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STRATEGIC COMMAND AND CONTROL SYSTEMS

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by

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C O N T E N T S

I. STRATEGIC COMMAND AND CONTROL: EVOLUTION OF THE 465L SYSTEM

Under normal circumstances, the command and control of the nation's strategic air forces is a tremendous task. At the start of the 1960's, for example, an average of 122 bomber and tanker aircraft of the Strategic Air Command (SAC) were airborne each day, with inflight refuelings taking place at the rate of once every 6.8 minutes. Large-scale exercises by the command often involved more than 500 aircraft. The enormous size of SAC, with 260,000 men and thousands of aircraft scattered around the globe and with intercontinental ballistic missiles (ICBM's) beginning to enter the force, greatly compounded the problems of command and control.[1]

To supervise and direct this widely dispersed force, the Air Force and SAC over the years built a worldwide communication network for the rapid transmission of information and action directives. The network in 1960 included: (a) a primary alert system of voice communications between SAC's underground control center at Offutt AFB and all base control rooms in the United States and overseas; (b) a single sideband high frequency point-to-point radio system; (c) a telephone system for day-to-day operational control purposes; and (d) a teletype system to convey printed operational information.

These several systems generated huge amounts of data on the daily status of the force which were continuously processed and displayed in the SAC control center. As early as 1954, however, the flood of

information had become so great the SAC commander (CINCSAC) expressed concern over the center's inability to stay current with the disposition of the force. The primary difficulty involved the center's machinery for data reduction, correlation, and display. Based on manual World War II devices and techniques, the processing fell further and further behind the improved operational capabilities of the airborne elements.

Seeking to resolve this problem, SAC recommended on 17 December 1954 that the Air Force initiate research and development of "electromechanical devices capable of high speed performance of a major portion of the sorting, summarizing, correlating, and displaying" of status information. Headquarters USAF agreed on the requirement and, during the summer of 1955, it approved contracts for the Radio Corporation of America (RCA) and International Business Machines (IBM) to study improved control techniques and equipment. These studies led in time to the installation of a closed circuit color TV system and an IBM computer in the underground control center. Starting on 20 May 1957, the computer was exercised with the existing manual system and soon proved the feasibility of using electronic data processing for command and control purposes.[2]

These experiments also uncovered serious deficiencies arising from the attempt to integrate electronic data processing with manual communication and posting techniques. The SAC battle staff found that the control center still remained an average of one hour and 30 minutes behind the force. In extreme cases, the center fell six hours behind.

Such "historical data" was unacceptable to CINCSAC when the threat consisted merely of air-breathing vehicles; it became even less acceptable when the ICBM arrived on the scene to compress warning and reaction time to less than a half hour. In the era of the ballistic missile, CINCSAC emphasized, he required "immediate, correct and current information in appropriate form upon which to base his decisions for control and direction of the SAC strike force." It was in the search for this "real-time" capability that the Air Force launched the development of the 465L SAC command and control system. The effort would last more than six years before the Air Force obtained even a limited operational capability.[3]

The Beginning of 465L

The Air Research and Development Command (ARDC) in January 1958 initially prepared an abbreviated system development plan for the proposed SAC system. Headquarters USAF then issued a general operational requirement (GOR 168)* on 11 February and a development directive on 27 February. Planning at this time called for an initial operational capability (IOC) by October 1960 and a complete operational capability (COC) by January 1963. In April and May, ARDC established a 465L system project office at Wright-Patterson AFB,/ prepared a work statement, and requested development proposals from seven interested companies. The bids, received by July 1958, contained system acquisition cost estimates ranging from $89 to $324 million.[4]

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*The GOR's later were redesignated as specific operational requirements (SOR's).

/In June 1960 the office was transferred to Waltham, Massachusetts.

While these proposals were under review, the 465L project office--assisted by SAC and other USAF agencies--prepared a preliminary operational concept for the system. It described a future system which would use "high speed data transmission, processing, and display" techniques to provide CINCSAC with the necessary data to "plan, direct, and control the worldwide operations of the strategic force." In addition to presenting information for decision-making, the system would also provide automated war planning, war gaming, flight path planning, missile employment, and training capabilities.[5]

In August 1958 the source selection board recommended a $107 million bid from the International Telephone and Telegraph Corporation (IT&T), which had offered to set up a separate division exclusively for the SAC system. On 15 September Headquarters USAF approved the selection, and several days later the Air Force awarded a letter contract to the International Electric Corporation (IEC), IT&T's new division, for the design, development, and production of 465L hardware. A major subcontractor, the Systems Development Corporation (SDC), became responsible for operations analysis, computer programming packages, personnel training procedures, and other "software" activities.[6]

Almost simultaneously with contractor selection, the Air Force on 16 September 1958 submitted a request to the Office of the Secretary of Defense (OSD) for $29.8 million in fiscal year 1959 funds. OSD said, however, that it wanted a thorough briefing on the proposed technical approach before it would release any funds. Headquarters USAF, ARDC, and SAC representatives gave the briefing on 31 October and obtained a

tentative OSD approval and $18 million. In its authorization OSD emphasized that system acquisition should be on a "fly before you buy" basis.[7]

Since OSD's actions constituted a "stretch out" of development and funding plans, the International Electric Corporation notified the Air Force that it would be unable to meet the originally planned IOC date of October 1960, and the company also revised program costs upward--from $107 million to $137.8 million. The Air Force consequently agreed to an initial operational capability date of January 1962. It also approved plans to build a prototype test facility at Paramus, New Jersey to demonstrate the operational feasibility and integration of the various 465L equipment. The worldwide system, as envisioned at this time, included: (a) installation of seven electronic data traffic control centers (EDTCC's)--at SAC headquarters, at the three numbered Air Force headquarters (15th at March AFB, 8th at Westover AFB, and 2d at Barksdale AFB), and in Hawaii, England, and Spain; (b) installation of a remote control complex (RCC) at all SAC bases and missile sites, about 127 in all; and (c) placement of computers and displays at SAC headquarters and in each of the three numbered Air Force headquarters.*[8]

System Costs and OSD Criticism

During 1959 a problem surfaced that would plague the entire history of 465L system acquisition--uncontrollable cost increases.

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*For the major components and subsystems of 465L as they evolved by the end of 1963, see Appendix 1.

They were attributed to various factors, including funding limitations placed on the program, the original lack of specific details on SAC's operational needs, unexpectedly high subcontractor costs, and growing system complexity. All told, these factors contributed to boosting the estimated costs of system acquisition first to $198.1 million, then to $228.3 million, and finally to $339.7 million by October 1959. This last figure was $200 million above the estimate given only 12 months before.[9]

It was not surprising, therefore, that when the Air Force approached OSD for release of fiscal year 1960 funds ($62.29 million), Dr. Herbert F. York, the Director of Defense Research and Engineering (DDR&E), rejected the request. To win his approval, Headquarters USAF reviewed the existing program in detail and deleted some of the planned equipment to cut costs. It submitted a revised plan to DDR&E in November 1959 which won approval on 1 December; however, York limited obligations to $40.6 million. While savings were thus effected, the Air Force's inability to obtain the full budget amount caused further slippage of the projected IOC date--to April 1963--and the COC date--to January 1965.[10]

For two consecutive years the Air Force thus had been unable to obtain the funds requested. This situation, as USAF officials became aware, in part reflected basic doubts over the validity of the entire 465L concept. For example, defense officials challenged the Air Force to justify why the system should be built at all if, as expected, a war begun with a Soviet missile salvo would destroy it even before it could be used. In briefing DDR&E representatives, SAC responded that the system

was worth the cost, if only for peacetime training and exercises.[11] This answer, although partly valid, was not very convincing to OSD--especially as costs continued to spiral upward.

Greatly concerned by the cost trend and system complexity, Headquarters USAF early in 1960 cautioned SAC that it was essential to take "a most austere approach" with the 465L configuration. It directed both ARDC and SAC to give special emphasis to reducing all "non-essential automaticity." At the end of May SAC and ARDC officials briefed Headquarters USAF on the latest proposed system configuration, but Air Staff representatives found it "too sophisticated to be financially palatable." Headquarters USAF renewed its warning that a continued upward cost trend would imperil the entire program.[12]

In response to these admonitions and warnings, SAC undertook a new review of its requirements and, with ARDC, made further changes and deletions, although they felt that these would erode system capability. The revisions were incorporated into a new revised phasing and funding plan published in June 1960. Among them were reduction of the traffic control center cross-tell rates from 4,800 bits to 2,400 bits of information per second and deletion of three oversea traffic centers and associated consoles, based on diminishing requirements. However, even with these revisions, total cost was estimated at $387.6 million--an increase of $48 million over the October 1959 figure.[13]

As a result the Air Force encountered still greater resistance from OSD. In November 1960 the Assistant Secretary of the Air Force for Research and Development, Courtland D. Perkins, brought the problem to

the attention of the Chief of Staff, General Thomas D. White. He reported that DDR&E had expressed "grave doubts" about the configuration of 465L, its survivability, and its planned employment. Perkins listed 16 general questions being asked which, he said, the Air Force had failed to adequately answer. They concerned USAF plans to proceed with hardening of certain 465L facilities, which indicated that the Air Force had "failed to differentiate" between shelter survival and "survival of the center as an operational entity." One question suggested that it might be more practical for the Air Force to rely on mobile command posts rather than on ground facilities "which can be eliminated by a determined enemy."[14]

Meanwhile, in late 1960 Headquarters USAF had renewed its attack on the problem of system costs. It established an ad hoc study group to propose an even more austere 465L configuration. New revisions and further adjustments in system equipment were made by the group to meet force structure changes, and these were approved by the Air Staff and submitted to DDR&E on 7 December 1960. After reviewing the revised configuration, OSD released additional funds and provided authority to proceed with the program.[15]

Despite these actions, Secretary Perkins felt that the Air Force was still in trouble, particularly in still not facing up to the problem of survivability. This and other command and control problems had been given considerable attention in 1960 by the Winter Study Group (see below) and the Air Force Scientific Advisory Board. Their reviews, Perkins said, had outlined problem areas clearly and made recommendations,

yet the Air Force follow-up "was not immediately apparent." He therefore urged the Air Staff to take corrective measures.[16]

The Problem of Survivability

The Winter Study Group was organized in January 1960 at the request of the Air Force "to examine critically and objectively from a technical viewpoint the entire complex of existing and planned" USAF command and control systems. An eight-month review followed, conducted by USAF and civilian consultants working with the Mitre Corporation and supervised by a senior advisory committee under Dr. A.G. Hill of the Massachusetts Institute of Technology. In its final report of 15 September 1960, the group generally endorsed the Air Force approach to automated systems, but it noted that the type to be built depended on the strategy the United States intended to pursue--one based on second-strike and quick reaction in the face of a Soviet ICBM attack or one based on survivability. The group felt that a strategy of relying entirely on quick reaction to warning was too risky and should be rejected. "The chances of either failing to get warning or 'retaliating' on a false alarm," it said, "are too great."[17]

The group further observed that there was a danger that USAF command and control systems would be neither sufficiently reliable to launch a quick retaliation on warning, nor survivable enough to control the remaining force after a first strike. In the group's opinion, the best solution to the problem of compressed time was not elaborate electronic equipment "to make quick reactions safe" but a survivable system to eliminate the need for quick reactions or "snap judgments."[18]

Long before the Winter Study Group recommendations were made, the Air Force had been studying the problems of survivability and quick reaction. As early as 1958 General Thomas S. Power, CINCSAC, had conjectured that ICBM's "would probably not be launched until and unless there is definite proof of agression--proof perhaps as drastic as the actual detonation of hostile bombs or missiles."[19] This policy--that missiles would be required to "ride out" an attack--was in fact adopted by the United States and led to the decision to embark upon a costly program of hardening and dispersing ICBM sites.

The Air Force, on the other hand, recognized that command and control systems--which involved thousands of miles of "soft" communications--could be hardened only at prohibitive expense and that the Eisenhower administration's emphasis on a tight defense budget made any such proposal unrealistic. As a compromise, the Air Force supported a plan to harden the 465L combat operations centers. Although OSD approved, Congress failed in 1959 to provide funds.[20]

After the Winter Study Group made its recommendations in September 1960, the Air Force renewed its attempts to harden the four centers. To bolster its case, the headquarters analyzed the weapons of various yields that the enemy required to destroy hard and soft centers. According to this analysis, the Soviets would have to launch 81 nine-megaton weapons with a circular error probability (CEP) of 1 nautical mile to destroy four centers hardened to withstand overpressures of 500 to 600 pounds per square inch (psi); whereas only 12 missiles would destroy the soft system if they fell in the general vicinity of the centers.[21]

In his presentation to a congressional committee in May 1961, Brig. Gen. Gordon H. Austin, Deputy Director of Operational Requirements, explained that the four hardened centers would "greatly increase the probability of survival of at least one of SAC's senior commanders and his command control center." This would assure that an experienced commander was available "and equipped to direct the exploitation phase to a successful conclusion." In private, however, USAF officials recognized that even with the hardened centers, "post-attack survivability of the land lines that link them will be very doubtful."[22]

Besides seeking survivability through hardening, the Air Force also wanted the development of an airborne command post capability. Beginning on 1 July 1960 the Strategic Air Command undertook feasibility tests with KC-135A aircraft and control teams on ground alert. Between then and 2 February 1961, SAC executed 42 no-notice flights of this airborne command post, with the average time from execution to take-off being 11.4 minutes. This system possessed a rudimentary capability to alert and direct the SAC force.*[23]

Early during the test program, Headquarters USAF authorized SAC to develop a detailed plan outlining concepts and procedures for maintaining a continuous airborne command post operation. Subsequently, on 1 February 1961, General White directed General Power to begin continuous airborne operations as soon as possible. These flights were instituted on 3 February. Shortly after, General White approved several new

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*For a more detailed discussion, see pp. 33-34.

development projects to enhance the survivability of command and control communications. These included an emergency rocket communication system and a hardened low frequency communication system.*[24]

Impact of the Kennedy Administration

By early 1961, when the new Kennedy administration took office, the USAF development program for the command and control of strategic forces included the austere 465L electronic data processing and display system, the airborne command post, the emergency rocket and low frequency communication systems, and the proposal to harden the four SAC combat operations centers. The new President and his Secretary of Defense, Robert S. McNamara, at once initiated a thorough review of the whole field of command and control, with emphasis on the strategic area.

The President's special interest in command and control was clearly reflected in his first defense message sent to Congress on 28 March 1961. In reaffirming that the United States would "never strike the first blow in any conflict," he emphasized the need to improve command and control of the nation's strategic forces. President Kennedy said:[25]

> ....what we have and must continue to have is the ability to survive a first blow and respond with devastating power. This deterrent power depends not only on the number of our missiles and bombers, but on their state of readiness, their ability to survive attack, and the flexibility and sureness with which we can control them to achieve our national purpose and strategic objectives.

Several weeks later, in testifying before a congressional committee, Secretary McNamara expanded on the administration's concern for effective

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*For a discussion of survivable communication projects, see pp. 36-42.

strategic command and control. The administration's goal, he said, was to reduce U.S. dependence on deterrent forces which were "highly vulnerable to ballistic missile attack, or rely for their survival on a hair-trigger response to the first indications of such an attack." Instead, emphasis would be placed on developing the kind of forces that could ride out a massive nuclear attack and then be applied "with deliberation and always under the complete control of constituted authority."[26]

These policy declarations and the new top-level review of the command and control systems under development would have major impact on the future evolution of the 465L system.

II. 465L AS A PEACETIME SYSTEM

On 8 March 1961 Secretary McNamara directed the Joint Chiefs of Staff (JCS) and the Director of Defense Research and Engineering to review existing command and control systems and recommend changes that would enable "duly constituted authorities to react to an attack in a deliberate way." To assist in these studies, the Air Force supplied detailed information on its systems under development, including the SAC command and control system.[1]

In mid-April DDR&E completed his study and filed a report highly critical of the Air Force. According to the director, USAF systems were being built on the "gamble" that they would be used before the United States was hit by a Soviet missile attack and that the President and other national authorities would be limited by the restrictions of time to order an all-out response or none. These premises, DDR&E claimed, were contrary to the President's policy for "deliberate employment of weapons." DDR&E characterized the USAF systems as "large and inflexible" and designed to operate "between identification of the attack and impact of enemy missiles." In effect, the systems "must race the enemy missiles."[2] From a policy viewpoint, this was intolerable.*

*On 1 September 1961, on the basis of these and JCS recommendations, Secretary McNamara appointed Gen Earle E. Partridge, USAF (ret) to head a task force to study national command and control problems. The task force issued a final report on 14 November and made recommendations aimed at creating a national military control system (NMCS), strengthening the JCS in this area, and centralizing development responsibilities.

DDR&E's views on the 465L system were that it would probably[3]

> function as designed in the absence of nuclear attack on the United States. Once the nation has been hit, its continuing value in the rapid reconstitution of the surviving force would probably be nil. If the system could be redesigned to be survivable, its communications needs would require survivability of almost all the peacetime network to feed it. This would be costly--billions of dollars if Rand's rough estimates are correct.

The Revised 465L Plan

Following DDR&E's severe criticism, Under Secretary of the Air Force Joseph V. Charyk met with Dr. Harold Brown, the new defense research director,* on 4 May 1961, reviewed possible solutions to the SAC command and control problem, and agreed on certain "revised principles for 465L." They decided that the planned system should be installed only at Offutt and March AFB's while limiting Barksdale and Westover AFB's to communication and display elements only. They further agreed that the Air Force would study the feasibility of a poststrike command and control system (PACCS) "which can be assured survival and which will have a capability to provide only the most elemental commands after a strike."/[4]

In the weeks that followed, Brockway McMillan, the Assistant Secretary of the Air Force for Research and Development, discussed revised concepts for "a modified, prestrike 465L system, and a survivable poststrike SAC control system" with Air Staff and OSD representatives. During these discussions, OSD officials restated their view that the 465L system, even if hardened, could not serve as a poststrike system

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*Dr. Brown took office on 3 May 1961.

/Development of the PACCS system is discussed in Chapter III.

because of its great dependence on "soft" communications. Failure to recognize this weakness would delay or even prevent development of a valid poststrike system. Meanwhile, Headquarters USAF notified SAC and the Air Force Systems Command (AFSC)* of the impending revised program to develop a survivable wartime system in addition to 465L.[5]

During August and September 1961 a major planning effort got under way at AFSC's Electronic Systems Division (ESD).[/] With the assistance of Air Staff, SAC, and Air Force Logistics Command (AFLC) representatives, ESD prepared a revised 465L development plan and a proposed system package for the poststrike system. It dispatched the completed "Comprehensive Plan for Strategic Command and Control Systems," covering both the peacetime and wartime systems, to Headquarters USAF in late September, where it was quickly approved.[6]

The estimated cost of the revised 465L system was $393 million--a rise of nearly $12 million over the previous estimate. Because this estimate appeared unwarranted in light of the reduced scope of the system, Dr. Charyk withheld the plan from OSD and directed Dr. McMillan to undertake a critical review. The Assistant Secretary

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*AFSC succeeded the former Air Research and Development Command on 1 April 1961.

/The primary mission of ESD was to provide electronic supporting systems for command and control of USAF forces and resources. In addition to 465L, others under development included: 412L--oversea theater tactical air weapon control and warning system; 416L--semi-automatic area weapon control and warning system for use by North American Air Defense Command (NORAD); 473L--a data processing and display system to assist Headquarters USAF in making command decisions.

soon found that the cost increase stemmed from eight Minuteman ICBM squadrons not previously included in the 465L program. He deleted these squadrons along with certain other equipment which he considered nonessential, and the Air Staff incorporated the cost reduction suggestions into another version of the revised plan. (Later, SAC sent in a reclama on some of the deleted equipment, which was then restored to the program.)[7]

On 18 October the Air Force presented its plans for the two SAC systems to defense officials. The 465L plan called for installation of electronic data traffic control centers and displays at SAC and its three numbered Air Force headquarters, plus two computers at Offutt and one at March AFB. The new initial operational capability date was set at 1 July 1963. The Air Force reported that all 465L equipment was on production contract, incrementally funded. OSD reacted favorably to these plans and, on 18 November, Secretary McNamara tentatively approved both. He also approved proposed facility changes including modification of the SAC underground control center to incorporate 465L system equipment, expansion of the existing control center at Westover and the headquarters building at Barksdale AFB, and construction of a new building at March AFB.*[8]

New Delays and System Cost Increases

Reorientation of 465L to peacetime operations was expected to ease the troubles plaguing system development and acquisition, but it did not.

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*The control centers at Offutt and Westover were "cut and cover" semi-hard (25 psi). The other two were above ground and completely soft.

Old problems continued, and new ones cropped up. For example, during the winter of 1961-1962 delays in obtaining congressional reprogramming authorizations slowed construction of the planned facilities. Congress did not approve the proposed changes until mid-February 1962. In addition, a six-week strike at one of the contractor's plants caused a one-month slippage in the program and a further cost increase. Consequently, the Air Force once again had to slip the IOC date, this time to 22 September 1963. The COC date remained at 1 January 1965.[9]

In the meantime, at the end of March 1962 Headquarters USAF revised the specific operational requirement to reflect the recent changes in system configuration. The system would serve for the peacetime command and control of the strategic force and provide poststrike support for as long as it survived. In April modifications began at SAC headquarters to accept 465L equipment, and in September installation of communication equipment for bomber/tanker units was started at Amarillo AFB, Texas.[10]

It was while the construction work was underway that the 465L program suffered still another delay and cost increase. With the inception of the Cuban missile crisis of October-November 1962, SAC went on increased alert. The 465L contractor and his installing crews were denied entry to the Offutt underground control center. At other SAC bases work also suffered as workmen were given only limited access.* Headquarters USAF soon received the bad news from ESD and

*Even earlier, during emergency war order (EWO) exercises, SAC cleared these workmen from sensitive areas in its underground center.

the contractor that there would be IOC slippage and additional fund requirements. It thereupon rescheduled the IOC to 23 October 1963.[11]

Concerned by the latest slippage and anticipating renewed OSD criticism, Secretary of the Air Force Eugene M. Zuckert in March 1963 requested an overall report on the various management studies involved in the original decision to procure 465L. He also asked for an analysis of the operational benefits to be derived from 465L in terms of increased SAC operational effectiveness. SAC undertook the new report and forwarded it to Headquarters USAF in early April 1963. Once again SAC pointed out that its existing command and control machinery was incapable of adequately responding to current reaction-time requirements. SAC said the 465L system, when installed, would "accept, process, and project combat report information in less than two minutes time," while the existing manual system took an average of 90 minutes to do the same task.[12]

Although the Air Staff needed little convincing that the 465L system was essential to efficient SAC operations, the continuing cost increases were hard to justify. In April 1963 Joseph S. Imirie, Assistant Secretary of the Air Force for Materiel, suggested that the Air Staff take a "hard objective look" at the entire complex of "L" supporting systems. He warned that their development, procurement, and installation were beginning to outstrip USAF's ability to support them. Congress at this time also raised questions concerning their validity and funding. Headquarters USAF thereupon ordered a complete review of the "L" systems by the Support Systems Panel of the Air Staff

Board. In its report of 1 August 1963, the panel concluded--with specific reference to 465L--that the SAC command and control program remained a valid requirement and should be continued.[13]

Earlier, at the direction of the Chief of Staff, Gen. Curtis E. LeMay, SAC undertook another cost reduction analysis of 465L. Concentrating on anticipated force structure changes and the planned phase-out of obsolescent Atlas missiles, B-47's, and tankers, SAC was able to cancel installations previously planned at eight British and Spanish locations. It also refined its plans so that no equipment would be installed at any location slated for inactivation within one year after the IOC date.[14]

In reporting the above changes to Secretary Zuckert, Maj. Gen. Joseph R. Holzapple, the Air Staff's Director of Production, noted that SAC had identified a dozen air bases or missile sites where 465L equipment would be installed and then phased out between September 1964 and December 1967. However, with one exception, all equipment would have been in operational use a minimum of 16 months. The single violation of the one-year ground rule was attributed to slippages caused by the Cuban crisis.[15]

465L Is Realigned Again

Despite these latest efforts to reduce system costs, AFSC in the spring of 1963 submitted a projected budgetary request for fiscal years 1964-1965 which exceeded OSD-approved funding levels by $34 million. The additional money would cover the procurement of equipment for three additional Minuteman wings (6, 7, and 8) and spares, the modification

of cryptographic communication equipment, as well as certain contract cost increases. After an exacting review, the Air Force asked for the full amount in a program change proposal submitted to OSD on 2 July 1963.[16]

Before defense officials could act on the new request, the Air Force learned that it required still another $18 million to pay for IOC/COC slippages and computer programming costs. Computer programming now emerged as a critical problem which might delay achieving an operational system. The Air Force was faced with the bleak fact that the "software" contractor, Systems Development Corporation, had greatly underestimated the technical problems, magnitude, and complexity of the job. It also became necessary to drop plans to use "blue suit" personnel to develop, assemble, and maintain the computer programs once the IOC had been attained. By the summer of 1963 it was clear that such a capability was beyond SAC and that continuing contractor support would be required.[17]

It was at this point that the Logistics Management Institute (LMI), a private agency, submitted a study of the 465L system to Secretary McNamara. This study was highly critical of the USAF acquisition procedures, the existing contractual arrangements, and the Air Force's current management approach. The report made a telling point by comparing the original and current cost estimates of the program: $138 million in November 1958 and $370 million in June 1963.* Planned

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*For total 465L system costs, see chart in Appendix 2. The LMI study referred to above had been initiated by OSD.

acquisition time had also greatly increased, from an original estimate of 33 months to 63 months.[18]

This critical evaluation of the SAC command and control system came at a time when the Kennedy administration, after several years of expanded military budgets, was beginning to tighten up on expenditures. As a consequence, OSD withheld action on the program change proposal of 2 July 1963, pending assurance from the Air Force that the program would be realigned to reduce costs and expedite SAC's takeover of the system. On 10 August Headquarters USAF directed SAC, AFSC, and AFLC to submit a new plan that would realign 465L within existing budgetary limitations.[19]

On 4 September 1963 the three commands reported that they could reduce fiscal year 1964 funding by terminating installation of missile equipment, deleting production of remote control consoles and other equipment for the three additional Minuteman wings, and immediately terminating all contractor work on computer programs beyond those already under way. They concluded that such changes would still permit an orderly implementation of the 465L system, but with a reduced capability and at a somewhat later date.[20]

On 24 September Headquarters USAF directed the commands to limit installation of missile equipment to the first five Minuteman wings, and to reduce other acquisition costs so as to stay within the existing budget of $38 million. It said procurement of equipment for the additional wings would be deferred to fiscal year 1965. It directed the commands to take "extraordinary measures" to reduce acquisition

costs even further "by immediate elimination of all contractor effort which does not contribute directly to the program as reoriented." In line with these actions, the scheduled IOC and COC dates were slipped to 14 December 1963 and 1 March 1965 respectively.[21]

After reviewing the reoriented program, Secretary of Defense McNamara on 7 November 1963 agreed "that the system in its present approved configuration can be delivered in an operational condition to SAC and the acquisition phase terminated during FY 1965." He thereupon directed the Air Force to "buy out" 465L and to take steps to insure that the system was turned over to the Strategic Air Command "not later than the presently scheduled COC date." At that time all existing contractual arrangements were to be terminated.[22]

Finally, on 14 December 1963--after six years of planning, development, and engineering efforts--the 465L program passed a major milestone when four electronic data transmission communication controls, and one computer at Offutt AFB were turned over to SAC. In addition 63 remote communications centrals were installed at SAC ZI bases. The command promptly began sending limited operational traffic on a time-shared basis while the contractor proceeded with Category II testing.[23]

III. DEVELOPMENT OF THE POST-ATTACK SYSTEM (481L)

During the spring and summer of 1961, while it was reorienting 465L to a peacetime system, the Air Force concurrently planned for a survivable post-attack command and control system (PACCS). As conceived at that time, the system would include redundant ground and airborne command post elements, survivable underground "capsules," and identical processing and display hardware for both the airborne elements and the underground facilities. Secretary McMillan, who had participated in planning conferences with OSD officials, urged the Air Staff to proceed with all possible speed to develop the system. On 13 July Headquarters USAF directed the Air Force Systems Command to prepare the requisite PACCS development plan.[1]

Post-Attack System Planning

In August 1961, while PACCS development planning was under way Deputy Secretary of Defense Roswell Gilpatric--in a memorandum to Secretary Zuckert--confirmed the original verbal agreements reached between Drs. Charyk and Brown concerning the system. Gilpatric directed the Air Force "as a matter of the highest priority," to develop, procure, and operate a trans-attack and post-attack strategic command and control system "designed for high survival potential and long endurance in the wartime environment." This system, Gilpatric said, should be suitable for the control of SAC forces "during thermonuclear war, including the application of alert

and follow-up forces in a controlled and deliberate way under a range of different attack options." In forwarding this guidance to the Chief of Staff on 30 August 1961, Secretary McMillan added that the Air Force should take steps to insure that there would be a "close coordination effort" and "conceptual and technical interface" between the peacetime and the post-attack systems.[2]

Meanwhile, Headquarters USAF completed a preliminary specific operational requirement (SOR 191) for the wartime system. Issued on 31 August, the SOR called for multiple airborne elements, deep underground "super hardened" command control capsules, and "a multiplicity of highly survivable modes of communications." At least one airborne command post would be maintained in flight at all times to permit effective and flexible command and control of the strategic forces.[3]

During September 1961 Air Staff, SAC, ESD, and other USAF representatives met at Hanscom Field to draft a proposed system package program (PSPP) for the post-attack system, which had been designated 481L. After a 25 September presentation, Headquarters USAF approved the proposed system package, and on 4 October Dr. Charyk forwarded it to OSD. According to this document, the post-attack system would consist of three main packages.

Package "A" was the initial airborne command post portion, based on KC-135 aircraft modified for long endurance. Since five of these aircraft were already available at Offutt, the Air Force asked authority to acquire 15 more to enable SAC to maintain a continuous airborne

operation for at least 30 days. The Air Force also asked for authority to convert 36 B-47 aircraft to UHF radio communication relay platforms, in order to provide direct communications at all times between CINCSAC and national authorities. The complete airborne system would be operational by December 1963.

Package "B" covered the automated data processing, display, and communications equipment to be incorporated into the KC-135 airborne command post to expand its capability. The B-47 relay aircraft would be outfitted with computerized UHF switching equipment to serve as ground-air-ground digital data links. This improved airborne capability would also become available by December 1963.

Package "C" involved the construction of a single (rather than multiple) deep underground support center for the airborne command post, to become operational in 1965. The center, constructed 3,500 feet below ground level, would contain 20,000 square feet of operational floor space and cost approximately $54 million. In briefing OSD officials on Package "C," the Air Force explained that it was impractical to get all the people and equipment needed to support strategic operations into the airborne command posts. Therefore, the Air Force proposed to augment the airborne system with a single "very deep" and "super hard" ground facility.[4]

On 19 November 1961 Secretary McNamara tentatively approved the above plan and authorized the Air Force to proceed with packages "A" and "B." He also approved the start of planning, design, and site selection and acquisition of the underground center.[5]

The Deep Underground Support Center

During the next 12 months Air Force officials became deeply enmeshed in almost continual studies and implementing actions aimed at development of the deep underground support center (DUSC). Initially, because SAC representatives had seemed lukewarm to the idea of going underground, Headquarters USAF requested an official position from the command. On 13 December 1961 CINCSAC responded that he not only strongly supported construction of the deep underground center, but he also desired to use a train as an interim facility pending its completion.[6]

SAC's interest in the DUSC had in fact increased so much that it became necessary to double its planned size to 40,000 square feet to handle new functions to be performed there. In response to a Headquarters USAF expression of concern over this change in plans, with its accompanying increased costs, CINCSAC reported on 18 January 1962 that he had given careful consideration to both the economic factors and operational requirements in developing the larger configuration. He assured the Air Staff that the project would remain under continual review. CINCSAC further reported that a site near Pawnee City, Nebraska, about 75 miles from Offutt AFB, appeared to offer realistic answers to the technical, economic, and operational considerations.[7]

On 20 February, during a SAC-USAF-OSD conference at Offutt, officials agreed to accelerate DUSC as much as possible, and in the following month SAC presented its plan to Headquarters USAF. It proposed

the construction of a 40,000-square-foot facility near Pawnee City, to accommodate 213 people that could operate up to 30 days in complete isolation. Being located at a depth of 3,500 feet would provide protection against the effects of direct hits by 100-megaton weapons. Although the Systems Review Board approved the plan in April 1962, at a subsequent meeting of USAF, SAC, AFSC, and OSD officials it was agreed that the Air Force should follow a cautious "evolutionary" approach in developing the underground center.[8]

While the Air Force compiled detailed data and final cost estimates on the center, Secretary Zuckert recommended to Secretary McNamara on 29 April that DOD obtain congressional authorization in fiscal year 1963 appropriations to permit land acquisition. Secretary Zuckert made his request only a day before the entire project took a new turn--as a result of a negative Air Force Council (AFC) position. During its meeting on 20 April, the council expressed skepticism over the basic DUSC concept. It believed that the facility might well survive an attack from current nuclear weapons, but there was no assurance that the center could survive oncoming weapons such as penetration types. The council also suggested that it might be unwise to make the Air Force strategic response dependent upon one fortified place. In thus challenging the concept from both a survivability and strategic standpoint, AFC asked that the whole problem be restudied.[9]

As a result of the council's stand, the Vice Chief of Staff established an ad hoc group within the Air Staff to review the center

and to examine alternate proposals. He declared that "due to the active interest of OSD in this subject," the group's conclusions and recommendations were required as soon as possible. Dr. McMillan seconded the need for prompt action, pointing out to General LeMay on 20 June that "one year after the inception of this program, the Air Force is unable to report firm decisions about what it intends to do." It was imperative, McMillan said, that the Air Force submit by 31 July "a valid plan for a PACCS, a plan firm enough in content that a clear course of action can be defined towards its accomplishment."[10]

The ad hoc study group began its review in late June 1962. Among the alternatives it considered were the use of mines, ships, submarines, blimps, trucks, and C-130's. On 19 July the group filed its report, recommending that the Air Force proceed with construction of the underground center as previously planned. It further recommended that to save both construction money and time the Air Force should take advantage of excavations already extant in a deep mine which had been located near Cripple Creek, Colorado.[11]

General LeMay on 24 July approved the group's recommendation to proceed with construction of a DUSC. However, the question of where to locate it remained unresolved since SAC felt that the Cripple Creek site (800 miles from Offutt) was too far away to be operationally practical. SAC reaffirmed its previous selection of the Pawnee City location. Since SAC was the user command, its requirements could not be ignored and it became necessary to undertake a new site study.[12]

In the meantime, to satisfy OSD's requirement for a status report, the Air Force on 25 July made a presentation on PACCS to Dr. Brown, who accepted it both "conceptually and in substance." This presentation, in summary, reaffirmed previous agreements between the Air Force and OSD that the wartime command and control system would include the airborne command posts, relay communication aircraft, and the deep underground support center.[13]

As for the center's location, during September-October 1962 a special USAF panel chaired by an AFSC representative undertook to find a favorable solution. The panel re-examined the Cripple Creek and Pawnee City sites, plus a third proposed site--Offutt AFB. However, it quickly eliminated the last because of severe underground water conditions which would make construction extremely difficult and expensive. In the end, the panel took into account SAC's criticism of Cripple Creek's remote location and recommended the Pawnee City site. On 17 October the Systems Review Board approved this recommendation.[14]

However, Dr. McMillan--concerned over the rising cost estimates of the center and the slippage of its operational date from 1965 to 1969--continued to argue for the Cripple Creek site. In a memorandum to the Vice Chief of Staff, he claimed that it would save an estimated $22 million in construction costs and 15 months in time. General LeMay subsequently agreed that the importance of attaining a survivable system at the earliest possible date, plus the cost factors, outweighed the disadvantages of the distant location. On 14 November 1962 he approved constructing the DUSC at Cripple Creek.[15]

The final plan as it was adopted by the Air Force called for construction of the center at a depth of 4,500 feet. At such a depth it was expected to withstand the effects of an enemy attack employing 200-megaton dig-in weapons with a .5-nautical-mile CEP and would be able to operate in a completely sealed condition for nine weeks. Redundant hardened and dispersed antennas would provide communication survivability equal to that of the facility itself. The cost was estimated at $115 million. Secretary McNamara approved the Air Force plan "in principle" on 30 November and directed that a request for funds be included in the next budget.[16]

General Power Kills the DUSC Project

Although it appeared that the Air Force and OSD had made a final decision, SAC remained dissatisfied with the proposed location of the center. In early March 1963, during a conversation with the Secretary of Defense, General Power expressed his misgivings. McNamara immediately requested JCS to review the project, stating that he did not believe construction should be pursued further "until the Chiefs have had an opportunity to discuss the matter with General Power."[17]

This "cataclysmic" event startled Headquarters USAF, then at work on an up-dated version of the 481L proposed system program package. This work now came to a complete halt pending the outcome of the JCS review. On 11 March General Power met with JCS and explained his reservations about the existing plan. He said that if a requirement for the center existed, it should be built at Offutt AFB. Otherwise,

as an alternative, he preferred the use of long-endurance aircraft for the post-attack system.[18]

General Power's position effectively killed the entire DUSC project. On 16 April the Joint Chiefs reported to Secretary McNamara that the DUSC requirement could not be supported "at this time," and that the Air Force should not construct it. On 1 May 1963 McNamara directed the Air Force to halt all work and to inform pertinent congressional committees of the deferment until "the requirement can be more clearly defined."[19]

Meanwhile, the Air Force had directed AFSC to study the possible use of NORAD's Cheyenne mountain underground facility as an interim solution to meet SAC's needs and to look into the possibilities of long-endurance aircraft capable of 72-hour sorties. On 1 August, while these studies were in progress, SAC published a conceptual plan calling for an all-airborne post-attack system, and on 24 September it reaffirmed CINCSAC's position that there was no need for a deep underground facility. Whereupon, on 15 October 1963 OSD formally recalled all construction funds previously allocated for the DUSC.[20]

IV. THE MODIFIED PACCS

As noted earlier, the Strategic Air Command on 1 July 1960 began testing an airborne command post concept. Results were so encouraging that General White on 3 February 1961 directed continuous airborne command post operations. Three times daily thereafter, a KC-135 command post took off from Offutt AFB and flew a sortie of about eight and one-half hours. Besides the regular flight crew, a SAC general officer was aboard and served as the "airborne emergency action officer." He directed a team of six men including a communication controller, two duty controllers, and three radio operators. Each week two general officers from SAC's numbered air forces augmented SAC headquarters' general officers, thus providing a three-man rotating team for the position of airborne emergency action officer.[1]

SAC's concept for the post-attack system, presented as Packages "A" and "B" to OSD in October 1961 and approved by Secretary McNamara on 18 November, called for a KC-135A aircraft to be airborne at all times in the vicinity of Offutt. Similar aircraft from each of SAC's numbered air forces would be on stand-by--on 15-minute ground alert, with three others serving as alternates. When authorities declared a prescribed readiness condition, the three ground alert aircraft would take off and orbit their respective headquarters, while the alternates dispersed to predesignated refuge sites. Simultaneously, B-47 communication relay aircraft would take positions around the quadrangle

formed by the airborne "alternate CINCSAC" over Offutt and the aircraft over their respective headquarters. The Air Force believed that this network would provide a survivable UHF high data rate communication system for the post-attack command and control of the strategic air forces.[2]

Airborne Automation

Early in 1962, while refining its airborne command post operation, SAC recommended a delay in proceeding with the automation phase (Package "B") of the post-attack system pending completion of simulation tests. SAC's view at this time was that the proposed computer capability belonged more properly in the deep underground support center, then still under serious consideration. On 20 February Assistant Secretary McMillan met with General Power at Offutt AFB to discuss the matter (and related subjects), and they agreed to defer the mechanical or electrical aids program for the airborne command post "pending evolutionary development of requirements."[3]

This agreement, Secretary McMillan was to admit several months later, "had the unfortunate effect of stopping further R&D for the airborne command post." When this fact became evident, he urged the Air Staff to reactivate the automation development program. The Air Force Systems Command subsequently was directed to prepare a new development plan, which it completed on 4 October. The plan called for developing operational prototype automation equipment, as well as the procurement of 17 KC-135B's to replace the KC-135A's.

The Air Force incorporated these proposals into a revised program change proposal, which Secretary McNamara approved on 1 December 1962. In giving his approval, the Secretary of Defense directed the Air Force to submit within 60 days a new system concept and development plan for the overall revised PACCS program (which at this time still included the DUSC).[4]

Towards this end AFSC prepared a revised proposed system program package (completed 11 February 1963) that described the SAC post-attack command and control system in five phases:[5]

Phase I - Already in operation, this phase included 17 KC-135A's, plus 36 B-47 communication relay aircraft;

Phase II - Procurement of 17 KC-135B's with improved performance to replace the KC-135A's;

Phase III - Addition of two special support systems: an emergency rocket communication system and a survivable low frequency communication system;*

Phase IV - Construction of the deep underground support center;

Phase V - Development of advanced airborne command posts (automated KC-135B's).

Before the package could be sent to OSD, it became obsolete with the elimination of the DUSC project in early 1963. Consequently, on 25 April the Air Staff issued a program directive on the advanced airborne command post that would limit its development to off-the-shelf

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*See below, pp. 37-43.

components only. Headquarters USAF approved a plan to use the second KC-135B off the Boeing assembly line as the prototype aircraft. After the computer was installed, SAC would carry out operational testing, beginning about October 1965. Toward the end of 1963, however, the Air Staff again reviewed Phase V and decided it would be wiser to first test the operational equipment and concept in a ground-based environment before proceeding with the airborne tests. On this basis, Secretary Zuckert on 22 November halted procurement of the airborne computer.[6]

This change, plus the elimination of the DUSC, left the SAC post-attack command and control system at the end of 1963 consisting of 17 KC-135A airborne command posts and 36 B-47 communication relay aircraft. For the future, the first of the improved KC-135B's was due off the assembly lines early in 1964. In addition, the Air Force was developing the two special survivable communication support systems. Finally, the Air Force had under study a plan that would provide SAC's airborne command posts with a capability to launch any or all Minuteman ICBM's should ground-based launching facilities be disabled or destroyed by an enemy attack.*[7]

Survivable Communications

Top defense officials very early realized that command and control could not be separated from survivable communications. General Power expressed the relationship with notable clarity in January 1959.

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*On 30 December 1963 Headquarters USAF announced that system designator 481L would be cancelled effective 1 January 1964, and that a revised specific operational requirement would be issued.

"Without communications," he told a congressional committee, "all I command is my desk, and that is not a very lethal weapon." It was in the search for survivable communications to enable him to launch the strike force under conditions of a surprise enemy attack that led the Air Force to support development of the emergency rocket communication system (ERCS) and the survivable low frequency communication system (SLFCS). In addition to these projects, the Air Force also actively pursued a number of other developments aimed at improving existing communications or achieving new and improved ones.*[8]

The ERCS program had its origins in a SAC proposal submitted to Headquarters USAF in June 1959. After a lengthy period of study and evaluation, the Air Staff in June 1960 directed ARDC to undertake research and development of an "operational emergency rocket command control" system. During the summer months of 1960 ARDC established Project Tattletale, a test program to demonstrate the feasibility of the proposed system. Six test launchings were made at the Eglin Gulf Test Range, using Aerobee rockets that carried tiny transmitters aloft. These tests demonstrated that messages could be sent and received over long distances. During one test flight a transmitter successfully broadcast a tape-recorded message over UHF that was received over a distance of 1,400 miles.[9]

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*Two new systems added to the existing SAC communication network during 1961-1963 were a high frequency single sideband radio system and a remote UHF communication system (488L). Other more advanced projects under way included Project West Ford--the orbiting of small reflecting dipoles for worldwide communications--and two active communication satellite systems.

On the basis of the Tattletale results, General White approved the start of a development program for an emergency rocket communication system, using Blue Scout rockets, and on 29 September 1961 the Air Staff issued the specific operational requirement. It called for installation of three unattended missile sites near Offutt AFB by January 1964, and a fourth site by January 1965. These would provide CINCSAC with a positive alternate means of communications for sending the weapon expenditure "Go" authorization to the strike force flying up to 2,500 miles away, including that portion proceeding along the northern Chrome Dome route.*[10]

Early in 1962, in an effort to implement recommendations made by the Partridge task force,/ the Air Force reoriented the ERCS program to a "crash" basis to achieve an earlier 1963 initial operational capability. The revised program centered on three mobile launchers and control vans deployed in the Offutt AFB area about one year ahead of schedule. However, even while the Air Force accelerated the program and undertook to initiate Blue Scout flight tests (Project Beanstalk), it realized that the system would be incapable of communicating with SAC airborne alert forces flying the southern Chrome Dome route, since they required a communication range of up to 5,000 miles.[11]

The above changes created significant problems in the ERCS program during 1962. To resolve the southern Chrome Dome difficulties,

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*SAC Chrome Dome operations began on 6 November 1961. The northern route completely circumnavigated Canada, while the southern route ran between the western Mediterranean area and the southern United States.

/See page 14n.

AFSC and SAC undertook a new study during the summer months and concluded that it would be necessary to use Minuteman ICBM's rather than the Blue Scouts in order to obtain the required range. On 31 December 1962 SAC formally recommended to Headquarters USAF that the final ERCS include six Minuteman boosters to loft the communication packages.[12]

During the early weeks of 1963 the Air Staff reviewed the proposal and subsequently approved it as the final operational capability (FOC). The cost of the Blue Scout IOC program--which was continuing--was estimated at $34.4 million and that of the Minuteman FOC at $35.4 million. On 7 June 1963 Headquarters USAF issued a revised specific operational requirement to include Minuteman and redesignated the ERCS system as 494L. Secretary of Defense McNamara approved and agreed to fund four Minuteman test launches during fiscal years 1965 and 1966.[13]

Meanwhile, the Air Force achieved the Blue Scout initial operational capability in the Offutt AFB area in July 1963. The reliability of the system was considered doubtful, however, on the basis of results of the flight test program that had begun on 31 May 1962. Between that date and the end of 1963 only one of five Blue Scouts launched specifically to test the communication payload produced a satisfactory transmission period--17 minutes and 43.5 seconds. The other four tests produced transmission times ranging from 12.6 seconds to seven minutes and 36 seconds. Most of the failures were attributed to electrical problems. At the end of the year the Air Staff was reviewing the

"questionable reliability" of the Blue Scout emergency communication system.[14]

The second of the emergency support programs--a survivable low frequency communication system--was the outgrowth of feasibility tests conducted by the Air Force during 1959-1961. These tests demonstrated that it was technically possible to transmit LF energy for distances up to 1,500 miles from a trailing wire antenna. The importance of such low frequency transmissions was that they were only slightly degraded by disruptive ionospheric conditions, such as those caused by high-altitude nuclear explosions.[15]

In March 1961 General White approved development of SLFCS, and in September the Air Staff issued a specific operational requirement for the system, designated 487L. The SOR called for creation of a dispersed ground and airborne network to transmit a variety of missile status information, combat strike reports, and post-attack reconnaissance data that would enable SAC and JCS to make decisions and transmit "Go" authorizations to the strategic forces. All airborne command posts, Headquarters SAC, its numbered Air Force headquarters, NORAD, and JCS would have LF receiving and transmission facilities. SAC missile launch control centers and air base control rooms would have receiving facilities only.[16]

During 1962, while AFSC conducted extensive testing of both ground and airborne equipment, operating over 27 to 60 kilocycles, the Air Force asked OSD to release $64 million for construction, procurement, operation, and maintenance of a fully operational ground

system (to include 250 receiving installations). In June 1962 OSD disapproved the request "without prejudice," pending further study and development. The Air Force was authorized to continue such activities as testing ground transmitter coverage and the airborne trailing wire (approximately 10,000 feet in length) at lower frequencies in the LF/VLF spectrum.[17]

In August a problem arose over the compatibility of 487L and a very low frequency system that the Navy had under way to provide emergency communications with the Polaris fleet. In order to achieve proper coordination of the two, the Air Force and Navy undertook a special compatibility study which they completed on 31 October 1962. On the basis of this study, JCS recommended that the Air Force proceed with its program but "procure equipment of suitable size and cost that is operationally compatible with the Navy's modulation program." Secretary McNamara approved this recommendation on 26 June 1963 and instructed the Air Force to expand its system receiver frequency limits to cover the range between 14 and 60 kilocycles.[18]

During the summer and fall of 1963, while the trailing wire antenna and LF radio equipment were being installed in a test aircraft, several new difficulties arose that led the Air Force to restudy the original SLFCS requirement. For example, it discovered that a suitable cryptographic system compatible with both USAF and Navy LF/VLF equipment was beyond the current state of the art and was not expected to be available until 1966 or later. In addition, there were questions on the number of redundant ground sites required, and the broad possible redundancy of

coverage between the LF system and the PACCS airborne UHF relay system. Because these problems remained unresolved, OSD in November 1963 limited USAF procurement of LF transmitters to five.[19]

Concurrently, Headquarters USAF directed AFSC to restudy these matters, and on 3 December 1963 General LeMay called for a complete "revalidation" of the low frequency communications system. However, he emphasized that there still was "a firm requirement for a survivable communications system to fill the vulnerability gap" in the existing SAC command and control system.[20]

The National Emergency Airborne Command Post

Besides PACCS and the emergency communication projects related to it, during 1961-1962 a separate requirement was levied upon the Air Force to provide a national emergency airborne command post (NEACP) to serve the President and other national authorities. The request originated in a proposal made to JCS on 26 January 1961 by General White. The plan presented by the Air Force called for basing the NEACP aircraft at Andrews AFB, with operational control exercised by the Director of Operations, Headquarters USAF.[21]

JCS and OSD approved the Air Force proposal, and in December 1961 SAC was directed to provide one of its KC-135A's to initiate the operation. In February 1962 SAC delivered the KC-135 to Andrews where it assumed a 15-minute strip alert on 1 March. Under emergency conditions, it would serve the President and other national authorities and enable them to communicate with CINCSAC and other key commanders.

Early in 1962 three additional KC-135's were requisitioned from SAC for the NEACP mission. They replaced the original NEACP aircraft and assumed an alert posture on 20 July, and became an important element in the development of a DOD worldwide national military command and control system.*22

*Other major components of the worldwide system include the National Military Command Center (NMCC) in the Pentagon; the Alternate National Military Command Center (ANMCC), Fort Ritchie, Maryland; the National Emergency Command Post Afloat (NECPA); the various unified or specified command systems, such as SAC's 465L and NORAD's 425L; and several DOD survivable communication programs.

V. SUMMARY AND EPILOGUE

During the 1950's, long before the era of the ICBM, the Air Force became aware that SAC's command and control machinery was lagging dangerously behind requirements. Fortunately, at the time that the problem appeared, U.S. technology had reached a stage where it was able to provide new and improved electronic devices and modern high speed automatic and semi-automatic communication systems to assist in the control function. In the spring of 1957 a computer was installed in the SAC underground control center and quickly demonstrated its usefulness, and in 1958 the Air Force initiated development of a new automated command and control system (465L).

Following the inauguration of the Kennedy administration in January 1961, the 465L system underwent review and was reoriented to a peacetime configuration because it lacked adequate survivability features. At the same time OSD and the Air Force agreed to proceed with development of a new survivable post-attack system consisting of airborne and underground elements. During 1961-1962 the Air Force expended a considerable effort in studying the construction of a deep underground support center. However, that portion of PACCS was killed in early 1963 as a consequence of CINCSAC opposition.

Following this action and other major changes, PACCS at the end of 1963 consisted of 17 KC-135A airborne command posts and 36 B-47 communication relay aircraft. In addition, an emergency rocket communication system using Blue Scout rockets achieved a limited

operational capability in July 1963, although its reliability was questionable. Planned improvements for PACCS included acquisition of 17 improved KC-135's; the use of Minuteman ICBM boosters in place of the Blue Scouts for the final ERCS; the addition of a low frequency communication system; and development of automation for the airborne command posts.

The six-year USAF effort to develop the two SAC command and control systems was carried out under the closest scrutiny of OSD. One of the latter's early complaints--that the 465L system could not survive an enemy nuclear attack--eventually led to the post-attack project. USAF planners were not unaware of this weakness; however, because of the high costs of hardening the system (including the soft communications that supported it) and other economy factors, the Air Force did not push the matter until the Kennedy administration indicated that it would provide the necessary funding.[1]

On the other hand, the Air Force was in a much more vulnerable position on 465L costs. In August 1963 the Support Systems Panel of the Air Staff Board recognized the problem when it declared flatly that past Air Force estimates had been unreliable. Admittedly, there were several reasons for this, primarily changes in system concept, scope, and capability, but the panel also noted that in many instances dollar requirements had been presented to the Air Staff as "cost increases," a euphemistic way of saying they had not been properly estimated in the first place. The panel agreed that industry had contributed greatly to the costing inaccuracies, but it aptly added

that the ultimate responsibility had rested with the Air Force "to make a thorough validation of cost estimates before using them as a program base."[2]

Originally estimated at $138 million and with an acquisition period of 33 months, the cost of the 465L system eventually ballooned to $317.9 million some 63 months later. And the system was still far from achieving the intended complete operational capability. Because of this poor record, the Assistant Secretary of the Air Force for Research and Development, Alexander H. Flax, in August 1963 reluctantly concluded "that the concepts used in the past to acquire the system appear unable to cope with the technical difficulties and subtleties inherent in the development of this command and control system."[3]

OSD was blunter in its criticism of the Air Force acquisition approach. The Deputy Director for Research and Engineering, Dr. Eugene G. Fubini, pointed out that the services had employed the same techniques and given the same treatment to command and control systems as they had to weapon systems. This approach, he maintained, was wrong because the former were "very different" from weapon systems, requiring a very close and continuing relationship between the commander of the using command and the development agency. Dr. Fubini suggested that the developer should perform the role of an architect, interpreting the needs of the commander, advising him of what was possible, and helping him to evolve a system adapted to the needs of his command. "The developer," he said,"...must have a closer and

more intimate interface with the user than is the case in the acquisition of a weapons system."[4]

To alleviate these shortcomings and improve acquisition techniques and management procedures in the command and control area, Deputy Secretary of Defense Gilpatric in October 1963 issued an important new policy directive that greatly increased the responsibilities of the user commands. Under its provisions, the unified and specified commands would establish and submit to JCS and OSD their operational requirements for command and control systems; participate in the formulation of system design, performance, and specifications as well as in engineering, management, procurement, facility construction, and installation planning; and review design and performance specifications and the principal engineering, management, and procurement plans and schedules proposed by their service headquarters--before initial contracts were negotiated or before amendments were made to current contracts.[5]

In support of these major procedural revisions, OSD requested the three service secretaries to notify their subordinate commands of the new policy and to undertake "whatever modifications of management relationships may be required." At the end of 1963, Headquarters USAF and the Air Force Systems Command were carefully examining existing management and command and control system acquisition procedures, in order to carry out fully the terms of the new OSD policy.[6]

NOTES

(The bulk of the documents cited below are located in the Record Branch files of the Directorate of Plans, Headquarters USAF, and in the files of the Secretary of the Air Force. Other key documents were located in the files of the Air Staff Board and the Deputy Chiefs of Staff for Programs and Requirements and for Systems and Logistics.)

CHAPTER I

1. Briefing by Col. E.D. Wooten, D/Opl Rqmts, in Rpt of Weapons Board Mtg 61-7, 25 Jan 61, subj: System 465L Hardening Requirements.

2. Ltr, M/G F.H. Griswold, VCINCSAC, to D/Rqmts, 17 Dec 54, subj: SAC Control Center Rqmts, in OSAF 153-63; rpt, Current Command and Control Systems, by Mitre Corp., 14 Jul 61, p 23, in OSAF 507-61.

3. Ltr, VCINCSAC to D/Opl Rqmts, 31 May 60, subj: SAC Control System, 465L, in OSAF 153-63.

4. Rpt, A Study of Changes During the 465L (SACCS) Acquisition Program, 1958-1963, by Logistics Management Institute (LMI), n.d., p 7, in OSAF 153-63; Hist, D/R&D, Jan-Jun 58, pp 53-54.

5. Ltr, Col. R.S. Carter, 465L ESSPO, ARDC, to D/CE, 14 Aug 58, subj: Comm Opl Concept, in OSAF 153-63.

6. AFC Decision 6/540, 15 Sep 58, subj: System 465L Source Selection; LMI Rpt, p 7.

7. Hist, D/R&D, Jul-Dec 58, pp 139-41.

8. Ibid.; LMI Rpt, p 10.

9. LMI Rpt, pp 11-12.

10. Hist, D/R&D, Jul-Dec 59, p 26.

11. Hist, SAC, 1960, p 43.

12. Msg 80147, CSAF to SAC, 23 Mar 60; msg 86902, CSAF to SAC/ARDC, 18 Apr 60; msg 95463, CSAF to SAC, 19 May 60; msg 97868, CSAF to SAC, 27 May 60.

13. Ltr, VCINCSAC to D/Opl Rqmts, 31 May 60; LMI Rpt, p 13.

14. Memo, D.C. Perkins, ASAF(RD) to CSAF, 9 Nov 60, subj: SAC Control System, in OSAF 386-60.

15. Hist, D/Aerospace Sys Div, Jul-Dec 60, pp 89-92.

16. Memo, D.C. Perkins, ASAF(RD) to DCS/D, 28 Dec 60, subj: Command and Control Developments, in OSAF 165-60.

17. Final Rpt, Winter Study Group, 15 Sep 60, p 12, in OSAF 165-60; ltr, D.C. Sharp, SAF to Dr. A.G. Hill, M.I.T., 12 Jan 60, in OSAF 165-62.

18. See note above.

19. Gen. T.S. Power, "SAC and the Ballistic Missile," in The United States Air Force Report on the Ballistic Missile, K.F. Gantz, ed. (New York, 1958), p 180.

20. Rpt, Weapons Board Mtg 61-7, 25 Jan 61; Hist, D/Ops, Jul-Dec 59, pp 82-83.

21. Minutes, Strategic Air Panel, 2 Feb 61, subj: 465L COC, p 4.

22. Statement by B/G G.H. Austin in House Hearings before Subcomte of the Cmte on Appropriations, 87th Cong, 1st Sess, DOD Appropriations for 1962, Part V, p 495; Current Status Presn, D/Mgt Anal, 3 Mar 61, p 21, in AFCHO files.

23. Msg 71280, CSAF to 480L ESSPO, SAC, AFBMD, 21 Jul 60; Rpt of Systems Review Board Mtg 62-38, 25 Apr 62, subj: SAC General Concept and Plan of Operations; AFC Decision 15/56, 31 Mar 61, subj: Survivable Communications; Hist, SAC 1961, p 37.

24. Ltr, Gen. T.D. White, CSAF to CINCSAC, 1 Feb 61; Hist, SAC, 1961, p 37; AFC Decision 15/56, 31 Mar 61.

25. N.Y. Times, 29 Mar 61.

26. Statement by R.S. McNamara, SOD, in Senate Hearings before Subcmte of the Cmte on Appropriations, 87th Cong, 1st Sess, DOD Appropriations for 1962, p 5.

CHAPTER II

1. Memo, McNamara to Secs of Mil Depts, et al., 8 Mar 61, subj: Assignment of Projects Within DOD; ltr, D/Plans to Chmn, JCCDG, 21 Mar 61, subj: Project No. 6, in D/Plans RL(61)27-5(3).

2. Rpt, Command and Control, by DDR&E, 19 Apr 61, in D/Plans RL(61)27-5(4).

3. Ibid.

4. Memo, J.V. Charyk, U/SAF, to E.M. Zuckert, SAF, 8 May 61, in Rpt of Systems Review Board Mtg 61-22, 26 Sep 61, subj: SACCS/PACCS; AFC Decision 15/57, 23 May 61, subj: System 465L.

5. Msg 73794, CSAF to AFSC, 26 May 61; Memo, B. McMillan, ASAFRD, to CSAF, 27 Jun 61, subj: Configuration of System 465L; ltr, M/G J.R. Holzapple, Asst DCS/S&L to AFSC, 13 Jul 61, subj: SAC Control System, Post-Strike, in OSAF 1042-61.

6. Minutes, Strategic Air Panel, 27 Sep 61, subj: 465L Phasing and Funding Plan; Hist, D/Systems Acquisition, Jul-Dec 61, p 137.

7. Memo, McMillan to CSAF, 16 Oct 61, subj: SACCS Plan 11; ltr, M/G J.R. Holzapple, Asst DCS/S&L to ASAF(RD), 26 Oct 61, subj: SACCS Plan 11, in OSAF 1042-61; msg 77648, CSAF to AFSC/SAC, 9 Nov 61; memo, H. Davis, Dep/Res, ASAF(RD) to Dep SOD, 26 Oct 61, subj: Presentation on SAC Command and Control Systems, in OSAF 1042-61.

8. Memo, McNamara to Zuckert, 18 Nov 61, subj: SAC Command Control System, in OSAF 1042-61.

9. Ltr, Col. D.E. Riley, 465L Systo to AFSC, 18 Jan 62, subj: Redline Presto Rpt, in OSAF 437-62; USAF Status Rpt, Mar 62, pp 1-26; memo, Zuckert to Gen. C.E. LeMay, CSAF, 15 Mar 62, subj: New IOC Date for System 465L, in OSAF 437-62.

10. SAC Spl Summary on 465L, 12 Apr 63, in OSAF 153-63; Hist, D/Opl Rqmts, Jan-Jun 62, pp 77-78.

11. Msg ESSCL 9-11-41, ESD to AFSC, 9 Nov 62; msg 69909, CSAF to AFSC, 19 Jan 61.

12. SAC Spl Summary on 465L, 12 Apr 63; ltr, M/G J.R. Holzapple, Asst DCS/S&L to U/SAF, 23 Apr 63, subj: 465L Study, in OSAF 153-63.

13. Memo, J.S. Imirie, ASAF (Mat), to VC/S, 3 Apr 63, subj: L Systems, in Rpt, Air Staff Board Mtg 63-35, 7 Aug 63, subj: Final Rpt "L" Systems Review; ltr, M/G W.W. Momyer, D/Opl Rqmts to Opl Spt Div, 13 May 63, subj: Review of L Systems; Final Rpt, "L" Systems Review, Support Systems Panel of Air Staff Board, 1 Aug 63.

14. Msg 20893, CINCSAC to ESD, et al., 12 Apr 63; Hist, D/Prod, Jan-Jun 63, p 64.

15. Ltr, M/G J.R. Holzapple, D/Prod to U/SAF, 22 Apr 63, subj: Impact of Force Structure Changes on 465L, in OSAF 153-63.

16. Hist, D/Opl Rqmts, Jan-Jun 63, p 45; USAF Current Status Rpt, Feb 64, pp 1-27.

17. Ltr, Col. W.R. MacDonald, D/Opl Rqmts to Chmn, Air Staff Board, 3 Jun 63, subj: 465L PCP; Status Briefing, SAC Control System 465L, in Rpt of Air Staff Board Mtg 63-35, 7 Aug 63.

18. LMI Rpt, pp 2-3; memo, A.H. Flax, ASAF(RD) to Zuckert, 23 Aug 63, subj: Rpt on 465L, in OSAF 153-63.

19. Minutes, Strategic Air Panel, 19 Nov 63, subj: 465L and PACCS; USAF Current Status Rpt, Jan 64, pp 1-31.

20. Rpt of Air Staff Board Mtg 63-41, 11 Sep 63, subj: Plan for Realignment of 465L Within Budgetary Limitations (4 Sep 63).

21. Msg 96448, CSAF to SAC, AFSC, AFLC, 24 Sep 63.

22. Memo, McNamara to Zuckert, 8 Nov 63, subj: Completion of 465L Acquisition Phase, in OSAF 153-63.

23. Interview, Carl Berger with Mr. Richard Gilbert, 465L Project Officer, D/Prod, 30 Jan 64; USAF Current Status Rpt, Jan 64, pp 1-30; Hq USAF Daily Staff Digest No. 3, 7 Jan 64.

CHAPTER III

1. Memo, Charyk to Zuckert, 8 May 61; memo, McMillan to DDR&E, 27 Jun 61, subj: Configuration of System 465L; ltr, M/G J.R. Holzapple, Asst DCS/S&L to AFSC, 13 Jul 61, subj: SAC Control System, Post-Strike, in OSAF 1042-61.

2. Memo, R.L. Gilpatric, Dep SOD to Zuckert, 26 Aug 61, subj: SAC Command and Control Systems; memo, McMillan to CSAF, 30 Aug 61, subj: SAC Pre-Strike and Post-Attack Control Systems, in OSAF 1042-61.

3. Specific Operational Requirement for a SAC Post Attack Command Control System, No. 191, Hq USAF, 31 Aug 61, in OSAF 689-62.

4. Memo, Charyk to Gilpatric, 4 Oct 61, subj: SAC Command and Control Systems; memo, Davis to Gilpatric, 26 Oct 61, in OSAF 1042-61; Hist, D/Systems Acquisition, Jul-Dec 61, p 136.

5. Memo, McNamara to Zuckert, 18 Nov 61.

6. Hist, D/Systems Acquisition, Jul-Dec 61, pp 142-43.

7. Msg 90348, CSAF to SAC, 4 Jan 62; msg CS 1205, SAC to CSAF, 18 Jan 62.

8. Rpt of Systems Review Board Mtg 62-38, 25 Apr 62, subj: PACCS Implementation Plan; Hist, D/Systems Acquisition, Jan-Jun 62, p 137.

9. Memo, Zuckert to McNamara, 7 May 62, subj: Deep Underground Support Center, in OSAF 689-62; ltr, Gen. F.H. Smith, VC/S to DCS/O, et al., 8 May 62, subj: Post Attack Command and Control System, in D/Plans RL(62)24AFC.

10. Ltr, Smith to DCS/S&L, et al., 8 Jun 62, subj: Ad Hoc Group to Consider PACCS Questions, in D/Plans RL(62)24AFC; memo, McMillan to CSAF, 20 Jun 62, subj: PACCS, in OSAF 1297-62.

11. Rpt of PACCS/DUSC Ad Hoc Group Study Effort, 19 Jul 62, in D/Plans RL(62)24AFC.

12. AFC Decision 15/22, 24 Jul 62, subj: Rpt of the PACCS/DUSC Ad Hoc Group Study Effort, in D/Plans RL(62)24AFC.

13. Ltr, M/G J.K. Hester, Asst VC/S to ASAF(RD), 7 Aug 62, subj: PACCS, in D/Plans RL(62)24AFC.

14. Rpt of Systems Review Board Mtg 62-82, 17 Oct 62, subj: PACCS Siting; ltr, D/Plans to DCS/P, 31 Oct 62, subj: AFC 15/122A PACCS/DUSC, in D/Plans RL(62)24AFC.

15. Memo, McMillan to VC/S, 24 Aug 62, subj: PACCS; Rpt of Systems Review Board Mtg 62-82, 17 Oct 62, subj: PACCS Siting; AFC Decision 15/122A, 15 Nov 62, subj: PACCS/DUSC, in D/Plans RL(62)24AFC.

16. Memo, McMillan to DDR&E, 25 Oct 62, subj: Design Authority for DUSC/PACCS; memo, D/CE to Asst SOD(I&L), 17 Dec 62, subj: Design Responsibility for DUSC, in OSAF 689-62; Hist, D/Plans, Jan-Jun 62, p 280.

17. Memo, McNamara to Chmn, JCS, 6 Mar 63, in OSAF 183-63.

18. Memo, Davis to Zuckert, 22 Mar 63, subj: PACCS Rpt for 15 Mar 63, in OSAF 183-63.

19. Memo, JCS to SOD, 16 Apr 63, subj: Deep Underground Hqs for SAC, in D/Plans RL(63)27-5; memo, McNamara to Zuckert, 1 May 63, subj: Deep Underground Hqs for SAC, in OSAF 183-63.

20. Rpt of Air Force Board Mtg 63-35, 27 Mar 63, subj: PACCS; JCS 2308/191, Encl B, 13 Apr 63, in D/Plans RL(63)27-5; Hist, D/Comd Control & Comm, Jul-Dec 63, pp 106-7; USAF Current Status Rpt, Jan 63, pp 1-33.

CHAPTER IV

1. Hist, SAC, 1961, p 37.

2. Memo, Davis to Dep SOD, 26 Oct 61.

3. Rpt of Systems Review Board Mtg 62-38, 25 Apr 62; Memo for Record by B. McMillan, ASAF(RD), 1 Mar 62, subj: Recapitulation on PACCS Understanding, in OSAF 689-62.

4. Memo, McMillan to Zuckert, 23 Oct 62, subj: PACCS Rpt for Oct 62, in OSAF 689-62; Hist, D/Advanced Engr, Jul-Dec 62, pp 42-43.

5. Proposed System Package Plan for PACCS, System 481L, 11 Feb 63; ltr, M/G J.R. Holzapple, D/Prod to AFSC, et al., 25 Apr 63, subj: System Program Directive on SAC PACCS, in OSAF 183-63.

6. Ltr, Holzapple to AFSC, et al., 25 Apr 63; memo, Davis to Zuckert, 21 Jun 63, subj: PACCS Rpt for 15 Jun 63; ltr M/G R.D. Curtin, D/Dev to ASAF(RD), 13 Aug 63, subj: Automated Airborne Command and Control, in OSAF 183-63; Hist, D/Dev, Jul-Dec 63, p 36.

7. Ltr, D/Prod to AFSC, 13 Sep 63, subj: Airborne Launch Control for Minuteman; msg 72061, CSAF to AFSC, 19 Nov 63.

8. Statement by Gen. T.S. Power in Joint Hearings before Preparedness Investigating Subcmte of Cmte on Armed Services and Cmte on Aeronautical and Space Sciences, 86th Cong, 1st Sess, Missile and Space Activities, p 13.

9. Msg 71280, CSAF to 480L ESSPO, et al., 21 Jul 60; Hist, SAC, 1960, pp 33-34; AFSC Annual Progress Rpt, 1961, pp 48-49; Aeronautics, Oct 60, p 13.

10. AFC Decision 15/56, 31 Mar 61, subj: Survivable Communications; Rpt of Systems Review Board Mtg 61-10, 23 Aug 61, subj: Emergency Rocket System SOR; Specific Opl Rqmt for an Emergency Rocket Comm System, No. 192, 29 Sep 61.

11. Minutes, Support Systems Panel, 28 Nov 62, subj: ERCS Presentation; ltr, D/Opl Rqmts to Chmn, Systems Review Board, 8 Jan 63, subj: Background on Proposed Change to ERCS Program, in Support Systems Panel files.

12. Msg 10222, CINCSAC to CSAF, 31 Dec 62.

13. Minutes, Joint Meeting of Support Systems and Strategic Air Panels, 22 May 63, subj: ERCS Program; memo, M/G R.J. Friedman, D/Aerospace Programs to SAF, 21 Nov 63, subj: Acknowledgement of Format B, UHF Rocket Comm System (ERCS); Hist, D/Comd Control & Comm, Jul-Dec 63, p 95.

14. Minutes, Air Comm Working Group Mtg, 15 Jan 64, subj: ERCS Review, in Support Systems Panel files.

15. Hist and Progress, AFCRL, Jan 61-Jun 62, pp 68-69.

16. AFC Decision 15/56, 31 Mar 61, subj: Survivable Communications; Specific Opl Rqmt for a Survivable Low Frequency Comm System, No. 193, 29 Sep 61, in Support Systems Panel files.

17. Memo, Gilpatric to Zuckert, 21 Jun 62, subj: LF Radio System, in OSAF 203-62; memo, DDR&E to Chmn, JCS, 4 Aug 62, subj: NMCS, in D/Plans RL(62)27-5(1); Hist, D/Comd Control & Comm, Jul-Dec 62, p 60.

18. Memo for Record by D/Plans, Nov 62, subj: Compatibility Study of VLF/LF Program, in D/Plans RL(62)27-5(8); memo, JCS to SOD, 13 May 63, subj: VLF/LF Utilization and Compatibility Rqmts; memo, McNamara to Zuckert, et al., 26 Jun 63, subj: VLF/LF Compatibility, in D/Plans 48-63.

19. Ltr, D/Opl Rqmts to SAF, 12 Nov 63, subj: SAF Directive No. 15, in Support Systems Panel files; memo, M.E. Curts, D/Telecom Policy, OSD, to ASAF(Mat), 7 Nov 63, subj: Program Objective for Survivable Low Frequency System, in OSAF 48-63.

20. Rpt of Air Staff Board Mtg 63-51, 13 Nov 63, subj: Revalidation of 487L Program; AFC Decision 8/41, 3 Dec 63, subj: Revalidation of the Survivable Low Frequency Comm System, 487L, in Support Systems Panel files.

SECRET

21. Memo, Gen. T.D. White, CSAF to JCS, 26 Jan 61, subj: NEACP; JCS to Chmn, JCCSG, 24 Oct 61, subj: Opl Concepts and Manning for Mobile National Emergency Command Posts, in D/Plans RL(61)27-5.

22. Memo for Record by L/C J.W. Hanley, 17 Jan 62, subj: Action on DJSM 1535-61, in D/Plans RL(62)27-5(1); USAF Program Guidance (PG-65-1), Jan 63, pp 111-15; Chief of Staff Policy Book, 1963, Item 13-61, 30 Nov 62.

CHAPTER V

1. Chief of Staff Policy Book, 1962, Item 12-5, 29 Dec 61.

2. Final Rpt, "L" System Review by the Support Systems Panel, Air Staff Board, 1 Aug 63, p 10, in Rpt of Air Staff Board Mtg 63-35, 7 Aug 63, subj: "L" Systems Review.

3. Memo, A.H. Flax, ASAF(RD) to Zuckert, 23 Aug 63, subj: Rpt on 465L, in OSAF 153-63.

4. Memo for Record by B/G J.W. O'Neill, ODDR&E, 14 Feb 64, in D/Plans (Col. C.L. Nicholson).

5. Memo, Gilpatric to Secs of Mil Depts, et al., 26 Oct 63, subj: Development, Acquisition, and Operation of the Command and Control Systems of the Unified and Specified Commands, in JCS 2308/241, 1 Nov 63.

6. Interview, Carl Berger with Col. C.L. Nicholson, D/Plans, 16 Mar 64.

G L O S S A R Y

AFC	Air Force Council
AFCRL	Air Force Cambridge Research Laboratories
AFLC	Air Force Logistics Command
AFSC	Air Force Systems Command
ARDC	Air Research and Development Command
ASAF(Mat)	Assistant Secretary of the Air Force for Materiel
ASAF(RD)	Assistant Secretary of the Air Force for Research and Development
Chmn	Chairman
CINCSAC	Commander-in-Chief, Strategic Air Command
COC	Complete Operational Capability
COC's	Combat Operations Centers
CSAF	Chief of Staff, USAF
D/CE	Directorate of Civil Engineering
DCS/S&L	Deputy Chief of Staff, Systems and Logistics
DDR&E	Directorate of Defense Research and Engineering
DOD	Department of Defense
D/Opl Rqmts	Directorate of Operational Requirements
DUSC	Deep Underground Support Center
EDTTC	Electronic Data Traffic Control Center
ERCS	Emergency Rocket Communication System
ESD	Electronic Systems Division
ESSPO	Electronic Supporting System Project Office
GOR	General Operational Requirement
IBM	International Business Machines
ICBM	Intercontinental Ballistic Missile
IEC	International Electric Corporation
IOC	Initial Operational Capability
IT&T	International Telephone and Telegraph Corporation
JCCDG	Joint Command and Control Development Group
JCS	Joint Chiefs of Staff
LF	Low Frequency
LMI	Logistics Management Institute
NEACP	National Emergency Airborne Command Post
NORAD	North American Air Defense Command
OSAF	Office, Secretary of the Air Force
PACCS	Post-Attack Command and Control System
PCP	Program Change Proposal
Presn	Presentation
PSPP	Proposed System Package Program
RCA	Radio Corporation of America
RCC	Remote Communication Complex
R&D	Research and Development

SAC	Strategic Air Command
SACCS	Strategic Air Command Control System
SAF	Secretary of the Air Force
SDC	Systems Development Corporation
SLFCS	Survivable Low Frequency Communications System
SOD	Secretary of Defense
SOR	Specific Operational Requirement
UHF	Ultra High Frequency
U/SAF	Under Secretary of the Air Force
VLF	Very Low Frequency
VCINCSAC	Vice Commander-in-Chief, Strategic Air Command
VC/S	Vice Chief of Staff
ZI	Zone of the Interior

APPENDIX 1

SAC COMMAND AND CONTROL SUBSYSTEMS (465L)*

Data Processing Subsystem (DPC)

The data processing subsystem consists of three FSQ-31 military computers and the necessary ancillary equipment to provide a completely automatic environment within the integrated framework and subsystems of system 465L. In its operation, the processing subsystem accepts, verifies, sorts, correlates, and stores incoming data; it compares these data with stored predetermined plans; and analyzes the data in the incoming messages in terms of the control of pertinent programs. Features of the data processing subsystem include instruction overlay capabilities, multiple index registers, direct address variable field length, error checking and reliability devices for 24 hour on-line operations, built-in automatic fault location and alarm circuits, and alternate means of data input during equipment failures. The first DPC was installed at Offutt during fiscal year 1963; the second was scheduled for installation at March AFB during fiscal year 1964; and the third at Offutt during fiscal year 1965.

Data Display Subsystem (DDC)

The data display subsystem provides static and dynamic information on a large scale and on demand, in a manner suitable for command

*Based on data contained in document PC 66-1, USAF Program Communications-Electronics, Dec 63, pp I-36 through I-39.

decision. The display is predominantly tabular in form (using alpha-numerical characters) augmented by graphic displays. Displays are flexible in design for rapid format changes. Each display accepts information from computers, switching centers (EDTCCs) and manual input stations. Equipment used, including quadrajector projection units, accepts processing information for immediate presentation without off-line storage. The quadrajectors contain electronic character generators and image plate transfer mechanisms which accept both automatic and manually operated inputs. Continuous error detection and correction means assure the accuracy of displayed data. Each display retains data on the last posted position in case of power failure or malfunction of automatic input. The first DDC was scheduled for installation at Offutt AFB in fiscal year 1964.

Data Transmission Subsystem (DTS)

The data transmission subsystem provides for an input/output device at all unit command posts and missile launch control centers and interconnects these devices with automatic switching centers (EDTCCs) to allow automatic transmittal of data between two points within the system without manual intervention. The data transmission subsystem is designed for manual operations at the rate of 2,400 bits per second with a degraded capability if required by line characteristics. It is secured with cryptographic equipment for transmission of classified material up to and including Top Secret. High reliability is achieved through a duplex hook-up between automatic switching centers. Major components of the DTS are listed below:

Electronic Data Traffic Control Center (EDTCC)

An automatic switching device, the EDTCC routes traffic from point-to-point within the data transmission subsystem as required. Each center includes duplexed input/output devices for local use.

Electronic Data Local Communications Console (EDLCC)

A duplexed input/output device, the EDLCC's are for use at SAC headquarters and at each of the three numbered Air Force headquarters. Two are required at each of these four locations to provide multiple ingress/egress to the EDTCC.

Remote Communications Complex (RCC)

The RCC's are duplexed input/output devices to be installed at the majority of SAC fixed installations as well as in the operations centers of other commands and agencies.

Simplex Remote Communications Complex (SRCC)

The SRCC is a simplex input/output device for use primarily at missile launch control centers designated as key control points.

Subscriber "A"

An input/output device of lesser capability than an RCC or SRCC, it is used in conjunction with one of these devices at locations in the vicinity of the RCC or SRCC where additional input/output access is required.

Subscriber "C"

This is an output device of lesser capability than the Subscriber "A," for use primarily within missile launch control centers other than "key" centers (in conjunction with the SRCC's located at the "key" centers).

APPENDIX 2

ESTIMATED COST OF 465L SYSTEM ACQUISITION*

(In millions of dollars)

Funds	Prior Years	FY 64	FY 65	FY 66	FY 67	FY 68	FY 69
O&M	29.4	49.0	59.2	56.3	55.8	55.9	55.9
R&D	86.0	4.6	1.4	0	0	0	0
Investment	202.5	57.0	15.7	1.3	0.2	0	0
TOTAL	$317.9	110.6	76.3	57.6	56.0	55.9	55.9

NOTE: O&M figures were added to system costs following a change in manpower bookkeeping, which transferred over 3,000 personnel to the 465L program from the base support element.

*Based on data furnished by Mr. Richard Gilbert, 465L Project Officer, Directorate of Production, Headquarters USAF.

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58.	AFRRP
59.	AFRST
60.	AFSDC
61.	AFSLP
62.	AFSMS
63.	AFSME
64.	AFSPP
65.	AFSSS
66.	AFSTP
67.	AFXDC
68-69.	AFXOP
70-72.	AFXPD
73.	AFTAC

MAJOR COMMANDS

74.	ACIC
75.	ADC
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78.	AFLC
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84-85.	ATC
86-87.	AU
88.	AFAFC
89.	AAC
90.	USAFSO
91-92.	CONAC
93.	HEDCOM
94-98.	MATS
99.	OAR
100-104.	PACAF
105-111.	SAC
112-116.	TAC
117.	USAFA
118-122.	USAFE
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OTHER

126-127.	ASI
128-132.	ASI(HAF)
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138-200.	AFCHO (Stock)