AIR UNIVERSITY REVIEW

Sudden Death

A REPORT ON SWIFT STRIKE III...SOME PATTERNS OF AIR FORCE THOUGHT...ULTRA-HIGH PRESSURE RESEARCH

JANUARY—FEBRUARY 1964

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A Report on Swift Strike III

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the cover

"Death the crowned phantom, with all the equipage of his terrors, and the tiger roar of his voice" (De Quincey, "Vision of Sudden Death") could hardly have been more real to this company commander, who was declared dead by the scoring techniques of United States Strike Command's Joint Exercise Swift Strike III.


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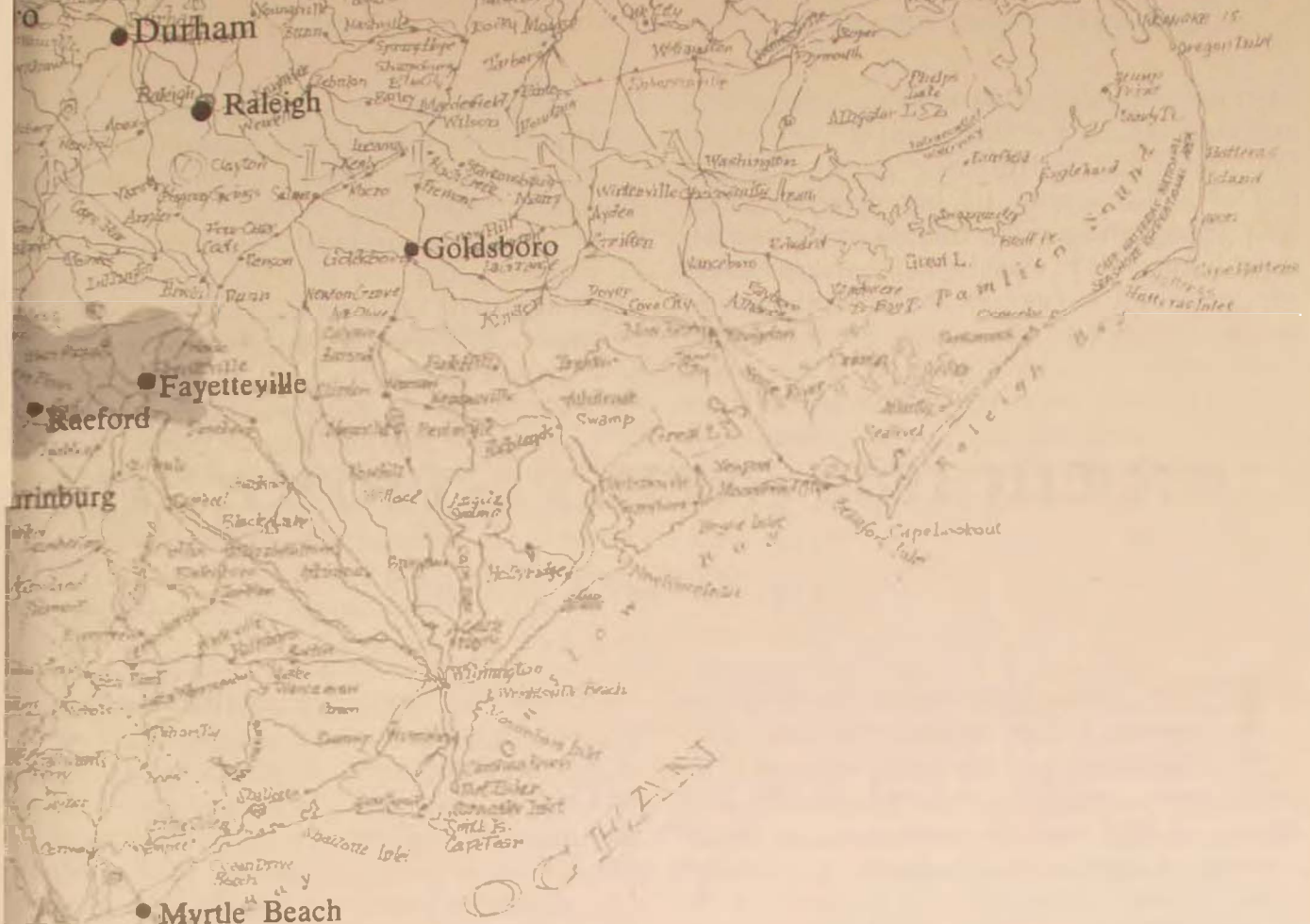


JOINT EXERCISE SWIFT STRIKE III

Prologue

TOWARD the middle of July 1963 the first of almost 100,000 officers and men of the Army and Air Force regular and reserve forces and many thousand tons of arms and equipment began to converge on the Carolinas from bases as far afield as Massachusetts and California for Joint Exercise Swift Strike III. This maneuver was the largest yet conducted by the United States Strike Command. It put into practice a number of new techniques heretofore untested in anything like so large or realistic an operation.

Air University Review offers a comprehensive report on Swift Strike III, prepared with the cooperation of STRICOM and other agencies involved, to examine the maneuver in breadth and sample it in depth. In this report Colonel Frederick A. Sanders' introductory overview presents an explanation of the action and an evaluation of the entire exercise. In "The Soldier and the Airman: Sketchbook Observations of a Joint Maneuver," staff artist William J. DePaola suggests by pencil and brush how it was in and around the mythical Territory of Columbia. "Swift Strike Diary" chronicles the background of the action and the events day by day. Major Robert I. Weber, Colonel Charles H. Phipps, and Major Albert C. Malone, Jr., explain and analyze specific elements in the exercise—close air support, communications-electronics, and civil affairs.

EXERCISE SWIFT STRIKE III

COLONEL FREDERICK A. SANDERS

THE United States Strike Command, the newest of the unified commands, has the mission of planning and executing contingency operations as directed by the Joint Chiefs of Staff and of maintaining a general reserve of combat-ready forces to reinforce other unified commands. To prepare for the accomplishment of this important mission, USSTRICOM conducts an extensive program of joint training exercises.

Joint exercises of various types are held each year. They range in size from those involving a reinforced battalion ground combat team and a small composite air force to the large-scale exercises involving corps headquarters, air force headquarters, multiple Army divisions, and large numbers of Air Force tactical fighter, reconnaissance, and troop-carrier squadrons.

Joint Exercise Swift Strike III, which was conducted during the period 21 July–16 August 1963 in the southeastern United States, was the largest of the joint exercises conducted by Strike Command since its activation in October 1961. This exercise is an excellent example of the joint operations which STRICOM forces are trained to conduct.

Swift Strike III was a semicontrolled joint exercise that stressed maximum freedom of action by commanders and freedom of maneuver consistent with exercise purposes and objectives. As a basis for establishing a geographic delineation of the exercise battle area, it was assumed that a hypothetical Territory of Columbia, a country with no armed forces, had requested military assistance from an ally, the Red Homeland, for defense against possible aggression from forces of the Blue Homeland. The employment of exercise forces resulted from deterioration of relations between the Red and Blue nations, with an incident established by the Director Controller used to trigger hostilities.

The actual ground maneuver area, which encompassed almost 6,000,000 acres in North and South Carolina, is shown on the frontispiece map. Most of the exercise was conducted on privately owned land. Maneuver rights were obtained for 97 per cent of the area desired for the exercise play. Air operations were conducted over a much larger area than that on which the ground battle was waged, and 15 air bases in North Carolina, South Carolina, Tennessee, and Georgia were used for support of Air Force forces.

Exercise Planning

Inasmuch as Swift Strike III was a USSTRICOM joint exercise which was directed and controlled by General Paul D. Adams, USA, Commander in Chief of USSTRICOM

(CINCSTRIKE), the exercise plan was developed in his headquarters at MacDill Air Force Base, Florida. Planning started nine months in advance of the exercise, and frequent and detailed joint planning conferences accomplished the coordination with the large number of military and civilian agencies that either participated directly or supported the exercise. Procurement of the required maneuver area was a major undertaking. It was successfully accomplished through the Third Army staff which visited the major communities in the exercise area to brief key civilian leaders and publicity media on the purposes of the exercise and the necessity for using civilian property. The work of representatives of the U.S. Army Corps of Engineers in arranging for land use permits from about 50,000 landowners was completed without difficulty.

The USSTRICOM General Plan for the exercise was published on 27 March 1963. It provided the necessary data for CINCSTRIKE's component commanders, General Walter C. Sweeney, Jr., Commander in Chief, United States Air Force Forces, Strike Command (CINCAFSTRIKE), and General John Knight Waters, Commander in Chief, United States Army Forces, Strike Command (CINCARSTRIKE), to prepare the plans required for the participation of their respective forces. USAFSTRIKE's planning required detailed coordination with the Military Air Transport Service, Continental Air Command, Air National Guard, and the Federal Aviation Agency. As the single point of contact for CINCSTRIKE on matters related to participation by or support from these organizations, the planning and coordination accomplished by USAFSTRIKE were essential to the success of the exercise.

Following publication of the General Plan, CINCSTRIKE also published Operations Plan Red and Operations Plan Blue in May 1963, to provide guidance and the parameters of operations required for the joint task forces to develop their individual detailed plans.

The basic purpose of this exercise, as of all USSTRICOM joint exercises, was to train major organizations and combat and service support units of USARSTRIKE and USAFSTRIKE in joint operations in order to integrate the combat powers of the USSTRICOM components into highly mobile, hard-hitting, and efficient teams of land and air forces. Allied to this purpose were several other more specific purposes covering many facets of the varied types of operations which USSTRICOM forces may be called upon to conduct in contingency operations, either as a separate and independent force or as augmentation for another unified command. It is of particular interest that the exercise provided essential large-scale joint training of airborne Army and Air Force forces in parachute assault and airlanded operations without benefit of ground linkup. Also of interest is the importance placed on the employment of infantry divisions in their normal land combat roles, with emphasis given to increased mobility and flexibility. The exercise provided for joint training of participating forces in guerrilla and counterguerrilla operations. In addition it provided the opportunity to test and evaluate the following important operational concepts:

- The USSTRICOM-developed system for joint air/ground operations.
- The USSTRICOM-developed system for coordination, control, and regulation of air traffic in the combat area.
- The joint effectiveness of USSTRICOM concepts for tactical air reconnaissance and battlefield surveillance (TARABS).
- The USSTRICOM command-directed joint logistics system.

Command Structure

General Adams, Director Controller for the exercise, had as his deputy Major General Henry Viccellio, Commander, Nineteenth Air Force. The Director Controller Headquarters, located at Spartanburg, South Carolina, employed a conventional joint staff. Key personnel from USSTRICOM Headquarters were in the field for Swift Strike III, but because USSTRICOM had to continue to function at

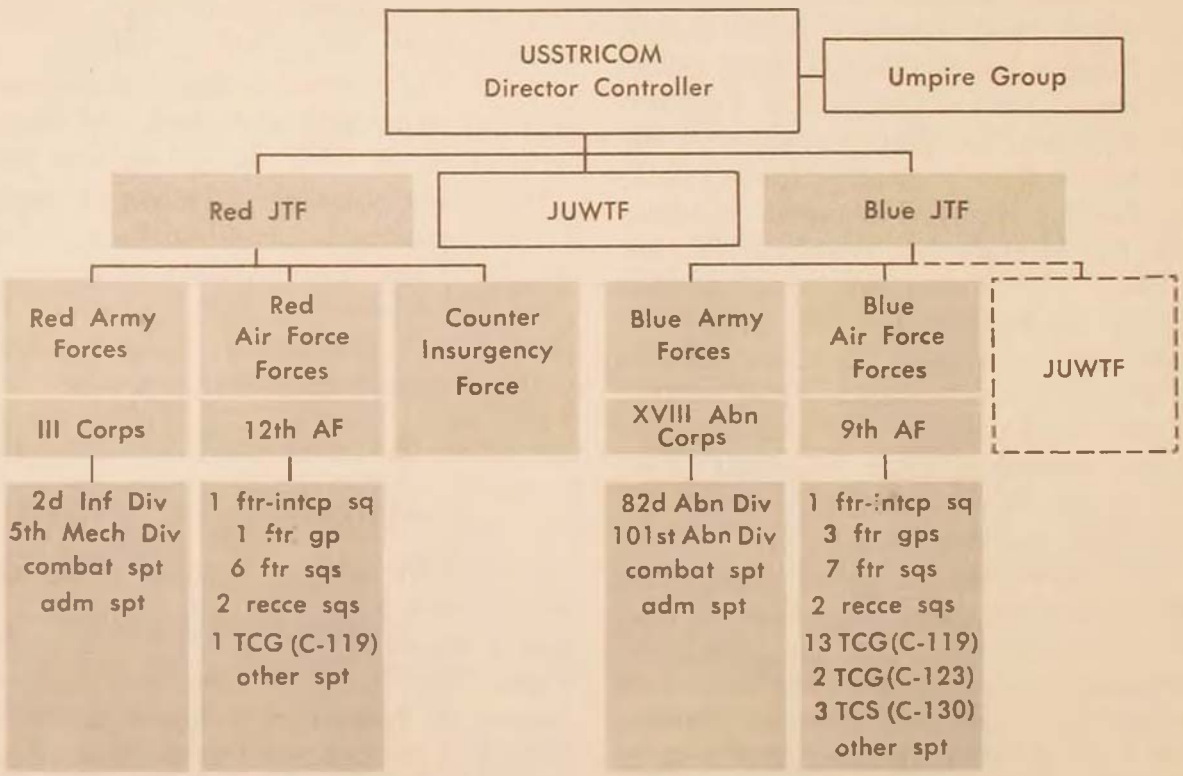
MacDill AFB during the exercise, the staff at Spartanburg was augmented by representatives from both of CINCSTRIKE's components, Army and Air Force. General Adams' headquarters at Spartanburg was known as Headquarters USSTRICOM (Advance); the headquarters at MacDill was Headquarters USSTRICOM (Rear). This organization was in keeping with the requirement that USSTRICOM be prepared to deploy a command element from the headquarters for command and control of joint forces committed to overseas operations as an independent fighting force.

Directly subordinate to the Director Controller Headquarters, or Headquarters USSTRICOM (Advance)—the more meaningful designation, as it reflects how the headquarters would function in a real contingency operation—were three joint task forces: Joint Task Force Red, Joint Task Force Blue, and the Joint Unconventional Warfare Task Force (JUWTF). These joint task forces, plus the Umpire Group attached to and operated from the Director Controller Headquarters, comprised the major organizational elements for the exercise.

Joint Task Force Red was commanded by Lieutenant General Thomas W. Dunn, USA, Commanding General, III Corps. Joint Task Force Blue was commanded by Lieutenant General Bruce K. Holloway, USAF, Deputy Commander in Chief, USSTRICOM. The Joint Unconventional Warfare Task Force was commanded by Major General William P. Yarborough, USA, Commanding General, U.S. Army Special Warfare Center. The major components of the three task forces are listed in the introduction to the "Swift Strike Diary."

The Umpire Group was integrated into the Director Controller Headquarters. For an

SWIFT STRIKE III
Command Relationships



Prior to the beginning of ground warfare on 4 August, Joint Unconventional Warfare Task Force Blue operated in the Territory of Columbia directly under the Director Controller, Swift Strike III. Later, when Blue Homeland forces moved into the Territory of Columbia, Joint Task Force Blue assumed operational control of JUWTF Blue.

exercise the size of Swift Strike III, the number of umpires and controllers employed was quite small, only 322 officers and enlisted men. The concept behind so small an organization was that control would be accomplished through the use of normal command channels, with minimum use of umpires. This new approach was designed to give commanders maximum opportunities to exercise command, with particular emphasis on battle leadership, decisions, and initiative. Through this procedure substantial savings were made in umpire and controller personnel and in communications requirements.

Exercise Phases

Phase I of the exercise was conducted from 21 July to 3 August. It consisted primarily of the air battle, but during the same time period Red Army forces moved into the maneuver area and were readied for the ground battle that was to ensue.

Air operations began on 21 July with the authorization from the Director Controller Headquarters for Commander Joint Task Force Blue to conduct unarmed reconnaissance operations over the Territory of Columbia. At the same time CJTF Blue was authorized to employ escorted aerial reconnaissance if the Red Air Force reacted to a degree which made unarmed and unescorted aerial reconnaissance missions infeasible. Concurrently, CJTF Red was instructed by the Director Controller to defend the Territory of Columbia from aggression by Blue forces, but he was not authorized to penetrate Blue Homeland airspace. By noon of 21 July, CJTF Blue found it necessary to escort his reconnaissance aircraft.

The reconnaissance phase lasted four days. During this period there was an intensive shakedown of air traffic control facilities to ensure the required reliability. Reliability was essential not only to the subsequent exercise play but also to flying safety. A total of 596 Air Force aircraft and some 370 Army aircraft participated in the exercise. This number of aircraft provided a density of traffic in the exercise area that dictated a requirement for the highest standards of air traffic control, coordination, and regulation.

By 24 July the air traffic control facilities, which were from USAFSTRIKE and the Air National Guard, were well established within both joint task forces. The Director Controller then directed CJTF Blue to conduct a one-time strike on the Red Hawk missile units that had been inflicting appreciable losses on Blue aircraft. This was done with the idea that subsequent exercise play in the air battle would depend on Red reaction to an attack on its force.

Following the aggressive Blue strike, CJTF Red was directed to conduct offensive air operations over the Blue Homeland. As soon as the Red Air Force initiated these operations, the Blue Air Force was instructed to extend offensive air operations into the Territory of Columbia. Thus on 25 July full-scale conventional air operations were initiated by both forces.

Concurrently with the air battle, Red Army forces moved into the maneuver area and prepared for ground battle. The 2d Infantry Division was deployed from its home station at Fort Benning, Georgia, by organic and commercial means. The 5th Infantry Division, Fort Carson, Colorado, was deployed from McConnell AFB, Kansas, to Donaldson Field, South Carolina, by MATS aircraft, a total of 7918 personnel and 8722 short tons of equipment flown into the exercise area. Severe weather in the Midwest disrupted the scheduled arrival of the 5th Division, but MATS responded with additional sorties and completed the deployment within the time allotted for this operation.

Phase II of the exercise was initiated on 4 August with JTF Blue's conduct of an airborne assault by the 82d Airborne Division into the Territory of Columbia. The 82d Division was followed on 5 August by the 101st Airborne Division. Both these divisions staged from the airfields in the vicinity of their home stations of Fort Bragg, North Carolina, and Fort Campbell, Kentucky, respectively. Associated with the airborne assault of the 82d and 101st Air-

Swift Strike Commanders

General Paul D. Adams (center), Commander in Chief of U.S. Strike Command and Director Controller of Exercise Swift Strike III, confers with U.S. Army Chief of Staff General Earle G. Wheeler (right) and Major General Henry Viccellio, Commander of Nineteenth Air Force and Deputy Director Controller of the maneuver, as they watch the 4 August airdrop of the 82d Airborne Division near Joanna, S.C.

Lieutenant General Bruce K. Holloway, Commander, Joint Task Force Blue, inspects troops of the 82d Airborne Division during Joint Exercise Swift Strike III. Accompanying General Holloway is Major General John L. Throckmorton, Division Commander.

General Thomas W. Dunn, Commander, Red Joint Task Force, comes to the defense of Newberry, capital of Territory of Columbia, on 29 July. General Dunn wears the distinctive markings of the Red forces, bright red "cockscomb" on his helmet and the red "Circle Trigon" on his uniform.

borne Divisions was the construction of assault landing strips in the immediate vicinity of the drop zones to support the air line of communications (ALOC), which was to be sole means of resupply for the XVIII Airborne Corps. The emphasis on air operations by both JTF's changed during this phase from counter-air operations to isolation of the battlefield and close-air-support missions.

The 82d and 101st Airborne Divisions had not worked together as a team since their participation in airborne operations in Holland in 1944. In Swift Strike III they again teamed together to demonstrate an efficiently integrated fighting force.

The airborne operations and resupply activities of JTF Blue were the largest ever accomplished in an exercise by U.S. forces. In a two-day period at the outset of the ground battle, over 14,000 troops were deployed into the assault airhead. Over 5000 tons of equipment and supplies were also dropped, air-landed, or delivered by the newly developed ground proximity extraction system during the first two days. Also illustrative of the scope of operations of the Blue forces is the fact that over 34,000 personnel and almost 27,000 short tons of equipment were delivered by the Blue Air Force during the period 4–16 August.

The construction of assault landing strips began immediately after the heavy drop of the required construction equipment on 4 August. Within 36 hours after the airborne assault began, the first strip was ready for limited use. Sustained operations from this assault strip were begun 72 hours after the airborne assault. Construction of a second strip was begun 56 hours after the airborne assault, and it was ready within 24 hours for the first C-130 landing. Both these assault strips were used throughout the exercise to support the ALOC, which was the lifeblood of JTF Blue's forces.

To support this operation, General Holloway had the following aircraft at his disposal:

48	C-130	(USAFSTRIKE)
16	C-123	(USAFSTRIKE)
18	C-130	(MATS)
142	C-119	(CONAC)
24	C-123	(CONAC)
16	C-97	(ANG)
2	C-121	(ANG)

Supplementing these resources, MATS C-124's flew 250 sorties in support of the aerial resupply operations.

In Phases III and IV the JTF Blue airhead was consolidated. The Blue forces were initially subjected to intensive air and ground attacks by the Red forces. The Blue forces launched a coordinated attack to destroy the Red forces. JTF Red conducted retrograde operations and regrouped to launch a counterattack.

Phase V of the exercise had as its major activity the withdrawal of an airborne division from the exercise. The purpose of this operation was to test USSTRICOM's ability to withdraw a large force from the exercise for commitment in a strategic contingency mission. The 101st Airborne Division was the unit selected for this action, and it was moved from the exercise area to Fort Campbell, Kentucky, by all available USAFSTRIKE, CONAC, and MATS troop-carrier aircraft. The major elements of JTF Blue were required to protect the withdrawal, thereby creating an opportunity for JTF Red to initiate successful offensive operations against the dwindling Blue ground forces. Upon completion of the withdrawal of the 101st Division, the exercise was terminated.

Air Operations Highlights

The scope of the tactical air play throughout the exercise, exclusive of troop-carrier operations, is reflected by the kind and number of sorties flown:

Mission	Red Air Force	Blue Air Force
air defense	1479	671
counter-air	270	1538
interdiction	918	404
close air support	820	1161
reconnaissance	645	654
	4132	4428

The fighter and reconnaissance units within both joint task forces proved overwhelmingly

that they were capable of responding to the heavy requirements placed upon them. For obvious reasons of safety and control, the rules of engagement and umpire rules prevented or nullified any detailed tactics of aerial warfare that would normally have been applied. As a result, each side was reduced to a common level of combat skills and, to some extent, of tactical planning.

The air battle phase was conducted for too long a period, a fact that was acknowledged at all levels of command. USSTRICOM had learned from previous exercises that realistic air play cannot always be achieved coincidental with the air/ground play, particularly the fight for air superiority, interdiction operations, and reconnaissance. Therefore in Exercise Swift Strike III the air battle took place for two weeks prior to initiation of ground operations. It was generally agreed that a period of seven to nine days would have been an ample duration for this phase.

The magnitude of the airlift operations conducted by JTF Blue deserves special mention. These operations were conducted under conditions which constituted major advantages and assets: first, almost ideal weather conditions existed throughout the exercise; and second, the air line of communications from the staging bases to the objective area was less than two hours' flying time. These advantages were partially offset by other factors: six different types of aircraft were used, each possessing varying degrees of capability; it was necessary to oversaturate and tax to the maximum the D-Day launch bases in order to meet the initial launch objectives. Additionally, the late scheduled arrival of Air Force Reserve units precluded the detailed preparations considered necessary to prepare these units for the D-Day airborne and airlanded operations.

A total of 266 troop-carrier and transport aircraft were available to JTF Blue. The total capability represented by this number of aircraft was 5536 sorties. As many as 4659 sorties were actually scheduled against the capability, and 4060 sorties were flown. When the number of noneffective sorties over which the Airlift Task Force had no control was deducted from the total, an overall effectiveness of 91.8 per cent resulted.

The airlift operations of this exercise were an undertaking never before attempted in peacetime. The results proved that an air line of communications can be established and maintained under conditions of air superiority. The necessary concentration of aircraft for operations of this type dictates the absolute requirement for complete protection of operating bases. Whether or not this standard could be achieved in a future war is open to debate.

Although new developments have been made in troop-carrier operations—e.g., assault strip operations, ground proximity extraction delivery, and the pop-up method of troop or cargo delivery—there is still a pressing requirement for an all-weather delivery capability. In Swift Strike III, weather did not hamper the airborne operations and subsequent resupply operations to any appreciable degree. This was extremely fortunate, for the JTF Blue ground operations could easily have been seriously jeopardized by significant breaks in the flow of aircraft engaged in aerial resupply.

The possibility of requirements for U.S. Strike Command forces to conduct air operations in many undeveloped and isolated areas of the world makes it essential that the capabilities and limiting factors associated with bare base operations be fully understood. To gain experience in this important field, operations were conducted throughout the exercise from three bare bases.

MATS operated under the bare base concept from Donaldson Field, which had been closed as an active base in June 1963. None of the available buildings were used, and MATS personnel operated from mobile facilities which they flew into Donaldson. The only exceptions to a true bare base operation that were allowed during the exercise were use of the installed runway lights and use of the base control tower in lieu of a mobile tower. This action was taken in the interest of safety because of the exceedingly heavy traffic using Donaldson during the exercise.

The mobility package to support bare base operations at Donaldson included a

Bare Base Operations

Fighter pilots scramble to their aircraft from bare base alert tents meet the Blue Air Force threat. Men and machines are pushed to the maximum in this realistic operation simulating wartime conditions.

Air Force C-130 Hercules line up nose-to-tail in a joint training maneuver, part of the integrated hard-hitting ground/air combat power of Continental Army Command and Tactical Air Command. At Donaldson Field the Military Air Transport Service operated under bare base conditions during the airlift of the 101st Airborne Division from Ft. Campbell.

Blue Joint Task Force soldiers load fuel drums aboard U.S. Army Caribou transports at the Newberry, S. C., grass strip during an exercise in air logistics within the Swift Strike III airhead.

Equipment for JTF Red 5th Infantry Division (Mech) is unloaded at Donaldson Field during the huge Red forces airlift. Under bare base conditions, the only prepared facilities used (other than runways) were the runway lighting and control towers for control of traffic and for safety.

An F-100 of the Red Air Force refuels from a 55,000-gallon collapsible tank on a bare strip. When empty, the tanks weigh only 1500 pounds and can be rolled up to simplify handling.

housekeeping kit, base support kit for fire-protection equipment and minimum transportation requirements, a traffic kit for material-handling equipment, a maintenance and supply kit, a weather and communications kit, a 400,000-gallon bladder refueling system, and a tactical hospital. Terminal navigation aids were furnished by the Air Force. All this equipment constituted the capability to support the heavy flow of MATS traffic generated by the movement of the 5th Infantry Division and other exercise units into and out of the exercise area. By use of cellular packaging, a force can be tailored from these kits to support any size MATS airlift operation. To airlift the same bare base kit package that was used at Donaldson to Turkey, for example, would require approximately 90 C-124 loads.

The Red Air Force also used the bare base concept of operations at Bush Field, Georgia, and at North Field, South Carolina. Bush Field was primarily the headquarters and headquarters support facility for Red Air Force forces. Operational components at North Field included two tactical fighter squadrons, a composite tactical reconnaissance squadron, a control and reporting center, and a combat support group.

North Field was a true test of the bare base concept in that there was nothing on the base except a runway complex. The first elements of the base package arrived on 11 July. On 19 July the tactical aircraft were in place, and on 20 July the base was ready for full operations. The time from first occupancy to first mission launch was nine days.

During the exercise 40 per cent of the Red Air Force's operations were conducted from North Field. A total of 1286 fighter, reconnaissance, and airlift sorties were flown from this bare base. During the course of the exercise an overall operational readiness of 88 per cent was maintained—a clear demonstration of the capability to occupy a bare base, establish the necessary support organization, and carry out extensive tactical air operations.

A natural question is, "Would the same degree of success prevail in an actual overseas operation?" With proper base defense and air superiority, the answer would probably be in the affirmative. However, runway damage, aircraft damage, disrupted communications, and personnel and equipment losses in an austere overseas environment are factors on which the success of the operation would hinge.

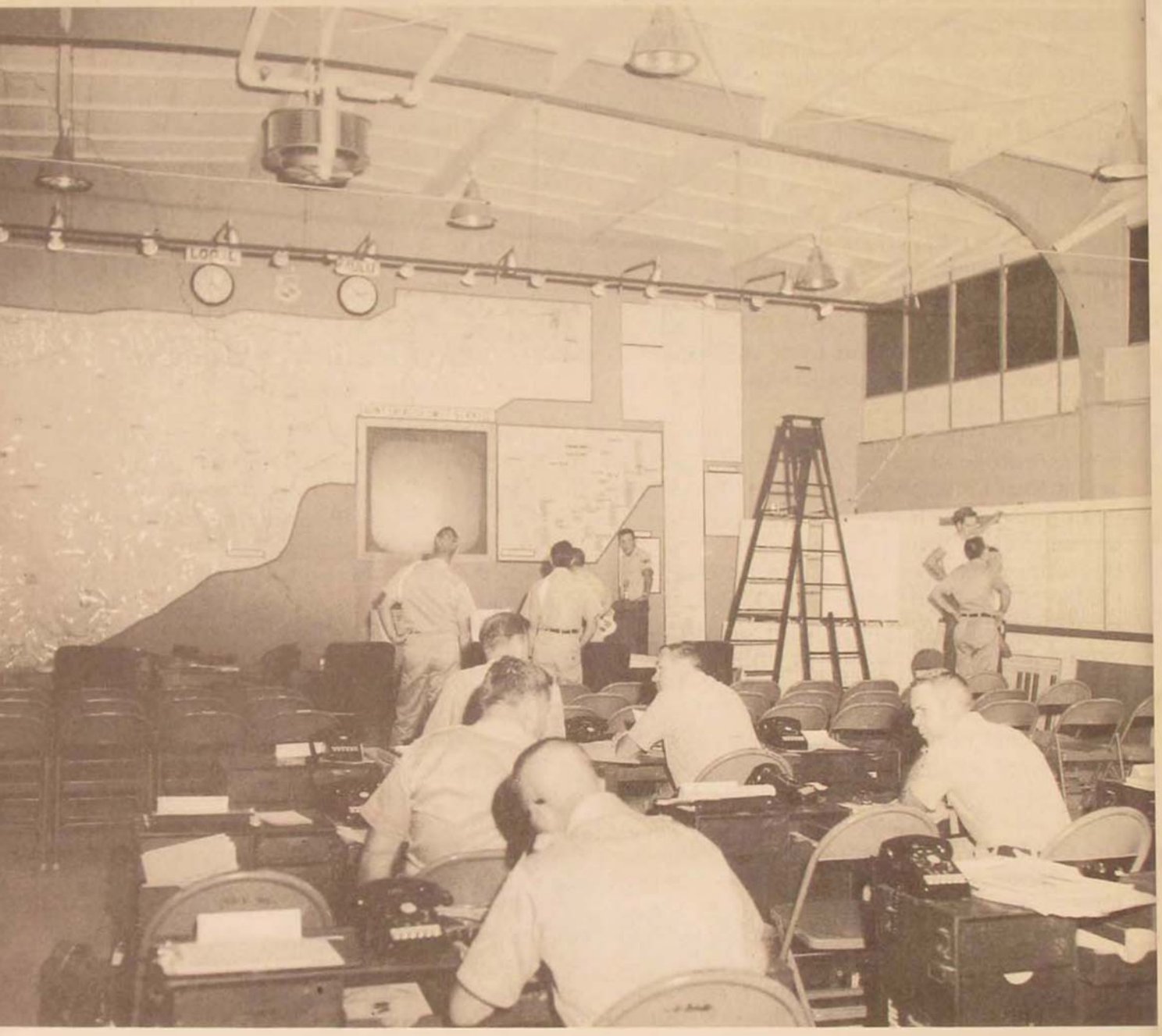
Bare base operations in Swift Strike III were highly successful and provided valuable experience to the personnel involved. The requirement for refinement of our capabilities in this essential field of operations dictates that bare base operations be played in all future USSTRICOM joint exercises.

Unconventional Warfare Operations

Unconventional warfare (UW) operations for this exercise began in early May 1963 with the activation of the Joint Unconventional Warfare Task Force Planning Staff. Although this may appear to have been early for an exercise scheduled for July and August, it was not. Considerable time was required to ensure the development and construction of a plausible covert and clandestine foundation on which the overt guerrilla operations could be based.

Special Forces detachments, guerrilla leaders, and aircrews were afforded the opportunity for some of the most realistic joint training they had ever experienced. Of equal importance was the fact that Army and Air Force UW forces were provided the opportunity to observe and arrive at solutions of mutual problems. The result was more effective coordination of UW operating policies, procedures, and techniques. Additionally the exercise provided an opportunity for close association, cooperation, and participation with other governmental agencies for the first time in a realistic UW scenario.

Air Force operations in the UW field consisted of obtaining photography of drop and landing zones for UW forces, photography of both UW and conventional targets, covert infiltration of personnel and equipment, exfiltration of personnel, psychological warfare operations, close air support for UW forces, and



Umpires, wearing the white armbands, consult with operations officers at the SS III situation map in the Joint Control Center set up in the South Carolina National Guard Armory at Spartanburg. In the Control Center, operations and intelligence officers of the Blue and Red joint task forces worked 12-hour shifts, 24 hours a day, with Director Controller Headquarters team chiefs and umpires to assess the results of tactical actions.

aerial weather reconnaissance. To support these varied operations, the following Air Force aircraft were available to the JUWTF commander:

4	C-46	2	T-28
7	C-123	2	B-26
5	U-10	4	HU-16

As the exercise play developed, it became apparent that, with the exception of the U-10 and B-26 aircraft configured for photo reconnaissance, allocated aircraft exceeded requirements. Those not required frequently for direct exercise play were used to good advantage for concentrated training of available crews.

The unconventional warfare play was extensive and aggressive, and certainly beneficial to all exercise participants. It served to educate and train; it confirmed the soundness of certain doctrines and procedures; and it highlighted the need for continuing development and improvement of other doctrines and procedures. There were, however, significant artificialities which must be overcome or corrected for future exercises if we are to prevent misconceptions being formed about the true complexity of unconventional warfare operations and of the requirements for successful counterguerrilla operations. The following are examples of areas in which inaccurate impressions may have been formed:

- Guerrilla speed of reaction to requirements and instructions of operational commanders. In reality, such reaction could well be extremely slow or nonexistent.

- The large volume of detailed intelligence data submitted by guerrilla forces. Acquisition and submission of intelligence are not the primary objective of guerrilla forces, although intelligence is potentially an important by-product of guerrilla operations. In this exercise the volume and detail of information submitted far exceeded that which could reasonably be expected in actual operations.

There is yet much to be learned about successful joint unconventional warfare operations. Exercise Swift Strike III contributed immeasurably to the required education processes and clearly pointed the direction which must be followed to reach the degree of understanding and cooperation which is essential to success in actual joint operations.

Joint Evaluation of Exercise Purposes

The development of joint doctrine is a unique responsibility of CINCSTRIKE, and joint exercises provide the means of testing and evaluating doctrinal concepts that have been developed by USSTRICOM. Exercise Swift Strike III provided the opportunity for evaluation of several areas of study of significant importance to joint operations. Results of these evaluations have not yet been completely analyzed. When analysis is complete, a determination can be made as to whether the doctrinal concepts are sound and should be recommended to the Joint Chiefs of Staff for adoption as joint doctrine.

Joint evaluation teams evaluated in detail certain special areas of interest in the exercise:

- Joint air/ground operations system.
- Unified/joint procedures for coordination, control, and regulation of air traffic in the combat area.
- Joint and unilateral intelligence activities, including tactical air reconnaissance and battlefield surveillance.
- Command-directed joint logistics system.

Each of these subjects has been of special interest to USSTRICOM, and Swift Strike III provided the opportunity for a thorough shakedown of procedures designed to improve the efficiency of joint operations. Much was learned from the evaluation effort. In some cases the validity of new procedures was proved. In others it was learned that additional testing of procedures will be required. The most important finding was that evaluations of the types mentioned provide opportunity for the detailed analysis that is required for a practical solution and confirmation of doctrinal theories.

Conclusion

Swift Strike III has been judged as an extremely successful and worthwhile joint exercise. Of utmost importance is the recognition and awareness of operational areas in which refinement of operating techniques is required. As one would expect in an exercise involving nearly 100,000 men, mistakes were made and problems were encountered. There were none, however, that cannot be corrected or solved with continued training, hard work, and original and imaginative thinking.

The after-action reports of the exercise are voluminous and contain many detailed recommendations that will have application for future exercises of USSTRICOM as forces are readied for possible use in emergency operations. The process of training is, of course, never ending. As this is being written, another major joint exercise for USSTRICOM forces is being planned. The lessons learned from Swift Strike III must be applied to this forthcoming exercise if we are to ensure maximum benefits from the time, money, and effort expended and continue the rapid progress made by USSTRICOM in readying forces to carry out its mission.

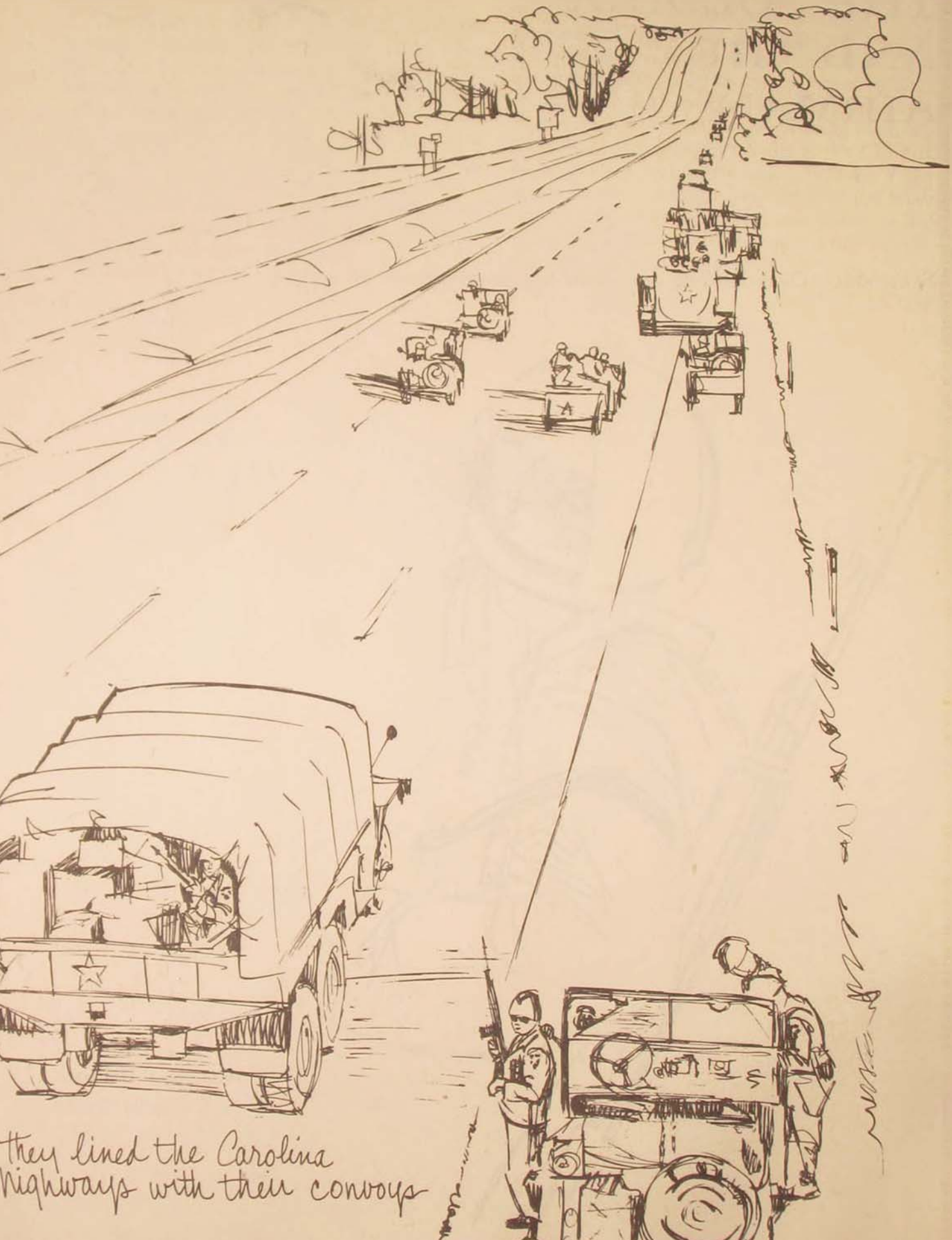
Hq USSTRICOM

THE SOLDIER AND THE AIRMAN

Sketchbook Observations of a Joint Maneuver

WILLIAM J. DEPAOLA
Air University Review

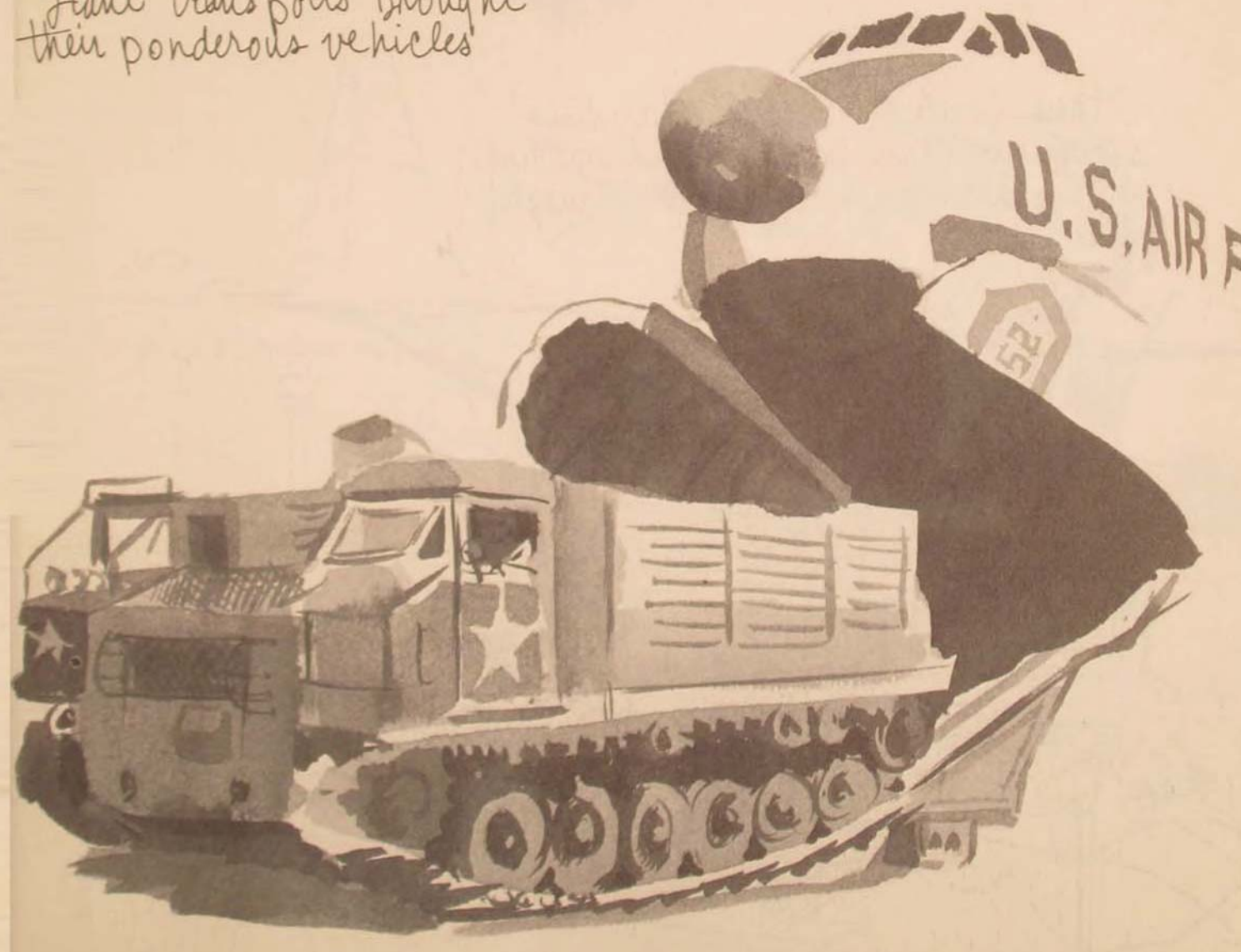
The Soldier and the Airman
play Swift Strike III



they lined the Carolina highways with their convoys

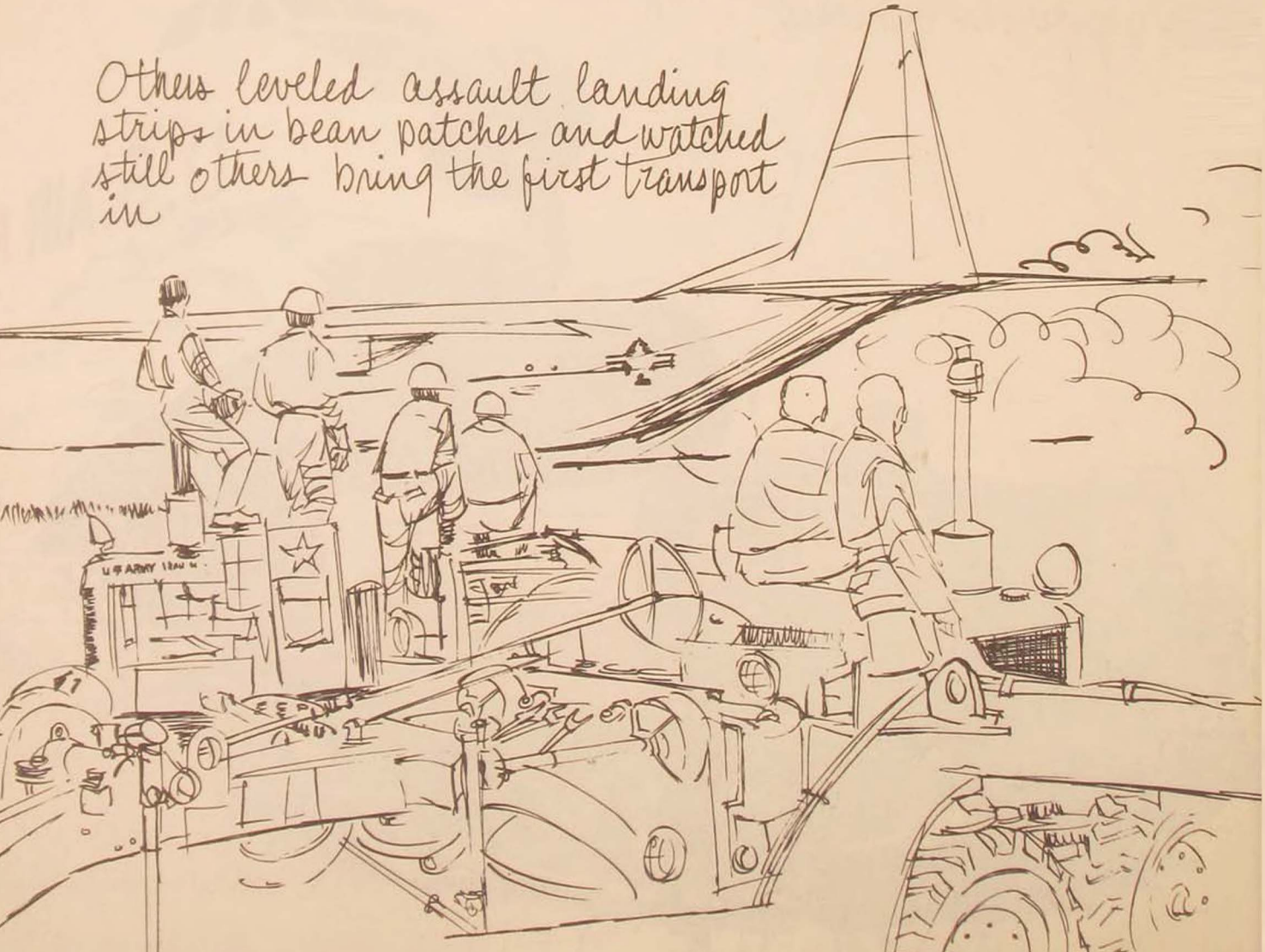
they came into the airfields by vehicle and plane

Giant transports brought their ponderous vehicles



Some ran wire

Others leveled assault landing strips in bean patches and watched still others bring the first transport in



this man waded the swamps in the guerrilla play

While others planned to track him down


Many carried
extra burdens

But not many missed the sweating marches, advance or retreat

While others lay in wait for them

this man in his turn
among thousands
tensed his muscles
for the big jump

they sank swiftly
down to the
enemy ground

Coming confidently to their feet
with the drop behind them—
ammunition is blank on the maneuver
field

On the hot airfields the fighter aircraft were serviced

the bare base tanks were pumped fat with fuel

For the basic job among all

SWIFT STRIKE DIARY

Preparations for the Maneuver

THE 1963 joint exercise of the United States Strike Command was designated Swift Strike III and scheduled for 21 July to 16 August. The third of the annual Swift Strike maneuvers was to be the largest of them all. Units of the U.S. Army Strike Forces (USARSTRIKE) and the U.S. Air Force Strike Forces (USAFSTRIKE), to take part in the exercise under operational control of USSTRICOM, would number 100,000 soldiers and airmen, with their thousands of vehicles and thousands of tons of heavy equipment. All would move by road, rail, or air into the maneuver area chosen in the Carolinas and the support bases in Georgia and Tennessee. Here the air and surface movements would converge from about 40 army posts and 25 air bases in 28 states stretching from Massachusetts to California.

This confluence of men and materiel was all according to the voluminous and detailed CINCSTRIKE General Plan, Joint Exercise Swift Strike III (JE-SS III), published in March 1963. Even more detailed plans for the operations and maneuver of the Red and Blue JTF's were also published by CINCSTRIKE. These plans were followed in May by the publication of separate joint task force operational plans detailing specific actions to be taken by each unit during the exercise.

Swift Strike III was to be a two-sided field training maneuver with opposing Red and Blue joint task forces maneuvering against each other. The preliminary air phase of the exercise would range over an indefinite area bounded by Air Force bases in Georgia, Tennessee, North and South Carolina, and over the maneuver area itself—approximately 7500 square miles bounded by Charlotte, N.C., Columbia, S.C., Augusta, Ga., and Greenville, S.C. The air/ground team maneuvers were to be confined to a smaller area, chiefly to the triangle formed by Greenwood, Columbia, and Union, all in South Carolina.

The United States Strike Command, a unified command operating directly under the Joint Chiefs of Staff with operational control over and joint training responsibility for all combat-ready units of the Continental Army Command (CONARC) and over Tactical Air Command (TAC) combat-ready units in the United States, called four army divisions and two numbered Air Forces, plus supporting units, to conduct the exercise. Participating forces of CONARC and TAC were to be alerted and strategically concentrated in the maneuver area for employment by the two opposing joint task force commanders. Each joint task force commander would be assisted by a deputy, a senior officer from a service other than

his own, and by a thoroughly integrated joint staff representing the services contributing forces to the exercise.

Lieutenant General Thomas Weldon Dunn, U.S. Army, Commander of Joint Task Force Red, would make his headquarters at Fort Gordon, Ga. Lieutenant General Bruce K. Holloway, U.S. Air Force, Commander of Joint Task Force Blue, would have his headquarters at Fort Bragg, N.C. Major General William P. Yarborough, U.S. Army, Commander of Joint Unconventional Warfare Task Force, would have his headquarters at Fort Bragg, N.C. The Neutral Forces headquarters, commanded by Colonel Leon A. Michaelis at Fort Jackson, S.C., would handle such important details as getting power shut off in paratroop drop zones, recovery of parachutes, first aid, and maneuver damage repair.

Of necessity, the 16 participating air bases were far-flung but within realistic fighter range of the combat area. To the north would be McGhee-Tyson Airport in Tennessee, Pope AFB, Stallings Field, and Seymour Johnson AFB in North Carolina, and McEntyre Field and Myrtle Beach AFB in South Carolina. To the south would be Turner, Dobbins, Robins, Hunter, and Travis, all in Georgia, and to the west in Tennessee would be Sewart AFB. In and close to the exercise area would be Donaldson Field, MacKall Army Air Field, and North and Bush Fields. All these fields in or near the exercise area were to be "bare base" operations, with personnel operating out of tents, the only real facilities being the runways.

Nearly 10,000 vehicles would roll into the Carolinas in convoy units ranging from division size with as many as 2300 vehicles and trailers to a small unit with only 6 vehicles. Every movement of motor convoys from home stations to the exercise would be conducted as a tactical march. Units assembling in the exercise area would operate under full field conditions simulating those that could exist in Strike Command contingency operations. The Joint Task Force ground units deploying to the assembly locations would become "fair game" immediately upon entering the Swift Strike maneuver area.

Objectives of Swift Strike III

The far-ranging purposes of Swift Strike III may be stated as general objectives and specific objectives.

general objectives

- To further develop joint operational tactics and techniques to ensure that Army and Air Force units can deal decisively as a team with all types of contingencies from a show of force to general war.
- To provide the participating Army and Air Force units and command echelons with essential realistic field training required to maintain them at the highest possible state of combat readiness.
- To provide a two-sided exercise, aimed at developing the freest tactical play possible through creating original and challenging tactical problems, to be solved whenever and wherever they arise by the opposing elements of the maneuvering forces.
- To encourage tactical initiative, creativeness, and innovation at all levels of command from squads upward, controls being exercised only to get the full measure of experiences and results out of the exercise. (No script was written forecasting a winning and a losing side.)

specific objectives

- To gain further experience with the new USSTRICOM-ARSTRIKE-AFSTRIKE agreed air/ground support system with particular emphasis on evaluating the effectiveness of the system in large-scale operations.
- To stress joint and unilateral intelligence operations at all levels of command in order to raise to the highest practical degree the effectiveness, coordination, and productiveness of all intelligence resources available.
- To train large airborne forces in parachute/airlanded roles without benefit of

ground linkup, as a means of further evaluating their capabilities and limitations in this respect as related to contingency-type operations.

• To rehearse USSTRICOM capability to withdraw and appropriately organize a joint task force from a CONUS exercise, or from an actual operation, for employment elsewhere on an urgent contingency operation.

• To test independently and in conjunction with other intelligence resources the joint effectiveness of USSTRICOM concepts of tactical air reconnaissance and battlefield surveillance (TARABS) means available to participating Army and Air Force units.

• To test and evaluate a command-directed joint logistical system as developed by USSTRICOM and concurred in for testing by Air Force Logistics Command and Army Materiel Command.

• To test doctrinal concepts for a joint unconventional warfare task force headquarters in the planning and conducting of unconventional warfare operations under specified principles and procedures.

• To test airhead feasibility, the capture of territory, and the airlifting of all personnel and equipment to construct an airstrip capable of servicing heavy cargo aircraft.

• To test the ground proximity extraction method of delivery of supplies and equipment.

• To test the pop-up method of droping paratroops.

• To test use of Hawk ground-to-air missiles.

• To test use of GAR air-to-air missiles.

• To improve insurgency and counter-insurgency techniques.

• To improve river-crossing and bridgehead techniques.

• To test use of nuclear weapons in limited warfare.

• To test use of helicopters in airborne operations.

The Maneuver Play

Background for War

To establish a realistic political background for the exercise, three theoretical countries were postulated. The Blue Homeland (BHL), a strong country and constitutional federal republic founded in 1948, has close political and economic ties with the Western world. The Blue government has a military assistance pact with the United States, which has a military assistance advisory group operating in the Blue Homeland.

The Red Homeland (RHL), which is adjacent to the Blue Homeland, also is a strong country and is desperately trying to remove all traces and effects of Western world influence from the entire continent.

Major Units of Joint Task Force Blue
Lt. General Bruce K. Holloway, USAF, Commanding

Army

Hq XVIII Abn Corps	101st Abn Div
82d Abn Div	5th Logistical Com

Air Force

Hq Ninth Air Force	356th TF Sq (F-100)
*46th TF Sq (F-84F) (TAC)	560th TF Sq (F-100)
557th TF Sq (F-84F)	*325th FIS (F-102)
309th TF Sq (F-100)	*29th TR Sq (RF-101, RB-66) (TAC)
333d TF Sq (F-105)	839th Air Div (C-130)
335th TF Sq (F-105)	516th TCW (C-130)
352d TF Sq (F-100)	152d TAC Control Grou

Air National Guard

184th TF Group (F-100)	186th TR Group (RF-84
102d TF Group (F-86F)	127th TR Group (RF-84
104th TF Group (F-86H)	190th TR Group (RB-57

Air Reserve Troop Carrier (TAC/CONAC/MATS)

*934th TC Group (C-119)	913th TC Group (C-119)
906th TC Group (C-119)	914th TC Group (C-119)
907th TC Group (C-119)	901st TC Group (C-119)
915th TC Group (C-119)	902d TC Group (C-119)
930th TC Group (C-119)	908th TC Group (C-119)
931st TC Group (C-119)	918th TC Group (C-123)
932d TC Group (C-119)	919th TC Group (C-123)
912th TC Group (C-119)	920th TC Group (C-123)

The small Territory of Columbia (TC), a traditionally neutral country, lies near the Red-Blue border but is completely surrounded by Red Homeland. The Territory of Columbia, with its capital at Newberry and with its Red-oriented government, has increasingly come under the control of the RHL and lacks any military force or adequate police protection.

Early in 1963 the BHL Embassy at Newberry reported that RHL was exerting an influence on the government. The direction of influence was against the feelings of the general population. It appeared that RHL would soon attempt to increase its control and that maintenance of internal order would be a problem. Since TC had no military forces and inadequate internal police, it would have to call on RHL for assistance. Quite a number of recent TC political decisions showed a definite lean toward RHL principles.

Just after the first of May, the RHL attempted to impose a treaty plan on the TC calling for the complete integration of the economy of the nation into the Red bloc. The government of the Blue Homeland, in return, stated that the neutral status of the TC must be preserved if peace was to be maintained and left no doubt that BHL would intervene if RHL attempted to carry out the plan to move forces into the TC.

By late May the civilian population of the TC had become anxious to form a new government and was favorably disposed to support a guerrilla effort for the eventual overthrow of the present government known as the "Circle Trigon Regime." Dissident territorial nationals, aided by clandestine BHL agents, were assist-

Major Units of Joint Unconventional Warfare Task Force

Major General William F. Yarborough, USA, Commanding

Army Special Force Group Hq (Abn)
Army Special Force operational detachments
Army Guerrilla Force
Army Psychological Warfare teams
Air Commando groups
Air Commando detachments
1 Troop Carrier Squadron (C-123)
Elements of Air National Guard

Major Units of Joint Task Force Red

Lt. General Thomas W. Dunn, USA, Commanding

Army

Hq III Corps
2d Infantry Div
5th Infantry Div
Joint Counterinsurgency Force
1st Logistical Com

Air Force

Hq Twelfth Air Force
428th TF Sq (F-100) (TAC)
436th TF Sq (F-104)
522d TF Sq (F-100)
612th TF Sq (F-100)
20th TR Sq (RF-101, RB-66) (TAC)
479th TF Sq (F-100)
476th TF Sq (F-104)
524th TF Sq (F-100)
613th TF Sq (F-100)
482d FIS (F-102)
157th TAC Control Group

Air National Guard

117th TR Wg (RF-84F)
127th TR Wg (RF-84F)
123d TR Wg (RB-57)

Air Reserve Troop Carrier

933d TC Group (C-119) (CONAC)

Both Army and Air Force include the necessary support elements.

*TF—Tactical Fighter
TC—Troop Carrier
TR—Tactical Reconnaissance
FIS—Fighter-Interceptor Squadron

ing antigovernment guerrillas committing acts of sabotage and openly clamoring for more voice in the government.

Due to the increased activity and growing dissatisfaction among the populace, the territorial government has asked RHL for armed forces to counter the growing instability. BHL government members have violently denounced the territorial government and announced that any moves or invasion of borders on the part of RHL will result in hostilities.

Antigovernment guerrillas, under the leadership of a man known as "Swamp Fox," disrupted communications, road and rail traffic. They also spread antiregime propaganda throughout the month of June. By July the guerrillas had strengthened to the extent that the TC had to request assistance from the RHL, which moved forces into the territory under the guise of holding summer maneuvers for their air and ground forces. Additional military forces were sent into the territory as "volunteers" to support the national police.

In mid-July the BHL Ambassador submitted to the leaders of the RHL government the minimum terms of compromise: political self-determination for the TC and withdrawal of all RHL military personnel from the territory. The only response from the RHL has been statements made in the government-controlled press accusing the BHL leaders of interference in the internal affairs of the TC with the object of converting it into a semicolonized dependency of the BHL. Using government-controlled newspapers, radio, and TV, the propaganda ministry of the Red Homeland has been conditioning the public for war and has assured the population that the BHL would bear the entire responsibility for any armed action.

Informed sources felt that the RHL, with its troops located in strategic areas, was ready to take over the TC and was prepared to risk war with the BHL. Blue Homeland attachés had lost all but the most formal contacts with the RHL Ministry of War officials.

Blue Homeland air force units had been flying visual reconnaissance missions along the border of the TC, and early-warning radar control locations had reported indications of probable aerial reconnaissance over the TC.

Specific events and incidents leading up to the hostile postures and eventually to actual warfare were made known to the exercise participants—

On 1 May two public demonstrations had been held protesting (1) government changes in policy and (2) the recent visit to Newberry of numerous RHL political figures.

On 6 May the RHL radio broadcast a plan for complete economic integration of the Territory of Columbia into the RHL bloc. The TC government also announced plans for private farms to be collectivized. Police in many areas were unable to control demonstrations.

On 15 May RHL announced that since TC was unable to pay debts owed RHL it would send managers to operate the TC's major industries for that country. The same day TC's foreign minister refused aid from BHL, stating that it interfered with TC's internal affairs.

Later in May BHL noted that RHL had quietly activated several military reserve units. As TC internal unrest mounted, the police became much stronger as a result of alleged "volunteers" from the RHL. On 29 May the TC government began a series of propaganda broadcasts denouncing the BHL. Refugees fled from TC across the Pee Dee River to BHL. Isolated sabotage took place in TC.

On 15 June BHL radar detected probable RHL recon flights over TC in violation of a 10-year-old treaty signed by RHL and BHL. Apparently RHL was intent on taking over TC and disregarding the treaty.

On 26 June BHL intelligence sources indicated that the TC general population was supporting some guerrilla-type activity against the TC government.

On 29 June the TC and RHL accused BHL of inciting subversive activities in TC. The BHL had, in fact, infiltrated guerrilla organizers.

On 3 July RHL stated they would supply military assistance to TC to combat increased guerrilla warfare activities inspired by BHL. On 6 July BHL denied any activity against the TC government and stated that the presence of RHL military forces in TC was in violation of the treaty. BHL would oppose it with force if

necessary. On 12 July RHL continued to berate BHL for interference.

By mid-July subversive activities within TC had become well organized and were taking a heavy toll on communications and transportation. RHL announced that a large-scale military exercise would take place along the Savannah River near TC "next week." During 13–17 July many RHL "volunteers" were flowing into TC to aid police. BHL intelligence reported military-type field communications sites being constructed at several locations in TC.

On 18 July BHL announced that evidence of RHL military forces was appearing in TC and if it did not cease immediately action would be taken by BHL to drive out the RHL aggressors. RHL denied the charge and announced that any violation of the borders by BHL would be an act of war against RHL. On 19 July BHL knew that an RHL buildup was taking place but was uncertain of the extent without reconnaissance flights over TC. BHL was not afraid to risk war to make the flights.

AT THIS POINT WAR WAS IMMINENT.

Blue guerrilla forces were strengthened to the extent that the Territory of Columbia had to request assistance from Red Homeland forces. Blue Homeland forces were alerted to go to the assistance of the guerrillas. During this time of increased tension BHL decided that direct observations of TC were necessary, and on 21 July actual reconnaissance flights crossed the border of TC and triggered Swift Strike III. "The war is on!"

Phases of the Action

Phase I, 21 July–3 August

For the first fourteen days of the exercise, rival air forces of the Blue and Red Homelands jockeyed for air superiority over and around the six-million-acre maneuver area in North and South Carolina. Supersonic jets simulated interdiction of opposition airfields and lines of supply, photographed potential "targets," and attempted to eliminate through gun-camera "hits" as much of the opposition air force as possible before the full-scale air/ground phase of the exercise got under way on 4 August.

For the opening air phase, Tactical Air Command aircraft assigned to the Red and Blue forces included F-100 Super Sabres and F-104 Starfighters. Air Reserve and Air National Guard forces contributed F-84 Thunderstreak and F-86H Sabrejet fighters to the rival forces. Aerial reconnaissance was supplied by supersonic RF-101 Voodoo jets, RB-66 Destroyers, RB-57 Canberras, and RF-84F Thunderflashes. Air Defense Command supplied one squadron of F-102 fighter-interceptors for both BHL and RHL.

Invading Blue Homeland air forces operated from Pope AFB, Seymour Johnson AFB, Cherry Point Marine Corps Air Station, MacKall Army Air Field, and Stallings Field in North Carolina, Myrtle Beach AFB, South Carolina, Sewart AFB, Tennessee, and Hunter AFB and Travis Field Air National Guard Base in Georgia.

Defending the Territory of Columbia were Red Homeland air forces operating from Bush Field, Turner AFB, Dobbins AFB, and Robins AFB in Georgia, from North Field, South Carolina, and McGhee-Tyson Air National Guard Base, Tennessee.

Blue unconventional warfare operations, headed by Swamp Fox and dedicated to the overthrow of the government of the Territory of Columbia, would have had an easy time if the Red-oriented Columbian regime had not asked for military help from the Red Homeland. However, this intervention by the Red forces immediately led to pledges of substantial military assistance by the Blue Homeland. These events led to full preparations for all-out war by both countries.

The Military Air Transport Service (MATS) began airlifting the 5th Infantry Division from Fort Carson, Colorado, into Donaldson Field. The Red 2d Infantry Division moved overland from Fort Benning, Georgia, and entered the Territory of Columbia in the southwest via a "port" on the Savannah River upstream from Augusta. These Red armies moved into position and began to deploy for ground operations.

Phase II, 4–8 August

Blue forces invaded Territory of Columbia in a joint airborne assault operation to establish an airhead.

Faced with a military takeover by the Blue Homeland, defenseless Columbia called upon its ally, the Red Homeland, for military aid. Reds counterattacked immediately against the airhead. Things happened fast: assault landing strip construction for resupply and re-enforcement—airlanded operations at Donaldson Field—repositioning of Red forces.

Assault airlift roles for the air/ground phase of the exercise were performed by Tactical Air Command C-130 Hercules, C-123 Provider, and Continental Air Command C-119 Flying Boxcar aircraft. These aircraft flew a variety of missions, including the parachuting of men and equipment, landing of both men and equipment on improvised airfields, and flying normal resupply missions. The Army Caribou aircraft and Air Force heavy helicopters played a major role in the air movement of troops and supplies within the zone of operation. Several C-130 turboprop aircraft were equipped to deliver cargo by "extraction"—Tactical Air Command's newest method of spot delivery, performed by snatching cargo packs from airlift aircraft as they fly very low over the ground. The assault aircraft also performed aeromedical and "pop-up" paratroop drops.

Through this phase tactical fighters flew close-support missions for Army front-line commanders. The fighters flew interdiction missions aimed at severing enemy communications lines. Daylight attacks consisted of mock attacks simulating the use of aerial machine guns, rockets, and conventional and nuclear bombs.

Tactical reconnaissance operations included the entire cycle, from taking photos to delivering the developed photographs to front-line commanders. Tactical aircraft flew visual, photographic, electronic, and weather reconnaissance missions for both Red and Blue forces throughout the exercise. Army OV-1 Mohawk turboprop aircraft were extensively used in the tactical air reconnaissance and battlefield surveillance (TARABS) role.

This period also marked the beginning of the free-play air/ground phase of this massive exercise.

Swamp Fox organized bands of volunteer civilians to form an unarmed auxiliary to assist the military guerrillas in gathering intelligence, marking drop zones, and acting as guides. Acts of sabotage increased as the insurgent bands attempted to inspire more and more Columbians to join efforts to gain freedom from Red-dominated rule. Acts of sabotage were simulated although the guerrillas did go through the steps necessary to actually accomplish their mission. They simulated the disruption of communications and road and rail traffic as well as spread anti-Red propaganda. As the guerrilla activities expanded, Swamp Fox announced the successes of his forces in order to embarrass the Red regime in the eyes of the world.

Phase III, 9–11 August

The free play in the maneuvering of opposing Red and Blue forces continued during this period . . . the Red attack on Donaldson Field—the Blue offensive—parachute assault —river crossings—continuation of supply deliveries to assault landing strips.

Two major supply units, each using special techniques, supplied the Red and Blue ground forces, providing the hundreds of items needed by an army and air force in the field. The Blue Joint Task Force moved all supplies by air, the Red JTF used a simulated port for landing supplies. For both supply unit commanders this was the first major field exercise.

A new concept in portable mobility was used during Swift Strike III at Seymour Johnson AFB, in the form of a completely self-supporting, portable photo-reconnaissance center. The portable processing center, developed for field situations, was airlifted in its entirety.

Blue forces captured the Columbian capital of Newberry and set up a new provisional government with the former mayor as president. Swamp Fox, the popular guerrilla leader,

was given the vital position of Minister of Defense.

Phase IV, 12–16 August

Operations continued while Blue forces detached and deployed one airborne division for a theoretical emergency contingency mission elsewhere. Initiation of nuclear warfare—Red offensive—withdrawal of 101st Air Division to Donaldson Field for deployment.

Blue forces, after conquering Newberry, set about assessing the influence of the Red invader on the social and political life of the people and the most effective means to quickly remove the effects of Red propaganda.

Red guerrillas countered by capturing Blue Homeland capital of Fayetteville, which was retaken again by Blue paratroops.

Phase V, 17 August

In the redeployment phase the Blue Homeland actually detached the 101st Airborne Division from combat and withdrew the entire unit to Donaldson Field, from where it was airlifted and redeployed to its home station at Fort Campbell. The entire redeployment of this unit was accomplished under simulated combat conditions in an effort to determine the problems involved in removing a combat unit under fire in order to meet emergencies elsewhere.

While the 101st Airborne Division was being deployed, it was under surveillance and subject to repeated attacks by Red Homeland forces. The 82d Airborne Division had the responsibility of extending itself so as to occupy all defense positions held by the 101st while protecting and covering the retreat of the 101st to Donaldson Field. The BHL Air Force of necessity had to increase its activities in order to protect and support the weakened positions of the 82d Airborne Division and prepare to withdraw the division from the Territory of Columbia should it become necessary.

The Play Day by Day

21 JULY 1963

The Territory of Columbia air border was violated by Blue aircraft this morning. Earlier both Red and Blue Homelands have charged violation of air borders.

Blue claimed destruction of two unidentified aircraft that had penetrated to the vicinity of Winston-Salem. The intruders were claimed shot down almost exactly on the international boundary but inside Blue territory. Early Blue reconnaissance flights were unmolested, but by noon armed escort was necessary as the Red air defense became active. The Red forces claimed five RF-84F and four F-84F aircraft destroyed. The Blue force claimed two Red F-102 interceptors downed. During the first day of the Swift Strike III air phase, Blue Air Force flew 99 missions, Red Air Force 50 missions.

Planes from the Blue Joint Unconventional Warfare Task Force (JUWTF) dropped propaganda leaflets depicting a high-ranking Red military leader as a "beast." The Army Special Forces and the Air Force Air Commandos have been combined into the JUWTF for this exercise. The 400 guerrillas that triggered the war were trained and equipped by Special Forces, while support in supplies and equipment as well as psychological warfare in leaflet drops and airborne loudspeaker broadcasts was provided by Air Force Air Commandos. Since civilians are barred from participating in active maneuver engagements, soldiers from nonparticipating organizations played the guerrilla role that would normally be played by civilian residents of the Territory of Columbia sympathetic to the Blue cause.

Red guerrillas were active during the early

Taking advantage of natural cover, Joint Unconventional Warfare Task Force guerrillas move behind enemy lines. Their hit-and-run task is havoc, confusion, and disaster.

morning, infiltrating Pope Air Force Base, N.C., at 0230 hours, where they claimed destruction of six Blue aircraft. The raiders marked each aircraft with a red cross and thus simulated placing explosives in each wheel well. The Pope base defense was put on high alert status and succeeded in capturing two of the guerrillas.

Anti-Red guerrilla leaders have been busy in the Territory of Columbia at forming bands of selected local citizens to assist military guerrillas by gathering intelligence, marking drop zones, and acting as guides. The "Swamp Fox," who takes his name from the famous guerrilla leader in the Carolinas during the American Revolution, heads an organization dedicated to overthrowing the Red-oriented Columbian government. Since the government has no military forces of its own, the Swamp Fox should have an easy time of it unless the government asks for military help from the Red Homeland. If such help is given, the Blue Homeland has pledged substantial military assistance to Swamp Fox.

22 JULY 1963

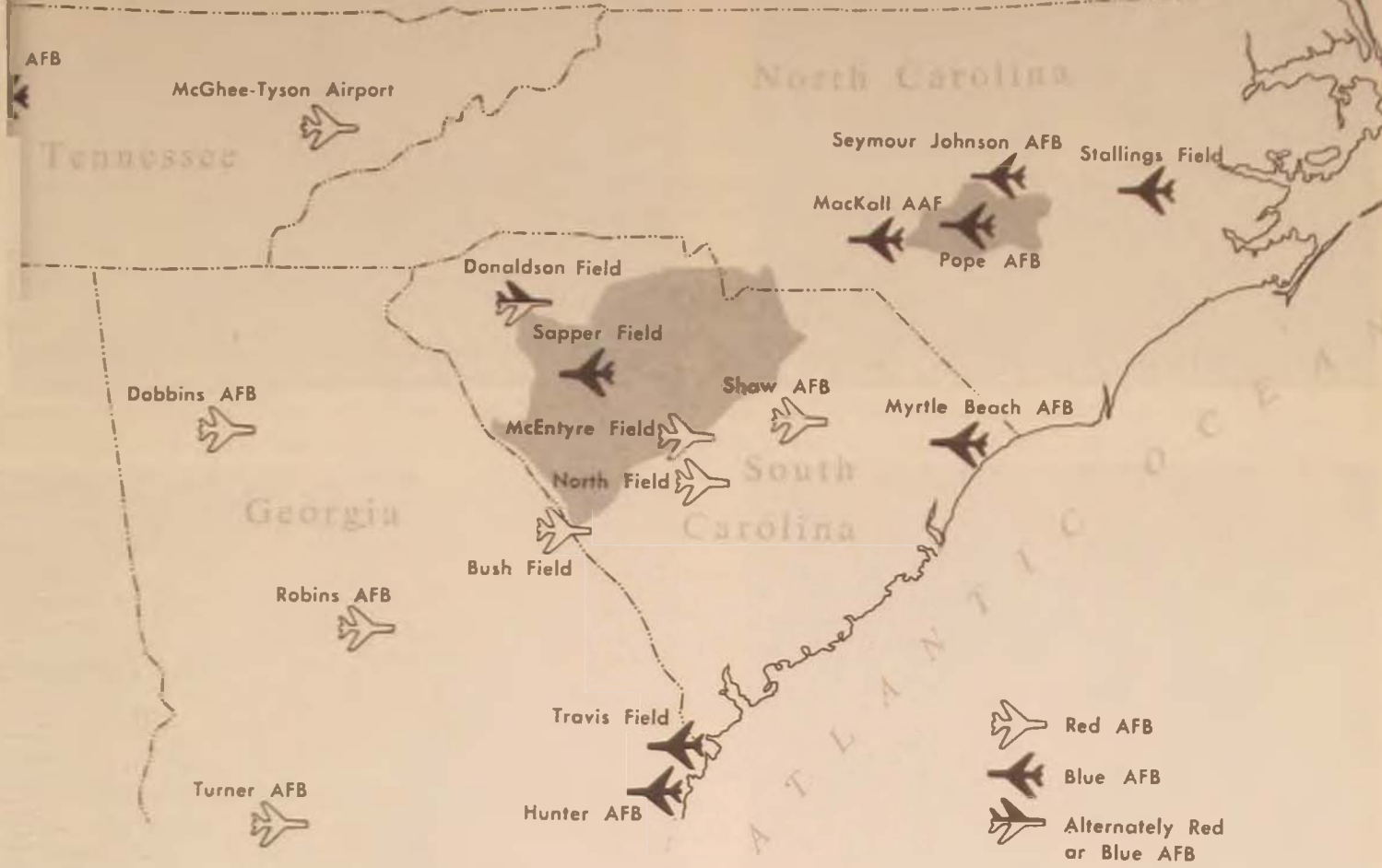
Red Air Force initiated reconnaissance flights into the Blue Homeland today, four unarmed aircraft penetrating 50 miles. The Blue forces claimed that all aircraft were engaged and two were destroyed. Blue further claimed the first aircraft shot down by ground defense at MacKall Army Air Field, N.C. Red forces reported 32 reconnaissance sorties and 117 air defense scrambles, while the Blue Homeland dispatched 25 reconnaissance flights with armed escorts and 38 air defense scrambles.

In ground action, Red counterinsurgency forces opened operations against the Blue guerrillas this morning and uncovered a cache of food and ammunition within the Territory of Columbia, apparently hidden there by the Blue guerrilla forces.

23 JULY 1963

Air reconnaissance was continued by both Red and Blue forces, the Blue aircraft being escorted by armed fighters. Airfields and transportation routes were kept under close surveillance by each side. The Blue Air Force made 24 reconnaissance and 8 air defense sorties. Four of the reconnaissance aircraft were destroyed and one was damaged. Of the fighters, eight were destroyed and one damaged. The Red forces sent

Aerial reconnaissance of Greenwood Airport on 31 July shows two twin-engine cargo aircraft and several helicopters. Continuous recce guarded against surprise by highly mobile enemy forces.



Map 1. Red and Blue Air Forces battle for control of the air from these bases.

out nine reconnaissance and 71 air defense sorties today and lost only two fighters.

It has been confirmed that at least 17 Blue aircraft have been destroyed over the Territory of Columbia by antiaircraft missiles since hostilities began.

Unconventional warfare increased in tempo as Red saboteurs infiltrated the parachute storage area at Fort Bragg, N.C., and destroyed 21,591 parachutes. Two Blue soldiers were "killed." Red guerrillas also struck the Fort Bragg water filtration plant. A senior artillery commander of the Red forces was "killed" in a Blue guerrilla ambush this afternoon.

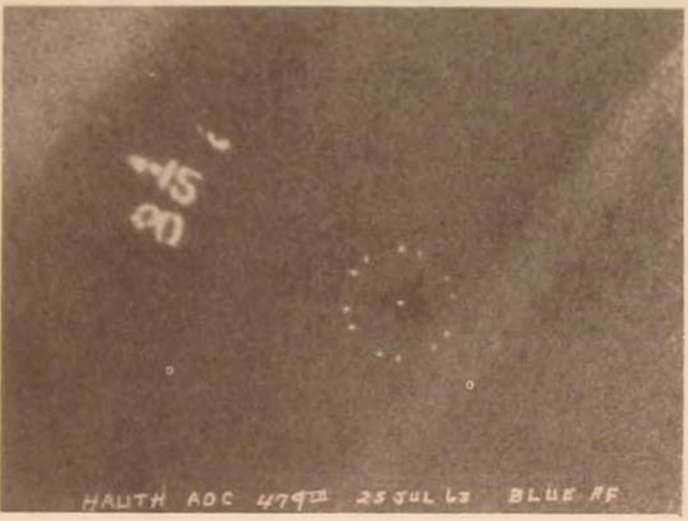
Blue unconventional warfare forces dropped psychological warfare leaflets within the Territory of Columbia near Edgefield, S.C., where considerable guerrilla activity has appeared.

MATS airlanded some 2250 troops and 4034 short tons of cargo at Donaldson Field, S.C., advance elements of the 5th Infantry Division (Mechanized).

Unconventional warfare highlighted the overnight action as a well-organized Blue guerrilla band raided a Red communications center 16 miles northeast of Columbia, damaging the 132-man, 16-vehicle unit so extensively that umpires ruled it out of action for 12 hours. In the predawn hours Blue forces dropped leaflets on troop units over a wide area of the Territory of Columbia, including the towns of Laurens, Clinton, Chester, Rock Hill, Greenwood, Saluda, Camden, Whitmire, Winnsboro, Kershaw, Batesburg, Johnson, and Edgefield. Red unconventional forces destroyed five trucks in a night raid on the Blue 82d Signal Battalion ten miles northwest of Raeford, N.C., and captured two Blue guerrillas near Camden, S.C., in a night engagement.

The Blue Air Force reported 25 reconnaissance and 33 fighter sorties, while the Red forces sent out 58 fighter sorties but no reconnaissance as cloud cover interfered. No reports on kills were available.

After targets such as troop concentrations,



Gun camera hits by Blue fighters during the air war phase. Umpires allowed three aircraft kills and assessed damage on the ground target strike.

convoys, supply dumps, and air strips are located by reconnaissance pilots, tactical fighter squadrons take over. As the fighter pilots zero-in their gunsights on a target, they shoot 16-mm gun camera film instead of a stream of bullets. That is the only difference between this exercise and actual war. The mission is the same as in a real war—destroy the enemy. The air war simulates combat conditions to the extent that both men and aircraft are extended to the maximum. Sleep and rest come when they can be had.

A photo lab operates round-the-clock, processing film within six hours. Edited and enlarged still prints are delivered to the air force commander, the fire control director of the exercise, and to Hq TAC at Langley AFB, Virginia.

25 JULY 1963

Taking advantage of early morning cover of darkness, the guerrilla and counterinsurgency forces continued their operations. At midnight Red guerrillas in the Blue Homeland destroyed a petroleum dump near MacKall AAF. In a separate raid nearby they destroyed several trailer trucks and supplies.

Blue-supported guerrillas conducted numerous raids throughout the Territory of Columbia during the night. Two of these raids were against the 63d and 94th Red Ordnance Battalions. Extent of damage is not yet available.

Red counterinsurgency forces in three separate areas captured two Blue guerrillas, uncovered a cache of food and ammunition, and, using

a propeller-driven fighter, attacked a Blue guerrilla airfield at Laurinburg, N.C.

All-out air war broke out today over TC as the Blue Air Force attacked four Red Hawk missile sites. At approximately 1700 hours the Red Air Force retaliated with air attacks on Blue airfields of Myrtle Beach, S.C., Travis Field, Ga., and Hunter AFB, Ga. At 1900 hours Blue aircraft attacked Red air bases of North and McEntyre Fields, S.C., and Robins, Turner, and Dobbins AFB, Ga.

The Blue forces flew 69 fighter and 17 reconnaissance sorties while the Red forces flew 104 fighter and 32 recon sorties.

The Blue Homeland reported detecting advance elements of Red ground forces in Kershaw, S.C., and at Donaldson Field.

26 JULY 1963

Air warfare in the Territory of Columbia was in full swing today as the Blue Air Force struck at Red missile sites in the Aiken, S.C., area and expanded its offensive to hit military installations, convoys, freight trains, and troop concentrations. The Blue forces also struck Red airfields at North, Greenwood, McEntyre, Robins, Dobbins, and McGhee-Tyson and claimed 191 aircraft destroyed and many buildings damaged. All four of the Hawk missile sites were ruled out of action temporarily after heavy attacks by the Blue forces. Counter-air and Blue aircraft were credited with destroying 21 Red aircraft and damaging another 10 while flying 160 tactical fighter and air defense sorties.

Reconnaissance pilots from the Blue Homeland, flying 24 missions, brought back evidence of continuing buildups of Red forces in the Territory of Columbia. They reported sighting air defense units, troop concentrations, a control and reporting post, a suspected Honest John surface-to-surface rocket site, and various artillery and supporting elements.

Joint Task Force Red reacted to the initial strike against its missile sites by launching attacks against Blue command posts, troop concentrations, supply installations, and airfields. In addition to damaging ground targets, Red air defense and counter-air efforts claimed 47 Blue aircraft destroyed and 25 more damaged. Twelve of the aircraft kills and two of the damage assessments were credited to the same Hawk missiles that were later knocked out. The Reds launched a total of 165 sorties, which included 79 air defense and 21 reconnaissance flights, and claimed 26 aircraft destroyed in attacks on Blue airfields.

To determine a "kill" in Swift Strike III air combat, a team of umpires is located in each Control and Reporting Center (CRC). When the air defense CRC of one of the mythical countries scrambles fighters to intercept hostile aircraft, the

The Army's Hawk surface-to-air missile ready for launching. Primarily designed to destroy supersonic aircraft flying as low as 100 feet, the Hawk can reach out higher than 50,000 feet and has hit targets moving more than 1500 miles per hour. A major feature of the radar-guided missile is its mobility. It can be transported by vehicles of standard design and flown by helicopter or plane.

umpires are looking over the shoulders of the radar observer. By watching the positions of the aircraft on the CRC radar as they are vectored into position, the umpires can determine which are "shot down" or "damaged" and report the extent of losses to the home base of the aircraft. An umpire there will then direct the unit command to sideline the plane until it can be replaced or repaired. An aircraft shot down must be grounded for 12 hours, and two planes downed would take 18 hours to replace.

Other methods of "air defense" are provided by the Army's ground-to-air Hawk missiles. Each of the four batteries of these now in position will "fire" on invading aircraft. Umpires, experts with the missile, will determine if the battery had time to fire the missile and if a hit was scored.

Red guerrillas infiltrated the Blue Homeland near Fort Bragg last night, causing considerable damage to several facilities.

27 JULY 1963

Guerrilla activity on both sides continued both in the air and on the ground. An armed Blue Air Commando T-28 fighter-trainer damaged a Red communications site near Round Top School east of Blythewood, S.C., while guerrilla ground forces attacked a Red Hawk missile battalion command post and several other military installations, causing considerable damage.

Red unconventional and counter-guerrilla forces flew sorties against Blue guerrillas inside Columbia and over the Blue Homeland.

The Red Air Force total of sorties yesterday was revised to 211, and this despite weather which kept planes grounded most of the morning. Red claims of yesterday were largely substantiated by later reports which confirmed that the Red Air Force destroyed a total of 55 Blue aircraft including 14 reconnaissance and 39 tactical and air defense fighters. Red Army Hawk missiles were finally credited with 37 total aircraft shot down but not identified as to type.

Red fighters attacked MacKall AAF three times today. They also attacked the airfield at Laurinburg-Maxton and hit Myrtle Beach AFB in three separate strikes. In addition they struck Hunter AFB three times; Travis Field twice; and Seymour Johnson AFB, N.C., four times.

Blue aerial reconnaissance showed continuous movement of Red Homeland convoys and the massing of supplies in the Territory of Columbia. Many bivouac areas were also sighted. The Blue Air Force began interdiction raids yesterday against Red forces moving men and equipment into Columbia. Fighter aircraft made nine attacks on Red airfields today: at Bush Field, Ga., three times; North Field once; McEntyre Field three times; Dobbins AFB twice; and Robins AFB once. Blue tactical fighters also attacked a military convoy in Columbia composed of heavy vehicles, armed vehicles, and 8-inch howitzers.

The Red Homeland Civil Affairs Officer in the Territory of Columbia reports general understanding among the populace of the fact that Red forces are in Columbia for their protection.

In yesterday's action the Blue Air Force flew a total of 184 sorties on interdiction, air defense, and reconnaissance missions.

28 JULY 1963

Blue guerrilla forces raided a Red signal battalion in the Territory of Columbia during the night.

Red counter-guerrilla forces continued to harass Blue guerrillas inside the Territory of Columbia. Red ground fire was credited with knocking down a Blue aircraft which flew a night loudspeaker mission over Bush Field. The Red Counter Insurgency Force (CIF) reported today they have captured 23 Blue guerrillas also with three caches of supplies, including ammunition, a field radio, and 10 field radio batteries. More important, they say, they have kept the Blue guerrillas on the move. The Blue guerrilla forces in Columbia, estimated to number 400 agents, are supported by at least 1000 cooperating civilian partisans. The Red CIF is proving that conventional forces are an effective counterforce to unconventional warfare by constantly seeking out Blue guerrillas.

The Red Air Force attacked Travis Field, MacKall AAF three times, Myrtle Beach AFB twice, and flew one strike each against Pope AFB, Blue Joint Unconventional Warfare headquarters in North Carolina, Hunter AFB, and Seymour Johnson AFB and attacked a Blue control and reporting center near Camden. In yesterday's air action against Blue airfields, umpires gave the Red Air

A Red Counter Insurgency Force fire team of the 1st Cavalry assaults a position believed held by Blue guerrilla insurgency forces. Red COIN patrols hampered Blue guerrilla agents operating in and around the hypothetical Territory of Columbia.

Force credit for the destruction of 53 aircraft. During the same period the Red Hawk missiles were given credit for destroying an additional 16 Blue aircraft.

The Blue Homeland initiated night strikes against Red Homeland last night when Blue F-100 fighters hit Bush Field with 21 separate attacks at 15-minute intervals. Blue Air Force reconnaissance aircraft completed night sorties against Dobbins and Robins AFB and Bush, North, and McEntyre Fields, using electrical illumination instead of flares. Also during the night a Blue aircraft flew a loudspeaker mission over Greenwood, S.C. The Blue Air Force concentrated attacks on Red supply lines, communications, and military equipment inside the Territory of Columbia. Blue fighters attacked heavy convoy traffic moving south from Clinton, S.C., and north from Augusta, Ga., and Aiken, S.C. They also attacked Red storage buildings at Edgefield and Kershaw; a petroleum dump and railroad and communications facilities near Trenton, S.C.; a Red communications facility at Lancaster, S.C.; and twice attacked Bush Field. Blue was credited by the umpires with destruction of 36 Red aircraft.

29 JULY 1963

The Red-oriented President of the Territory of Columbia, Kenneth W. Riebe, welcomed the Red Task Force Commander, Lt. Gen. Thomas W. Dunn, to this mythical country today. Joining with the President, who is also Prime Minister, in the capital city of Newberry were key cabinet ministers of the Red government and staff members of the Red Army. At the same time Red Homeland troops moved quietly into Newberry's City Square. All buildings facing the square were combed for clandestine agents. Armed guards took strategic lookout positions atop the buildings while other crack troops, equipped with tripod-mounted machine guns, burp guns, and rifles, surrounded the Civic Center. Addressing the dignitaries, the Red commander outlined his aims of stabilizing the Columbian government and repelling Blue forces. President Riebe read a proclamation calling on the Newberry population to support the Red forces "who are protecting the sacred soil of Columbia from Blue invading tyrants."

Meanwhile Blue Homeland continued air strikes against the Reds, hitting North, McEntyre, and Bush Fields, Dobbins and Turner AFB. Blue fighters also attacked a large convoy west of Columbia, S.C., and attacked two Red F-100 Super Sabres encountered in the area. During the night Blue fighters attacked four Red airfields: McEntyre, Turner, North, and Dobbins. All four attacks were directed toward cratering the airfield runways.

Red Homeland concentrated reconnaissance

Red Joint Task Force Commander, Lt. Gen. Thomas W. Dunn, arrives to visit the Prime Minister of the Territory of Columbia on 29 July. The meeting took place in Newberry's Civic Center, where City Manager Kenneth W. Riebe assumed his role as head of state for the mythical country.

Camouflage discipline—aircraft

Repositioning of forces during an administrative break in hostilities. Blue and Red troops talk it over.

Trooper covers helicopters with BAR.

activities over the Blue Homeland and on Blue guerrillas operating in the Territory of Columbia. Red tactical fighters struck eight times at Blue installations: at Myrtle Beach, Seymour Johnson, Hunter, twice at Travis, and at a control and reporting center and other installations at Camden.

Red Homeland continued efforts toward neutralizing Blue guerrillas operating in the Territory of Columbia. Red guerrillas, operating in the Blue Homeland, attacked Blue Task Force headquarters and raided a truck concentration during the night.

Reds and Blues continued psychological warfare by night leaflet drops and loudspeaker broadcasts from aircraft.

The Blue Homeland guerrillas reported three raids today against Red installations in the Territory of Columbia.

30 JULY 1963

The Blue Air Force made several night attacks on Red airfields, strafing with cannon and dropping bombs and napalm. Blue fighters hit both McEntyre and North Fields twice during the night and attacked Bush and Turner once each. The fighters are concentrating night attacks on runway systems and communications facilities. Verified "kills" by the Blue Air Force totaled 42 Red aircraft destroyed on the ground and in the air.

Blue forces made three air strikes today against North Field and one against McEntyre Field, cratering runways and causing damage to parked aircraft. Blue reconnaissance still shows an intensive buildup of Red ground forces in the Territory of Columbia.

Both Red and Blue Homelands continued a wide variety of aerial photo and electronic reconnaissance sorties. The Red Air Force was active against Blue airfields and in counter-air and defense missions. In yesterday's air battles the Reds destroyed 47 Blue aircraft on the ground and in the air. For the first time yesterday, the Reds were credited with destruction of an RC-121 Constellation, which is both an airborne command post and a surveillance aircraft.

The Red Air Force attacked Travis Field three times and Seymour Johnson and Hunter AFB twice each. Red aircraft also struck at Blue headquarters twice and once against a Red control and reporting center. The Reds also cratered Blue runways and damaged parked aircraft.

Headquarters of the Joint Unconventional Warfare Task Force announced that the Army Special Forces and Air Force Air Commandos made six successful resupply missions to Special Forces and Blue guerrilla units within the Territory of Columbia last night. There also was one infiltration mission of three personnel into the Territory of Columbia. Continuing psychological warfare against the Red forces, the JUWTF hit designated targets last night, dropping leaflets. There were also two loudspeaker missions of harassment against a Red troop concentration.

31 JULY 1963

Tension is still building between these two nations as Blue Air Force subjected Red fighter bases to the heaviest attacks of the war. The Red bases of Dobbins, Turner, North, and McEntyre were under steady attack today. Blue continued night and dawn attacks on Red fighter bases, reducing the Red Air Force's ability to get airborne on early attacks of its own this morning. Blue Air Force struck North Field before midnight and again at 0500 hours, using napalm fire bombs and high-explosive bombs. Blue hit McEntyre Field once in the early morning and Dobbins AFB twice (once at 0300 hours and again two hours later), damaging runways, hangars, ramps, and aircraft. Turner AFB was also bombed. All these bases were out of action for at least two hours.

The Red Air Force also gave Blue bases their heaviest pounding, with numerous strikes against Hunter, Travis, Myrtle Beach, and Seymour Johnson. Red Air Force attacked the two Blue airfields of MacKall and Travis at 0515 hours this morning. At MacKall the Red F-100 fighters caused damage to parked aircraft, ramp areas, and vehicles. No report from Travis Field was immediately available. Red reconnaissance reported that Blue forces at MacKall AAF and Pope AFB are expanding the fuel-storage and parachute-rigging facilities, indicating an impending airborne assault.

Both sides are reported preparing their armies for the impending ground battle. A steady flow

of MATS transports into Donaldson Field has added to the strength of the Red forces.

In unconventional warfare, Blue forces made several infiltrations into the Territory of Columbia and brought a number of people out. Blue Air Force dropped psychological warfare leaflets on 17 targets last night in the Territory of Columbia.

1 AUGUST 1963

After a lull in air activities last night, both Red and Blue Homelands began tactical fighter strikes anew early today with attacks against airfields.

Red Air Force fighters hit Hunter AFB and Travis Field and also attacked Blue Air Force headquarters this morning between 0615 and 0715 hours. Results of these attacks were not immediately available. Photo-reconnaissance flights by Red Air Force were made last night over Travis Field, Myrtle Beach AFB, and Donaldson Field. Other Red fighters attacked a Blue control and reporting center at Woodward on four separate missions. A total of four attacks was made against Travis Field and four against Seymour Johnson. During the day the Red Air Force also flew "column cover" for Red vehicles in the Territory of Columbia and continued aerial reconnaissance of Blue Homeland airfields and troop concentrations. Yesterday's air actions brought Red pilots another 48 air and ground kills of Blue aircraft.

Blue Air Force fighters were out early this morning, striking airfield runways and taxiways on three Red bases. Bush Field, North Field, and Turner AFB were hit at 0500. At Bush Field the Blue pilots struck a Red Air Force command post. Dobbins, McEntyre, and North airfields were also hit as the Blue forces made a total of 23 air strikes for the day. Pilots concentrated on cratering airfield runways with bombs and attacking Red aircraft on the ground. At McEntyre Field ten F-102 Delta Dagger fighter-interceptors of the Red Homeland were caught in take-off position and destroyed by Blue air attack. In yesterday's air action, the Blue Air Force was credited with destroying 55 Red aircraft on the ground and in the air.

Blue guerrillas in the Territory of Columbia made two raids against Red installations, and a Blue Air Commando B-26 Invader was credited with destroying 11 Red vehicles north of Lake Murray.

The Army/Air Force exercise will undergo an "administrative break" between 1901 hours 2 August and 1901 hours 3 August. During this time the Red and Blue Task Forces will not engage in tactical operations. Normal supply, maintenance, and personal rest will be the rule during the 24-hour breather.

Director Controller Headquarters said that the joint airborne assault phase of the exercise will begin following the day-long break. Up to now the exercise has concentrated largely on a battle for air superiority and on ground and air action between Blue guerrillas and Red counter-insurgency forces and guerrillas.

2 AUGUST 1963

The Red Counter Insurgency Force in the Territory of Columbia yesterday captured seven Blue guerrillas near Union, S.C., and two near Johnson, S.C. At the same time the Red Logistics Command troops captured two more Blue guerrillas near Greenwood.

Today the Red Counter Insurgency Force made its largest catch of Blue guerrillas to date, capturing 13 near Union, S.C.

Red guerrillas attacked a petroleum dump in Blue Homeland southwest of Fort Bragg and destroyed large quantities of jet fuel, aviation gasoline, and diesel fuel besides destroying several large cargo parachutes.

Red tactical fighters today hit Seymour Johnson AFB and Myrtle Beach AFB twice each. Red fighters claim to have attacked Blue Joint Task Force headquarters in North Carolina. During the day the Red Air Force also flew "column cover" over Red Army convoys, in defense against possible Blue air attacks. The Reds were credited with a total of 31 Blue aircraft destroyed, 13 of which were attributed to "kills" by Hawk missiles. In yesterday's action the umpires credited the Red Air Force with destroying 33 Blue aircraft and damaging 44 more, and Red Hawk missiles were credited with destroying an additional 18 Blue aircraft. The umpires ruled that Reds knocked out various Blue airfields for a total of 21 hours.

Blue Air Force tactical fighters today at-

Red Task Force troops search a Blue Task Force prisoner captured on the banks of the Saluda River near Newberry.

tacked seven Red airfields, hitting runways and parked aircraft on each. Airfields hit were McGhee-Tyson, Bush, North, Robins, Dobbins, Turner, and McEntyre. Other fighters attacked a troop bivouac area at Donaldson Field and a control and reporting center at Aiken. Pilots of the Blue Air Force, who in the 24 hours preceding 0800 had been credited with 52 aircraft destroyed and 50 damaged, claim to have destroyed another 90 aircraft in today's raids. The Blue Air Force was also given credit for knocking out various Red airfields for a total of 34 hours.

At 1901 hours a 24-hour administrative break was established for the 96,000 Army and Air Force personnel engaged in Swift Strike III. Before the break the Blue Air Force was ruled to have closed Red airfields for a total of 16 hours, and Blue fighters were given credit for destroying 18 Red aircraft and damaging 14 more.

Red Air Force raids closed Blue airfields for a total of two hours, while Red fighters were credited with destroying 16 Blue aircraft and damaging 11 others. Red Hawk missiles were given credit for destroying 13 more Blue aircraft.

Blue guerrillas made nine raids on Red Army forces in the Territory of Columbia near Chester, Lancaster, Aiken, Batesburg, and Trenton. Red railroads, motor vehicles, facilities, and personnel were objects of these attacks.

3 AUGUST 1963

After 1901 hours today a small force of Joint Task Force Blue paratroopers dropped on the Territory of Columbia in the vicinity of Saluda at dusk in the first ground action of Joint Exercise Swift Strike III. Reds estimated the invading force, which immediately deployed in the area of the drop, as a company-size unit. A number of JTF Red units are seeking to close with the invaders. This surprise airborne action drew to a sudden close a day of uneasy "truce" throughout the Territory of Columbia and the homelands of the Blue and Red forces, where no other tactical activity was reported during the day.

Phase II

4 AUGUST 1963

The first major ground action of the campaign

was launched this morning at 0607 as Blue forces made simultaneous parachute assaults near the cities of Joanna and Newberry deep in the Territory of Columbia. More than 7000 paratroopers were dropped, and 131 assault aircraft flew 405 sorties dropping heavy equipment in the two drop zones. Paratroopers of the 82d Airborne Division began hitting drop zone United, some three miles south southwest of Joanna, and drop zone Pan American, about three miles south southwest of Newberry, shortly after 0600 hours this morning. Waves of paratroopers, followed by drops of heavy equipment and then more paratroopers, came from Air Force C-130's, C-119's, and C-123's.

In preparation for today's airborne assaults Blue guerrillas had captured three bridges across the Saluda River, and the Blue Air Force made heavy attacks on Red airfields before dawn.

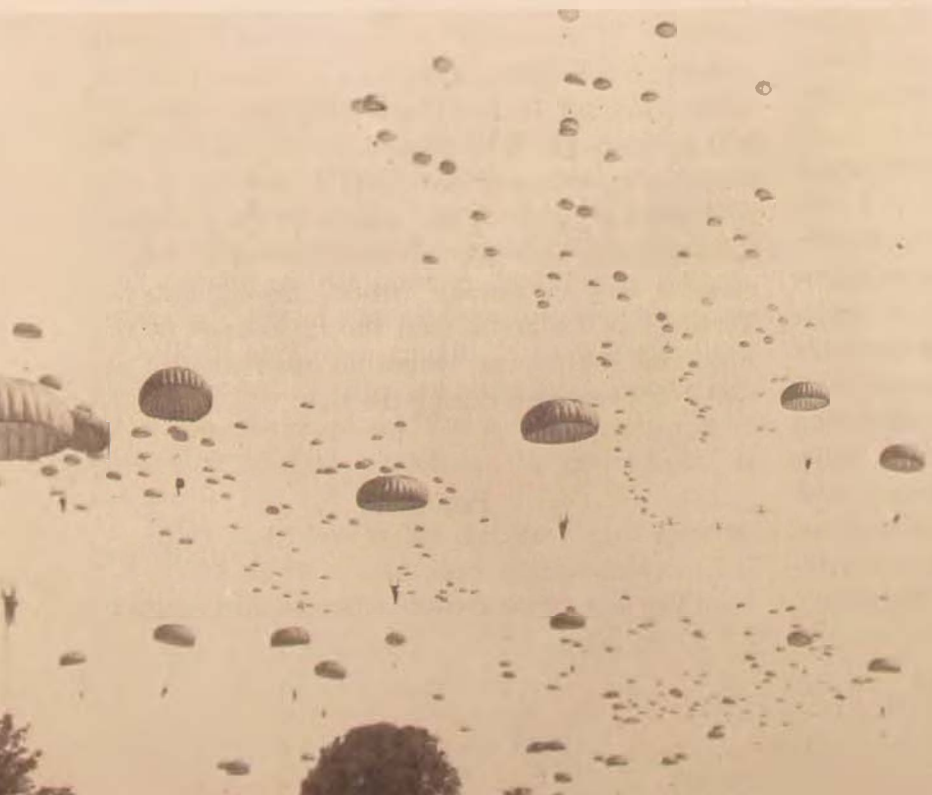
The forces dropped on United, the more northern of the two drop zones, found only scattered, sporadic resistance initially. Those who hit DZ Pan American to the south dropped among a number of Red units, which engaged the Blue paratroopers in brisk fighting. At last report, among the more than 7000 personnel who jumped, there were 4 possible fractures and 15 other cases requiring hospitalization.

The effort to establish two initial airheads for later consolidation resulted in sharp ground and air actions throughout the day. In the south, where the invading forces landed in the center of several Red units, the issue still was in doubt. By late afternoon, however, Blue forces were supplying the northern airhead by additional drops and by the low-level ground proximity extraction method while improving the facilities in the airhead.

The ground proximity extraction procedure was developed in Project Close Look conducted at Sewart AFB, Tennessee, during the past year. Its use in this giant exercise provided the first opportunity for tactical evaluation. Developed by TAC and Army engineers, the extraction system involves securing equipment on a platform inside the aircraft. A 12-foot rod with a hook on the end is attached to the load and trails out the open rear cargo door. A steel cable is stretched across the ground, only a few inches above the turf. Each end of the cable is coiled on a reel which is also an energy-absorbing device. The aircraft flies about five feet above the ground, allowing the trailing hook to engage the cable, which in turn "snatches" the load from the aircraft. The load falls to the ground and is brought to a sliding halt by the energy-absorbing devices.

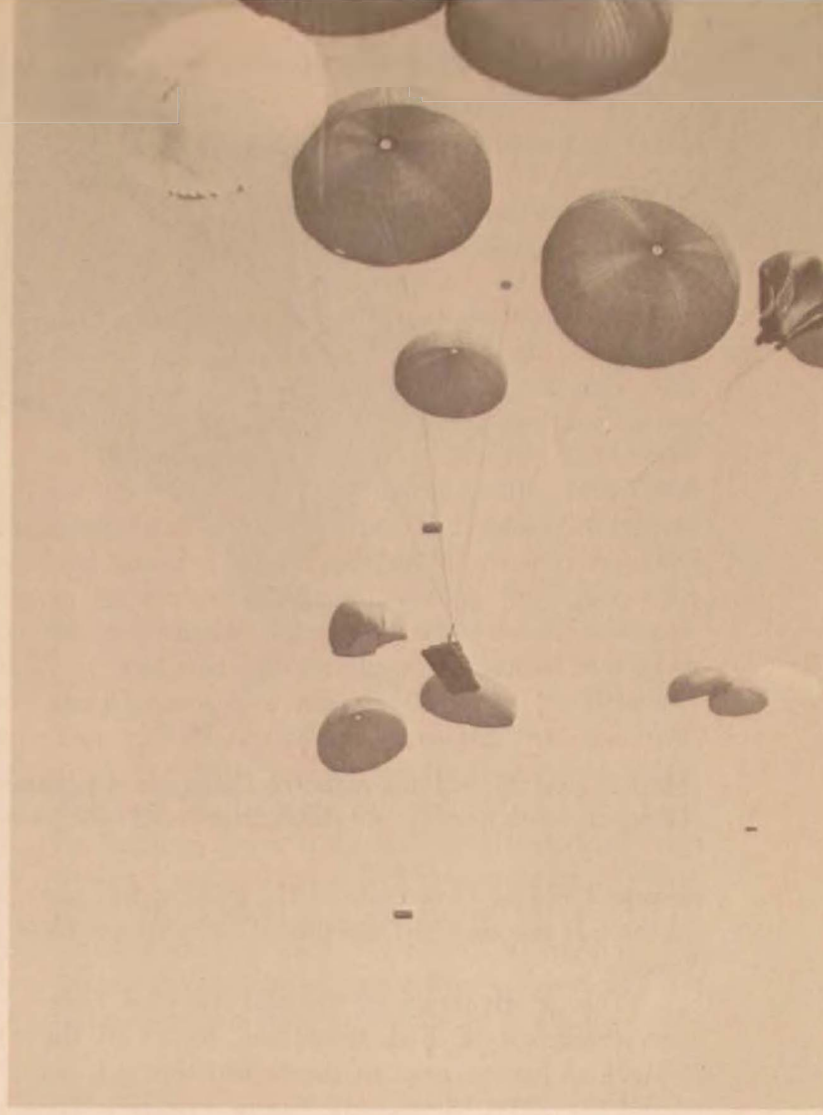
5 AUGUST 1963

Blue Homeland launched another surprise airborne attack today and by noon captured Don-



Airborne assault. Paratroops of the 101st "Screaming Eagles" Airborne Division dropping from MATS C-124 Globemasters near Gray Court, S. C. The 101st captured Donaldson Field, two miles north, for the Blue side in less than two hours after the initial landings.

A bulldozer and other heavy equipment go in during the major Blue forces' air assault into the Territory of Columbia.



An 82d Airborne Division unit forms up to attack Red defenders just after landing as part of the massive early morning paradrop of Blue forces.

Map 2. Red 2d and 5th Infantry Divisions in position as Blue 82d Airborne Division drops to establish an airhead near Joanna and Newberry.

aldson Field at Greenville, S.C., making full use of the fast reaction and mobility of airborne assault forces.

Taking advantage of the 82d Airborne Division's tiedown of Red Homeland forces in the Newberry-Joanna area to the south, the BHL ordered the 101st "Screaming Eagles" Airborne Division dropped from C-130's, C-119's, and C-124's supplied by the Tactical Air Command, Continental Air Command (Air Force Reserves), and Military Air Transport Service. At 0822 hours an Air Force combat control team and its protective Army airborne assault team jumped from a C-130 into a large field a mile and a half south of Donaldson. The small elite spearhead force set up communications, security guards, and smoke flares and directed the first wave of aircraft in by radio at 0900 hours. By 1115 hours the first wave of 101st paratroopers had seized the north and south edges of Donaldson Field and confirmed by radio to the troops advancing behind them that the big airfield was undefended by the Reds. Immediately an Army light plane was directed by radio to land at the field. Within minutes the Army liaison plane was airborne again with the Air Force forward air controller who had parachuted with the 101st. The FAC established radio contact with Blue tactical fighters orbiting protectively overhead and with a task force of Tactical Air Command and Air Force Reserve assault airlift transports which were alerted to fly reinforcements to the field as soon as its capture was verified.

Under the umbrella of Blue fighters, C-123 and C-119 twin-engine troop and cargo carriers began arriving in a steady stream at 1215 hours, with one airplane barely having landed and cleared the runway before the next touched down. Around 30 of the assault aircraft landed and unloaded their troops and vehicles by 1230. Swiftly the 101st troops unloaded their armed jeeps and formed up in convoys. By 1245 the first convoy moved off the airfield and headed south to join the paratroop force. Before 1300 hours the task force C-119's and C-123's were lined up nose-to-tail and taking off at one-minute intervals to return to Pope AFB and Fort Campbell AAF, Kentucky, for additional assault loads.

This swift tactical response which led to the capture of defenseless Donaldson Field was a modern-day classic in the use of mobile, air-transportable forces under operational control of the U.S. Strike Command.

Intensive Blue ground action resulted in the capture of the town of Newberry, capital of the Territory of Columbia, and strategic Higgins Bridge across the Saluda River. The bridge was taken by helicopter assault as the 82d Airborne Division also expanded its airhead and moved

northwest, capturing the town of Clinton.

In air actions the Blue Air Force attacked Red airfields and flew ground support missions, destroying 29 bridges, using flares to illuminate its targets.

The Red Air Force flew 84 sorties, and Red Hawk missile batteries destroyed 22 Blue aircraft.

Blue and Red guerrillas were active during the night, both dropping leaflets and flying loudspeaker propaganda missions.

The Blue Homeland today announced recognition of a new provisional government of Columbia with J. E. Wiseman, Newberry civic leader and former mayor, as President. Wiseman has chosen Newberry attorney Thomas H. Pope as Minister of Foreign Affairs and Minister of Justice.

Swamp Fox, the popular Territory of Columbia guerrilla leader whose activities helped topple the Red-oriented government of Prime Minister Kenneth W. Riebe, has been given the vital position of Minister of Defense. The guerrilla leader had successfully disrupted communications and road and rail traffic during the period of the Red occupation. Formation of the new government came as a climax to the military operations which drove the Red forces south of the Saluda River and drove the Riebe government from the Territory of Columbia.

The selected Newberry civilians were spirited out of Columbia last week by Blue forces, and final negotiations were completed in Blue Homeland, where before the actual conflict began the provisional government was organized secretly by Blue Civil Affairs personnel working directly with undercover agents. A number of agreements defining the legal status of Blue forces in Columbian territory were negotiated between Blue Homeland Civil Affairs legal experts and President Wiseman and Minister Pope. President Wiseman is expected to issue a proclamation defining the agreements his government has made with the Blue forces.

The Red forces claimed fast action to remove the Blue invaders from the Territory of Columbia. The 2d Infantry Division, coming from the east, drove the Blue forces from Newberry late today. The Red 5th Infantry Division (Mech) squeezed the airhead from the south and took back two strategic positions that had been captured by the Blues—the airfield at Laurens and the bridge on South Carolina state highway 19 crossing the Saluda River. The southern Blue airhead appears to be consolidating its position as it awaits assist-

A Tactical Air Command C-130 Hercules demonstrates the ground proximity extraction method of delivering equipment to a Blue force airstrip near Joanna, S. C. The extraction method uses a hook connected to the equipment and a preset ground wire to jerk the equipment from the plane flying just above ground level.

ance from the 101st Airborne Division coming from the north. In two diversionary raids on the towns of Saluda and Union, S.C., both groups of airdropped raiders melted into the night, apparently with the aid of friendly guerrillas.

6 AUGUST 1963

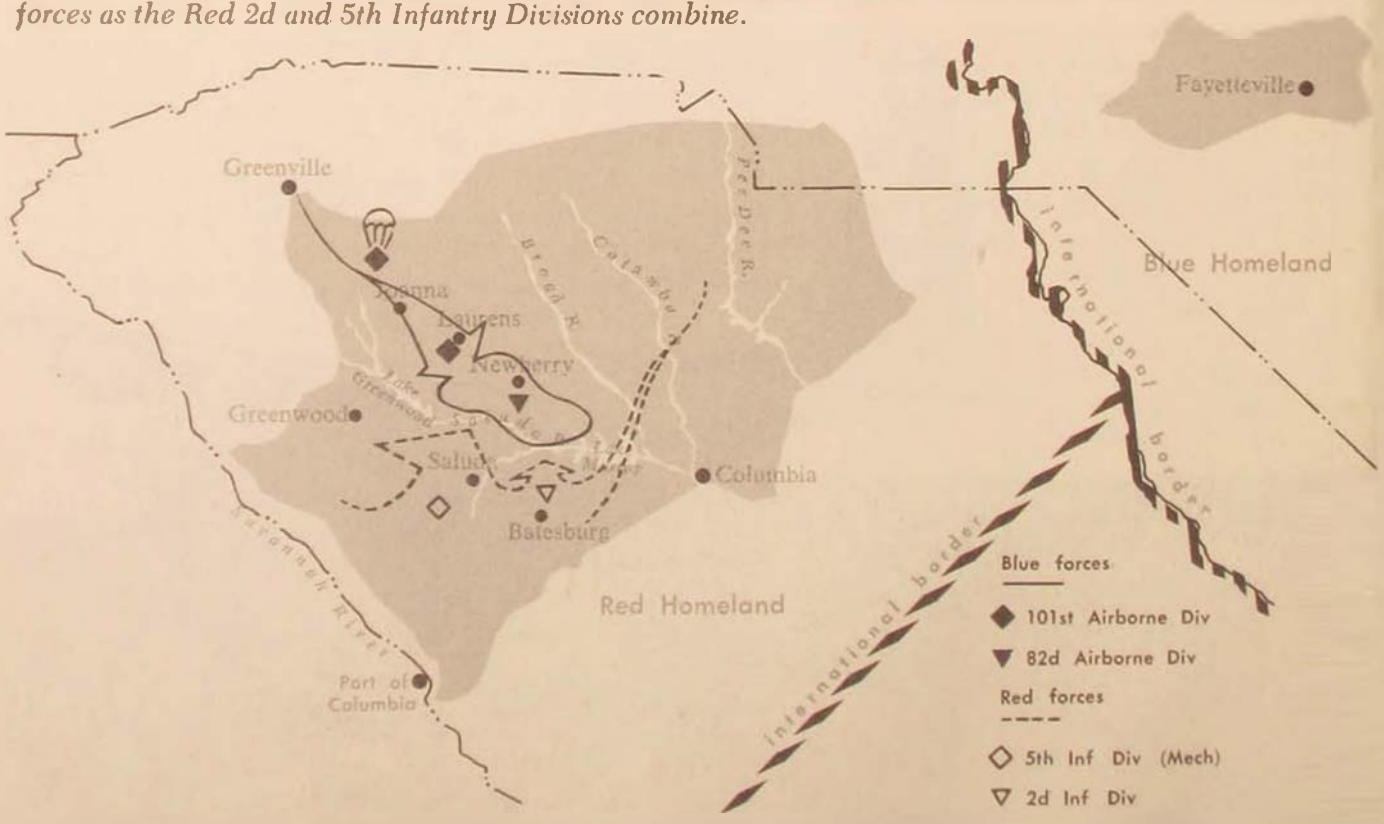
Blue Air Force fighter aircraft gave first priority to the close air support of their airheads today, striking only two Red airfields: North and Bush. North Field was put out of action for 11 hours by these air strikes. To deliver supplies and equipment to the airhead, six C-130 transports were landed on a new Blue air assault strip.

This strip had been quickly constructed using a new technique. For the first time, either in actual warfare or in simulated combat, a landing strip was constructed with all personnel, equipment, and materials delivered by aircraft. Army engineers along with their heavy equipment were airdropped near the quiet community of Hopewell, S.C., about 0900 hours 4 August. Immediately after detaching themselves and their equipment from parachutes, the Army engineers began construction of the assault strip with bulldozers and heavy earth-moving machines, and in 36 hours the strip was operational, with a pierced aluminum planking (PAP) runway 3000 feet long and 100 feet wide. There was also a hardstand measuring 200 by 500 feet for parking aircraft. Adding more military significance to this airstrip, named Sapper Field, was the delivery of 65 tons of PAP from air to ground in less than two seconds per ton load, by the new ground proximity extraction system.

The Blue Joint Task Force made its third major air assault today by dropping an estimated 2500 paratroopers of the 101st Airborne Division near Gray Court, S.C., to reinforce the spearhead from Donaldson Field in joining with the southern airheads. The airdrop began at 0845 and continued past 1300 hours. Approximately two hours prior to drop time, dummies were dropped ten miles east of Union in a diversionary move. The heaviest forces are now concentrated in the Laurens-Clinton-Newberry area, with Blue forces maintaining a supply line from Donaldson Field. Blue transports also made many landings today on two assault strips they constructed northwest of Newberry, delivering cargo and personnel.

In today's airdrops, some of the Blue aircraft used the "pop-up" technique. For this pop-up paradrop, the aircraft flies at less than 400 feet above the ground until it enters the drop area. Then the pilot climbs his aircraft rapidly—the pop-up—to the thousand-foot safe drop altitude

Map 3. The Blue 101st and 82d Airborne Divisions join forces as the Red 2d and 5th Infantry Divisions combine.



and gives the paratroops the signal to jump. This method of paratroop delivery gives the ground forces very little opportunity to fire on either the paratroops or the aircraft.

Blue fighters hit Bush Field, destroying parked aircraft and some tents. They also attacked a Red command post near Newberry, putting it out of action for a short time.

The Red 5th Infantry Division (Mechanized) is again applying pressure on the Blue's southwest flank.

Red air strikes were against Donaldson Field and Myrtle Beach AFB, the latter hit heaviest by three strikes. The sod assault strips within the Blue airhead were also hit, and the runways were cratered.

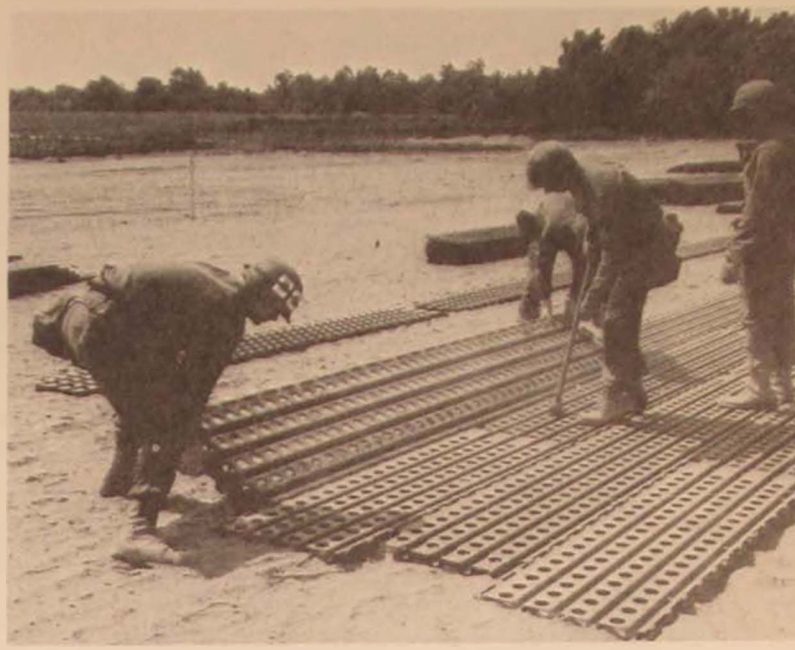
The opposing air forces each claimed approximately an equal number of kills today, the Red Army's Hawk missiles accounting for a large part of the Red claims.

Two major supply units, each using special and different techniques, have been supplying the Blue and Red ground and air forces, providing the hundreds of items needed by an army and an air force operating in the field.

The services provided by both these commands include food, clothing, replacement parts, medical, religious, police, and fire-fighting needs. One unit moves all its supplies by air, and the other uses a simulated port for landing supplies.

The 1st Logistical Command has the mission of supporting the Red forces, which include the 2d Infantry Division, 5th Infantry Division (Mechanized), Headquarters III Corps of the Army, the Joint Counter Insurgency Force, and the Twelfth Air Force. The 1st Log, with 75 subordinate units, uses the simulated "Port of Columbia." It conducts all its supply functions as though it had a supply line extending over 3000 miles of water and as though the port used were the only entry into the Territory of Columbia.

The newly organized 5th Logistical Command provides for the needs of the Blue forces, which include the 82d and 101st Airborne Divisions, Headquarters XVIII Airborne Corps, and the Ninth Air Force. The 5th Log, which has 52 subordinate units, uses aircraft to deliver all supplies needed by the Blue forces in the exercise area.



Army engineers build an assault airstrip, Sapper Field, of pierced aluminum planking (PAP). All men and materiel were airlifted into the zone—the planking by proximity extraction—and the 3000' x 100' runway was operational within 36 hours.

During the exercise under simulated combat conditions, the Log commands have had to counteract sabotage of communications lines, raids on equipment and supplies by guerrillas, and harassment by opposing aircraft. As a result the supply units have become adept at camouflage and strong security measures.

7 AUGUST 1963

As Exercise Swift Strike III completed its second phase, Blue Joint Task Force had control of the area north of the Saluda River. The 101st Airborne Division moved east after its airdrop yesterday and now occupies the northwest corner of the ground maneuver area extending east toward Union and the Broad River, including the town of Whitmire. The 82d Airborne Division has driven forward and engulfed the city of Newberry as it spread south, expanding west and southwest, and is now holding the area immediately north of and along the Saluda River.

Elements of the Red 2d Infantry Division are successfully fighting a delaying action against the Blue 82d Airborne Division. The main concentration of Red forces is south of the Saluda River where the Red 5th Infantry Division (Mech) was located yesterday and now holds the center of the

Ground maneuvers and civilian life go on simultaneously.

Red ground force bivouacs under cover against aircraft after targets of opportunity.

line while the Red Counter Insurgency Force holds the west end. As Red forces withdrew across the Saluda River last night, they blew up several bridges. The 937th Engineer Group holds the east end as the 2d Division withdraws to a reserve position after fighting the delaying action against the 82d Airborne Division. When the Red CIF withdrew from last night's battle to the present position south of the river, it destroyed the bridge behind it. Almost all bridges across the Saluda are now destroyed. One bridge crossing the west end of Lake Murray is intact and still held by Red forces.

Red aircraft were primarily concerned with the close air support of ground forces but did conduct reconnaissance flights over the Territory of Columbia.

In the air today Blue aircraft hit North Field twice, struck at a Red command post five miles northwest of Saluda this afternoon, and flew armed reconnaissance along the Saluda to maintain a close watch for possible attempts at crossings. Blue night air strikes destroyed 4 Red pontoon bridges between Lake Greenwood and Lake Murray. In other night air raids, the Blue night-fighting F-100 squadron struck the Red airfields of Turner, Dobbins, and North before midnight and again shortly after midnight, including Bush and Robins Fields in the second raid.

The most significant combat action today was an afternoon heliborne assault south across the Saluda River by a battle group of the Blue 101st Airborne Division. In a deep-penetration attempt, some 900 troopers of the 1st Battle Group, 505th Infantry, were lifted to two areas south and east of Greenwood. A Red Counter Insurgency Force pilot discovered the first aerial column en route to its objective and took it under attack while alerting the CIF command post. The CIF immediately scrambled a number of its aircraft to the attack and called on the 5th Infantry Division (Mech) and the 2d Infantry Division, which immediately sent ground units against the airheads. Umpires ruled that 40 per cent of the assault force were casualties and assessed heavy losses in helicopters. The Red forces are maintaining close surveillance for any river crossings.

Red unconventional warfare forces harassed Blue forces with aerial loudspeaker broadcasts last night. Other unconventional warfare elements are in Blue Homeland continuing their raids on Fort Bragg and Pope AFB near Fayetteville.

Blue unconventional warfare forces dropped psychological warfare leaflets on a large number

Red Army troops dig in. Pushed into the southern part of the Territory of Columbia, they are in danger of losing the important Port of Columbia.

of Red installations. They also brought 3 agents out of Red-held territory.

An administrative break in Exercise Swift Strike III began tonight at 1901 hours, to extend over the next 24 hours. Action will resume tomorrow evening, 8 August, at 1901, with stepped-up ground fighting expected thereafter.

8 AUGUST 1963

After heavy action and major shifting of forces by both sides late yesterday, the JTF Blue and JTF Red were still generally facing each other north and south of the Saluda River, respectively, as the second phase of Joint Exercise Swift Strike III drew to a close. Combat will resume at or after 1900 hours today.

During today's administrative break the attacking force is being repositioned in Blue territory for Phase III.

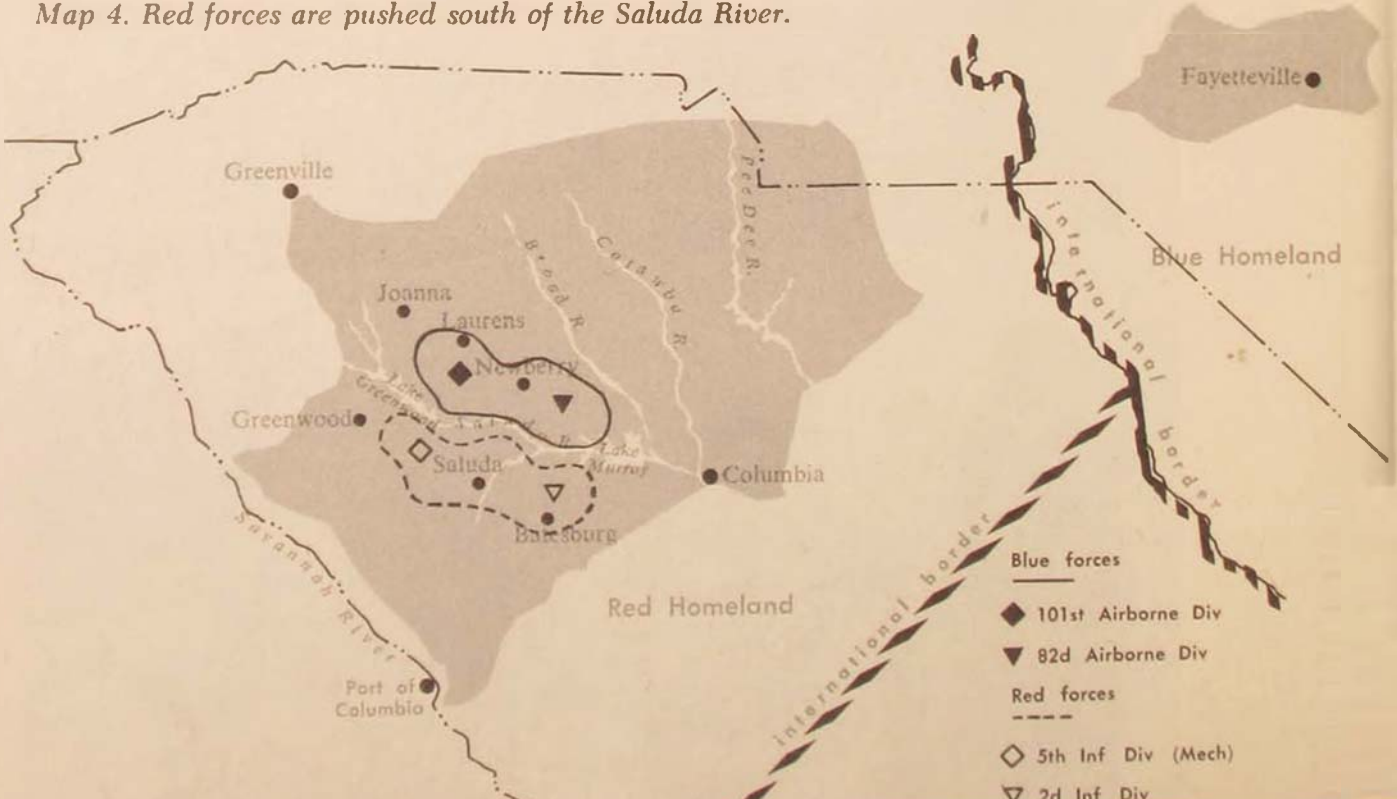
Thus far in the exercise Blue aircraft have flown 2588 sorties for a total of 3672 hours in the air. Red Air Force planes have flown 2645 sorties for a total of 4425 flying hours. Up to the start of the administrative period at 1900 hours yesterday, there were 93 injuries from parachute jumps. None was of a critical nature. There have been three fatalities and four serious injuries. All told, the 100,000-man maneuver has recorded three aircraft accidents and six vehicle accidents.

With Swift Strike III's assault airlift phase only five days old, the assault airlift forces of the Blue Air Force have already far exceeded the total airlift efforts of Swift Strike II in 1962. More than 21,000 personnel of the Army's 101st and 82d Airborne Divisions have been airlifted into the exercise area since 4 August. To assist the forces in carrying out the U.S. Strike Command maneuver in the Carolinas, more than 30.5 million pounds of heavy equipment and supplies also have been brought in by combined airlift forces of the Tactical Air Command, Continental Air Command, Military Air Transport Service, and the Air National Guard.

In last year's Swift Strike II, the total airlift effort was about 14,000 personnel and slightly more than 7 million pounds of equipment.

This year's airlift feat, including accomplishments through 1800 hours 8 August, required over 2000 sorties using more than 4500 flying hours. The 2000-mission total is equivalent to one of Blue Air Force's assault airlift aircraft taking off every 3.6 minutes in support of the Army mission. The Blue Airlift Task Force plans for and controls some 269 aircraft in addition to a mission commitment of 500 sorties for which no specific aircraft is allocated. The aircraft inventory includes C-130's, C-124's, C-123's, C-119's, C-121's, and C-97's.

Map 4. Red forces are pushed south of the Saluda River.



The pilot of this H-13 was killed when the helicopter crashed near Joanna, S.C. No passengers were aboard.

Phase III

9 AUGUST 1963

Last night Joint Task Force Red combined a wide end run for some 200 miles around surprised Blue forces with an airlanded assault and seized Donaldson Field in a coordinated air and ground attack about dawn this morning. At 0735 Red C-119 assault airlift aircraft landed at Donaldson with troops of the 2d Infantry Division. Some 17 minutes later a ground attack was launched against the airfield by Task Force "Hot Finger," which had made a 14-hour motor march from the vicinity of Greenwood. The 200-vehicle convoy had traveled a twisting "hare and hound" route through Columbia, Union, and Greenville to smash into Donaldson, apparently catching the Blue forces there by complete surprise. With both air and ground attack virtually unopposed due to surprise and confusion, the forces linked up immediately and drove the few Blue defenders northwest of the field. Since its capture by Blue forces on 5 August, Donaldson has been a main airhead, and round-the-clock flights have delivered mountains of equipment and cargo to support the lengthy Blue supply lines. Large quantities of supplies and equipment were captured by the Red forces.

Blue forces, caught by surprise in the lightning move, suffered more than 700 casualties and prisoners. The Red attackers lost approximately 90 as casualties and prisoners.

Terming the combined land and air attack a masterpiece of timing, the Red Joint Task Force

commander was enthusiastic in his praise of the forces involved. "This daring raid appears to be a complete success," he said. "It illustrates once again the unbeatable combination of Air Force and Army units. When working in close coordination with each other, just about any military objective is possible."

Shortly after midnight last night, Blue Air Force F-100's struck Red ground forces south of the Saluda River. They attacked troop concentrations in the Saluda-Batesburg-Edgefield areas, hit 8-inch howitzer units, and reconnoitered over Red-held territory. In other actions they struck troop concentrations at Wateree Church and Philippi Church south of the Saluda River.

Ground action by both Blue and Red forces increased along a line from Ware Shoals to Lake Greenwood and on to the western end of Lake Murray.

At nightfall the Reds were still in control of Donaldson Field but were under heavy counter-attack by Blue forces from the east and west, they having reached the runways in some areas.

Red and Blue Air Forces concentrated on close-air-support missions for maneuvering ground forces, and air action was heavy over and around Donaldson Field. In other action Red fighters attacked Blue command posts near Donaldson.

Both sides conducted reconnaissance flights by Army light aircraft, with a concentration in the Saluda River area between Lake Greenwood and Lake Murray.

The photo-reconnaissance center for both sides is located at Seymour Johnson AFB. Ten carloads of equipment and 15 shelters are included in this $2-million unit of the 363d Composite Reconnaissance Squadron from Shaw AFB, S.C. This new concept in portable mobility is a completely self-supporting photo-reconnaissance center which can be unloaded and erected in a matter of hours. With this equipment the complete cycle of mission requirement is accomplished—execution, processing, data extraction, and dissemination of intelligence product to meet the requirements of all agencies. Two hours after arrival, the film has gone through all the processing and security steps. The information is then passed on to commanders and other agencies needing it.

10 AUGUST 1963

Blue forces recaptured Donaldson Field before midnight last night in brisk ground action. The Red Task Force, which had captured the airfield yesterday, broke contact with the Blue counterattacking forces and withdrew toward the southwest under radio silence. As they move southward, the Red forces are expected to infiltrate individually through the Blue battle line in their attempt to join other Red troops across the Saluda River.

Blue forces conducted an airborne assault south of the Saluda River, commencing at 1601 hours. A battle group, along with heavy cargo, was dropped in an area three miles west of Saluda. The drops were considered "good," with only 17 minor personnel injuries and negligible equipment damage. Helicopter-borne landings of Blue troops were made in a number of areas from Highway 19 northwest to Ware Shoals and south of the Saluda River and Lake Greenwood. Blue ground forces conducted hasty river crossings all along the river front, with heavy concentrations of troops in the vicinity of Ware Shoals and Chappells.

Three 150-foot-long nylon ropes were the key to the Blue thrust by the 82d Airborne Division across the Saluda River at Chappells. Using three one-rope bridges, all troops crawled across the river under cover of darkness and set up a staging area from which the attack on Saluda was initiated. Once on the south bank, the entire unit remained in Red territory undiscovered, maintaining patrols and reconnaissance to screen Red movements in the area. The units later moved southward to seize vital crossroads to the north and west of Saluda and link up with elements of the 101st Airborne Division, which had parachuted three miles southwest of Saluda.

In air action Blue fighters attacked the Red forces' Bush Field at dawn this morning, inflicting damage on vehicles, on troop concentrations, and on the C-119 aircraft that took part in yesterday's capture of Donaldson Field. The Blue Air Force flew 311 sorties, with major efforts to seek out Hawk missile sites and provide close air support to Blue ground forces.

During the early morning hours Red F-100 aircraft struck the Blue XVIII Airborne Corps headquarters near Donaldson, inflicting some dam-

age to tents and vehicles. The Red Air Force flew 169 sorties and concentrated on Blue troop build-ups along the Saluda River and on convoys on roads leading out of Ware Shoals.

In the Territory of Columbia officials hinted that the new provisional government of President Wiseman was experiencing some policy difficulties with the Defense Minister, Swamp Fox. The "strong man" guerrilla leader has found high favor with the Columbian farmers, who see in him the rallying point of national pride.

11 AUGUST 1963

The citizens of Newberry officially and enthusiastically welcomed the conquering Blue forces to their capital city today. An armed Blue convoy swept into the old City Square from the airport at 1230 hours, bearing the new Provisional Government of Columbia and the leader of Blue Homeland's Joint Task Force. Taking seats on a platform in front of the Old Court House—draped with banners reading "Welcome, Blue Forces"—were President Wiseman, Minister of Foreign Affairs Pope, JTF Blue Commander Holloway and members of his staff, JUWTF Blue Commander Yarborough and his deputy, AF Brig. Gen. Gilbert L. Pritchard, and Swamp Fox. The Commander promised that "it will not be long before the Red invader is successfully banished from the Territory of Columbia. The Red invader is in a desperate state," he told the cheering populace, "and is forced back into the southernmost reaches of the Territory." The Commander paid high tribute to the people of the North and South Carolina areas where Exercise Swift Strike III is in full swing. He spoke warmly of the cooperation of all the citizens toward the field exercise.

Blue ground forces seized Saluda at 1900 hours on a broad front paralleling Highway 19 and extending west to Chappells in the major action last night. At 0600 this morning Blue forces moved out of Saluda south toward Johnson and Augusta. They forced a bridgehead over the Saluda River at Wyses Ferry during the night, and attacked southwest toward Saluda. Greenwood was captured by a Blue Task Force at 2230 hours last night but was under heavy counter-attack by Red forces at dawn this morning. A Blue attack from the Saluda penetration was also launched toward Greenwood this morning but was being contained by Red forces along Highway 178. Blue guerrillas struck at Hawk missile sites and a Red army airfield during the night, with results not reported at this time.

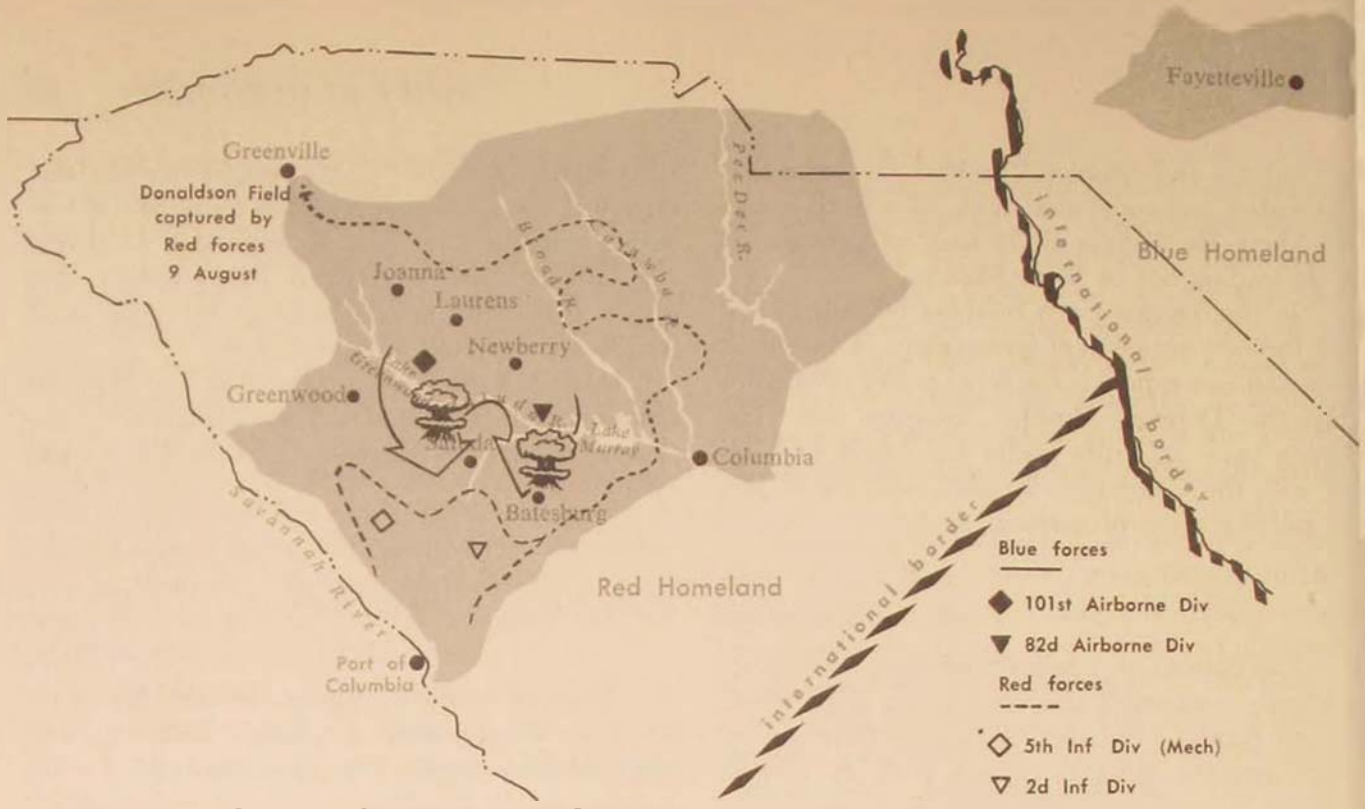
At first light this morning Red and Blue air missions were mounted against troop concentrations in the Saluda perimeter and the Greenwood area.

PHASE IV

12 AUGUST 1963

Nuclear warfare erupted for the first time today as the maneuvers resumed following the administrative break. The first simulated nuclear weapon struck the Blue spearhead at Batesburg, S.C. The Red forces, backed against the southwest corner of the exercise area and in grave danger of losing the seaport of Augusta, fired another nuclear burst at Blue troop concentrations 10 miles northeast of Saluda. Damage to the Blue

Thomas H. Pope (left) Minister of Foreign Affairs, James E. Wiseman, Sr., Provisional President, and Lt. Gen. Bruce K. Holloway, Blue Commander, appear at Newberry Civic Center 12 August after Blue forces had driven Red forces from the capital.



Map 5. JTF Red uses nuclear weapons and captures Donaldson Field in a surprise maneuver.

forces cannot be determined at this time. The atomic attack followed other major actions in which a large Red force made a night attack against Blue positions near Mayson crossroads west of Saluda, but the attack was repulsed and some 1100 Reds were captured. The eastern flank of the Blue force advanced to the outskirts of Batesburg, where it was heavily engaged by the Reds.

Red Air Force flew two night photo-reconnaissance missions against three Blue air bases and highways in the Blue territory using strobe night photography techniques.

A newly developed aerial strobe light is being used to provide illumination for night photography by reconnaissance aircraft. The strobe light appears on the ground as a series of rapid flashes, much like a flashlight signal. This strobe replaces the former method of dropping flares for night photography. The strobe is triggered automatically by the camera, and an unlimited number of pictures can be taken. Pictures taken by strobe light at various altitudes—from one thousand to several thousand feet—have been very clear in content and detail.

Blue Air Force mounted numerous fighter strikes at dawn today against bridges and Red convoys with unknown results.

Red Civil Affairs officials announced earlier in the day that, as a precautionary measure, planning had been initiated for rationing of food and medical supplies. Deposed Prime Minister Riebe has expressed serious concern over the defection of Minister of Health Long to the Provisional Government of President Wiseman. Dr. Long, dedicated to his duty of serving the people of TC, chose to remain at his post of Minister of Health rather than be evacuated with other government officials and Red leaders to the city of Saluda. The BHL has welcomed Dr. Long with open arms and considers him a solid citizen of the community, but the Red government has branded him as a traitor and claims he remained at home to protect his own capitalistic interests.

In the Blue Homeland a Red guerrilla was captured by Blue forces at 0510 hours today. Although the prisoner is noncommittal, BHL suspects he is the notorious Red guerrilla leader, Charlie Brown.

Blue forces continue to dominate the entire Saluda River basin and control all major highway networks leading into the area. Unconventional warfare activities have been waged throughout the area but with no significant highlights.

In addition to the thousands of Red and Blue forces operating in the giant exercise, there are

some 1400 soldiers of the Neutral Forces which operate between the battle lines. Recognizable in the maneuver area by their green hatbands and shoulder loops, the Neutral Forces have taken part in every major action. They have been particularly active in the recovery of parachutes and equipment in the paratrooper attacks—a special feature of the 1963 maneuver exercise. In addition to administrative duties these "roustabouts" also are truck drivers, helicopter-equipped medics, military traffic experts, fence-mending engineers, and weather forecasters. The Neutral Forces commander is also responsible for establishing an Administrative Holding Area and for transportation of prisoners of war. Additional realism has been added to Swift Strike III by the Neutral Forces' relieving the Red and Blue forces of administrative functions, which enables the combat forces to concentrate on their military objectives.

In addition the Neutral Forces helped keep damage claims relatively low by assigning Army Engineer companies to repair property damage as soon as maneuvering troops and equipment moved out of the area. Those claims that were asserted were swiftly adjudicated by a maneuver claims organization composed of 1 Air Force and 15 Army legal officers. This organization had its main office in Columbia and branch offices in Saluda, Clinton, and Chester.*

The Neutral Forces further contributed to the success of the joint exercise by providing all medical services and by recovering damaged equipment as well as personnel and equipment parachutes while the maneuvers were in progress. These services enabled maneuvering forces to get maximum benefit from the brief intensive air/ground phases by freeing them from the cumbersome administrative detail with which they otherwise would have been burdened.

13 AUGUST 1963

The Red forces launched a major counterattack last night to drive the Blue forces from their penetration south of the Saluda River. The attack was in conjunction with the employment of two nuclear weapons, reported yesterday. In the face of this nuclear-supported counterattack, the Blue forces have withdrawn north of the Saluda River, where they are now preparing strong defensive positions for a showdown battle.

The Red guerrilla forces, in coordination with the Red offensive in the Territory of Columbia, made a surprise attack today into the Blue Homeland and captured the city of Fayetteville, capital of the Blue Homeland. The guerrilla band, led by Charlie Brown, who had been released by the Blue Homeland in a prisoner exchange yesterday, entered the capital and secured four bridges over the Cape Fear River. They also captured the police station, city hall, and the court house. Radio station WFAI was taken over and became the voice of the guerrilla. Charlie Brown's followers arrested the city manager and raised the flag of the Circle Trigon over city hall. He then read a proclamation calling on the people of Fayetteville and Blue Homeland to support his new government.

In other ground warfare the Red forces captured the Higgins Bridge over the Saluda River and had a small bridgehead across the river by noontime. Later in the afternoon the Blue forces repelled this force and drove it south of the Saluda River.

Red patrols report that the Blue forces seem to be making a general withdrawal in the direction of their airfields.

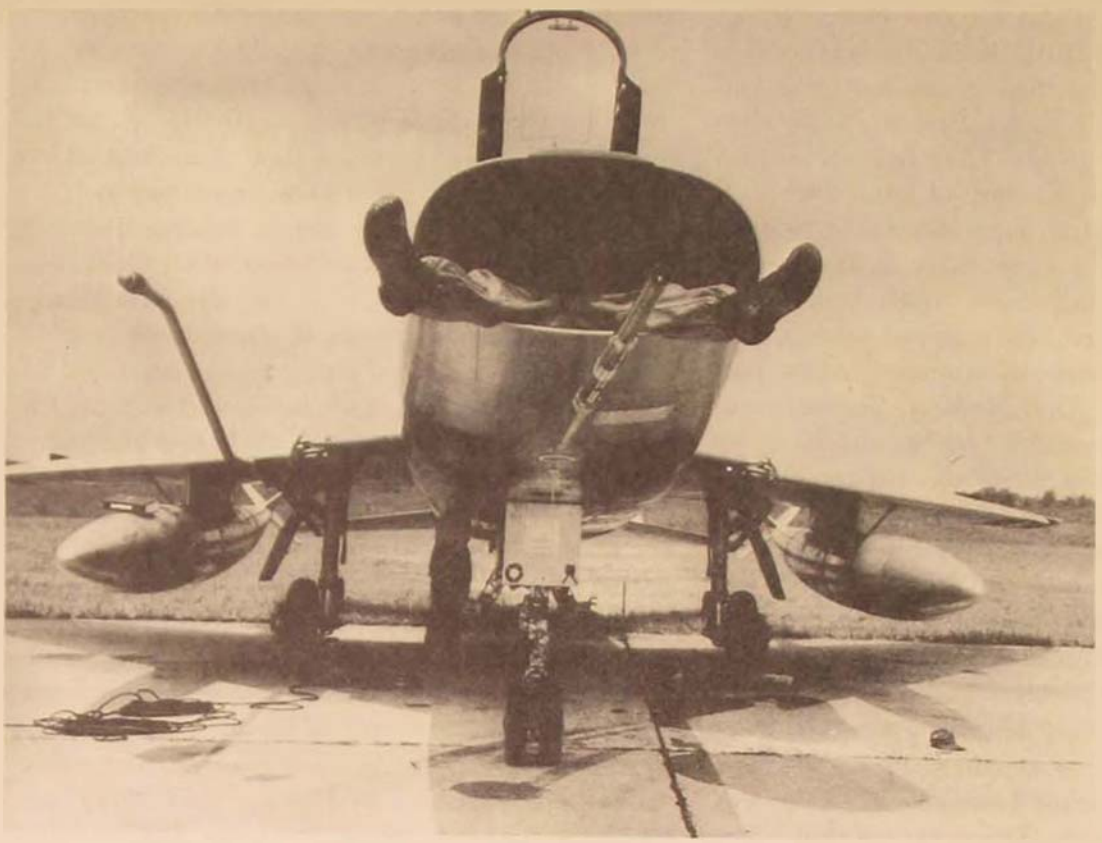
The Red forces are also making a right end run in the direction of Columbia, swinging around the east end of Lake Murray. This attack may be a diversionary or harassing action as the main Red attack seems to be aimed at developing a bridgehead across the Saluda River at Higgins Bridge.

In the air war the Blue Air Force flew 82 sorties and claimed 140 Red planes destroyed. The Red Air Force flew 110 sorties and claimed 78 Blue "kills."

14 AUGUST 1963

The use of nuclear weapons was again the highlight of action in Swift Strike III today. The Blue Air Force dropped nuclear weapons on North Field at 0340 and on Dobbins AFB at 0430 hours. Both strikes were successful and will render these

*The maneuver claims offices remained in operation until 9 October (8 weeks after the war ended), by which time more than 95 per cent of all claims for maneuver damages had been settled. Through 24 October, 1823 claims had been settled for a total of $314,000—a very minor figure for air/ground maneuvers that covered 7500 square miles and used numerous airfields not under DOD jurisdiction.



Mechanic on inside job

Red bases inoperative from 12 to 36 hours. On the ground the Blues employed 4 nuclear weapons along the south bank of the Saluda River from west of Chappells Bridge to east of Higgins Bridge. Large concentrations of Red troops are believed to be in this area, but casualty assessment is not complete. Blue guerrilla activity increased in the rear of the Red-held Territory of Columbia.

During the night Red forces attempted to force the Saluda River but were thrown back. At 0340 a Red patrol reported contact with Blue forces in the area of Ware Shoals. The Red forces had 2 battalions across the river at this point at one time, with other units attempting to gain a foothold at Newberry. For a short time they had 3 small bridgeheads in the Higgins Bridge area, but they were all thrown back by strong Blue counterattacks in coordination with the employment of the 4 ground nuclear weapons mentioned earlier.

The Red Air Force was hampered by the loss of planes at North Field and Dobbins AFB this morning as a result of the nuclear blasts. They flew 92 sorties and claimed 14 Blue planes downed.

Blue airborne forces swept back into the Blue Homeland this morning and recaptured the city of Fayetteville from Red guerrillas led by Charlie Brown. Elements of one battle group of the 82d Airborne Division were dropped 5 miles east of Fayetteville at approximately 1000 hours and began advancing toward the city immediately. A second drop was made about noon northwest of the city. The first contact with Red guerrillas was made at two bridges over the Cape Fear River. After a sharp fire fight the Blue forces overwhelmed the guerrillas. Red aircraft dropped leaflets in the area of the drop zone and on Fayetteville, offering safe-conduct passes to Blue soldiers and urging them to defect to the Red forces. Blue Air Force tactical fighters tangled with Red

fighters over the drop zone during the paradrops.

After a fire fight in the Market Place the Red forces took down their flag from the city hall and withdrew from the city, escaping in civilian automobiles.

Elsewhere the 82d Airborne Division continues to move to cover the entire Saluda River front as the 101st Airborne Division moves back to Donaldson Field for redeployment.

In the air war the Blues flew 110 sorties in airlifting paratroops to Fayetteville. They flew 198 additional sorties, claiming 98 Red planes destroyed.

15 AUGUST 1963

Red forces have attacked all along the battlefront from Ware Shoals to Columbia. Red bridgeheads were established at the eastern end of Lake Murray and at the Ware Shoals area of Lake Greenwood. The Red 5th Infantry Division (Mechanized) continued to advance in the west out of the Ware Shoals bridgehead, and on a line between there and Laurens it attacked toward Donaldson Field. A brigade of the 2d Infantry Division, which launched the attack around the eastern end of Lake Murray last night, had advanced to the outskirts of the Provisional Govern-

Blue forces overcome the defending Red guerrillas and recapture Fayetteville, N.C.

ment capital at Newberry by nightfall, but it has begun to encounter increasing Blue opposition.

The Provisional Government, which evacuated earlier in the day to a new location at Fountain Inn, is preparing to move to the Blue Homeland as the Government in Exile. The Minister of Defense, Swamp Fox, did not withdraw from Newberry with the rest of President Wiseman's government.

Blue forces employed small nuclear weapons against the Ware Shoals bridgehead during the night and in the vicinity of Chappells this afternoon. The first attack caused only minor damage to the Reds, who continued to reinforce the crossing site. The nuclear strikes near Chappells, however, turned back two separate Red attack forces which had forced the Saluda River in an early morning assault. Elements of the 101st Airborne Division began flights out of Donaldson this morning, and Red intelligence reported upwards of 2000 Blue troops on the field. The Blue Air Force attacked North Field twice before noon and hit McGhee-Tyson Airport five times this afternoon. Some 150 sorties were flown.

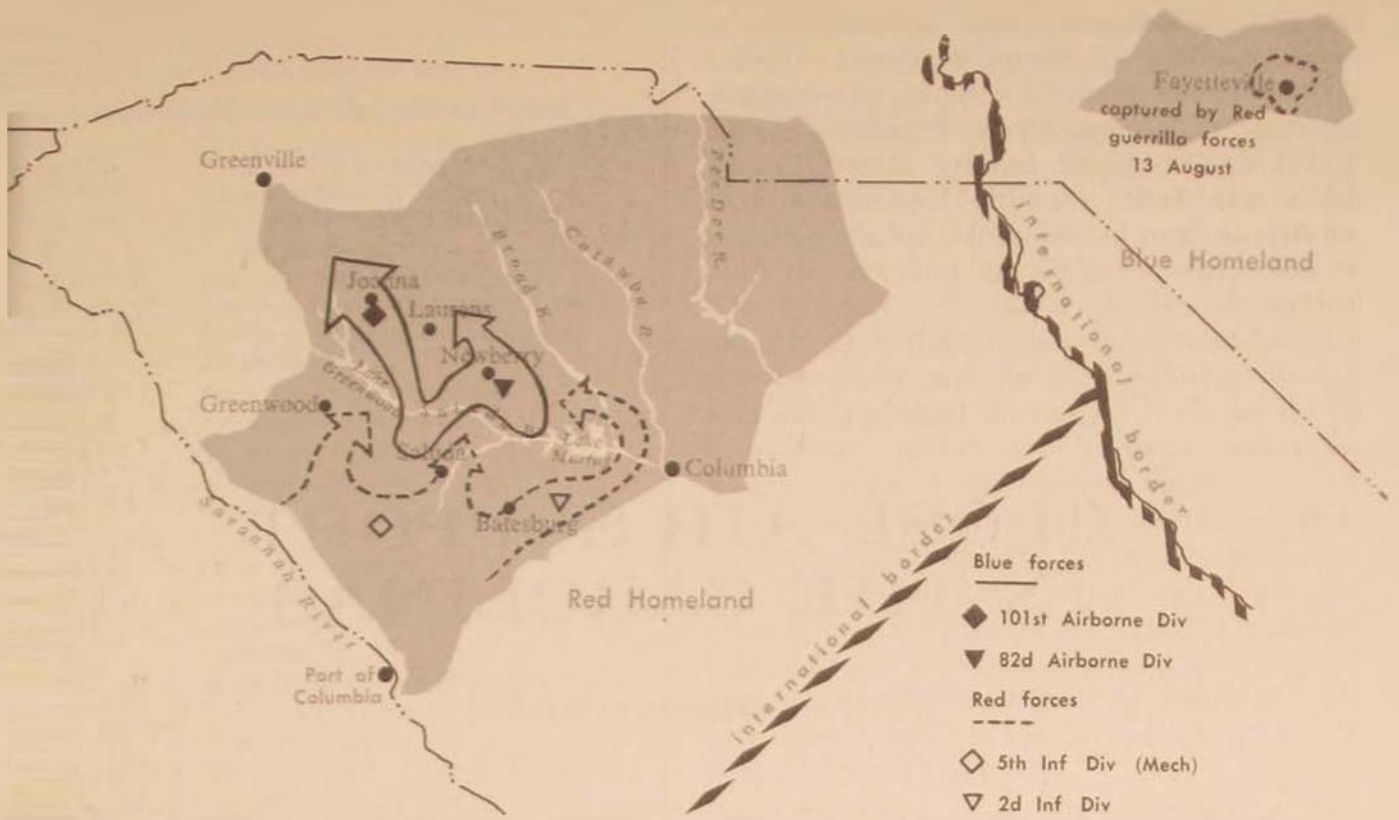
The Red Air Force concentrated on counter-air strikes and close air support, flying 166 sorties.

Blue Civil Affairs units are in contact with many friendly guerrilla bands and are planning to absorb them into the Provisional Government's military structure. Blue guerrillas were active throughout the Red rear areas but concentrated their major effort against Red logistical installations in the Edgefield area.

16 AUGUST 1963

The Red ground forces are well north of the Saluda River in two places as Exercise Swift

Paratroopers of the Army's 101st Airborne Division double-time aboard an assault airlift C-130 in a test of troop redeployment under combat conditions.



Map 6. Blue 101st Airborne begins redeployment under Red pressure. All Red air bases were hit by nuclear weapons on 16 August.

Strike III enters the last day. At 0200 hours the Blue forces made two nuclear strikes against Red infantry along the Saluda River between Lakes Greenwood and Murray. They followed with a counterattack against forces approaching the capital of Newberry and managed to push them south of the Saluda at one point. During the night the Blues discovered land mines planted by the Reds on Route 34 near Newberry. At 0400 the Blues launched a two-pronged attack against the main Red effort just east of Ware Shoals in an attempt to halt the Red march toward Donaldson Field.

As these battles were starting, the Blue Air Force delivered nuclear blows to all Red airfields, putting the Red Air Force out of action for the rest of the day. This will allow the Blue aircraft to concentrate on the close air support of the 82d Airborne Division, the last remaining Blue division in action. The 101st Airborne Division is continuing its redeployment out of Donaldson Field. To date, the Red Air Force has flown 3692 sorties for 5282 flying hours, and the Blue Air Force has flown 4087 sorties for 6987 flying hours.

As the war ended at 1400 hours today, the Blue forces were withdrawing toward Donaldson Field under the protective screen established by paratroopers of the 82d Airborne Division. Troopers of the 101st Blue Airborne Division have been moving out of Donaldson Field by MATS troop carriers since 0900 hours 15 August for their home station at Fort Campbell, Kentucky, in a simulated emergency deployment. Red forces were pressing the Blues from the south and threatened the capture of Donaldson Field. Newberry, the capital of the Territory of Columbia, was claimed by both sides as the war ended.

CLOSE AIR SUPPORT IN THE CAROLINAS

MAJOR ROBERT I. WEBER

ONE OF THE purposes of Swift Strike III was to gain further experience with the proposed USSTRICOM Joint Air/Ground Operations System (JAGOS) while evaluating the effectiveness of the system in a large-scale operation. The statistical data compiled from the hundreds of close-air-support (CAS) missions flown during Swift Strike III remain as evidence of the fact that USSTRICOM component commands gained considerable experience in the operation of JAGOS.* But what is JAGOS? What were the CAS procedures used during Swift Strike III? How do these procedures differ from current CAS procedures? And, finally, what are the results of the evaluation?

Joint Air/Ground Operations System

JAGOS is a composite of integrated command and control systems available to joint forces and includes the Joint Task Force Command and Control System, the Air Force Tactical Air Control System, and the Army tactical support systems—Army Air Defense System, Army Air/Ground System, and Army Air Traffic Regulation and Identification System. By integrating, coordinating, and collocating the personnel, procedures, and equipment of these command and control systems, the joint task force commander and his subordinate force commanders have the means to direct and control joint operations. JAGOS provides for the centralized direction of JTF forces and for the decentralization of the command and control required by subordinate commanders so as to employ their combat units and weapon systems effectively.

The size of the JAGOS varies directly with the size of the JTF it supports. A small JTF, consisting of an airborne infantry rifle company, reinforced, and a composite air strike force, comprised of a tactical fighter squadron plus reconnaissance elements, would require fewer command and control systems than would a large JTF consisting of one or more divisions and tactical fighter wings. Therefore it is readily apparent that the building-block technique applies to the selection of the appropriate JAGOS to support a JTF just as it applies to the selection of the JTF for a specific political, tactical, or strategic situation.

*The combat-ready forces of the Tactical Air Command and of the United States Continental Army Command are under the operational control of the Commander in Chief, United States Strike Command.

Abbreviations for Joint Air/Ground Operations System

AADS	Army Air Defense System
AAGS	Army Air/Ground System
AATRI	Army Air Traffic Regulation and Identification System
AbnACP	Airborne Air Command Post
AbnDASC	Airborne Direct Air Support Center
AFFCP	Air Force Forces Command Post
ALO	Air Liaison Officer
ARFCP	Army Forces Command Post
ASOC	Air Support Operation Center
ASRT	Air Support Radar Team
ATRC	Air Traffic Regulation Center
Bde	Brigade
Bn	Battalion
CAS	Close Air Support
CASF	Composite Air Strike Force
CJTF	Commander Joint Task Force
CP	Command Post
CRC	Control and Reporting Center
CRP	Control and Reporting Post
DASC	Direct Air Support Center
DASC(–)	Direct Air Support Center (Reduced)
FAC	Forward Air Controller
FSE	Fire Support Element
GFRP	Gap Filler Reporting Post
GLO	Ground Liaison Officer
JAGOS	Joint Air/Ground Operations System
JOC	Joint Operations Center
JTF	Joint Task Force
TAC(A)	Tactical Air Coordinator (Airborne)
TACC	Tactical Air Control Center
TADC	Tactical Air Direction Center
TACP	Tactical Air Control Party
TACS	Tactical Air Control System
TASE	Tactical Air Support Equipment
TOC	Tactical Operations Center (Army)

Among the many functions and responsibilities of the JTF commander is that of providing close air support for his ground forces. JAGOS is the means by which the commander controls his forces while fulfilling that responsibility.

joint organization for CAS

Close air support is an exact and demanding business that epitomizes the concepts of joint operation, for in CAS the joint commander's ultimate Air Force weapon—the manned aircraft—directly supports the ultimate Army weapon—the infantry rifleman. CAS is that air action requested by the ground commander against hostile ground targets which are in close proximity to friendly forces and which require detailed integration of each air mission with the fire and movement of these forces. This support is provided by the JTF tactical aircraft when the requirement cannot be satisfied by Army organic fire-support means. It was accomplished during Swift Strike III by coordinated action at all levels, using the JAGOS command and control systems.

During Swift Strike III continuous coordination between the JTF and component commands was essential for integrated JTF CAS operations. To facilitate this detailed coordination of the air and ground effort, the command posts and operations/control facilities were collocated whenever the tactical situation permitted. (See Figure 1.)

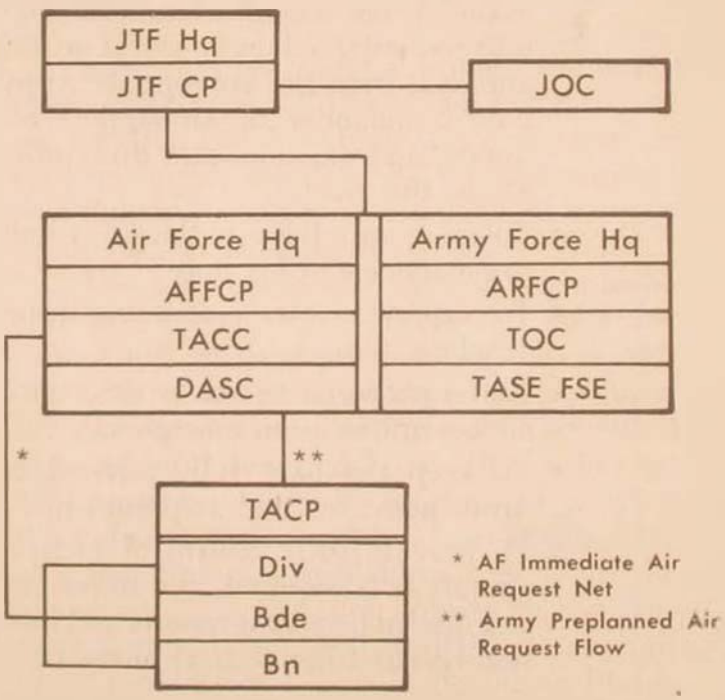


Figure 1. Army/Air Force agencies for close-air-support coordination

The Air Force agencies necessary for coordinating close air support are the Tactical Air Control Party, the Direct Air Support Center, the Tactical Air Control Center, and the Air Force Forces Command Post. Their functions may be explained briefly.

Tactical Air Control Party. A TACP, consisting of selected Air Force officers who are combat-ready tactical fighter pilots, was assigned to each Army unit headquarters down to battle group/battalion level. They served as direct representatives of the Air Force Forces commander and were responsible for providing any information and advice the Army unit required on air matters. The size of the TACP depended on the Army unit to which it was assigned. Those assigned to Army units above the battle group/battalion level were composed of one air liaison officer, vehicle-mounted communications, and enlisted communications personnel to operate and maintain the equipment. The duties of this type of TACP are:

- To monitor the air request net, acknowledge receipt of subordinate-unit requests, obtain approval or disapproval from the appropriate Army unit commander of air-support requests, and communicate disapprovals to the DASC.
- To act as air adviser to the Army unit commander and his staff.
- To supervise TACP's at subordinate echelons.
- To be prepared to act as a forward air controller in an emergency.
- To keep the DASC fully advised of Army activities and requirements.
- To provide such control of tactical aircraft as is required, and to receive and disseminate spot reports and mission results from tactical aircraft.

The TACP at battle group/battalion level consisted of two officers—the air liaison officer and the forward air controller—with vehicular and portable communications equipment and enlisted personnel to operate and maintain the equipment. TACP's were not assigned below battle group/battalion level, although they frequently worked directly with company commanders. This type of TACP has essentially the same functions as do those assigned at higher levels but has the following additional duties:

(a) To communicate immediate air-support requests directly to the DASC. (Normally done by the ALO.) Other TACP's will monitor these transmissions.

(b) To provide prompt and accurate direction of tactical aircraft against ground targets. (Normally done by the FAC.)

(c) To assist friendly aircraft.

(d) To coordinate air strikes with artillery fire.

Direct Air Support Center. The DASC was the Air Force facility located in or closely adjacent to the Army's Tactical Operations Center.* It was at the DASC that minute-to-minute CAS coordination was effected between the Army Forces and Air Force Forces of the JTF. (During the early stages of operation, prior to the establishment of a ground DASC, it may be necessary to employ an airborne DASC if a favorable air situation exists.) A director, fighter and reconnaissance duty officers, intelligence officers, weather personnel, and personnel required to provide transportation, administration, and communications support were assigned to the DASC. In addition, Army intelligence and operations representatives were located within the DASC. DASC functions and responsibilities were:

- To keep the TACC advised of the air effort needed to satisfy the Army close-air-support requirements.
- To employ the air effort allocated for immediate Army close-air-support requirements.
- To act as net control station for the Air Force air request net.
- To coordinate with the Army TOC on the detailed integration of the tactical

*The Tactical Operations Center (Army) is an integrated staff facility within which are grouped representatives of the Army commander's general and special staff sections concerned with current combat and combat support operations.

air strike with the fire and maneuver of the surface forces.

- To request additional air effort from the TACC when Army requirements exceed the sortie allocation.
- To advise the Army TOC of the current air situation and of forecast Air Force operations.
- To exchange intelligence information with the Army TOC and the TACC.
- To inform the TACP's of the current and forecast air operations and supervise their activities.
- To exchange weather information with the TACC and provide the Army TOC with weather data as requested.
- To assist the TOC as required in developing Army preplanned close-air-support requirements and coordinate on these requirements prior to forwarding to the TACC.

Tactical Air Control Center. The TACC was the planning and employment facility which directed the activities of all flying units and the Tactical Air Control System.* The TACC issued the "frag" orders to satisfy the preplanned Army CAS requests and, although not involved with immediate CAS requests, monitored these requests and could have taken over the DASC responsibilities had the DASC been incapacitated. Briefly, the TACC performed the following CAS functions during Swift Strike III:

- Provided centralized control of the Air Force effort.
- Planned and monitored the current air operation.
- Recommended allocation of air effort for Army close-air-support requirements.
- Decentralized execution of immediate close air support to the DASC.
- Planned and controlled tactical air reconnaissance pertaining to preplanned close air support.
- Designated personnel, equipment, and facilities to operate in an advanced alternate AFFCP.
- Maintained communications with the JTF headquarters, Army Force headquarters, Direct Air Support Center, tactical air units, Control and Reporting Center/Air Traffic Regulation Center.
- Planned and committed preplanned close air support based on Army plans.

Air Force Forces Command Post. The AFFCP was that portion of the Air Force Forces commander's headquarters which directed, planned, and coordinated the full range of the Air Force Forces operation. The functions of the units above the AFFCP/ARFCP level are self-explanatory.

*The Tactical Air Control System is composed of the following facilities or portions thereof: Air Force Forces Command Post, Airborne Air Command Post, Tactical Air Control Center and Tactical Air Direction Center as required, Direct Air Support Center, Airborne Direct Air Support Center, Tactical Air Control Parties, Direct Air Support Center (Reduced), Tactical Air Coordinator (Airborne), Control and Reporting Post, Control and Reporting Center, Gap Filler Reporting Post, and Air Support Radar Team.

how the system worked

Now that we have examined the functions and responsibilities of the JACOS, let us see how the system actually handled close air support during Swift Strike III and ensured that fighter aircraft were available to support ground forces when needed.

The JTF commander defined the mission and tasks for his Army Forces and Air Force Forces and assigned priorities for the employment of these forces. Within this guidance, the Air Force Forces commander committed the CAS effort required by the Army Forces. To be more specific, let us consider a hypothetical situation in which 50 CAS missions are allocated from the available air effort for the following day's operation. These 50 CAS missions represent the total available to support Army requirements. Should the Army Forces request 30 preplanned missions, 20 would then remain for immediate CAS requests.

Depending on the nature of the target, the criticality of the battle, and availability of resources, the Army commander determined

whether CAS should be requested. The Army commander made this decision after consulting with the ALO/FAC of the TACP assigned to his headquarters. If the Army commander decided that CAS would provide the most advantageous firepower, he then forwarded the request, specifying the target, location, description, desired results, and time on target. These CAS requests fell into two categories: preplanned and immediate.

Preplanned requests were submitted through Army command channels to reach the Tactical Operations Center at the Army Forces Command Post by a specified hour. The TOC then evaluated, assigned priorities (in accordance with the JTF commander's guidance), and forwarded the requests to the TACC for planning and execution. (See Figure 2.)

Immediate CAS requests—those not foreseen and included in the preplanned requests—were passed through the Air Force air request net direct to the Direct Air Support Center. Intermediate Tactical Air Control Parties would monitor the net and acknowledge receipt of the subordinate unit's request. After acknowledgment, silence signified Army approval. If an Army unit disapproved a subordinate unit's request, the attached TACP would transmit disapproval direct to the DASC.

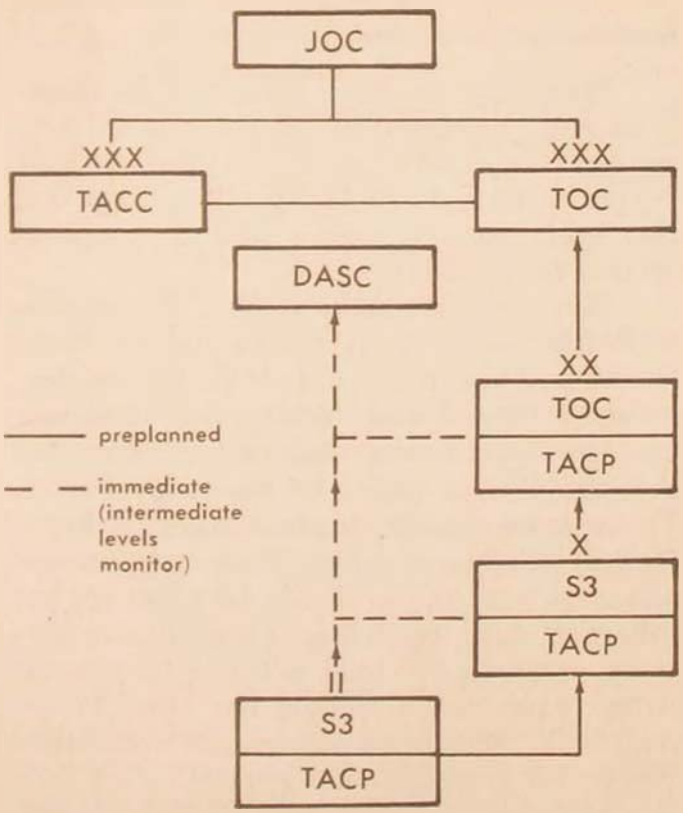


Figure 2. Close-air-support request flow

On receipt of the immediate CAS request, the Air Force officers at the DASC determined the type and amount of ordnance to achieve the desired destruction or neutralization, computed the exact time on target, and prescribed any necessary control measures. The DASC immediately advised the requesting Army unit if the requested support was not available.

The senior Army representative in the TACC kept the Army Forces commander informed of sorties available for preplanned air support and action taken on preplanned requests. In a similar manner the DASC kept the Army Forces commander informed of aircraft available on ground or air alert for immediate CAS missions.

One final part of the system remains to be discussed—radar. The primary control radars of the JTF were located at the Control and Reporting Center. The CRC was subordinate to the TACC and provided radar control and aerial surveillance within its designated area. It had the capability of collecting, displaying, evaluating, and disseminating surveillance information on the aerial activity in the area assigned. The capabilities of the CRC could have been extended by the addition of Control and Reporting Post and gap-filler radars.

The backup capability of JAGOS is impressive. The TACC is able to assume the functions of the DASC. The CRC has the ability to take over the TACC responsibility if the TACC is disabled. The CRP can relieve the CRC of its functions should the need arise.

CAS changes during Swift Strike III

The air/ground procedures used to provide close air support during Swift Strike III differed from the current air/ground procedures° in several major respects:

°Current air/ground procedures are contained in AR 97-75/AFR 55-9, Aviation, Delineation of Service Responsibilities for Air Control Teams, 5 December 1957, and CONARC TR 110-100-1/TACM 55-3, Joint Air Ground Operations, 1 September 1957.

• The JTF commander established the priorities for CAS, including both preplanned and immediate, and specified the allocation of air power to be applied to these CAS sorties.

• Preplanned missions were planned and directed by the Tactical Air Control Center located at the Air Force Forces headquarters rather than at the Air Support Operations Center. The remainder of the ASOC immediate CAS functions were assumed by the Direct Air Support Center. For this reason the ASOC does not appear in the JAGOS.

• That portion of the air effort allocated for close air support not required for preplanned missions was made available to the DASC for immediate missions. Upon receipt of requests approved by Corps, the DASC scrambled the aircraft required for the mission unless the mission was beyond the performance capability of the aircraft.

• Immediate requests were not transmitted through and processed by intermediate Army headquarters. The request was transmitted by the air liaison officer at the originating headquarters directly to the DASC over the air request net of the Air Force. Radio operators at intermediate headquarters acknowledged receipt of the transmission. If these headquarters subsequently remained silent, the silence indicated concurrence in the request.

• The full requirements for the air request net—i.e., ALO's, radio operators, radios, drivers, and wheeled vehicles—were provided by the Air Force. The only exception was that tracked vehicles/radio-equipped tanks were provided by the Army. Previously the Army had provided all radios, vehicles, and operating personnel for the TACP. The Army had the responsibility for maintenance of tactical vehicles of TACP's serving with Army Forces.

evaluation of CAS during Swift Strike III

At the exercise critique the Deputy Director Controller of Swift Strike III, Major General Henry Viccellio, described the air request system as "excellent." The evaluation of the Joint Air/Ground Operations System concluded that the composite command and control systems of the Air Force Forces' Tactical Air Control System and the Army Forces' Army Air/Ground System are capable of supporting the JAGOS procedures and that these procedures are suitable to meet the requirements of JTF air/ground operations.

IN RETROSPECT, the close-air-support effort of Swift Strike III provides a prime example of the flexible combination of military forces under a joint task force commander so essential in modern warfare. This effort typifies the intent of the Congressional Declaration of National Policy contained in the 1958 amendment to the 1947 National Security Act which recognized that except for certain specialized tasks, such as the nuclear retaliatory mission assigned to the Strategic Air Command, modern warfare transcends the capability of any one service and demands the flexible combination of the combat powers of two or more of the armed services in order to properly project the United States military power to serve national interests.

Hq USSTRICOM

COMMUNICATIONS-ELECTRONICS SWIFT STRIKE III

COLONEL CHARLES H. PHIPPS

THE COMMUNICATIONS element at Director Controller Headquarters of Swift Strike III handled more than 274,000 telephone calls over a cable and radio system, 9000 calls over a tactical radio and wire integration system, and processed more than 23,000 teletype messages. When considering this volume as representative of communications traffic of a major headquarters, Brigadier General Robert W. Paulson, Assistant Chief of Staff J-6, observed that operational requirements (from which communications requirements grow) must be reduced through decentralization, delegation, and development of strategic and tactical options with a reduction in reports and unnecessary data in command channels. Otherwise the already disproportionate share of airlift, dollars, and personnel resources available for front-line elements will be further reduced.

An area of continued concern and one that was clearly demonstrated throughout the exercise is the overloading of telephone switchboards of tactical units. Command action is mandatory to reduce the number of users of the system from those for "convenience purposes" to those "necessary to have" based on operational requirements. As a by-product, communications security would improve.

A discussion of the communications-electronics networks involved in this exercise may assist in an understanding of a few of the command and staff problem areas involved in communications for command control.

These communications networks were unique in many ways. In addition to the tactical communications organic to the 100,000 player forces operating in an area over 11,000 square miles, a communications network was established to tie in the opposing Red and Blue Joint Task Forces comprising Army Forces and Air Force Forces with Director Controller General Paul D. Adams and his staff at Spartanburg, South Carolina.

The network provided communications between the Director Controller Headquarters and the Joint Chiefs of Staff; U.S. Strike Command Headquarters, MacDill AFB, Florida; Army Strike Command, Fort Monroe, Virginia; Air Force Strike Command, Langley AFB, Virginia, and all commands serviced by the worldwide Defense Communications System. Thereby rapid reaction capability was provided in the event of a national emergency.

This secure and reliable exercise communications network was a multichannel military microwave and tactical high-frequency radio and cable system, integrated with facilities of the commercial telephone companies in South Carolina. There were over 20 military signal centers in this network, which extended over 300 miles within the exercise area.

Communications for an austere air and ground umpire system were designed to make maximum use of normally established command channels above division level and to use independent radio nets below division level. The system employed 104 vehicle-mounted FM radios throughout the maneuver area, each having the capability of entering the military communications network through 12 strategically located radio wire integration stations collocated at military microwave towers.

Two Air National Guard units, the 152d Tactical Control Group from Long Island, New York, and the 157th Tactical Control Group from St. Louis, Missouri, provided command and control communications facilities. both radar and radio, for the air element of Joint Task Forces Blue and Red. (They thus fulfilled their two-week annual active-duty training requirement.)

Communications support procedures were developed for new and revised concepts under tests. One of these concepts had to do with joint air traffic control procedures in the combat area to provide the ultimate in safety and mission response for Air Force high-performance aircraft and the slower-moving Army aircraft operating in the same zone.

Another system heavily dependent upon communications was a STRIKE-proposed air/ground close-air-support concept employing a specially packaged mobile radio communications unit recently introduced into the military family of equipment. This system, operated by elements of the 507th Communications and Control Group, Shaw AFB, South Carolina,

had to do with the control of air-delivered weapon systems in support of front-line troops.

Still another test that required special communications procedures and techniques was the revised tactical air reconnaissance and aerial battlefield surveillance system for joint operations.

Not to be overlooked was the requirement for exercise codes and ciphers for opposing forces; air navigational aids communications support by USAF 3d Mobile Squadron, Tinker AFB, Oklahoma; the exacting requirements for drop-zone communications; and over 2000 frequency assignments centrally controlled and coordinated by a Joint Frequency Assignment Section in Director Controller Headquarters, to minimize mutual interference.

Supporting the Director Controller system were communications units from resources of the United States Air Force and United States Army. The microwave and cable system was installed and operated by the 40th Signal Battalion (Construction), Fort Gordon, Georgia, augmented by 578th Signal Company (Construction), Fort Meade, Maryland, 261st Signal Company (Construction), Fort Bliss, Texas, and 518th Signal Company (Ultra High-Frequency Radio), Fort Gordon, Georgia. To provide the backbone of this system, the 518th Signal Company had been in the area since mid-May, occupied with the installation of the ten 200-foot towers and associated microwave equipment.

The 41st Signal Battalion (Combat Area) from Fort Lewis, Washington, augmented by the 270th Signal Company from Fort Ord, California, and the 228th Signal Company from Fort Gordon, Georgia, installed and operated the tangent and lateral 12-channel radio relay and carrier systems which were fed into the microwave system. Additionally the 41st Signal Battalion operated 12 radio-wire integration stations and "radio" switchboard facilities.

The USSTRICOM Communications Support Element (CSE), composed of both Army and Air Force personnel from MacDill AFB, Florida, with a detachment of the 206th Signal Company from Fort Gordon, Georgia, and a detachment of USAF personnel, established and operated the "operations" and the "administrative" telephone switchboards and the communications center for the Director Controller Headquarters. Also provided were special radio circuits to maneuver forces and the Defense Communications System. The major effort of the CSE was to provide communications support for Headquarters Joint Task Forces Blue and Red and for subordinate Army Forces and Air Force Forces. The 504th Signal Company (Supply and Maintenance), Sacramento Signal Depot, California, provided maintenance support for all the Director Controller communications support units.

The Assistant Chief of Staff J-6, Communications-Electronics, USSTRICOM, exercised operational control of the foregoing communications elements and was responsible for all communications aspects of the exercise. He was assisted by an integrated staff of Air Force and Army personnel. Based in part on results of exercises, and within STRIKE's terms of reference from the Joint Chiefs of Staff, he has initiated requirement studies which are continuous in nature and which have resulted in improvements in the quality of the communications posture for STRIKE forces. These studies range from exotic moon-bounce communications links to streamlined procedures in the distribution of codes and ciphers. Communications systems, like weapon systems, are usually outdated when issued to the forces because of advances in technology, a frustrating, time-consuming drawing-board-to-hardware acceptance period, and the shortage of dollars.

It is through service support of such actions and continued test and refinement of communications and procedures that future improvements can be expected.

Hq USSTRICOM

CIVIL AFFAIRS IN SWIFT STRIKE III

Major Albert C. Malone, Jr.

THE DIFFICULTIES in planning and organizing realistic and effective civil affairs training in joint exercises derives directly from the nature of civil affairs itself. The term "civil affairs" is defined as "those phases of the activities of a commander which embrace the relationship between the military forces and civil authorities and people in a friendly country or area, or occupied country or area when military forces are present." This definition presupposes the existence of a sovereign government and an indigenous population with whom a relationship will evolve and must be controlled—a situation difficult to develop in the friendly climes of South Carolina, the setting for Swift Strike III.

The concept of Swift Strike III also posed certain civil affairs planning difficulties. This concept revolved around the mythical Territory of Columbia, a sovereign nation without an armed force or an effective police force and beset by internal dissidence in opposition to the existing government. The government was oriented toward the neighboring Red Homeland, a totalitarian state that was coming more and more to dominate the internal affairs of the Territory of Columbia. Opposition to this trend evolved in direct proportion to the internal interference by Red Homeland, and eventually a number of guerrilla bands were organized. These developments were actively encouraged by the Blue Homeland, a nation of democratic processes considerably disturbed by the trend of events in the Territory of Columbia. Eventually internal conditions so degenerated that the Territorial Government called upon the Red Homeland to dispatch military forces to stabilize the situation. Shortly thereafter, Joint Task Force Red deployed to the Territory of Columbia, and a civil/military relationship commenced.

On the other side of the border, the arrival of JTF Red caused grave concern in the Blue Homeland and a concomitant flurry of military reaction resulting in the creation of JTF Blue. This military force was to prepare itself for eventual liberation of the Territory of Columbia and was to aid in and encourage the establishment of a government in the Territory of Columbia friendly to the Blue Homeland. This mission would require establishing contact and building a relationship with dissident elements in the country, a civil/military relationship compounded in its difficulties by obviously clandestine requirements.

To create an atmosphere for active and realistic civil affairs play during Swift Strike III would, it was recognized, require the extensive participation of local residents. Early in the planning stages Newberry, South

Red "Invasion" of Newberry

On 29 July Red Homeland forces moved into Newberry City Square

. . . surrounded the Civic Center

. . . and set up gunposts at all strategic intersections.

Carolina, was selected as the "capital" of the Territory of Columbia, and representatives of the USSTRICOM Civil Affairs Office approached a number of leading citizens of Newberry to solicit their assistance. These contacts were conducted in a guarded manner because of the necessity of organizing not one but two sets of civilian players, one to represent the incumbent government for the JTF Red civil affairs play, the other to represent the dissident political elements for JTF Blue play. The latter group could not be known to the first group because of the patent dangers to their security in the framework of the exercise concept. The cooperation and enthusiasm of the people of Newberry were beyond all expectations, and in short order the two sets of players were created. The incumbent government of the Territory of Columbia was largely composed of officials of the Newberry city government and included a Prime Minister, Minister of Foreign Affairs, Minister of Health, and Minister of Justice, among others. The dissident leaders were recruited from the leading citizens of Newberry, the proprietor of the leading hotel as the popular leader and a leading attorney as his principal adviser. The existence and identity of these men were not known to the other group until they publicly announced themselves at the appropriate time during the exercise. This was one of the best kept secrets of the war.

With the stage thus set for the civil affairs play, planning of the civil affairs organi-

City Manager Kenneth W. Riebe and Lt. Gen. Thomas W. Dunn, with members of the Territory of Columbia government and the Red Joint Task Force staff, descend the Newberry Civic Center steps after a "state luncheon" honoring the entry of General Dunn's forces into the capital of the Territory of Columbia on 29 July. Riebe agreed to serve as Prime Minister of the Territory of Columbia for the Swift Strike III civil affairs play.

zational structure commenced. Each JTF included a staff Civil Affairs Officer, who bore overall responsibility for civil affairs matters. Civil affairs operational responsibility was delegated from the JTF to the Army Forces commander, who had a civil affairs company assigned to him. The 41st Civil Affairs Company was assigned to Army Forces, JTF Red, and the 42d Civil Affairs Company to Army Forces, JTF Blue. Both units are from Fort Gordon, Georgia.

These two companies, together with their parent unit, the 95th Civil Affairs Group, constitute a unique military organization. Each unit comprises approximately 180 officers and men, divided into teams specializing in various aspects of the civil/military relationship. There are, for example, teams trained in close-combat-support functions, such as displaced person and refugee control, establishment of refugee centers, the feeding and housing of displaced elements of the population, and civilian public health and public safety problems in areas immediately adjacent to the combat area. There are, in addition, teams trained in the more sophisticated areas of governmental administration—economics, law, agriculture, labor, public facilities, public information, and so forth. Civil affairs units are capable of performing missions ranging from simple advisory roles to friendly governments to complete assumption of all governmental functions in the event of a military occupation. The active Army units

alone could not hope to contend with an operation as extensive as, for example, the occupation of Germany in World War II. However, they can be quickly deployed to a contingency objective area and can institute immediate necessary steps in the civil/military relationship. If the situation shows signs of escalation, they can call out from a highly qualified and well-organized civil affairs reserve structure sufficient reserve civil affairs units to perform the mission. Although a reserve organization (the 307th Civil Affairs Group from St. Louis) was utilized in Swift Strike III, the primary training objective in the civil affairs field was to present to the active Army units an exercise problem like that which could confront them in any contingency operation.

Civil affairs play resolved itself essentially into two phases. The first phase was concerned with those civil affairs functions in the general category of governmental contacts and relations. This phase occupied the air war period, 21 July–3 August. The second phase coincided with the ground war period of 4–16 August, during which civil affairs activities were concentrated primarily on combat support functions.

In the first phase, JTF Red arrived in the Territory of Columbia late in July. On 28 July the 41st Civil Affairs Company established itself in a wooded area on the outskirts of Newberry. The JTF Red Civil Affairs Officer assessed his fundamental problems as, first, to establish a sound civil/military relationship with an unpopular government in an essentially unfriendly atmosphere; second, to initiate a program designed to regain popular support for the government and establish an amicable relationship between the Red Homeland forces and the civilian populace; and third, to prepare to support the combat mission. With this general guidance, the 41st Civil Affairs Company set to work.

On 29 July the legal team instituted negotiations with the Territorial Government for a number of highly important international agreements on such matters as status of forces, labor, and civil affairs relationships. After realistic negotiations with the civilan government players (who, incidentally, played their role to the hilt in defending their "national" interests), these agreements were concluded. At the same time economics teams began surveys of the Territory's economic problems, which resulted in the formulation of an economic aid plan for the Territory. Other civil affairs personnel instituted community relations councils in a number of communities, thereby serving the dual purpose of engaging in exercise play with local residents and establishing a means for mutual solution of actual problems that were sure to arise in a relatively small area inundated with almost 100,000 military personnel.

In the meantime refugee control and displaced person teams began surveying sites and facilities for camps, holding points, and evacuation routes calculated to cause the least hindrance to military movements. Civil affairs personnel also launched an aggressive public information and public relations program to promote public support for the government and public understanding of the reason for the presence of Red Homeland forces in the Territory. Lieutenant General Thomas W. Dunn, JTF Red Commander, paid a formal call on Prime Minister Kenneth W. Riebe (actually Newberry's City Manager and a retired Marine officer). Prime Minister Riebe and members of his cabinet visited JTF Red troop units in the field escorted by civil affairs personnel. The JTF Red Civil Affairs Officer was able to report on 3 August that general understanding and a perceptible softening of public attitude was noticeable.

At the same time JTF Blue was marshaling forces in the Blue Homeland (Fort Bragg, North Carolina). The JTF Blue Civil Affairs Officer was dealing with a substantially different problem, that of establishing contact with dissident political leaders in the Territory of Columbia and setting the stage for the formation of a provisional government friendly to the Blue Homeland. This required close coordination with the Joint Unconventional Warfare Task Force of JTF Blue, which had clandestine channels to the guerrilla bands

and the dissident political leaders. On 30 July Mr. James E. Wiseman, Sr., the popular leader of the political resistance, and Mr. Thomas Pope, a Newberry attorney and Wiseman's principal adviser, were exfiltrated by air from the Territory of Columbia to Fort Bragg. "Swamp Fox," the National Guerrilla Commander, arrived at Fort Bragg at the same time on invitation of the Blue Homeland government. This group of Columbians met in secret sessions with the JTF Blue Civil Affairs Officer, Army Forces civil affairs personnel, and the legal team of the 42d Civil Affairs Company. The Commander JTF Blue, Lieutenant General Bruce K. Holloway, attended some of the negotiating sessions. Again the civilian participants displayed outstanding imagination and initiative in making the negotiations tough and realistic. Swamp Fox (a role played throughout the exercise by Lieutenant Colonel Fred Livingston, a unit commander in the 1st Armored Division, Fort Hood, Texas) was especially effective in asserting his personal aims, supported by veiled allusions to the fact that he controlled the only native armed force in the country, the guerrilla bands. Finally a provisional government structure was worked out which included Mr. Wiseman as Prime Minister, Mr. Pope as Minister of Justice, Swamp Fox as Minister of Defense, and other preselected Newberry citizens in other roles. Thereafter the negotiations continued to the conclusion of the various international agreements previously mentioned. That evening these men were reinfiltrated to their homes.

This contact having been established, it now became imperative to retain it until such time as JTF Blue could enter the Territory of Columbia and establish the provisional government. The Civil Affairs Officer knew that a loose sort of contact could be maintained through the Joint Unconventional Warfare Task Force and Swamp Fox, but in view of the latter's personal ambitions this alone was decidedly unsatisfactory. Therefore on 2 August a five-man national government advisory team, headed by Major Douglas Waters of the 42d Civil Affairs Company, was infiltrated to Newberry to maintain direct contact with the Provisional Government. This team remained hidden and performed its mission in Newberry until the capital fell to Blue forces.

The second phase of civil affairs play began with the airborne invasion by JTF Blue on 4 August 1963. Civil affairs emphasis was now on close combat support functions—refugees, displaced persons, and the concomitant housing, health, and feeding problems. The 41st Civil Affairs Company on 7 August evacuated the capital, taking with it key members of the government and necessary archives. Thereafter a number of platoons were detached from the company and attached directly to the divisions for refugee control work. Throughout the remainder of the exercise the JTF Red civil affairs effort was essentially confined to this type of work. (Unfortunately the element of realism was lost, as no satisfactory means had been devised for injecting realistic refugee problems into the exercise play. Simulated or "canned" situations had to be utilized, which detracted from the otherwise excellent training.)

Some civil affairs personnel of JTF Blue were airlanded in the Territory of Columbia on 5 August (D+1), but the 42d Company did not arrive until D+4. It immediately established its base at the town of Laurens, where its headquarters remained throughout the remainder of the exercise. The functional teams ranged throughout the maneuver area, giving direct support to the combat forces. Blue forces captured Newberry on 7 August, and the Provisional Government declared itself the following day. On 11 August General Holloway presented his credentials to Prime Minister Wiseman at a formal ceremony in the Newberry town square.

Meanwhile a potentially serious problem was developing in the parts of the Territory of Columbia held by JTF Blue. As conventional forces uncovered guerrilla bands, they exhibited marked reluctance to disarm and become part of a national military establishment. This tendency had to be stopped immediately, as it could develop into brigandage or, in the extreme, civil war. The civil affairs staff was

given the responsibility for solving this problem. The method used was simple and direct: boots, clothing, showers, and food. The uncovered guerrillas quickly became tractable and were processed and absorbed into the nucleus of a national military force.

Another problem handled by the Blue civil affairs personnel was the control and supervision of civilian contract labor hired to offload supply aircraft at various points in the JTF Blue airhead. This was not a simulated problem; civilian laborers were actually hired for this purpose very much as they would be in actual operations.

JTF Blue civil affairs personnel also engaged throughout the remainder of the exercise in refugee control activities, but, as previously mentioned, lack of realism detracted from this aspect of the play.

IN FINAL ASSESSMENT, the civil affairs activities in Swift Strike III constituted the most comprehensive and successful field training afforded these units in many years. Their performance was on the whole excellent, despite the fact that the compressed time frame required the telescoping of events which would normally extend over a period of many months and despite personnel shortages in the civil affairs units.

The exercise, in addition, afforded the opportunity to isolate problem areas, the more significant of which should be mentioned. The lack of realism in the play of refugee problems has already been noted, and a means for injecting realistic refugee play in future exercises must be devised. There was also some lack of cohesiveness in unconventional warfare and civil affairs activities. Closer coordination of these two efforts is mandatory in order that they may complement one another in the sociopolitical aspects of contingency operations. Finally, at no time during the exercise did the Air Force Forces in either JTF call upon the services of the civil affairs personnel,

Mr. James E. Wiseman, Sr., former mayor of Newberry, S. C., greets Lt. Gen. Bruce K. Holloway, Blue JTF Commander, upon his arrival 11 August at the Newberry airport to "liberate" the mythical capital of the Territory of Columbia from the Red occupancy. Mr. Wiseman was installed as Provisional President of the Territory of Columbia after General Holloway's Blue Task Force deposed the former government of the Territory.

although they were certainly available and in a number of instances could have been extremely useful. As one example, during the air war phase of the exercise, the runways on a Red air base were "cratered" by a Blue bombing attack and put out of operation by the umpires for a period of several hours. During this time the base commander, who had no organic engineer capability, took no steps designed to simulate repair of the damage, and as a result the umpires assessed an additional period of operational nonavailability. Had the base commander communicated the problem to the JTF Red Civil Affairs Officer, local labor and supplies could have been marshaled on a simulated basis and could have restored the field to operation. It is probable that many Air Force commanders are unaware of the variety of services available to them from civil affairs units, and an effort should be made to apprise them of these capabilities.

In the last analysis, the keen awareness of and interest in civil affairs displayed by General Paul D. Adams, Director/Controller of the exercise, and by the two JTF commanders were among the most gratifying aspects of the exercise. Had it been otherwise, the success achieved by the civil affairs units would not have been possible, for without command support the civil affairs function, which is an essentially adjunctive one, can easily be submerged in the operational tempo. That it was not demonstrates that in the United States Strike Command the sociopolitical problems of war are not overlooked.

Hq USSTRICOM

SOME PATTERNS OF AIR FORCE THOUGHT

Dr. Robert F. Futrell

A VERY knowledgeable reporter stated recently," said General Curtis E. LeMay, USAF Chief of Staff, on 21 September 1961, "that in the early 1950's he felt he knew what the Air Force stood for, but today he doesn't. . . . His statement puzzled me," continued General LeMay. "It also alarmed me because understanding our doctrine and concepts is basic and important to our very existence."[1]

General LeMay thus noted a matter that had concerned Air Force officers for many years. "The Air Force has so recently achieved its full stature as to be something of a doctrinal mystery in comparison with the older, more familiar services," General Thomas D. White, then USAF Chief of Staff, had pointed out in December 1957.[2] Unlike the United States Navy—which operates in accordance with a seemingly complete set of sea power principles recorded more than half a century ago by Admiral Alfred Thayer Mahan—or the United States Army—which draws its principles from generations of American and foreign military scholars—an Air Force officer speaking in 1955 could only conclude that "the Air Force as a service does not have a set of ideas against which it is operating, at least not a complete set of ideas."[3] Provoked by an Army officer's magazine article entitled "Air Power Needs Its Mahan," Major General John DeForrest Barker, Deputy Commander of Air University, observed in 1953: "We definitely need a body of air principles backed by the historical evidence of air employment."[4] "The Air Force," stated an Air University staff study in 1948, "has never maintained a complete and current compilation of those concepts, principles, policies, tactics, techniques, practices, and procedures which are essential to efficiency in organizing, training, equipping, and employing its tactical and service units."[5]

The testimony of qualified Air Force officers thus indicates that Air Force thinking about its fundamental beliefs has not been systematically recorded. These and other Air Force authorities, however, have always believed that the Air Force requires a recording of its fundamental beliefs. In the midst of World War II, an Army Air Forces staff officer pointed out: "In any field of endeavor, private or public, the first essential is a body of working principles, and the next is a clear concept of the manner of following those principles with the means at hand. Without such principles and concepts being clearly expressed, at least in the minds of the users, it is not at all possible to attain coordination and efficiency, and it is not reasonable to expect, as is desirable, that all workers to the common

end will have in mind the same possibilities and objectives. In military matters, especially those of the magnitude of the operations of the present war, where mistakes and inconsistencies cost thousands of lives and millions of man-hours, it is all the more important that there be clearly expressed guiding principles which are clearly understood by all planners, as well as by all who are charged with the handling of forces in the field."[6]

A study conducted by an Air War College seminar in 1951 concluded that the United States Air Force had a vital requirement for a codification of its doctrine. The very size of the USAF demanded a codification of doctrine. Prior to World War II virtually all senior Air Corps officers would pass through the Office of the Chief of Air Corps, exchange views with the several division heads, and draw from these conversations "the essence of air doctrine." By 1951 the USAF had grown into a larger and more complicated organization. If an officer in the field was to point his efforts along constructive lines he had to know "the over-all policies and objectives of the Air Force. . . . Without a well established doctrine the efforts of all but a few key personnel, who can remain sensitive to the changes as they occur, are to a very considerable extent negated."[7]

Five years later Professor Henry A. Kissinger pointed out that "strategic doctrine" enables society "to act purposefully as a unit . . . by reducing most problems to a standard of average performance which enables the other members of the group to take certain patterns of behavior for granted and to plan their actions accordingly. . . . By explaining the significance of events in advance of their occurrence," Kissinger concludes, "[doctrine] enables society to deal with most problems as a matter of routine and reserves creative thought for unusual or unexpected situations."[8]

The reasons why the Air Force has been hesitant to record its fundamental beliefs have interested a number of students. "Air activities have most often attracted men of active rather than literary leanings. . . . The Air Force has never boasted a high percentage of scholars," Col. Noel F. Parrish pointed out in 1947.[9] So far as writing was concerned, Professor W. Barton Leach, Brigadier General, USAFR, called the Air Force "The Silent Service."[10] General Barker further stated in regard to the provocative article on air power's need for a Mahan: "As you know, the scholarly life is not particularly respected in the profession of arms. . . . I don't believe, however, that we can ever detail an officer to do a work of this sort. Mahan, as with all great thinkers, was inspired. Of course he had to spring from an environment which allowed him to study long and deeply the problems of sea power. His many years on shipboard were devoted to these exhaustive studies—but he would have been playing poker . . . and reading fiction if he hadn't been inspired to learn all he could of naval history and to give it pattern and meaning."[11]

Other factors also have hampered the expression of fundamental Air Force beliefs. Prior to 1947 the subordinate position of the Air Force to the Army and Navy is said to have hampered air publications, as did the fact that the Army's manuals system was unsuited to the needs of the Air Force. An Air University study in 1948 stated that the "outstanding obstacle to writing air force doctrine in the past was the rapidity of the development of air power . . . from a limited supporting role to its present position of preeminence in warfare."[12] In some cases senior Air Force officers are said to have discouraged the preparation of air doctrine because they felt that air doctrines were too short-lived to warrant publication. Word of mouth generally sufficed to keep senior air commanders well abreast of Air Force policy, and it was much easier "to scrap the worn-out doctrine that remains unpublished than it is to drop a doctrine that has been published."[13] The basic shortcoming of "verbal doctrine" was that it remained vague. "It is this reluctance to publish as official anything imperfect," stated an Air War College study, "that restrains our commanders from the dissemination of current doctrine. Until we accept the fact that

all doctrine is imperfect . . . and that it is highly changeable we cannot hope for the issuance of doctrine."[14] This same study noted that in 1951 "the air leaders of today are not so old that they can easily forget the punishment meted out to the doctrinaires of the past." A statement of Air Force policy in 1950 to the effect that "all Air Force military personnel will refrain from preparing proposed articles or public addresses of a controversial or provocative nature" caused Air University to contemplate suspension of publication of the *Air University Quarterly Review*.[15] Eleven years later the same publication found that Department of Defense blue pencils left a number of holes in its pages at printing time.[16]

Air Force thinkers not only have found it difficult to codify the Air Force's fundamental beliefs but, as the foregoing quotations reveal, have employed a diversity of discourse to categorize these fundamental beliefs. "There appears to be a fine line of demarcation between concepts and doctrines on the one hand, and doctrines and principles on the other hand," concluded an Air War College study in 1951. "It is difficult to differentiate between concepts which existed in the minds of some far-sighted individuals in the Air Force and the doctrine which was accepted as official by the War Department. Also doctrine is easily confused with strategy."[17] Adding additional complexity to any attempt to analyze basic Air Force thought patterns is the fact that the terms used to categorize fundamental Air Force beliefs apparently varied with the persons using them and certainly varied with the time period in which the terms were employed.

It is not too hard to imagine why early Air Force thinkers began to refer to their fundamental ideas as "doctrines." In his first book, published in 1921, Brigadier General William Mitchell referred to "our doctrine of aviation."[18] In 1928 the Commandant of the Air Corps Tactical School submitted a paper entitled "The Doctrine of the Air Forces" to the Office of Chief of Air Corps.[19] The term "doctrine" had an old meaning in military establishments as a teaching, or, in a collective sense, a body of teachings. Although the Air Service and Air Corps were virtually unable to change the War Department's Field Service Regulations and Training Regulations, the chief of the Army's air arm, in common with the other chiefs of Army arms and services, was entitled to issue the doctrinal literature for the Air Service and its successor, the Air Corps. The War Department General Staff emphasized, however, that doctrine should be formulated only by the chief of an Army arm or service.[20] "Doctrinal literature originates with the highest authority," said an Army Air Forces staff officer in 1944, "and states in general the over-all policy to be followed."[21]

Given agreement on the proposition that doctrine derived from the highest authority in the Air Force, there was less agreement as to its precise nature. In 1938 the Air Corps Board stated: "Principles change not at all, or but slightly, over considerable periods. Doctrines generally change slowly, but will change as different applications of principles bring forth different beliefs and teachings. Methods are influenced both by doctrine and technical improvement and will change more rapidly than doctrines. The most satisfactory Field Service Regulation would be one dealing only with principles and expressed in terms that would never change. However, air warfare is relatively new and there is much difference of opinion as regards principles of employment."[22]

In 1943, however, an AAF staff officer defined doctrine as "a body of fundamental principles expressing the logical possibilities and objectives of air warfare, as well as its general limitations. Like any other doctrine, especially one for a weapon so new as the air arm still is, it is only natural that the AAF doctrine should include speculative as well as proved truths, but they are all necessary to provide a basis for initial decisions in the design of airplanes and in the training of personnel to accomplish the desired end." This same officer defined "policies" as "derivatives of doctrine and the expressions of decisions based upon doctrine."[23]

By 1948 the growth to maturity of the Air Force during World War II and the achievement of separate status as the United States Air Force led Air University thinkers to suggest that the time was opportune to undertake that part of their mission which charged them to prepare, review, and revise all USAF publications pertaining to "basic doctrine."[24]

As this work progressed, Air University accepted the definition of doctrine stated by the Joints Chiefs of Staff: "A compilation of principles and policies, applicable to a subject, which have been developed through experience or by theory, that represent the best available thought, and indicate and guide but do not bind in practice. Its purpose is to provide that understanding within a force which generates mutual confidence between the commander and his subordinates in order that timely and effective action will be taken by all concerned in the absence of instruction."[25] Looking backward at Air Force experience, Air University students of doctrine noted that there had been an implication that doctrine represented an official view and that, once it had been stated, some general efforts had been made to follow it. These students recognized, however, that the Air Corps and Army Air Forces had not always been guided by "prevailing existing doctrines," which were influenced by the ground-oriented War Department. They accordingly sought to find Air Force doctrine through a "logical analysis of historical fact" rather than through official statements, organizational designs, or other apparent factors that might appear to contradict the actual doctrine which was practiced.[26]

The vigorous efforts of Air University to define USAF doctrine in the early 1950's did much to clarify the semantic thought patterns of the Air Force. "In this attempt to strike out on our own," said Colonel William W. Momyer, Deputy Commandant for Evaluation, Air War College, "we have encountered many obstacles that were certainly anticipated, and others that could not be foreseen. Of course, we have encountered . . . prejudice in respect to what constitutes doctrine."[27] To accomplish their task, Air University students had to relate Air Force doctrine to the hoary principles of war, to the roles and missions of the U.S. armed forces, to tactics and strategy, and to "concepts," a relatively new Air Force term.

As a part of its Army heritage, the United States Air Force had received the age-old principles of war which derived from the writings of Napoleon, Clausewitz, and Jomini and which had been best recorded in modern times by Great Britain's Major General J. F. C. Fuller. The American version of the principles of war first appeared in War Department Training Regulation 10-5 of 1921. They were discussed in the Air Corps Tactical School text on air warfare dated 1 March 1936. In September 1943 Colonel Ralph F. Stearley wrote a paper on the applicability of the principles of war to air power, which was published as AAF Memorandum 200-7, October 1943. Colonel Stearley stated that the nine fundamental principles of war (which, like common sense, applied to all forms of military power) were the principles of cooperation, objective, offensive, mass, movement, economy of force, surprise, security, and simplicity. He also stated that the application of principles of war to the preparation for war and the direction of war constituted "strategy," whereas their application to specific operations was called "tactics."[28]

In an article on "Air Power and Principles of War" in 1948, Colonel Frederick E. Calhoun of Air University suggested that air power had strengthened the validity of the first eight principles, but he argued that air warfare could not be simple and that the ninth principle should be replaced by "capacity," or constant combat readiness.[29]

Within the U.S. armed forces the principles of war were accepted by the Army and were taught by the Air Force at Air University. The Navy's attitude was that they were permissible as maxims, precepts, factors, guides, or even basic considerations, but the Navy questioned whether they could be accepted as principles. The Navy did not list the principles in its U.S. fleet publications, but

the basic thoughts of the principles were taken cognizance of in these doctrinal publications.[30] The Royal Air Force distinguished between principles of war, which it considered to be not principles but guides or *aides-memoir*, and doctrines which were devised from them. [31]

Possibly in line with these same trends of thought, Air University did not include a specific discussion of the principles of war in its proposed manual on USAF basic doctrine published in October 1951.[32] A USAF committee which revised this manual and published the result as Air Force Manual 1-2, *USAF Basic Doctrine*, nevertheless inserted a section entitled "Air Forces and the Principles of War."[33] Although an Air War College officer suggested that this consideration of the principles of war was a "dissertation" which was "hardly doctrinal," General Otto P. Weyland, Commander, Far East Air Forces, stated that this section of the manual was too brief and ought to be developed and elaborated.[34] Later editions of AFM 1-2 prepared at Air University did not include specific discussions of the principles of war, but there was a continuing recognition that these principles applied to air power as well as to the other military services.[35]

In drawing up its statement of USAF basic doctrine, Air University preferred to relate the role of the Air Force to the national objectives and national policies of the United States rather than to the current statement of armed forces organization and roles and missions which emanated from the National Security Act of 1947. It was the opinion of Lieutenant General Idwal H. Edwards, Commanding General, Air University, that "current decisions on matters of organization and roles and missions . . . are not basic doctrine."[36] Air Staff officers questioned the fairly precise Air University statements of what it believed the U.S. national objectives and policies to be,[37] but the USAF-approved manual on basic air doctrine issued on 1 April 1953 accepted the broad proposition that the USAF supported the nation's objectives and policies, without telling what they were.[38] In a speech before the Scientific Advisory Board on 4 December 1957, General Thomas D. White, USAF Chief of Staff, strongly asserted that "Air Force doctrine is not a thing apart nor a code sufficient unto itself. The Air Force is a national instrument and evolves no doctrine, makes no plans, and makes no preparations other than those clearly and unmistakably called for or anticipated by the national policy."[39] The requirement that USAF doctrine must support national objectives and policies necessarily marked it as distinct from pure air power doctrine, which would enunciate through theory and logic the immutable principles that characterize air power as differentiated from land power and sea power.[40]

An Air War College study in 1951 noted that doctrine was easily confused with strategy on the one hand and with tactics and techniques on the other hand. Air University found little difficulty in distinguishing doctrine from tactics and techniques, for the latter depended quite manifestly upon specific equipment and special situations and were designed to implement specific actions within the broad framework of doctrine. Strategy was also concerned with specific situations, although on a tremendously broader scale than tactics. Brigadier General Alfred R. Maxwell, an Air Force author on the subject, stated that the tools of strategy were a sound plan, adequate forces, appropriate execution, and guidance by proper principles. "Therefore strategy," wrote General Maxwell, "is the art of infusing into a plan and/or applying a central idea, design, or timing which will give the greatest possible advantage in a campaign or situation. The strategy is the specific design used."[41]

Prior to World War II the teachings of the Air Corps Tactical School had frequently gone beyond the somewhat narrow confines of officially approved doctrine,[42] but, probably because it held that the principal characteristics of doctrine were that it be "reasonable" and "progressive,"[43] the Air Corps Tactical School did not differentiate between the doctrinal and the nondoctrinal in its teachings. As early as March 1943, however, AAF officers were referring to ideas that did not have the proved

validity of doctrine as "concepts." "No concept, particularly one pertaining to a new weapon," wrote Colonel Charles G. Williamson of the AAF Directorate of Bombardment on 3 March 1943, "can reasonably be stated as a fixed and permanently inviolable rule, but must be accepted as a guide until actualities justify, in the mind of the proper authority, a change in concept."[44]

In 1948, writing of the need for vision in the new United States Air Force, Major General Robert W. Harper, Commander, Air University, described General Billy Mitchell as being among the "visionaries and missionaries" of the Air Force. "For atomic warfare," wrote Harper, "new concepts of Air Power will have to be formulated."[45] Early in the 1950's USAF regulations charged Air University with the responsibility for developing doctrine.[46] But Air University specified that the mission of the Air War College included "the conduct of special studies and evaluation which will provide sound air power concepts" and "the preparation . . . of doctrinal manuals." The first objective of Air War College evaluation was: "To develop doctrines and concepts for the employment of air power."[47] In September 1951 General Edwards stated that the Air War College had the mission of "promoting sound concepts on the broad aspects of air power in order to assure the most effective development and employment of the air arm."[48]

By the autumn of 1951 Air Force usage suggested that "concept" was more visionary, more dynamic, and more comprehensive than "doctrine," but an Air War College study of Air Force ideas proposed to establish "concept" at an orderly position in Air Force thought. According to this study: "In the field of ideas there is evidently a degree of general acceptance ranging from the first nebulous ideas of an individual, up successively through concepts, doctrines, and principles. The point at which an idea becomes a concept, a concept a doctrine, and a doctrine a principle is not always clear. Thus at any one time our Air Force doctrine may be said to be partly concept, partly doctrine, and partly principle."[49]

In his pioneer book, *U.S. Military Doctrine*, Brigadier General Dale O. Smith, who had worked with the Air War College students in the preparation of their study, accepted the proposition that Air Force ideas progressed first from concepts to doctrines, the latter having gained enough official support to be taught at service schools or to be accepted at the highest staff levels. General Smith further proposed that a service doctrine which was accepted by the President, the Congress, or the people of the United States become an executive, legislative, or a national "policy."[50]

Although recent usage accents the proposition that a concept is a hypothesis which has not yet received the acceptance required by doctrine,[51] there is less agreement as to whether doctrine is confined to the service level of the armed forces. In 1957, for example, Colonel Wendell E. Carter contemplated a "national doctrine" which grows out of the deliberations of the Joint Chiefs of Staff and dictates how wars will be fought.[52] That same year Professor Kissinger referred to "strategic doctrine" which would desirably issue from the Joint Chiefs of Staff and the National Security Council.[53] In 1958 an Air War College study identified a need for a U.S. military doctrine which would represent "some substantial concensus of the whole body politic, and particularly among all military personnel, as to objects of military enterprise."[54]

Early in the 1950's studies at Air University successfully identified a pragmatic hierarchy of Air Force thought patterns, and Air University maintained the proposition that "USAF doctrine, developed within the parameters of the more valid concepts of air power, is intended for practical purposes to be used as a guide for organization, development, equipment, and employment of the United States Air Force."[55]

Other USAF officers, however, were more skeptical of the role of doctrine in Air Force development. Even as the pioneer draft of a USAF basic doctrine statement was under review in Headquarters USAF, General Nathan F. Twining, Acting Chief of Staff, stated to Congress: "The Air Force is not bound to any fixed doctrine or concept. It grew out of sci-

entific achievement."[56] Looking back at past events, General Laurence S. Kuter admitted that he could not suggest that doctrine had ever been the controlling factor in setting the rate of development of air power. Instead, he recognized "the mutual interdependence of doctrinal, technological, political, and other elements."[57] In his foreword to the initial USAF basic doctrine manual issued on 1 April 1953, General Hoyt S. Vandenberg stated: "Basic air doctrine evolves from experience gained in war and from analysis of the continuing impact of new weapons systems on warfare. The dynamic and constant changes in new weapons make periodic review of this doctrine necessary."[58]

AFTER so many years of seeking to record its doctrine, it was ironic that when USAF's first basic doctrine manual appeared there were already in the offing technological developments that would soon render it obsolete. Until 1954 USAF developmental planning had looked only about five years ahead. Under such short-range planning, new weapon systems tended to be extrapolations of the existing state of the art. Had this phased developmental process continued, the USAF basic doctrine of 1953 might have continued applicable for many years. Beginning in 1954, however, USAF attempted to project its weapon system development ten years ahead, and soon it was seeking to see fifteen years into the future. "We believe that our long range planning efforts must be . . . so revolutionary," wrote Brigadier General John W. Carpenter, Director of Plans and Programming of the Air Research and Development Command, "that we will be seeking scientific breakthroughs rather than wondering what to do with them if and when they occur."[59]

Although the USAF had expected to keep its doctrine "dynamic," the revisions of the basic doctrine manuals issued on 1 April 1955 and 1 December 1959 were generally descriptive of the existing state of the art in those years. "We try to make our doctrine and strategy conform to glamorous hardware," wrote Major General Lloyd P. Hopwood, "instead of studying modern conflict to find acceptable solutions from which to establish the hardware requirements we need."[60] Under the circumstances of tremendous technological development and requirements for prognostications of the future, almost every element of the USAF gave increasing attention to concept, which according to the semantic definition of the term was futuristic rather than provable. In February 1960 a long-time student of doctrine, Colonel Orin H. Moore, stated that in a future local war USAF would employ its proved doctrine of the past but that a general war would be waged according to concepts of aerospace power.[61] Major General Dale O. Smith agreed that USAF doctrinal manuals apparently could not keep pace with technological advance, but he urged that USAF doctrine could nevertheless be found in the actions of the Air Force. "Actions not pronouncements," he said, "are the real indicators of doctrine."[62]

In view of the failure of written doctrine to provide useful guidelines for the future development of the United States Air Force, there was a feeling in the late 1950's that the Air Force should turn its attention away from its old predilection for doctrine and seek a broader field of investigation which might be termed "militology" or "military science." Such a field of investigation would examine the basic tenets of military success and would weld together the bits and pieces of military thought which had been described as objectives, policies, principles, strategy, tactics and techniques, long-range plans, general operational requirements, doctrines, and concepts. The objective of such an intensive study of military science would be to produce "models" or theoretical projections of military concepts and principles of military influence.[63]

AS THIS INTRODUCTION should have indicated, Air Force thought has seldom been comprehensive, and the Air Force has never perfected semantic thought patterns that encompass the totality of its rationale. Although no history can capture the totality of Air Force rationale, an investigation of the manner in which the

Air Force has attempted to manage research in the broad field of ideas, the thoughts of Air Force leaders as to the nature of international conflict and military power, the characteristics of air power and aerospace power, and the major functions of air and space endeavor is overdue. This statement, then, is but a prologue to a full recording of what the Air Force ideas have been and how they have developed through the years.

Aerospace Studies Institute

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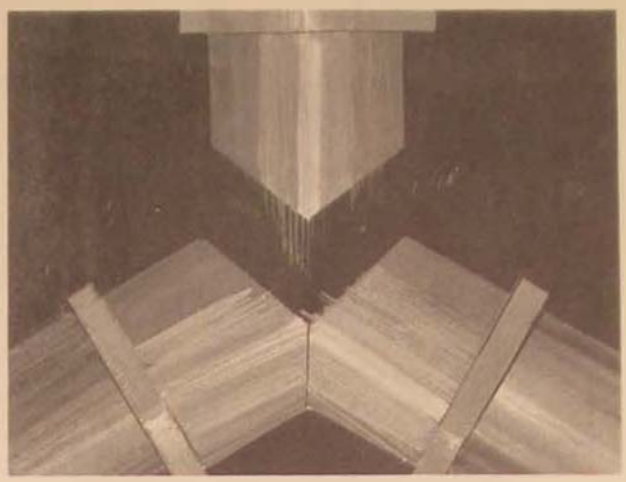


ULTRA-HIGH PRESSURE RESEARCH: PRESENT–FUTURE

WILLIAM G. FIELD

IF WE SUBJECT a material to extremely high pressures and temperatures, we may change its basic structure. In other words we are able to change the lattice structure of the material or alter the alignment of the atoms within the crystal. When this is done, an entirely different material can be created. The best known example of this is the conversion, under pressure and temperature, of graphite to diamond.

This conversion is referred to as a change in phase of the material. Such a change in phase can change the material's hardness, strength, electrical properties, etc. All this leads to the intriguing prospect of creating new materials not found in nature—materials that could be extremely useful to the Air Force. It may be possible to discover a material that is highly resistant to the cosmic, solar, and Van Allen radiations in space—the ionizing radiation which deteriorates the performance or causes malfunctions in electronic hardware aboard space vehicles. From this work may evolve new types of materials which demonstrate electronic properties far more favorable than any now in existence and which may find their way into many future generations of Air Force electronics hardware. These promises underlie Air Force interest in ultra-high pressure research and have led the Air Force Cambridge Research Laboratories to undertake one of the country's largest programs in this area of investigation.

Prior to 1955, research in the field of ultra-high pressures was limited to a few academic studies, and development work aimed at utilizing such high pressures was almost nonexistent. It was in this period, however, that Professor Percy Williams Bridgman and others laid the groundwork for much of the present research in this field. In 1955 the successful production of man-made diamond powder, together with other developments in high-pressure research, made it apparent to scientists that techniques were now available or could be developed which would permit the simultaneous generation of ultra-high pressure (UHP) and high temperatures. This realization led to the rapid development of essentially a new field of research that has been pursued both in this country and abroad with ever increasing interest for approximately the last eight years. Much has been accomplished in the design of equipments, in basic and applied research, and, in some cases, in the application of UHP to certain production processes. Much remains to be accomplished, however, in all

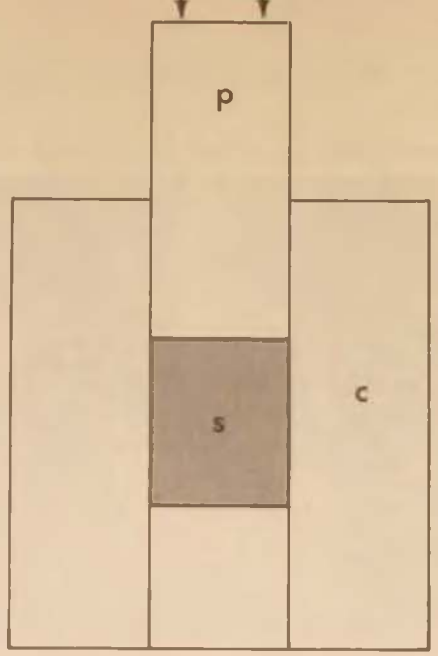


Figure 1. Simple piston and cylinder

these fields. This seems the appropriate time, therefore, to consider the present state of the art and to indicate or predict what the future may hold from the research aspect and also what important practical results it may develop.

Before proceeding with these discussions, let us review briefly what is meant by ultra-high pressure, the means for obtaining it, and some of the results so far obtained.

Ultra-high pressures can be produced in various ways. Transient UHP can be produced by the use of shock tubes and by chemical explosives in the form of shaped charges. Static UHP can be produced by means of gases, liquids, or solids for transmitting and/or confining pressure. When solids are utilized, a large hydraulic press is generally used to produce the pressure. This approach is the one mainly employed at the present time. Methods using gases or liquids are essentially hydrostatic (uniform pressure) but are limited to a maximum pressure of about 35 kilobars.* For this and other reasons the range of UHP is usually assumed to start at 25 to 30 kb. The techniques utilizing solids, which are capable of the highest pressures, have one inherent disadvantage in that shearing stresses are also applied to the sample under study. This shearing affects many properties that are sensitive to the crystal structure of the material, since imperfections are introduced into the structure.

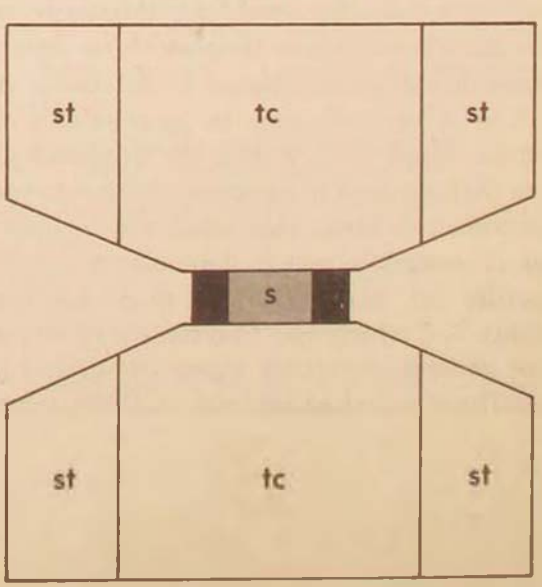
*One bar equals 10^6 dynes/cm^2 and is approximately one atmosphere (14.7 pounds per square inch). One kb is, therefore, about 15,000 psi.

high-pressure equipment

We shall limit our discussion to those techniques that utilize forces produced by hydraulic systems. The simplest example is shown in Figure 1, the simple piston and cylinder arrangement. The sample *s* has a pressure exerted upon it which can be determined as the force per unit area. The force is supplied by a standard hydraulic press. The pressure distribution throughout the sample will be nonuniform due to various friction effects. The maximum pressure which can be obtained with this device is approximately 50 kilobars. This limit is imposed by breakage of either the piston or cylinder. The piston will usually break in the unsupported region above the cylinder.

The Bridgman anvils shown in Figure 2 can be operated at pressures up to 400 kb. This method has achieved the highest pressures so far produced in the laboratory, but it is seriously limited, since the sample size is quite small and only low-temperature operation is permissible. These anvils, however, involve the basic techniques that have led to the development of most present-day ultra-high pressure equipment. There are three techniques which allow the production of these very high pressures: the massive support principle, the use of binding rings, and the utilization of a self-gasketing material. As shown, the tungsten carbide anvils *tc* exert a force on the sample. The total force which can be exerted will be limited by the strength of the anvils. It will be noticed that the force on the anvil tips is rapidly spread out over a larger area in the tungsten carbide anvils. In this manner the total force which can be applied is in excess of that determined by the usual compressive

Figure 2. Bridgman anvils

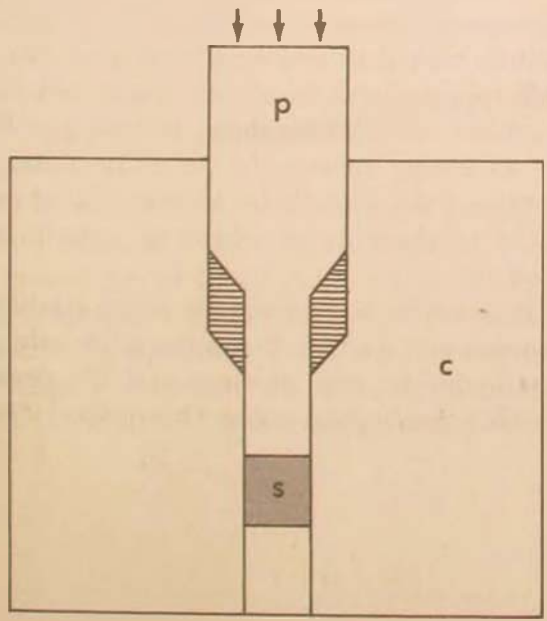


strength measurement. The steel binding rings *st* exert a radial force on the tungsten carbide. This radial force increases the total force which can be applied to the anvils, and it is obtained by making the anvils larger than the hole in the steel binding ring, forcing the carbide into the binding ring by means of a hydraulic press. By utilizing a series of binding rings which gradually reduce the radial pressure, very large supporting forces can be developed. In order to contain the sample under high pressure, it generally must be surrounded with a doughnut-shaped gasket. The gasket must be compressible to permit the generation of high pressure and must also be capable of retaining the pressure generated in the sample. This is accomplished by making the gasket from pyrophyllite, a silicate mineral. Pyrophyllite, because of its high internal friction, can be compressed until it reaches a thickness of approximately 1/16 inch, at which point it ceases to flow. This gasketing effect forms a self-containing vessel for the sample. Owing to the difficulty of providing thermal insulation, this method is restricted to low temperatures of several hundred degrees.

In recent years the basic techniques utilized in the Bridgman anvils have been extended to permit the generation of high pressures in larger volumes.

In the apparatus shown in Figure 3, the supported piston, separate cavities are utilized for piston support and for the sample. The larger piston area in contact with the hydraulic press reduces the stress in that portion of the piston external to the cylinder. This arrangement can be made double-acting; that is, two pistons may be utilized to compress the sample cavity. In this manner a more even distribution of pressure is produced throughout the sample volume. With the supported piston high-temperature operation can be achieved by utilizing a carbon or metal heater in the center of the sample cavity. Heater current is supplied through the piston and cylinder by keeping them electrically insulated. These devices can produce pressures of approximately 100 kb.

Figure 3. Supported piston apparatus



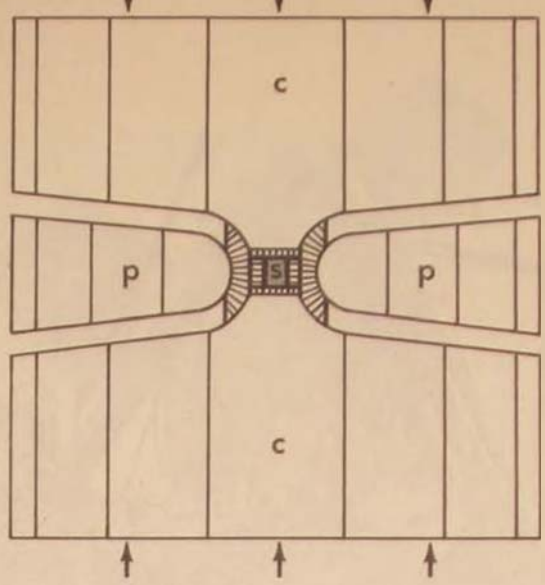


Figure 4. The belt apparatus

One high-pressure device involving the previously mentioned principles is the belt apparatus shown in Figure 4. Here the cylinder is in the form of an annular-shaped piece of tungsten carbide, which is supported by several binding rings. The two pistons are essentially conical and supported with a binding-ring structure. As shown, the sample is contained in appropriately shaped pyrophyllite pieces. As the sample is compressed, the pyrophyllite flows out between the piston and the cylinder and, by its gasketing action, seals the experimental cavity. Heating current for high-temperature operation is conveniently supplied through the two pistons.

Another excellent form of high-pressure apparatus is the tetrahedral-anvil press shown in Figure 5. The high pressure is generated by four hydraulic rams, which push upon a very small volume of pyrophyllite in the shape of a pyramid or tetrahedron. The force of each hydraulic ram pushes on one side of the tetrahedron. The pyrophyllite tetrahedron is slightly larger than the volume confined by the anvils when they are completely closed, so that it will flow out between the

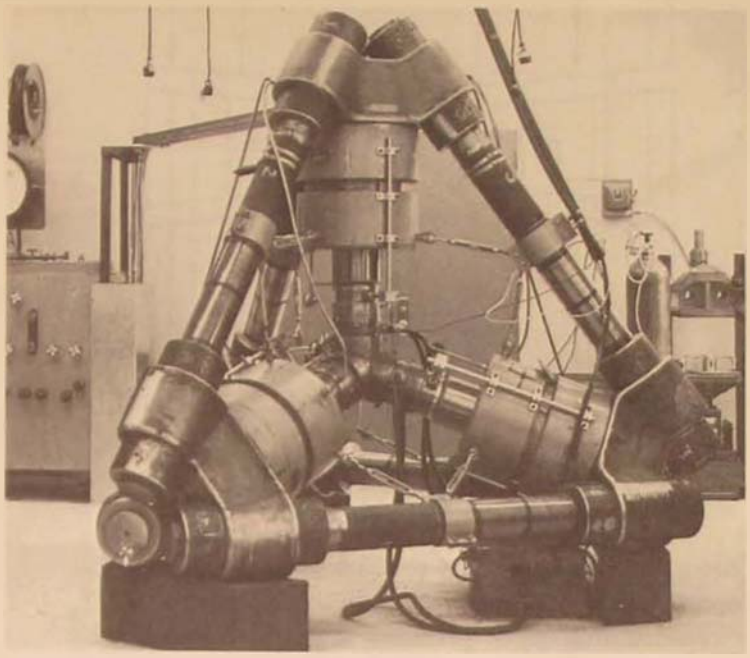
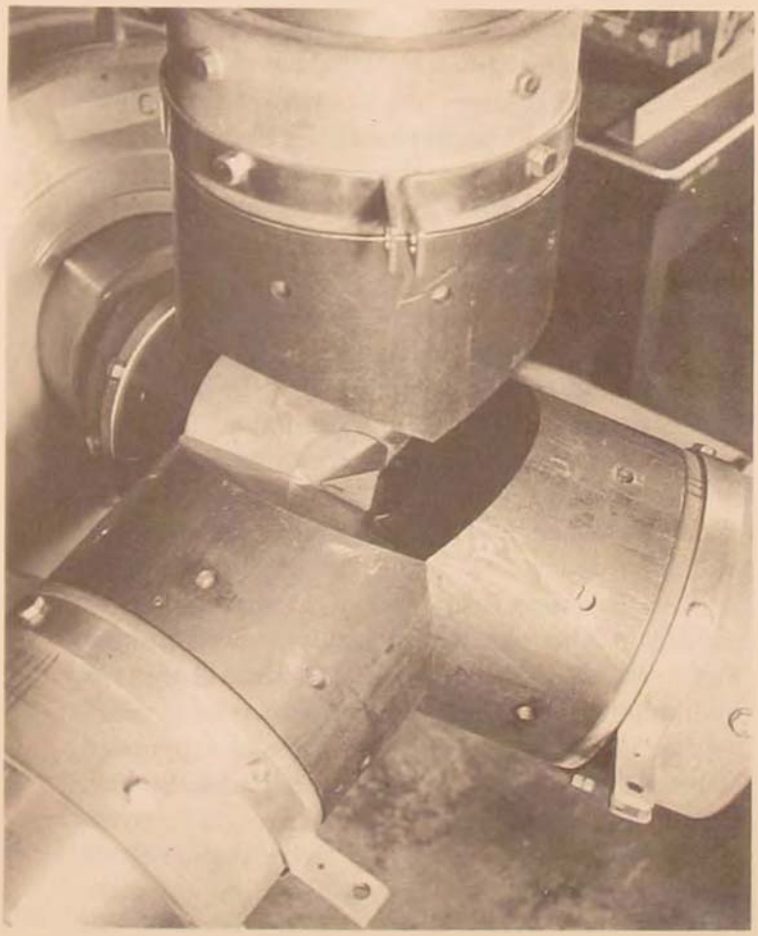


Figure 5. The tetrahedral-anvil press

Figure 6. Tetrahedron in tetrahedral-anvil press



anvils and form a seal, as previously described. The experiment is carried out in a cavity in the center of the tetrahedron. High temperatures are produced by a heating element surrounding this cavity, wherein the heating current is applied to one pair of anvils, then through the heater and out a second pair of anvils. The high temperature is, therefore, produced by simple resistance heating. The press, which was designed and built at AFCRL, weighs approximately 8½ tons and stands 7½ feet high. Each hydraulic cylinder is capable of exerting a total force of 600 tons. The pyrophyllite tetrahedron is a little over one inch on edge. In Figure 6 the tetrahedron is shown positioned in the anvil cavity.

The assembly of the tetrahedron is shown in Figure 7. In the center is the pyrophyllite tetrahedron, and below this are shown the thermocouple and carbon heater. On both sides of the heater are metal slugs, the heater tabs and pyrophyllite prisms, which are utilized to fill in the slots where the heater tabs are introduced. The heater tabs are in contact with the anvils, providing the path for heater current. A completely assembled tetrahedron is shown in the upper left-hand corner. In the upper right-hand corner a tetrahedron is shown after it has been subjected to high temperature and high pressure. The gasket usually crumbles upon removal of the tetrahedron and is not shown. This particular arrangement is utilized for the synthesis of single-crystal diamond and will be described later.

calibration

While it is desirable to be able to make various measurements under conditions of high temperature and high pressure, such measurements will usually require the design of specialized cavity assemblies and measurement techniques. However, to obtain meaningful scientific data, two quantities must always be known: the pressure and the temperature at which an experiment is carried out.

Pressure is determined by a pre-established calibration curve which shows the relationship between hydraulic ram pressure and the pressure inside the experimental cavity. One method utilized

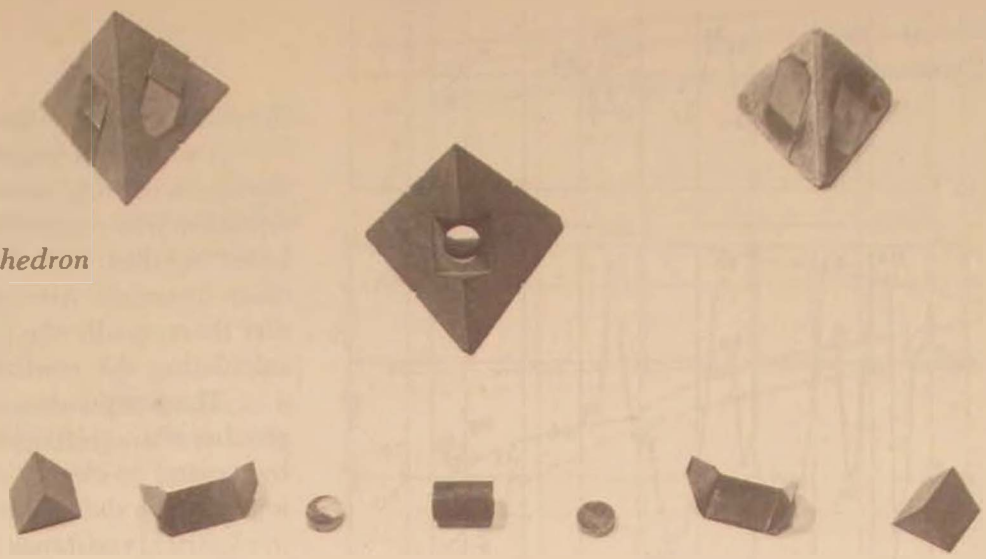


Figure 7. Assembly of tetrahedron

to determine this calibration makes use of established phase transitions (formation of a new compound or material) in various metals. These phase transitions are indicated by a change in the electrical resistance. The sharp discontinuities are easily determined and are used as calibration points. Extruded in the form of wires approximately 0.020 inches in diameter, these metals are then inserted in a silver chloride slug which is placed in the tetrahedron cavity. Small silver contact tabs are utilized to obtain contact with the wire. The tetrahedron is then assembled in the usual way described herein. The change in resistance is indicated by an external bridge circuit and recorder. Silver chloride is used because it is an almost perfect pressure-transmitting medium.

Temperature is determined by a simple thermocouple placed in the tetrahedron so as to indicate the temperature of the sample cavity.

effects of high pressure

While it is not possible to discuss all the effects of high pressure in an article of this length, some of the more fundamental ones can be considered.

Volumetric Effects of Pressure. Various physical and chemical results come within the scope of the general law of Le Châtelier: "If a stress (pressure, temperature, and so on) is brought to bear on a system in equilibrium, the equilibrium is displaced in a direction which tends to undo the effect of the stress." One consequence of this principle is that materials tend to contract under pressure.*

Compressibilities of substances vary widely. While gases are more compressible than liquids or solids, there is also a wide range of change among liquids and solids. A volume change of 5 per cent can be caused in solid helium by 50 bars, in cesium by 1400 bars, and in beryllium by 100 kb.

Single crystals are composed of atoms or combinations of atoms arranged in a definite periodic structure in three dimensions. Depending upon the type of crystal, the forces between the atoms will be of different origin and therefore will have different characteristics. Some are more easily compressed than others. Not only can the atoms be pushed closer together, they can also be distorted to the extent that rearrangement of the electron shells may result. Electrons can actually be stripped from the atoms, resulting in the change of a nonmetal into a metallic conductor. Cesium,

*This can be expressed by the relation

$$\left(\frac{\partial V}{\partial P}\right)_T < 0$$

which is based on the second law of thermodynamics, provided that the system is a stable one.

Let us define two terms commonly used to express the amount of contraction of a substance under pressure. One is compressibility:

$$k = -\frac{1}{V}\left(\frac{\partial V}{\partial P}\right)_T$$

and the other is compression:

$$\frac{\Delta V}{V_o} = \frac{V_o - V}{V_o} = \frac{1}{V_o}\int_{P_o}^{P} VkdP$$

where V is the volume at pressure P, and V_o is the volume at pressure P_o. Compressibility gives the rate of fractional contraction, and compression denotes the total change due to pressure.

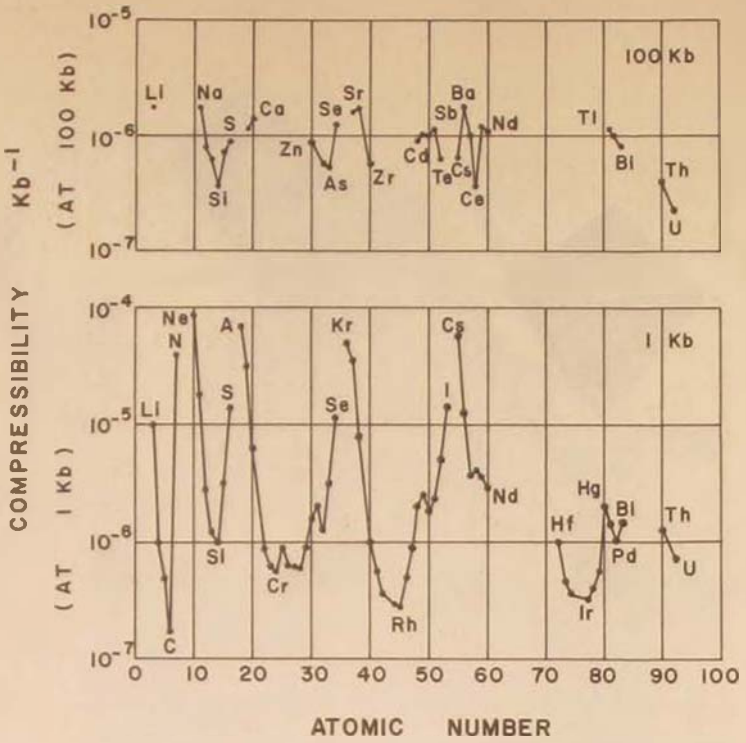


Figure 8. Compressibility of elements

cerium, calcium, strontium, and barium have transitions which require rearrangement of the electron shells, while phosphorus, tellurium, and iodine are among those materials which can be forced to behave as metallic conductors. In general, however, the atoms of a compressed material are structurally unaltered by pressures below 100 kb.

When the periodic lattice of the crystal is compressed by pressure, it may be forced into another pattern called a polymorphic transition, constituting a new phase of the material. Such a phase change will cause a discontinuity in the compressibility of the material. The new phase will, however, continue to be compressed as pressure is increased.

It has been shown, by measurements made at atmospheric pressure, that the compressibility of the elements is a periodic function of the atomic weight. At 100 kb the periodicity is retained, but the range of compressibilities is greatly reduced. This effect is shown in Figure 8, where all elements are in the solid state. At extreme pressures, say 10^{10} bars, the compressibility of all materials should be identical.

Melting Point. Since most materials expand upon melting, the application of high pressure would be expected to retard the melting process. The temperature required to melt the material should increase. This is, indeed, found to be the case. Pressures in the order of 125 kb can increase the melting point of some materials by several fold.

A semiempirical equation which predicts the change in melting point was given by Simon.° This equation was originally proposed for frozen inert gases but has been found to be valid for many other materials. Attempts have been made to predict theoretically the character of fusion curves by calculating the constants of the Simon equation.

The temperature required for melting a sample that is an electrical conductor can be produced by passing an electric current through it. The melting point is determined by observing the change in electrical resistance in the sample. If the current which produced the heating in the sample is held fairly constant, the melting point will be indicated by a change in voltage drop. Temperature is measured by a thermocouple imbedded in the sample. Corrections for heat loss are usually required for accurate determinations.

The melting point curves (fusion curves) for several materials are shown in Figure 9. The fusion curve for indium, for example, can be fitted to within 1 per cent by the Simon equation.°° The fusion curve for tin indicates a phase transition at about 318°C and 38 kb. Each portion of the curve can be accurately fitted by the appropriate Simon equation. The success of the Simon equation to fit these fusion curves, as well as those for other metals, indicates that it must be based on real physical characteristics of the material.°°°

Mechanical Properties. Of interest to the mechanical engineer are the effects of high pressure on the so-called mechanical properties of solids, such as rigidity and Young's modulus. They are important not only from an academic point of view but also in the design of high-pressure equipment.

When a substance is subjected to an external force, it may undergo changes in size or shape. Within the elastic limit we define stress as the ratio of the internal force F to the area a over which it acts, and strain is defined as the ratio of

°This equation has the form

$$P/A = (T/T_o)^c - 1$$

where T is the temperature required for melting at pressure P, and T_o is the melting point at normal atmospheric pressure. A and c are constants considered to be related to the internal pressure and interatomic forces.

°° $$\frac{P}{15{,}000} = \left(\frac{T}{429°K}\right)^{4.34} - 1$$

°°°The nature of the constants A and c is not well understood.

change in size to the original size. According to Hooke's law, for any material within the elastic limit *the strain is proportional to the stress*. Therefore the ratio of stress to strain is a constant called the linear modulus of elasticity or Young's modulus. That is,

$$\frac{\text{stress}}{\text{strain}} = E = \frac{F/a}{l/L}$$

where L is the original length, l the increase in length, and E is the linear modulus of elasticity.

Table 1
(At 10 kb)

	Per cent change of rigidity	Per cent change of compressibility
steel	+2.2	+7.2
tungsten	−0.3	+8.8
tantalum	+0.3 to +1.5	+1.1
molybdenum ..	+0.15	+6.9
platinum	+2.4	+10.0
nickel	+1.8	+7.9

When a bar is in tension, the axial elongation is accompanied by a lateral contraction, and the ratio

$$\mu = \frac{\text{unit lateral contraction}}{\text{unit axial elongation}}$$

(called Poisson's ratio) is constant for a given bar within the elastic limit. In the case of isotropic materials, $\mu = 0.25$.

Shear is produced when we change the shape of a solid without changing its volume. If a rectangular solid has a downward force F along the top and an equal and opposite force on the bottom, the solid will be distorted into a parallelogram. If the force becomes too great, the solid will be sheared. The shearing stress is the ratio of the force F to the area A over which it acts. The shearing strain is the ratio of the amount X, through which the top is moved relative to the bottom, to the height h between these two surfaces. By Hooke's law

$$m = \frac{F/A}{X/h}$$

where m is the shear modulus or modulus of rigidity.

It would be of great interest to determine the effects of high pressure on all the elastic constants of single crystals. This is extremely difficult to do.

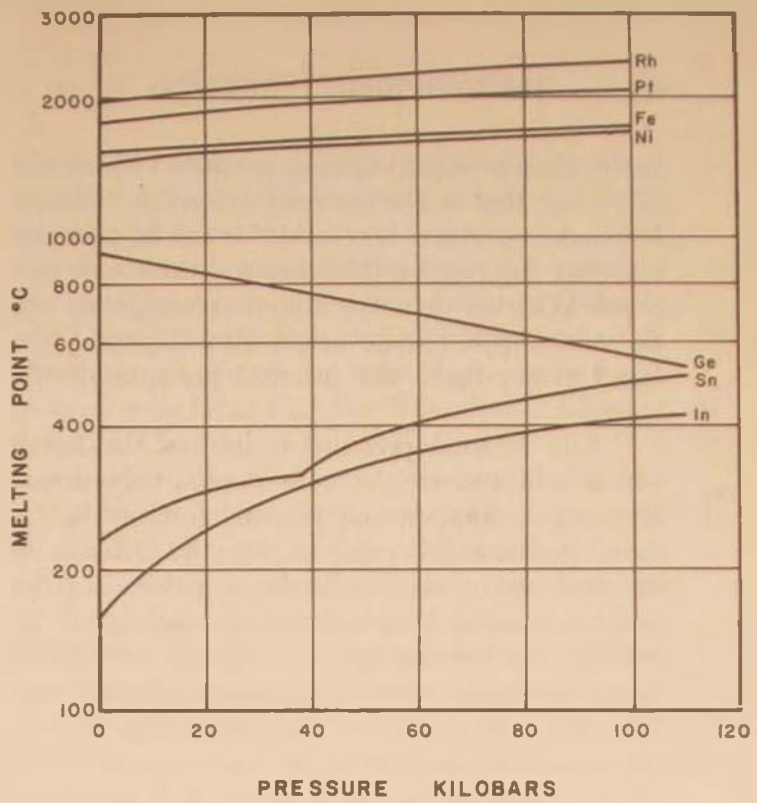


Figure 9. Melting curves of various materials

The experimental approach generally used involves the propagation of an ultrasonic pulse through the material and measurement of the elapsed time between initiation of the pulse and its reflection from the opposite face of the crystal. It is possible to determine the elastic stiffness constants from the measured velocities.

Bridgman has measured the effects of high pressure on rigidity of various materials. Some of these results are shown in Table 1. We see that, in general, rigidity increases with pressure and that the effect on rigidity is less than on compressibility. By using certain approximations, one can utilize the data from Table 1 to calculate other mechanical constants. In general, it is found that Young's modulus increases with pressure by an amount between the increase of rigidity and the increase of compressibility. Poisson's ratio also increases.

Phase Transitions. Most materials of interest to the mechanical engineer and physicist are crystalline; that is, the atoms of the material are arranged in a definite geometrical pattern called the crystal lattice. When the material is subjected to high pressure, the lattice is compressed. If the pressure reaches sufficient magnitude, it is possible for the lattice to be pushed into a new geometrical arrangement or phase. Not all materials exhibit this property with the pressures now available. In some

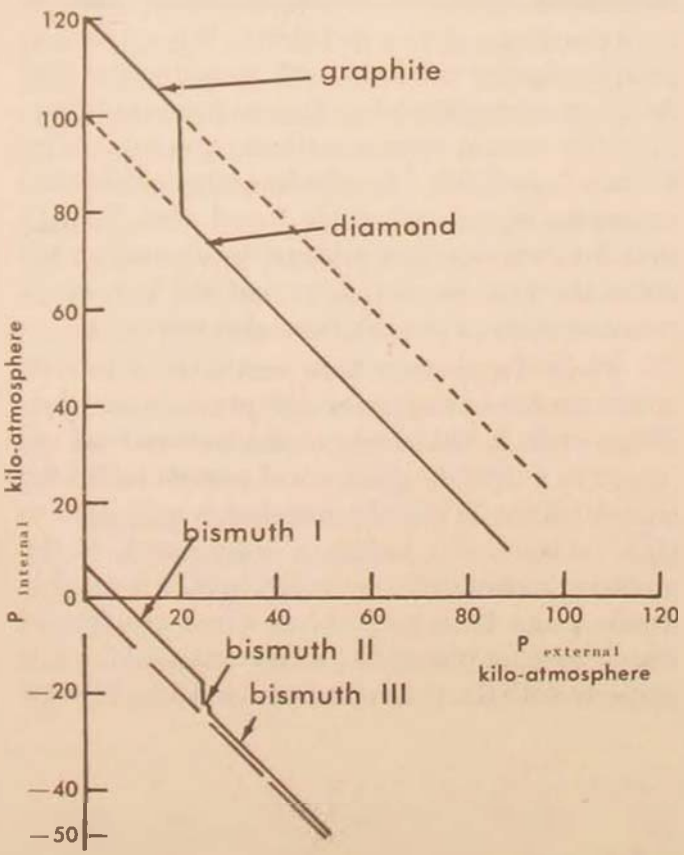
materials, a new phase can be produced which will be stable; that is, the material will retain the new form when pressure is released. It can be a known material, such as diamond, or an entirely new material. Whether or not a high-pressure phase will be stable upon release of pressure depends to a large extent upon the internal pressure of the material.

The internal pressure is due to the forces which hold a material together against the action of thermal agitation and external forces. The internal pressure of crystals is generally different in different directions. It can be negative, but the sum of internal and external pressure must be positive for a stable system. When a material is compressed, the internal pressure will decrease, since the atoms tend to repel each other as they are pushed closer together. It might seem that the internal pressure would increase, but one must remember that internal pressure holds the material together and that pushing the atoms closer produces a force which tends to destroy the material, so that internal pressure is actually decreasing.

Internal pressure decreases with the application of external pressure, but it cannot become so low that the resulting internal repulsion forces exceed the externally applied pressure or an explosion would result. At extremely high pressure, the internal and external pressures may be nearly equal. This is borne out by the fact that compressibility decreases as pressure increases. If the material undergoes a phase change, the forces between atoms will be still greater.

If a new phase is formed, a good criterion for telling whether it will be stable upon the release of pressure is the magnitude of the internal pressure. It must be positive and large. If it becomes negative, the new phase will not be stable nor can it be retained by any means when the pressure is released. Carbon probably has the highest internal pressure of any material while the internal pressure of bismuth is very low and quickly becomes negative with the application of external pressure, as shown in Figure 10. Bismuth therefore reverts to its original state while carbon, if properly handled, changes to diamond, which is stable at atmospheric pressure.

Figure 10. Internal pressure of diamond and bismuth



results to date

Advances made during the last few years can best be described in terms of general equipments, specialized equipments, and research accomplished.

Although some equipment for generating pressures below 30 kb is now available in a form that can be easily utilized by most scientists, the utilization of pressures above this value still is the realm of the high-pressure specialist.

Most UHP equipment for general experimental work is based on the principles described earlier. In this area the maximum pressures attainable by techniques utilizing Bridgman anvils have been increased by about a factor of two, but equipment capable of generating UHP together with high temperatures has not progressed as fast as anticipated. The size of samples that can be processed has been increased, yet the maximum pressures have increased only slightly since 1955. Improved design can be expected to increase this value somewhat, but a genuine breakthrough will be required to increase the pressure by any major amount.

The main progress in equipment design has been the development of techniques for more advanced measurement procedures. Until several years ago the only measurements that could be carried out were those involving the direct meas-

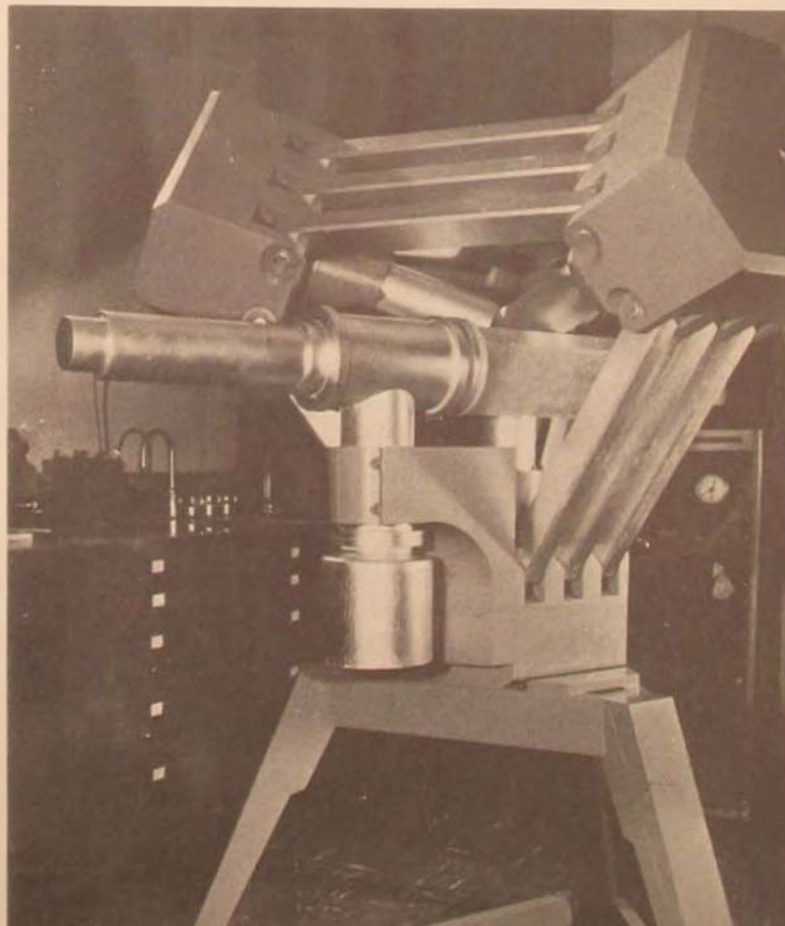
urement of temperature and electrical resistance. This meant that the more important advanced techniques were not available to the experimenter. Techniques now exist, however, for optical observation, infrared spectroscopy, X-ray diffraction, electron and nuclear resonance, and low-temperature measurements over at least part of the UHP range. Work is also advancing on techniques for differential thermal analysis (DTA) and ferrimagnetic resonance. Several of these techniques are under advanced development by the Solid State Sciences Laboratory at Air Force Cambridge Research Laboratories. They include DTA, X-ray diffraction, ferrimagnetic resonance, and the measurement of index of refraction.

In certain experiments when a material is subjected to high pressures and temperatures, a change in phase is expected. If this change occurs, there will be a difference in the thermal characteristics of the original and the new material. Differential thermal analysis can sense this change, thus permitting determination of the existence of this new phase. Although DTA cannot tell what the new phase is, it does prove its existence. When the character of the new phase can be predicted by theoretical means, this technique is of great value. It must be remembered that this measurement is carried out while the temperature and pressure are actually applied. In the usual DTA apparatus the unknown is compared to a known standard, and the difference in thermal properties is measured (hence the name differential thermal analysis). This capability is advantageous, since the change in thermal characteristics when a new phase is formed may be quite small. Because of the small size of UHP cavities this approach was not deemed satisfactory, and a modification is being developed which does not require the internal standard. At the present time the basic method has been developed and is being tested in the large tetrahedral-anvil press.

X-ray diffraction, on the other hand, not only permits determination that a new phase has been formed but also is capable of determining what it is. Most diffraction techniques now being used do not permit the application of high temperatures. The one under development at AFCRL overcomes these difficulties. In X-ray diffraction a beam of X-rays is directed onto the sample, and the resulting reflections are detected by an appropriate means. These reflections are different for all materials and therefore act as a fingerprint by which the materials can be identified. In UHP work some means must be devised for getting the beam of X-rays into the high-pressure equipment and onto the sample and for getting the resulting reflections out. The absorption of X-rays by most high-pressure apparatus is so large that the reflections cannot be detected. The method being followed here is based on a specially designed tetrahedral-anvil press. The X-rays will be produced by a special high-powered tube and thence guided onto the sample through the small slit or opening that always exists between the anvils. Special low-absorbing materials will be used for the gasketing material, and highly sensitive detectors will pick up the resulting reflections. The special press has been designed to permit the maximum amount of X-ray radiation in and out of the cavity. A model of this press and special X-ray tube is shown in Figure 11. Again it must be remembered that this technique is being developed so as to permit the determination of new phases under ultra-high pressure and temperature.

Also under development are methods for ferrimagnetic resonance measurements and for the determination of index of refraction at UHP.

Figure 11. The X-ray press

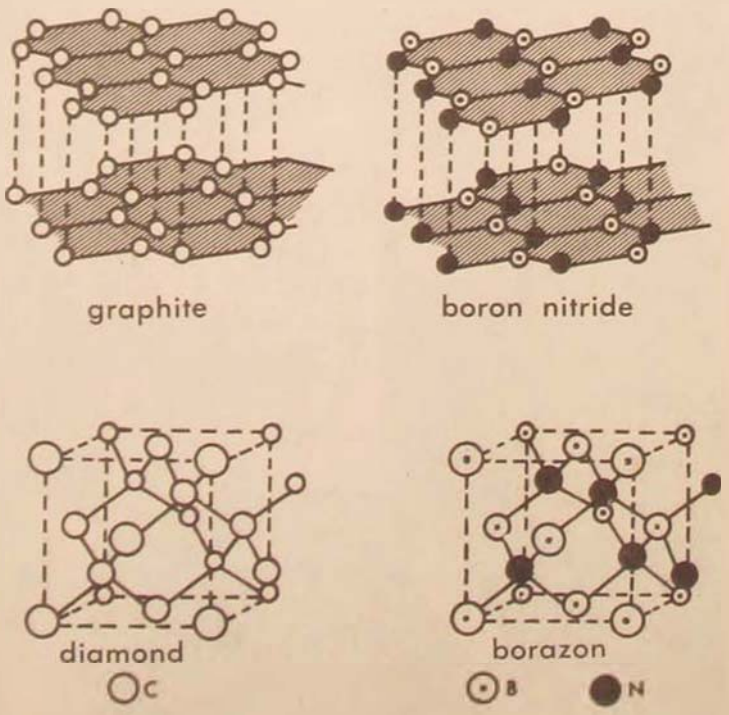


Ultra-high pressures have the capacity of producing many effects not previously obtainable in the laboratory. Pressure, which is actually a form of mechanical energy, is capable of causing marked changes in the properties of matter. It can also affect the possibility and speed of various reactions. When solid materials with a definite crystal structure are subjected to high pressure, it is possible for the pressure to force the atoms in the material into a new atomic arrangement or phase. When the most compact arrangement has finally been obtained, we can in certain cases deform the atom itself. In this case it is possible to free electrons from the atom and produce such strange effects as to change a nonconductor into a material that behaves like a metallic conductor.

Valuable experiments have been carried out in solid state physics, metallurgy, biology, chemistry, geology, and many other fields of research. Light has been shed on the properties of semiconductors, new materials have been made, knowledge of the structure of the earth has been increased, new metallic phases have been created, high-pressure extrusion of metals has resulted in materials with twice the strength of the former ones, and new ideas for the sterilization of foods have been observed. These advances only indicate the present contributions of high-pressure research and hint at its bright future.

The chief commercial application of UHP to date is the production of diamond, the most important abrasive material available to an industrial nation. Two companies now have synthetic diamond powders on the market. Other concerns may enter this field in the near future, and larger industrial diamonds will soon be a reality. This most important application of UHP will be described in more detail.

Figure 12. Changes in crystal structures



Growth of Single-Crystal Diamond. The growth of single-crystal diamond has been a challenge to crystallographers for many years. Although there are various reports relating to the growth of diamond in the laboratory, conclusive proof of success is not available. The first successful growth of diamond was announced in 1955, but the factors affecting growth are not completely understood.

Graphite has a layered crystal structure, as shown in Figure 12. The bonding between layers is very weak, accounting for its good lubricating properties. When subjected to high pressure and temperature, the atoms of carbon are pushed closer together and assume the new equilibrium arrangement of diamond. Diamond, as already explained, remains stable when the temperature and pressure are removed. Boron nitride can likewise be converted to a cubic form, called borazon. The similarity between this change and that of diamond can be seen also in Figure 12, as the two structures are essentially identical.

Diamond research clearly indicates that the conversion of graphite to diamond can occur only at very high pressures and temperatures. While the most obvious method for the growth of diamond would be the direct conversion of liquid carbon to diamond, it is not now possible to produce the conditions necessary to achieve this effect. The triple point diamond/graphite/liquid-carbon is estimated to be in the vicinity of 150 kilobars. Steady pressures of this magnitude, together with the required temperature, are unobtainable at the present time. It is therefore necessary to produce diamond by the conversion of graphite. Most methods use a solvent to induce the graphite-to-diamond transition. One very good solvent is nickel. Heated to its melting point, it diffuses through the graphite. Diamond crystals are formed in this region. The reaction rate of the graphite-to-diamond transition will, of course, be affected by the temperature. The higher the temperature, the higher the reaction rate. The lowest pressure at which diamond growth occurs, in the presence of

a solvent, is approximately 35 kilobars.

The crystal structure, perfection, and color of the diamond are also functions of the temperature and pressure at which growth occurs. At the lowest pressures, approximately 35 kilobars, the crystals will be cubic, almost black, and imperfect. As the pressure and corresponding temperature are increased, the crystals will change into octahedron-cubes and finally into octahedrons. The octahedron is the form most commonly found in nature. With the increase in temperature and pressure, the diamonds change from nearly black to dark green, then to pale green, and finally to almost colorless or clear. The perfection of the crystals is, in general, improved with the increase in temperature and pressure. For many years geologists considered that most minerals were formed within approximately twenty miles of the earth's surface. Research in the field of high pressure and in geology, during the last ten years or so, has indicated that various minerals must have formed at far greater depths. The pressure at which diamond is grown in the laboratory corresponds to a depth of several hundred miles in the earth. The genesis of natural diamond remains a question for debate.

The assembly shown in Figure 7 has been successfully employed for diamond growth. The graphite cylinder is ¼ inch in diameter and approximately ⅜ inch long. A nickel slug, also ¼ inch in diameter and approximately 1/16 inch thick, is placed against each end of the graphite. The procedure for growing diamond crystals is to increase the pressure to the correct magnitude and then increase the temperature to the growth level. To produce small diamond crystals, these temperatures and pressures need to be maintained for only a matter of seconds. Under these conditions the nickel will melt at the nickel/graphite interface and then diffuse into the graphite for approximately 1/16 inch. The temperature is then lowered to room temperature, and finally the pressure reduced to the atmospheric range. Examination of the sample will show dozens of small diamond crystals in that region of the graphite through which the nickel diffused. Use of a nickel solvent at a pressure of 62 kb and a temperature of 1600° C will produce octahedron-cube crystals of light greenish color. Their average diameter is approximately ½ millimeter. The largest diamond crystals grown to date weigh approximately 4 carats.

future development

Future development in the field of very high pressures will lie in two main directions: (1) the development of high-pressure equipment and (2) its utilization in the study and processing of materials. Equipment developments will include improvements in existing designs, the utilization of new techniques, and the development of associated measurement methods to determine material properties while under high temperature and pressure. Results of such research will include an improved understanding of material properties, the manner in which materials are formed (including the formation of minerals in the earth), the possible development of new materials or modification of properties of existing ones, and, finally, the utilization of very high pressure in the processing of materials. These results will be of both scientific and technical importance as well as of great technological value to the Air Force.

Not only must equipment be available but it must also be reliable. The compressive strength, measured in the usual manner, of sintered tungsten carbide materials utilized for anvils is about 500,000 psi. The actual operating pressure is, however, in the order of 1,500,000 psi. This pressure is achieved by the massive support principle and radial support by binding rings. These conditions place severe limitations upon the maximum pressure obtainable and on the useful life of the anvils. The anvil life may be as low as a few experiments under severe conditions.

It is therefore necessary to do further research to improve anvil characteristics. A detailed analysis of anvil stresses would permit optimum design, and new materials may be developed which have better properties for this application. Anvil stress characteristics should be studied both theoretically and experimentally. The experimental approach should include photoelastic analysis of stress distribution and actual laboratory determination of the factors which control anvil strength and life. Anvil characteristics are also dependent upon other material properties besides compressive strength. The ductility of the materials, which tends to prevent cracking, is an important factor. It is believed possible to increase present maximum pressures by a factor of two through optimum utilization of existing materials. Larger gains

must await the development of stronger materials or new approaches. Anvil life will, of course, be increased by better anvil design.

There is also the possibility of producing very high pressures by other means. These may be either transient or steady state in nature. Transient generation of pressure includes such methods as shock tubes, pulsed magnetic fields, and explosions. Magnetic fields can exert large forces. Pulse techniques permit the production of higher magnetic fields and, in turn, larger forces for short periods of time. Methods may be developed for the utilization of these forces for the generation of high pressure. Chemical explosions, especially in the form of shaped charges, can exert tremendous forces. Diamond has been formed by the utilization of this method. The development of these methods for controlled experiments will undoubtedly be quite difficult.

There are several possible methods for the generation of large steady-state pressures which have not as yet been extensively studied. Among these are internal pressure generation and various mechanical effects. The simple piston and cylinder apparatus shown in Figure 1 should be capable of withstanding pressures up to approximately 500 kilobars if the cylinder is supported by a suitable binding-ring structure and the entire assembly confined in a press, so that no portion of the piston protrudes from the cylinder. Since the piston does not protrude, the pressure must be generated from within. Internal pressure may be generated by several known methods. Certain materials, such as water, bismuth, and germanium, expand upon freezing. These materials could possibly be utilized for internal pressure generation. Germanium has a theoretical capability of producing about 180 kilobars. Other properties of materials which could possibly be used include thermal expansion and phase changes. Mechanical techniques that are possible pressure generators include the anisotropy of mechanical deflection and the application of torsional forces.

The highest pressures in the universe are produced by gravitational forces. The laboratory utilization of gravitational force does not, at this time, seem possible.

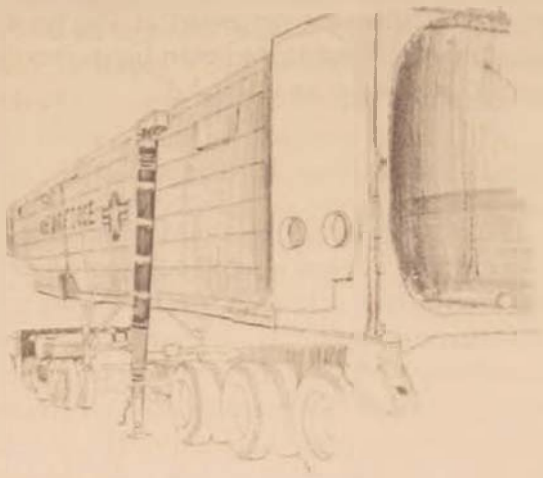
While techniques for the generation of very high pressures with high temperature are now available, many important methods of evaluating materials under these conditions are not. Such desirable evaluation techniques include X-ray diffraction, infrared and visible spectroscopy, optical studies, thermal properties, and microwave spectroscopy. Certain simple measurements, such as temperature, electrical resistance, etc., have been made at pressures up to 200 kilobars. Some optical studies have also been made at 200 kilobars. In general, however, measurement methods are far behind the advances made in high-pressure generation. X-ray diffraction is required to determine the change in lattice constant of materials and hence their compressibility. This is one of the more important parameters required for theoretical studies. Reaction rate, or the speed at which an effect progresses, is another important function, and techniques for its evaluation should be developed. Some progress has been made in extending X-ray diffraction techniques to permit studies in excess of 100 kilobars. Other advanced measurement techniques will require extensive research to be useful.

Future results of research in high pressure will be of both practical and scientific importance. Practical value will accrue from knowledge of such subjects as the formation of minerals, the structure of the earth, and improvements in the properties of metals—results of obvious economic importance. Improvements in structural metals and materials can be produced in several ways. For instance, high pressure can harden metals in the same manner as temperature and can also control the type and characteristics of grain structure. The Russians have developed high-pressure hydraulic extrusion processes for metals and alloys. In certain cases the strength of extruded parts is twice the strength of materials produced by other means.

The scientific knowledge to be gained from the application of very high pressure is almost unlimited. Not only will the properties of materials be better understood, but the possibility of the discovery of entirely new materials is always present. Perhaps the greatest reward will be an increase in our understanding of their behavior under normal conditions of temperature and pressure.

Air Force Cambridge Research Laboratories

Air Force Review



RECYCLE REQUIREMENTS OF THE LGM-30

COLONEL E. R. JACOBY

THE Ogden Air Materiel Area (OOAMA) at Hill Air Force Base near Ogden, Utah, is the site of a completely new and unique concept in the Air Force today. In November 1959 the Secretary of Defense authorized a recycle plant here for major maintenance of the Minuteman strategic missile (LGM-30). OOAMA had been assigned the management of the LGM-30 in January 1959. The Air Force Logistics Command plan for accomplishing organically the initial and follow-on recycle of the missile was approved in an AFLC letter of 15 February 1960. By March 1960, OOAMA had developed the programing plan called MAMBO, *M*inuteman *A*ssembly and *M*aintenance—*Bo*eing/*O*gden.

The Minuteman ballistic missile system was developed to provide a strike force capable of instantaneous retaliation. One of the major problems encountered in the successful operation of a system with such responsiveness is continued and precise reliability. Failure of one piece of hardware can cause a missile to become completely inoperative. Failure of a portion of the propulsion system can destroy a launcher as well as the entire missile. The OOAMA mission is to develop, operate, and maintain a timely, adequate organic maintenance capability for the LGM-30 Minuteman and related aerospace ground equipment (AGE). Provision has been made for a proper and adequate physical and service environment in which the missile and AGE disassembly/assembly, test, and repair are accomplished. The recycle site must be within easy airlift or road access to deployment sites. The missile maintenance facility at Hill AFB provides the necessary facilities to accomplish this mission.

Field maintenance is practical and logical to a limited degree in that some parts of the missile can be repaired or maintained at the launch site. However, a component failure in any of the three stages of the missile becomes a major item requiring depot-level support. The maintenance concept

of the Minuteman system dictates that a malfunctioning missile be repaired and returned to operational status as soon as possible. Maintenance capability for the depot maintenance and recycling requirements of the LGM-30 continues to advance and become ever more efficient. Estimated man-hours per missile were projected at 750 for FY 63, with a drop to 420 estimated man-hours per missile for FY 64 as experience is gained.

facilities

The Missile Assembly and Maintenance Shops (MAMS) at Hill AFB are located adjacent to AF Plant 77 (Boeing), which originally assembles the missile. Special-purpose buildings are required to provide a maintenance disassembly/assembly capability simultaneous with the buildup of the Minuteman missile in the Air Force inventory. The number of predicted component failures in relation to total missile inventory provides the basis for estimating the workload for depot-level maintenance of the Minuteman system. The special-purpose buildings are used for major assembly checkout, compatibility tests, inspection acceptance, and to meet the safety requirements for disassembly/assembly and checkout of the missile complete with its three solid-propellant motors.

The first five maintenance assembly buildings have been constructed. The buildings are 51′ x 102′ with annexes 40′ x 40′5″ and 10′ x 13′5″, suitably separated from the main building. A building and its annexes contain a floor area of 6952 square feet. The buildings and annexes are of type "N" construction and are separated to isolate hazardous functions. Earth barricades are provided for each building to improve the safety factor. The buildings themselves are provided with blowout panels, explosion-proof equipment and fixtures where necessary, safety hardware, environmental control, bridge cranes, compressed air systems, grounding systems, and electric test power equipment. Steam is provided from a central plant. These buildings also need certain supporting facilities. Each building requires roads and hardstands capable of supporting loads in excess of 50 tons supported on specially designed equipment. Utilities such as heating, power, water, and sewage lines are required from each of the programed utility mains to each missile assembly and maintenance building. Air conditioning is required with evaporative cooling of 24,000 BTU/hr and 18,750 cu ft/min capability.

Storage facilities for the Minuteman are known as "igloos." They are standard earth-covered 30′ x 60′ buildings for storing missiles, engines, and hazardous missile components before, during, and after the depot maintenance cycle. The propellants contained in the missile engines require uniform temperature environment in the range of 80°F, plus or minus 20°, in order that maximum serviceability and performance can be ensured. The physical nature of the missile case with propellant is such that wide temperature variations cannot be tolerated because of the different coefficients of expansion. A great savings was realized by using storage buildings already in existence and formerly used by the old Army Ordnance Depot, located adjacent to Hill AFB. Modifying 12 of the old igloos cost approximately $90,000, whereas new special-purpose buildings would have cost an estimated $453,000. These igloos are used for storage of missile stages awaiting assembly or repair; others are used to store missile stages undergoing aging and surveillance. By careful surveillance of these stages, stored in humidity- and temperature-controlled igloos and silos, the propellants in the stages can be studied and possibly the service life of the missile can be extended beyond original estimates.

To accomplish the assigned mission, the Air Force has found it necessary and logical to undertake the complete and exacting repair of all the LGM-30 components. Facilities have been created which meet this need, and all components except the re-entry vehicle and the guidance and control unit are processed at Hill AFB. The re-entry vehicle is taken care of at Kelly AFB, Texas, and the guidance and control unit is repaired at Newark Air Force Station, Ohio.

Depot-level repair of missile components and aerospace ground equipment is that process needed to repair, test, and calibrate items that have failed or have been removed from the weapon system because they did not meet the precision tolerances. Much of this work is done in special environmentally controlled areas called "clean rooms." The missile components and aerospace ground

equipment are disassembled, repaired, assembled, tested, calibrated, and returned to serviceable condition for reassembly into a complete missile.

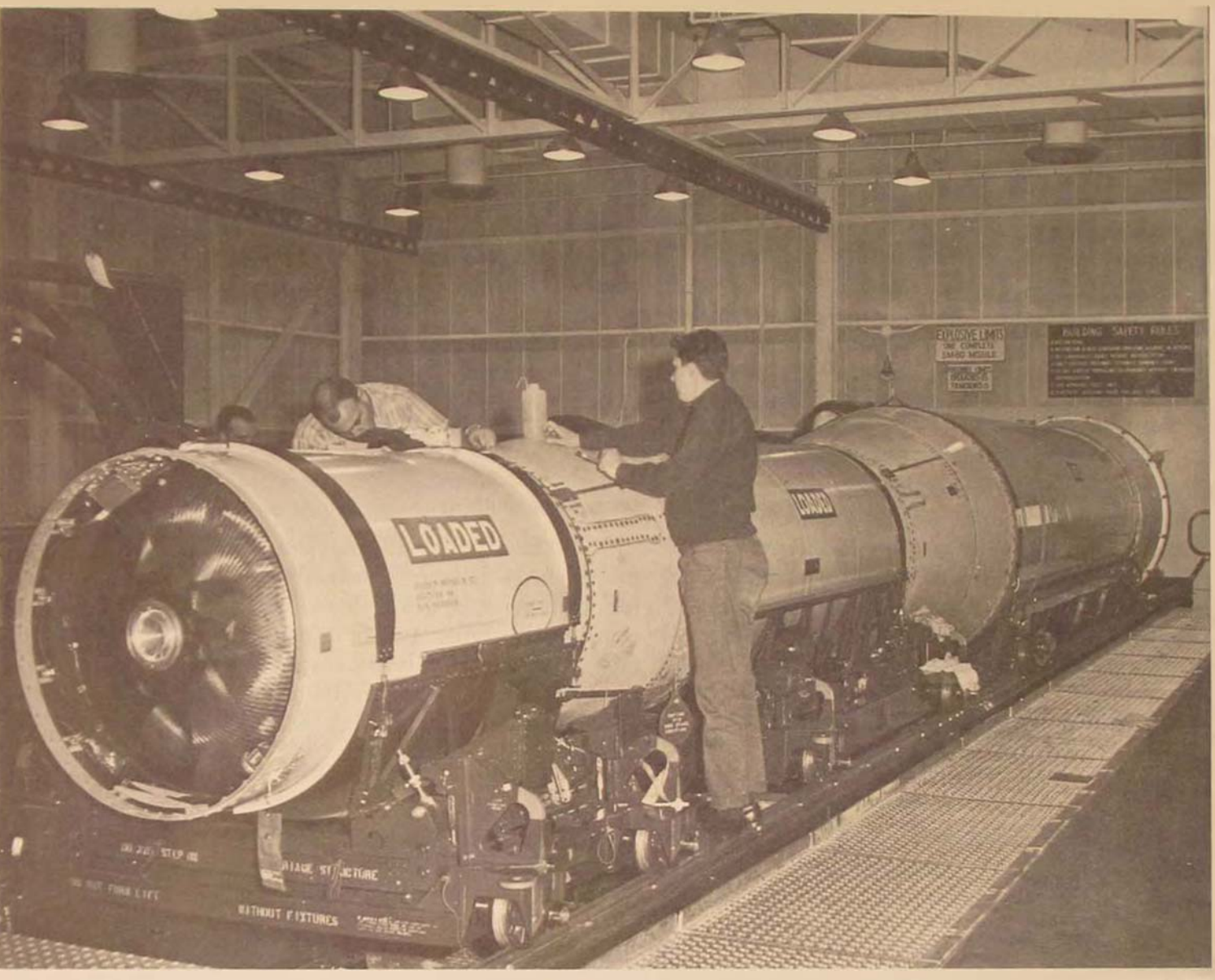
A "clean room" is a laboratory or shop incorporating high standards of temperature, humidity, and dust control. These qualities are necessary to meet exacting operations and critical tolerances during repair, assembly, calibration, and test of precision instruments, electronic-mechanical devices, and other precision items. The increasing precision required in Air Force weapons demands a repair area virtually free of dust and other foreign particles. A microscopic particle of dust in a tiny precision bearing can create havoc and could jolt the bearing to a stop with the suddenness of a rock in front of a wheelbarrow. Hill AFB now has three of these specialized rooms in operation. Each was built at an approximate cost of $300,000 and incorporates between $2 and $3 million in test equipment. The first of the three was built in an existing warehouse, utilizing 21,600 square feet of available space. The rooms are used for the depot repair, test, and calibration of missile electrical assemblies, hydraulic actuators, and other aerospace ground equipment. The production area, where the components are processed, requires a controlled atmosphere. The temperature must be held at 74°F with no more than a one-degree variance. Humidity is maintained at 40 per cent with not more than 5 per cent deviation. Through use of an extensive filtering system, the air in the area is kept 99.95 per cent free of dust particles 0.3 of a micron or larger. (This is about 12 millionths of an inch. By comparison, a human hair is approximately 100 microns in diameter.)

In support of the assigned maintenance mission for the LGM-30, two other new facilities have been created and are in active operation at Hill AFB. These are the propellant cutting facility and the propellant test laboratory.

propellant analysis

It is most important that the LGM-30's solid propellant be constantly tested and analyzed. Information must be available as to its length of life, comparative thrust, etc. In the propellant cutting facility, samples of this fuel are cut into the various sizes and shapes necessary for laboratory testing. Special buildings and cutting machines have been

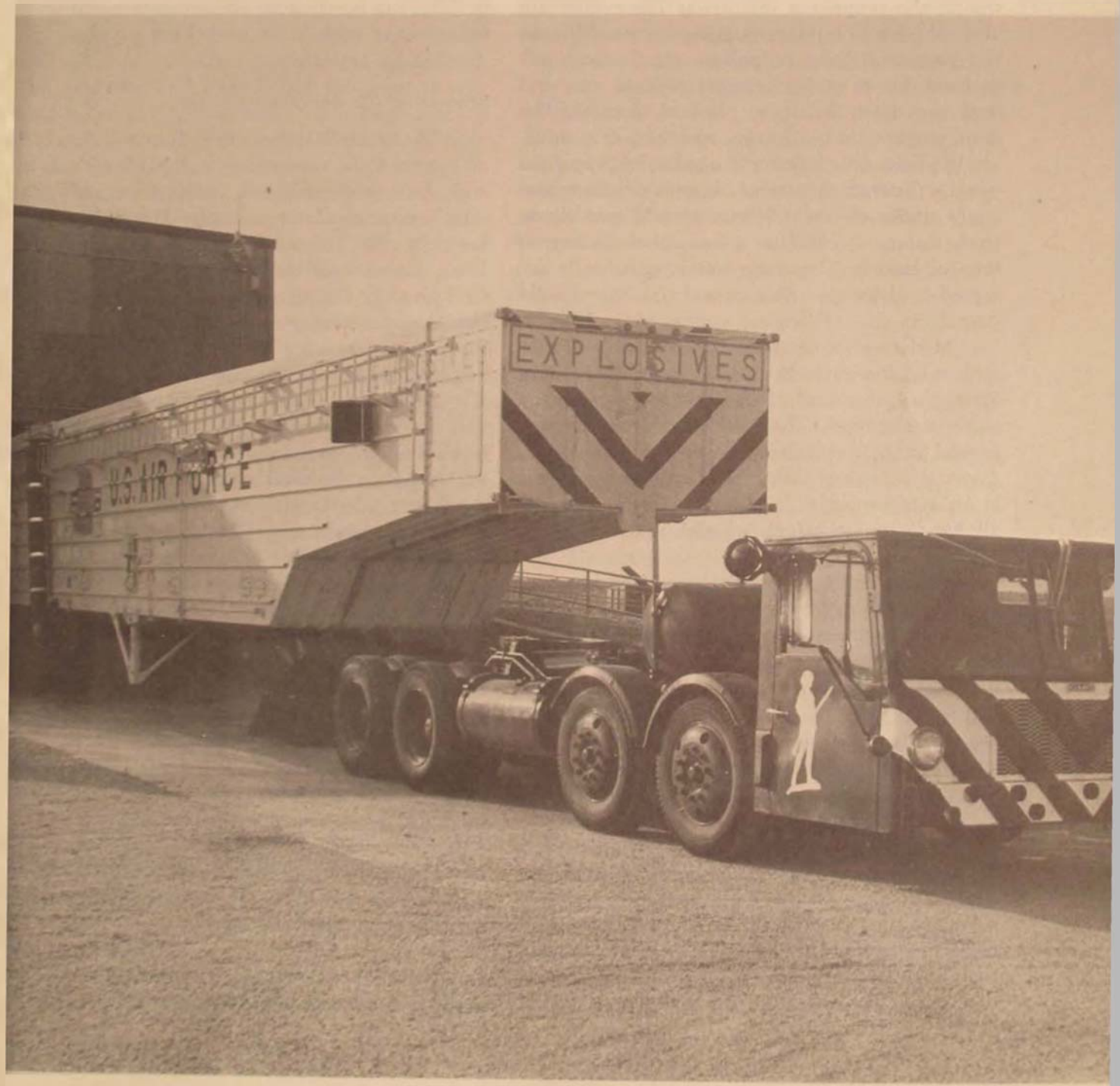
An igloo at Ogden Air Materiel Area, Hill AFB, Utah, for storing LGM-30 Minuteman missiles, engines, and other hazardous missile components.



Maintenance technicians put final touches to an LGM-30. The missile has been recycled and is ready for return to active service.

constructed for this purpose, so that the propellant can be cut and sampled with a maximum safety factor. The cutting is done by remote control, the operator of the cutting machine looking through specially designed mirrors. The cut propellant samples of various shapes and sizes are sent to the propellant test laboratory, where technicians test them for stress, aging, etc. One of the first tests performed is the strand burning rate test. In this test a long, relatively slender sample of propellant, usually coated with an inhibitor, is burned. The test provides a measure of the linear burning rate of solid propellant under various conditions of pressure. One use of the test data is to predict burning conditions inside rocket motors. Changes in burning rate may be directly related to other changes such as hardness, tensile properties, etc. It is hoped that this test will give an indication of

The transporter-erector, a familiar sight at Hill AFB, awaits onloading of the first LGM-30 recycled at Ogden Air Materiel Area, January 1963. Behind the TE is one of the five maintenance assembly buildings used for disassembly/assembly of Minuteman.



deterioration due to environmental storage or age in sufficient time to permit long-range disposition and procurement planning.

There are several tests that could be included under the heading of low-rate mechanical-properties tests, some of which test low-rate tensile properties, tear resistance, strain endurance, and stress relaxation.

Data from all these tests are normally disseminated widely in order to ensure good quality control in the propellant industries. These tests are also valuable in supporting aging and surveillance test programs. Solid propellant may become soft or hard due to storage environment or age, and tests can determine these physical changes. The main purpose for conducting such tests is to measure the behavior of new and aged solid propellant when subjected to various degrees of stress and strain under different environmental conditions, from storage in silos to actual shock-loading at time of launch. The creep test is specifically designed to determine dimensional stability of solid propellant.

Modern elastomeric materials heavily loaded with solid inorganic or metallic compounds have given the propellant characteristics that are not easily understood. Therefore tensile testing and several other mechanical-property tests, such as dynamic shear and fatigue tests, are also required in order to properly characterize propellant under all conditions to which missile motors may be subjected.

Definite evidence exists that a drop in tensile strength of 25 to 50 per cent can be very serious. The mechanical integrity of the propellant in each large missile motor must be known in order to ensure that the weapon is reliable as far as the propellant is concerned. Tensile, creep, and similar tests are conducted in hopes of assisting engineers responsible for propellant reliability to accomplish their assignment.

The importance of knowing what the mechanical integrity of the propellant in every large missile motor is at all times cannot be overemphasized. Knowing mechanical degradation trends in sufficient time to predict shelf life of the missile motors can permit procurement personnel to make timely budget forecasts for replacement motors and at the same time ensure adequate deterrent capability. These tests become ever more important to the maintenance of the missile, since they form the basis for judging the life span and power of the propellant.

At present a 2-million-electron-volt X-ray machine is used at Hill AFB for checking smaller rocket motors and some parts of the larger motors. A radiographic inspection facility is being constructed to X-ray the larger booster stages. It will be a 24-mev linear accelerator and will be capable of detecting bonding-to-case separation and internal cracks or voids in the propellant.

processing the complete missile

The LGM-30 is the only ballistic missile weapon system to be removed to a depot-level activity and there processed as a complete missile. The missile consists of three stages. The first stage is built by the Thiokol Company, Brigham City, Utah; the second stage by the Aerojet General Company in California; and the third stage by the Hercules Company near Magna, Utah. The three stages are initially assembled at AF Plant 77 (Boeing) at Hill AFB.

Depot-level repair of a complete missile involves a missile that has "failed," one that cannot be depended upon to perform its assigned mission and has been replaced at the launching site by a reliable missile. Depot-level missile repair may be necessary because of either (a) random failure of continuously operating components or (b) periodic inspection of deteriorating and malfunctioning components which are not continuously monitored at the launch site. The depot operation requires removal and replacement of components in order to return the repaired missile to the launch site in as short a time as possible. The missile is brought in as a complete weapon except for the re-entry vehicle and the guidance and control unit. In the missile maintenance facility, a missile is disassembled and the various components sent to the overhaul support shop. Serviceable components are then reassembled into the missile, after which it will be functionally checked, calibrated, and returned to the launching site.

When a faulty missile is returned to OOAMA for maintenance, it is placed on the rails in one of the maintenance buildings, grounded, and wheel

chocks installed. The technicians assigned to the recycle task first remove all safing pin access doors and check each safe-and-arm and disarm device to make sure that the missile is in a safe condition to work on.

After the missile is checked for safety factors, the vertical restraints are removed and then quality control personnel make a complete visual inspection of the missile for any deficiency that may be clearly visible. While quality control inspection is proceeding, other depot personnel are recording and removing the shock and temperature monitor devices on all missile transportation equipment. The guidance and control test simulator is now installed on the missile, and a no-voltage check is made on G&C and skirt umbilical cables, prior to connecting them to the missile.

The preliminaries being completed, a complete end-to-end test is run to check out and pinpoint the faulty area in the missile. After the end-to-end checkout has been accomplished, a complete breakdown of the missile is required. First the stage separation ordnance items are removed and routed to the shop. Sealant is removed from all screwheads and interstage mating surfaces, the guidance and control unit and re-entry vehicle simulator are taken off, as well as the raceway caps and covers from all three motors. The left-hand and right-hand interstage panels from interstages A and B are removed, and the second- and third-stage motors are repositioned. The base adaptor ring and aft skirt and forward and aft support rings are removed. Raceway cable brackets and chutes are taken off interstages, and the raceway cables are disconnected from the nozzle control units. The cables are routed to the electronic shops for checking and repair as needed.

Next the angular accelerometer is removed and sent to the shop for checking, as are the first-, second-, and third-stage nozzle control unit heat shields and third-stage nozzle control unit amplifier. A nozzle torque and deflection test is performed on all three motors, plus a leak check. The pressure transducer, igniter, and safe-and-arm device are removed from all three stages and routed to appropriate shops for checking and repair as necessary.

Now the borescope comes into use to check any deficiency that may exist in the propellant, such as surface grain defects. After the propellant is checked, the vertical restraints are installed. All three stages are then transferred to the radiograph facility for radiograph inspection. This inspection will detect any propellant cracks, separation from motor case, and any forward and aft closure defects.

From the radiographic facility the motors are routed to motor maintenance for all major repairs, such as nozzle replacement, etc. The motors are then returned to the Missile Assembly and Maintenance Shops for assembly and final testing.

In the final testing of the missile, the vertical restraints are first removed. Then the igniter and safe-and-arm devices are installed, and a leak check is performed to make sure that the igniters are properly sealed. A linkage adjustment is accomplished on the first-, second-, and third-stage nozzle control units, and they are installed on the three stages. Alignment is checked on seal boots, and they are placed on the nozzles. Forward and aft support rings are installed on interstages, the raceway cable support brackets are placed in position, followed by the raceway cables and thrust-termination chutes. The first-stage aft skirt is installed, raceway cables installed and checked for disconnect; then the ordnance, continuity, and no-voltage checks are performed. All areas in the interstages are sealed, then first the right-hand forward interstage panels and then the left-hand panels are installed on the first two stages.

Mounting bolts on the panels are torqued, followed by installation of the pressure fixture. Then a technician torques all the bolts joining the motors together.

After the stage-separation ordnance is installed on the first two stages, all ordnance access doors are replaced. A final end-to-end test is performed before the raceway caps and base adapter ring are installed. When all sealing is completed on the interstage, a final visual inspection is made.

After necessary maintenance has been performed on the faulty missile, it must be loaded and moved back into the silo or placed in storage. Here the shipping and storage container, ballistic missile (SSCBM) comes into use. This container has been specifically designed to carry an assembled Minuteman missile from the disassembly/assembly building to a support base. The SSCBM, which is 52

feet long, 8 feet wide, and 8 feet high, is mounted on skis so that it may be carried by aircraft, railroad flatcar, or on a specially designed trailer. A special trailer with a rigid frame to support the load of the missile is used for highway travel. The reassembled missile is loaded into the SSCBM when the missile is checked and ready to be returned to the missile site or placed in one of the storage igloos. The LGM-30 is placed in the SSCBM also when it leaves the Boeing plant or is moved during or after the recycling process. The storage container has an environmental control system that requires maintenance by highly qualified refrigerator and heating specialists. These technicians remain with the SSCBM and monitor the control system throughout the journey when the missile is shipped by railway. This constant watch is maintained on both active and inert missiles during transit. When the package is shipped by air, the SSCBM is in the controlled temperature of the fuselage. The internal heating system of the plane provides environmental control for the package, and no technicians other than the aircrew are required.

After the SSCBM reaches the designated site, it is loaded and moved in a specially designed vehicle known as the transporter-erector (TE). This vehicle is used to haul the missile by road and to emplace the missile in a launch tube, sometimes referred to as a silo. The truck-tractor-semitrailer rig weighs over one hundred thousand pounds when carrying its cargo. This type of rig has been found to be the most efficient way of returning the missile to the launch site.

Repair work was completed on the first Minuteman sent to the Ogden Air Materiel Area in January 1963. The missile was sent for repair from the deployment site at Malmstrom AFB, Montana, because of a malfunction in an electrical cable inside the weapon. The missile was disassembled, components checked and returned to the disassembly/assembly area, and a functional checkout of the entire LGM-30 accomplished.

SAC responsibility for maintenance

The Strategic Air Command is responsible for organizational and field-level maintenance on the re-entry vehicle and aerospace ground equipment of the LGM-30. SAC performs organizational maintenance on the missile but not field-level maintenance.

Organizational and field maintenance beyond SAC's capability is referred to the geographically appropriate air materiel area. Depot maintenance is accomplished as directed by the Systems Support Manager at Hill AFB. When SAC cannot perform organizational or field-level maintenance because of lack of skills, manpower, or equipment, OOAMA provides support in any or all of the three maintenance categories.

LGM-30 depot support teams have been created to provide depot-level assistance. As part of its assigned mission, OOAMA dispatches skilled personnel and necessary equipment to work at support bases or at the launch facility itself. The support teams consist of depot personnel who are trained and qualified to take contractor-furnished technical data and contractor checkout equipment to the site for use in organizational and field maintenance. This method is used until the equipment and technical data have been verified and validated for SAC use.

MAINTENANCE support for the Minuteman is constantly growing. OOAMA will furnish support to five ground sites: Malmstrom AFB, Montana; Ellsworth AFB, South Dakota; Minot AFB, North Dakota; Warren AFB, Wyoming; and Whitman AFB, Missouri. Each launch site consists of numerous wings, with approximately 150 missiles to a wing.

OOAMA is justifiably proud of the progress being made in support of the Minuteman. Special facilities and highly trained technicians are establishing an excellent reputation in the depot repair and maintenance of the LGM-30, and Hill Air Force Base is becoming well known as the solid-propellant center of the Air Force. The training and assistance provided by OOAMA in support of the Minuteman are constantly increasing and already without equal.

Ogden Air Materiel Area

AIRLIFT CARGO-HANDLING RECORD

AN AIRCRAFT-loading record was claimed at Pleiku, Viet Nam, during a combat support mission when "Project Speedload" was unveiled before Brigadier General Richard H. Ellis, Commander, 315th Air Division. The 309th, 310th, and 311th Squadrons of the 315th Air Division form the airlift group of the 2d Air Division in Viet Nam.

Speedload is a newly developed air cargo-handling system designed to expedite supplies to counterinsurgency forces. The record time at Pleiku for a high-priority cargo offload and onload of a C-123 aircraft was 3 minutes 27 seconds. The previous cargo-handling record is believed to be approximately 25 minutes for a transport aircraft.

The aircraft offloading was actually accomplished within 10 seconds after the C-123 had landed. The palletized load, consisting of 9100 pounds of 2.75-inch rocket motors, moved out of the aircraft on a specially designed conveyor system. As the cargo ramp was lowered and the aircraft taxied forward, the chain of cargo pallets automatically rolled out on the ground. This taxi-away technique is designed primarily for a fast offload at forward areas where no materials-handling equipment is available.

Immediately after the offload, the 8th Aerial Port Squadron's Detachment 3 went into action with the 8220-pound onload of general cargo. This material had been prepositioned on five large aluminum pallets specially designed for air mobility operations. Within 3 minutes 17 seconds, all five pallets had been positioned in the rollerized aircraft by forklift.

This onload operation demonstrates the speedload technique for normal logistics flights operating into fields where materials-handling equipment is available. By combining the tactical offload and the logistic onload techniques, a new air cargo-handling record was possible.

Speedload appears to be a relatively simple means of improving airlift capability of the C-123. It is planned to equip all U.S. transport aircraft for speedload operations by January 1964.

2d Air Division,
Tan Son Nhut Air Base, Viet Nam

A C-123 lands (left) at Pleiku in Viet Nam for tactical offload and logistical onload. Palletized 2.75-inch rocket motors roll off in 10 seconds as the aircraft taxies forward. Five newly developed aluminum pallets (right) with 8220 pounds of general cargo are loaded into the aircraft in 3 minutes 17 seconds. The total cargo-handling time sets a new speed record for the offload and onload of the C-123 aircraft—3 minutes 27 seconds.

BARE BASE MOBILE MAINTENANCE

A SYSTEM of mobile aircraft maintenance has proved effective and economical in backup services for U.S. and Viet Nam Air Force aircraft in South Viet Nam.

Six mobile vans offer on-the-spot maintenance as shops for repair or rebuilding of engines, propellers, electronic and hydraulic instruments, and communications and navigational aids. Sheet-metal construction and welding are also among their services. In addition they can be used to mount aircraft tires and wheels. Nearly all these jobs were previously done through a time-consuming and costly pipeline system of shipping parts to Clark Air Base in the Philippines for repair or replacement.

The U.S. and the Viet Nam air forces operate several types of aircraft on a heavy flying program in the area. They include the C-47, C-54, and C-123 in addition to the tactical B-26 light bomber, T-28 and AD-6 fighter-bombers, H-34 helicopter, and L-28 liaison plane.

"Right now" maintenance means a low rate of aircraft out of commission and constant flying capabilities for continuing missions. The C-123 assault and cargo transport, for example, is extremely vital in airlifting food, supplies, and equipment to remote South Viet Nam government outposts, as well as for transporting Republic of Viet Nam Rangers into action against the Viet Cong insurgents.

The urgent need for mobility in aircraft maintenance became apparent early in the COIN operations. The original plan called for "bare strip" air operations in Southeast Asia because of the political and military factors involved. From the outset, the USAF Tactical Air Command units arriving in South Viet Nam did not bring their maintenance equipment with them. All repair work was planned for Clark Air Base in the Philippines, a thousand miles away, where first-class shops, hangars, and other facilities were available.

As the tempo of operations increased in Viet Nam, the problem of maintenance skyrocketed for Maj. Grover S. Jeane, Director of Maintenance, 2d Air Division. The situation was complicated by the nonexistence of equipment-component-list or unit-authorization-list authorizations for maintenance equipment in South Viet Nam. Nor were the necessary buildings available at Tan Son Nhut Air Base, Saigon.

The idea for mobile maintenance vans occurred to Major Jeane during a trip to the Tan Son Nhut flight line one day, where he saw light maintenance performed on U.S. Army helicopters. Back at his tent office, Jeane put his ideas on paper and immediately sent them through channels to Thirteenth Air Force headquarters at Clark AB.

From there the proposal went to Headquarters Pacific Air Forces in Hawaii. In PACAF, the concept of mobile maintenance vans became the special project of Col. Earl Longacre, Jr., of the Directorate of Maintenance Engineering. Together with Lt. Col. H. D. Cameron from the Materiel staff and other supply, maintenance, and engineering officers, Colonel Longacre further developed the mobility maintenance concept and gave it firm, official life.

"We didn't have any vans in PACAF," said Colonel Longacre, "so that meant we would have to go to Air Force Logistics Command with a top-priority request." The two colonels rushed the concept through key staff offices to PACAF's vice commander in chief, Lt. Gen. Thomas S. Moorman. There it received immediate approval. The next step was to visit AFLC at Wright-Patterson AFB, Ohio.

"Logistics Command went right to work on our request," Colonel Longacre said, describing the action on the mobile vans—from planning to outfitting and projected delivery—as the "fastest thing I ever saw."

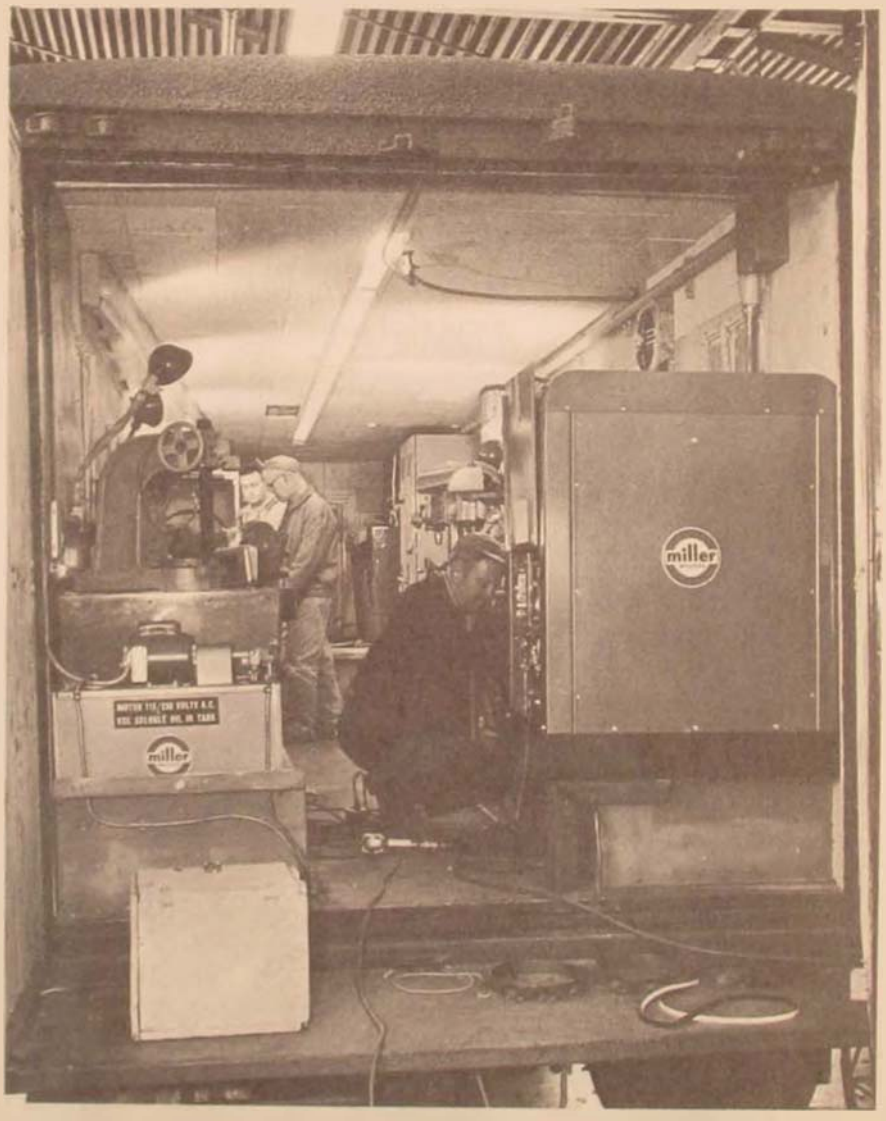
Project PAC-VAN, nickname for the solution to this knotty maintenance problem, was first discussed in July 1962. Initial shipment was made in November by MATS C-124 Globemasters. Two vans were soon serving the "Mule Train" combat airlift operation at Tan Son Nhut AB. Remaining deliveries arrived in Viet Nam by priority shipment as the vans were completed.

No longer were the long delays of shipment to and from the Philippines a serious bottleneck. Now all parts could be bench-checked on the spot at bases of operation. Repair work could be done by the maintenance specialists responsible for keeping their own aircraft in commission. The savings adds up to tens of thousands of dollars.

The mobile shops can be moved quickly to other locations, by truck or in C-124 Globemasters. Such mobility is a prime factor in keeping South Viet Nam a free republic. It is typical of the many special efforts being made by the Air Force in adapting modern aerospace firepower and equipment to demanding new roles in the jungles and swamps of a nation struggling for survival.

Within the larger concept of air mobility, the use of transportable vans is another important step in the creation of flexible, combat-ready Air Force units that can operate independently of hard base facilities anywhere in the world.

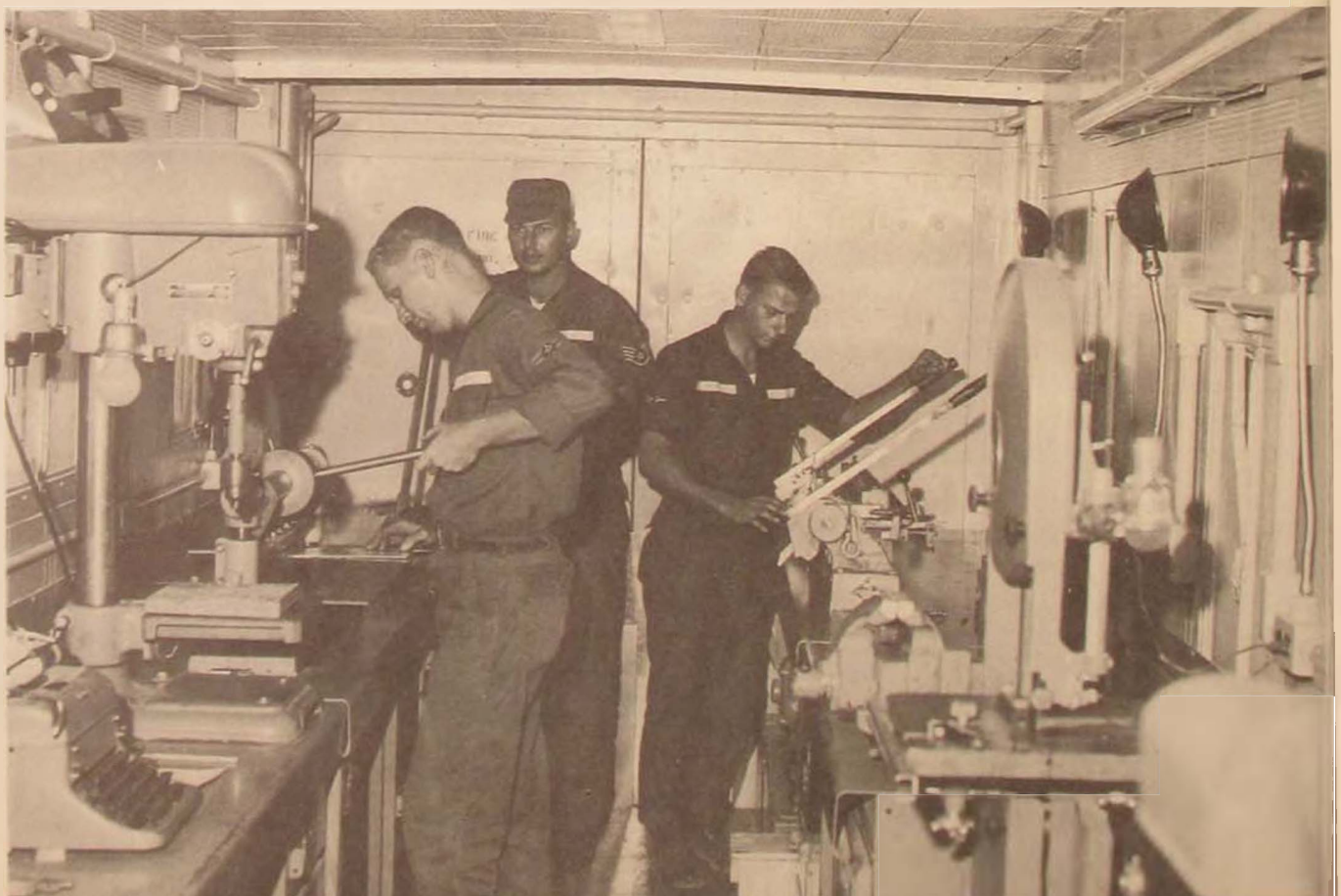
2d Air Division, Saigon



Interior of machine shop van nearing completion at McClellan AFB, California

Two mobile maintenance shops at Tan Son Nhut AB, Saigon

Maintenance specialists assigned to the C-123 airlift force at Tan Son Nhut demonstrate that working space of sheet metal shop van is suitable for more than one job



TITAN II RESIDENT LOGISTIC TEAM

COLONEL WILLIAM J. CAMPBELL

IN THE fall of 1961, the Air Force and the Martin Company recognized a serious time shortage with respect to initial provisioning for Titan II. Initial provisioning has been defined as the process of determining what items, in what quantity and at what time, are required to support and maintain an end item of materiel for an initial period of service. Its phases include the identification of items of supply, the establishment of data for cataloging, technical manuals, and the preparation of instructions to ensure delivery of necessary support items with related end articles. Specifically the then current provisioning technique, the conference method, did not permit the completion of the required process soon enough to provide spares needed early in the Titan II operational program.

In a joint effort between the San Bernardino Air Materiel Area (SBAMA) of Air Force Logistics Command, the Ballistic Systems Division of Air Force Systems Command, and the Martin Company, the Air Force is service-testing a new concept: a resident logistic team at a contractor's facility. Specifically, in April 1962 SBAMA established a resident team at the Denver division of the Martin Company for the purpose of accomplishing source coding/provisioning actions in support of the Titan II weapon system.

The concepts employed by the resident team involve variations and departures from normal Air Force provisioning practices and are for the express purpose of ensuring timely and adequate support for the Titan II weapon system in the most effective and economical manner.

In order to reduce the amount of provisioning documentation, we have eliminated the vendor items list, production list, and the 100 per cent provisioning parts breakdown. Maximum utilization is made of the data collected on AFLC Form 402A, "Logistic Data Record for Advanced Weapons" (LDR). The LDR is designed to document technical information in a series of 80-digit punch-card accounting machine (PCAM) cards so that annotated information can be introduced into the advanced logistic system tape files.

The resident team performs those provisioning control-type functions normally accomplished by the provisioning control branch of the prime depot. All correspondence from the various air materiel areas and depots on matters pertaining to provisioning/source coding is directed to the resident team. All clerical-type duties are performed by personnel provided by the contractor. This permits members of the resident team to spend their time in "over-the-shoulder look" at what the contractor is doing in the spares selection area and provides them time to make those decisions that need be made by the Air Force.

Provisioning requirements are based on factors affecting support requirements, such as issue rates, anticipated yearly issues, recoverability, cost category, quantity per article (QPA), program effectivity, installation and checkout (I&C) assets availability commitments, stock deployment requirements, etc. All data are recorded on the AFLC Form 402A, and on the logistics data/parts change notice (LD/PCN) this is signed by the supply representative upon his review and approval. This provides required data to the inventory manager, who in turn is responsible for preparing detailed computation work sheets as prescribed by existing regulations.

The resident team consists of the team chairman, maintenance representative, supply representative, cataloging/interchangeability representative, and provisioning control technician. Through the efforts of these five individuals we have been able to provide on-the-spot determination of support requirements for SBAMA prime items and ex-

pedite the determination of support requirements for nonprime items by direct coordination with the prime inventory manager.

After one year of operation, we feel that considerable progress has been made in improving the overall source coding/provisioning effort. As far as we know, this is the first time the Air Force has been able to establish an integrated effort whereby the contractor's provisioning personnel and the Air Force jointly look at engineering data as they are released by the design engineering group.

San Bernardino Air Materiel Area feels that the use of a resident team has led to the making of better decisions in the buying program, which should result in a substantial yearly reduction in costs. Better decisions are being made because resident personnel have continuing on-the-spot access to a greater amount of information upon which to base their decisions.

Team members gain an increased confidence in decision-making, in part through their prolonged opportunity to evaluate contractor recommendations and contractor test programs and in part through their opportunity to discuss and review problems more thoroughly with the many involved contractor organizations, i.e., reliability, field support, engineering, etc. The daily contacts with hardware trends and contractor personnel all serve to raise greatly the confidence level of our provisioning team members in their provisioning decisions. Since the team is able to work directly from data developed through engineering and test programs, a maximum opportunity exists to adjust rapidly the range and quantities of items in accordance with engineering changes and test results.

With the short lead time now experienced in the Titan II program, we are able to place on procurement the spares requirements within a one-week period, whereas under normal procedures it took 30 to 60 days. We have reduced the amount of TDY, since the team only calls for assistance to meet peak workloads. We have also reduced the amount of documentation submitted by the contractor. Furthermore, we have been able to provide the inventory manager with more technical data than ever before by sending him copies of our Logistic Data Record and of the Characteristic Item Description and drawing as they become available.

The Titan II resident team will save not only on reduced documentation costs, provisioning conference costs, man-hours of time, and TDY costs but also a substantial though undetermined savings through improvement in the quantities of spares provisioned in the Titan II program. These savings are facilitated by the active participation and invaluable assistance provided by the Martin Company in the development of the new provisioning/source coding techniques.

The Air Force has applied the resident team concept to the Minuteman program also and will consider it for other advanced weapon systems developed in the future.

San Bernardino Air Materiel Area

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