books began to show an occasional speck of black ink. Yet, according to Leary, CNAC could never overcome the problems endemic to all such business ventures in China. The Chinese goverment (whatever that might be at the time) was suspicious of all foreign investment schemes and was never convinced the partnership had real value in an American-run airline. Resentment over American management and the lack of Chinese aircrews added to the distance between Chinese and American officials jointly responsible for CNAC.

In addition to these problems, Leary describes the misuse of CNAC's airplanes by warlords, revolutionaries, and bandits, none of whom added to CNAC's profit margin. The author also describes how vintage airplanes, primitive ground facilities, the absence of navigational aids, uncharted terrain, and unbelievable weather all conspired to destroy CNAC. Yet, the human element, both Chinese and American, rallied after crash and crisis to keep CNAC flying. Several such human interest stories highlight each of Leary's chapters.

The author gives excellent coverage to the effect of the Sino-Japanese War (1937-45) on CNAC. Chinese officials then viewed CNAC in a more favorable light. As the Japanese pushed further south into China, CNAC became a significant communications link for a truncated China. Later in the war, Leary notes that CNAC blazed the trail for the Hump air bridge over the Himalayas from India into South China. CNAC carried more tonnage and flew more sorties per aircraft than the Army Air Forces Transport Command.

Following the collapse of the Japanese war effort in China, CNAC aided the Nationalists during their struggle against Mao's Communist forces. But Leary notes that the Nationalists' loss was CNAC's loss. CNAC left China with the other tattered fragments of Western business, taking no profit, no gain, no airline, only memories and adventure.

Although Leary never addressed in any depth the question of "need" in China, he is puzzled that the Chinese would not fully accept the value and need for an airline. If any item can be faulted in the book, it is Leary's overstatement of the importance of commercial air service for China during the time between the two world wars. The frontier spirit of American pilots and investors was not shared in China, which had more pressing problems and a frontier period which had ended 3000 years earlier.

Yet this is an excellent book for students of China, flying, and international business. Leary provides an ideal study to follow up the Willard Straight business stories in China from an earlier decade. As a product of meticulous research and careful writing, this book is well suited to both scholar and layman for its insights into little known areas of flying and abortive attempts to Westernize China.

Captain Thomas F. Menza, USAF
Department of History, USAF Academy

BOOKS RECEIVED

The books listed herein are those received since the last list was published. Many of them have already been sent to reviewers, and their reports will be printed later.

I. AIR POWER

Carter, Kit C., and Robert Mueller. *The Army Air Forces in World War II: Combat Chronology, 1941-45*. Washington, D.C.: Government Printing Office, 1973. $14.30.

Coffey, Thomas M. *Decision over Schweinfurt: The U.S. 8th Air Force Battle for Daylight Bombing*. New York: McKay, 1977. $12.50.

Conquest, Robert, et al. *Defending America*. New York: Basic Books, 1977. $13.95.

Luttwak, Edward N. *Strategic Power: Military Capabilities and Political Unity*. Beverly Hills, California: Sage Publications, 1976. $3.00.

Morgan, Patrick M. *Deterrence: A Conceptual Analysis*. Beverly Hills, California: Sage Publications, 1977. $6.00.

National Strategy Information Center. *Toward a New Defense for NATO: The Case of Tactical Nuclear Weapons*. New York: NSIC, 1976. $2.00.

Quester, George. *Offense and Defense in the International System*. New York: Wiley, 1977. $10.95.

Thomas, Gordon, and Max Morgan Witts. *Elona Gay*. Briarcliff Manor, New York: Stein and Day, 1977. $11.95.

II. AVIATION: TALES, TECHNIQUES, AND TECHNOLOGY

Chapman, Clark R. *The Inner Planets: New Lights on the Rocky Worlds of Mercury, Venus, Earth, the Moon, Mars, and the Asteroids*. New York: Scribner's, 1977. $8.95.

Collins, Richard L. *Flying Safely*. New York: Delacorte Press, 1977. $8.95.

French, Bevan M. *The Moon Book*. New York: Penguin, 1977. $4.95.

Garbett, Mike, and Brian Goulding. *The Lancaster at War*. New York: Scribner's, 1977. $10.95.

Gill, Brendan. *Lindbergh Alone*. New York: Harcourt Brace Jovanovich, 1977. $11.95.

Green, William. *The Observer's Book of Aircraft*. New York: Scribner's, 1977. $2.95.

Gunston, Bill. *F-4 Phantom*. New York: Scribner's, 1977. $8.95.

Hallion, Richard P. *Legacy of Flight: The Guggenheim Contribution to American Aviation*. Seattle: University of Washington Press, 1977. $15.00.

Heppenheimer, T. A. *Colonies in Space*. Harrisburg, Pennsylvania: Stackpole Books, 1977. $12.95.

Hess, William. *Thunderbolt at War*. New York: Doubleday, 1977. $10.95.

Hurst, Ronald, editor. *Pilot Error: A Professional Study of Contributory Factors*. London: Crosby Lockwood Staples, 1976. $19.95.

Mrazek, James E. *Fighting Gliders of World War II*. New York: St. Martin's, 1977. $10.00.

Murray, Bruce, and Eric Burgess. *Flight to Mercury*. New York: Columbia University Press, 1976. $12.95.

Piggott, Derek. *Understanding Gliding*. New York: Barnes and Noble, 1977. $20.00.

Powers, Barry D. *Strategy without a Slide Rule*. New York: Holmes and Meier Publishers, Inc., 1976, $18.00.

Price, A. *Luftwaffe Handbook*. New York: Scribner's, 1977. $6.95.

Price, Alfred. *Spitfire at War*. New York: Scribner's, 1977. $10.95.

Stockton, William. *Final Approach: The Crash of Eastern 212*. New York: Doubleday, 1977. $7.95.

Taylor, Richard. *Understanding Flying*. New York: Delacorte, 1977. $10.00.

Villars, J. B. *Notes of a Lost Pilot*. Hamden, Connecticut: Archon, 1975. $12.50.

Weal, Elke C., et al. *Combat Aircraft of World War II*. New York: Macmillan, 1977. $17.95.

III. MILITARY AFFAIRS

Anderson, Martin, editor. *Conscription: A Select and Annotated Bibliography*. Stanford, California: Stanford University Press, 1976.

Bachman, J. G., et al. *The All-Volunteer Force*. Ann Arbor: University of Michigan Press, 1977.

Barker, A. J. *Prisoners of War*. New York: Universe Books, 1975. $8.95.

Barron, John, and Anthony Paul. *Murder of a Gentle Land: The Untold Story of a Communist Genocide in Cambodia*. New York: Reader's Digest Press, 1977. $9.95.

Beard, Edmund. *Developing the ICBM: A Study in Bureaucratic Politics*. New York: Columbia University Press, 1976. $15.00.

Bidwell, Shelford, editor. *Brassey's Artillery of the World*. Boulder, Colorado: Westview, 1977. $39.50.

Binkin, Martin, and Shirley Bach. *Women and the Military*. Washington: Brookings Institution, 1977. $7.95.

Bouc, Alain. Mao Tse-tung: A Guide to His Thought. New York: St. Martin's Press, 1977. $10.00.

Burchett, Wilfred, and Derek Roebuck. *The Whores of War: Mercenaries Today.* New York: Penguin, 1977. $2.95.

Burt, Richard. *Congressional Hearings on American Defense Policy, 1947–1971.* Lawrence: University Press of Kansas, 1974.

Caputo, Philip. *A Rumor of War.* New York: Holt, Rinehart and Winston, 1977. $10.00.

Carman, W. Y. *A Dictionary of Military Uniforms.* New York: Scribner's, 1977. $12.50.

Connelly, Thomas L. *The Marble Man: Robert E. Lee and His Image in American Society.* New York: Knopf, 1977. $10.00.

Cooling, B. J., editor. *War Business, and American Society: Historical Perspectives on the Military-Industrial Complex.* Port Washington, New York: Kennikat, 1977. $12.50.

Coox, Alvin D. *The Anatomy of a Small War: The Soviet-Japanese Struggle for Changkufeng/Khasan, 1938.* Westport, Connecticut: Greenwood, 1977. $25.00.

Cortese, Charles F. *Modernization, Threat, and the Power of the Military.* Beverly Hills, California: Sage Publications, 1976. $3.00.

Davis, W. C. *The Battle at Bull Run: A History of the First Major Campaign of the Civil War.* New York: Doubleday, 1977. $9.95.

Devore, Ronald M. *Spies and All That . . . Intelligence Agencies and Operations, A Bibliography. Los Angeles, California:* Center for the Study of Armament and Disarmament, 1977. $3.00.

Dung, General Van Tien. *The Great Spring Victory: An Account of the Fall and Liberation of South Vietnam.* New York and London: Monthly Review Press, 1977. $15.00.

Enser, A. G. S. *A Subject Bibliography of the Second World War: Books in English, 1939–1974.* Boulder, Colorado: Westview, 1977. $25.00.

Foss, Christopher F. *Jane's World Armoured Fighting Vehicles.* New York: St. Martin's Press, 1977. $25.00.

Foss, Christopher F., and T. J. Gander. *Infantry Weapons of the World.* London: I. Allan, 1977. $7.95.

Gansberg, Judith M. *Stalag, U.S.A.: The Remarkable Story of German POW's in America.* New York: Crowell, 1977. $8.95.

Goodpaster, Andrew J., and Samuel P. Huntington. *Civil Military Relations.* Washington, D.C.: American Enterprise Institute for Public Policy Research, 1977. $2.50.

Grechko, Marshal A. A. *The Armed Forces of the Soviet State.* Washington, D.C.: Government Printing Office, 1975. $3.20.

Halder, Franz. *The Halder Diaries: The Private War Journals of Colonel General Franz Halder.* Dunn Loring, Virginia: Deputy Association, 1976. $125.00.

Heller, Francis H., editor. *The Korean War: A 25-Year Perspective.* Lawrence: Regents Press of Kansas, 1977. $13.00.

Krendel, E. S., and B. L. Samoff, editors. *Unionizing the Armed Forces.* Philadelphia: University of Pennsylvania Press, 1977. $10.00.

Laqueur, Walter. *The Guerrilla Reader.* Philadelphia: Temple University Press, 1977.

Lee, William T. *The Estimation of Soviet Defense Expenditures, 1955–75: An Unconventional Approach.* New York: Praeger, 1977.

Lee, William T. *Understanding the Soviet Military Threat: How the CIA Estimates Went Astray.* New York: National Strategy Information Center, Inc., 1977. $2.00.

Leutz, James R. *Bargaining for Supremacy: Anglo-American Naval Collaboration, 1937–1941.* Chapel Hill: University of North Carolina Press, 1977. $17.95.

Lord, Walter. *Lonely Vigil: Coastwatchers of the Solomons.* New York: Viking Press, 1977. $12.50.

Lowe, Joseph D. *A Dictionary of Military Terms: Chinese-English, English-Chinese.* Boulder, Colorado: Westview, 1977.

Lubow, Robert E. *The War Animals: The Training and Use of Animals as Weapons of War.* New York: Doubleday, 1977. $7.95.

Luttwak, Edward N. *The Grand Strategy of the Roman Empire.* Baltimore: Johns Hopkins University Press, 1977. $12.95.

Milward, Alan S. *War, Economy and Society, 1939–1945.* Berkeley: University of California Press, 1977. $12.95.

Nelson, Harvey W. *The Chinese Military System.* Boulder, Colorado: Westview, 1977. $18.00.

Price, Jane L. *Cadres, Commanders and Commissars: The Training of Chinese Communist Leadership, 1920–45.* Boulder, Colorado: Westview, 1976. $20.00.

Robertson, J. I., and R. M. McMurry. *Rank and File.* San Rafael, California: Presidio, 1977. $12.95. The life of the Civil War soldier.

Royal United Services Institute for Defence Studies. *Defence Yearbook, 1976/77.* Boulder, Colorado: Westview, 1977. $27.50.

Sabrosky, A. N. *Blue-Collar Soldiers? Unionization and the U.S. Military.* Philadelphia: Foreign Policy Research Institute, 1977. $5.95.

Sampson, Anthony. *The Arms Bazaar: The Companies, the Dealers, the Bribes, From Vickers to Lockheed.* New York: Viking Press, 1977. $12.95.

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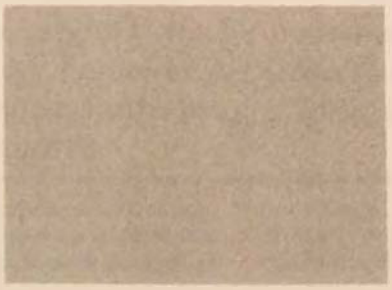

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AWARD

The Air University Review Awards Committee has selected "The Impact of V/STOL on Tactical Air Warfare" by Wing Commander Peter P.W. Taylor, AFC, the Royal Air Force Exchange Officer, Hq Tactical Air Command, Langley AFB, Virginia, as the outstanding article in the November-December 1977 issue of *Air University Review*.

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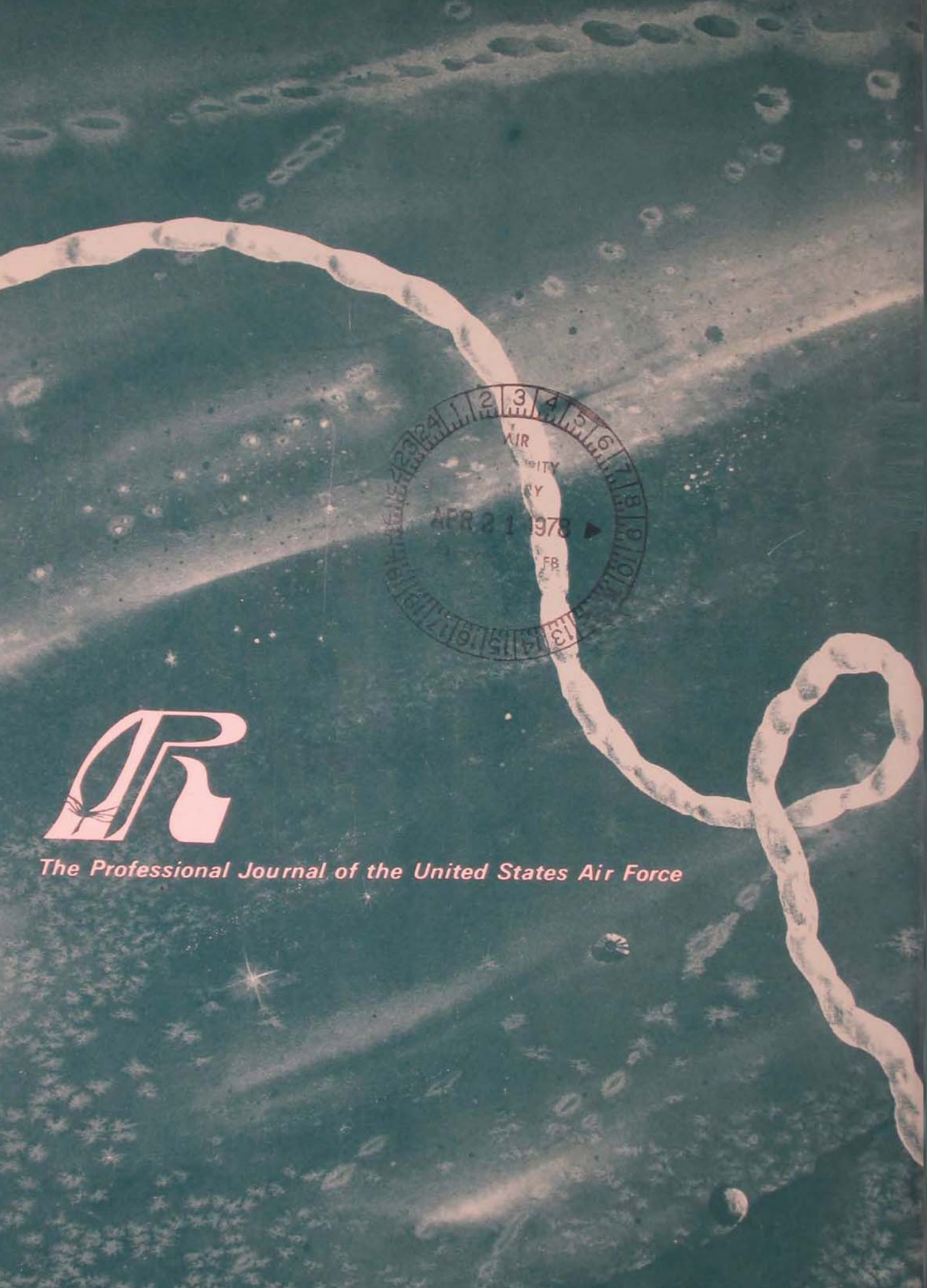

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