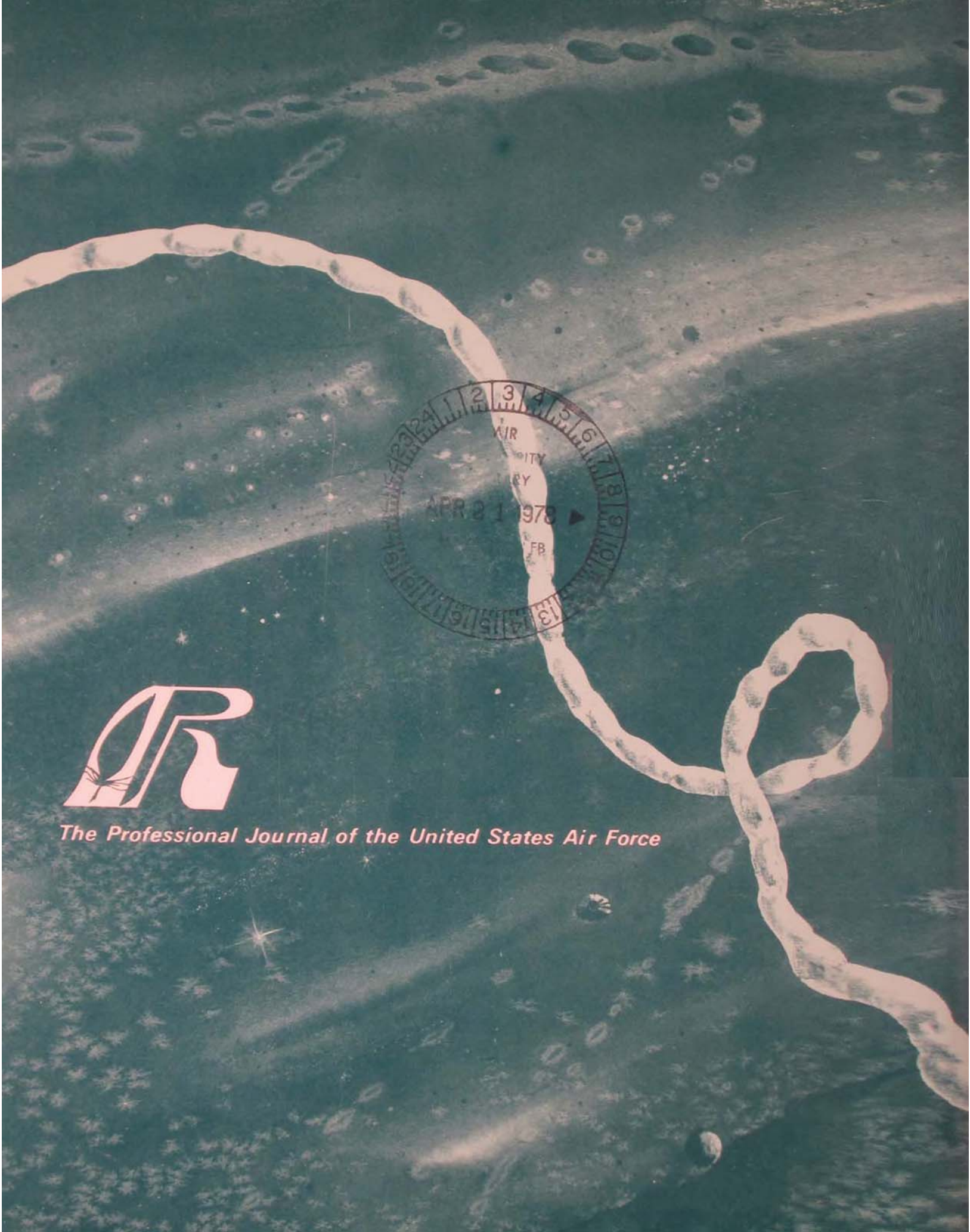
AIR UNIVERSITY review

MARCH–APRIL 1978



AR

The Professional Journal of the United States Air Force

AIR UNIVERSITY
review

from the editor's aerie

Potential authors frequently ask, "What are you looking for?" Our first response is to refer them to the inside back cover, where the editorial policy of the journal is stated. To narrow that general guidance further, we are always looking for articles that examine the interrelationships between national objectives and developing aerospace capabilities, particularly in the light of technical advances by ourselves, our allies, and our adversaries. We do not limit our contents to matters of national policy; rather, we try to cover a broad spectrum of subjects of professional interest. New applications of improved hardware, management problems solved in innovative ways, technical breakthroughs described in lay language, human relations, and reviews of defense-related literature have always been pertinent. We are especially receptive to thoughtful and informed challenges to existing doctrine and practice.

Contributors also express curiosity about the acceptance rate and if the *Review* pays for its articles. Acceptance rates vary, but an overall average would run close to 15 percent of the material submitted. Cash awards to eligible contributors currently vary between $80 and $150 for articles and major reviews (DOD employees are not considered eligible if they prepared the articles during normal duty time).

Potential contributors should not be discouraged by the acceptance rate for major articles. Although we have a comfortable backlog of articles awaiting publication, we have an immediate and constant need for vignette and space-filler material. Flashes of humor or anecdotes that provide insight into leadership are particularly welcome.

Our cover photo is of a Delta launch vehicle carrying the Intelsat III spacecraft. As emphasized in our lead article by Brigadier General Charles E. Williams, USAF (Ret), communications satellites and transportable terminals will be indispensable in the management of future crisis situations.

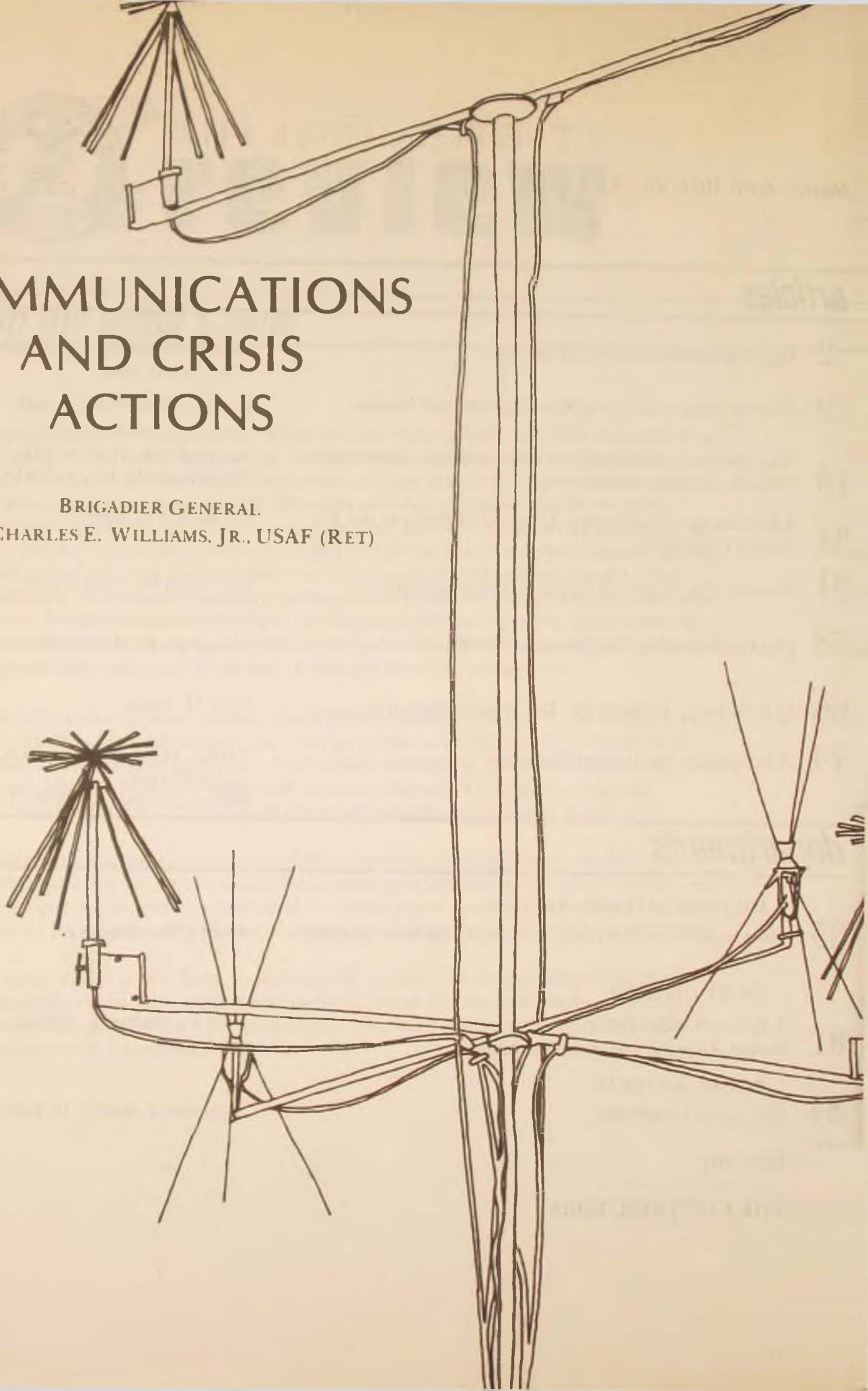
March-April 1978/Vol. XXIX No.3

articles

departments

COMMUNICATIONS AND CRISIS ACTIONS

BRIGADIER GENERAL
CHARLES E. WILLIAMS, JR., USAF (RET)



CRISIS SITUATIONS generally do not attract the deep analysis that historians give to general wars. Nonetheless, crises can lead to serious conflict if not controlled or resolved promptly. They really deserve more attention. With the growth in number, power, and diversity of atomic weapons as well as the number of countries possessing them since World War II, the penalties for failing to control crisis situations could be unnacceptably severe. As study of the conventional wars and numerous crisis/contingency operations in the intervening 30 years illustrates the fragile border between crisis and general conflict.

The growing impact of world opinion, the change from a bipolar world to one of multipolitical orientation, and the ever more severe consequences of general war make it increasingly important that we be aware of potential trouble spots and handle crises with speed, precision, and good judgment. Commanders must have fast and secure upward reporting, accurate situation reports, tight reins on the use of force, and, when needed, the capability to apply the right amount of force at the right time. For vast areas like the Pacific, this calls for forward-based forces and in-being, highly active command and reporting channels.

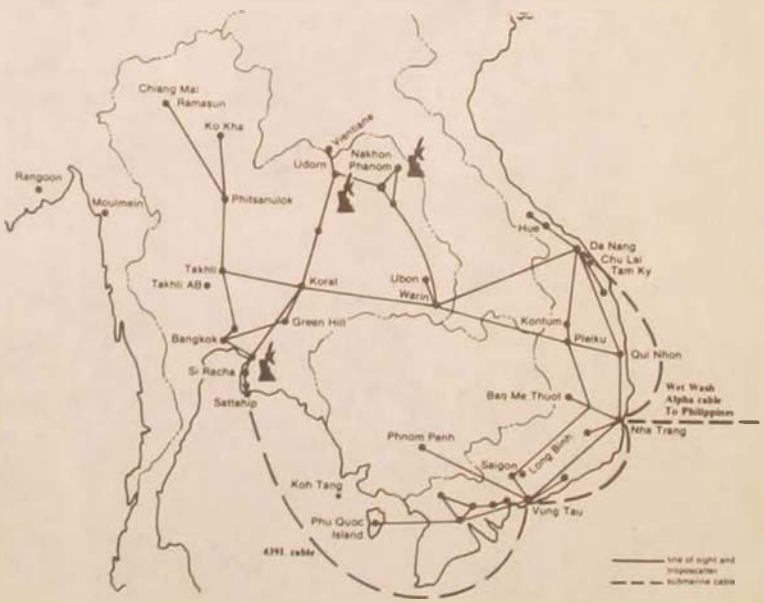
As a general rule, fast-moving, event-driven crises place great stress on command, control, and communications systems. By and large, we have to go with resources on hand or available in theater within a matter of hours. The situation usually involves use of highly mobile forces that must be supported by easily transported communications equipment. Timely communications both for reporting and control are extremely important. Voice coordination and direction of tactical operations become paramount over record communications, although both are needed. The Southeast Asian crises of 1975 illustrate the point well.

The collapse of the South Vietnamese and Cambodian governments during the spring of 1975 involved Pacific Command (PACOM) in a series of joint crisis/contingency operations. Eagle Pull, Frequent Wind, and *Mayaguez* are familiar names, at least to those of us in the PACOM. The response from United States forces was superb. The evacuation of Phnom Penh (Eagle Pull) proved to be a dress rehearsal for the rapid planning and fast response demanded in the evacuation of Vietnam (Frequent Wind) and the *Mayaguez* rescue. Analysis of these operations reconfirms many of our earlier conclusions about the importance of flexible communications in support of crisis actions and provides some new insights.

For example, one of the most important lessons is to recognize the value of satellite communications as a flexible, high-quality communication medium. This is not a new lesson, for we here in PACOM have stated our communication requirements in these terms over the years. But these crises provided real world situations wherein satellites and transportable terminals proved indispensable.

Figure 1 shows the general communications

Figure 1. Southeast Asian communications in early March 1975



backbone for Southeast Asia in early 1975. The bulk of our precrisis communications to Southeast Asia depended on the military undersea cable (Wet Wash) from San Miguel Bay, Philippines, to Nha Trang, Vietnam.* The only other entry points were in Thailand, through the military satellite terminal at Ramasun, another very important link to Nakhon Phanom, and a few leased channels** on the commercial Intelsat terminal at Si Racha. Onward connection to Vietnam was via the military undersea cable (439L) from

*This does not include limited teletype communication via the Diplomatic Telecommunications System directly to the embassy in Saigon.

**A channel refers to a signal narrow-band voice path (nominal 3 to 4 kilohertz of bandwidth). It may be used to carry several teletype or data signals instead of one voice signal.

One of the important lessons from the fighting in Southeast Asia was recognition of the value of satellite communications as a flexible, high-quality communication medium. The satellite earth terminal AN/TSC-54 (below) occupied much of the MACV compound courtyard in April 1975. . . . The satellite communications (SATCOM) complex at Clark AB, Philippines (opposite) provides long-range communications. The complex includes two MSC-46 satellite ground terminals in the large geodesic domes and a TSC-54 terminal in the smaller one.

Sattahip and multichannel radio (troposcatter or tropo)••• from Warin. Communication with Cambodia depended on a military troposcatter link from Long Binh, South Vietnam. (See Table I.)

•••Troposcatter is a transmission technique that involves bouncing signals off the troposphere. Through use of large (60-120) foot "billboard" antennas, it is good for distances up to 600 miles. It was especially useful in Vietnam, where it was not feasible to have microwave relay towers every 20 miles.

The undersea cables to Thailand and Vietnam were clearly vulnerable to enemy interdiction, as can be seen from Figure 1. Enemy capture or sabotage of the Nha Trang cable head would cut communications betwen the Philippines and Southeast Asia. A similar loss at Vung Tau would sever the cable link with Thailand. This vulnerability was a

matter of serious concern to Commander in Chief, Pacific (CINCPAC), hence the provision of satellite communications that bypassed the Republic of Vietnam. Even with our considerable investment in satellite communications, loss of Nha Trang would seriously cut communications to the Southeast Asian mainland. Further, loss of Vung Tau and cross border troposcatter sites at Monkey Mountain (Da Nang) and Pleiku would virtually isolate South Vietnam by removing access to the Thailand satellite terminals. It was not difficult to predict the effect on communications of a successful southward sweep by North Vietnamese forces.

Figure 2 portrays the actual advance and the date each major link was lost. Our primary concern around the tenth of March was to retain high-quality communications with the embassy in Saigon, the defense attaché office at Tan Son Nhut, and the embassy in Cambodia, where evacuation was already imminent. It was essential to preserve the troposcatter link between Long Binh (Saigon) and Phnom Penh until the Cambodian exit was completed. Through the dedicated efforts of U.S. Army communications personnel on the Long Binh end and at the Military Equipment Delivery Team, Cambodia (MEDTC), in Phnom Penh, this important channel remained operational until all U.S. personnel left the embassy in Cambodia on 11 April. With the loss of terrestrial links to Saigon imminent, we put a transportable satellite terminal (TSC-54) into Tan Son Nhut, and it provided effective communications support after these terrestrial links were lost.

FROM the tactical commander's point of view, the most vital communications in all three operations were his tactical radio networks—ultra high frequency (UHF), very high frequency (VHF), and high frequency single sideband (HFSSB). Radio was our only means of linking the widespread air, naval, and ground forces involved in these three operations. In the main, tactical radio

Figure 2. Southeast Asian communications events, 18 March–29 April 1975

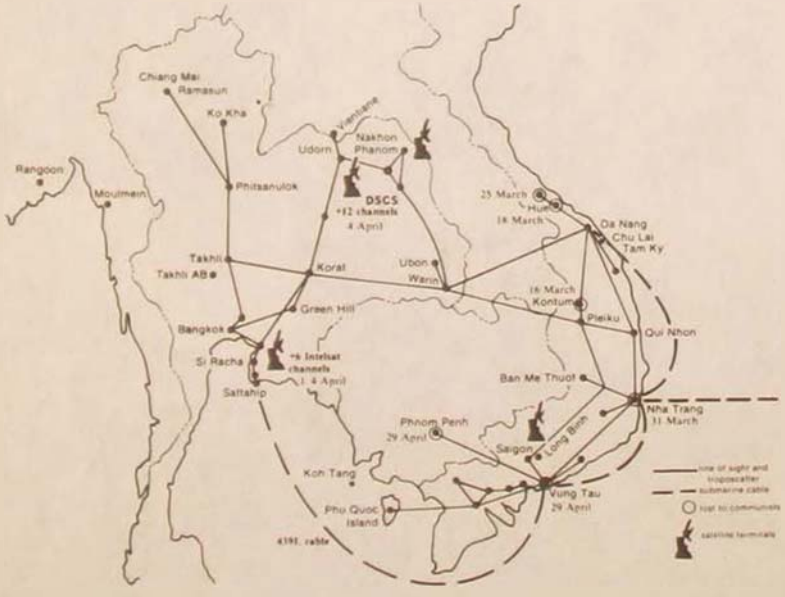


Table I.
Sequence of crisis events in Southeast Asia, 1975

13 March	Ban Me Thuot fell.
16 March	Lost Pleiku. Tropo link to Warin out. Kontum lost.
25 March	Fall of Hue.
26 March	Loss of Chu Lai and Tam Ky.
28 March	Monkey Mountain (Da Nang) fell. Lost remaining tropo link to Warin.
4 April	Added 12 Defense Satellite Communications Systems (DSCS) and 6 Intelsat channels to Thailand.
12 April	Eagle Pull (evacuation of Phnom Penh).
28-30 April	Frequent Wind (evacuation of Saigon).
12 May	Hijacking of *Mayaguez*.
13 May	*Mayaguez* anchored at Koh Tang.
15 May	Koh Tang landing. *Mayaguez* recovered.

networks functioned as expected. There are, however, important lessons for the future.

Because of its range and flexibility, high frequency single sideband was the mainstay for tactical contact among distant forces and back to their immediate headquarters. In terms of reliability and capacity, it did not measure up. Inherent high frequency propagation anomalies (fading, skip, frequency interference, etc.) lower reliability below an acceptable level for fast-moving crisis situations. The HF frequency spectrum is highly overcrowded, producing mutual-user interference. Loss of signal even for short periods of time can impede timely coordination of forces. Further, these propagation characteristics and the narrow bandwidth of the signals yield only marginal quality and capacity. This makes HFSSB unsuitable for high-level coordination and the transmission of high-speed data. Heavy reliance on HFSSB for teletype/data communications results in message backlogs during crises, especially in field tactical communications centers and on ships of the fleet. HFSSB is also strongly susceptible to hostile intercept and direction finding. The really frustrating fact here is that although the shortcomings of high frequency have been identified over many years of use in exercises and actual conflict, we are still having to rely on it for key command and control communications. With today's demands for high-speed, high-capacity communications, HF is at best a backup medium.

Further complications arise from the fact that some nets are UHF, some VHF, and others HFSSB. Of course such nets *cannot* interoperate without special interfacing equipment. Few of the tactical aircraft involved were equipped with each type of radio. The Marine landing team on Koh Tang during the *Mayaguez* recovery needed both UHF and VHF radios to contact supporting aircraft directly. The quantitative impact of such a lack of interoperability is difficult to measure; however, there is no question that it complicates tactical coordination among diverse force elements, hampers operational monitoring, and forces ground units and aircraft to cover multiple frequency bands.

VHF and UHF gave effective service. Limited to line-of-sight distances, they lack the range of HFSSB; but they compensate through better voice quality, greater bandwidth, and reliability. In Frequent Wind and *Mayaguez*, an improvised manual airborne radio relay effectively doubled UHF range, extending it to approximately 400 miles. This added range was extremely important because of the geographical spread of forces. Unfortunately, the relayed links were not secure and were severely limited in capacity, i.e., to the number of calls the pilot could relay by voice while flying the aircraft.

An old lesson learned again—it is essential to have direct communications between ground forces and supporting TACAIR. A new twist on another old lesson—the task force commander needs secure voice and data communications, not only with supporting/senior headquarters but probably extending up the unified command chain to the National Military Command Center/National Command Authority and, of course, downward to his own forces, however dispersed.

Mobility and flexibility are increasingly important characteristics for PACOM forces. For the future, our communications backbone must be as flexible as we can make it; we must avoid the rigidity that characterized communications into Vietnam. We must increase communications capacity to remote areas. In my view, this calls for more reliance on satellite communications and the provision of highly mobile/transportable terminals, switches, nodal technical control elements, and local distribution equipment.

Effective solutions to these problems call for better investment decisions, perhaps some compromises, and resource reallocations. Satellite communications offer an important

means of providing the tactical user a high-quality alternative to HFSSB. Both commercial and military satellite communications can supply flexible, high-capacity alternatives to fixed undersea cables. Some corrective programs are under way, but they deserve stronger emphasis and acceleration. We cannot continue our present policy of launching only a few satellites at widely spaced intervals. Failure of the double Defense Satellite Communications System II launch in May 1975 delayed our achieving adequate satellite capacity in orbit. Fortunately, our one double launch in 1977 was successful, but these two satellites only replaced the two orbited in 1973 and now are essentially worn out.

Both UHF and super high frequency (SHF) satellite communications are scheduled for the fleet and SHF for the mobile ground forces. SHF satellite terminals for secure voice and data are needed *now* in tactical command and control aircraft as well as in some strategic airborne platforms. Our FLTSAT/AFSAT program* will help, but it will not provide direct/flexible connectivity for joint force operations. Automatic, wideband, high-altitude airborne radio relay in tactical operations has been a recognized need for many years but continues to fall out in favor of higher priority programs. The Airborne Warning and Control System (AWACS) would have been extremely useful in these three crisis situations, especially if it had contained an onboard SHF satellite terminal with secure voice/data modems to link it to component, theater, and National Command Authorities through the Defense Satellite Communications System.

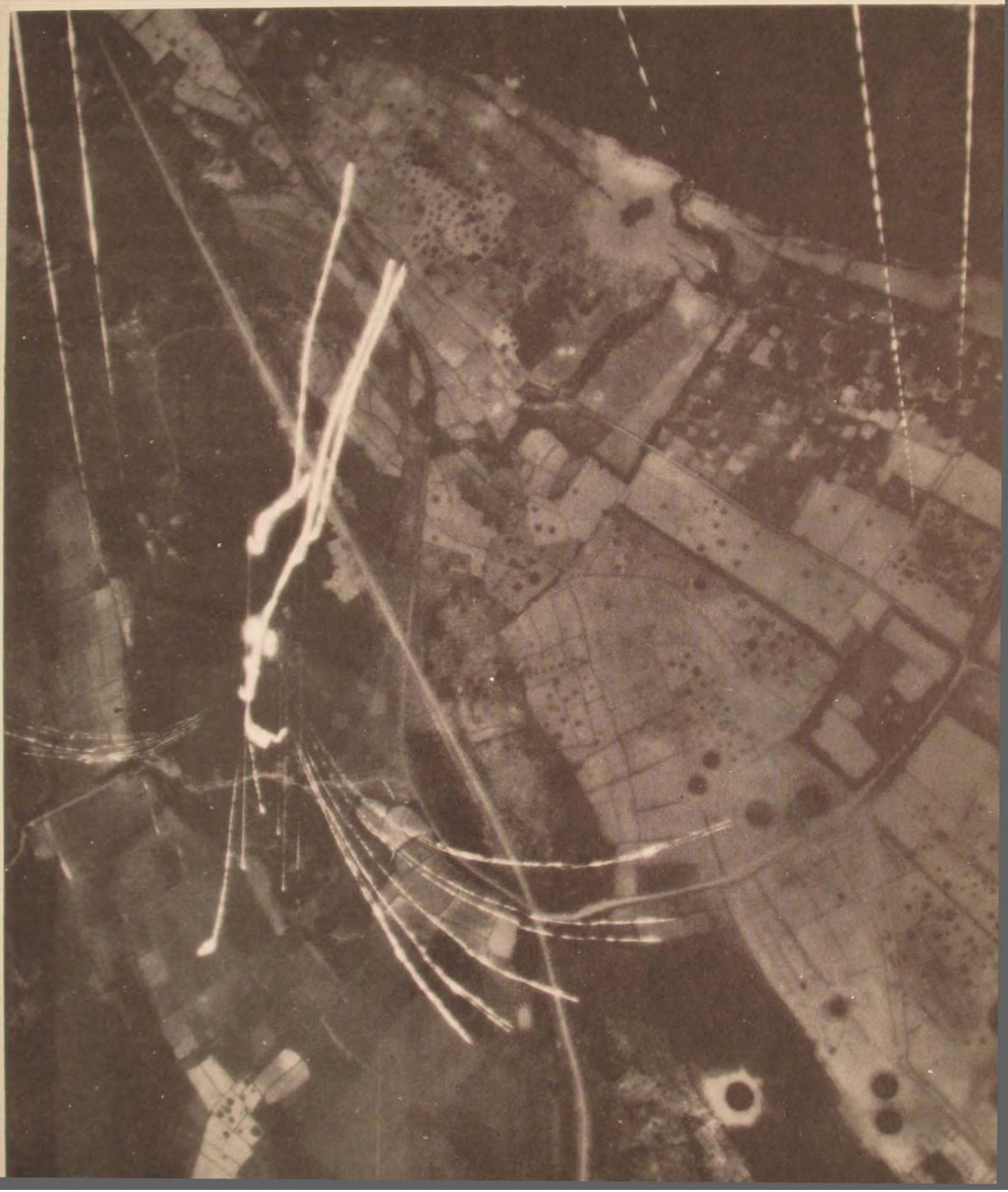
*FLTSAT/AFSAT combined formerly separate Navy and Air Force satellite programs into one program. The space vehicle provides two technically separate sections which require distinctly different earth terminal accessing equipment.

CERTAINLY there can be no question of the need for assured communications to control our strategic nuclear forces. Emphasis on these communications is appropriate, but there must be stronger emphasis on crisis communications. If we can effectively detect, report, and control the smaller crises, there is a diminished likelihood for conflict to expand to a nuclear level. To that end, we need a thoroughly integrated, satellite-based, high-capacity communications *system* with mobile/flexible terminals, secure voice/data conferencing, and flexibility to interoperate/interchange with commercial systems. (Flexibility to interoperate with commercial satellites would greatly increase redundancy and survivability.) The technology already exists. No new developments are required. Let's face the problem squarely and solve it, not study it for another ten years.

San Antonio, Texas

DEFENSE SUPPRESSION AS A BASIC OPERATIONAL MISSION

LIEUTENANT COLONEL DAVID BROG



THE AIR FORCE currently faces an unprecedented combination of problems and opportunities, the responses to which may shape its roles and structure through the end of the century. Air defense capabilities of potential enemies, as demonstrated in North Vietnam and the Middle East, pose a serious threat to air operations. At the same time, tactical air power has become increasingly necessary to counter enemy ground strength, particularly armor.[1]

The proliferation and sophistication of hostile air defense systems have caused the defense suppression problem to become increasingly complex. Past efforts to grasp the problem analytically have been for the most part fragmented and issue-oriented.[2]

The Soviet Union and the Warsaw Pact nations have tried to offset or reduce the USAF's combat power effectiveness through the use of extensive and sophisticated mobile air defenses—defenses involving mixes of guns and missiles that provide overlapping coverage. Warsaw Pact air defenses now provide a mobile umbrella that accompanies each echelon of the pact armies, including forward deployed battalions. The variety and numbers of air defense weapons accompanying a typical Warsaw Pact army of four or five divisions are impressive.

Table I shows the variety and density of a typical Soviet air defense system near the forward edge of the battle area (FEBA):[3] The weapons listed are organic to and controlled by a Soviet army group. They cover a front approximately 50 kilometers long and 100 kilometers deep.

Whenever and wherever the heavy use of air power is needed to win the air-land battle, the enemy air defenses must be suppressed, or losses of aircraft will be too high and the effectiveness of air support too low. Suppression operations may include temporary neutralization of selected facilities and short-term degradation of other installations, as well as the planned destruction of critical defensive elements. The overall aim is to reduce friendly defensive elements. The overall aim is to reduce friendly attrition to an acceptable level.[4]

Defense suppression encompasses both the destruction of defensive systems as represented by lethal weapons and the degradation of defensive systems as accomplished by nonlethal means represented by electronic warfare (EW) capabilities. EW means include the passive capabilities used for receiving signals and the countermeasures, such as chaff and active jammers, used for degrading the radars.

Defense suppression has already been identified in AFM 2-1 as an essential supportive task contributing to the

Table I. These heavy weapons do not include air defense weapons common to all troops (rapid fire AAA guns, machine guns), shoulder-fired SA-7 Grail missiles, and BRDM-2 vehicles mounting quadruple SA-9 Gaskin launchers. Electronic Warfare, *March/April 1976.*

Weapon	Type	Units (batteries)	Weapon Launchers	Maximum Vertical Range (in meters)
ZSU 23-4	AAA	32	128	2000
S-60	AAA	23	138	over 4000
SA-6	SAM	5	15	10,000
SA-4	SAM	9	27	15,000
SA-2	SAM	3	18	25,000

effectiveness of other operational missions.[5] It has also been used as a tactic against enemy ground-to-air defenses. The sole purpose of the tactic is to detect, locate, identify, and then degrade, neutralize, attack, and destroy hostile air defense systems[6] by the use of either destruction or EW means.

Until now the defense suppression role has been identified vaguely as a submission of the counterair combat operational missions.[7] Surface-to-air defensive systems are further identified as one example of offensive counterair targets.[8] However, the hostile air defense systems have proliferated, improved, and become more complex. Therefore, the nature, method of operation, tactics, and equipment necessary to perform defense suppression have become more and more peculiar to that specific mission. A new generation of weapon systems has evolved to perform defense suppression. These weapon systems are not at all related to counterair. The tactical electronic reconnaissance (TEREC) system has been developed to identify and locate the hostile air defenses. The EF-111A support jamming system has been developed to degrade or neutralize hostile early warning and acquisition radars. The EF-111A is further required to perform this mission either by standoff or escort jamming in support of the strike force. The F-4G Advanced Wild Weasel has been developed from the Southeast Asia vintage F-105F/G Wild Weasel to identify, locate, and destroy both early warning/acquisition radars and the terminal threat surface-to-air missile systems that constitute as great a threat to Air Force strike aircraft as enemy aircraft. To enable the Wild Weasel to perform its mission, a new generation of air-to-ground radar homing missiles has been developed to destroy the hostile radars. These include the AGM-45 (Shrike) family, the AGM-78 (Standard ARM) family, and the AGM-88 (HARM). These missiles are specifically designed to be integrated with the unique F-4G Wild Weasel Avionics system, the APR-38. The Precision Location Strike System (PLSS) has been developed to use time of arrival, distance measuring equipment (TOA/DME) to allow guided weapons to be targeted against radiating defensive systems.[9]

In addition to the specific manned weapon systems described, another totally different family of systems has been under development. These are the unmanned remotely piloted vehicles (RPVs), recoverable and expendable, and expendable support countermeasures such as chaff and battery-operated jammers. The RPVs can be used to degrade the air defense net by acting as decoys, thus drawing missile fire that would otherwise be used against the strike force. At the same time they can be used to seed areas with chaff and carry a variety of small jammers. RPVs could also be used to carry explosives and homing devices that would enable them to destroy hostile radars.[10]

A final important development peculiar to defense suppression has been the addition of a self-protection electronic warfare capability for each combat aircraft. This is the one development that can be used by all aircraft on all types of missions. The self-protection capability consists of radar warning receivers (RWR) and electronic countermeasures (ECM) pods to provide warning of and jamming against enemy terminal threat systems. The newest RWR and ECM pod systems, the ALR-46 and ALR-56 RWRs and the ALQ-131 ECM pods, have brought along with them a unique logistic support system that is needed to monitor and change settings and techniques through a software center located at the Warner Robins Air Logistics Center, Robins AFB, Georgia. [11]

Primary among the basic operational combat missions for tactical air forces are counterair, both offensive and defensive, close air support, interdiction, and tactical air reconnaissance. AFM 1-1 states that counterair is the mission to destroy or neutralize an enemy's offensive and defensive air capability.

Offensive counterair is conducted to seek out and destroy targets that constitute or support the enemy order of battle.* Defensive counterair counters enemy aircraft penetrating friendly airspace. Close air support is conducted in support of and in close integration with friendly surface forces. Interdiction is conducted against enemy surface forces before they can be brought to bear against friendly forces. Tactical air reconnaissance primarily provides field commanders with timely intelligence on the enemy order of battle.[12]

None of these combat operational missions stands alone. Each one requires some complementary action by another. However, defense suppression is a mission that must be accomplished prior to performing interdiction, close air support, counterair, or reconnaissance effectively. Even in an air-to-air encounter the battle is best fought after the ground-to-air threat has been neutralized. In close air support and interdiction missions flown at low altitudes, the need for defense suppression far outweighs the need to neutralize the enemy aircraft threat. The importance of defense suppression and its associated need for specialized equipment, training, and logistics—all strongly suggest that it has grown to the status of a unique basic mission essential to the accomplishment of overall objectives of the Air Force. The Soviet military is continuing to develop and deploy newer air defense systems, such as the SA-8. Additionally, there is increased interest at all U.S. governmental levels. Therefore, it is vital that defense suppression be identified sufficiently to ensure adequate emphasis, proper funding, and appropriate planning for future force structure and development.

Because of the great proliferation of the Soviet threat and the increased activity in developing countermeasures, defense suppression has become a mission requirement. Therefore, to ensure that it is fully recognized as such at all levels of the military and the government, defense suppression must be given the status of a full-fledged basic operational mission rather than remain a vague submission that it has outgrown.

AFM 1-1 should be amended to include the following defense suppression mission along with the other operational missions in paragraph 3-5:

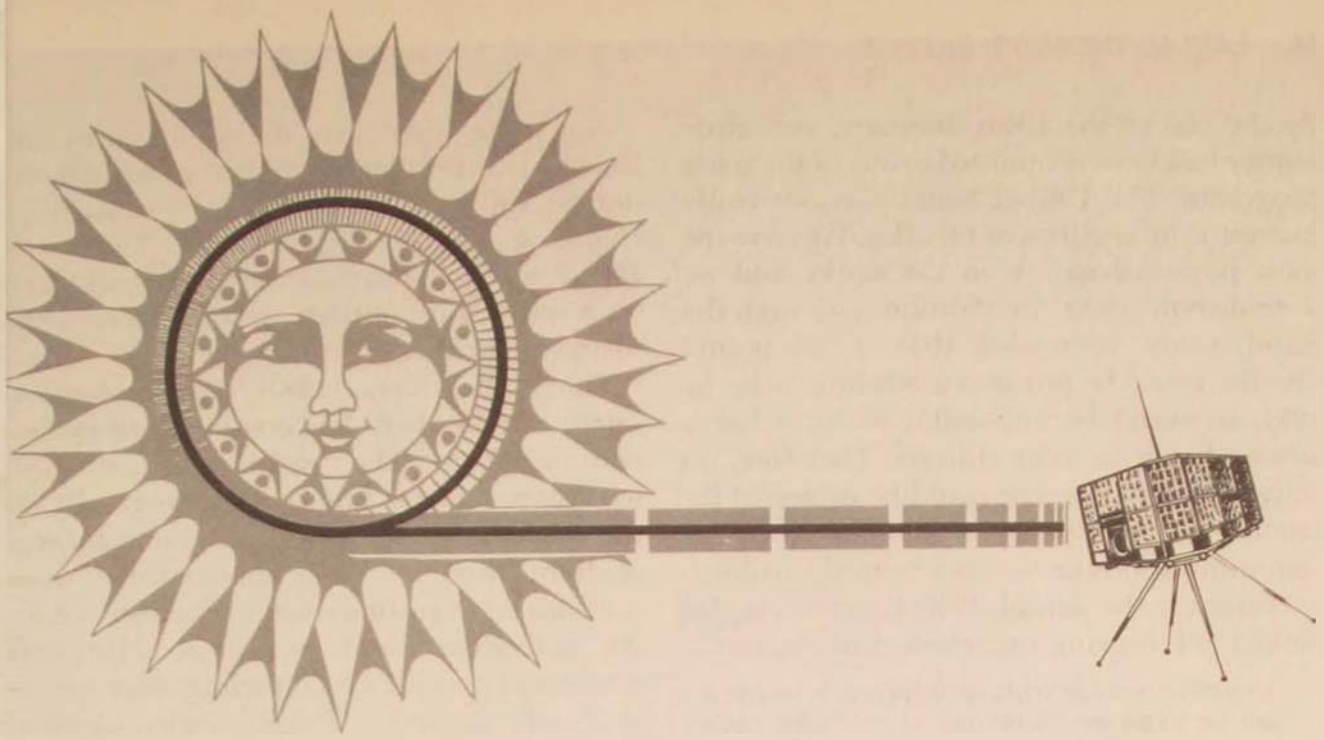
> The purpose of defense suppression is to allow friendly air forces to conduct, with minimum exposure to enemy surface-to-air defenses, those other missions required to destroy enemy aircraft, support friendly ground forces, and interdict enemy lines of communication. Defense suppression operations are conducted using both lethal and nonlethal means to destroy, degrade, or neutralize enemy surface-to-air defenses. Lethal means consist of those specific air-to-ground guided and unguided weapons, either bombs or missiles, required to locate, identify, and destroy enemy SAM sites and AAA defenses. Nonlethal means consist of those electronic warfare systems needed to locate, identify, degrade, neutralize, or avoid enemy radar, electro-optical, and infrared surface-to-air threats. When in conjunction with close air support missions, these operations will require close cooperation with friendly ground forces. The integration of ground and air defense suppression efforts will help to optimize the use of all available defense suppression forces against the enemy surface-to-air threat.

Hq USAF

*Author's note: This is the vague reference to defense suppression.

Notes

1. Donald E. Lewis et al., *An Analysis of Alternatives for Improving U.S. Air-to-Ground Capability in NATO (1980); Executive Summary (U)*, The Rand Corporation, R-1732-PR, November 1975 (Secret), p. 1.
2. United States Air Force Defense Suppression Analysis and Evaluation Steering Group, "Charter," Minutes of 21 October 1976 Meeting of same group.
3. Headquarters, Department of the Army, "Operations," FM 100-5, 1 July 1976, p. 8-3.
4. Ibid., p. 8-1.
5. United States Air Force, *Tactical Air Operations—Counter Air, Close Air Support, and Air Interdiction (Aerospace Operational Doctrine)*, AFM 2-1, 2 May 1969, para 5-2.
6. Major W. Kross, (AF XOXFT), *Defense Suppression Conceptual Framework—A Position Paper (U)*, 17 November 1976.
7. *United States Air Force Basic Doctrine (Aerospace Doctrine)*, AFM 1-1, 15 January 1975, para 3-5.
8. *USAF Operational Doctrine*, AFM 2-1, 2 May 1969, para 5-2.
9. Edgar Ulsamer, "Needed: A New Family of EW Systems," *Air Force Magazine*, February 1976, pp. 27-30.
10. "USAF Augments Drone EW Capabilities," *Aviation Week & Space Technology*, January 27, 1975, pp. 119-22.
11. Ulsamer, pp. 27-30.
12. *USAF Basic Doctrine*, para 3-5.



THE METEOROLOGICAL SATELLITE

an invaluable tool for the military decision-maker

MAJOR ERNIE R. DASH MAJOR WALTER D. MEYER

As far as I am concerned, this weather picture is probably the greatest innovation of the war. I depend on it in conjunction with the traditional forecast as a basic means of making my decisions as to whether to launch or not launch the strike. And it gives me a little bit better feel for what the actual weather conditions are. The satellite is something no commander has ever had before in a war.

SO STATED General William Momyer while Seventh Air Force Commander during a nationally televised interview on CBS in May 1967.[1] General Momyer was referring to the value of the Defense Meteorological Satellite Program (DMSP) in providing pictorial weather coverage over the data-void regions of North Vietnam, Laos, and the South China Sea. The use of meteorological satellite photography was conceived during the technology explosion of the 1940s and 1950s. During the 1940s, cloud photography was studied from high-altitude platforms such as rockets or manned and unmanned free-floating balloons.[2] Also, from 1945 to 1950, the military services were involved in several independent missile and preliminary space projects. In 1946, the Army Air Forces started specific satellite studies through Project Rand, a consultant group of scientists and technicians.[3]

By the end of the 1940s, however, very little money had been committed to any of the space programs. The United States was not really interested in satellites or missiles. We were the most powerful nation in the world, and we were demobilizing. In addition, although the Rand study contended that a 500-pound satellite could be put into a 300-mile orbit by 1951, it would be impossible to lift a heavy atomic bomb to orbit altitude. Therefore, no active military purpose could be projected for satellites: only passive missions such as communications or weather seemed feasible.[4]

However, the initial 1946 Rand study did make the following interesting observation:

> A satellite vehicle with appropriate instruments can be expected to be one of the most potent scientific tools of the Twentieth Century. The achievement of a satellite craft by the United States would influence the imagination of mankind, and would probably produce repercussions in the world comparable to the explosion of the atomic bomb. To visualize the impact on the world, one can imagine the consternation and admiration that would be felt here if the United States were to discover suddenly that some other nation had already put up a successful satellite.[5]

In 1949, the Soviets detonated their first nuclear weapon, and we immediately re-established our missile programs. Then on 4 October 1957, the Soviets launched *Sputnik I*, and it caused all the psychological and political impacts that had been predicted by the 1946 Rand study. The Soviet threat of the 1950s resulted in top priority and funding for our space efforts, including meteorological satellites.[6] By the end of the 1950s, experimental meteorological packages were actually in orbit, and the stage was set for the launch on 1 April 1960 of the first meteorological satellite, Tiros I (Television and Infrared Observation Satellite). Tiros I was a forerunner to the civilian polar-orbiting meteorological satellites that provide the APT (Automatic Picture Transmission) data to several hundred civilian (both U.S. and foreign) and military installations throughout the world.

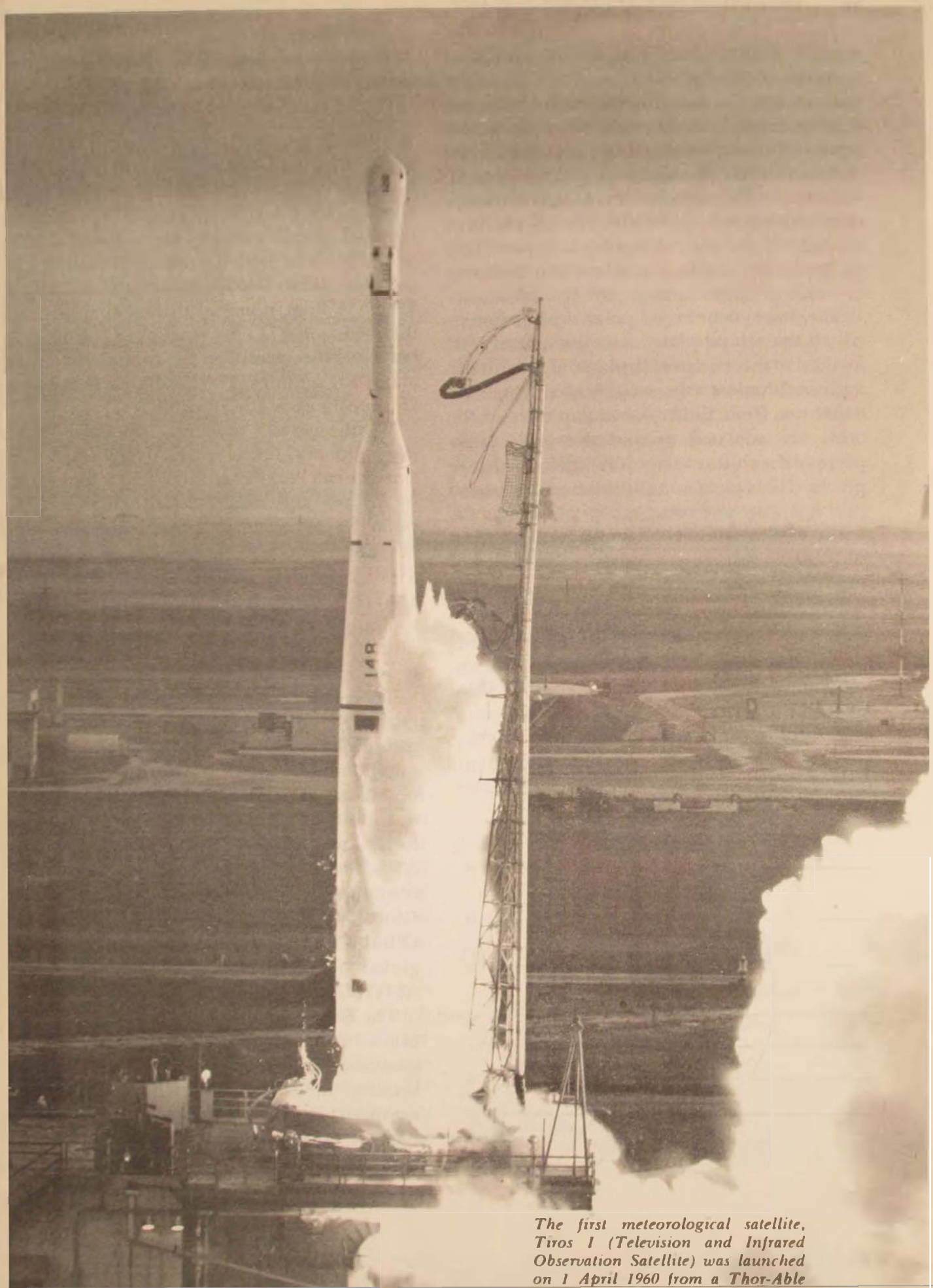
Not long after this the Department of Defense realized that the civilian system would not be sufficiently responsive to constantly changing military requirements. Thus, the DMSP was subsequently established and has been providing military commanders with meteorological satellite imagery.

Since the early 1960s, meteorological satellite technology has continued to evolve and advance. The early satellites used television cameras and took photographs of the Earth's cloud cover only during the daylight hours. The photographs were transmitted to ground receiving stations where the individual frames were assembled into mosaics to provide a total picture covering the area of interest. Today, meteorological satellites use a multitude of sophisticated sensing instruments covering a wide portion of the electromagnetic spectrum. They provide a variety of data, including images of the Earth, and operate day and night in both polar and geostationary orbits.

the principles

Of the several types of orbits that can be used by meteorological satellites, experience has shown that two specific kinds are preferred for the meteorological satellite role: the earth-synchronous, geostationary orbit and the sun-synchronous, near polar orbit.

The geostationary orbit is defined by a spacecraft flying in the equatorial plane at sufficient altitude to require 24 hours to complete one orbit. This means that the spacecraft is traveling at the rotational speed of the Earth, and, therefore, the satellite remains essentially stationary over a fixed point on the Earth's equator. The altitude required for geostationary satellites is 35,786km (19,323nm). The fixed position combined with the high altitude allows the geostationary satellite to view a large portion of the Earth on a nearly continuous basis. The current civilian system was developed by NASA and is operated by the National Environmental Satellite

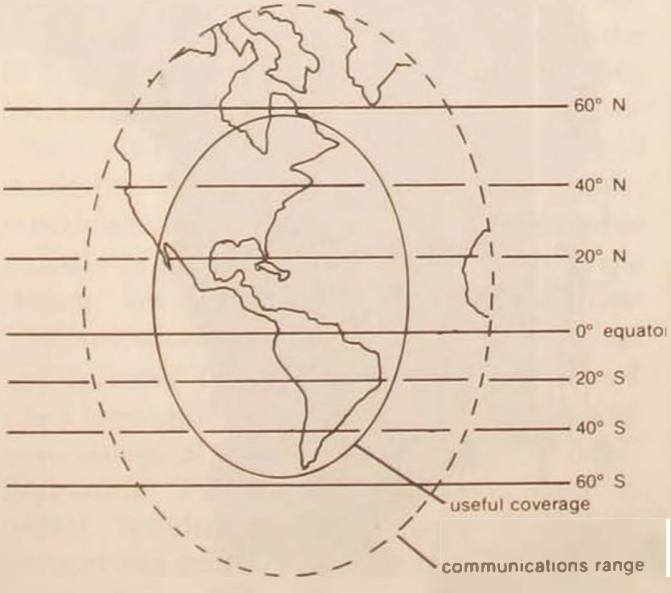


The first meteorological satellite, Tiros I (Television and Infrared Observation Satellite) was launched on 1 April 1960 from a Thor-Able

Service (NESS) of the National Oceanic and Atmospheric Administration (NOAA); it is called the Geostationary Operational Environmental Satellite (GOES). The GOES spacecraft views an area illustrated by Figure 1 routinely every 30 minutes or, when desired, subsets of that area as frequently as every minute, depending on the size of the area viewed. It should be noted, however, that geostationary satellites cannot view areas north or south of approximately 60° latitude.

The sun-synchronous polar orbit is one in which the orbital plane is inclined nearly 90° to the Earth's equatorial plane. The altitude and inclination (the angle specifying the departure from the equatorial plane) of the orbit are adjusted so that the orbit plane precesses or shifts exactly 360/365th of a degree per day. This precision shifts the orbit plane so that it makes one complete revolution as the Earth makes one revolution around the Sun and thereby maintains a constant orientation of the orbit plane to the Sun. This sun-synchronous orbit means that the satellite passes over a given latitude at the same local sun time, an important characteristic for meteorological satellites.

Figure 1. Typical geostationary satellite coverage



It is possible to select the proper altitude and inclination to match desired sensor coverage requirements so as to obtain full global data coverage. NOAA polar-orbiting meteorological satellites, for example, fly at a 1300km (890nm) nominal altitude circular orbit inclined at 102° to the equator with an orbital period of 115 minutes. The DMSP spacecraft are at an 833km (450nm) nominal altitude circular orbit inclined at 98.7° to the equator (8.7° from true polar). This results in an orbital period of about 101 minutes. The Earth rotates just over 25° during each DMSP orbit.

While aerial coverage obtained from geostationary orbit is relatively fixed (the satellite can be relocated at different longitudes by proper thrusting), aerial coverage from polar orbit is much more complex. The coverage obtainable from real-time readout of a polar-orbiting satellite at a single ground station depends on line-of-sight communication. Because of the much lower altitude, coverage is much smaller than from geostationary altitudes. (See Figure 2.)

To receive data on a global basis, polar-orbiting satellites must carry on-board recording equipment. Recorders on the DMSP satellite collect and store as much as four orbits of data. These data are subsequently transmitted to command readout stations located at Loring AFB, Maine, and Fairchild AFB, Washington, for relay via a communications satellite to the Air Force Global Weather Central (AFGWC) located at Offutt AFB, Nebraska. Through this system, global imagery data are received at the AFGWC with minimum delay.

The Soviets have flown decidedly different orbits for their meteorological satellites. The geostationary orbit is of little use to them because of their extensive area in high northern latitudes. The Soviets thus have typically flown a combination of non-sun-synchronous polar orbits and the Molniya

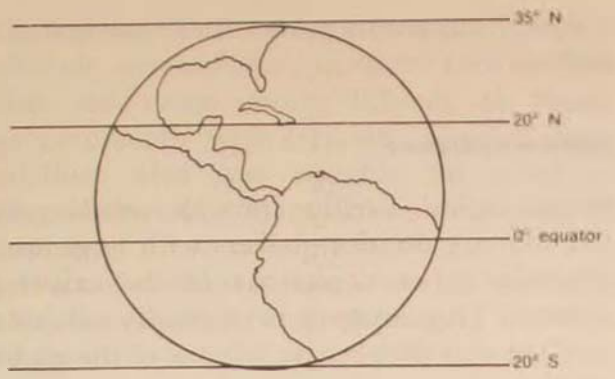


Figure 2. Typical polar-orbiting satellite coverage (direct readout at Howard AFB, Canal Zone) illustrates the rough size of the DMSP readout circle, as the aerial coverage is called. It is only within this circle that Howard could receive real-time data from a DMSP satellite.

orbit, which is highly elliptical. The latter has the advantage that when apogee is in the Northern Hemisphere the spacecraft can view most of the Soviet Union continuously for up to 12 hours.

the imaging system

The fundamental imaging system used on both geostationary and polar orbiting satellites is the scanning radiometer. Figure 3 illustrates the scanning concept for the current DMSP polar-orbiting system. The radiometer consists of a telescope-detector combination that sweeps across the Earth's surface. In polar orbiters the scanner sweeps perpendicular to the orbit plane. For geostationary orbiters the entire spacecraft rotates in one direction, and the radiometer is mechanically stepped in the other direction.

The DMSP primary imager covers a swath width of about 2960km (1600nm), which equates to about 26° at the equator. (See Figure 3.) Therefore, the DMSP satellite will image every point on the Earth at least twice each 24-hour day, once ascending (traversing from south to north) and once descending (traversing from north to south).

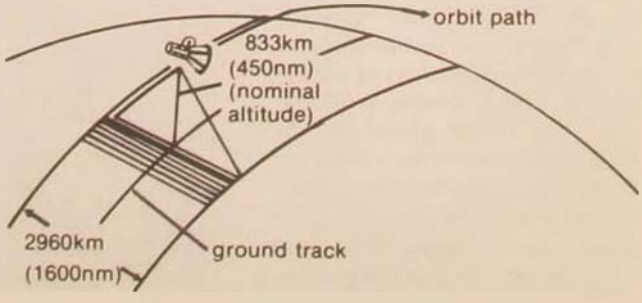
The Block 5C DMSP imager senses in the visible (0.4–1.1μm) as well as in the window region (8–13μm) of the infrared portion of the electromagnetic spectrum and obtains images at two different surface resolutions, 0.6km (one-third nm) and 3.7km (2nm). Some improvement in resolution is being achieved with the Block 5D satellite now in operation.

The resolution of the imagery defines the smallest detectable element that can be displayed in the data directly below the satellite. Because of the geometry of the Block 5C scanning radiometer systems, the resolution of the imagery degrades by a factor of about six from the center toward the edges. The resolution of the DMSP VHR and WHR data, for example, degrades from one-third NM at picture center to about two NM at the edges.[7] The resolution of the data from the Block 5D satellite is more constant, resulting in a degradation of less than two to one.

additional sensing capabilities

In addition to the imaging systems, most meteorological satellites carry a complement of instruments that measure a number of atmospheric, exoatmospheric, and solar parameters. One of the most important of these instruments is the infrared profiling radiometer, which measures upwelling energy

Figure 3. DMSP scanning radiometer concept



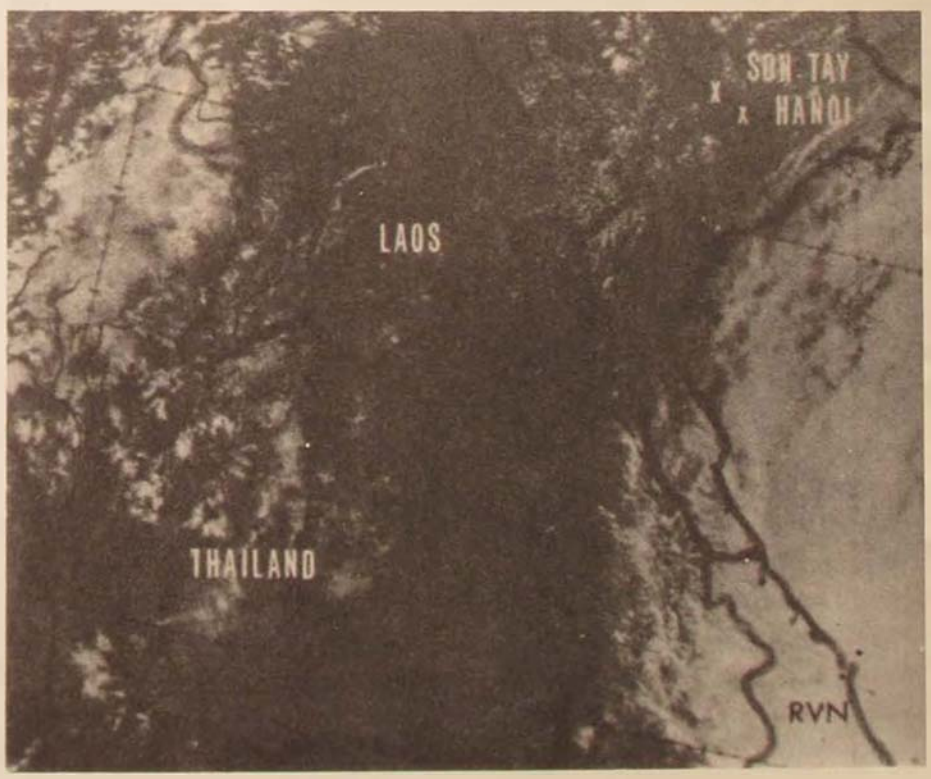
from narrow spectral intervals in a region of strong atmospheric absorption. The energy data are then inverted to temperature or absorber concentration. By careful selection of the proper spectral intervals, a mean vertical profile of temperature and water vapor concentration (humidity) can be obtained. This information is input into global numerical weather analysis models. Both NOAA and DMSP polar orbiters have carried a vertical temperature profile radiometer since 1972, and the retrieved temperature information is used operationally to prepare forecasts at the AFGWC.

Instruments that measure upper atmospheric, exoatmospheric, or solar parameters are still in their infancy. They cover the electromagnetic spectrum, ranging from measurements of cosmic and x rays to the monitoring of high frequency radio waves to determine the critical frequency for over-the-horizon communication and navigation systems.

decision assistance

Meteorological satellites provide weathermen and military decision-makers with large area observations or depictions of the existing weather. This imagery is especially valuable over the vast data-sparse regions of the globe and is indispensable over unfriendly, data-denied areas during times of conflict.

Geostationary satellites provide wide area coverage that is almost continuously available on demand. This can be a significant advantage, for example, for battlefield support. However, the resolution and usefulness of the data degrades north-south from the equator as well as east-west from the longitude of the satellite subpoint; useful coverage does not extend much beyond 55°

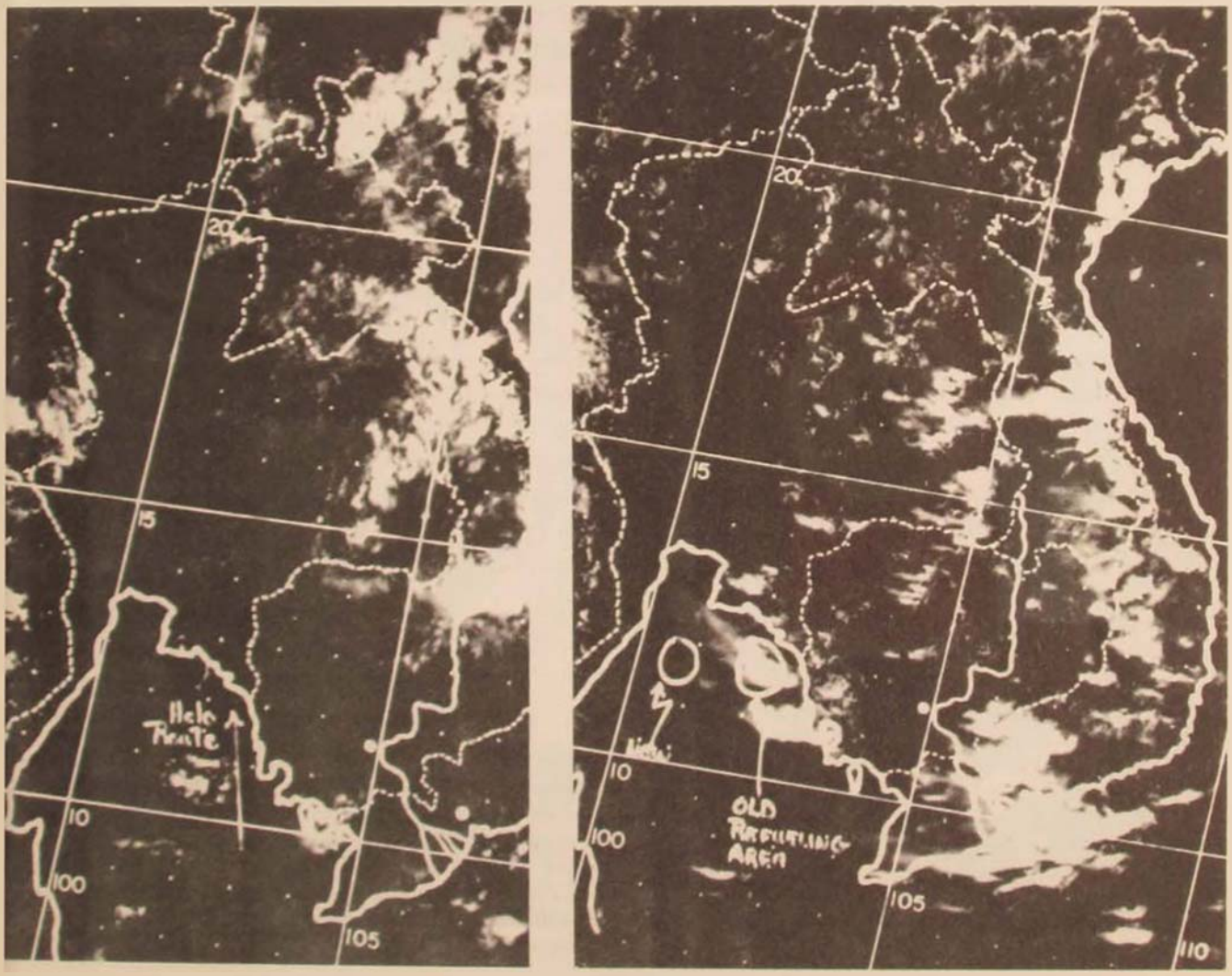


The Defense Meteorological Satellite Program (DMSP) provided invaluable weather support in Southeast Asia. The Son Tay raid was scheduled to coincide with a break in the weather between two tropical storms that moved across the South China Sea and into the mainland. The remains of the first storm can be seen (right) in northeast Thailand while the second storm, Patsy, is off the coast of South Vietnam near Da Nang. . . . The more recent DMSP photos (opposite) augmented available weather data for the recovery of the crew of the Mayaguez. *The poor weather conditions in the initial location are clearly evident (left) as are the original and relocated refueling areas. The DMSP photo used to support the recovering operation (right) shows that weather along the Cambodian coast improved, enabling some damaged helicopters to recover on the Thai mainland.*

north or south. Because of their much higher altitude, geostationary satellites provide data that are much more difficult to locate geographically with certainty. Geostationary satellites also cost roughly an order of magnitude more than corresponding polar orbiters.

Since the military needs worldwide high-resolution satellite weather imagery that can be precisely gridded, the DMSP system has relied on sun-synchronous polar-orbiting satellites. Two satellites are routinely kept in operational orbits to provide coverage four times per day over all areas of the globe. One satellite is in an early morning/evening orbit, and the other is in a near noon/midnight orbit.

The DMSP system has designed the ground-processing and display equipment to be responsive to military needs. The display equipment produces a high-quality positive film transparency that is available within five minutes after receipt of the last line of data from the satellite. The display system also has many enhancement and processing options. For example, the brightness of the visible imagery can be enhanced to accentuate the



clouds, or the ground, or water; infrared imagery is presented as Kelvin temperature, and selected temperature levels can be displayed separately. The foreshortening of the imagery at the edges caused by the Earth's curvature is reduced in the display system by using a sinusoidal sweep rate on each scan line. While this produces an equal-area rectified image, it does not compensate for the loss of resolution at the edges.[8]

The DMSP direct readout equipment has been installed in trailers that are transportable by C-5 aircraft. With this equipment, known as Transportable Terminal Systems (TTS), direct readout of DMSP imagery can be made available to military commanders anywhere on the globe within a matter of hours after arrival on site.

As mentioned previously, the AFGWC receives the stored global imagery and other data from the DMSP satellites. These data are reproduced on positive transparency film for immediate use. Simultaneously, the data are input into electronic data processing equipment and used in developing the many AFGWC computer-assisted analyses and forecasts. Examples of the support that is enhanced by these computer-processed meteorological satellite data include detailed cloud information for computerized flight plans, cloud cover forecasts for aerial refueling operations, point analysis information for the environmental impact determination for new weapon system testing, and a comprehensive cloud climatological data base for the development of algorithms for computing probabilities of cloud-free line-of-sight (CFLOS) for electro-optical guidance systems.

the future

The role of the meteorological satellite and the DMSP program will continue to grow. In 1976, the first of the newest generation of DMSP satellites, referred to as Block 5D, was launched. These satellites are designed for longer on-orbit operational lifetime, improved gridding and data location accuracies through improved satellite positioning techniques, and increased data resolution by making the resolution of the imagery nearly constant across the photograph. The constant resolution is accomplished by varying the detector size and orientation (smallest at data edge, largest at data center) while scanning at a sinusoidal rate (slowest at data edge, fastest at data center). In addition, a feasibility model of a smaller direct readout system has been tested. The smaller Transportable Terminal Systems will be transportable by C-130 or C-141 aircraft and suited for tactical bare base deployments.

Military and civilian scientists are also testing and evaluating new satellite-borne sensors that promise to overcome some of the limitations of today's systems. Microwave sensing instruments, depending on frequency, are not sensitive to higher, drier cloud formations; they can (in a sense) see through many cloud types and depict the areas of concentration of rainfall or clouds with larger

Composite photograph of the four types of imagery data. The two top photographs are 3.7km resolution visual (HR) and 0-6km resolution visual (VHR). The two bottom photographs are 3.7km resolution infrared (IR) and 0.6km resolution infrared (WHR). The visual HR imagery was taken at night (near midnight) with the aid of reflected moonlight about three days before a full moon. This visual channel is highly sensitive and can provide useful cloud cover information with as little as one-half moon conditions. The image also shows city lights in the eastern half of the United States.


HR


VHR


IR


WHR

water droplets. Microwave sounders and imagers have been flown on NASA experimental satellites, and a sounder will be flown on future DMSP and NOAA satellites.

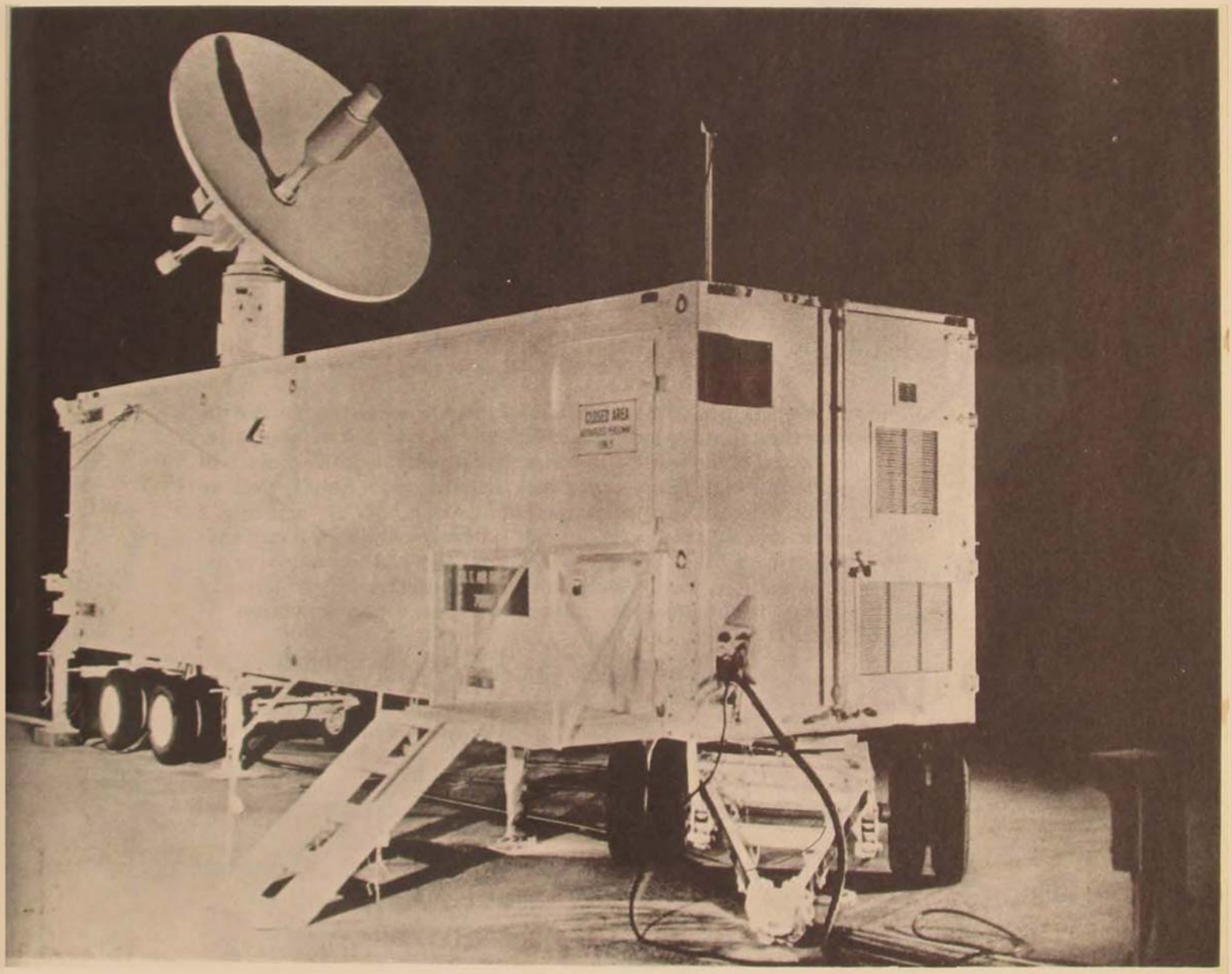
The Space and Missile Systems Organization of Air Force Systems Command is sponsoring a mission analysis and follow-on studies that include analyses of meteorological satellite support to strategic and tactical forces. These studies will review such topics as the adaptation of geostationary satellite systems to meet military needs as well as the development

The Geostationary Operational Environmental Satellite (GOES) provides wide-area coverage, as evident here, but useful coverage is limited to 55° north and south.

of computer forecasting models based entirely on data inputs from satellite-borne sensors.

In addition, the World Meteorological Organization is conducting Global Atmospheric Research Projects (GARP) in an attempt to improve man's understanding of the basic atmospheric circulation patterns and associated weather phenomena. The First GARP Global Experiment (FGGE) will be conducted during 1978. Nations around the world will join in taking detailed simultaneous observations of the Earth's

The Transportable Terminal Systems (TTS) are trailers that accommodate the DMSP direct readout equipment. These trailers can be transported by C-5 aircraft.



atmosphere in the mid-latitudes and the tropics. Geostationary meteorological satellites are scheduled to be placed around the globe to ensure total coverage of the Earth's surface between 60°N and 60°S. FGGE should provide some new insights to observing and forecasting techniques using geostationary platforms.

MUCH HAS BEEN accomplished since the launch of Tiros I in 1960, yet military meteorologists and space engineers are continually working to improve the weather support provided to the military decision-maker. Satellite meteorology, as supported by the Defense Meteorological Satellite Program, is an invaluable aid. In unveiling some of the DMSP photos before a Pentagon press conference in March 1973, Dr. John L. McLucas (then Secretary of the Air Force) said that DMSP "furnishes the best data possible to decision-makers anywhere in the world whose operations are affected by weather."

Air Weather Service

Notes

1. John F. Fuller, *Weather and War*, Scott AFB, Illinois: Military Airlift Command, December 1974, p. 16.
2. Charles W. Dickens and MSgt Charles A. Raverstein, edited by John F. Fuller, *Air Weather Service and Meteorological Satellites 1950–1960*, Air Weather Service Historical Study No. 5, Scott AFB, Illinois: Military Airlift Command, December 1973, p. 1.
3. Eugene M. Emme, *The History of Rocket Technology* (Detroit: Wayne State University Press, 1964), pp. 46–47.
4. Ibid., p. 75.
5. Ibid., p. 74.
6. Ibid., pp. 108–9.
7. James R. Blackenship and Richard C. Savage, "Electro-Optical Processing of DAPP Meteorological Satellite Data," *American Meteorological Society Bulletin*, January 1974, p. 9.
8. Ibid., p. 5.

. . . the United States still maintains its technological edge. But the important thing to look at is not a static picture, but trends relative to the rest of the world. . . . Certainly, the world is gaining much of our technology. Many nations are investing more heavily than we are in terms of their gross national product. We are realizing, I think, that we are in a very urgent and real technological race with the rest of the world, in terms of general economic trade considerations, our economic security, and certainly in terms of military research and development vis-à-vis the Soviet Union.

DR. MALCOLM R. CURRIE
Director of Defense Research and Engineering
Countermeasures, December 1976

military affairs abroad

THE UNITED STATES ON DIEGO GARCIA

a question of limits

RYAN J. BARILLEAUX

IN *Through the Looking Glass*, Lewis Carroll describes the country of the Red Queen, where one has to run as fast as possible to stay in the same place. This situation is similar to the one faced by modern American foreign policy. Because it is a superpower, the harder the United States works at protecting its interests the more it seems that there can be no advancement of those interests. Many nations, especially those in the third world, automatically respond to American actions with charges of imperialism. Furthermore, military moves by the United States can touch off reciprocal moves by the Soviet Union. At home, too, government policy is the subject of pressure to minimize defense expenditures. Liberals regard increases in the military as something of an overkill. While the accuracy of such a charge is debatable, the idea of overkill raises an important issue in American foreign policy: the problem of setting limits on the size and scope of military operations that will provide maximum benefits without generating new security threats.

This concept of limits is especially applicable to the American presence in the Indian Ocean, specifically concerning United States policy toward the island of Diego Garcia. That island, the home of an American communication facility, lies in the approximate center of the Indian Ocean, no closer than about 2500 miles to any major land mass. This centrality, as well as the fact that it is isolated from the sensitive littoral states,[1] accords it great value to strategists. Effective use of this position thus depends on the nature of the facilities installed there. The transformation of the communication facility into a naval support base, therefore, focuses the question of limits on what the status of the installation on Diego Garcia should be.

Distance of Diego Garcia from other countries

Country	Approximate distance (miles)
Australia	3000
India	1000
Mauritius	1200
Somalia	1800
Yemen	2400

The purpose of this article is to show how a policy of nonexpansion beyond present construction projects on Diego Garcia would best promote peace. This objective will be accomplished by examining major aspects of the problem: development of the American presence on Diego Garcia and in the Indian Ocean in recent years, the nature of the controversy surrounding the facility there, the failure of alternate proposals to achieve a solution, and the way in which a nonexpansion policy will work to promote peace.

Development of the United States Presence

The problem of Diego Garcia has been developing for more than a decade, and a multitude of events has contributed to today's complex situation. To appreciate the significance of Diego Garcia thus requires an understanding of those past events, beginning with the change in the British government in the early 1960s.

Soon after taking power in 1964, Britain's new Labour government found itself heir to defenses that were overextended and underequipped. Seeking to minimize foreign defense commitments, the British leaders decided to withdraw forces from areas east of Suez within seven years. However, in 1966 the United States and Great Britain decided that their mutual security interests would be best served if they maintained an installation in the Indian Ocean.

In order to obtain such a facility, Britain formed the British Indian Ocean Territory (BIOT) from the Chagos Archipelago.[2] As an incentive to British participation, the United States agreed to lower the cost of a group of Polaris submarines that it was selling to Britain by $14 million.[3] The agreement,

however, was kept as quiet as possible, so as to secure purchase of the islands from Mauritius, which at this time was gaining its independence and feared a foreign military establishment in the area, even though it would be some 1200 miles away. Despite assurances to the contrary, the purpose of the BIOT was to serve as the home of such an installation; and soon after its purchase, the island of Diego Garcia was quietly leased to the United States.[4]

At that time, the British withdrawal "East of Suez" was viewed in the West as a disastrous move, for it was felt that the cutback would create a power vacuum. This view was predicated on the assumption that littoral states would be unable to defend themselves.

The Western notion of a power vacuum was not echoed elsewhere. Indian Ocean area nations claimed that this concept would undermine their independence and development by inviting Big Power intervention and negating third world nonalignment. Joining the littoral states in denouncing the West was the Soviet Union, charging that the power-vacuum concept was imperialistic.[5]

Despite the rhetoric, the Soviet Union was the first major power to increase naval activities in the area. In 1968, a small naval force, including missile-bearing warships, entered the Indian Ocean. In 1969, the Pacific and Black Sea fleets of the Soviet Navy held joint maneuvers in those waters. Later in the same year, the Soviets began maintaining a permanent surface vessel presence in the area.

As for the United States, its actions at this time were largely confined to the Navy's bid for a base on Diego Garcia, designed to counter the growing Soviet presence. Failing in its attempt, the Navy was left with only the Mideast force at Bahrain, a symbolic patrol unit of outdated ships that had been there since 1948.[6] The Navy tried again with a different plan in 1970 and received approval for an austere communication facility on Diego Garcia. This base was to provide support for the increased activity that naval authorities had convinced Congress would be necessary in the near future. That naval escalation was not begun until 1971, when decreasing activities in Vietnam offered the opportunity to send modern ships into the Indian Ocean.

The need for such escalation was soon evident. The India-Pakistan and Yom Kippur wars had brought a larger Soviet force into the area, as well as the greater American presence. United States national security analysts perceived the Soviet build-up as a threat to American interests. This threat was especially significant in terms of the military and diplomatic pressure that the Soviet Union would be able to employ in its dealings with littoral states.[7] Moreover, the 1973 oil crisis demonstrated the vulnerability of the sea-lanes and how easily oil shipments might be blocked in some future war. The United States thus drastically increased its naval forces in the Indian Ocean.[8] The American policy was justified in terms of the Nixon Doctrine, which called for a reduced United States presence around the world. State Department officials contended that such escalation would aid American allies in the area by providing a stabilizing influence, apparently to pre-empt the need for a major United States action if the situation were to become more precarious in the future.[9] American presence was also expected to ensure that the lanes of oil traffic, running from the Persian Gulf through the Indian Ocean and on to Europe, Japan, and America, would not be blocked.[10] Nevertheless, the United States failed to keep pace with the advance of Soviet activity, which always managed to have more ships in the region. Because of the superiority of some American ships, it is impossible to determine objectively if either side held a clear advantage.[11] The Soviets, however, did not merely escalate their naval presence. Anchorages and installations were actively sought and gained. The most significant of these were on the island of Socotra, at the entrance to the Red Sea; in Yemen; in Mauritius;[12] and most important, in

Berbera, Somalia, which was later discovered to be a substantial missile-handling facility.[13]

In addition to increasing its presence in the Indian Ocean, the Soviet Union also looked forward to the reopening of the Suez Canal, which would shorten by about 8000 miles the distance that Soviet ships would have to travel.

The United States at this time was not inactive in the Indian Ocean area. In addition to stepping up naval activities, it, too, sought bases in the region. The long-standing base at Bahrain was under pressure from the local government to close. Yet because of improved relations with Iran and Saudi Arabia, possibilities of building establishments there were increased. The United States Navy wanted a dependable, permanent base in the Indian Ocean. The logical Navy choice was Diego Garcia. Without such a base, the nearest fuel facilities would have to be in distant Australia or the Philippines. These seemed remote or inefficient possibilities. Thus, in 1974, a request was sent to Congress for the money to expand the communication facility into a logistics support base. With this request, the present controversy about Diego Garcia began.

Nature and Roots of Present Controversy

By the time of the 1974 Hearings before the House Subcommittee on the Far East and South Asia, the question of desirable limits on military deployment had produced two major schools of thought: the expansionists and the minimalists. Expansionists feared the growing Soviet presence and the instabilities of the Indian Ocean region. They sought to remedy this problem by establishing a real and permanent facility that would strengthen the American presence in the Indian Ocean, to be accomplished by a major naval commitment there. Minimalists feared that such actions would cause a superpower arms race in the region and sought to halt or minimize American activity in the area.

These two attitudes were rather pronounced in the Subcommittee Hearings, which in themselves were quite significant. Recommendation or disapproval of the proposed Diego Garcia expansion by the Foreign Affairs Committee would have a major impact on American foreign policy. The hearings would effectively determine the nature of American activities in the Indian Ocean, and Diego Garcia was to be the test-case. The veracity of this statement is better appreciated after examining the island's strategic significance, the expansion plans, and the nature of the present controversy.

As previously noted, Diego Garcia's isolated central position in the Indian Ocean makes it very valuable to strategists in that the nature of the facilities there would determine how effectively such a position would be used. Until the summer of 1976, Diego Garcia held only a communication facility. In July construction began which will transform the island into a logistics support base, intended to service a carrier task force and relieve the strain of having to depend entirely on facilities in Australia or the Philippines. This installation would have a twenty-eight-day fuel storage capacity, a harbor capable of admitting fleet warships, and a 12,000-foot runway. This is not the original base that the Navy had wanted, however, although it is close to it.[14] The Navy had desired a base in the Indian Ocean since 1959, when it saw that those waters would probably be an area of future American deployment.[15] Eventually, the plans were developed to a point that required a permanent naval and air support facility capable of troop-staging and extensive aircraft trafficking.

Unable to achieve this goal immediately, the Navy then decided to approach it in stages: the first stage was the communication facility; the projects now under way constitute the second; and the third stage would be further expansion to achieve a permanent, multipurpose base.[16] It was this final step that most disturbed minimalists, who feared that it would

stimulate an arms race in the Indian Ocean. Although the Navy denies that what it actually wants is the maximum facility, the evidence indicates that this argument is only rhetoric used to quiet minimalist forces.

The minimalists met head-on with expansionists in the 1974 Hearings and again in Congress in 1975. The views expressed by both sides also reflect the worldwide controversy about the question as well as the American debate.

Illustrations of this debate can be found repeatedly in those hearings. The expansionists argued that upgrading the facilities on Diego Garcia was crucial to the entire spectrum of United States' interests in the region. Essentially, the argument was that the status of the base directly influenced naval effectiveness and that the security of American interests was dependent on that effectiveness. The Defense Department stated that the United States had three major concerns in the area: (1) maintaining dialogue with Arab states; (2) protecting the sea-lanes, especially oil routes; and (3) countering the Soviet presence. All three were considered justifications for strong United States forces in the ocean, especially the latter two.

Because of the "delicately balanced system"[17] of oil production and distribution, American military presence was necessary to provide a deterrent against disruption of oil supplies vital to national defense. The Defense Department witness, James H. Noyes, Deputy Assistant Secretary for International Security Affairs, explained that the 1973 oil crisis had demonstrated that threats or coercion on the part of a major or even minor power could check the flow of oil to the United States and its allies. The essential value of Diego Garcia thus lay in the idea that it allowed a stabilizing American presence to be maintained "efficiently and economically." The central location of the island would provide better defense of the sea-lanes than any of the more remote support bases, by enhancing the effectiveness of American naval deployment in the area. The American deployment, then, was the key to advancing United States security interests in the Indian Ocean.[18]

That "stabilizing influence" that the Navy was to provide was a maintenance of conditions favorable to trade.[19] The Soviet presence was seen as counter to this goal. Noyes pointed out that the Soviet Union then had 29 ships in the Indian Ocean, of which approximately one-half were combatants. He further stated that this presence was a potential threat to United States interests.[20]

Herein lies a crucial issue in the understanding of the expansionists' beliefs, i.e., the perception of a Soviet threat. It is important to note that, in the hearings, the expansionists attempted to minimize their obvious concern over Soviet activity in the area. They apparently wanted to justify Diego Garcia in terms of interests that can be perceived as other than military competition between the superpowers and thus negate the fears of the critics of expansion that a war might be the result of such competition. A State Department witness, Seymour Weiss, Director of the Bureau of Politico-Military Affairs, echoed Noyes in the statement that "there is a potential threat when there is a Soviet force which is substantially in excess of our own."[21] Further questioning of Weiss revealed that instability in the region was regarded as counter to American interests, a point important to understanding why expansionists want a larger United States presence: they fear Soviet control.

This attitude is reflected on a world scale by nations such as Iran and China, who see United States activity as an aid in protecting their interests.[22] Britain, Singapore, and Pakistan also favor American response to the Soviet Union.[23] Japan and Western Europe are concerned about oil shipments. Even Australia and France have sent ships in hopes of aiding the United States in striking a balance. The main idea, however, is that American presence will prevent Soviet domination of the region.

It is this reasoning that minimalists attack. They view it as merely power-balance politics. Furthermore, they are afraid that the result of this competition will be either superpower domination of the area or an Indian Ocean war. This opinion was reflected in the testimony of Dr. Earl Ravenal, Professorial Lecturer at the School for Advanced International Studies, Johns Hopkins University, a leading advocate of the minimalist position.

Dr. Ravenal insisted that the United States could no longer be the "policeman of the world" and that the decision concerning Diego Garcia would also concern the question of whether the United States was going to continue to engage in power politics abroad.[24] The statements of Dr. Ravenal were reinforced by those of Rear Admiral Gene LaRocque (Retired), Director of the Center for Defense Information, who declared that the United States Navy was trying to start an arms race in the Indian Ocean by exaggerating Soviet strengths and American weaknesses.[25]

In this declaration, the minimalist view becomes apparent, i.e., that the military is misleading Congress (and everyone else) as to the actual importance of Soviet presence. In doing so, the minimalists fall victim to their own perceptions. In attempting to detract from the formidability of the Soviet naval forces in the Indian Ocean, the minimalists tend to ignore it almost completely. Instead, they place extreme emphasis on United States activities and how these are dangerous to peace.

India, one of the main opponents of American presence in the region, is representative of this attitude. It has been stated by the Indian Ministry of Defense that it has regarded superpowers in the region as a security threat since 1972. Furthermore, American presence has been viewed as an "adverse factor."[26] The base at Diego Garcia is expected to increase the threat, rising out of the fear of intervention.[27]

That fear, however, is not limited to littoral states. It is also apparent in Congress, where many members fear another war like Vietnam. Even stronger is the fear of instigating a major arms race in the Indian Ocean. In 1975, the majority leader, Senator Mike Mansfield (D-Montana) led a move to block the expansion of Diego Garcia on the grounds that it would start such competition. This move revived the arguments that had been used in the hearings, but with an addition.

While the minimalists once again spoke of leading the way to peace, the usual expansionist response was supplemented by the proof that the Soviet base at Somalia was indeed a missile-handling facility.[28] This new "threat" effectively killed opposition to expansion at the time. Nevertheless, a short time later the minimalists sought a delay so as to allow arms-limitation talks with the Soviet Union. This time they succeeded, and construction was postponed until July 1976.[29]

That time has passed, and expansion is now under way. This decision would seem to settle the affair, but it does not. Instead, the question of limits becomes more exacting, demanding a better grasp of reality, not merely rhetoric.

The Failure of Alternate Proposals

In the light of a decision by Congress concerning Diego Garcia that does not settle the issue, one would do well to consider what courses of action are available. Apart from nonexpansion on Diego Garcia, which will be discussed later, there are two major possibilities: the "zone of peace" concept and bilateral arms-limitation talks.

The arms-limitation talks idea has been the subject of much debate in recent years, as both the United States and the Soviet Union claim to desire such meetings but seem to actively avoid them. Despite governmental inaction, the debate over the merits of this proposal goes on. Its supporters argue that such an agreement would eliminate the need for a base on Diego Garcia. Critics claim that the talks will not be honored. Whether either argument

is right is unknown, as both the Soviet Union and the United States have taken steps to avoid such discussions.

On the Soviet side, those steps are part of Brezhnev's "Peace Program," which is responsible for establishing a permanent presence in the Indian Ocean. An important aspect of the program, renewed last year by the Party Congress, is to advance the superpower status of the Soviet Union through an undermining of United States policies abroad.[30] Thus, the Soviets are uninterested in arms-limitation in the Indian Ocean.

On the American side, actions taken to delay talks range from charging a lack of Soviet interest to claims that the United States needs a position of strength before it can begin bargaining, i.e., an Indian Ocean base. Even in the delay period established by Congress for promoting talks, no action was taken.[31]

While neither country makes a move to start any discussion, both blame each other for the delay. Even without the rhetoric, however, each party's working policy has shown that neither wants arms talks nor considers them in its interests.

Also, both sides refuse to come to terms with the concept of a "zone of peace" in the Indian Ocean. While this idea is favored by the littoral states as the best road to peace and development, the superpowers view it as an infringement on the concept of an "open" sea. The United States and the Soviet Union do not wish to have their extensive naval activities in the region limited.[32]

It becomes apparent that both the United States and the Soviet Union are unwilling to engage in situations that would depend on bilateral or multilateral agreements and thus regulate their respective defense policies in the area. The renewal of Brezhnev's Peace Program and reports from inside the Department of State attest to this idea. Thus, the alternatives die before they have a chance to work, as a result of the Big Power foreign policies.

Those policies make the question of limits paramount, since the United States must then achieve the goal of security on its own.

The Wisdom of Nonexpansion

In order to establish a desirable limit to United States policy regarding Diego Garcia, it is necessary to eliminate the vast amount of rhetoric and determine the true state of affairs. Effectively, this imperative requires a judgment of whether Soviet presence is a threat to the United States. If there is such a threat, then the issue becomes one of how much presence is enough. Is Diego Garcia crucial to this presence?

There is little doubt in the West that the Soviets are in the Indian Ocean to stay. Their objectives in the area are threefold: (1) to establish a shipping outlet to the south, a goal which has been of Russian concern for centuries;[33] (2) to solidify the image of the Soviet Union as a superpower by undermining Western power and influence, especially by jeopardizing oil shipments vital to the West;[34] and (3) to inhibit Chinese actions and influence in the area.[35]

Despite minimalist arguments, these objectives are perceived as a threat to American interests. The threat is real rather than imagined because of the Soviet naval presence in the Indian Ocean. That presence might be used to block oil traffic. Furthermore, the forced withdrawal of the Mideast force from Bahrain leaves the United States without a permanent establishment in the area. Thus, Diego Garcia assumes a physical value in terms of American response to the Soviet presence. The threat is enhanced, however, by the perception of such a threat by American leaders. The problem for the United States is the establishing of a necessary limit to its response to the Soviet build-up. (As noted above, Diego Garcia is also accorded a symbolic significance.) Therefore, policy concerning the status of the base there is

crucial to both physical and perceived aspects of United States security.

That policy should be one of nonexpansion. While the Soviet presence is real,[36] overreaction by the United States would only expand it. The Soviet naval forces in the Indian Ocean, already numerically superior to American forces, have managed to stay ahead of any increases by the United States. Much of this expansion has been from motives that are purely Soviet initiatives. Some, however, were triggered by American expansion. One example of such increases came in 1971, when Soviet and American naval forces in the Indian Ocean were enlarged because of the India-Pakistan war. The additional Soviet ships did not withdraw until the *Enterprise* had done so. Another example was in 1973, when the United States increased its Indian Ocean presence following the Yom Kippur War. The American increases were soon followed by expanded Soviet deployment.[37] Such increases place additional significance on Diego Garcia. The status of the base there will affect the character of the American response to the Soviet presence and thus influence Soviet reaction to United States policy in the area.

When present projects (runway extension, fuel storage, and harbor dredging) have been completed, the base at Diego Garcia will provide a valuable but limited support facility for United States operations in the Indian Ocean. There will be no troop-staging activities on Diego Garcia, nor will there be any permanent naval detachment. Yet, these limits do not necessarily compromise security, as the base will be able to service B-52s and attack-submarines.[38] These limits will not exist, however, if the expansionists are triumphant. It therefore becomes important for the United States to develop a specific policy concerning that base, in terms of its functions and status, if the expansionists are not to win merely by their persistence.

The function of the base must be a minimal one. Presently, the United States has access to ports in eighteen littoral states.[39] Diego Garcia is necessary because of the Bahrain withdrawal and especially as a "potential." It must not be used as a troop-staging facility, for this could be interpreted as a belligerent act, as could any further expansion in the base. Moreover, a larger base on Diego Garcia is not needed to compete with the Soviet base at Berbera. In 1977, Somalia ordered all Soviet personnel and facilities out of the country.[40] Diego Garcia, combined with American, French, and Japanese naval forces in the area, thus provides an adequate response to the Soviet presence in the Indian Ocean region.

For those who argue that the facility should be removed because it is unnecessary, there are four considerations. The first is that the base does exist. Removal might be taken as a lack of resolve on the part of the United States, which could spur further Soviet increases. Second, in light of the Bahrain withdrawal, there is no longer a permanent American force in the area. Without an establishment such as Diego Garcia to be a constant reminder of American intent, security of the oil routes could be jeopardized. Third, the island lends itself to efficiency and economy in military deployment. Finally, the base is necessary for its potential uses. Due to the instability of the Indian Ocean region, it is highly desirable to have a dependable facility ready. The word *potential* must be stressed, however. To use the base as little as possible would offer diplomatic advantages, as both internal and external forces regard Diego Garcia as a symbol of United States interventionism.

These considerations lead to the question of the future status of the base. While it is useful in countering the Soviet presence and protecting American interests, to expand it would invite increases on the part of the Soviet Union in addition to the regular Soviet schedule of escalation. Moreover, increases on Diego Garcia would provide excellent "justification" for such additions.

Furthermore, the policy of nonexpansion

should specifically deal with this idea of status. As the evidence has borne out, the Navy has been able to accomplish its goals, if only by sheer persistence. This is largely due to the lack of a comprehensive policy that states the objectives and limits of a Diego Garcia base.

Such policy is not without its critics. Expansionists will view it as a compromising of security interests. Minimalists will still have to face the United States presence and the possibility of intervention.

This fear is unfounded. American leaders have expressed the attitude that the United States should not dominate the Indian Ocean region, but as yet these leaders have not taken concrete action to implement such a policy. Nonexpansion offers the opportunity of transforming this idea into action.

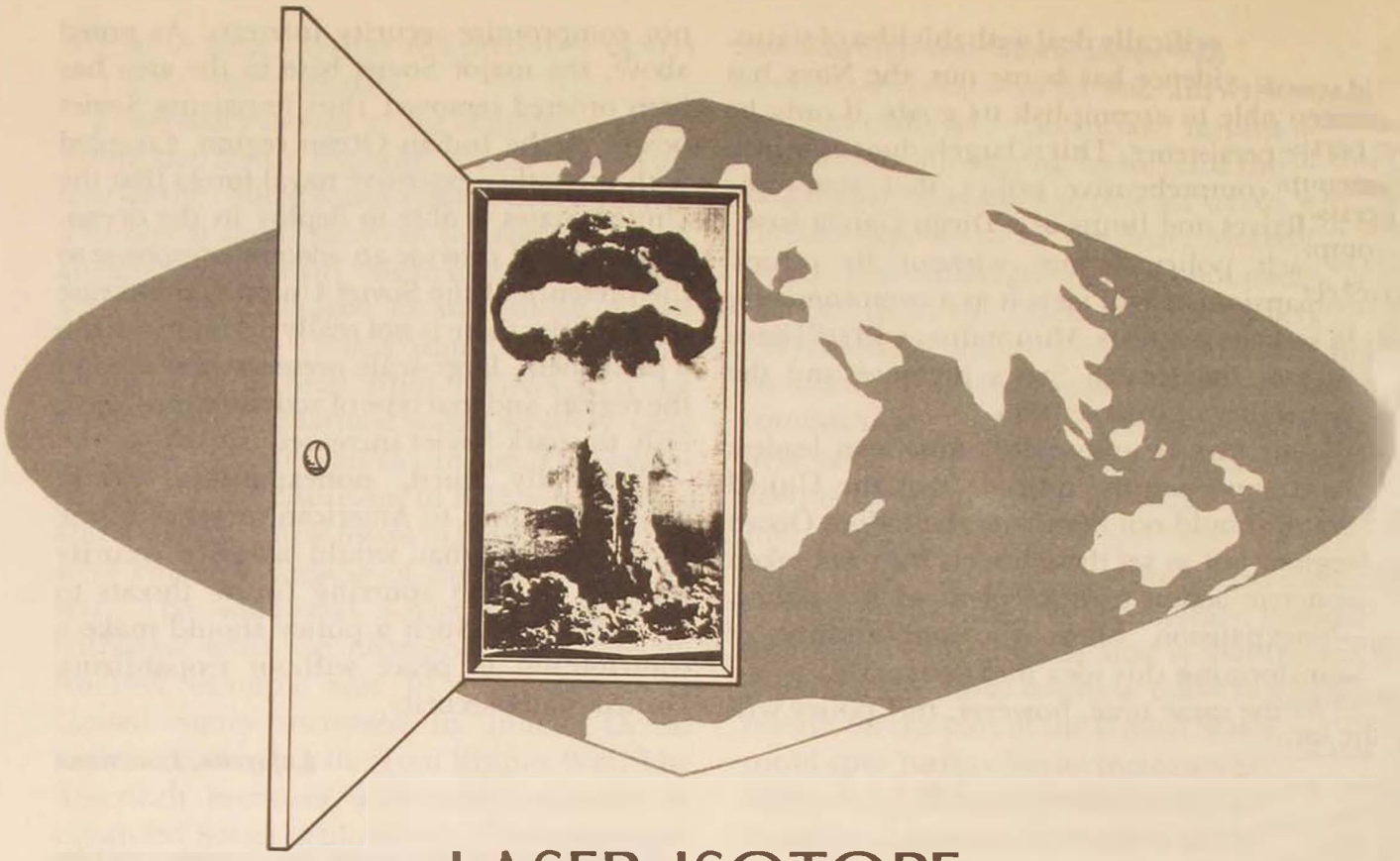
At the same time, however, this policy will not compromise security interests. As noted above, the major Soviet base in the area has been ordered removed, thus impairing Soviet power in the Indian Ocean region. Coupled with the rather extensive naval forces that the United States is able to deploy in the ocean, this base will provide an adequate response to the presence of the Soviet Union. To increase the facilities there is not really necessary unless a permanent, large-scale presence is desired in the region, and that type of activity would serve only to spark Soviet increases.

Essentially, then, nonexpansion would establish a limit to American presence in the Indian Ocean that would advance security interests without spurring future threats to those interests. Such a policy should make a contribution to peace without jeopardizing United States security.

Lafayette, Louisiana

Notes

1. U.S. Congress, House, Committee on Foreign Affairs, *Proposed Expansion of the U.S. Military Facilities in the Indian Ocean, Hearings before a Subcommittee of the House Committee on Foreign Affairs*, 93d Cong., 2d sess., 1974, p. 90.
2. While Chagos is its most important part, the British Indian Ocean Territory also contains the islands of Aldabra, Farquhar, and Desroches.
3. *New York Times*, 17 October 1975, p. 3.
4. K. P. Misra, "International Politics in the Indian Ocean," *Orbis*, Winter 1975, pp. 1099-1100.
5. Ibid.
6. Mideast force consists of a flagship, *La Salle*, and two destroyers.
7. Hearings before the House Foreign Affairs Committee on the Indian Ocean, 93d Cong., 2d sess., 1974, p. 56.
8. Bruce Chou, "The United States and Soviet Union in the Indian Ocean," *Asian Outlook*, July 1974, p. 22.
9. Hearings before the House Foreign Affairs Committee on the Indian Ocean, 93d Cong., 2d sess., 1974, p. 141.
10. Japan, which depends on the Persian Gulf for 79.6 percent of its oil, is reached through the Straits of Malacca. Europe and America, which depend, respectively, on the Gulf for 64 percent and 30 percent of their oil, are reached through the Red Sea or around the Cape of Good Hope.
11. U.S. Congress, House, Committee on Foreign Affairs, *Means of Measuring Naval Power with Special Reference to U.S. and Soviet Activities in the Indian Ocean*, by the Foreign Affairs Division of the Congressional Research Service, Committee Print (Washington, D.C.: Government Printing Office, 1974), pp. 15-16.
12. Mauritius has apparently changed its policy on foreign activity after learning of the true nature of the BIOT.
13. *New York Times*, 6 July 1975, p. 3.
14. U.S. Congress, Senate, Senator John Culver (D-Iowa) speaking on the amendment to the 1976 Military Construction Act, No. 1054, 93d Cong., 2d sess., 6 November 1975, *Congressional Record*, pp. S19451-52.
15. Hearings before the House Foreign Affairs Committee on the Indian Ocean, 93d Cong., 2d sess., 1974, p. 90.
16. U.S. Congress, Senate, Senator Strom Thurmond (R-South Carolina) speaking on the Amendment to the 1976 Military Construction Act, No. 1054, 93d Cong., 2d sess., 6 November 1975, *Congressional Record*, p. S19462.
17. Hearings before the House Foreign Affairs Committee on the Indian Ocean, 93d Cong., 2d sess., 1974, p. 87.
18. Ibid.
19. W. A. C. Adie, *Oil, Politics, and Seapower: The Indian Ocean Vortex* (New York: Crane, Russak, and Co., 1975), p. 12. Although Adie concludes that military manipulations are the wrong answer to the oil supply problem, he emphasizes that a major American goal is regional stability.
20. Hearings before the House Foreign Affairs Committee on the Indian Ocean, 93d Cong., 2d sess., 1974, p. 61.
21. Ibid.
22. Ibid., p. 28.
23. G. S. Bhargava, "India's Security in the 1980's," *Adelphi Paper* No. 124 (Summer 1976), p. 23.
24. Hearings before the House Foreign Affairs Committee on the Indian Ocean, 93d Cong., 2d sess., 1974, p. 37.
25. Ibid.
26. Bhargava, p. 19.
27. Ibid.
28. *New York Times*, 6 July 1975, sec. 4, p. 3.
29. U.S. Congress, Senate, 93d Cong., 2d sess., 6 November 1975, *Congressional Record*, p. S19465.
30. *Strategic Survey 1975* (London: International Institute for Strategic Studies, 1976), p. 25.
31. *New York Times*, 8 July 1975, p. 2.
32. Misra, pp. 1098-99.
33. Alvin J. Cottrell and R. M. Burrell, "Soviet-U.S. Naval Competition in the Indian Ocean," *Orbis*, Winter 1976, p. 1109.
34. Ibid.
35. Dennis Chaplin, "Somalia and the Development of Soviet Activity in the Indian Ocean," *Military Review*, July 1975, p. 9.
36. Ibid.
37. Norman Polmar, *Soviet Naval Power: Challenge for the 1970s* (New York: Crane, Russak, and Co., 1974), pp. 313-14.
38. Hearings before the House Foreign Affairs Committee on the Indian Ocean, 93d Cong., 2d sess., pp. 125-26.
39. U.S. Congress, Senate, 93d Cong., 2d sess., 11 July 1975, *Congressional Record*, p. S12440.
40. "Airlift to Ethiopia," *Newsweek*, January 23, 1978, p. 34.



LASER ISOTOPE ENRICHMENT

a new dimension to the nth country problem?

DR. ROBERT L. BLEDSOE

IN THE post-World War II atomic era, the issue of the spread of nuclear weapons beyond those countries then possessing them (the United States and the Soviet Union) was typically referred to as the "third country" problem (before Great Britain acquired the capability), then the "fourth country" problem (until France detonated a nuclear device in 1960), and, finally, symbolic of the emerging trend, simply the "nth country" problem. This issue of nuclear proliferation was generated a sizable body of literature both within and outside the scientific communities of many countries during the past fifteen years or more.[1] Whether optimistic or pessimistic in outlook, the basic assumptions of

much of this literature can be summarized as follows: (1) the technological inputs for nuclear weapon development are beyond the capability of all but the most advanced states; (2) the capital outlay requirements for such weapon systems are prohibitive even for those states possessing the requisite technological capability and resources; (3) the acquisition of nuclear weapon poses as many problems to a nation's security as such weapons are designed to resolve; and (4) a primitive nuclear arsenal is not cost-effective.

The nonproliferation of nuclear weapons is aided, therefore, strategic and political considerations aside, by the extremely costly and complex technological demands placed on countries considering the nuclear option. In fact, the question of proliferation of nuclear weapons cannot be separated from that of the proliferation of nuclear technology. Indeed, it is nuclear technology that "has risen above nuclear weapons and is proliferating into every corner of the world."[2] As long as such technology remains complex and capital intensive, the nth country problem remains manageable. However, more than one study of the problem has ended on a note of caution comparable to that in the National Planning Association's study of 1960: "It is not inconceivable that simpler methods will in time be developed."[3]

The time has now arrived to reopen the issue raised in this statement in light of widespread discussion within the scientific community, recently made public by declassified research of the Atomic Energy Commission (AEC)* involving purportedly significant advances in *laser isotope separation* and in *laser fusion*.[4] This analysis will make some exploratory observations on the question: *Do research advances in the use of lasers for the enrichment of uranium and for fusion power portend a profound technological breakthrough in both cost and development factors which add a new dimension to the problem of nuclear weapons proliferaton?*

SINCE THE first laser demonstrations by Theodore H. Maiman in 1960, research has been under way in laser application to computers, surgery, and a variety of other uses, including nuclear fusion and isotope separation. In these latter areas, a major focus has been to develop an alternate source of civilian energy that will replace conventional nuclear reactors. Conventional production of nuclear energy uses enriched uranium as the fuel for fission reactions that release usable energy. Capital costs, technological complexity, enriched uranium fuel supply, and waste disposal are all factors that have inhibited the application of nuclear energy to electrical power production. Those working with lasers are hopeful that laser-induced fusion reactions might provide an attractive alternative, minimizing the drawbacks of conventional nuclear energy methods by providing an energy source that is clean, safe, efficient, low-cost, and uses readily available, relatively inexhaustible fuel materials.[5]

Research efforts in these areas were begun during the 1960s in the laboratories of a number of countries: for the United States, the Lawrence Livermore and Los Alamos Scientific Laboratories of the University of California, the Oak Ridge National Laboratory, Sandia Laboratories at Albuquerque (under AT&T's Western Electric Company), Exxon Nuclear, and KMS Industries of Ann Arbor; in Russia, the Lebedev Physics Institute; the Max Planck Institute for Plasma Physics in West Germany; the Limeil Laboratory in France; and government-sponsored research in Israel, among others.

*In 1974, Public Law 93-438 reorganized the AEC by functions into the Nuclear Regulatory Commission and the Energy Research and Development Administration (ERDA). The older title will be retained in this analysis as it is the more familiar of the two.

Initial research successes were apparently handicapped by the technological limitations of laser design and of high-power requirements, but with advancing laser technology, breakthroughs in laser applications were reported in the mid-1960s by N. G. Basov of the Lebedev Institute in the Soviet Union.[6] This, in turn, led to substantially increased research programs in several of the aforementioned countries.

In the United States, for example, advances at the Lawrence Livermore Laboratory, the Los Alamos Scientific Laboratory, and Oak Ridge[7] (among others) have generated a more than tenfold increase in AEC-provided funds for laser fusion research since 1970, to a level of some $30 million annually.[8] AEC support for laser isotope separation research and development (R&D) alone—a segment of the much larger laser fusion program—was projected to increase from less than $1 million in fiscal year 1974 to over $10 million in fiscal year 1975.[9] It is reported that industrial funding on laser separation research by Exxon-Avco Nuclear is comparable to this latter figure.[10] At the Los Alamos Scientific Laboratory alone, which did not begin a laser separation R&D program (Project Jumper) until 1971, the budget had risen to $5.7 million for fiscal 1975. The AEC invested an additional $3.1 million for similar R&D at the Lawrence Livermore Laboratory during the same period.[11]

Such an increase in financial support in this short period of time would seem to validate the observation that ". . . laser-induced fusion has recently joined magnetic-confinement fusion as a prime prospect for generating controlled thermonuclear power."[12] Of more pressing interest to those concerned with the problems and prospects of nuclear proliferation, however, is the impact of these research advances on the nth country question.

A brief comparison of existing and potential uranium-production methods will help provide insight into the revolutionary potential of laser technology.

Uranium Enrichment Methods

Essential to any nuclear program, whether for civilian power production or for nuclear weapon production, is the availability of "enriched" uranium.[13] Natural uranium is composed primarily of two isotopes: fissionable U-238 and fissile U-235. "Enrichment" involves the process of concentrating the fissile uranium isotope U-235, which comprises only 0.7 percent of uranium in its natural state. For use in civilian power reactors, this concentration must be increased to about 3 percent; nuclear weapons demand an enrichment to over 90 percent.

Various methods, both present and future, can produce the required materials.

power reactors

A common method of acquiring nuclear weapon material is as a by-product of the generation of electrical power from nuclear reactors, since reactors that utilize uranium as their fuel source produce plutonium (Pu). However, as with U-235 and U-238, Pu-240 is formed from Pu-239 and is not desired for military use. Thus, the fuel can be left in the reactor for only a short time. As a method of acquiring weapon-grade material, therefore, it is an extremely slow and very inefficient means of utilizing the uranium feeder ore. Only gram lots of weapon-grade Pu-239 can be extracted from a ton of feeder ore. The Israeli reactor at Dimona, for example, is rated at 24 megawatts and could produce 4-6 kilograms of Pu-239 per year if operated at full capacity.[14] This amount would be sufficient for a single, small-yield nuclear weapon. A nation desiring to develop a modest-sized nuclear force in a reasonable period of time would, therefore, be inclined to seek alternate methods of acquiring the needed fissile material for warheads.

An alternate method used specifically for the production of enriched uranium is gaseous diffusion.

gaseous diffusion

The standard method for enriching uranium, gaseous diffusion involves the diffusing of hot uranium hexaflouride gases up and down porous stacks of synthetic membranes that pass and collect the lighter U-235 in their upper layers. Since each pass increases the U-235 concentration only slightly, the process must be repeated thousands of times before high levels of enrichment are achieved for weapon-grade material. The process is slow and costly and requires massive production facilities. At the Oak Ridge Gaseous Diffusion Plant, for example, buildings to house the "cascades" of diffusion stacks (cells) cover some sixty acres and are often half a mile long. Investment costs and energy demands are equally impressive. The three gaseous diffusion plants presently operating in the United States require some 6000 megawatts of electrical power at peak production (approximately 1 percent of the total power generated nationwide).[15] The investment figures for the construction of such a facility are widely quoted at between $1 to $3 billion; the French plant at Pierrelotte is reported to have cost close to $1 billion some ten years ago.[16]

Thus, the technological demands, investment and operating costs, energy requirements, and impossibility of disguising such a facility have acted as deterrents to nuclear proliferation. Even in those countries that have invested in gaseous diffusion plants,[17] a search has been under way to discover less cumbersome and less expensive methods of enriching uranium such as the gas centrifuge.

gaseous centrifugation

Research in the gas centrifuge process has been under way in several countries since the early 1960s, particularly in the United States, the Soviet Union, Japan, and France. Essentially, the centrifuge process relies on extremely powerful gravitational forces produced through the rotation of long, rotating drums. Uranium hexaflouride gas is pumped into the drum, and the rotation movement disperses the molecules outward from the center. As pressure builds, the molecules of the lighter U-235 isotope concentrate toward the center, and this enriched flow is then passed into the next centrifuge drum in the cascade for similar treatment. This process is repeated until the desired enrichment level is achieved. The process is similar to that of gaseous diffusion, except that the separation factor is reportedly ten times higher than that achieved by the diffusion method. Therefore, an advantage to the centrifuge process is the shortened time required for uranium enrichment in comparison to the more repetitious separation process in gaseous diffusion.

It is projected that the centrifuge process will supplant the gaseous diffusion process sometime in the 1980s. Although initial capital outlay is expected to be comparable to that for gaseous diffusion facilities, the power requirements are estimated to be only 10 percent of that needed for gaseous diffusion operations, as well as operating costs decreasing by 20–30 percent.[18] Even at this, however, the technological requirements and investment costs remain beyond the capacity of all but a handful of nations.

For these reasons, a nation desiring nuclear energy sources or weapon-grade fissile materials cannot avoid being interested in the research advances and potential offered by lasers for uranium isotope separation and fusion power. At present, such nations are bound largely to the slow and inefficient production of plutonium from nuclear power reactors or to the purchase of enriched uranium from the few highly advanced nations possessing gaseous diffusion facilities.

laser isotope enrichment

As noted earlier, the use of lasers for uranium isotope separation has made rapid progress in the past decade. Essentially, the process

consists of adjusting tunable dye lasers to extremely fine frequencies (corresponding to absorption frequencies characteristic of the isotope in question), which can then excite one isotope of an element without exciting other isotopes. This is possible due to the difference in atomic weight between two isotopes of the same element. The excited isotope can then be ionized and separated by any of several methods: chemical, electrical, or magnetic.[19] Although laser isotope enrichment is hypothetically applicable to any element, its potential employment for uranium separation/enrichment is of particular interest.

Projections released by the Lawrence Livermore Laboratory indicate that the physical plant facilities for such a process are minuscule in comparison to those for gaseous diffusion or centrifugation; thus, investment costs would be less than for either of the aforementioned processses. In addition, energy demands should be far less than even the centrifuge process requires, and the laser process would be the most efficient user of the natural uranium fuel, removing virtually all the U-235 (in comparison to the approximately 60 percent use-level achieved by either diffusion or centrifugation).[20] This results from the extremely high separation factor in laser isotope separation, which produces more enrichment in fewer stages and requires no cascades as in gaseous diffusion plants.

Laboratory successes with this method have been reported from various sources within the past several years. In an address before the Eighth International Quantum Electronics Conference in June 1976, Benjamin B. Snavely of the Lawrence Livermore Laboratory announced results of experiments conducted at Livermore that succeeded in separating microscopic quantities of the uranium isotope in which the proportion of U-235 exceeded 60 percent.[21] According to a report in the March 22, 1974, issue of *Science*, Israeli scientists have also succeeded in enriching uranium through the employment of lasers.[22] In testimony before the Joint Congressional Committee on Atomic Energy in October 1973, Exxon Nuclear's president, Raymond L. Dickeman, reported laboratory successes in cooperation with Avco Everett Research Laboratories. He predicted that within two years Exxon Nuclear would begin the construction of a pilot plant for uranium enrichment utilizing a laser process and that by the mid-1980s processing on a commercial scale would be feasible at an overall cost of 10 to 20 percent below projected costs by gas centrifuge methods.[23]

Although the ability to jump rapidly from laboratory to commercial scale production has not been optimistically accepted by all observers, it would seem likely that the laser isotope enrichment process is largely a function of time. If this process realizes its preliminary promises of low cost and high efficiency, it will make "alternative enrichment processes economically obsolete," according to the AEC's former general manager, John A. Erlewine.[24]

The implications of such developments are of the first magnitude. The successful commercial development of laser enrichment technology might not only greatly reduce the cost and complexity of acquiring enriched uranium for civilian power reactors *but also do the same for nuclear warhead materials.*

laser fusion

Research in laser isotope separation enrichment is only a segment of a much larger AEC research and development program in laser fusion. Unlike laser separation, laser fusion research is geared directly to producing a fusion reaction of elements, such as deuterium (found in water) and lithium or tritium. It is speculated that first generation plants would be similar to fission plants, consisting of a reactor, heat exchange, and generator.[25]

Success at this stage is not readily known, as much remains classified for security reasons, both military and industrial; however, in 1974 KMS Industries announced success with laser

fusion experiments. Although such claims met with skepticism among some observers,[26] it has been reported that KMS signed a contract to work closely with both the Los Alamos Scientific and the Lawrence Livermore Laboratories.[27] Although the AEC has hopes of developing a system that produces more power than it consumes sometime in the 1980s, there are scientists who predict that the laser enrichment process will prove successful much sooner than laser fusion efforts.[28]

Even if laser fusion advances were to remain in the more distant future in comparison to laser isotope enrichment advances, ultimate success in such efforts would produce an inexhaustible source of inexpensive neutrons for energy production from ordinary water. It might also produce, however, a low-cost and readily available source of weapon-grade material for nuclear weapons. Either way, they both represent significant new elements to the nth country problem, which require serious investigation and clarification in the years ahead.

Cost Comparisons

A typical gaseous diffusion plant requires an initial investment of between $1 to $3 billion for the physical plant itself and, since its operation requires approximately 2000 megawatts of electrical power, forces investment in large-scale power plants (unless a nation is fortunate to have a ready supply of cheap hydroelectric power).

A centrifuge facility is projected to be somewhat more capital intensive (initially) than a diffusion plant, with cost-declines likely for successive plants that place it on a level comparable to gaseous diffusion plants.[29] The savings accrue in the centrifuge process from the much lower power requirements needed for its operation—about one-tenth the energy requirements for a diffusion plant. The cost comparisons in the two techniques are represented in Table I.

Theoretically, a laser separation enrichment facility should be less capital intensive than either a diffusion or centrifuge facility, since size requirements are minimized (only a single pass being required for enrichment rather than the thousands of repeated stages found in the cascade-stack method of gaseous diffusion plants). Additionally, energy power requirements are less than for either of the above methods.

Overall, the laser separation method would

Table I. Cost comparison of gaseous diffusion and centrifuge methods

	Gaseous diffusion	Centrifuge (first plant)	Centrifuge (later plants)
capital investment per plant	$1.4 billion	$1.71 billion	$1.13 billion
operating costs per plant	$16 million	$115 million	$70 million
power costs per plant	$210 million	$21 million	$21 million
total cost/plant	$1.63 billion	$1.85 billion	$1.22 billion

Source: Adapted from William J. Wilcox, Jr., D. M. Lang, and S. A. Levin, *Process Selection for New Uranium Enrichment Plants* (Oak Ridge, Tennessee: Oak Ridge Gaseous Diffusion Plant, 1975), pp. 7-8.

	Gaseous diffusion	Laser enrichment
plant investment	$20 billion	$2 billion
separation costs	$65 billion	$8 billion
feeder ore costs	$70 billion	$30 billion
total costs	$155 billion	$40 billion

Source: See James W. Dubrin, *Laser Isotope Separation* (University of California Press: Lawrence Livermore Laboratory, November 1974), p. 16.

Table II. Total cost comparison of gaseous diffusion and laser isotope separation enrichment methods, 1980-2000

appear to offer three distinct advantages over either the gaseous diffusion or centrifuge methods:

(1) less costly and complex plant facilities—since a single pass can theoretically produce enrichment levels above 90 percent;
(2) less energy demands—approximately 10-100 kilovolts per separated atom by centrifuge and 3 megavolts per separated atom by gaseous diffusion;
(3) more efficient use of the feeder ore—which might ultimately amount to a saving of between $40-$100 billion by the end of this century.[30]

Although figures for cost comparison purposes remain a matter of conjecture, the figures in Table II provide a general indication of the cost involved.

Projected costs of a laser fusion facility are not widely available as yet, but it is speculated that the capital costs of the support facilities, at least, should be no greater than those of conventional plants. The savings derive from operating costs, which are projected to be extremely low in comparison to existing methods. According to one source, the costs for deuterium and lithium would amount to about 3¢ per million British thermal units (BTU) compared to present figures of 40¢ per million BTU for fossil fuels.[31] On the basis of these figures, laser fusion methods remain attractive at even several times the capital outlay of conventional nuclear power plants.

Cost comparison figures for gaseous diffusion and gas centrifuge processes versus laser isotope separation and laser fusion processes are observably an intriguing source of speculation. Although uranium enrichment will probably be processed by conventional methods for at least the next decade, it is certainly not too soon to begin evaluating the potential impact of these newer methods under laboratory development, for in somewhat Draconian overtones, the program director of the Lawrence Livermore Laboratory has announced that "the main thrust of the research for the next several years is to demonstrate the feasibility of laser-induced thermonuclear reactions *regardless of their final application. . . .*"[32]

The major assertion of this analysis is that technological advances in laser isotope and laser fusion may in time so reduce the cost and complexity of uranium enrichment as to induce present nonnuclear nations to re-evaluate their positions on the acquisition of nuclear weapons. Whether this will lead to a situation where, as stated by one researcher at Los Alamos, "the whole world had better be a

little bit uneasy, because it will be a whole lot easier to make bombs,"[33] provides the focus for the remainder of this article.

The Nuclear Option

The acquisition or availability of fissile material for nuclear weapons does not, in itself, constitute a nuclear capability. Any nation contemplating the nuclear option must have available to it the requisite scientific and technological expertise in nuclear, materials, and electronics fields, among others, to enable it to resolve the complex problems in uranium enrichment production; warhead design, assembly, and testing; and development of delivery systems. As noted by former Secretary of Defense James R. Schlesinger, in an article published some years ago, "these problems will not be swept away through the growing availability of plutonium."[34]

In addition, a nation must evaluate the nuclear option in light of its economic capabilities, geographic location, alliance commitments, domestic pressures, overall military capability, and the presence or absence of regional threats. The variety of these considerations makes an impact study of laser enrichment effects on the nth country problem extremely difficult insofar as providing concrete or definitive conclusions. In general, however, one can begin such an assessment with the proposition that the above variables, either singly or in combination, would seem to rule out for the foreseeable future all but a dozen or so of the present near-nuclear states regardless of advances in laser research. It is for this handful of states that laser enrichment and laser fusion advances might well activate (or reactivate) debates over the acquisition of nuclear weapons.

For Western Europe, such a list might include Italy, West Germany, and Sweden if they view American defense commitments as weak and Soviet intentions toward Europe as increasingly hostile. For Asia, a nuclear China and, more recently, India are forcing a re-evaluation of security conditions in Japan, Australia, and possibly Indonesia. Elsewhere, regional conflicts, both real and potential, expand the nth country problem noticeably: in Latin America (Argentina, Brazil, Chile, and Peru); in Africa (South Africa versus black Africa); in South Asia (India versus Pakistan); in the Far East (North Korea versus South Korea); and in Central Europe (East Germany versus West Germany).

It is largely, though not exclusively, for these nations that advances in uranium enrichment techniques might hold the greatest interest. Yet all nations must grapple with a complex variety of interrelated problems and demands when evaluating their need and ability to take up the nuclear option.

Major Considerations

It has become conventional wisdom as portrayed by Leonard Beaton and John Maddox in their pioneering work on nuclear weapon proliferation that "only the most sophisticated among industrial nations" can opt for a nuclear weapon capability.[35] The reasons for this are varied, but they include research and development costs, manpower skills, production facilities, weapon design, and delivery systems. Many of these factors exist both for the production of weapon-grade materials and for delivery systems as well.

research and development costs

Acquiring the nuclear option requires a sizable investment of capital in research and development programs prior to and during the development of military weapon systems. According to the Stockholm International Peace Research Institute (SIPRI), the annual level of world military R&D expenditures during the past decade was from $15 to $16.5 billion. Of this amount, 85 percent was spent by the United States and the Soviet Union; an additional $2 billion was spent by the United

Kingdom, France, China, and West Germany. The remaining 3 to 4 percent of the total constitutes the R&D expenditures of the rest of the globe, with Japan, Sweden, Canada, Australia, and India the dominant investors.[36]

For a nation to develop the broad range of weapon systems symbolic of a great power requires military R&D outlays in the range of $5 to $10 billion annually. A more limited nuclear capability can be achieved with annual R&D expenditures of $500 million to $1 billion.[37] In examining defense budgets of the world's nations, one finds that even a limited outlay of $500 million annually for R&D constitutes the *total defense budget* of some 16 of the world's more advanced nations, and if one considers the larger expenditure figure of $1 billion, the number of countries increases to 30 or more. In fact, only some 20 nations have defense budgets in excess of $1 billion.[38] Table III provides a general comparison of research and development outlays for a variety of near-nuclear countries.

A cursory glance reveals that only West Germany comes anywhere near the base figure suggested in the SIPRI study. To increase present military R&D to the base level of $500 million would require both a sizable increase in present defense budgets and the division of total R&D funds from the governmental and industrial sectors. R&D outlays for nuclear weapons can constitute from 15 to 25 percent of a country's total annual defense expenditures, but this amount appears to be beyond the present resources of all but a small percentage of the present nth countries. Laser processes are likely to increase the R&D demands for nuclear and nonnuclear states alike.

production factors

Suffice it to say that a nation embarking on a nuclear capability must expect to devote financial resources of a magnitude beyond the resources of the majority of nations. For most nations it would amount, in essence, to the creation of an entire new industrial sector to a

Table III. Expenditures for research and development among select near-nuclear countries

Country	military R&D ($million)	% total defense budget	total R&D ($million)	government funded R&D ($million)	defense budget ($million)	defense budget % GNP[3]	GNP ($billion)
	1971[1]	1971[1]	1970[2]	1970[2]	1974[3]		1973[3]
Belgium	2.8	.41	176	132	1,079	2.2	49.9
Canada	80.8	4.24	1,103	600	2,429	2.1	118.1
India	24.4	1.59	236.89	203.3	2,443	3.2	78.6
Italy	14.4	.55	952	470	3,673	2.7	138.2
Japan	25.3	1.84	4,488	1,226	3,835	0.87	439.4
Netherlands	13.9	1.26	835	308	2,303	3.6	63.7
Spain	1.2	.36	87	43	1,131	1.9	61.02
Sweden	86.8	6.85	381	159	1,641	3.0	55.2
Switzerland	7.7	1.92	383	77	884	1.9	45.9
West Germany	321.9	4.58	4,317	2,017	10,764	2.8	385.4

Sources: Adapted from [1]SIPRI, *Resources Devoted to Military Research and Development* (Stockholm: Almqvist and Wiksell, 1972), pp. 76-83; [2]*United Nations Statistical Yearbook, 1973* (New York: United Nations, 1974), pp. 788-89; [3]*Military Balance, 1974-1975* (London: Institute for Strategic Studies, 1975), passim.

nation's economy, a fact which could lead to imbalance and distorted economic growth, at least for developing nations. To illuminate the point, Beaton and Maddox compare a developing nation's decision to build nuclear production facilities as equivalent to constructing the nation's electric generating system or building several of the world's largest steel complexes.[39]

manpower skills

Even with those nations possessing the requisite financial resources, there are other restraining factors such as manpower skills. The inhibiting factor becomes evident when it is realized that most of the countries now generating power from nuclear reactors rely on the major nuclear powers for technical advice and support. The industrial, scientific, and engineering skill demands placed on a nation when building enrichment facilities (whether conventional or laser) are considerable. A country must have skilled labor for plant construction, but even more difficult to find are the trained metallurgists, scientists, and engineers for plant and weapon systems design and the technicians and maintenance personnel for ongoing operations and repairs. If the experiences of Sweden and Britain are any indication, more than 10,000 technically skilled workers and hundreds of research scientists are needed to build and maintain a production facility alone.[40] In addition to this manpower requirement, a United Nations study conservatively estimates that at least 500 scientists and 1300 engineers are needed to develop and maintain warhead production facilities, and an additional 19,000 personnel (more than 5000 of them scientists and engineers) are required to produce delivery vehicles of the intermediate ballistic missile variety.[41] A country survey of scientists and engineers in the *United Nations Statistical Yearbook* reveals more than 50 nations with fewer than 8500 personnel in these categories.[42] The scientific and technical manpower R&D levels for a cross section of countries considered capable of achieving nuclear status within 5–10+ years are represented in Table IV. For comparative purposes, a 1961 survey of 400,000 scientists and engineers doing R&D work in the United States showed that 250,000 (5 of 8) were involved in space and defense projects.[43]

As revealed by Table IV, only Japan achieves an R&D manpower level of a magnitude approaching that of the United States. For the remainder, the gap is quite significant and varies greatly among the selected countries themselves. Even among countries with comparable R&D manpower levels, the industrial base of a Sweden or Belgium alters the significance of these figures in comparison with a Chile, Argentina, Egypt, or Pakistan, whose less-developed industrial bases would be significantly affected by the diversion of scarce manpower resources into military R&D. The gap in manpower levels between near-nuclear countries such as those listed in Table IV and the remainder of the developing countries of the world is as significant as the gap between near-nuclear countries and Japan or the United States.

Clearly, for most of the nonnuclear countries of the world, manpower may well be a more inhibiting factor than finances. Laser advances are neither likely to alter this observation nor lessen the requirement. Although physical plant requirements for laser isotope separation are much smaller (hypothetically) than conventional processing plants, laser-based technology is no less demanding of high skills.

warhead design and construction

In addition to the production of fissile material for weapons, one must consider the financial, industrial, and manpower demands of nuclear warhead design and construction. Although little is available in the general literature of the field, William Davidon and his associates have provided an indication of the extent and

complexity of the problem. The range of activities includes exacting measurements of the properties of the bomb materials; theoretical and experimental design of the weapons; purification, heat treatment, and alloying of the fissionable materials; preparation of shaped charges of explosives; manufacture of electronic and other components for fusing and detonating; and instrumentation for design, manufacture, and testing.[44]

Success in this effort would require an annual investment of approximately $2 million per warhead for a modest program producing ten 20 kt-sized bombs yearly,[45] and a design effort of 10 to 20 top-ranked scientists working continually for two to three years.[46] In addition, the testing of a nuclear device requires an expenditure of some $12 million.[47]

delivery systems

A nation embarking on a nuclear strike force is limited to four options for its delivery system: subsonic fighter-bombers, supersonic fighter-bombers, fixed land-based missiles, and mobile land-based or sea-based missiles. To ensure success, a nation will have to design a system that is within its technological means and financial resources. For most states, this would mean a manned delivery system, as the experience of both the United States and the Soviet Union testifies to the enormous investment required for intermediate and long-range ballistic missile systems, whether land- or sea-based. Even such a technologically advanced nation as France relies more on its Mirage IV supersonic bombers for its nuclear strike force than on its ballistic missile system.

Table IV. Scientific and technical manpower employed in research and experiment development

Country	scientists/engineers engaged in R&D	technicians engaged in R&D
Argentina	6,500	9,800
Belgium	10,070	12,854
Canada	20,425	20,130
Chile	4,904	1,329
Czechoslovakia	38,572	57,906
Egypt	6,522	- - - - - - -
Hungary	16,282	23,811
Israel	2,900	- - - - - - -
Italy	29,304	22,488
Japan	310,870	85,089
Netherlands	22,670	34,130
Pakistan	1,054	847
Poland	59,000	55,100
Spain	5,842	1,526
Sweden	7,537	11,791
Switzerland	12,001	3,406
West Germany	82,000	188,000
Yugoslavia	15,118	9,601

Source: *United Nations Statistical Yearbook, 1973* (New York: United Nations, 1974), pp 788-89.

Country	ballistic missiles	antitank, ship, aircraft missiles	armored vehicles	aircraft	combat ships
Argentina					X
Australia		X		X	
Belgium			X	X	X
Brazil				X	X
Canada				X	
Czechoslovakia			X		
Egypt	X			X	X
Hungary			X	X	
India				X	X
Israel	X	X	X	X	X
Italy				X	X
Japan	X	X	X	X	X
Netherlands			X	X	
Poland				X	
South Africa		X		X	X
Spain					
Sweden	X	X	X	X	X
Switzerland			X	X	X
West Germany		X	X	X	X
Yugoslavia		X	X	X	X

Source: Adapted from Stockholm International Peace Research Institute, *Resources Devoted to Military Research and Development* (Stockholm: Almqvist and Wiksell, 1972), pp. 46–47.

Table V. Weapons development projects of near-nuclear countries, 1960–68

The cost requirements for even a relatively simple subsonic bomber force can be quite formidable. The British subsonic Vulcan bomber fleet developed in the 1950s represents an investment of $1.5 to $3 billion.[48] To develop a supersonic bomber would require average annual R&D expenditures of $80 to $100 million per plane excluding bombs. For comparison, the average annual R&D figures for a single solid-fuel, intermediate-range ballistic missile is from $300 to $500 million.[49]

An examination of major military R&D programs of various near-nuclear countries reveals that nearly all have an existing or potential capability in the area of manned delivery systems, but few have operational programs in the ballistic missile category. (See Table V.) Of those nations listed, only three have invested R&D resources in all the major weapon categories (Japan, Israel, and Sweden), and two others invested in four of the five major categories. For most of the countries listed, research and development experience is focused on conventional armament categories, although seven have some degree of familiarity with special purpose missiles but not with ballistic missile systems.

If an nth country should decide, nonetheless, to embark on a missile delivery system, the French experience proves instructive. Table VI provides investment figures for the French nuclear program from 1960 to 1964 and is indicative of program costs. The total cost of the French program for the last decade has been variously estimated at between $8 to $15 billion.[50] In general, then, a nation deciding

Program	Expenditures ($ million)
nuclear weapon development	805
manned bomber system	201
ballistic missile system	203

Source: Leonard Beaton and John Maddox, *The Spread of Nuclear Weapons* (New York: Frederick A. Praeger, 1962), p. 92.

Table VI. French nuclear program costs, 1960-64

on a modest nuclear capability should expect to invest approximately $1.5 billion annually.[51]

Should a nation make the monumental decision of embarking on a full-scale program to develop delivery systems comparable to those of the United States and the Soviet Union, it could mean a development time frame of up to twenty years and an investment of $4 to $5 billion annually.[52] A total investment of $50 to $80 billion is frightening to even the most advanced of the nth countries.

On the basis of the above considerations, the best that even the most ambitious nth country could hope to attain would be a modest-sized nuclear force, comparable to that of Britain or France. To what extent would breakthroughs in the commercial application of laser isotope separation processes alter this situation? A glance at Table VII reveals that the acquisition of fissile material for nuclear weapons is only a small part of the total cost picture.

Since figures are as yet not available on investment costs of a single laser isotope separation facility (other than the broad assumption that it should be significantly less than for contemporary methods), it is difficult to provide comparative data. If one assumes, for illustrative purposes, that the employment of laser methodology could produce a fissile program of the French magnitude for the cost of a small plutonium-based program listed in Table VII, then a near-nuclear country could indeed acquire a warhead stockpile of respectable proportions. This does not affect, however, the procurement costs and annual operating costs of various delivery modes. The development of nuclear warheads appears to constitute only 5 to 10 percent of the total investment costs of a nuclear weapon program, depending on the method of processing and the size and type of delivery systems. (It should be cautioned, nevertheless, that the above assessment does not take into account the possibility of using commercial aircraft already available to nonnuclear nations.)

Overall Assessment

In addressing the problem of nth country nuclear proliferation, one would be more precise to speak in terms of N minus 5 to 10 years. When the decision is made to acquire the nuclear option, two to three years of effort are needed for the planning, design, and construction of conventional enrichment facilities; and an additional two to three years for material production and weapon assembly.[53]

In Hearings before the Senate Foreign Relations Committee, the AEC estimated that, within five to ten years after deciding on the nuclear option, the following countries could join the ranks of the nuclear powers: Australia, Canada, West Germany, Italy, India (has since exploded a device), Japan, and Sweden. Other nations requiring more time to achieve the

status included: Argentina, Netherlands, Belgium, Brazil, Chile, Czechoslovakia, Hungary, Israel, Pakistan, Poland, South Africa, Spain, Switzerland, the United Arab Republic, and Yugoslavia.[54] The general capabilities of several of the nations cited are represented in Table VIII.

The decision to develop a nuclear capability involves even more than the technical obstacles and considerations presented here. To some

Table VII. Procurement cost summary for various nuclear force levels (in $ millions)

	small plutonium-based program (10x20-kt, devices over ten years)	moderate program (10x20-kt, devices over ten years)	French gaseous diffusion program (to 1964)
fissile material	70.0	151.0	1040
design and manufacture	18.0	18.0	500
testing	12.0	15.0	340
storage, maintenance	4.0	4.0	
Total	104.0	188.0	1880

system category	system description	procurement costs	annual operating costs
aircraft, elementary	30–50 bombers (Canberra, B-57)	180	25
missile, elementary	50 missiles (soft, 1000-km range)	440–540	5
	50 missiles (soft, 3000-km range)	800–900	10
	140 missiles (U.S. Atlas-type)	4900	280
aircraft, mid-level	50–60 French Mirage IV bombers	940	100
	300 British V bombers	1800	120
missile, mid-level	50 Minuteman I (hard, 10,000-km range)	1250	5
	25 French SSBS (hard, 4000-km range)	700	?
	140 missiles (U.S. Titan-type)	4900	?
aircraft, advanced	210 U.S. FB-111	2200	340
missile, advanced	3 French nuclear submarines w/16 missiles each of 3000-km range	1000	20
	41 U.S. Polaris submarines w/16 missiles each	13,000	?

Source: Data adapted from Report of the Secretary-General, *Effects of the Possible Use of Nuclear Weapons and the Security and Economic Implications for States of the Acquisition and Further Development of These Weapons* (New York: United Nations, 1968), pp. 24-26.

Country	nuclear power/ research reactors	chemical separation/ enrichment plants	annual plutonium production (kg)	uranium resources	weapon delivery systems
Argentina	5	1	200	M	Canberra bombers
Australia	2	0	6	L	Phantom aircraft; Canberra bombers
Belgium	1	0	4	N	F-104 aircraft; short-range missiles
Brazil	3	0	N	L(T)	N
Egypt	1	0	N	N	Tu-16 bombers
India	3	1	220	L(T)	Canberra bombers
Israel	2	0	10	N	Phantom aircraft; short-range missiles; artillery
Italy	3	1	227	S	F-104 aircraft; missiles
Japan	5	1	494	S	Phantom aircraft; short-range missiles
Netherlands	1	0	19	N	short-range missiles; artillery
Pakistan	1	0	90	S	N
South Africa	1	1	5	VL	Canberra and Buccaneer bombers
Spain	2	1	225	M	Phantom aircraft
Switzerland	3	0	382	N	N
West Germany	9	1	387	N	several types of aircraft, missiles, and artillery.

Abbreviations: N = none/negligible; S = small; M = medium; L = large; VL = very large; (T) = thorium

Source: SIPRI, *The Near-Nuclear Countries and the NPT* (Stockholm: Almqvist and Wiksell, 1972), pp. 14–15.

Table VIII. Nuclear capabilities of fifteen near-nuclear countries

nations there are political and moral considerations that work against a pro-nuclear decision (Japan, Sweden, Netherlands, Belgium, Denmark, Norway, and Switzerland, for example).[55] For these and others, there is the broader concern of the global impact of nuclear spread. All but eight of the above nations (India, Argentina, Brazil, Chile, Israel, Pakistan, South Africa, and Spain) have either signed or ratified the Nuclear Non-Proliferation Treaty (NPT).[56]

Strategic considerations further serve as an ameliorating influence. The most that any of the nth countries could hope to achieve is a strategic capability comparable to that of Britain or France—a capability that has produced as many problems (or more) for security as it has resolved. Whether such a capability can provide even regional security is a question that has been the focus of much of the Indian debate over the nuclear option.[57]

ALTHOUGH THE tangible impact of laser isotope separation/enrichment and laser fusion processes remains for the future, it is suggested that such advances will neither dispel nor resolve the problems, demands, and

considerations discussed. It is not at all conclusive that "rapid proliferation is much more likely in the next decade than ever in the past simply because it will be technically more easy. . . ."[58] Simply because technology advances, it is not that much easier.

The most likely impact of these new technological advances—if they prove successful and achieve their designers' claims—is to *reduce* the five- to ten-year time frame now imposed on nth countries. Although it is true that the cost figures for weapon-grade materials will probably be reduced considerably, the much more important consideration bearing on the nth country problem would appear to be the potentially greater ease of generating such materials through laser application. This could conceivably reduce the nuclear option time frame from N minus 5 to 10 years to perhaps N minus 2 to 5 years. Whether this time compression would automatically lead to unprecedented nuclear proliferation or instead produce a situation of *potential* proliferation is an important distinction to examine.

One can only conclude that laser advances will be a major factor in contributing to potential proliferation, but it is quite possible that such advances will not cause actual proliferation. The latter depends on prevailing international trends, alliance configurations, and regional animosities and developments.

One could also adopt the position that, by shortening the time frame for nonnuclear states to N minus 2 to 5 years, laser advances might be a significant step in the direction of dampening rather than exacerbating the nth country problem.[59] This hypothesis is based on the observation that by shortening the lead time, near-nuclear nations would still retain the nuclear option without forcing them to make the crucial decision immediately simply because of the excessive development span demanded under present methods of nuclear material production.

In short, one can still subscribe to former Defense Secretary Schlesinger's observation that the acquisition of fissile material does not elevate a nation to the status of a nuclear power. Whatever advances are actually made in the emerging field of laser fusion and laser isotope enrichment would seem to have only a negligible to slight effect on the major considerations in nth country proliferation—weapon research and development costs and manpower/skill demands.

Florida Technological University
Orlando, Florida

Notes

1. A sampling of such works might include George Quester, *The Politics of Nuclear Proliferation* (Baltimore, Maryland: The Johns Hopkins University Press, 1973); Leonard Beaton and John Maddox, *The Spread of Nuclear Weapons* (New York: Frederick A. Praeger, 1962); William B. Bader, *The United States and the Spread of Nuclear Weapons* (New York: Pegasus, 1968); Bennett Boskey and Mason Willrich, editors, *Nuclear Proliferation: Prospects for Control* (New York: The Dunellen Co., Inc., 1970); Richard N. Rosecrance, editor, *The Dispersion of Nuclear Weapons* (New York: Columbia University Press, 1964); and Georges Fischer, *The Non-Proliferation of Nuclear Weapons*, translated by David Willey (London: Europa Publications, 1971).

2. Johan Jorgen Holst, *Security, Order, and the Bomb* (Oslo: Hestholms Boktrykkeri, 1972), p. 129.

3. William C. Davidon, Marvin I. Kalkstein, and Christoph Hohenemser, *The Nth Country Problems and Arms Control* (Washington, D.C.: National Planning Association Pamphlet No. 108, January 1960), pp. 6-7.

4. Much of the declassified literature can be found in such journals and publications as *Scientific American*, *Physics Today*, *Science*, and *Science News*. It is interesting to note that prior to the AEC's decision, two major laser bibliographies—Kujo Tomiyasu, *The Laser Literature: An Annotated Guide* (New York: Plenum Press, 1968); and Edward V. Ashburn, editor, *Laser Literature: A Permuted Bibliography* (North Hollywood, California: Western Periodicals Co., 1967)—shed little light on the revolutionary advances then under way.

5. Likely candidates widely cited for energy sources include deuterium (a virtually inexhaustible element found in the oceans); the less common tritium; and, potentially, the common isotope of boron, B-11. See John L. Emmett, John Nuckolls, and Lowell Wood, "Fusion Power by Laser Implosion," *Scientific American* (June 1974), pp. 24-37; and Moshe J. Lubin and Arthur P. Fraas, "Fusion by Laser," *Scientific American* (June 1971), pp. 21-33.

6. For an overview of the developments of the 1960s, see Lubin and Fraas.

7. "A method for converting the fusion energy from laser-ignited deuterium-tritium pellets into electrical power was evolved at the Oak Ridge National Laboratory early in 1969 in conjunction with fusion-power feasibility studies that had been under way there since 1967." Ibid., p. 29.

8. John Nuckolls, John Emmett, and Lowell Wood, "Laser-induced Thermonuclear Fusion," *Physics Today* (August 1973), p. 46. The authors suggest that the Soviet Union's investment in laser research is of comparable size.

9. Robert Gillette, "Uranium Enrichment: Rumors of Israeli Progress with Lasers," *Science* (March 22, 1974), p. 1173.

10. William D. Metz, "Uranium Enrichment: Laser Methods Nearing Full-scale Test," *Science* (August 16, 1974), p. 602.
11. *Physics Today* (September 1974), p. 20; and Metz, p. 603.
12. Nuckolls et al., p. 46.
13. Descriptions of these processes have been derived from Gillette, pp. 1172-73; Beaton and Maddox, Chapter One; Davidon et al., Chapter One; Boskey and Willrich, Chapter Four; and SIPRI, *The Near-Nuclear Countries and the NPT* (Stockholm: Almqvist and Wiksell, 1972), Appendices 1 and 2.
14. Beaton and Maddox, pp. 171-73.
15. Gillette, pp. 1172-73.
16. Rosecrance, p. 135.
17. At present, gaseous diffusion plants are in operation in the United States, the Soviet Union, France, Britain, and China.
18. Gillette, p. 1173.
19. See Metz, pp. 602-3; and *Science News* (June 22, 1974), pp. 396-97, for descriptions of this process.
20. See James W. Dubrin, *Laser Isotope Separation* (University of California: Lawrence Livermore Laboratory, November 1974), p. 16.
21. *Science News*, p. 396.
22. Gillette, p. 1172.
23. Ibid., pp. 1172-73; and Metz, p. 602.
24. Gillette, p. 1173.
25. Schematics of such a system are found in Lubin and Fraas, pp. 28-30.
26. "Laser Fusion Claims: An Evaluation," *Science News* (May 25, 1974), p. 333.
27. *Physics Today* (March 1975), p. 20.
28. Metz, p. 603.
29. William J. Wilcox, Jr., D. M. Lang, and S. A. Levin, *Process Selection for New Uranium Enrichment Plants* (Oak Ridge, Tennessee: Oak Ridge Gaseous Diffusion Plant, 1975), pp. 7-8.
30. Benjamin B. Snavely, *Laser Enrichment of Uranium, Why, How, and When* (University of California: Lawrence Livermore Laboratory, September 3, 1974), pp. 2-5.
31. Lubin and Fraas, p. 33.
32. Benjamin M. Elson, "Laser Studied as Nuclear Power Trigger," *Aviation Week & Space Technology* (March 25, 1974), p. 46. Italics added.
33. Gillette, p. 1174.
34. James R. Schlesinger, "Nuclear Spread," *The Yale Review* (October 1967), p. 79.
35. Beaton and Maddox, p. 21.
36. Stockholm International Peace Research Institute, *Resources Devoted to Military Research and Development* (Stockholm: Almqvist and Wiksell, 1972), Chapter One.
37. Ibid., pp. 10-14 and 44-52.
38. *The Military Balance: 1973-1974* (London: The International Institute for Strategic Studies, 1973), pp. 74-75. This includes such nth countries as Czechoslovakia, East Germany, Poland, Canada, Denmark, West Germany, Italy, Netherlands, Spain, Sweden, Egypt, Iran, Israel, and Japan.
39. Beaton and Maddox, p. 22.
40. Ibid., p. 23.
41. Report of the Secretary-General of the United Nations, *Effects of the Possible Use of Nuclear Weapons and the Security and Economic Implications for States of the Acquisition and Further Development of These Weapons* (New York: United Nations, 1968), p. 28. Hereafter referred to as Report of the Secretary-General.
42. *United Nations Statistical Yearbook, 1973* (New York: United Nations, 1974), pp. 788-89.
43. John S. Tompkins, *The Weapons of World War III* (New York: Doubleday, 1966), p. 201.
44. Davidon et al., pp. 20-21.
45. Quester, p. 61.
46. Davidon et al., p. 24.
47. Report of the Secretary-General, p. 24.
48. Beaton and Maddox, p. 75.
49. C. J. E. Harlow, *Defence, Technology, and the Western Alliance* (London: The International Institute for Strategic Studies, I, 1967), p. 22.
50. Fischer, p. 33.
51. Schlesinger, p. 82.
52. Ibid., p. 73.
53. Davidon et al., p. 21.
54. *Nonproliferation Treaty, Hearings Before the Committee on Foreign Relations, U.S. Senate, 10, 11, 12 and 17 July 1968, p. 31.*
55. For an examination of these considerations, see the cross-national survey in SIPRI, *The Near-Nuclear Countries and the NPT* (Stockholm: Almqvist and Wiksell, 1972).
56. For the text of the Nuclear Non-Proliferation Treaty (NPT) and list of signatories, see Boskey and Willrich, pp. 151-68. Argentina, Brazil, and Chile are signatories to the Latin American Nuclear Free Zone Treaty.
57. See *A Strategy for India for a Credible Posture against a Nuclear Adversary* (New Delhi: The Institute for Defense Studies and Analyses), n.d.
58. James E. Dougherty and J. F. Lehman, Jr., editors, *Arms Control for the Late Sixties* (New York: D. Van Nostrand Co., Inc., 1967), p. 162.
59. I am indebted to Mr. Ryukichi Imai who advanced this interesting thesis in a different respect in his article "The Changing Role of Nuclear Technology in the Post-NPT World: A Japanese View," found in Holst, pp. 120-30.

Acknowledgment

I am indebted to Joseph M. Mack of the Los Alamos Scientific Laboratory, who introduced me to the advances being made in laser isotope separation and laser fusion. Both he and Professor Roger B. Handberg, Jr., of Florida Technological University, have offered valuable suggestions and critiques of this article.

The purpose of all but little people is not to dominate but to inspire, not strike fear into men or women but to enlist their goodwill, not to gain a point by fighting but to win support by making people want to get behind the plan.

The Royal Bank of Canada Monthly Letter
October 1954

HOW MANY times have you nodded assent during a meeting or as you coordinated on a paper, even when you did not totally agree? At the same time you may have recognized that implementation of the decision in its present form would not be feasible, and if put into action would lead to adverse and far-reaching consequences.

Today's leaders face rapid and continual change in a highly competitive environment. Change has become commonplace. To compete successfully—even to survive—leaders must adapt to these conditions by *managing* change. Thus, leaders must make timely and correct decisions to rectify deficiencies caused by changed circumstances.

DISSENT

the neglected factor in decision-making

COLONEL EDSEL R. FIELD

Much has been written concerning the importance of systematic approaches to executive decision-making. We have been taught, using various steps and terms, that we should identify the problem, consider alternatives, choose the best alternative, and implement the decision. Analytical and behavioral decision techniques continue to be advanced in various publications and courses. Are we, as a result, becoming increasingly successful leaders and managers? Is our greater knowledge of the decision process producing better results? I doubt it. George Odiorne supports this in his examination of the "activity trap," when he asks why things are going awry. New ideas should be improving the system, but their unintended side effects are in reality killing us.[1]

If you agree with these generalizations at least in part, then you agree that a fresh effort must be made to improve our decisions. We need to better understand why decisions are made as they are.

Typically, we Americans are anxious to find the trouble and fix it as quickly as we can. We learn early that successful leaders should attack problems quickly and decisively, that decisiveness and confidence are desirable traits—key indicators of the effective leader. This is especially true in the military, where "battlefield" decisions are considered the ultimate test.

However, we seem to do a poorer job of anticipating change than of reacting to it. We spend relatively little time considering the consequences of our solutions—consequences that often are worse than the original problem. This is where our decision process seems to be the weakest—in failing to evaluate the consequences of important decisions prior to implementation. In short, it is not enough to be change-oriented, we must be consequence-oriented as well.

A simple example might be of value here. However, such examples seem unnecessary when we consider the far-reaching consequences of our recent Vietnam and Watergate experiences. Decisions concerning "guns and butter," incursions into Cambodia, and "break-ins" will continue to affect and constrain our decisions, actions, and capabilities far into the future. Decisions by a limited few (concerning what seemed to be the central problem at hand) are causing us presently to spend considerable time repairing the unfavorable consequences of earlier incomplete judgments. Inflation, the War Powers Act, and loss of confidence in the basic integrity of government officials combine to reduce our effectiveness.

Look about you. Have our people and organizations profited from the lessons learned from Vietnam and Watergate? Open dissent concerning those important decisions was not visible; it was more important at the time to be a good team player. To some this indictment may seem too harsh—to be judging after the fact. They may be true, but the significant point is that we do not seem to have made a conscious effort to apply the lessons learned. We tend to think of those problems as being behind us, but the basic cause still exists.

Where are the Billy Mitchells of today? Is it coincidental that questioning our own military doctrine and strategies has been at low ebb since we began increasing emphasis on institutionalizing our decision processes? Increased standardization of rules and regulations and greater centralization in making those rules have removed many of the prerogatives of decision-making from leaders at lower levels. If new and conflicting ideas do not enter our decision deliberations, we should consider the cause rather than continue to mourn the consequences. That cause is at least partially due to the climate we create within our organization.

What are the alternatives? It appears much easier and the time better spent in questioning, debating, and dissenting before making a decision rather than trying to salvage the results of a bad decision at a later date. To

adopt such a methodology means that one must consider change on a wider scale than just problem solving. If executives are to be effective in the long run, they must evaluate alternatives not only in terms of the solution of an immediate problem but also in terms of the long-run implications of that solution. Peter Drucker points out that

> . . . effective executives do not make a great many decisions. They concentrate on the important ones. They try to think through what is strategic and generic, rather than "solve problems." They try to make the few important decisions on the highest level of conceptual understanding. They are not overly impressed by speed in decision making; instead, they know what the decision is all about—what the underlying realities are which the decision has to satisfy. They want impact rather than technique; they want to be sound rather than clever.[2]

A competitive and changing environment fosters a certain degee of risk and uncertainty for all leaders; decision-makers are essentially risk takers. It is seldom possible to gather all the information concerning a problem. Not only is it prohibitive from a time or cost standpoint but sometimes misleading. Facts are concerned with what has already happened; decisions are concerned with the future.

Ford's Edsel is a case in point. Considerable data were collected concerning the kind of automobile the American consumer preferred, but it was misleading because it did not identify changing attitudes. If yesterday's information were appropriate for tomorrow, there would be no need for decisions. Instead, we must draw on the opinions of others and try to learn which facts will still be relevant, and that means taking risks concerning what the future will be like. This requires a careful weighing of risks—do the benefits outweigh the costs?

The easiest way to avoid risk and uncertainty is to deal with the present rather than the future, to concentrate on immediate problems rather than far-reaching strategies. No wonder so many organizations consist of people who are continually putting out fires, staying busy (but comfortable) in their "activity trap." Our decision methodology actually encourages such activity.

In the military, we are taught the staff study method, a very systematic and formal decision process. Its limitation, however, is that it considers problems, not objectives. Each action officer attempts to restrict his problem as much as possible so as to sell his solution with the least possible opposition. "Completed staff work" implies that the various alternatives have already been questioned and argued. Actually, constructive debate about alternatives seldom takes place. Instead, the positive aspects of the preferred solution are emphasized. Staff members normally have vested interests in the outcome—increased power, prestige, and reward for being a problem solver are powerful incentives. The pressure to be a positive team member is very strong, and the role of the devil's advocate is considered to be a hindrance to action.

Such an environment produces decisions that appear optimal on the surface, decisions that indicate consensus among the key people. But a similar consensus on the adverse effects of the decision frequently does not exist. Questioning and dissent on how the decision will affect the overall organization are typically not encouraged. As a result, the department that has the action is usually the only one interested in the implementation of the decision.

The Japanese method of decision-making takes a very different tack. Policy changes are debated throughout the organization until agreement is reached. The emphasis is on defining the question and transmitting information. When the decision is finally made, there is more ready acceptance, and implementation proceeds smoothly.[3]

The American method jumps to the decision much more quickly. We tend to want to overcome obstacles and motivate people to get the job done successfully.

The difference between the two approaches is that the Japanese spend their time involving people in the decision process while we Americans spend our time trying to implement the decision. The most significant contrast is the point in time during which leaders attempt to *challenge the behavior* of people so that new procedures will be followed in more purposeful and productive ways.

The Japanese way is understandably cumbersome and inefficient if it is applied to minor decisions or to decisions that must be made quickly. We need to understand that different situations call for different leadership styles, ranging from autocratic to participative. Therefore, dissent and questioning are not always appropriate. However, the greatest value of dissent and questioning is found in higher-level policy decisions where adverse consequences would be disastrous and especially when effective implementation requires acceptance by subordinates.

Innovation has become a way of life in an environment where doing "more with less" is not only in vogue but necessary for survival. To encourage innovation, organizations frequently create ad hoc groups to study and recommend new and fresh ways of doing things—of keeping up with change. The military is no exception. Ad hoc groups are less constrained by established procedures and freer to cut across bureaucratic lines. But even those decisions made in this innovative atmosphere must be implemented within the established hierarchy. Since the implementers of the decision were not consulted during the deliberation, the outcome of the change largely depends on imposing or successfully selling the decision. Consensus and understanding among those who must execute the decision probably play the most important part in the ultimate success of any change.

In recent weapon acquisition programs one can find examples of attempts to analyze the consequences of decisions prior to their implementation. After several problem acquisition programs during the 1960s, the President's Blue Ribbon Defense Panel in 1970 recommended a "fly-before-buy" approach, one in which greater technical realism and testing would augment the paper studies of the McNamara era.[4] This was in reaction to serious cost overruns and problems encountered with systems like the C-5A and FB-111. Considerable discussion and questioning took place at the operating level during the planning for these aircraft concerning roles, missions, and requirements and capabilities. The failure to actively *challenge* requirements prior to the ultimate decision partially contributed to subsequent problems in both of these very vital national defense programs.

The "fly-before-buy" approach attempts to see just how new ideas will work before committing them to costly development and production stages. The production decision occurs only after careful testing and a thorough evaluation of life-cycle costs.

These same principles can be applied to other decisions. The complete consequences of a decision must be forced into the open. Future benefits and total costs must be realistically weighed and debated. If the decision can profit from a trial test (such as with flights of the Concorde aircraft into certain airports), it makes sense to do so. If a test is not feasible, wide-ranging viewpoints must be solicited. The more critical the decision, time permitting, the greater the number of views which should be sought. Dissenting or diverse viewpoints ultimately strengthen the final decision.

How can we provide the methods needed for better decisions? It appears that our decision process needs revision in two basic areas. First, alternatives need to be considered in light of overall objectives, not just compartmentalized problems. Second, greater constructive debate and dissent prior to the making of decisions are needed and should be *encouraged*. If dissent does not occur, the decision-maker must become the protagonist. He must ask such questions as *how* will this decision better

promote organization objectives? And *what* could go wrong with all of this?

The decision-maker must set the climate for active and well-thought-out dissent. That climate is easier to establish once the decision-maker realizes that the real threat to authority occurs when dissent takes place during the implementation of the decision and not during the deliberation stage.

As an example, changes such as eliminating intermediate headquarters or adding consulting teams mean that we plan to change the way people will interact (behave) within the organization—to elicit that behavior which will get the job accomplished more effectively for the dollars expended. However, before implementing any change, we should have a very clear idea of what that decision will do to the behavior of our organization. How will *communication* be affected—will it be faster, more direct, and complete? What happens to *decision-making?* Is it improved? Will the right people make the decisions? What about *conflict*—are we creating conflict by not clearly delineating responsibilities? Do we have to sell or impose the idea throughout the organization? Are we creating a situation that yields more effective use of our *human resources,* one in which our best people will want to stay? What about *cost*—are we expending our resources where the marginal return is the greatest?

This kind of questioning requires a more thorough analysis of the entire situation. We must consciously weigh the decision's advantages and disadvantages and make only those changes that clearly benefit the organization. For example, the consolidation and centralization of our organizations may show dollar savings in the short run but hinder ongoing efforts for increasing the effectiveness of our people.

We should continue to look for better ways to communicate within the hierarchy. However, the elimination of intermediate headquarters does not mean that corresponding decision authority automatically ascends to higher headquarters; instead, it should be delegated to lower levels when the need and analysis so dictate.

We must, therefore, continue to ask ourselves, "What is it that we are really trying to accomplish?" The overall answer should be to provide maximum effectiveness of our war-fighting capability within an ever changing environment. That calls for some hard questions and tough answers from our best people at all levels.

The task, then, is to intelligently and consciously hedge against that uncertain future—to use all of the tools and information available. This is probably why some executives exercise intuitive judgment so well. They have the ability to estimate on a wider range the future possible effects of their actions. They avoid actions which they "feel" have high probability of producing serious loss; however, a systematic and conscious examination and inquiry are good substitutes for such intuition.

At your next meeting, if there is no disagreement concerning an important decision, reflect a while on these words of Alfred P. Sloan, Jr., who said at a meeting of one of the General Motors top committees (during the 1920s):

> "Gentlemen, I take it we are all in complete agreement on the decision here." Everyone around the table nodded assent. "Then," continued Mr. Sloan, "I propose we postpone further discussion of this matter until our next meeting to give ourselves time to develop disagreement and perhaps gain some understanding of what the decision is all about."[5]

It is interesting to note that the matter in question was not adopted during the next meeting.

These remarks are not meant to advocate committee action or a retreat from decisiveness. Responsive and responsible leadership is probably more important now than ever before. These remarks are, however, a call to actively involve those who best understand the

situation and who are closest to the problem. Those people are often other than the immediate staff and advisers to the executive. Participants may include a larger group or only a few, either individually or collectively. This is perhaps the successful leader's greatest ability—to identify those subordinates who are best qualified to aid in a specific decision. The extent of participation and the techniques used to foster it are necessarily dictated by the urgency and importance of the situation in question.

Most of our great presidents have understood the value of conflicting opinions. Washington knew and valued the frequently divergent views of Jefferson and Hamilton. Those presidents who sought conformity are remembered more for their lack of accomplishment. For it is only through dissenting views that new alternatives and creativeness can surface. It is not possible to have new solutions without new and differing ideas and opinions.

Some decisions, such as those that involve safety and dynamic operations, must be made quickly. However, executive decisions are normally not that pressing. Leaders must take time to ensure that the right questions get asked. If these questions are not asked, then complex policy decisions will be made by a single individual within a small circle of confidants (in at least a partial vacuum), and subordinates will continue to react to and resist implementing decisions they do not and cannot understand.

During the past few years, there has been growing appreciation of the role which involvement plays in the decision process. The decision process at the national level has seen a proliferation of advisory groups, the best known and most influential being the National Security Council. The Air Force Board Structure is also a highly formalized body of advisory groups that highly influence our decision-making elements. General William V. McBride recently remarked that "the Air Force Board Structure permits the best minds and the best effort to be placed on corporate concerns, with the leadership able to tap their advice and experience before making a decision."[6] This process also recognizes that the broader the base of support for a decision, the better is the possibility for successful implementation.

There is need to transfer this concept to our overall decision process. Our leaders must be given the flexibility they need to do the job—to involve, when practicable, the decision capability at the level that knows most about the decision.

Our military organizations need to get back to employing all of our leaders, the people we have hired and the people we hold responsible for guiding and directing our organizations, especially our middle leaders and managers. When we first began to experience substantial external change during the 1960s, our leaders found that the bottom (operating) level of our organizations increasingly did not accept and implement directions from the top. Since a climate for dissent did not exist within the hierarchy, there arose a need for the top to find out what problems existed at lower levels. The result was that the top increasingly bypassed middle management and went directly to the operating level through mediums of inspection, various councils, and the like.

The results have not been encouraging. In fact, they have often been disastrous. In some instances, lower levels demanded that the top hear their problems directly; dissent became violent in other instances. Middle leaders responsible for putting decisions into action were and are even now largely excluded from participating in making decisions that directly affected their daily activities. The point is that we need a forum for dissent, but differing views most fruitfully occur *within* the structure which we have carefully created and staffed.

Ultimately, a decision process that continually bypasses our middle leaders will fail. Lower levels that report directly to commanders and reliance on external change agents are

basically "quick fix" arrangements. They are indicators of an *unhealthy* organization—one that needs to get back to the basics of managing *within* its established capabilities. Lasting change can only occur *within* the group of people who have daily responsibilities for the unit.

We should realize by now that arbitrary decisions are seldom implemented as originally conceived, because considerable power to resist exists at lower levels. On the other hand, decisions which capitalize on the knowledge and experience of those on the firing line have little trouble being placed into action. Involvement breeds commitment, and commitment produces team action.

If the foregoing is correct, the time has come for us to shift our yes men from the decision mode to the implementing mode, and to bring our dissenters out of the implementing mode and into the decision mode. We must encourage—even demand—questioning and well-thought-out dissent from our knowledgeable people and make it a part of our decision process. Once the decision is made, we need to press on positively and strongly with its implementation.

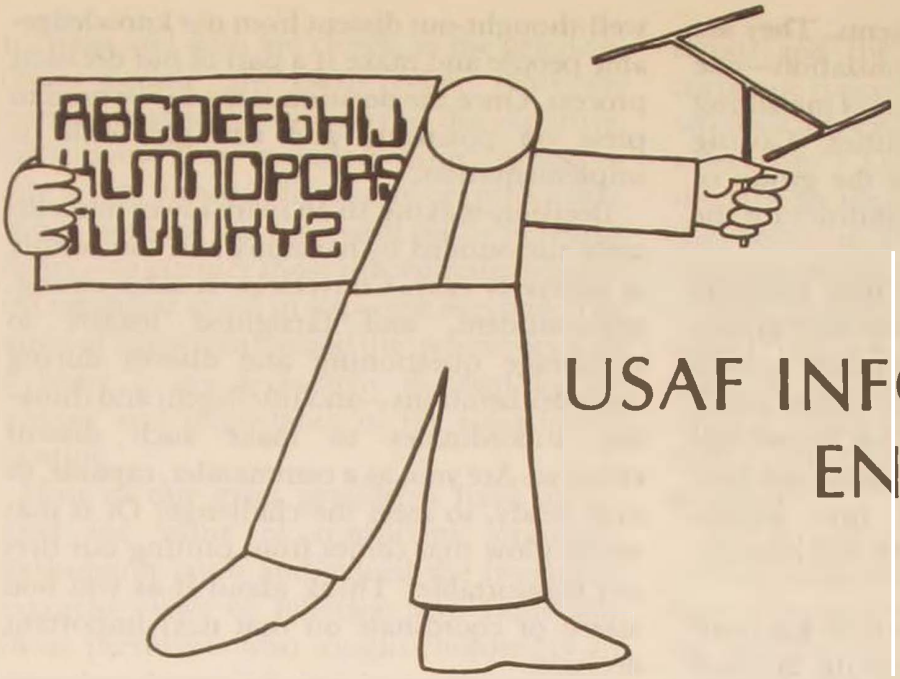
Decision-making in an ivory tower immediately surrounded by harmony and conformity is relatively easy. Conversely, it takes strong, self-confident, and farsighted leaders to encourage questioning and dissent during their deliberations—and intelligent and thinking subordinates to make such dissent effective. Are you, as a commander, capable, or even ready, to meet the challenge? Or is that warm glow that comes from putting out fires too comfortable? Think about it as you nod assent or coordinate on that next important decision.

It may well be that our ability to question and the freedom to think and act may be our single most important advantage in any future conflict with our potential adversaries.

Air War College

Notes

1. George S. Odiorne, *Management and the Activity Trap* (New York: Harper & Row, 1974), p. 5.
2. Peter F. Drucker, *The Effective Executive* (New York: Harper & Row, 1967), pp. 113, 114.
3. Peter F. Drucker, *Management* (New York: Harper & Row, 1974), pp. 466, 467.
4. *Report to the President and the Secretary of Defense on the Department of Defense Panel* (Washington, D.C.: U.S. Government Printing Office, July 1970), p. 74.
5. Drucker, *Management*, p. 472.
6. General William V. McBride, "The Air Staff—A View from the Top," *Air Force Magazine*, April 1976, p. 28.



USAF INFORMATION ENGINEERING: 1990 PLUS

MAJOR JERRY C. HIX

Good evening! Time: 2200. Date: 3 June 1990. Welcome to Futucomm AFB. I am UNIBAC, the central base computer. Please insert your precoded, sensitized ID card into the terminal and repeat your name, rank, and serial number for voice print authentication. . . . As you can see from the display screen, your records have already been filed with me, and I will update your personnel file and inform the CBPO, finance, and your duty unit that you have arrived. I have also verified that all your family medical and dental records are here. Please call 834-1716 if you have any questions. Thank you and good night.

THIS SCENARIO sounds strange even to those of us who have lived with the relatively sophisticated communication systems of the '70s. But project yourself into 1990 and a closer look at your surroundings shows that they are even less familiar.

Few clerical people are assigned to your office in the base aerospace maintenance complex. Instead, your terminal, consisting of a keyboard and video system tied to the base computer system, does the work that formerly required many base support people such as secretaries, stock clerks, posting clerks, runners, switchboard operators. For instance, by pressing the "dictation" button on the terminal, you can edit the text as it is displayed on your screen and receive a finished copy for signature. The letter is also forwarded through the system to other offices for coordination and filing as necessary.

In addition, through your video terminal you can participate in conferences and briefings, check the maintenance status of projects, refer to the latest technical order data updated by video messages from Air Force Logistics Command, and give and receive training—all without leaving your desk. If you are moving around the base, messages reach you over a pocket unit, or your terminal stores all routine messages until you return. All this

freedom from confining, routine administrative details gives you more time for your primary job, managing.

Sound fanciful? Just look at all the technological developments of the past ten years. The truth is we now stand on the verge of communication changes that will vastly alter and improve the way we do business.

According to author and information futurist Ben Bagdikian:

> In the near future, the computer linked to electronic communications will probably alter personal and social life in ways comparable to the combined changes produced by the telephone, automobile, and television in the last 90 years, but do it in the life-time of most of us.[1]

These far-reaching communication developments will impact virtually every aspect of our lives and certainly have a profound effect on how USAF managers function. Hopefully, by giving some insight into what is coming, this article can help avoid the "future shock" these developments portend. for the average USAF manager.

In future communications, two key technological areas—coaxial or cable television (CATV) and word processing computers—seem to hold most potential for USAF application.

Cable Television

To understand cable television, you must first understand the nature of television. Television has been called the greatest instrument of human communication ever developed. Certainly, it is the most pervasive force in American life today. As Nicholas Johnson, former FCC commissioner, states:

> There are 60 million homes in the US and over 95 percent of them have TV. (More than 25 percent have two or more.) In the average home, TV is turned on some 5 hours and 45 minutes a day. The average male viewer, between his second and 65th year, will watch TV for over 3000 entire days—roughly nine full years of his life.

Further, according to Johnson, Americans receive much more of their education from TV than from elementary and high schools. "By the time the average child enters kindergarten," he continues, "he has already spent more hours learning about his world from television than the hours he would spend in college earning a bachelor's degree."[2] Unfortunately, all this exposure is not necessarily good, and television has been blamed for everything from increased violence and drug use to the trivialization of the nation's brainpower.[3]

American public television, including educational TV, has put up a good fight to provide alternatives, but its history is marked by persistent developmental problems that have retarded its growth. These include an unsteady relationship with government, confusion over its mission and intended audience, and, above all, chronic underfinancing. Despite these problems the Public Broadcasting System has managed to offer some excellent programming.[4]

Given public television's chronic difficulties and commercial television's 25-year big business profit-motivated history, you might well ask how television will ever reach its full potential as a communication medium. The answer probably is not in either of these systems, but the abundance of outlets and innovative opportunities of cable television offer great potential.

Cable or Community Antenna Television (CATV) is not new. The first system was constructed in 1948, only a few years after commercial television broadcasts began in the U.S. As its name implies, CATV consists of a large central antenna, amplifiers to boost the signal, and cables connected to subscriber homes. Until recently, CATV's sole purpose was to give poor reception areas an increased number of channel options, but recent technological developments have broadened cable's capabilities with the promise of more to come.

Early systems could relay no more than five to seven channels. Modern systems can carry up to 30 channels and, in the future, may have any

number of multiples of 20 up to 24,000.[5] Two-way communication via cable, though not perfected, has been demonstrated experimentally, and computer digitization of video signals is feasible and could vastly increase system versatility. The cable industry is also currently investigating the possibility of linking cable systems nationally via satellites.[6]

Thus, the prospect of cable television, computers, and satellites linked in a common carrier system could produce yet another communication revolution this century. Think of the great variety of innovations possible in this "wired world" environment. The cable is as accepted as the telephone and as necessary as the mail.

Of course, cable television is not a panacea. It has problems—primarily a lack of money and regulatory limitations imposed by the Federal Communications Commission (FCC) under pressure from network lobbies. These opposing forces have combined thus far to keep CATV from fulfilling the predictions of the prestigious 1972 Sloan Commission. In its projections for CATV, the commission stated that, "Its (CATV) impact on society's most immediate needs might be enormous."[7] The optimism of the report was based on the belief that 40 to 60 percent of all American homes would be "wired" by 1980. To date CATV has reached only 15 percent of American homes, but with favorable legislation in the next few years to ease some restrictions, it could be in 90 percent of the urban homes by 1990.[8]

USAF and the Cable

How has the Air Force reacted to this potential communication revolution? Until recently, not very well. Certainly, USAF has been using closed circuit television (CCTV) in education, security, and weather programs for some time. However, these and other systems were procured to satisfy "specific" communication requirements. This approach has resulted in a proliferation of specialized systems with little or no interface capability with present or follow-on systems.[9] This inherent equipment limitation was further aggravated by rapid technological change and a lack of comprehensive communication plans. There has also been some confusion as to how the USAF should use television.

The 1970 AFR 100-1, "Closed Circuit Television," listed six managerial uses for TV:

- Immediately interchange audio-visual information to meet an operational requirement.
- Immediately transmit audiovisual information to expedite decision-making at high echelons of command.
- Achieve face-to-face communication capability.
- View events of major significance as they occur.
- Attain real-time reporting.
- Achieve data remoting.

The 1975 version deleted all reference to managerial applications and now recognizes only four routine uses for CCTV: R&D instrumentation, audiovisual production, surveillance, and weather briefing. (Note: There really is little difference between CCTV and CATV. Both use a cable, and both are capable of providing a wide variety of services. CCTV is usually used to refer to a smaller closed system within a building or facility.)

Present USAF policy for CATV in AFR 70-3, "Cable Television (CATV) Systems on USAF Installations," and AFR 190-18, "USAF Internal Information Program," is equally lacking. AFR 70-3 is devoted to CATV franchise agreements and, in many respects, is a valuable document. One area that should be re-examined, however, is the provision of one reserved on-base channel as a franchise fee. One channel will not be enough to handle future base needs, and since this current policy is based on today's small-volume systems, it fails to consider the vast capabilities of the future. Perhaps exacting a percentage of total

channels available would be wiser than asking for a specific number.

The information regulation, AFR 190-18, presents a similar problem in that it perpetuates a traditional view of CATV as largely a commercial TV reception improvement device. While it does propose some base CATV uses, such as broadcasting commander's call, base orientation, and other programs, its narrow view does not recognize the true potential of the cable in future base information systems.

One of the central problems concerning USAF's entry into the cable age is the lack of a single Office of Primary Responsibility (OPR) for system development. An October 1976 Secretary of the Air Force Office of Information (SAFOI) study showed that of the 48 bases with CATV installed, only 56 percent obtained the required franchise fee dedicated channel. Further, none of the 27 bases that had the channel had any comprehensive use plans. Only six bases had designated OPRs, and these six chose the office of information.[10] Given the tremendous potential of the cable as a base communication asset, it would seem more prudent to charge the base communication unit with responsibility for developing plans that could benefit all potential base users through base Communications Electronic Meteorological Board activities.

So, there is great promise in CATV, but there are severe regulatory and economic problems that must be overcome before the promise can be fulfilled. There is also a philosophical question that must be answered in the USAF. What role will CATV play in future USAF communications? Beyond these problems, however, is the fundamental question of "how much information people can absorb." The cable, with its abundance of choice, could overload the human reception capability.[11]

Word Processing Computers

One area where we are already overloaded is in printed pages. As Bagdikian points out, "The fact is that print, for quite prosaic reasons, may be reaching the upper limits of its usefulness to man: the accumulation of published paper since the invention of printing five hundred years ago has become so massive that it is too difficult to manage."[12]

Newspapers, along with all forms of printed material, have experienced massive multiplication of printed pages. In the last 20 years, the number of pages entering the home has increased two and one-half times, and a 400-page Sunday paper is not uncommon. Such a paper is the equivalent of more than sixteen 300-page books.[13] It is not surprising, then, that our newspapers spend more than 80 percent of their budgets on production.[14]

There is some parallel between newspaper production and USAF administration functions, and anyone who has fought the never-ending "battle of the in basket" knows how much USAF paperwork volume has increased. Since the written word is key to both operations, perhaps we can learn from the newspaper industry's application of computers to word processing functions.

Every newspaper has a system for converting news into type. New typesetting machines are much more efficient than older models, but there is still a great deal of time lost in the editing process. Usually, the writer has the basics in his story, but some editing is required. The key is to preserve as many of the original keystrokes as possible without retyping after each editing process.[15]

Computers, video display terminals (VDT), optical character recognition (OCR) machines, and other forms of new technology are beginning to decrease editing time. Typed copy with minor editing marks is now fed through an OCR machine and converted into type at vastly improved speeds up to 1500 words a minute. This process is good for volume input but tends to be ineffective when copy must be heavily edited.[16]

Video display terminals, on the other hand, seem to hold the most promise for speed in

editing. By pressing a button, an editor can call up any story from computer storage to his video screen. Working with a keyboard (or light pencil on more sophisticated versions), he can add or delete words and rearrange paragraphs as required. This process can be repeated by any number of editors, and when the story is ready, it is fed into computerized typesetting machinery and then printed.[17] Thus, scanners are great for volume input, but video terminals are better for selective input and editing. In addition, they provide direct computer links and ready access to a variety of reference information at computer-to-computer speeds of 2400 words a minute.[18]

But newspapers are not alone in their recognition of the economies word processing computers can produce. Other industries are beginning to establish word processing centers that concentrate all administrative support paperwork functions in one area. This allows for cost-effective use of modern electronic office systems to extend worker productivity. The USAF is very much interested in this concept, and phototype centers have been set up at Hq USAF and several major commands. However, here, as in the CATV area, there is little central guidance, and the commands seem to be developing their programs independently.

So most of the computer technology mentioned in the opening scenario is available today and in the embryonic stages of employment. Why, then, is the USAF scenario dated 1990? Well, USAF has been studying local communication updates for some time, but thus far there has been little real progress. With the current and the predicted funds shortages, most of the USAF's communication development efforts are going toward new command and control communications (C^3) systems such as the World-Wide Military Command and Control Systems (WWMCCS). Nevertheless, there is a very real need to modernize intraoffice/intrabase communication networks.

Looking toward the Future

USAF actually began examining local communication improvement options in the early '70s. In 1972 MITRE Corporation completed a year-long study on using the CATV "wired city" concept for an improved base network. They proposed a Universal Intra-Base Communications (UNIBAC) system that would integrate data processing with audio and video signals to form an interactive information handling system capable of providing a wide range of services. The system would allow offices to tailor terminal configuration to particular needs through various modular keyboard and video display configurations. Although telephone services were not included in the system, current telephone equipment is compatible with the UNIBAC concept.[19]

Rather than proceed with the MITRE proposal, USAF chose to establish a Base Communications Analysis (BCM) group to study alternatives further. This represented an initial in-house effort to identify, investigate, and propose conceptual solutions to base information transfer problems on a total system basis projected into the 1985 time frame. Base communications, administrative services, and data automation—the user groups primarily concerned with intrabase information transfer—were included in the study along with 20 other functional support areas.[20] Interestingly, the information function, which is a key element in information flow and is being entrusted with USAF's growing CATV assets, was not included in the analysis.

To anyone involved with base communications, the BCM groups initial assessment of current base systems was predictable. They found a proliferation of subsystems, designed to meet specific user needs, with major interfacing problems. While long haul systems had improved dramatically, they saw base systems that had remained relatively stagnant over the past 30 years.[21]

For example, most base telephone exchanges are step-by-step electromagnetic systems operating on the same basic design as a 1928 exchange. They are expensive to maintain and operate, but they do meet most basic user needs. Where they have not met increased digital data needs, "engineering by addition" has produced the current incompatibility problems.[22]

We can transmit a message half way around the world in a few minutes, but the process and time required to get it to and from the base communication center is about the same as in 1947. About the most significant changes in the base distribution system over the past three decades have been the introduction of the electric typewriter and the trade-in of bicycles for mobile distribution vans.[23]

The BCM study group looked at six alternative concepts:

- Concept 1 was to continue operating and maintaining the various parallel subsystems that now comprise the base information transfer system and respond only to individual program requirements for new capabilities. In other words, more diverse proliferation.
- Concept 2 provided a new electronic analog circuit switch to handle integration of most special circuits. Video circuits were handled by a separate dedicated system.
- Concept 3A simply represented a further refinement of Concept 2 and was a dead end in achieving total system integration.
- Concept 3B preserved the present telephone switch and provided a CATV-type broadband transmission medium—a dual coaxial cable in tree configuration—capable of handling all digital and pictorial services in one distribution plant. The digital add-on capability of the system seemed to make it a logical evolutionary step in total system integration.
- Concept 4A provided an all-new set of distribution hub switches with a common control center. Obviously, this is a very expensive and complex option.
- Concept 4B was an extension of Concept 3B using narrow-band frequency slots to provide the necessary analog channels to incorporate the telephone system.[24]

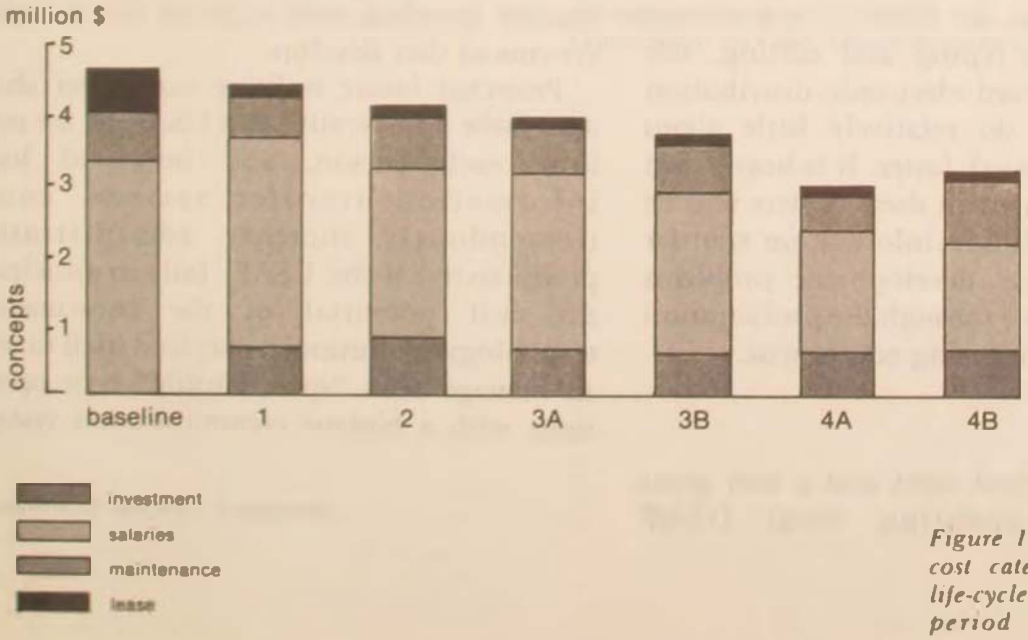


Figure 1. Concept evaluation by cost categories (average annual life-cycle costs over a 16-year period by cost categories)

The Air Force must pursue one of these latter options to obtain an integrated system. Given the preference for incremental funding, it would probably be more viable to obtain Concept 3B capability and then add the Concept 4B option later. Also, life-cycle cost data over a 16-year period (Figure 1) show that all alternatives have a lower operating cost than present labor intense Concept 1 operations. To date, however, USAF seems to be continuing down the same old path, using add-on engineering to accommodate new requirements.

Meanwhile, USAF's administrative people apparently have tired of waiting for a new communication system to develop and have pressed for the development of the new word processing centers mentioned earlier. One of the more promising efforts in this area is Air Force System Command's Project IMPACT (Improved Administrative Capability Test). The project is designed to demonstrate an optimal automated office system that will provide the greatest benefits in reduced manpower and increased administrative efficiencies. Results of the test, which will be conducted over the next three years at Electronic Systems Division, should help develop and refine criteria for automated office systems throughout the USAF. These centers promise to speed typing and editing, but without an improved electronic distribution system, they can do relatively little about moving the paperwork faster. It is hoped that the systems employed in these centers will be compatible with future information transfer systems. Otherwise, development problems will be compounded through the proliferation of diverse word-processing equipment.

THERE IS a very real need and a very great challenge in updating local USAF information systems. The Air Force needs a new intraoffice/intrabase communication system, but there are many problems associated with developing such a system. Designers face complex choices in a wide variety of design options, and customer requirements are difficult to determine. New systems involve high-risk technology and are difficult to phase in to existing installations. The ideal system should provide efficient, modular elements that can be economically connected to any appropriate information resources. The challenge is to develop a planned evolutionary process to integrate new technology with existing systems.[25]

USAF has been trying unsuccessfully for the past five years to develop such a concept. Insufficient funds and lack of central direction have contributed to the inability to define an Air Force system adequately. The recently established Assistant Chief of Staff, Communications and Computer Resources, should provide the necessary cohesive direction, provided USAF adopts the philosophy that modernization is essential and is willing and able to devote sufficient funds toward such a system. In developing its plan, USAF should ride piggyback on civilian CATV wherever possible, to save money and provide interface with regional and national systems as they develop.

Projected future military manpower shortages make it imperative that USAF get the most from each person, and improved local information transfer systems could tremendously increase administrative productivity. If the USAF fails to anticipate the full potential of the information technology revolution, it may find itself unable to manage 1990 "space shuttle" type operations with a biplane communication system.

Aerospace Defense Command

Notes

1. Robert J. Glessing and William P. White, *Mass Media: The Invisible Environment* (Palo Alto, California: Science Research Associates, Inc., 1973), p. 306.
2. Ibid., p. 3.
3. Robert J. Glessing and William P. White, *Mass Media: The Invisible World Revisited* (Palo Alto, California: Science Research Associates, Inc., 1976), p. 26.
4. Ibid., p. 23.
5. Glessing and White, *Mass Media: The Invisible Environment*, p. 308.
6. Glessing and White, *Mass Media: The Invisible World Revisited*, p. 23.
7. Ibid.
8. Ibid., p. 24.
9. Lt. Col. D. L. Eppinger, USAF, "Cable TV (CATV): Commercial Growth and Air Force Application," Unpublished Air War College Study, Air University, Maxwell AFB, Alabama, 1973.
10. USAF, Secretary of Air Force, Office of Information, "Air Force Cable Television Survey," Washington: SAFOI, December 1975.
11. Glessing and White, *Mass Media: The Invisible Environment*, p. 308.
12. Ben H. Bagdikian, *Information Machines: Their Impaction Men and the Media* (New York: Harper and Row, 1972), p. 190.
13. Ibid., p. 193.
14. Glessing and White, *Mass Media: The Invisible World Revisited*, p. 53.
15. Ibid.
16. Ibid., p. 55.
17. Ibid., p. 54.
18. Bagdikian, p. 180.
19. USAF, Air Force Systems Command, *UNIBAC: Concepts and Applications*, vol. 1, Bedford, Massachusetts: MITRE Corporation, 1972, p. 8.
20. USAF, Air Force Systems Command, *Mission Analysis on Air Force Base Communications: 1985*, vol. IA, Hanscom Field, Massachusetts: Electronic Systems Division, 1978, p. 1.
21. USAF, Air Force Systems Command, *Mission Analysis Air Force Base Communications—1985*, vol IB, Hanscom Field Massachusetts: Electronic Systems Division, 1973, p. 6.
22. Ibid., p. 4.
23. Ibid., p. 5.
24. Ibid., pp. 58–71.
25. USAF, Air Force Systems Command, *UNIBAC: Concepts and Applications*, p. 1.

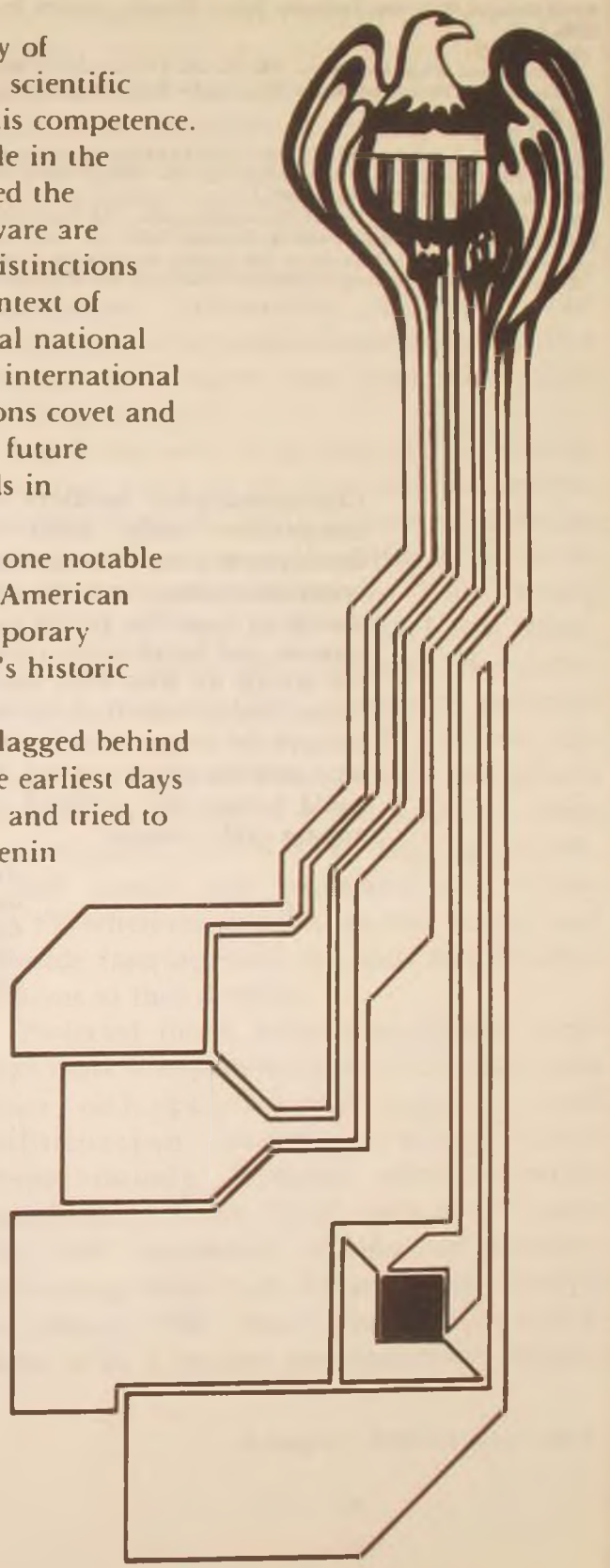
Communications satellites will be complementary to, not competitive with, cable systems. Two recent technical developments are of major importance for the future of satellite communications: random access (making it possible for any earth station in a satellite system to communicate with any other earth station), and broadcasting capability. Thus satellites are likely to be the vehicle for large-scale interconnection of cable systems in the future, and are also likely to be the vehicle that provides broadcast services for homes that are beyond the reach of either cable or terrestrial broadcast systems. Much farther in the future, satellites could become the preferred vehicle for switched interconnection among cable systems.

ABRAM CHAYES, "The Impact of Satellites on Cable Communications"
On the Cable: The Television of Abundance. Report of the Sloan Commission on Cable Communications

MILITARY TECHNOLOGY

the Soviet perspective

PAUL M. KOZAR



THE TERM "technology" suggests a variety of meanings. It may define a body of applied scientific knowledge or even the actual product of this competence. Moreover, advanced technology may not be visible in the product itself but rather in the process that created the prototype. Integrated circuits and computer software are obvious examples.[1] However, such definitional distinctions become academic when considered within the context of national security. Technology emerges as a critical national resource and an equally important dimension of international political power. Most industrially advanced nations covet and nurture this asset. Consequently, a perception of future technological trends may well emerge from trends in acquisition and development.

The Soviet Union shares this perspective with one notable exception. The Soviet leadership's perception of American technology is filtered through the lens of contemporary Marxism-Leninism and a unique view of Russia's historic relationship with the West.

Historically, Russia, with few exceptions, has lagged behind the West in technological development. From the earliest days of the Soviet state, its leaders recognized this fact and tried to rectify it. In 1921, for example, an exasperated Lenin complained,". . . it is necessary to establish who

will be responsible for acquainting us with European and American technology clearly, timely, practically and not formally."[2] Three years later, Joseph Stalin concluded that "American efficiency . . . combined with the Russian revolutionary sweep" are essential to the successful construction of socialism in Soviet Russia.[3] Neither statement is surprising when considered in relation to the observation of Dr. Herbert S. Levine, an economist at the University of Pennsylvania, that ". . . modern Russian history—from the middle of the 15th Century to the present day—had been dominated by the need perceived by Russian leaders to catch up with the more advanced nations of the West."[4] This motivation has not abated in recent years. On the contrary, it has assumed even a greater sense of urgency. In a 1969 address to the International Conference of Communist and Worker's Parties, General Secretary Leonid I. Brezhnev declared:

> . . . we must compete in the scientific-technical arena. The struggle here will be long and hard. But we are resolved to carry it out seriously to prove the supremacy of socialism.[5]

Such competition is not only a reflection of the "historically inevitable struggle between socialism and capitalism" but the essence of a new stage of socioeconomic development. The 1961 Soviet Communist Party Program concluded that ". . . humanity is entering a period of scientific-technical revolution associated with the mastering of nuclear energy, the conquest of space, the development of chemistry, the automation of production and other enormous achievements of science and technology."[6] Over time this concept has proved to be more substantive than polemical.

> It [the scientific and technical revolution] defines the accepted ideological stance toward science and its social role. The concept's development is a way of seeking popular support for leadership goals. It also assigns a national priority to science and scientific achievement and exhorts greater effort from the scientific community.[7]

This interpretation by Dr. Thomas P. Kridler of the U.S. Air Force's Foreign Technology Division offers a framework within which to gauge the actual Soviet commitment to science and technology. During the decade of the 1960s, the U.S.S.R.'s research and development establishment expanded rapidly. For example, the number of research institutes increased from 1729 in 1960 to 2388 in 1969.[8] By the early 1970s the Soviets claimed that one out of every 250 people in the nation was employed in science; the growth in the science labor force exceeded by several times the growth in the nation's total labor force; and, furthermore, 15 percent of each annual college-level graduating class entered a scientific career.[9] Between the years 1970 and 1976, Soviet scientific and engineering manpower engaged in research and development increased from 600,000 to 800,000 individuals.[10] It is estimated that during the same period, at least a quarter million engineers were graduated annually. This is five times greater than that of any other country in the world.[11]

A major effort in the Soviet drive to catch up and surpass the West is devoted to the application of science and technology to military needs. "Scientific research should be subordinated primarily to the interests of further strengthening of the army and navy."[12] The judgment is that of Victor G. Kulikov, Marshal of the Soviet Union and Commander in Chief of the Warsaw Pact Forces. Moreover, this assertion is corroborated by the growth in Soviet research, development, test, and evaluation expenditures since 1964. In thirteen years, this financial investment has increased from approximately $9 billion per annum to a current expenditure of about $20 billion.[13]

One of the principal formulations created by Soviet military theoreticians to explain and

justify this commitment to military-oriented research and development is the ". . . sharp, leap-like transition from conventional to nuclear-missile weapons as the main means of waging war and the corresponding new means of achieving the basic aims of the war, [which] comprise the essence of the contemporary revolution in military science."[14] The "revolution in military affairs" demarcates a historical period concurrent with the revolution in science and technology.

The first stage began in the Soviet Union with the "creation of atomic weapons" in 1953, and it was followed in 1960 by the "emergence of a carrier for the atomic charge (rockets) and the creation of nuclear-missile weapons" under the control of the newly established Strategic Missile Forces. Both the U.S. and the U.S.S.R. are now in the midst of the third and final stage. It is characterized by the "comprehensive automation of military equipment and the combat actions of troops, the intensive introduction of scientific knowledge into the military field, notably for control of troops."[15]

In their survey of military applications of automated control and management systems in the United States, V. A. Baranyuk and V. I. Vorob'yev noted that while the employment of an excessively large number of different types of computers is an important deficiency of such systems, the immediate prospects in this field include the standardization of hardware, the development of time-sharing multiprocessor computers, and the development of mobile computer systems for troops control in the field. The authors urge their Soviet counterparts to analyze foreign experience critically "in adopting means of automation in the practical activities of headquarters staffs and military establishments" in order to reach the "most objective conclusions."[16]

The impact of science and technology as manifest in the "revolution in military affairs" is considered by many Soviet military analysts to be the most important condition and the basis for raising the military might of the capitalist states.[17] Yet, a fundamental question remains: What are the technological aspects of this "condition," and how are they perceived by the politico-military hierarchy of the Soviet Union?

IN HIS evaluation of the Defense Department's research and development program for fiscal year 1978, Dr. Malcolm R. Currie related technology to military power in the following manner.

> Technology, *per se*, does not equate to military power. Rather the real significance of technology to the balance of military power lies in the ability of each nation to transform its scientific discoveries and engineering breakthroughs into military capability—in the form of equipment which enhances or multiplies force effectiveness and which can be deployed in militarily significant numbers . . .[18]

Strategic weapon programs such as the B-1, the Trident, and air- and sea-launched cruise missiles, together with various tactical systems, demonstrate this relationship. The development of each of these systems prompted a spate of commentaries that partially reveal a Soviet perception of U.S. military technology and what it may augur for the future.

The following examples reflect some of the assumptions relative to American science and technology that consistently appear in Soviet publications. For instance, in one of his many commentaries on the role of science in military strategy, Colonel V. M. Bondarenko argues that "science has become an independent element in the system of the defensive might" of the Soviet Union; "militarization as usual is a characteristic feature of the development of scientific knowledge . . ." in the United States.[19] The growth in U.S. defense expenditures is often cited to justify this assertion. Citing the increase from FY 1970 of $74.5 billion to $112.3 billion for the fiscal year that ended 30 December 1976, S. Novoselov concludes in his July 1976 article published in *Military Knowledge*, the monthly journal

jointly sponsored by Soviet Civil Defense and DOSAAF,* that

> A significant portion of the US military budget goes for the continued buildup of strategic offensive weapons: purchases and maintaining the combat readiness of ICBMs in underground silos and on nuclear-powered submarines, plus scientific research and experimental design work on the development of new types of weapons.[20]

The American military-industrial complex is accused of attempting to "expand the range of military applied scientific research and development in order to establish conditions for the constant qualitative improvement of military potential . . . in order to make use of new scientific discoveries for military purposes."[21] Finally, the "fruits" of U.S. science and technology are converted into a "lever with which it will be able to create new ways in which other states are dependent on American imperialism" or to entice "scientists from other capitalist countries . . . to perpetuate the so-called 'technological gap' between the economies of the socialist countries and that of the United States."[22]

As one might expect, the development of the B-1, Trident, and the cruise missile provided ready grist for the Soviet agitation and propaganda machinery. The standard fare included allegations of "mass protest movements" and "broad domestic opposition" in the United States to the continued development of these systems.[23] Of greater significance are those political and technical commentaries subsumed beneath such obvious Soviet rhetoric.

In a 13 June 1975 speech at the Kremlin's Palace of Congresses on the occasion of his victory in the single-party elections to the Russian Republic's Supreme Soviet, General Secretary Brezhnev proposed an international ban on the development and production of new types of weapons of mass destruction and their associated delivery systems. In some quarters, this declaration was welcomed as a sincere step toward further arms control, while others dismissed the proposal as merely a Soviet propaganda ploy designed to orchestrate international pressure opposed to the development and deployment of the B-1 and Trident. The latter interpretation is far closer to Brezhnev's true motives. As the General Secretary declared in the CPSU Central Committee Report to the 25th Party Congress eight months later,

> We specifically proposed reaching agreement on banning the creation of new and even more destructive arms systems, particularly new submarines of the Trident type equipped with ballistic missiles and new strategic bombers of the B-1 type in the United States and analogous systems in the USSR.[24]

The nature of such analogous systems in the Soviet Union was never clarified. Nevertheless, explanatory articles generated in support of the Brezhnev proposal are quite revealing; in particular, an essay contained in the monthly, *USA: Economics, Politics, Ideology*, published by the Soviet Union's Institute of the U.S.A. and Canada (IUSAC). The article was written by two senior staff members of this institute, General-Lieutenant (Retired) M. A. Mil'shteyn and L. S. Semeyko.

The authors pose the following question: "What does the United States see as the main directions in the creation of a new, 'superpowerful weapon'?" Based on an analysis of "U.S. sources," they foresee three alternatives: first, "the production of new weapons on the basis of already known types (classes) of mass destruction weapons—nuclear, chemical, or bacteriological (biological)"; second, "the development of fundamentally new types of mass destruction weapons differing fundamentally from existing ones in terms of their physical nature"; and, finally, "the creation of original systems mainly connected with new delivery weapons."[25]

In support of the first proposition, Mil'shteyn and Semeyko state that "scientific research work is being performed in the United States

*DOSAAF, the Voluntary Society for Cooperation with the Army, Air Force, and Navy.

on the utilization of uncharged-particle and charged-particle accelerators to create weapons of powerful destructive action . . ."[26] The second trend is illustrated by research in the field of genetic weapons. It is alleged that the Advanced Research Projects Agency— " 'an elite of civilian scientists engaged in highly risky scientific research work of a revolutionary nature' in the military field" is involved in such an effort.[27] Research into military applications of lasers together with the B-1 and Trident systems exemplify the third trend. Interestingly, the authors appear to give credence to an unattributed report that indicated the "possibility of arming the B-1 strategic bomber with a laser gun . . ."[28]

U.S. military technology, therefore, is perceived broadly in terms of specific products that are, in and of themselves, examples of advanced technological achievement. The Soviets do not indicate that they foresee any curtailment of this trend.

Such a conclusion does not imply the existence of a reactive relationship between Soviet military research and development and similar activities in the United States. There is little evidence to question the veracity of the late Marshal A. Grechko's contention, expressed during the 24th Party Congress, that "the constant strengthening of the armed forces is an objective necessity for the successful building of socialism and communism . . ."[29] Nevertheless, the potential for a reciprocal Soviet response does exist. The current Soviet Minister of Defense, Marshal Dimitri F. Ustinov, commented that "our country's economy, science and technology are now at such a high level that we are capable, within the shortest period, of matching any type of weapon that the enemies of peace create."[30]

About four years ago, a leading Soviet observer of American military affairs, V. M. Kulish, argued that the main direction of the "military-technical race being conducted in the United States reflects two principal trends: modernization of existing arms . . . the development of a broad front of long-range scientific studies that will provide a good freedom of selection."[31] A *TASS* political news observer, Vladimir Goncharov, subsequently described one outcome of these earlier U.S. studies, viz., the B-1, as follows: "It does not attend meetings, deliver speeches or give interviews, nevertheless it plays an important part in the election campaign battles, now unfolding in the United States . . . Its sharp beak, glassy eyes, and widespread wings rub shoulders on newspaper pages with the emblems of the biggest American political parties."[32]

While the Soviet press gave wide play and implicit approval to the U.S. congressional debate surrounding procurement funding for the B-1 during the spring of 1976, President Carter's decision to discontinue deployment of the B-1 in favor of the cruise missile elicited a uniformly negative response within the U.S.S.R. In its initial coverage of the President's 30 June 1977 announcement, *TASS*, the official Soviet press agency, attached far greater importance to his decision to authorize deployment of strategic cruise missiles in contrast to the cancellation of B-1 production although the dispatch did note that "the United States will continue tests and research for perfection of the 'B-1' bomber."[33] In the judgment of Oleg Skalkin, a *Pravda* columnist, "There was simply no other outcome." "The White House," he concluded, "was too strongly committed by election campaign promises to prevent the production of these aircraft."[34] However, the American decision to begin deployment of air-launched cruise missiles was viewed by *Izvestiya's* V. Kobysh as a significant reinforcement of "US military-strategic potential."[35]

THE SOURCES of information available to Soviet military and political analysts are, in many respects, as interesting as the

insights gleaned from their writings. The party and governmental organs of the U.S.S.R. literally pursue a vacuum cleaner approach to the acquisition of Western scientific and technical knowledge. The techniques range from the translation of professional articles to espionage. While the methods vary, the goal does not. Each technique is designed to extract the maximum advantage for the Soviet Union in its military and technical competition with the United States.

Today, the scientific and technological data mechanism that Lenin lacked exists in the Soviet Union. It is the reponsibility of the All-Union Institute of Scientific and Technical Information (VINITI), a branch of the State Committee for Science and Technology (GKNT) of the U.S.S.R. Council of Ministers. VINITI provides information storage and retrieval and abstracts domestic and foreign literature. In 1971, it was reported that VINITI processed publications from 117 different countries which encompassed approximately one million articles, books, and descriptions of inventions.[36] A. I. Mikhaylov, the present Director of VINITI, stated in 1973 that the number of items compiled for publication in its journal of abstracts increased since 1961 at an average rate of 5 percent per year; the journal's preparation time from original sources was reduced from 7.5 to 4 months; and, the number of subscriptions had increased from 264 to 317,000.[37] VINITI also publishes "Express Information" reports, which contain sources with limited access, and the reference work *Results of Science and Technology*.[38]

Among the principal consumers of VINITI publications are IUSAC and the Institute of the World Economy and International Relations (IMEMO), two of the Kremlin's key foreign policy think tanks. As a Stanford Research Institute study concluded, "Information generated by this system serves a dual function: it is used directly to supplement Soviet knowledge in specialized fields and as a primary input into the strategic intelligence activities of the USSR concerned with long-range forecasts of the future."[39]

While the international technology transfer issue falls beyond the purview of this paper, the channels utilized provide the Soviet leadership with a valuable source of information. Professor Joseph Berliner of Brandeis University labeled these: publications, products, and people in ascending order of importance and effectiveness.[40] The first channel is comprised of VINITI et al. The significance of the last two conduits graphically emerged during the course of the May 1972 Nixon-Brezhnev summit in Moscow.

Point 8 of the agreement on "Basic Principles of Relations between the U.S. and the U.S.S.R." endorsed at this conference states:

> The two sides consider it timely and useful to develop mutual contacts and cooperation in the fields of science and technology. Where suitable, the US and USSR will conclude appropriate agreements dealing with concrete cooperation in these fields.[41]

As a consequence, eleven intergovernmental cooperative agreements were developed in such fields as environmental protection, space cooperation, transportation, and atomic energy. The cooperative agreement that dealt with the general field of science and technology has provided the basis for a rapid increase in American trade with the Soviet Union. Of the total number of contracts for industrial equipment placed with American firms, half are for the Kama River heavy truck production complex.[42]

The recent growth in U.S.-U.S.S.R. commercial and cooperative ventures spawned a commensurate increase in official travel between the two countries. During the first eleven months of 1975, approximately 359 Soviet commercial groups came to the United States, more than four times the figure for 1972. The number of official Soviet representatives almost doubled, reaching 1197 during the same period. The number of Soviet exchange visitors also doubled in less than four years,

and the figures on groups jumped from 330 in 1972 to 530 for the first five months of 1975. By way of comparison, about 5500 American commercial and technical travelers journeyed to the Soviet Union in 1975 as opposed to 2300 in 1972.

Scientific and technological symposia offer a prime source of information on U.S. technology to the Soviets. Among those academic functions included in the proposed itineraries of Communist bloc exchange visitors during 1975 were the Seventh Conference on Laser Atmospheric Studies sponsored by the Stanford Research Institute and the Sixth International Conference on High-Energy Physics and Nuclear Structure at Santa Fe, New Mexico.

The breadth of technological data flowing to the Soviet Union through each of these various overt mediums defies accurate measurement. Moreover, there is a covert dimension to this process. The Scientific and Technical Directorate of the KGB engages in clandestine operations abroad and coordinates the scientific and technical espionage of all other KGB divisions. This organization is also responsible for liaison with the State Science and Technical Committee (GKNT), and it determines the membership of Soviet scientific exchanges with other nations. Western technical data with respect to nuclear, space, and missile research, cybernetics, and industrial techniques remain an area of intense interest to Soviet intelligence collectors.[43]

To those in the United States who remain skeptical about the aggregate benefit of increased cooperation with the Soviet Union, Leonid Ilich Brezhnev responds curtly: "Those who believe that we need contacts and exchanges in economic, scientific and technological spheres more than others need them are mistaken."[44]

MARXISM-LENINISM provides an ideological device by which the relative status of its rivalry with the United States can be "scientifically" demonstrated by the Soviet leadership; it is referred to variously as the "balance or correlation of forces." This concept integrates military, political, economic, and social considerations and the correlation is determined by ". . . capabilities developed with respect to, and effectiveness in utilizing, not just one or another, but the combination of these elements."[45]

Although the Soviet Union recognizes the United States as the most powerful economic, scientific, and technical country in the capitalist world, its national leadership is confident that the world correlation of forces has shifted decisively in favor of socialism and communism.[46] From the perspective of Georgi A. Arbatov, Director of IUSAC, "the changing balance of forces . . . is contributing to the shifting [of] the main bridgeheads of the struggle into non-military spheres," one of the most important of which is science and technology.[47]

Paradoxically, the very confidence with which the U.S.S.R. approaches the struggle between capitalism and socialism is tempered by a continuing awareness of U.S. technological power. The future credibility of America's nuclear deterrent may well hinge on the operational deployment of such weapon systems as Trident and the strategic cruise missile. This is one eventuality that the Soviet Union undoubtedly wants to impede.

To isolate, let alone study, Soviet perceptions is an exercise fraught with obstacles. However, encouragement is to be found in an appraisal made more than a century ago in Russia by a French traveler, the Marquis de Custine.

> In a free society everything can be published—and it is forgotten because it is all seen at a glance. Under absolutism everything is hidden, but may be divined; that is what makes it interesting.[48]

His wisdom remains an appropriate commentary on the Soviet Union today.

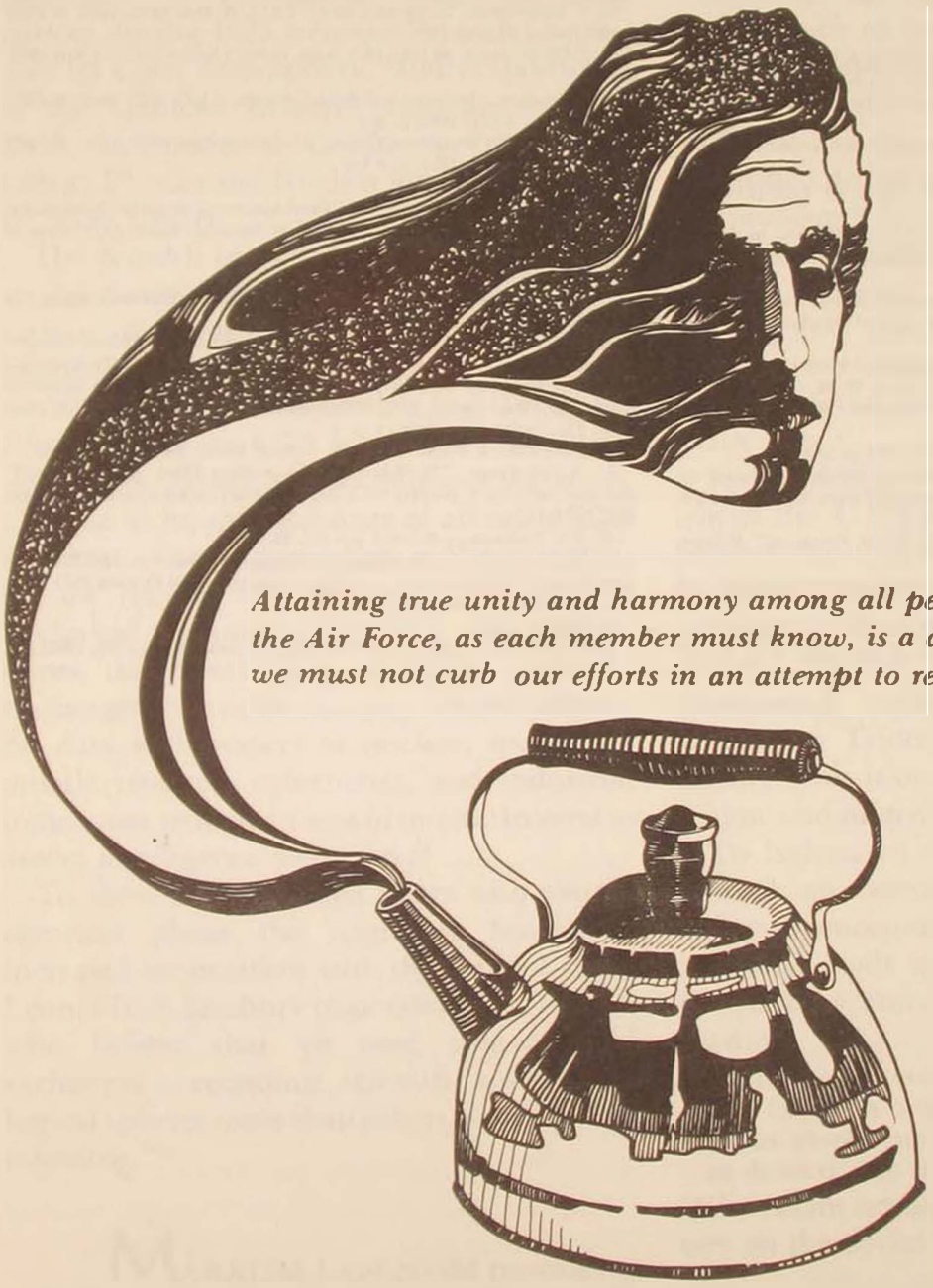
Fort Belvoir, Virginia

Notes

1. U.S., Congress, House, Committee on Science and Astronautics, *The Technology Balance*, Hearings before the Subcommittee on International Cooperation in Science and Space, 93d Cong., 1st and 2d sessions, 4–6 December 1973, no. 27, p. 28. Hereafter referred to as *The Technology Balance*. J. Fred Bucy, *International Technology Transfer—Chairman's Plenary Session Summary, National Security Affairs Conference*, Washington, D.C.: National Defense University, 1976, p. 209.
2. V. I. Lenin, *Polnoye Sobraniye Sochinenii*, 5th edition, Moscow, 1965, vol. 53, pp. 163–64, in Mose L. Harvey, Leon Gouré, and Vladimir Prokofieff, *Science and Technology as an Instrument of Soviet Policy*, Miami: Center for Advanced International Studies; 1972, p. 214.
3. Harvey, Gouré, and Prokofieff, p. 105.
4. *The Technology Balance*, p. 25.
5. Thomas P. Kridler, *Soviet Science Policy of the Seventies*, DIA DST1830S-160-76, U.S. Air Force Systems Command, 10 May 1976, p. 2.
6. Ibid., p. 6.
7. Ibid., p. 8.
8. Ibid., p. 9.
9. Ibid., p. 8.
10. U.S. Department of Defense, *Program of Research, Development, Test, and Evaluation* (RDT&E) FY 1978, 18 January 1977, p. II-25.
11. General George S. Brown, *US Military Posture for FY 1977*, 20 January 1976, p. 88.
12. Marshal Victor G. Kulikov, "Soviet Military Science Today," *Kommunist*, May 1976, p. 43.
13. U.S. Department of Defense, *Annual Report FY 1978* (Executive Summary), 17 January 1977, p. 12.
14. *Marxism-Leninism on War and Army*, Moscow, 1972, trans. by the U.S. Air Force, Washington, D.C.: Government Printing Office, p. 253.
15. Ibid., p. 255.
16. V. A. Baranyuk and V. I. Vorob'yev, *Automated Control System for Staffs and Military Installations*, Moscow: Voyenizdat, signed to press 24 April 1974, p. 211.
17. General-Colonel N. A. Lomov, editor, *Scientific-Technical Progress and the Revolution in Military Affairs*, Moscow, 1973 in W. M. Carpenter et al., *Soviet Perceptions of the United States*, Arlington: Stanford Research Institute, 1975, p. 181.
18. U.S. Department of Defense, RDT&E, FY 1978, p. II-2.
19. Colonel V. M. Bondarenko, "Soviet Science and Strengthening the Defense of the Country," *Communist of the Armed Forces*, September 1974, pp. 23, 24.
20. S. Novoselov, "In the Nuclear Vaults of the Pentagon," *Military Knowledge*, July 1976, p. 44.
21. G. S. Khozin, "Book Review," *USA: Economics, Politics, Ideology*, no. 12, December 1975, p. 79.
22. Yu. P. Davydov, V. V. Zhurkin, and V. S. Rudnev, *Nixon Doctrine*, Moscow: Izdatel'stvo Nauka, signed to press 18 September 1972, p. 120. Harvey, Gouré, and Prokofieff, p. XIII.
23. Moscow Domestic Service, 6 February 1971, trans. in *FBIS Soviet Union*, 7 February 1977, p. B-14. A. Tolkunov, "Clouds over the Ghetto," *Pravda* (Moscow), 7 January 1977, trans. in *FBIS Soviet Union*, 11 January 1977, pp. B-3 to B-6. "A Dangerous Course," *TASS*, 3 December 1976, trans. in *FBIS Soviet Union*, 7 December 1976, p. B-1.
24. M. A. Mil'shteyn and L. S. Semeyko, "The United States and the Question of New Types of Mass Destruction Weapons," *USA: Economics, Politics, Ideology*, no. 5, May 1976, p. 32.
25. Ibid., p. 27.
26. Ibid.
27. Ibid., pp. 29, 30.
28. Ibid., p. 33.
29. Harvey, Gouré, and Prokofieff, pp. 24–25.
30. "Soviet Defense Minister Says Russians Can Match Any New U.S. Weaponry," *New York Times*, 18 February 1977, p. 7.
31. V. M. Kulish, *Military Force and International Relations*, Moscow, 1972, trans. in *JPRS* 58947, 8 May 1973, p. 59.
32. V. Goncharov, "Dangerous Idea," *TASS*, 20 May 1976, trans. in *FBIS Soviet Union*, 21 May 1976, p. B-3.
33. *TASS Dispatch*, 30 June 1977, trans. in *FBIS Soviet Union*, 1 July 1977, p. B-1.
34. O. Skalkin, "International Week," *Pravda*, 3 July 1977, trans. in *FBIS Soviet Union*, 5 July 1977, p. B-1.
35. V. Kobysh, "Dangerous Game," *Izvestiya*, 6 July 1977, trans. in *FBIS Soviet Union*, 8 July 1977, p. AA-3.
36. W. M. Carpenter, p. 174.
37. "The Status and Prospects of Development of Scientific Information Systems," *Herald of the USSR Academy of Sciences*, March 1973, trans. in *JPRS* 59000, 14 May 1973, p. 1.
38. Ibid., pp. 2, 3.
39. W. M. Carpenter et al., *Soviet Perception of the United States*, p. 174.
40. *The Technology Balance*, p. 27.
41. Lawrence H. Theriot, "U.S. Governmental and Private Industry Cooperation with the Soviet Union in the Fields of Science and Technology," in *Soviet Economy in a New Perspective*, U.S. Cong. Joint Economic Committee, Washington, D.C.: Government Printing Office, 1976, p. 740.
42. *The Technology Balance*, p. 4.
43. John Barron, *KGB* (New York: Bantam Books, Inc., 1974), p. 107.
44. A. Stroganov, "To Whom Is Cooperation More 'Advantageous'?" *Socialist Industry*, 5 January 1977, trans. in *FBIS Soviet Union*, 12 January 1977, p. B-11.
45. *The Technology Balance*, pp. 114–15.
46. G. A. Arbatov, "U.S. Foreign Policy and the Scientific and Technical Revolution," *USA: Economics, Politics, Ideology*, no. 10, October 1973, trans. in *JPRS* 60504, 9 November 1973, p. 4.
47. Ibid., p. 11.
48. Michel Tatu, *Power in the Kremlin* (New York: Viking Press, 1969), p. 5.

A PERSPECTIVE FOR HUMAN RELATIONS

CHIEF MASTER SERGEANT WILLARD P. ANDERSON, USAF (Ret)
SENIOR MASTER SERGEANT THOMAS E. WOLFE



Attaining true unity and harmony among all personnel throughout the Air Force, as each member must know, is a difficult task. However, we must not curb our efforts in an attempt to realize this goal.

THE AIR FORCE needs strong, dedicated leaders with the "super vision" necessary to see beyond day-to-day details of the work process. People do not inherit such ability; they must develop it through experience and conscious effort. A primary element of "super vision" is the leader's understanding of human needs on the job and the ability to relate this understanding to subordinates. The basic skills needed by an effective leader are those that teach self-discipline, promote human dignity, and emphasize positive human relations. Perhaps most important, the leader needs to recognize and concern himself with people as individuals without making prejudgments based on obvious differences. This is not to imply that the differences are not important. What we are saying is that the leader needs to understand differences and similarities *among* people.

One significant result of cultural, ethnic, and personal diversity is the tendency of people to express personal prejudices and stereotypes in their relationships with other people. Individuals develop prejudices on the basis of past experience, lack of knowledge or understanding, intimidation or fear, resentment, and incomplete or incorrect information. Many people recognize prejudice in the racial or ethnic connotation, but prejudice also plays a significant role in other areas of human relationships. Supervisors and other leaders, for example, must realize that their personal prejudices can be significant influences in the attitudes of their subordinates and that subordinates may use prejudice to stereotype other people. Supervisors reveal their personal prejudices when they express attitudes and feelings about their superiors, stereotype certain military ranks or career fields as inferior, degrade the educational accomplishments of others, or stereotype people on the basis of their cultural heritage or sex. Such expressions reinforce the prejudices of subordinates and cause resentment and conflict from the offended or injured people.

This article presents a perspective for positive human relations in the context of social changes and their implications for Air Force supervisors. Many changes have been legislated, and others have come as the result of trends in the social order. For example, legislation has outlawed discrimination and suppression based on ethnic or cultural differences, but Air Force supervisors must recognize social reality in that people can use subtle forms of behavior to discriminate against other human beings. The authors of this article offer some concepts based on their experiences in certain important areas that supervisors can easily overlook or misunderstand in their relationships with people; namely, pluralism, need frustration, and "preventive maintenance" in human relations. They do not contend that their approach is "the way" to achieve positive relationships, but it is definitely "a way" that has proved effective for them.

One of the most significant social realities today is the refusal or failure of people to recognize interests, values, and beliefs common to all human beings. They focus instead on differences that tend to divide rather than on common interests that tend to unite people. For instance, there are those who would argue that there are three distinct races of people based on inherited physical characteristics: Mongoloid, Negroid, and Caucasoid. Yet, there may frequently be more inherited physical differences within any of the three given "races" than among the alleged three races of people. There are others who think of race in nationalistic terms, such as the German race, the Jewish race, the Italian race, and so forth. Today many scientists such as geneticists, anthropologists, behaviorists, and sociologists cannot agree on a common definition of race; however, most do agree that biological differences between races do not in any way indicate superiority or inferiority within any race, regardless of the definition used. Nevertheless, many people still act and think

as if physical characteristics were indicators of superiority or inferiority. Supervisors must recognize this reality because people attach major significance to ethnic identity in their relationships. For example, one of the authors has often been the victim of personal abuse and ridicule because of his heritage, but, in other instances, he has received outstanding support and encouragement from the most unlikely sources.

Most people like to think that laws have eliminated all trace of discrimination and inequitable treatment, but, in reality, discrimination has merely taken a variety of new forms. Often, people try to exercise specific rights prescribed by law, but they are denied these rights simply because they come from a different ethnic group. For example, in a large Southern city, an Air Force member sought to join a locally advertised ballroom dance club. He discovered, however, that club bylaws did not permit certain ethnic groups to attend club dances or to become members. In some communities, Air Force members are reluctant to invite members of different ethnic backgrounds into their homes because of community or peer pressures.

On many Indian reservations in the United States, tribes observe religious customs that are traditional and sacred in their daily lives. Recently, at a large Air Force base in the Southwest, security police arrested a young Navajo airman who had been born and reared on a Navajo reservation. The airman was carrying a small bag of sacred corn that he used in his daily prayers. Although he tried to explain the importance of the sacred corn bag, the police took it. They finally returned the bag to the airman, but only after the base social actions officer contacted the security police officer and pointed out its significance in Indian culture.

In another incident, a technical sergeant had completed the Air Force instuctor course in small arms and was assigned as a small arms instructor at a major Air Force base. When he arrived at his new base, he was assigned the task of cleaning weapons in a back room rather than instructing. When he asked why he was not teaching, his supervisors told him that he had a Spanish-sounding surname, and they assumed that he could not speak English well enough to teach others.

In still another incident, some Air Force members taunted and tormented a young woman in the Air Force because of her Apache heritage. Her peers ridiculed her off-duty dress and her "learned cultural behavior." She had begun her Air Force career as a hard worker with a positive attitude, but, as a result of the conflict caused by her peers, her performance steadily declined until a concerned social actions officer became aware of her situation.

A leader must understand social reality as a vital part of the human relations concept if he expects his subordinates to understand people from different cultural backgrounds. Both the leader and subordinates must recognize that all people have the right to be proud of their cultural background. Unfair or biased comparisons of people from diverse cultures often lead to discord because such comparisons cause people either to become overly concerned with their own personal qualities and achievements or to resort to expressions of bitterness, resentment, and animosity. This inevitably opens the door to conflict with people from different cultural backgrounds and even with people of similar backgrounds.

The right of the individual to express pride in his cultural heritage is very meaningful to most people, but this *right* is no more meaningful than the individual's *duty* to respect the rights of others to express pride in their cultural heritage. Recognition of this dual concept is frequently a difficult task in supervisory relationships because leaders must earn the respect of their subordinates. An effective leader understands that respect for the rights of others depends largely on the respect that the individual receives from supervisors and peers. Obviously, in relationships with

people of diverse cultural backgrounds, a leader must be a model of open and unbiased behavior worthy of emulation by his subordinates. One can never assume that problems will resolve themselves because the priorities of human needs differ greatly from time to time.

PEOPLE frequently focus their attention on cultural differences. This tendency may indicate either deliberate or inadvertent efforts to stereotype people as undesirable or inferior. Of course, people of various cultures may differ considerably in their typical motivations and reactions to their environment, but cultural differences are not indicators of inferiority, low morals, or social degradation. Admittedly, majority members of any social group may not always approve the behavior of other members. But people differ primarily from one another because of what they learn in their formative years. That is, their cultural environment determines the interests, attitudes, values, and beliefs that they develop in relation to other people.

For example, significant characteristics of the Balinese people of Indonesia are their gentle, relaxed, and unaggressive social relationships. These people passively conform to the demands of tradition and show little inclination to compete with other people for pre-eminence or mastery. These are cultural traits developed by tradition. Balinese parents and other family members deliberately tease infants and small children to outbursts of love and anger and then ignore them when they become emotionally aroused. Early in their lives, children learn not to expect responses to embraces or temper tantrums, and they become adults with no strong emotional responses to other people. If a Balinese child wanders away from his village area, emotionally distraught parents do not chase after him. Any person who finds the child leads him calmy back to his family. These and numerous other learning patterns distinguish the Balinese culture from other cultures.

By contrast, the Sioux Indians nurse their babies for three or more years and rarely permit them to cry from hunger or other needs. Sioux parents feel that crying makes fearful children and poor adult hunters. As the infants grow older, the parents encourage frustration and anger because they believe that habitual outbursts of anger make their children strong and brave. Traditionally, Sioux adults have been perceived as aggressive, hostile to outsiders, and quarrelsome among themselves.

Social scientists state that many of the differences in human personality, behavior, and achievement are learned entirely from cultural influences; such differences are rooted in cultural tradition, opportunity, and reward and not in heredity. Numerous Air Force members of all cultures have experienced the trauma that results from a lack of opportunity and appropriate rewards. These experiences are critical elements of their learning patterns in the military culture, and they compound the tasks of Air Force leaders at all levels of command. Of course, opportunities are available in the Air Force, but leaders should help open doors to opportunity. Although everyone recognizes that the door of opportunity is marked *push*, some people do not know how to open the door, or their leaders may even block the way to the door. Nor are these experiences common only to minorities within the Air Force.

Leaders confront still another social reality when they become mediators in instances of perceived discrimination. Recently enacted social changes and learned behavior based on past cultural practices often cause people to misinterpret the attitudes, actions, and responses of others. Consequently, a person may perceive discrimination when another person is not aware that he or she is discriminating.

Perceived discrimination may not always be based on cultural factors; it may be perceived between rated vs. nonrated officers, noncom-

missioned officers vs. commissioned officers, male vs. female, or married personnel vs. single personnel. Nevertheless, a person feels the same whether the discrimination is real or imagined. Leaders must recognize that all victims of discrimination respond in similar behavior patterns. These patterns of behavior do not indicate that people are immature or that they are rocking the boat or fighting the system. They merely offer a leader another opportunity to improve relations with his subordinates.

FOR YEARS, the dominant culture in American society sought to make "culturally different" minorities more "American" in their values, beliefs, and attitudes. This represents the traditional melting pot concept applied by the dominant culture to perpetuate its own values and beliefs. To become "true" Americans under this concept, minority groups were expected to abandon their cultural values and adopt the values and beliefs of the dominant cultural group. In recent years, however, minority cultures have demanded recognition of their rights to preserve and perpetuate their traditional values, interests, and beliefs. These demands have led to a new concept of social accommodation known as cultural pluralism. Under this concept, various minority groups maintain their cultural differences and traditions and still cooperate as relative equals in the economic, political, and social life of the dominant social group.

Switzerland provides a good example of cultural pluralism in practice. The Swiss people maintain a high degree of national unity although they have no national language and are divided in their religious beliefs. Protestants and Catholics speak German, French, and Italian and live in peace under the same government. Swiss citizens do not feel threatened by other citizens because of differences in ethnic or religious backgrounds; therefore, every citizen is free to give complete allegiance to the Swiss nation.

Major differences between American society and Swiss society are the attitudes, beliefs, and feelings of diverse cultural groups. In a large pluralistic society, such as that of the United States, various cultural groups often engage in struggles for influence, but these struggles do not reflect disloyalty to a common national government. National patriotism and loyalty to a common government do not require cultural uniformity. As has been proved in Switzerland and elsewhere, a country can tolerate differences in ethnic origins, nationality, language, religion, and customs and still live under a common government.

Numerous groups in the United States accept the idea of cultural pluralism, but American Indians and Mexican Americans (descendants of the earliest Mexican settlers in the Southwest) have expressed the strongest desire to retain their cultural independence. Their espousal of the idea may stem from the fact that their cultures predate the Anglo-Saxon culture in America, and they have maintained a degree of cultural autonomy despite considerable pressure. Many Americans derive a great deal of meaning from such holidays as Thanksgiving, Columbus Day, Washington's Birthday, and St. Patrick's Day, but people of minority cultures may not observe these holidays with the same feelings as other Americans. Members of various American Indian tribes, for example, frequently derive more significant meaning from their holy days and spiritual ceremonies (the Bear Dance of the Utes, the Green Corn Festival of the Senecas, the Snake Dance of the Hopis). Although some of the cultural values, beliefs, and interests of black Americans, Hispanic Americans, American Indians, and other minority groups differ in many respects from those of the dominant cultural group, people with diverse cultural backgrounds maintain their national pride as citizens of the United States. The military traditions of these and

other groups have always reflected genuine American patriotism in spite of cultural differences.

Understanding the concept of cultural pluralism and accepting cultural differences are important elements of the "super vision" needed by modern Air Force leaders. Cultural pluralism is a significant characteristic of the Air Force environment. Frequently, however, individuals or groups are denied the right to express their cultural identity, or their peers and supervisors make them feel inferior because of different behavior and learning patterns based on cultural differences. These people tend to become frustrated and resentful over their perceived or real inability to gain acceptance, understanding, or recognition from other Air Force members. In most instances, individuals can cope with frustrations and injured feelings if they can release their emotions through alternate channels. These channels may be a supervisor who can listen and understand, a concerned and compassionate friend, or some activity that dissipates excess energy.

Considered in this context, a human being and his behavior can be compared to a teakettle full of water. If no heat is applied, the teakettle rests calmly and causes no concern. When heat warms the water, the kettle will remain relatively calm unless the water becomes too hot. But, if the water reaches the boiling point, the kettle will let off excess steam (frustration) through a safety valve (alternate channel). The valve even whistles to attract attention. However, if the safety valve fails to open and prevents the escape of excess steam, the kettle will continue to boil and finally overreact. If someone recognizes the problem and turns off the heat, the kettle will cool and be ready again to perform its function. On the other hand, continued heat will cause internal pressure to buildup until the kettle explodes. If the kettle has been overused, dropped, or otherwise abused, it probably will have a weak spot, and this will be the point at which it explodes. In their relationships with subordinates, supervisors should realize that people behave in much the same manner as teakettles. They either need safety valves (alternate channels) to vent their frustrations when pressure begins to increase or less heat when the water boils.

People who feel good about themselves, their jobs, and their relationships with others experience few, if any, frustrations. Unfortunately, all human beings, at one time or another, face personal difficulties or experience frustrations in their relationships with others. At such times, individuals may deviate from their normal behavior patterns, and group behavior may deteriorate unless safety valves are available. When supervisors understand their people and show a genuine interest in them, they recognize the boiling signs and apply the "super vision" that will prevent undesirable or disruptive behavior. Understanding human behavior does not imply approval of unacceptable behavior, but it does provide insights into the causes and cures for such behavior. Key elements of this understanding are respect for human dignity and the individual's right to express pride in his cultural heritage.

All Air Force members recognize the importance of preventive maintenance on aircraft, in their homes, in shops, and elsewhere, but all too often supervisors and other leaders overlook or forget the importance of preventive maintenance in their relations with people. Just as the pilot or the mechanic knows and respects his aircraft, a supervisor should know and respect his people, their problems, their frustrations, and their needs and should convey concern for them in person-to-person communications. Positive interest in people and genuine recognition of their efforts are primary obligations of effective leaders. Recognizing, understanding, and accepting human differences not only make the supervisor's task easier but also ensure more efficient accomplishment of the Air Force's mission.

Positive supervisory action produces posi-

tive human relations, and positive action begins with positive thought along the following lines.

- Every person is an individual with his own unique personality and character traits.
- All human beings have common feelings, aspirations, and attitudes.
- All human beings have a right to be proud of their cultural heritage.
- Cultural differences are real, but they are not the sole determinant of behavior.
- All members of the U.S. Air Force want a responsible military society.
- Every person, to some degree, is a part of the problem.
- Openness and honesty are healthy attributes.

The next step is to apply specific behavior that will facilitate positive relationships:

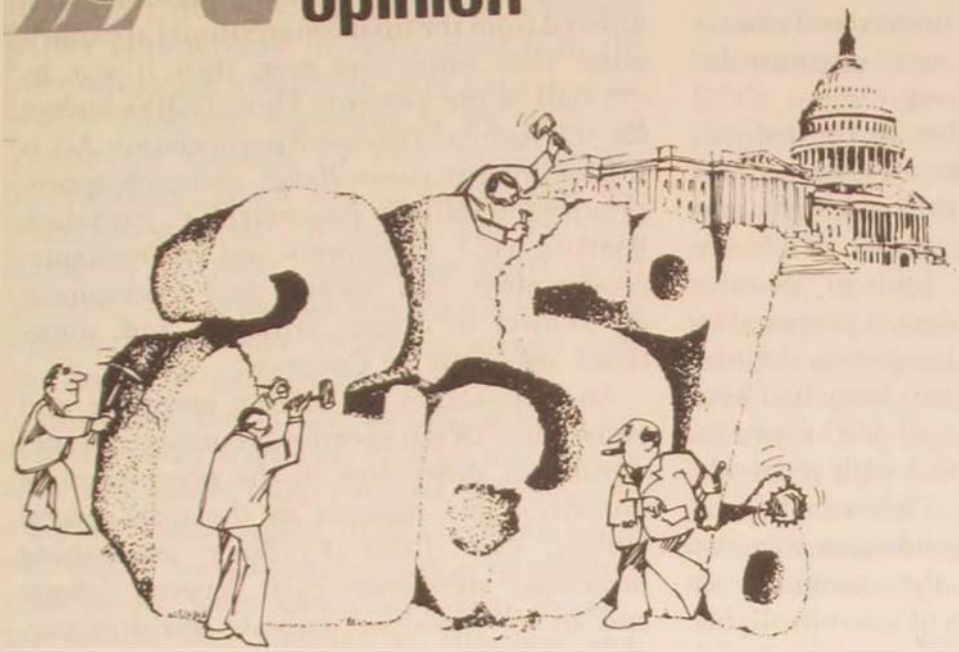
- Listen without interrupting.
- Work through difficult confrontations.
- Take a risk—demonstrate an interest in the perceptions of others.
- Practice self-discipline and assist others in achieving self-discipline.
- Examine personal motives in efforts to develop better self-understanding.

NO INDIVIDUAL or group of individuals can claim a monopoly on personal dignity and feelings. The red man's injuries are just as deep, the yellow man's fears are just as real, the black man's frustrations are just as great, and the white man's sadness just as strong as those of any other human being. Contentment and serenity are not rationed by color, dispersed by race, divided by sex, or determined by position. All people share the spectrum of human needs.

People are similar, and they are also quite different. But are they so different that they cannot see their similarities? Recognition of common bonds and emphasis on similarities can only lead to greater unity and harmony. This challenge obviously requires "super vision" from outstanding leaders throughout the Air Force.

Air Force Leadership and
Management Development Center
Air University

in my opinion



A RESEARCH NOTE

DOD's budget requests and appropriations

FIRST LIEUTENANT ANDREW J. SHERBO, JR.

THE MOST VISIBLE aspect of the entire federal budgetary process is the submission of the President's budget to Congress each year in January. For fiscal year 1979, the President submitted a total federal budget request of approximately $500 billion; approximately $115 billion or 23 percent of this total is designated as the budget of the Department of Defense (DOD). Reducing the budget is always a strong objective of both the White House and Congress. During the past decade, the objectives of reducing federal spending by reducing DOD's budget have become almost synonymous. Why, one may question, is it DOD's budget that is under such intense annual political scrutiny on Capitol Hill?

Undoubtedly, general attitudes and opinions of the American taxpayer concerning the military have an influence on the annual congressional debates about the federal budget. However, public opinion on reducing the total federal budget and DOD's portion in particular may be obscured by an important intervening variable that I believe to be of utmost significance.

I suggest that the federal budget can be effectively reduced only in certain areas because many of our federal expenditures are of such an uncontrollable or sunk-cost nature that congressional reduction of the budget becomes an extremely arduous task.[1] To elaborate further, one must understand what is meant by "controllability" and "uncontrollability" of federal expenditures.

Not all spending, whether at the federal, state, or local levels, is under the absolute and unchallenged control of the executive and legislative branches of government. Many public sector programs are "built-in" or sunk costs when a particular budget is prepared in the executive branch and subsequently debated and voted on by the legislative branch. These programs generate "uncontrollable" expenditures, which are appropriated with relatively little debate or discussion. They can best be considered as recurring expenditures once the initial commitment to the program is established. Good examples of uncontrollable programs are the transfer payments for Social Security and Medicare and the many public assistance programs throughout the federal structure. The Department of the Treasury has a very large annual appropriation considered uncontrollable because it pays interest on the national debt.

In examining the budget of the Department of Defense, one observes that the only uncontrollable item within that budgetary process is pension funding for retired military personnel. These payments are of a recurring and uncontrollable nature. In the last six years the administrations' requests for pension funding for retired military personnel has differed from the final congressional appropriation only once, and even then it was by one-half of one percent. Thus, DOD's budget for the Annual Defense Appropriation Act is predominantly *controllable*, and such appropriations as military personnel (i.e., pay raises, benefits, etc.), operations and maintenance, procurement, and research and development are subject to debate, criticism, and, sometimes, reduction by Congress.

An itemization of defense spending and social (non-DOD) spending requests indicates significant differences in the percentages of uncontrollable requests in the total federal budget. (See Table I.) Some astonishing percentage differences exist between defense and social spending requests. Pension payments for retired military personnel comprise DOD's entire uncontrollable request. On the other hand, in the social spending area Social Security payments, Medicare, public assistance programs, interest funding for the national debt, etc., constitute a huge uncontrollable portion totaling over 80 percent of such social spending requests in FY 1974.

Such data clearly indicate why DOD's

Table I. Percentages of federal budget requests that are considered uncontrollable, FY 1965 through FY 1974[2]

fiscal year	% social spending requests uncontrollable	% defense spending requests uncontrollable
1965	58.7	2.8
1966	58.9	3.1
1967	62.6	3.4
1968	63.5	3.7
1969	71.0	4.0
1970	74.1	4.3
1971	69.7	4.7
1972	71.1	5.1
1973	75.9	5.5
1974	80.4	6.1

budget always comes under intense scrutiny and debate each year. In an era of budget conservatism the extremely high controllability of the administration's DOD request is conducive to reduction by Congress. From the late 1950s through the mid-1960s, Congress either appropriated to DOD *more* than the administration request or very close to that figure. However, beginning in FY 1968 and continuing through FY 1976, Congress has appropriated much less to DOD than the President originally requested. For FY 1976, Congress cut these requests for DOD by 7½ percent. Yet congressional social spending appropriations were 13 percent *greater* than the President had requested.

Moreover, the public attitude toward national security is another variable that greatly affects the size of DOD's budget. When public opinion is unfavorable, DOD's budget is quite vulnerable to reduction because of its controllable nature. Social spending requests, though, are much less subject to criticism and reduction in that they are protected by the growing percentage of uncontrollable budget requests. The end result is an uncertain climate for DOD's annual budget.

THERE SEEM to be no easy solutions as to what DOD might do to alleviate this inherent problem. The very nature of defense expenditures subjects them to a high degree of controllability by Congress. The controversy over the B-1 bomber was an excellent example as well as the Navy's Trident missile submarine program and the Army's Patriot, Stinger, and Roland missile requests for FY 1978. An acute awareness on the part of the members of Congress and the armed forces, and especially the public, of this important variable would aid in understanding the annual relationship of the defense budget to the total federal government request.

Rhein-Main Air Base, Germany

Notes

1. Economist Murray Wiedenbaum has discussed this area extensively in "On the Effectiveness of Congressional Control of the Public Purse," *National Tax Journal*, December 1965, pp. 370–74 and "Institutional Obstacles to Reallocating Government Expenditures," in Robert H. Haveman and Julius Margolis, editors, *Public Expenditures and Policy Analysis* (Chicago: Markham Publishing Company, 1970), pp. 232–45. Also, an excellent study of this subject was prepared by John R. Gist in "Mandatory Expenditures and the Defense Sector: Theory of Budgetary Incrementalism," *Sage Professional Papers in American Politics*, vol. 2, Series 04-020 (Beverly Hills and London: Sage Publications, 1974), pp. 6–11.

2. Congressional Quarterly Weekly Reports; *Facts & Figures on Government Finance*, 18th Biennial Edition (New York: Tax Foundation, Inc., 1975), p. 88; see also Gist, pp. 6–11.

books and ideas

There is a difference between leadership and management. The leader and the men who follow him represent one of the oldest, most natural and most effective of all human relationships. The manager and those he manages are a later product with neither so romantic nor so inspiring a history. . . . Managers are necessary, leaders are essential.

FIELD MARSHAL SIR WILLIAM SLIM
Australian Army Journal, November 1957

A myth has been conceived and is growing that management and command are synonymous. They are not.

GENERAL LUCIUS D. CLAY, USAF
Commander in Chief, North American Air Defense Command, July 1975

THE ART OF LEADERSHIP

SQUADRON LEADER J. D. BRETT, RAF

THE MOST remarkable feature of these two quotations is their similarity, not the obvious difference in time and experience of the authors. The concern that leadership and management should be seen in their correct places has been a recurring but muted theme for the past twenty years, as it has appeared that more and more of our professional military institutions emphasize management to the exclusion of leadership. The proliferation of management techniques in the business world and the increasing demands made on the military profession for management expertise are responsible for the confusion in the minds of many young officers about to embark on their chosen careers.

The art of leadership cannot be taught, but the realities of leadership become increasingly clear after studying some of the Great Captains of recent times. The quantity of recently published military biography suggests that leadership still has a fascination both for the general public as well as for the military profession.

Field Marshal Sir Michael Carver, recently Chief of Defence Staff in Britain (the equivalent of the Chairman of the Joint Chiefs of Staff in the U.S.), has edited an impressive collection of biographical sketches of military commanders of the twentieth century in his book *The War Lords.*† Twentieth century

†**Field Marshal Sir Michael Carver, editor, *The War Lords: Military Commanders of the Twentieth Century* (Boston: Little, Brown and Co., 1976, $17.95), 624 pages.**

commanders have been continually placed on the horns of a dilemma—the generally conservative nature of the military profession, especially in time of peace, faced with the necessity to adapt to the most rapid technological developments in warfare of any century. Although mistakes were clearly made, it may be easy to underestimate their actual achievements. In his introduction, Sir Michael is at pains to suggest that the commanders of the Second World War achieved much more than their predecessors, particularly in economy of effort.

The author's selection criteria were that the man should have commanded a considerable force (land, sea, or air) in an important campaign and that as many different campaigns of the two world wars were covered. Excluded, therefore, are such U.S. commanders as Marshall, King, and Arnold as well as Alanbrooke and Portal of Britain. The criteria have also excluded any coverage of unconventional or guerrilla warfare, either in the two world wars or, more important, since. The contributions to both military leadership and warfare of the twentieth century of Lawrence, Tito, Mao Tse-tung, and Giap must surely have been worthy of inclusion in such a collection, and their exclusion could be considered a weakness.

There will be some disappointment that only five airmen are included: four British—Trenchard, Dowding, Harris, and Tedder; and one American—Spaatz. "Tooey" Spaatz was a most private person who shunned personal publicity to such an extent that he is still largely unknown not only to the American public but also to the heirs of the tradition he did so much to shape. Present-day cadets at the USAF Academy can talk endlessly of Mitchell, Doolittle, and Chennault but know relatively little of Spaatz. Unlike Harris at RAF Bomber Command, Spaatz had the common touch of being able to identify easily with his combat crews, and he was a pragmatist in his belief in air power. Consequently, he achieved much more. He did not prevail in the transportation vs. oil debate prior to Overlord, yet he still retained the confidence and respect of Eisenhower, Tedder, and Portal. This portrait shows the debt owed to Spaatz and places him alongside the other great American commanders in this volume—MacArthur, Eisenhower, and Nimitz.

The Royal Air Force's most private and sensitive commander never became Chief of Air Staff, but as Commander-in-Chief of Fighter Command he won the Battle of Britain in 1940. Hugh Dowding's real achievement, as Gavin Lyall shows clearly, was more in the building of the system of command and control from the radar stations to the operational airfields than in dynamic leadership once the battle had begun. Yet that was a supreme achievement against the lack of time, resources, and a sense of urgency from above that characterized British military policy in the 1930s. At the time of Munich, there were only five radar stations and three squadrons of Hurricanes. Once the Battle of Britain was seen to have been decisive, the controversy began, and has continued, over the shabby treatment of Dowding by Churchill; relieved of command, Dowding was never given another operational duty, nor was he accorded the highest rank of the RAF. Dowding himself remained outside the arguments. Like Spaatz, he never wrote an autobiography and left it to others to make a fuss.

Robert Wright, personal assistant to Dowding for a short time during the Battle of Britain, made the most fuss in his book, *The Man Who Won the Battle of Britain.*† It was published just a year after the film *Battle of Britain* had fanned the flames of argument with Laurence Olivier's impressive portrayal

---

†Robert Wright, *The Man Who Won the Battle of Britain* (New York: Charles Scribner's Sons, 1969, $6.95), 291 pages.

of Dowding's strength of character. Based on private papers, this book is a personal story and defense by Wright of his former commander; it is the best portrayal of the man himself. Much has been written elsewhere, and again here, of the controversy that arose between Dowding's two senior commanders, Park and Leigh-Mallory, over the correct employment of fighter squadrons during the battle. Park, often heavily outnumbered in the most vulnerable southeast of England, put his squadrons into the air to disrupt the Luftwaffe as best they could and so prevent targets from being bombed. Leigh-Mallory, with more time, in the group to the north of Park, preferred to build up a strong force which could deliver a decisive blow—as Bader's "Duxford Wing" did—but often after the Luftwaffe had bombed. While the merits of the respective cases will continue to be debated, what is surely not in doubt is that Dowding failed to appreciate what was happening until late in the battle and even then failed to act decisively. Dowding thought Park was right, that loyalty to a senior commander was to be taken for granted, but his sensitivity in this case nearly had grave consequences.

Few wartime reputations have been enhanced by subsequent investigation of the records; many have been tarnished. Of those whose reputations remain intact, and, if anything, have grown, is Field Marshal Sir William Slim. Both the portrait in *The War Lords* by General Geoffrey Evans (a divisional commander under Slim) and Ronald Lewin's official long biography, *Slim: The Standard Bearer*,† show why. Put simply, in Lewin's words, it is because "his military distinction was founded on his humanity." No British general had the knack of being so adored by his troops—not in the Montgomery image of cap badges and pep talks, but for the simple feeling of trust he inspired because he understood how basic to his profession was "the smell of soldiers' feet."

Slim restored the morale of the battered British forces in Burma by proving that the jungle was neutral and that the Japanese soldier could be defeated. He was quick to grasp that air supply could nullify the Japanese tactics of infiltration and penetration behind lines of communication, but above all he realized that no jungle battle could be won without physical and mental robustness and improvisation on the part of the commander, and confidence and high morale from the soldier. Evans, with firsthand experience of what this meant, shows this side of Slim most clearly. Slim showed a rare moment of pure anger at the treatment given his forces by the staff in India after their 1000-mile retreat. He could accept shortages of food and medical supplies but not the lack of consideration. Such moments re-emphasized to him that simple maxim that the staff are the servants, not the masters, of fighting troops. It was Slim who remained implacable towards the Japanese when the treatment of prisoners of war became known and he who ignored MacArthur's ruling that the surrender of swords was an archaic practice by ordering all Japanese officers in his area of command to surrender their swords to British officers. He was determined that no legend of an unconquered army should flourish in Japan as it had in Germany after the First World War. Like Bradley, Slim's integrity and sense of justice made him the man everyone—soldiers to commander in chief—trusted. "Uncle Bill" was every inch the "soldiers' general."

A collection of biographical sketches may sometimes be the lazy man's approach to an understanding of military history. Given quality of authorship and care in selection, such collections may be useful in showing a broad sweep in the development of the art of

---

†Ronald Lewin, *Slim: The Standard Bearer* (Hamden, Connecticut: The Shoe String Press, 1976, $15.00), 350 pages.

leadership over a period of time. Oliver Warner's *Command at Sea*† fits that description. From the great Lord Hawke, who established English sea power in the eighteenth century, through Nelson's Collingwood, to Farragut "damning the torpedoes," and on to Nimitz, Warner traverses the age of sail and steam. What emerges is that distinguishing mark of all naval commanders, not shared by their equals in land or air operations, that they stand the same chance of death or capture as the most junior and inexperienced seaman under their command. The "quality of command," as the author describes it, is unique in both sail and steam. The dominant commander is very clearly Nimitz—"the greatest commander of them all"—whose Pacific Fleet was the most powerful naval force ever assembled for combat. Nimitz could be bold and imaginative in the seafaring tradition of Nelson when he directly assaulted the central island of the Marshalls while all his staff were urging caution. He was also modest and compassionate in blaming no one when he took command of the Pacific Fleet just 24 days after Pearl Harbor. He could be tough and determined in getting the best out of his two contrasting subordinates, Halsey and Spruance, in a style similar to that used by Eisenhower to bring the best out of Patton and Bradley. In retirement, he was determined that there should be no repeat of the acrimony between leaders that had marked the aftermath of previous wars, and this seemingly modest achievement may eventually be seen as comparable to his defeats of the Japanese fleets at Midway and Leyte Gulf.

TWO GENERAL conclusions seem clear from looking at these military leaders of the twentieth century. First, the diversity of the men is so obvious, not just in nationality or whether they commanded land, sea, or air forces, but across the entire spectrum of background, intellect, training, and experience, which can be documented, as well as integrity, loyalty, honesty, and vision, which cannot. Clearly there is no set pattern for successful leadership in twentieth century warfare, no model which will guarantee success. No greater contrast can be seen than between the two most successful Allied generals of the Second World War in the arena of coalition warfare: Eisenhower, the diffident Midwest farm boy who went to West Point to get a free education, and Alexander, heir of an aristocratic feudal tradition, whose impeccable manners complemented his diplomatic skill. Second, all these men commanded large forces demanding control of complex logistics, planning staffs, and personnel management on a scale unknown to a civilian organization. Management to them was absolutely necessary as a prerequisite for combat leadership, but it was only a prerequisite. They had an instinct for command that has no rules. They practiced an art that is essential and which our profession can ignore only at its peril.

United States Air Force Academy

---

†Oliver Warner, *Command at Sea* (New York: St. Martin's Press, 1976, $8.95), 196 pages.

POTPOURRI

The Second World War: An Illustrated History by A. J. P. Taylor. New York: G. P. Putnam's Sons, 1975, 234 pages, $17.50.

Year after year we Americans are barraged with new books on World War II. Some treat specific battles or operations, such as the Allied parachute assault at Arnhem, while others consume thousands of pages rehashing the military action that took place around the world from 1939 through 1945. A. J. P. Taylor's *The Second World War* does not fit either mold. Instead, it is the first short survey of note since Gordon Wright's *The Ordeal of Total War, 1939–1945*, to cover the six-year conflict in both its military and political aspects.

Taylor, one of today's best known and most respected diplomatic-military historians, is a man of penetrating insight. Employing a smooth, flowing writing style, he examines nearly every aspect of the war—from causes, strategy, and economic policy to leadership, operations, and political considerations—offering judgments on events as he goes. Two major conclusions stand out throughout the book: Hitler, Stalin, Churchill, and Roosevelt shaped and directed the course of the war, and Russia deserves credit for defeating Germany.

One can hardly contest Taylor's first contention, but he goes too far with his second. Certainly, the Soviet Union faced the overwhelming majority of German divisions and did far more to destroy the enemy's army than her two Western Allies. Taylor is also essentially correct when he writes that, due to circumstances, Britain and the United States were fighting Italy throughout much of the European war while Russia, alone, was fighting Germany. But he errs by continually underplaying the Western Allies' contribution to Nazi defeat. By Taylor's own count, Anglo-American operations or threats of invasion were tying down 112 German divisions by early 1944, at a time when the German army needed as many men as possible on the Eastern Front. To dismiss this fact, as well as the contributions to ultimate victory made by U.S.-British surface forces in Westen Europe in 1944–45 and the Combined Bomber Offensive, is to do a great injustice. The Soviet Union may deserve the lion's share of the credit for defeating the Nazis, but to say that "Great Britain and the United States had acquired an ally who would win the war against Germany for them" is to distort the truth.

The Second World War does not slight the strategic bombing campaign against Germany, for Taylor provides an interesting, although brief, analysis of its effectiveness. He classifies the Royal Air Force's area bombing strategy as worse than useless throughout the war and explains that once the U.S. forces received fighter escorts and began bombarding German synthetic oil plants in 1944 "the effect was devastating." Coming at a time when the Nazis were producing large quantities of jet fighters and snorkel submarines, the American precision bombing efforts were "decisive," according to Taylor, for they destroyed the lifeblood of the enemy's war machine.

Many American readers may find *The Second World War* excessively complimentary to the Soviet Union in both its appraisal of the Soviets' contribution to victory and their lack of responsibility for the emergence of the Cold War; yet this new volume, replete with numerous excellent pictures, is undoubtedly the best brief survey and analysis of World War II. If one wants to know about such diverse subjects as the Russian method of warfare, Germany's wartime economic and occupation policies, or why British and Americans invaded North Africa in late 1942, he will find the answers in *The Second World War*. Do not look for much on the Pacific Theater in this British writer's work and expect an occasional error in judgment as Taylor analyzes the war. But, also, expect some keen insights into the conflict and excellent coverage of nearly all of its diverse aspects, for they are both part of this exceptional volume.

Major John F. Shiner, USAF
Department of History, USAF Academy

Terrorism: From Robespierre to Arafat by Albert Parry. New York: Vanguard, 1976, 624 pages, $15.00.

On 4 July 1976, an elite Israeli army unit applied a military solution to a terrorist situation when they freed 103 hostages at the Entebbe airport outside Kampala, Uganda. Today's military officer must understand terrorism as a type of military contingency he may well have to face.

Dr. Albert Parry's book traces the employment of terror from French revolutionaries to Palestinian guerrillas. Parry's detailed knowledge of both Red and White terror (he is a White partisan) in the Russian Civil War (1918–1921) will benefit scholars, while his in-depth investigation of modern terrorism—that used by the Weather Force Underground (Weathermen) in the United States and Palestinian terrorists abroad—provides a timely reference for military people involved in intelligence and security.

The comprehensive nature of this lengthy book is a significant fault. In his attempt to cover too much, Parry failed to distinguish adequately between terror and violence. Without a workable definition of "terror" or "terrorism," Parry rambled from Hitler's policy of exterminating Jews to Red Chinese purges, then on to the Tupamaros of Uruguay and the Black Panthers of the United States. The author should have described the defining characteristics of "terror" that set it apart from the larger and more inclusive category of "violence." With terrorism indistinguishable from violence, the machinations of the Joint Strategic Target Planning Staff become no less reprehensible than the plottings of Dr. George Habash and his Popular Front for the Liberation of Palestine. Additionally, in his fast-paced accounting of inhumane and grotesque acts, Parry often lapses into needlessly detailed descriptions of torture techniques. Parry's personal aversion to terrorism as practiced today obscures the objectivity that enhances his historical accounts of terror in the French Revolution, the nineteenth-century Russian revolutionary movement, and even Stalin's bloody reign.

Air Force officers engaged in current intelligence, counterintelligence, or security should read this book, despite its flaws. It provides a useful reference to many obscure terrorist and guerrilla groups operating today. With judicious reading, one can gain a better understanding of the many forms of terrorism that threaten our safety and security.

Captain Earl H. Tilford, Jr., USAF
Office of Air Force History

Energy and Conflict: The Life and Times of Edward Teller by Stanley Blumberg and Gwinn Owens. New York: G. P. Putnam's Sons, 1976, 460 pages, $9.95.

Edward Teller has sought relentlessly to protect with atomic weaponry the America that gave him refuge. As a Jew, he had fled from persecution by the Fascists and Communists who had, in turn, engulfed his native Hungary with hate and genocide. The decades-long gulf between J. Robert Oppenheimer (who headed the famous Los Alamos atom bomb laboratories) and Teller, mainly over the reluctance of Oppenheimer to vigorously pursue the "super" or thermonuclear weapon, is another of the conflicts pervading the book.

Although sometimes dealing with seemingly contradictory material, the authors manage to retain balance and objectivity. Their descriptions of the nighttime-knock-on-the-door terrors that the Teller family endured in Budapest at the hands of the Nazis, and later the Communists, make the reader's blood boil. But these are matched by not dissimilar outrages visited on the Tellers in California in the 1970s by an organization called the Red Family, among whose founders was Thomas Hayden, husband of political activist Jane Fonda. This group and others contrived a war crimes tribunal, held a mass meeting on the University of California Berkeley campus, and roused the emotions of a student-faculty group on trumped up charges of Teller's alleged war crimes. The meeting degenerated into a mob, shouting "Get Teller. Burn his house. Kill him." They headed for the Teller home, occupied by the scientist, his wife, and two children. A concerned friend warned Teller, who called the police. Held at bay by a riot squad, the mob spent its energies burning Teller in effigy. The Tellers have remained in their tree-shaded home, but it is now guarded by a high chain link fence, an alarm system, and a huge dog.

These chronicles of his problems only serve to

complete the authors' picture of the towering Teller personality. Teller had the satisfaction of pushing the nuclear arming of the U.S. before potential adversaries could develop the capability. But he later suffered the chagrin of seeing the earlier-than predicted detonation of a Soviet atomic weapon in 1949. Even more disturbing, according to the authors, was the only recently revealed 1953 explosion by the Soviets of a *deliverable* hydrogen bomb using lithium ahead of the U.S. They tell that it was only later, on 1 March 1954 at Bikini atoll, that the U.S. caught up with the Russians in thermonuclear weaponry "by exploding a deliverable fusion bomb using lithium deuteride."

On his retirement from the Lawrence Livermore Laboratory on 16 June 1975, Edward Teller made a farewell speech. Over the years, he had been accused of crying "wolf" in his many warnings to the people of the U.S. In his valedictory, Teller stated:

> I did not cry "wolf" too often. I did not say the Russians are ahead of us. I said the Russians are going to be ahead of us. And now they are. They are very cautious. They are very conservative, and they know that five years from now they will be much farther ahead of us. This is the situation in which the country finds itself. . . . The Russians are ahead of us and they are going to stay ahead of us for years to come. This means danger. This means hardship.

The book is a sometimes-tangled chronicle of fission and fusion weapons and of one who contributed so much to their development. It provides perspective and dimension regarding the personal sacrifices necessary to persevere for one's beliefs. Edward Teller suffered personally at the hands of the totalitarians, as have others such as Solzhenitsyn, and their warnings on military preparedness deserve special attention.

Lieutenant Colonel Richard E. Hansen, USAF (Ret)
Prattville, Alabama

Oil, Divestiture, and National Security edited by Frank N. Trager. New York: Crane, Russak, 1977, x + 130 pages, $4.95.

Many Americans and U.S. congressmen betray their populist heritage by equating bigness with badness and blaming the largest oil corporations for much of today's energy crisis. President Carter's energy speech before Congress in April 1977 drew its largest applause from a familiar charge: the petroleum industry needs more competition. To that end, the so-called Bayh bill (S. 2387) aimed to break up the nation's largest oil companies with the assumption that lower petroleum prices would follow. This line of reasoning may be good politics, but it is poor economics.

The National Strategy Information Center has produced this very useful book of seven essays that address two problems: the need for breaking up large oil companies and the ramifications of divestiture, particularly as it relates to national security. The authors contend that vertical divestiture would neither affect the current market structure of international oil nor weaken the Saudi Arabian-based cartel. Moreover, such action would hinder development of new oil supplies and fail to lower petroleum prices for U.S. consumers. Contrary to popular belief, they argue, corporate profits in petroleum are comparable to those of other large industries, and current figures show that the oil industry has become *more* competitive in recent years, not less.

The authors argue convincingly that OPEC (Organization of Petroleum Exporting Countries) interests and those of the large oil companies are not always identical. The 1973 embargo, for example, forced the oil companies to redirect exploration and development funds away from the Middle East, certainly an undesirable move for the Arab producers. The embargo's severity was reduced by the large oil companies when they deliberately shifted petroleum supplies to ensure that shortages fell more equally on all nations. Smaller companies, regardless of number, could not offer this capability. In short, critics who consider the interests of OPEC and large companies identical oversimplify the situation.

The authors provide fewer concrete answers concerning the impact of divestiture. Domestically, battles would follow over the reassignment of assets pledged against corporate indebtedness, and realignment could take twenty years to complete. Meanwhile, confusion and instability would adversely affect oil production and distribution, making the United States increasingly dependent on Middle East oil. But other influences on national

security are less clear. Although the United States soon will be importing half its oil needs, the Arabs must practice care in applying this as an economic weapon against the West since American power acts as a counterweight to Soviet influence in the Middle East. Any future embargo or attempt to use oil as a weapon carries political and economic costs. And, except for Saudi Arabia, most Arab nations are overly dependent on oil production to fuel their own economies. The overall impact of their future decisions on U.S. national security is difficult to measure.

The answer to oil shortages, the authors warn, is not divestiture of the large oil companies whose resources and capabilities offer the best hope of solving the immediate problem through further exploration. Quite possibly these corporations could lead in the development of alternative energy sources for the long term. Finally, the problem of too little competition is not real. Divestiture would solve nothing and would disrupt the industry to the point of making the United States more vulnerable to another Arab embargo.

The National Strategy Information Center has produced another fine publication on a vital topic. The work offers no solid solution to the problems of American dependence on foreign oil, but it does point out serious flaws in divestiture plans. Those in high government positions who support such measures would do well to put their populist rhetoric aside and examine the problem from a more realistic viewpoint.

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

The Military in the Third World by Gavin Kennedy. New York: Scribner's, 1975, 368 pages, $17.50.

Unlike the usual surface generalities about the arms trade and coups, this book is rich in empirical detail, reaches balanced assessments, and offers corrections to the common, but all too vague, theories regarding military men and costs in the development process. Arms do not create tensions, they reflect tensions. An indigenous arms industry may provide economic benefits and may be a better building block than social services. Violence is endemic in the Third World, but a regime's legitimacy is the key to how much violence.

Of particular merit is the discussion of the Marxist conception of the "permanent revolution" contrasted to the "legitimacy crisis." The author, however, is incorrect in criticizing the failure of others to analyze development from both political and economic perspectives.[1]

Those who seek either party tidbits or empirical precision will enjoy the wealth of data: deposed Egyptian King Farouk received a 21-gun salute sailing into exile; quantitative tables on coups reflecting the influence of per capita gross national product or types of political systems; and the detailed information on the military impact on development in 13 countries.

The faults are those of new exploration. More economic scrutiny is needed on the contribution of defense budgets to the development process. The framework of elites and legitimacy, while valid, begs the impact of other variables such as economic resources, societal cohesion, and the impact of the developed world on these fragile systems. Further, is it not possible that the arms trade, as a substitute for U.S.-U.S.S.R. defense pacts, may both have lowered the threshold of superpower conflict and lessened the actual number of military interventions (a most imprecise word)? Although the book is clearly written, an index of tables would greatly enhance its usefulness.

For those seeking stimulating summaries on the role of the military in less developed countries, this is an ideal book. The subject *is* the frontier of civil-military relations.

Roy A. Werner
Washington, D.C.

Note

1. See especially *The Political Economy of Change* by W. F. Ilchman and N. T. Uphoff, Berkeley: The University of California Press, 1969; and, after Kennedy, *Brazil since 1964—Modernization under a Military Regime* by George-André Fiechter, New York: John Wiley and Sons, 1975.

America in a Divided World, 1945–1972 edited by Robert H. Ferrell. Columbia: University of South Carolina Press, 1975, xxxviii + 353 pages, index, maps, $7.50.

America in a Divided World is the last book in a three-volume documentary history of American foreign relations since 1775. While any such collection must of necessity be selective, Robert H.

Ferrell, one of this country's foremost diplomatic historians, has drawn on his extensive knowledge of the field to assemble a useful compilation of primary sources dealing with a vital period of American history.

The documents are grouped chronologically within topic areas that cover the world geographic regions as well as such specialized subjects as the United Nations, atomic diplomacy, and the constitutional crisis revolving around the issue of who controls foreign relations. Going beyond formal "documents" in a narrow sense, Ferrell has included treaties, executive agreements, communiqués between heads of state, laws passed or proposed by Congress, memoranda, speeches, press conferences, and off-the-record remarks. The material varies from single paragraph excerpts to complete texts. The supporting maps are clearly drawn; the detailed index covers the entire three volumes.

The primary purpose of this book is to provide a handy collection of the record of the most active years of American diplomacy. However, the editor does more than merely lump documents together. In the thirty-eight page introduction as well as in the commentary he uses to place each item in the context of specific events, Ferrell interprets both the policies and the actions of the United States. His objectives in doing so are clearly awareness and understanding rather than simply condemnation or condonation. Moreover, Ferrell's introduction is an excellent brief essay on American foreign relations since 1945. Lucid, well-organized, and thematic, it presents ideas and suggestions on the conduct and direction of American foreign policy which every individual involved in either the planning or the execution of that policy should consider.

Although this work is not for everyone's personal library, it is certainly worth knowing about and being familiar with. Students in PME schools at all levels will find it particularly useful. Nowhere else can one find such a convenient compilation of the important statements on American policy from this crucial period.

Captain Robert C. Ehrhart, USAF
Department of History, USAF Academy

Doenitz at Nuremberg: A Reappraisal edited by H. K. Thompson, Jr., and Henry Strutz. New York: Amber Publishing Corp., 1976, xxxii + 194 pages, $10.00.

This work, subtitled "War Crimes and the Military Professional," is very interesting but very odd. It consists of 387 collected commentaries on the war crimes trial of Grand Admiral Karl Doenitz, the German U-boat commander who succeeded Hitler as German chief of state.

Following World War II, the United States, France, Great Britain, and the Soviet Union agreed to establish an International Military Tribunal to bring German war leaders to justice. Admiral Doenitz was indicted at Nuremberg for "crimes against peace," in that he built and trained the German U-boat arm for specific "war crimes," and for participating in the "common plan or conspiracy." Convicted on the latter two counts, he served ten years in Spandau prison. More than that of any other defendant, Doenitz's conviction was criticized because he had merely executed military duties and ordered submarines to operate in accordance with the dictates of modern war.

After the Admiral's release from Spandau in 1956, the two editors apparently shotgunned letters to the armed services' retired lists and to foreign dignitaries, seeking statements critical of the trials and favorable to Doenitz. Those statements, the result of twenty years of effort, form the body of the work.

Of these commentators, more than one hundred were U.S. Navy admirals. Another 135 were American generals, lawyers, diplomats, educators, artists, and political leaders. The remainder are European, British Commonwealth, South Asian, Middle Eastern, and African leaders, both military and civilian. Unfortunately, the credentials of many of the commentators are obscure.

The opinions presented in the book are one-sided; the editors admit publishing no opinions unfavorable to the admiral. Perhaps the only generality that can be made from such a biased sample is that among military professionals there is a considerable body of opinion opposed to "war crimes trials" by victorious powers.

Any further generalization is hazardous at best, largely due to the book's shabby editorial standards. Its value as a historical document is extremely limited. There is no concise brief of the actual proceedings against the admiral. The points of law

involved in the debate over the trials are mentioned only in cursory fashion. The editors have not shared with the readers their editorial standards, and one is led to wonder whether the excerpts fully represent the opinion of the writers. To make their point, did the editors quote only the most forceful paragraphs? Did they omit qualifications or reservations? And finally, the editors failed to provide the dates of the opinions. Had the commentators considered the Nuremberg trials in the light of Mylai?

In sum, Admiral Doenitz's case deserves better treatment than this book provides.

Captain Donald M. Bishop, USAF
Department of History, USAF Academy

Precarious Security by General Maxwell D. Taylor, USA (Ret). New York: W. W. Norton, 1976, xi + 143 pages, $7.95.

The foreword and first pages of this aptly titled study commence rather gloomily. General Taylor systematically identifies the environment of negative external and domestic factors that impinge on American security. Pessimistically, Taylor admits "to a lack of faith in the governmental apparatus as a primary means in itself for guaranteeing our future security." The interested layman, however, to whom the book is addressed specifically, should not recoil from reading on. As might be anticipated from such of his earlier writings as *The Uncertain Trumpet* (1960) and *Responsibility and Response* (1967), Taylor now devises a bold prospectus that could contribute immensely to the construction of an improved national carapace.

The author's treatment of the relationships among national security, policy goals, and supporting power is magisterial. Although he still speaks of dominoes in Southeast Asia, he calls the events of spring 1975 a defeat and a debacle. Taylor also has astringent comments about congressional intervention in the conduct of foreign affairs: the Cyprus tragedy, the "tilt" toward Israel, and the enactment of the oft-forgotten War Powers Act of 1973 (against which former President Ford inveighed, incidentally, in April 1977).

The heart of Taylor's book deals with components of a national security program. Embracing strategic deterrence and conventional requirements, the detailed military chapters are splendidly informed by personal experience. Undoubtedly, the shoe will pinch certain readers, e.g., the low estimated probability accorded the Navy-Marine mission of traditional amphibious warfare. But the most innovative prescriptions are found in Chapter VIII, dealing with the civil segment of national security. Having pinpointed weaknesses in national power and the nonmilitary sector in particular, Taylor proffers counsel to any chief executive regarding choices of policy goals and programs and ways to counter "media adversaries."

Taylor's sagest suggestion is to create an Executive mechanism incorporating "nonmilitary power into national programs—something analogous to the National Security Council in the foreign-military sector." He clearly comprehends that security and well-being are intertwined. Hence, a broadened National Policy Council would replace the NSC and bring in the Treasury and HEW secretaries and a new economic representative of the President. Undoubtedly, Stansfield Turner would find Taylor's suggested restructuring of the national intelligence system interesting, including renaming the CIA Director as Director of Foreign Intelligence—"purely . . . an intelligence specialist, never . . . a foreign policy adviser to the President." Another substantive recommendation envisages creation of a "Center for Policy Research."

Whereas Taylor abounds in intelligent ideas and thoughtful approaches, his empiricism is complemented by literary felicity and rugged espousal of traditional virtues. Happiness, he reminds us, cannot be bestowed by government; national security, too, is "dependent on the character and quality of the people who would enjoy it." *Precarious Security* could well serve today as a vade mecum for President Carter and Zbigniew Brzezinski.

Dr. Alvin D. Coox
Department of History
San Diego State University

the contributors

Brigadier General Charles E. Williams, Jr., (Ret), (M.S., George Washington University) worked in command and control communications and computer activities much of his military career. He was Director, Communications and Data Processing (J-6), on the staff of the Commander in Chief, Pacific, when he retired on 1 March 1977. He has commanded operations in FEAF and Vietnam; filled command and staff positions in TAC related to operations, command and control, communications and electronics; and served as Vice Director, Joint Tactical Communications Office, Fort Monmouth, New Jersey. General Williams is a graduate of the Air Command and Staff College, U.S. Army Command and General Staff School, Air War College, and the National War College.

Lieutenant Colonel David Brog (M.E., University of Southern California) is assigned to Hq USAF, Directorate of Military Assistance and Sales. His early career was spent in special operations in Europe, and much of his service has been in electronic warfare. In 1968 he flew a combat tour in the F-105F Wild Weasel out of Korat AB, Thailand. In 1969 he was assigned to Hq USAF, Directorate of Operations, Electronic Warfare Division, where he was primarily responsible for tactical fighter electronic warfare capabilities. A colonel selectee, Colonel Brog is a graduate of the Industrial College of the Armed Forces and Air War College.

Major Ernie R. Dash (M.S., University of Southern California) is Commander of Detachment 75, 3d Weather Squadron (MAC), Hurlhurt Field, Florida. He has served as a Defense Meteorological Satellite Program tactical site commander and recently was assigned as the DMSP Staff Officer in the DCS/Operations of Headquarters Air Weather Service. Major Dash is a graduate of Air Command and Staff College and Industrial College of the Armed Forces.

Major Walter D. Meyer (Ph.D., University of Washington) is Special Assistant for Air Force/Army to the Defense Meteorological Satellite Systems Program Office, Headquarters, Space and Missile Systems Organization, Los Angeles. He has served as operations officer of the meteorological satellite data processing section at the Air Force Global Weather Central, Offutt AFB, Nebraska, and recently was assigned as DMSP Staff Officer in the DCS/Aerospace Sciences of Headquarters Air Weather Service. Major Meyer is a graduate of Air Command and Staff College and of the Industrial College of the Armed Forces.

Ryan J. Barilleaux is an honor student in political science and holds an academic scholarship from the University of Southwestern Louisiana. He serves on the Curriculum Committee of the department of political science and heads a research committee of the university honors program. He has been selected as the Louisiana state alternate in the Harry S. Truman Scholarship competition.

Robert L. Bledsoe (Ph.D., University of Florida) is an Associate Professor of Political Science at Florida Technological University, Orlando. Dr. Bledsoe was an Intelligence Officer in the Latin American Branch, Military Capabilities Division, of the Defense Intelligence Agency. His special interests are defense policy and techniques of international violence, particularly deterrence theory and low-level techniques of subversion, coups, and unconventional war theory.

Colonel Edsel R. Field (M.B.A., Kent State University) is Deputy Commander, Operations, 438th Military Airlift Wing, McGuire AFB, New Jersey. His experience has been primarily in airlift operations, including tours in Military Airlift Command and Southeast Asia flying C-123s. He has served as a plans and programs officer at Hq USAF and on the faculty of Air War College, of which he is a Distinguished Graduate.

Major Jerry C. Hix (M.A., University of Denver) is Chief of Internal Information and Plans, North American Air Defense Command Aerospace Defense Command. He is a career information officer and has served as Director of Information for the Alaskan communications region and Air Force Institute of Technology. He has written extensively for base and local newspapers and published several magazine articles. Major Hix is a graduate of Air Command and Staff College.

Paul M. Kozar (M.I.A., Columbia University) is a Military-Political Affairs Analyst with the Air Force Intelligence Service. Additionally, he is studying for his Ph.D. in Russian Area Studies at Georgetown University. His professional training has also included attendance at the Defense Intelligence School.

Chief Master Sergeant Willard P. Anderson, USAF (Ret), (B.S., University of Tampa) was a Management Consultant, Leadership Management Development Center, Hq Air University, at the time of his recent retirement. He presented seminars and workshops worldwide on effective leadership and management at all levels of command. He has lectured in all the Air University PME schools and helped develop phases of the Human Relations Education program. Mr. Anderson is Assistant Personnel Manager at ITT-Rayonier Corporation, Jessup, Georgia.

Senior Master Sergeant Thomas E. Wolfe (M.S., Troy State University) is on the faculty of the Air Force Leadership and Management Instructors' Course, Maxwell AFB, Alabama. Prior to his assignment to the Senior NCO Academy, he was a faculty member of the MAC NCO Academy and was one of the initial members of the Leadership and Management Development Center. He has lectured in all the Air University PME schools. Sergeant Wolfe is author of numerous articles used in Air Force PME and has aided in developing the Human Relations Education program.

First Lieutenant Andrew J. Sherbo, Jr., (M.P.A., University of Georgia) is Deputy Accounting and Finance Officer, 435th Tactical Airlift Wing (MAC), Rhein-Main Air Base, Germany. Previous work experience includes three years as a budget analyst in the State Comptroller's Office, Iowa. He obtained his commission through AFROTC in 1973 at Drake University. Previous publications include articles in the *National Tax Journal* and the *Air Force Comptroller* magazine.

Squadron Leader John D. Brett, Royal Air Force, (M.A., Cambridge University) is on the staff of the Director of Ground Training, Ministry of Defence, London. Until June 1977, he was the RAF Exchange Officer and an Assistant Professor in the Department of History, USAF Academy. His RAF service has been in the Education Branch with instructor and staff appointments in officer and airmen training schools. He has also been seconded to the Royal Malaysian Air Force for three years as an instructor at the Royal Military College at Kuala Lumpur.

The Air University Review Awards Committee has selected "The Extraterrestrial Imperative" by Dr. Krafft A. Ehricke, Head of Space Global, La Jolla, California, as the outstanding article in the January-February 1978 issue of *Air University Review*.

attention

The *Air University Review* is the professional journal of the United States Air Force and serves as an open forum for exploratory discussion. Its purpose is to present innovative thinking and stimulate dialogue concerning Air Force doctrine, strategy, tactics, and related national defense matters. The *Review* should not be construed as representing policies of the Department of Defense, the Air Force, or Air University. Rather, the contents reflect the authors' ideas and do not necessarily bear official sanction. Thoughtful and informed contributions are always welcomed.

Address manuscripts to Editor, Air University Review Division, Bldg. 1211, Maxwell AFB, AL 36112. Printed by Government Printing Office. Address subscriptions to Superintendent of Documents, GPO, Washington DC 20402, yearly $11.60 domestic, $14.50 foreign; single copy $2.00, Air Force Recurring Publication 50-2.

The Professional Journal of the United States Air Force

AIR UNIVERSITY review

MAY-JUNE 1978

The Professional Journal of the United States Air Force

AIR UNIVERSITY review

MARCH-APRIL 1977