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SUPPORTING DOCUMENT NO. 1

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AGENDA

CONAD OPERATIONAL PLAN FOR NIKE AND AA GUNS

0830 - Room 231

15 December 1955

Explanation of Purpose of Meeting - Colonel L. G. McCollom

Organization of Working Group - Colonel L. G. McCollom

Guidance for Working Group & Time Schedule - Colonel L. G. McCollom

AA Weapons Control SACE Era - Colonel O. T. Malley, Jr.

AA Weapons Control Manual System - Colonel B. I. Mayo

Selection of Working Group Chairman - Colonel L. G. McCollom

Coffee Break

Open Discussion to Determine Approach to Problem

SUPPORTING DOCUMENT NO. 1

CONAD Operational Plan for NIKE & AA Guns
DCS/O CONAD 12 Dec 55

[illegible] USAF
[illegible] ADAMS

1. [illegible] referenced USAF letter AFOOP, Subject: (U) Weapons Control [illegible] dated 18 November 1955.

2. The Executive Agency of CONAD, USAF, has directed that a joint Operational Plan be developed for NIKE and AA guns. This headquarters replied to the referenced letter stating the plan would be completed by 1 February 1956.

3. The [illegible] of the plan will be in consonance with the operational concept of an integrated weapons system for CONAD, both in [illegible] Air Defense system as well as during the SAGE era.

4. In order to provide a capable working group, the best [illegible] available to the CONAD staff will be assigned to design the plan. The Army and Navy representatives to USAF sections, [illegible] representation of CONAD may require an augmentation of personnel to form the working group. You are requested to assign additional personnel, as required, to function as members of this group.

5. The initial meeting of the working group will be at 0830, 15 December 1955, in Room 231. The purpose of the initial meeting will be to form the group, determine complement of the group, and the method of approach. Colonel Loren G. McCollom, Director CONAD Plans and Requirements, will act as chairman at the first meeting.

t/s/ HUGH A. PARMER
Major General, USAF
DCS/Operations CONAD
Ext 2321-2322

COPY

1. Guidance for the Working Group.

A. Plan will be consistent with criteria established in "Weapons Control SAGE Era" briefing and USAF letter. (This will be guidance for portion of plan applicable to SAGE era.)

B. Rules of engagement must be revised to be consistent with operational concept.

C. Plan should be workable during todays operation, during the passing in of the SAGE system, and finally during SAGE era.

D. AF Commanders at all levels of Command must be located at same location as [illegible] by ADC and USN Commanders.

E. Plan will be concerned solely with operational aspects - not administrative or logistical problems.

F. Requirements for equipment will be dictated by operational concepts set down in final plan.

G. Working group will determine the extent of detail necessary to assure that plan will be workable.

2. Following is the time schedule to be followed by the group.

[illegible] progress report to General Parker.

[illegible] draft of plan for coordination in CONAD [illegible] 1955

[illegible] CONAD coordination completed by 16 January 1955.

[illegible] final plan 30 January 1955.

SUPPORTING DOCUMENT NO. 2

[illegible] ARMY ANTIAIRCRAFT COMMAND
[illegible]
[illegible]

[illegible]

SUBJECT: Integration of SAGE into CONAD Operations (U)

[illegible]

TO: Commander-in-Chief
Continental Air Defense Command
[illegible] Air Force [illegible]
Colorado Springs, Colorado

1. Receipt by CONAD headquarters of a USAF directive [illegible], "Weapon Control, SAGE Era", dated 18 November 1958, requires the preparation of a CONAD plan for the employment of NIKE and AA guns.

2. The directive furnishes detailed guide lines for the development of a plan which embody principles with which this headquarters has expressed disagreement in the past, since they operate to weaken the capability of the antiaircraft weapons available to this Command and are based largely on the employment of fighter interceptors and the TALOS missile. In the former instance, the principles of employment are not analogous to those for missiles. In the latter instance, the weapon is not operational nor is it presumably to be used in the local defense role where the attack is focused and freedom of action is important.

3. The basic USAF directive has been expanded locally in that the CONAD staff has been furnished additional "principles" to be followed in developing the plan. This guidance is of such a nature as to seriously and unfavorably affect the operational effectiveness of the Antiaircraft Command to an additional extent and I would be remiss if I did not advise you of the deleterious effects:

a. Despite the stated intent that the plan will not be concerned with administrative or logistical problems, a necessary requirement is that AA Commanders (at all levels of command) must be located at the same location as their counterparts to ADC and USN Commanders. This provision, which has

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[illegible]
Subject: Integration of SAGE into CONAD Operations

3. [illegible] far as centralized control of weapons is concerned, as is evident in the proposed procedures and antiaircraft weapons may not even be permitted to engage except at altitudes outside the capabilities of interceptors. In a large attack, centralized control systems tend to be saturated, and attacks may well be planned to effect such saturation. In such a contingency, under the proposed "principles", the great effectiveness of antiaircraft guided missile actions may be seriously curtailed, perhaps to the point of no engagement.

4. The general content of the USAF directive amplified by the locally promulgated principles affect doctrine, organization, deployment, logistical support, administration, and operations of this Command in such a fundamental manner that I believe this matter is one for consideration by other agencies of the Army charged with formulation of doctrine, determination of funding, research and development, provision of installations, logistical support, organization, deployment, tactical employment based on weapons techniques, and other basic functions of the Army. -

5. In my capacity as principal advisor to CINCONAD on tactics, techniques, and equipment to be employed by Army Antiaircraft [illegible] in support of the mission assigned to CINCONAD, I feel it necessary to state my considered opinion and advice in regard to these matters which are so basically concerned with the effectiveness of Army forces and Army weapons. I recommend that the principles to be employed by SAGE as advanced by ADC, which have been enlarged upon by the Chief of Staff, U. S. Air Force, and further prescribed by tentative CONAD principles, be reexamined with a view of permitting the employment of Army weapons in the functional manner contemplated by the JCS.

S. R. MICKELSEN
Lieutenant General, USA
Commanding

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Hq AA Comd, ADOAA 354.2, subj: Integration of SAGE into CONAD Operations (U)

Hq CONAD, 1st Ind (Cont'd)

[illegible]. When the two plans are completed, I intend to go into them in detail and decide on a final plan which may incorporate appropriate portions of the two documents. My objective is to end up with a single plan which, when implemented, will provide for the best possible air defense of this country.

3. I do not have a closed mind on exactly how our over-all system should be organized, equipped and operated. Further, I do not believe that we can put down on paper at this time all of the details of operation that will be required, say, in the SAGE time era. We can and must, however, decide on certain principles so that design, procurement and installation of equipment, training of people and manning of organizations can properly proceed. The details of operation will have to be worked out by personnel at the various operational levels as we proceed with the development of the air defense system.

E. E. PARTRIDGE
General, USAF
Commander-in-Chief

SUPPORTING DOCUMENT NO. 2

[illegible] (20 Dec 55) 2d Ind (C)
SUBJECT: Integration of SAGE Into CONAD Operations (U)

HEADQUARTERS, ARMY ANTIAIRCRAFT COMMAND, Ent Air Force Base, Colorado Springs, Colorado, 16 February 1956

TO: Commander-in-Chief, Continental Air Defense Command, Ent Air Force Base, Colorado Springs, Colorado

1. I am enclosing the concept for a CONAD Operational Plan which was developed under the criteria you directed in paragraph 2a, your 1st indorsement.

2. However, I am constrained to reiterate that a mode of operation which would integrate AA weapons into the SAGE [illegible] is not consistent with the principles of "Joint Action Armed Forces" in which, in the operation of a joint command, missions are assigned for execution by responsible component commanders. Under the terms of reference for CONAD, "operational control" of antiaircraft weapons is not provided for below the Air Division defense level. Furthermore, the Collins-Vandenberg Agreement also specifically stipulates that the control of antiaircraft fires will not be delegated below the Air Division level.

3. Maximum effectiveness of AA weapons can be obtained by their complementary use with interceptors as equal members of your air defense team. It can be expected that the ADC interceptors will meet the enemy first and by proper employment will have full opportunity to inflict maximum casualties upon the attackers before they come within range of AA weapons. At this latter time, the AA should have complete freedom to fire under the direction of officers who have the best knowledge of the local situation and the experience to direct that knowledge in the optimum manner. Early warning and target information from Air Force sources will enhance the effectiveness of AA weapons; detailed control will most certainly degrade it.

1 Incl
HQ ARADCOM Opr Plan for Employment of Army AA Wpns in Air Def of US

S. R. RICKELSEN
Lieutenant General, USA
Commanding

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[illegible] non-commercial circuits will be provided at all times [illegible] (1 [illegible] [illegible] by the [illegible] indicator). These key [illegible] the [illegible] Direction Center will inform that applicable target [illegible] forwarded to the [illegible].

[illegible] requirements. (Exclusive net frequencies to be provided in [illegible] including voice-grade circuits.)

(1) [illegible] Control Center - [illegible]

One full period, two-way voice link.

(2) [illegible] Direction Center - [illegible]

One full period, two-way voice link. (Talking line)

One full period, two-way voice link. (Liaison line)

One full period, two-way radio - voice link. (Darkey)

(3) [illegible] Control Center - Alternate [illegible]

One [illegible], two-way voice link.

(4) [illegible] Direction Center - Alternate [illegible]

One [illegible], two-way voice link.

6. [illegible] - [illegible] with the [illegible] System.

[illegible] - The [illegible] Direction System [illegible]-1 [illegible] be [illegible] in some [illegible] prior to the [illegible] date of the [illegible] the period when the [illegible]/FSS-1 system is [illegible] and [illegible], it is visualized that the [illegible] AN/[illegible]-1 system will [illegible] - designated AN/[illegible].

b. [illegible]. [illegible] personnel requirements [illegible] Direction [illegible] period as exist [illegible] Mode I. Duties of key personnel in the [illegible] and [illegible] will be the same as under Mode of Operation I - key [illegible] system with the [illegible] system.

c. [illegible]. [illegible] will be the same as Mode I.

d. [illegible] - [illegible] with the [illegible] System.

[illegible] Direction System AN/[illegible]-1 [illegible] calendar year 1958. Although [illegible] the AN/[illegible]-1 is

SECTION G DOCUMENT NO. 2

[illegible] period, it is expected that the AN/TPS-1 will be [illegible] in all ten (10) defenses, during the latter part of 1960 or early 1961.

b. Personnel and Their Duties.

(1) One liaison officer will be located in the SAGE sector control - [illegible] with duties as described under Mode II. See para 5b(1).

(2) The four personnel to be employed in the SAGE Direction Center during this mode of operation are:

1 Officer - Detachment Commander and representative on Wing Staff (AIOC)

1 Officer - Antiaircraft Representative per AIOC in SAGE subsector

1 EM - Antiaircraft Operator per AIOC in SAGE subsector

1 EM - Clerk and driver in support of this AA Detachment

Barracks personnel will be provided to insure that all of the above positions, with the exception of the Detachment Clerk, will be manned on a twenty-four hour day basis.

The Antiaircraft Operations Officer will be the adviser to the Air Defense Sector Commander and will represent the Antiaircraft Defense Command on Wing Staff. The Antiaircraft Representative is responsible for determining that the proper air surveillance information is sent to the AIOC. The Antiaircraft Operator will aid the Antiaircraft representative in his duties. The Antiaircraft Representative, may, at his discretion, delegate certain of his responsibilities to the Antiaircraft Operator.

c. Communications. (Equipment and frequencies to be provided in accordance with existing inter-service agreements.)

(1) SAGE Combat Center to each AN/TPS-1 in the Sector:

One full period, two-way voice link.

(2) SAGE Direction Center to each AN/TPS-1 in the Subsector:

One full period, one-way data link, 750/bits per second

One full period, one-way data link, 1300/bits per second

One full period, two-way voice link for status and situation

One full period, [illegible] link for teletype data control

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SUPPORTING DOCUMENT NO. 4

SUPPORTING DOCUMENT NO. 4

WILL SHOW YOU WHY IS IT THE ONLY HEADQUARTERS IN THE OVERALL DEFENSE SYSTEM WHICH DOES.

NEXT LET ME REVIEW BRIEFLY FOR YOU THE SAGE ORGANIZATION AS NOW PROGRAMMED. THE COUNTRY IS DIVIDED INTO 8 SECTORS, OUTLINED BY THE HEAVY RED LINES. EACH SECTOR IS THE AREA OF RESPONSIBILITY OF AN AIR DIVISION. ITS OPERATIONAL HEART IS THE SAGE COMBAT CENTER. OUTLINED BY THE BLUE LINES ARE 33 SUBSECTORS, THE AREAS OF RESPONSIBILITY OF AIR DEFENSE WINGS. THE OPERATIONAL HEART OF THE SUBSECTOR IS THE SAGE DIRECTION CENTER. WE SHALL GO INTO MORE DETAIL AS TO THE OPERATION OF COMBAT CENTERS AND DIRECTION CENTERS LATER. CONSTRUCTION OF THE REQUIRED FACILITIES AND EQUIPMENT IS PROCEEDING, AND THE FIRST SUB-SECTOR WILL BE OPERATIONAL IN MID-1957.

WHILE WE ARE LOOKING AT THIS SLIDE, I ASK YOU TO [illegible] THAT ISE LAND-BASED RADAR; OFF-SHORE [illegible] ON TEXAS TOWERS, PICKET SHIPS AND AIRCRAFT, AND [illegible] RADARS FOR LOW LEVEL COVERAGE ABROAD ARE TO BE FEEDING INPUTS TO THE COMPUTERS AT SAGE DIRECTION CENTERS, GIVING SOAD LOW TO VERY HIGH LEVEL SURVEILLANCE COVERAGE OVER THE UNITED STATES AND THE SEA AND LAND AREAS CONTIGUOUS TO US. CANADA, AS YOU KNOW, IS PLANNING

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A SUPERIOR OR AT LEAST COMPATIBLE SYSTEM.

END SLIDE

NOW LET'S LOOK AT A SINGLE SECTOR, THE 26TH. WITHIN THIS DIVISION AREA OF RESPONSIBILITY ARE 5 SUB-SECTORS, EACH WITH ITS SAGE DIRECTION CENTER. PRINCIPAL TARGET CITIES ARE SHOWN BY STARS. FOR AIR DEFENSE IN THESE SUB-SECTORS WE WILL HAVE DEPLOYED FIGHTER-INTERCEPTOR SQUADRONS; BOMARC AND/OR TALOS SQUADRONS; AND NIKE BATTALIONS.

OVERLAY

THIS OVERLAY SHOWS IN DARK RED THE 50 MILE RADIUS PROTECTED FOR THE NIKE B WEAPON FROM THE WEAPON SITE PLANNED FOR NEW YORK CITY. NOTE THAT THIS RADIUS EXTENDS INTO BOTH THE STEWART AND SYRACUSE SUB-SECTORS, INVOLVING A COORDINATION PROBLEM. THE LIGHT RED CIRCLE INDICATES THE SAME LEVEL COVERAGE OF THE FPS-6 RADAR, PROPOSED AS AN INDEPENDENT SURVEILLANCE ENGINEMENT FOR EACH NIKE DEFENSE BY THE ARMY. THIS IS A RELATIVELY SMALL CASE.

OVERLAY

THE RED CIRCLES SHOW NIKE COVERAGE WITHIN AND

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[illegible] AND THE NEW AIR DIVISION. [illegible] COORDINATION AND CONTROL PROBLEMS INVOLVED ARE EVIDENT. IF WE ADD THE EXTENDED SURVEILLANCE COVERAGE OF ARMY [illegible]'S THE CONFUSION WHICH COULD BE CREATED UNDER A SEPARATE CONTROL [illegible] THE SITUATION BECOMES APPARENT.

SLIDE

THIS SLIDE SHOWS SCHEMATICALLY THE CONAD PLAN FOR INTEGRATION OF AIR FORCE WEAPONS SYSTEMS, AND NAVY [illegible]. THE SAGE DIRECTION CENTER CONTROLS ALL WEAPONS AVAILABLE FOR AIR DEFENSE [illegible] WEAPONS ASSIGNMENT TO TARGETS AND [illegible] FLOW DIRECTLY [illegible] WEAPON SYSTEMS INVOLVED. ALLOCATION IS BASED ON A COMPLETE KNOWLEDGE OF THE AIR SITUATION OVER THE [illegible], AND THRU AUTOMATIC CROSS-TELLING, THE [illegible] ADJACENT SUB-SECTORS. EACH WEAPON SYSTEM CAN BE MATCHED TO TARGETS ACCORDING TO ITS CAPABILITIES AND LIMITATIONS. NOW FOR NIKE. (OVERLAY) THE ARMY PROPOSES THAT THE NIKE WEAPON BE [illegible] FROM THE REST OF THE [illegible] ANTI-AIRCRAFT OPERATIONS [illegible] DETECTION CENTER. [illegible] AND [illegible] FROM THE SAGE SYSTEM [illegible]

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OPERATIONAL CONTROL NOW EXTENDED TO THE DIVISION LEVEL BY CINC J.C.S. CENTER OF EXPER MGM. FROM THE DIRECTION CENTER LEVEL COORDINATED CONTROL WOULD BE EXTENDED BY THU APPROPRIATE SERVICE COMMANDERS - THE AACC WOULD BECOME AN INTEGRAL PART OF THE DIRECTION CENTER. A DETAILED PLAN FOR THE ACCOMPLISHMENT OF THIS CONCEPT WOULD BE SUBMITTED BY CINC CONAD IN THE NEAR FUTURE. A FAMILIAR QUESTION AS TO THE DIRECTION WE ARE TO FOLLOW IN THE FUTURE, YOU BLACK BOXES HAVE TO BE MATCHED, AND EACH GRAY BOXES HAVE TO BE FIT THE PROPER PROGRAM.

SUPPORTING DOCUMENT NO. 4

PART II

PRESENTATION OF OPERATIONS DEPUTIES OF JCS
21 FEBRUARY 1956
BY
COLONEL O. T. HOLLEY

GENTLEMEN, MY PURPOSE IS TO EXPLAIN, IN SOME DETAIL, THE CAPABILITIES OF THE SAGE SYSTEM; AND, IN PARTICULAR, ITS CAPABILITIES TO PROVIDE TARGET ASSIGNMENT ORDERS TO NIKE BATTERIES. THOSE WHO HAVE BEEN WORKING CLOSELY WITH THE SYSTEM ARE CONVINCED THAT IT OFFERS THE CAPABILITY TO INTEGRATE THE EFFECTIVENESS OF ALL AIR DEFENSE WEAPONS FOR THE FIRST TIME IN HISTORY.

CHART I.

THIS CHART SHOWS ALL OF THE COMPONENTS REQUIRED IN A COMPLETE AIR DEFENSE SYSTEM. THE COLORED BLOCKS DEPICT THE MAJOR COMPONENTS OF THE SAGE SYSTEM. BY USE OF LARGE ELECTRONIC DIGITAL COMPUTERS FOR HIGH SPEED AND VOLUME DATA PROCESSING, THE SAGE SYSTEM WILL PROVIDE OUR AIR DEFENSE COMMANDERS WITH THE MASS OF INFORMATION NEEDED TO ASSESS THE ATTACK SITUATION AND MAKE THE NECESSARY DECISIONS [illegible] COMMITMENT AND EMPLOYMENT OF WEAPONS.

THE COMBAT CENTER, SHOWN IN YELLOW, IS THE OPERATIONAL FACILITY FROM WHICH THE JOINT AIR DIVISION COMMANDER

SUPPORTING DOCUMENT NO. 4

SUPERVISES AND DIRECTS THE SEVERAL DIRECTION CENTERS WITHIN HIS ASSIGNED SECTOR OF RESPONSIBILITY. HERE, THE AIR PICTURE OF THE BATTLE IS SUMMARIZED, CONDENSED, AND IS AVAILABLE FOR DETAILED ANALYSIS AS AUTOMATICALLY PROVIDED FROM DIRECTION CENTERS. AN AN/FSQ-6, DIGITAL COMPUTER, AND ASSOCIATED DISPLAY EQUIPMENT, ALONG WITH THE MILITARY PERSONNEL OF THE OPERATING CREWS, MAKE UP THIS FACILITY.

IT IS AT THE DIRECTION CENTER THAT THE ACTUAL AIR BATTLE WILL BE FOUGHT. THIS IS THE HEART OF THE SAGE SYSTEM. THE AIR DEFENSE WING COMMANDER, HIS STAFF, OPERATING CREWS, AND THE AN/FSQ-7 DIGITAL COMPUTER MAKE UP THIS DIRECTION CENTER FACILITY.

THE DIRECTION CENTER ACCEPTS INFORMATION OF VARIED NATURE FROM MANY SOURCES, AS SHOWN ON THE LEFT OF THE CHART. THE INFORMATION IS INSERTED INTO THE COMPUTER EITHER AUTOMATICALLY OR MANUALLY, AS APPROPRIATE. THE COMPUTER THEN SORTS THE INFORMATION FOR STORAGE, OR PROCESSES IT FOR DISPLAY AND ACTION AS DIRECTED BY ITS COMPUTER PROGRAM - ITS STANDING OPERATING PROCEDURE.

UPON DIRECTION FROM THE OPERATING PERSONNEL, THE DIRECTION CENTER CARRIES OUT THE REQUIRED DUTIES TO MAKE THE ACTION COMPLETE. FOR EXAMPLE, MID-COURSE GUIDANCE ORDERS

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ARE GENERATED FOR INTERCEPTORS TO REACH THEIR ASSIGNED TARGETS. LIKEWISE, ASSIGNED TARGETS CAN BE FURNISHED DIRECTLY TO WEAPONS HAVING GROUND-BASED FIRE CONTROL SYSTEMS, SUCH AS NIKE AND TALOS.

THE DIRECTION CENTER IS CAPABLE OF MAINTAINING 400 TARGET TRACKS SIMULTANEOUSLY. AS MANY AS 20 OF THESE TRACKS MAY BE INTERCEPTORS ON MISSION. IN ADDITION, 140 PROJECT TRACKS MAY BE AUTOMATICALLY FLOWING TO NIKE AND TALOS UNITS. SIMULTANEOUSLY, 150 TRACKS MAY BE SENT TO ADJACENT DIRECTION CENTERS AND A COMPLETE AND SUMMARIZED PICTURE OF WHAT THE DIRECTION CENTER IS DOING IS BEING REPORTED FORWARD TO ITS COMBAT CENTER.

THERE IS AN ADDITIONAL MAJOR CAPABILITY THAT COMES FROM THE FLEXIBILITY OF THE SAGE SYSTEM ITSELF. SINCE RADAR, THE MAJOR SOURCE OF INFORMATION TO A DIRECTION CENTER, IS NOT LIMITED TO DELINEATED AREAS OF RESPONSIBILITY, AND RADARS ALONG SUCH BOUNDARIES ARE TIED TO ALL DIRECTION CENTERS THAT MAY NEED THE INFORMATION, EACH DIRECTION CENTER IN EMERGENCY COULD OPERATE IN THE AREA OF ITS ADJACENT NEIGHBOR. LIKEWISE, WEAPONS ALONG AREA BOUNDARIES ARE CONNECTED TO ADJACENT DIRECTION CENTERS.

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WE EXPECT THAT SUCH AN OPERATION WOULD BE AT SOME REDUCED CAPACITY FROM THOSE I HAVE DESCRIBED FOR YOU. INTEGRATED WEAPON CONTROL COULD STILL BE MAINTAINED NONETHELESS.

THESE CAPABILITIES CAN BE AVAILABLE FOR MILITARY USE FOR THE FIRST TIME IN HISTORY WHEN THE FIRST FACILITY BECOMES OPERATIONAL 1 YEAR FROM THIS JULY. ALL CRITICAL COMPONENTS OF THE ELECTRONIC EQUIPMENTS HAVE BEEN DUPLEXED. THE FSQ-7 ITSELF IS ESSENTIALLY A DUPLEX COMPUTER. ITS UNEXPECTED FAILURE RATE IS ESTIMATED TO BE LESS THAN 10 HOURS PER YEAR. ALTERNATE COMMON ROUTES HAVE BEEN PLANNED TO MINIMIZE THESE UNEXPECTED FAILURES. ALSO, THE DIRECTION CENTER FACILITIES HAVE BEEN LOCATED 15-20 MILES AWAY FROM PRINCIPAL ENEMY TARGET OBJECTIVES. SOME BLAST AND RADIATION PROTECTION IS PROVIDED IN THE BUILDING DESIGN ITSELF.

NOW A FEW WORDS SPECIFICALLY IN REGARD TO THE INTEGRATION OF THE AAOC FUNCTION INTO THE DIRECTION CENTER.

CHART II

THIS CHART SHOWS A SAGE DIRECTION CENTER FUNCTIONALLY CONNECTED TO AA FIRE UNITS - NIKE BATTERIES - WITH DATA AND VOICE CIRCUITS. ALSO DEPICTED ARE ONE OF ITS RADAR SITES AND

SUPPORTING DOCUMENT NO. 4

AN ARMAGEDDON DIRECTION CENTER WITH APPROPRIATE DATA AND VOICE COMMUNICATIONS LINKS.

THE FORMER FUNCTIONS OF THE AAOC HAVE BEEN INTEGRATED INTO THE SAGE DIRECTION CENTER. THE OVER-ALL AIR SITUATION, AS SEEN IN THE DIRECTION CENTER, WILL BE THE BASIS FOR INTEGRATED WEAPONS ALLOCATION, COMMITMENT, AND EMPLOYMENT. PROVISIONS HAVE ALREADY BEEN MADE FOR ARMY PERSONNEL WHO ARE SKILLED AND EXPERIENCED IN THE EMPLOYMENT OF THE NIKE WEAPON.

OPERATING POSITIONS HAVE BEEN PROVIDED FOR THEM AT DISPLAY CONSOLES AS ACTION MEMBERS OF THE WEAPON DIRECTION TEAM - JUST AS POSITIONS HAVE BEEN PROVIDED FOR INTERCEPTORS. WE FORESEE THAT THIS OPERATION WILL PROVIDE AN OUTPUT OF TARGET ENGAGEMENT INSTRUCTIONS, ALONG WITH THE NECESSARY TARGET DATA, DIRECT TO THE NIKE BATTERIES CONCERNED.

EVEN THOUGH THE PLANNED RELIABILITY OF THE SAGE SYSTEM IS EXTREMELY HIGH, ADDITIONAL COMMUNICATIONS ARE PROVIDED, AS SHOWN IN BLUE, TO SUPPORT ALTERNATE METHODS OF EMERGENCY OPERATION.

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[illegible] A CLEARER UNDERSTANDING OF THE OPERATION UNDER THE [illegible] DIRECTION CENTER, I WOULD LIKE TO APPLY IT FOR POINTS THE 26TH AIR DIVISION SITUATION DESCRIBED BY GENERAL [illegible].

CHART 10

[illegible] IS THE SAME CHART HE USED AND I WOULD LIKE TO TAKE A SIMPLE EXAMPLE OF THE NIKE BATTERIES AROUND NEW YORK.

Overlay 1

THE EFFECTIVE ENGAGEMENT AREA UNDER THE CONTROL OF THE [illegible] DEFENSE COMMANDER IS SHOWN IN RED.

Overlay 2

THE EFFECTIVE FIRE OF THE NIKE BATTERIES ON TARGETS DESIGNATED TO THE MCGUIRE COMMANDER BY THE STEWART COMMANDER IS SHOWN IN BLUE, AND

Overlay [illegible]

[illegible] FOR THE SYRACUSE COMMANDER IN YELLOW. TARGETS [illegible] BY ADJACENT SUBSECTORS FOR ATTACK, TO ANY OTHER [illegible] WILL ENSURE EFFECTIVE INTEGRATION OF FIRE FOR A&E, AS WELL AS FOR ALL OTHER WEAPONS.

Overlay off

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[illegible] overlay all

ENGAGEMENT AREAS FOR ALL NIKE BATTERIES IN THE 25TH AIR DIVISION, [illegible] IN LIKE MANNER, PROVIDES CLEAR DELINEATION OF AREAS OF RESPONSIBILITY FOR THE OPERATIONAL CONTROL OF ALL AIR DEFENSE WEAPONS.

GENERAL SMITH WILL CONCLUDE THE PRESENTATION.

CONTINENTAL AIR DEFENSE COMMAND
ENT AIR FORCE BASE
COLORADO SPRINGS, COLORADO

OFFICE OF THE COMMANDER-IN-CHIEF

28 February 1956

MEMORANDUM FOR COMMANDER-IN-CHIEF

SUPPORTING DOCUMENT NO. 5

1. As a result of my conferences and exchange of correspondence with the Commanding General, ARRACOM, and our recent visit to the Joint Western Air Defense Force, I recommend the following courses of action in connection with Antiaircraft elements of the air defense system:

a. In order to clarify procedures and fix responsibilities, publish at the earliest practicable date the proposed regulation for the exercise of operational control contained as Annex B in the CONAD [illegible] which I recently submitted to you. In addition to the minor amendments which I proposed in connection with "hold fire" orders, we should delete the paragraph referring to the duties of artillery liaison officers at the Division level (General Mickelsen has stated he would have his comments on the draft regulation in this headquarters in the very near future).

b. That we proceed at once to augment Division and Defense Force staffs with Antiaircraft Artillery officers. At the Division level, these officers should be concentrated in the operations area, with emphasis on the achievement of smooth teamplay and procedures to insure maximum utilization of combined weapons. Insofar as the Defense Force level is concerned, Antiaircraft officers should participate not only in current operations, but in extensive planning for exercises designed to optimize the use made of training sorties available. The joint staff at this level should also recommend to this headquarters force requirements and generalized deployment.

c. We should issue a CONAD directive in connection with (b), above, specifically delineating the authority and responsibility of the Division and Defense Force Commander, with emphasis on the fact that operational channels are from Joint Air Defense Force to Joint Air

SUPPORTING DOCUMENT NO. 5

SUPPORTING DOCUMENT NO. 6

SUPPORTING DOCUMENT NO. 6

[illegible], [illegible]: (U) Operational Plan for Employment of NIKE in the Local Area

[illegible] that the essential operational functions now [illegible] by the Army at the Antiaircraft Operations [illegible] be integrated into existing Direction Centers. [illegible] convinced that the functions of the Army AAOC's must be [illegible] into the Joint Direction Centers. Such integration [illegible], of course, obviate the need for separate AAOC installations, the AN/TPS-2 System, and separate surveillance records. [illegible], it would seem to that appropriate component station [illegible] be provided at Joint Direction Centers and Joint Air Divisions. I believe that this is the only way I can be assured that [illegible] operational control is properly established.

[illegible] of requirements vitally affect the planning and [illegible] for the NIKE System, approval of this plan is [illegible] vitally required. Accordingly, request that you, as executive [illegible], obtain approval for this plan as soon as possible and [illegible] adjust the terms of reference for Continental Air Defense Command.

1 Incl
As sgd of
Ops Plan

H. H. ARNOLD
General, USAF
Commander in Chief

SUPPORTING DOCUMENT NO. 7

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HEADQUARTERS
CONTINENTAL AIR DEFENSE COMMAND
Ent Air Force Base
Colorado Springs, Colorado

SUPPORTING DOCUMENT NO. 7

OPERATIONAL PLAN FOR EMPLOYMENT OF AA WEAPONS

IN THE SAGE ERA

This plan is not concurred in as of this date by the Army and Navy component Commanders of CONAD.

15 March 1956

SECRET

SECRET

OPERATIONAL PLAN FOR EMPLOYMENT OF AA WEAPONS

IN THE SAGE ERA

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OPERATIONAL PLAN FOR EMPLOYMENT OF AA WEAPONS IN THE SAGE ERA

I. INTRODUCTION.

The purpose of this operational plan is to establish a method of employment of AA weapons which coordinates and integrates their effectiveness with all other weapons under the operational control of CINCONAD.

The plan is devoted to the control methods used during the SAGE time era for two basic reasons. For the first time in air defense history a system will exist having a control capability which can effectively employ all air defense weapons. This capability must be fully exploited. Secondly, for timely and economic considerations, there is an urgent requirement to resolve the problems related to the marrying of the SAGE control system with AA weapons. These problems are computer programming, communication requirements, and the design and procurement of equipment. The finalization of a concept of operation, related to the control of AA weapons, is a prerequisite to finding solutions to these problems.

The plan has been designed taking primary cognizance of the NIKE- type of weapon, since guns will constitute only a minor portion of the AA weapons in the SAGE era. The pattern of this plan can be followed for those specific cases where

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operational control of AA guns is a continuing requirement.

The plan will cover CINCONAD's operational responsibilities, a brief description of the NIKE and SAGE systems, a description of the operational control of an integrated weapons control system, and an explanation of the methods of control of NIKE.

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II. CINCONAD's OPERATIONAL RESPONSIBILITIES.

The organization and mission for CONAD are prescribed by JCS Secretary Memo 688-54, dated 2 August 1954. The Terms of Reference in this Secretary Memo state that, "CINCONAD will exercise operational control over all forces assigned or otherwise made available by the Joint Chiefs of Staff or other proper authority, for defense of the continental United States against air attack." CINCONAD's operational responsibility for air defense, in peace or war, is further defined by this directive to require CINCONAD to exercise operational control responsibility in the execution of the air defense function.

The determination of CINCONAD's operational responsibility, and the delegation of this responsibility, is founded on the basic military doctrine that all forces assigned to the execution of a distinct mission should be under one commander, not only to insure unified execution of the mission, but also to insure a single channel of operational control during the operation.

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III. DESCRIPTION OF NIKE AND SAGE.

A. Description of NIKE.

1. NIKE Missile. The NIKE is a guided missile provided by the Army Antiaircraft Command under the operational control of CINCONAD. NIKE I is an 1196 pound rocket missile armed with three fragmentation warheads totaling 309 pounds. NIKE I will be directed by ground based command guidance equipment to intercept high speed maneuvering targets up to an altitude of 60,000 feet and out to a maximum practical range of impact of 50,000 yards against a bomber possessing a ground speed of up to 650 knots. NIKE B, a modified missile, will replace the NIKE I missile during the SAGE time era. This missile will have an increased range and altitude capability, and in addition be capable of carrying an atomic warhead.

2. NIKE Battery Guidance System. The guidance system consists of an acquisition radar which accepts targets from an air surveillance system and generates information for placing a tracking radar on a selected target. A guidance radar acquires the missile in the launcher, tracks it during flight, and serves as a means for transmission of control orders. These radars produce present position information for use in a computer which supplies the Battery Commander with information for monitoring the weapon-target

interception.

3. NIKE Battery Capability. The battery contains a guidance and a launcher area. The launcher area contains four launcher sections. Each section contains four launcher-loaders, and each launcher-loader accommodates four missiles. The total of 64 missiles will sustain a firing rate of one round per minute for one hour.

B. Description of SAGE.

1. The SAGE System. SAGE is that portion of the air defense system that provides the means for the semi-automatic processing of data and issues guidance instructions for weapons control. The data from the air defense system's long-range, gap-filler and height finding radars will be transmitted by automatic digital data links to SAGE Direction Centers, where data will be processed by a high speed digital computer. The computer will store and display the current position and velocity information on all significant air objects within an air defense subsector. Height, identification, and flight size information will be added as ancillary data to furnish a continuous, timely and complete presentation of the air situation. Radar inputs into the computer will provide coverage down to 500 feet on the perimeters and up to 100,000 feet in all subsectors. Air defense weapons, including manned and unmanned interceptors, will be

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assigned targets to be intercepted. In addition, some weapons will receive launch and mid-course guidance instructions from the high-speed data processing computer.

2. Computer Capability. The AN/FSQ-7 of the direction center is a high-speed duplex digital computer which will have the capability of processing information on 400 tracks, of which 200 may be weapons, for which launch and mid-course guidance instructions are generated. In addition, the AN/FSQ-7 may receive 150 cross-told tracks by automatic digital data link from adjacent subsectors. From these total tracks, data will be transmitted to weapons with their own guidance systems for information and assignment on up to 140 tracks every ten second period. With the capacity of 400 action tracks plus 150 cross-told tracks, the assignment of 140 tracks to weapons with their own guidance systems increases the overall capacity and effectiveness of the air defense system. This allows the system, therefore, to issue target assignment and/or guidance instructions to 340 (up to 200 interceptor targets plus 140 targets for NIKE and/or Talos) defensive weapons simultaneously.

3. Continuity of Operation. The SAGE system has been designed to assure the maximum reliability. One factor of reliability is attained by the duplex computer concept. The duplex arrangement consists of separate and identical

computers which are located in one building and have common input and output equipment. Both input sections of this computer will be operating and each will have the same air situation information so that in the event of failure of one, the other can assume the load. One computer controls the direction center operation, while the second constantly checks for proper operation of the first. The unscheduled down time for one AN/FSQ-7 is estimated to be less than ten hours per year. This system will be as vulnerable to sabotage as any other system dependent upon wire communication. However, to minimize the vulnerability from this source, all critical facilities have been provided with alternate communication routes. Additional precautions have been taken by locating the direction centers away from major target areas and designing the buildings to be shock resistant and contamination proof.

4. Direction Center Organization. The SAGE Direction Center is operationally divided into three sections; Air Surveillance, Identification and Weapons Direction. The three sections are under the Senior Director. The Air Surveillance Section is responsible for collecting, displaying and disseminating data from all pertinent sources within the subsector and from adjacent subsectors. The Identification Section places identity on the tracks established by

the Air Surveillance Section. The Weapons Direction Section takes action required for employment of weapons and the conduct of the air battle. This section is headed by a Senior Weapons Director with provisions for four Weapon Directors, each supervising five Intercept Directors. In addition, AA weapons direction positions are presently provided for employment of AA weapons. This number of AA positions can be increased to accommodate more AA weapons if required.

5. Operating Positions. Each operating position in a direction center or combat center is equipped with a 19 inch Cathode Ray Tube (CRT) for display of the air situation, a five inch CRT for display of status or detailed information, and a bank of insertion switches. The insertion switches permit the operator to select displays, insert data or corrections into the computer, or otherwise impose his decisions into the computer for properly conducting the course of an air battle. Voice-phone equipment is also available for each operator position and between appropriate positions.

6. Command Post. Each direction center will have a Command Post with a large vertical summary situation display for the commander and his staff including an AA officer. Individual displays for required detailed data will also be available.

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IV. CONCEPT OF OPERATION.

A. CONAD Forces. In carrying out the mission of CINCONAD to defend the continental U. S. against air attack, operational control will be exercised over all forces assigned or made available to CINCONAD. The forces assigned to CINCONAD include AA forces assigned for defense of the continental U. S.

B. CONAD Functional Responsibilities. The Terms of Reference also specify that USAF ADC forces assigned to CONAD will provide the air defense functions of surveillance, warning, and control for CONAD.

1. The SAGE system will be the primary means available to CONAD to carry out the functions of surveillance, identification, target assignment and/or weapon control. All of these functions will be centrally performed in the SAGE Direction Center. The complete air situation will be displayed and integrated control of all weapons to be committed will be accomplished within this facility. This will include launch and guidance instructions to some weapons and target assignment by priority to other weapons which have their own guidance systems. The SAGE system will be capable of properly conducting an air battle within the area of responsibility assigned.

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2. The SAGE Direction Center will be responsible for consolidation of all available surveillance data provided by surveillance radars and other inputs within the subsector. This consolidated air picture will be available to the AA officer and AA Director in the direction center. There is no requirement for AA surveillance radars for the AA weapons which are located in the SAGE subsector; no requirement exists for a separate surveillance system for each air defense weapon. The functions ordinarily performed at the Army Antiaircraft Operations Center can be accomplished by AA personnel at the SAGE Direction Center and using equipment made available for this purpose.

C. Joint Control Structure of CONAD. The Terms of Reference state that operational control will be exercised through Joint Regional or Sector Air Defense Commanders. Under the concepts expressed in this plan, the Joint Command is extended to the Joint Subsector Commander who will exercise operational control of all forces.

1. The Joint Air Defense Wing (SAGE) will be the primary operational control element for control of the air defense battle. At this command level all weapons in the subsector will be under the control of the Joint SAGE Subsector Commander.

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D. CONAD Control Concept. The aim of the CONAD control concept is to attain the highest degree of effectiveness and efficiency of all air defense weapons, including NIKE, by the integration of the control functions, i.e., allocation, commitment, and employment. The integration of control of all weapons will be exercised at the lowest operational control element of CONAD with a facility capable of performing this function.

1. The aim of air defense, destruction of an attacking force, can best be accomplished by the efficient allocation and commitment of all weapons. In order to achieve this objective the allocation and commitment of each type of weapon must be made considering the use of all others in a given geographical area. The SACE system provides this capability under one commander through the facility of the Joint SAGE Direction Center.

2. The Joint SAGE Direction Center will control all air defense weapons including providing target assignment to weapons with their own guidance system. Target assignment for AA weapons will be accomplished taking cognizance of all other air defense weapon-target matching within the entire subsector. Air defense weapon control will be completely integrated at the Joint SAGE Direction Center.

3. The reliability and capability of the SAGE system,

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as described earlier in this plan, supports the concept of assigning targets for all weapons from one control source. The control capability of the Joint SAGE Direction Center must be degraded considerably before an emergency method of weapons control will be required. With dual communications routing, both routes must be inoperative before the SAGE Direction Center is unable to effectively employ weapons. However, since communications or the computer can fail, alternate methods must exist for the control of weapons. The SAGE system itself provides the first alternate capability. The remaining components of the air defense system, which ordinarily support the SAGE system, also have a limited independent manual control capability. The various methods of control of weapons are designated Modes of Operation. There are four modes of operation for control of weapons which are briefly described below in order of their effectiveness. (Annex "A" describes these modes of operation in detail.)

a. Mode I. The primary mode of operation is Mode I. Complete control of the entire system with the functions of surveillance, identification and interception or target assignment will be performed at the Joint SAGE Direction Center. Control will also include the dissemination of "States of Preparedness," "Conditions of Warning"

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and "States of Fire" to radar squadrons and weapon units as required.

b. Mode II. If the primary SAGE Direction Center is out of operation, the adjacent SAGE Direction Centers will accept portions of air defense responsibility in the disabled subsector. Although this method is less effective, it is the second best method to provide the highest degree of combat effectiveness.

c. Mode III. In this mode of operation the primary SAGE Direction Center and the adjacent SAGE Direction Center do not control weapons. The responsibility for limited operational control of weapons will shift to designated radar sites. The operational control exercised by the radar site will be limited in authority to the imposition of firing restrictions on designated air defense weapons only when necessary to protect friendly aircraft. The radar site will have a capability to assign targets and control manned interceptors, but it will not have the capability to assign specific targets or control other air defense weapons. A limited capability will exist at the radar site to pass information, such as, track data and identity to its designated weapon units.

d. Mode IV. In this mode of operation weapon units operate autonomously and no capability is assumed to

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function in Modes I, II or III above. Operational control by a higher control element no longer exists and target assignment is accomplished at the individual weapon site.

4. The use of any particular mode of operation may be dictated either by capabilities existing at any given time - or may be dictated by the tactical consideration of the air battle. In general, the most effective mode of operation appropriate to the tactical situation and for which a capability exists will be used. A detailed description of the modes of operation, the emergency and tactical situations which require a switch from one mode of operation to another, and the procedures to be followed in each case are covered in the Annexes to this plan.

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V GENERAL CONAD COMMUNICATION REQUIREMENTS.

A. The following are estimated communication requirements which will be necessary to tie AA Batteries, located in the same defense area, to operational control facilities: (Detailed requirements will be determined upon approval of this plan.)

1. Communications between the Joint Direction Center and AA Batteries located in that subsector are described below. The same communication requirements will be necessary between these AA Batteries and a designated adjacent direction center to provide a Mode II capability.

a. Two-way digital data communications will be required for target assignment from the Joint Direction Centers to AA Batteries and for weapon status from Batteries to the Joint Direction Centers.

b. A voice communication capability will be required to each AA Battery from the Joint Direction Centers.

2. A voice capability from designated radar sites to the AA Batteries will be required to aid the batteries in Mode III operation.

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ANNEX A

OPERATIONAL CONTROL MODES

This Annex describes procedures to be followed for each of the four operational modes outlines in the basic plan.

I. DESCRIPTION OF WEAPONS CONTROL PROCEDURES.

A. Mode I. The Joint SAGE Direction Center will make the target assignment for all air defense weapons including long range and medium range interceptors, Bomarc, Talos, NIKE, and other weapons which may be available. Control of all air defense weapons is vested in the Joint Subsector Commander of the SAGE subsector in which the weapons are located. Target assignment for NIKE missiles will be made at the Joint SAGE Direction Center. Weapon status, air surveillance data, target assignment and operational engagement status will all be passed directly between the SAGE Direction Center and the NIKE Batteries. The commitment of NIKE against available targets in adjacent subsectors will be by request of the adjacent direction center and approval of the direction center having operational control. Where two or more NIKE defense systems exist in the same subsector, coordination of target assignment will be accomplished by the AA Weapons Directors in the SAGE Direction Center.

1. The functions of monitoring, supervision and

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coordination for AA weapons will be accomplished at the Joint SAGE Direction Center by the AA officer, the AA Weapon Directors and the AA Weapon Directors Assistants. The AA officer advises the Joint Subsector Commander, or his representative, and coordinates matters concerning the employment and capabilities of AA weapons within the subsector. The AA Weapon Director and the AA Weapon Director Assistant comprise an AA Weapons Director Team similar to the Weapons Director Teams for Bomarc, Talos and manned interceptors. The AA Weapons Director Team accepts target assignment directly from the Senior Weapons Director. The AA Weapon Director makes the target assignment to the battery which is to engage the target. The actual target assignment to the battery can be made by the AA Weapon Director by selection switches at his console. In the event of high concentration of targets the computer program may be designed to perform the target-weapon matching. In the latter case, the AA Weapon Director will monitor the computer assignments and override, if necessary, in favor of a better target-weapon assignment.

2. The battery will receive the target assignment information by automatic data link. The Battery Commander will monitor the target-weapon assignment and the actual interception of the target by the NIKE missile. The battery will forward to the Joint SAGE Direction Center, by digital

data, the weapon engagement status and the weapon availability status. A voice circuit will also be available for operational coordination of target or weapon information, as well as for the dissemination of states of preparedness, conditions of warning and states of fire.

3. A less sophisticated degree of control can be exercised under this mode of operation for those temporary periods of time when the automatic data circuits are lost to certain weapons. This type of control will be exercised through voice communications only and will consist of target assignment and/or directing the states of fire that will apply to these weapons.

4. The primary mode (Mode I) of operation will be the most effective means of conducting the air defense mission and every effort will be made to maintain this mode of operation.

B. Mode II. In the second mode of operation, all AA weapons located in the primary subsector will be controlled by adjacent subsectors. Under this mode of operation the AA Director of the adjacent subsector accepts responsibility for target assignment to designated AA weapons located in the disabled subsector.

1. The computer program of the adjacent subsectors will be designed to accept these additional inputs and provide

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the output data to assign targets to batteries located in adjacent subsectors. The AA officer, located in the Command Post, will coordinate activities between the AA Batteries within his subsector and those AA Batteries of the disabled subsector.

2. The second mode of operation will be inferior to Mode I in two aspects:

a. The low altitude capability in the second mode of operation will be effective only at altitudes of 5000 feet or higher. This is due to loss of gap-filler radars which will not be tied into the adjacent direction centers.

b. The second limitation is an undetermined factor which will vary in each subsector. The computer may reach its maximum capacity more quickly if it must assume responsibility for an adjacent area as well as its normal SAGE subsector area. Thus, the adjacent SAGE Direction Center may suffer a degraded control capability. This possibility will depend entirely upon the tactical situation existing at the time that a SAGE computer must take on the responsibility for an adjacent area.

3. A voice circuit, between the adjacent direction center and designated weapons in the disabled subsector, will be available for operational coordination of target or

weapon information, as well as for the dissemination of states of preparedness, conditions of warning, and states of fire. A less sophisticated degree of control can be exercised under this mode of operation for those temporary periods of time when the automatic data circuits are lost to certain weapons. This type of control will be exercised through voice communications only and will consist of target assignment and/or directing the states of fire that will apply to these weapons.

C. Mode III.

1. In the third mode of operation the CONAD surveillance radar site has a limited capability to act as an Air Defense Direction Center. The radar site, acting in the capacity of an ADDC, can control manned interceptors to which it has communication ties. The radar site cannot effectively control weapons with their own guidance systems, such as NIKE and Talos or Bomarc, which are normally dependent upon guidance instructions from a SAGE Direction Center.

2. To increase the effectiveness of NIKE during Mode III, the radar site will attempt to obtain identification, target acquisition data and target priority. Voice communication will be available from the radar site to the various weapon sites, including AA weapons, within the radar site surveillance area. By this means the radar site can determine weapon availability, those weapons committed

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against targets, and make a limited evaluation of the air situation. These factors will aid in establishing target priority and assignment for the AA defenses in the area. This information will be forwarded to the appropriate Battery Commanders.

3. In this mode of operation the radar squadron commander, or his authorized representative, will be responsible for the designation of friendly aircraft based on the air situation and identity available to him. He has the authority to impose the temporary restriction "Hold Fire" to designated weapons. Generally these designated weapons would be those weapons having communication to the radar site.

D. Mode IV. In this mode of operation AA weapons operate autonomously. The weapon-target assignment will be accomplished at the battery in Mode IV.

1. An SOP will exist which insures economical distribution of fire among the AA Batteries. The SOP will insure as near a uniform target-weapon assignment as is possible under this mode of operation.

2. Target assignment will be made in this mode of operation either with or without surveillance or identification data. The effectiveness of this function will be determined by the ability of the Battery Commander to obtain

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condition of warning, surveillance and identity from any source which might be available. The AA Battery Commander will have acquisition radars available to provide target information, and thus the battery will have limited capability to operate autonomously, even though contact with a surveillance radar site may be lost.

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ANNEX B

STATES OF FIRE FOR MODES OF OPERATION

I. The definitions of the three states of fire which will apply to AA weapons during the SAGE time period are as follows:

A. Weapons Free - Fire at any target not identified as friendly.

B. Weapons Tight - Fire at any target identified as hostile.

C. Hold Fire - Do not open fire. Cease fire.

II. The states of fire under the various modes of operation are as follows:

A. Mode I - The necessity for states of fire for AA weapons in a subsector is based on the control capability of the direction center.

1. If the primary direction center can assign targets to the AA Batteries, no specific states of fire need be designated for the AA weapons in the subsector. Individual target assignment for AA weapons is based on the full knowledge of the air defense situation.

2. If the primary direction center cannot assign targets but can determine the states of preparedness and conditions of warning the direction center will impose the

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states of fire on AA Batteries consistent with these conditions. This can be passed to the AA Batteries by voice communication.

B. Mode II - Same as for Mode I, except that control will be exercised by the designated adjacent direction center over AA weapons in the disabled subsector.

C. Mode III - The states of fire for weapons under Mode III will be governed by the last known state of preparedness and condition of warning which existed at the time the switch to Mode III occurred. The states of fire for conditions of warning or the states of preparedness for Mode II are as follows:

1. Increased Intelligence Watch - "Weapons Tight"
2. Normal Preparedness - "Weapons Tight"
3. Increased Readiness - "Weapons Tight"
4. Warning White - "Weapons Tight"
5. Warning Yellow - "Weapons Tight"
6. Warning Red - "Weapons Free," except that the radar site can impose "Hold Fire" on AA Batteries. "Hold Fire" will not be ordered for an entire defense but will be applied to specific targets, tracks, sectors, altitudes, or corridors on a temporary basis as required for protection of friendly aircraft. This temporary restriction is imposed: (1) Only when essential to combined effectiveness of the

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air defense, (2) for the minimum length of time, and (3) to the least possible degree. Temporary restrictions are automatically terminated if communications fail.

D. Mode IV - The states of fire for Mode IV are also governed by the last known state of preparedness and condition of warning which existed at the time the switch to Mode IV occurred. These are:

1. Increased Intelligence Watch - "Weapons Tight"
2. Normal Preparedness - "Weapons Tight"
3. Increased Readiness - "Weapons Tight"
4. Warning White - "Weapons Tight"
5. Warning Yellow - "Weapons Tight"
6. Warning Red - "Weapons Free"

E. Changes of States of Fire During Mode III and IV Operation.

1. The AA Battery will change the state of fire only if positive determination of a shift in condition of warning has occurred. The state of fire of AA weapons will agree with the conditions of warning outlined above. All components of the air defense system will use every means available to notify weapon units of conditions of warning. The AA Batteries and designated radar sites will determine the condition of warning. Examples of the means available for determining the condition of warning are as follows:

a. Long distance telephone to air defense agencies.

b. Tactical radio circuits to air defense agencies or other military agencies.

c. Monitoring emergency defense broadcasts such as CONELRAD, Civil Defense, etc.

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ANNEX C

PROCEDURES FOR SHIFTING MODES OF OPERATION

This Annex describes the various conditions under which a shift from one mode of operation to another may be required. Whenever a change in mode of operation is made, it is operationally desirable to return to a more effective mode of operation as soon as time and capability will permit. It is possible to foresee tactical situations which may be more effectively handled by a shift in operation, such as, sharing the conduct of an air battle in one subsector with its adjacent neighbors. Computer programs and SOP's will be required to insure that such changes in operation will provide the most effective control system at any time. For simplicity the many variables have been divided into two broad categories - Planned and Orderly Implementation and Automatic Implementation by SOP.

I. Planned and Orderly Implementation.

A. General. When a condition arises (whether it be for tactical reasons or equipment failure) that can be corrected by directing a shift in modes of operation, such a decision can be made and carried out while the communication capability still exists to do so in an orderly manner. The operational effectiveness of the direction center to conduct

air defense in a subsector is directly related to the effectiveness of the components and communication supporting the system. The basis for change from one mode to another will depend on the degree of control effectiveness that can be exercised by the direction center. Partial or major loss of control capability will determine whether control remains with the primary direction center (Mode I) or is shifted to another agency (Mode II, III, or IV).

B. Flexibilities of Mode I. There is considerable flexibility in Mode I for the employment of all weapons. The capability inherent in the SAGE system and the components thereof provide the Subsector Commander with many alternative methods of weapons employment. Consequently, the Subsector Commander need not necessarily shift to a less effective mode simply because of a partial loss of capability of the system. For example, a partial loss of capability might occur if the digital data circuit between the primary direction center and certain AA Batteries became inoperative. However, target assignment could still be made by the AA Weapon Director by voice communication. In addition, "Condition of Warning" and "States of Fire," based on the current air situation, could be passed to the AA Battery by the direction center. The integrated target assignment function for all weapons would again be assumed by the

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direction center when the data circuit was restored. Should the control function be further deteriorated by the loss of digital data circuits to large numbers of weapon units, consideration should be given to a shift from Mode I to Mode II.

C. Shift from Mode I to Mode II. There is also flexibility in the overall SAGE system based on the mutual support of one subsector by the adjacent subsectors. The Subsector Commander can exploit this capability in the event of a major loss of capability in the primary subsector, such as:

1. Both Computers Out, Communication Operational.

a. The loss of both computers in the primary direction center would be a major loss of capability in that subsector. If communication existed to the batteries and to the adjacent direction center, the Subsector Commander could direct the shift from Mode I to Mode II.

b. The procedure for shift from Mode I to Mode II would be as follows: The AA officer of the primary SAGE Direction Center will direct the Battery Commanders to switch to the second mode of operation and accept target assignment from the adjacent direction center. At the same time the adjacent direction center will be requested by the primary direction center to take control of the AA Batteries in the primary subsector.

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2. Primary Direction Center Computers Operational, Communication (Data) Out.

a. Even though the computers are operating in the primary subsector, the data circuit necessary for target assignment to AA units could be inoperative. In addition, the use of voice circuit for target assignment might be unsatisfactory because of numbers of targets and speed of transmission of information. In this case it might be desirable to shift to Mode II. The decision to shift or remain in Mode I would be made by the Subsector Commander based on the tactical situation and the capabilities of the direction center.

b. The procedure for shift from Mode I to Mode II, in this case, would be the same as outlined above, paragraph I.C.1.b.

D. Shift from Mode I to Mode III. The emergency capability of the radar network provides additional flexibility which is available to the Subsector Commander. This shift might be directed in such cases as:

1. Computers Out at Primary and Adjacent Direction Center, Communication Operational.

a. In the event of loss of computers at both the primary and adjacent direction center, the primary direction center will direct a shift to Mode III operation.

b. The radar squadron commander in this case would be responsible for judicious use of the "Hold Fire" directive to protect friendly aircraft.

II. Automatic Implementation by SOP.

A. General. When a condition arises that can be corrected by shifting mode of operation, but the capability does not exist to do so in an orderly manner, an alternate mode of operation must be adopted automatically through SOP by the unit affected.

B. Communication Loss. In general the conditions which require an automatic shift in Mode of Operation are those where complete loss of all communication occurs. These conditions, loss of communications, could occur during any mode of operation which had been orderly implemented. Automatic shift will be accomplished by the Weapon Commander who is cut-off from his control authority.

C. Shift to Mode IV. Complete loss of communications to a higher control element will require that the weapon unit immediately shift to Mode IV, autonomous operation, regardless of which former mode it had been operating under. The state of fire will be immediately adopted consistent with the condition of warning at the time of communication loss.

D. Procedure. When complete communication loss occurs, the commander who has lost control will immediately attempt

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to [illegible]lish some means of communication to the weapon unit. Likewise, the Weapon Unit Commander who has been cut-off from his control authority will attempt to re-establish communication with any or all of his designated control authorities (Mode I, II, or III).

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5 March 1956

MEMORANDUM FOR: Vice Commander, ADC

1. The attached paper was brought here from Washington by Lt Colonel Burch and Major Lombardo. I have read the paper in its entirety and agree that it presents the case fully and accurately.

2. In order to express this view to Everest, I called him on the phone and found that he feels further technical explanations may be required in Washington to refute the allegations made by the Army presentors who appeared before the Ops Deps. Please have reviewed by our technical people the presentation made by the Army before the Ops Deps, prepare a briefing which will cover in technical detail the Air Force position on the argument between SAGE and FSG-1, and have it ready for dispatch to Washington on short notice.

3. I should like to review this briefing personally in order that I may be completely aware of the technical aspects of this problem. The detailed technical briefing must, of necessity, refute those positions of the Army Signal Corps presentation which were at variance with the facts of life.

E. E. PARTRIDGE
General, USAF
Commander-in-Chief

1 Incl
Memo for Secy/Def, subj:
Signal Control of Wpns Sys
in Continental Air Def

SUPPORTING DOCUMENT NO. 9

UNREADABLE - POOR ORIGINAL

SUPPORTING DOCUMENT NO. 9

SUPPORTING DOCUMENT NO. 10

SUPPORTING DOCUMENT NO. 10

SECURITY CLASSIFICATION (If any)

DISPOSITION FORM

SUPPORTING DOCUMENT NO. 11

FILE NO. | SUBJECT: [illegible] Control of Aerial Systems

TO [illegible] | FROM [illegible] | DATE 12 Apr 56 | COMMENT NO. 1

1/051-Gollard/ebn/2377

1. The following [illegible] extracted from a JCS paper on the [illegible] in extracts for your information:

* * * * * * * * * * * * * * * * * * * *

2. The Chairman of the JCS [illegible] the Army and Air Force split views on [illegible] on 9 April 56 and did not concur with [illegible] view.

3. The Chairman of the JCS recommended that [illegible] Department of Defense be [illegible] so that:

a. [illegible] shall be responsible for design [illegible] for control of the tactical air battle, for [illegible] control of all military [illegible] Forces and [illegible] the suppression and elimination of [illegible].

b. [illegible] shall have responsibility for the operational control of all air and [illegible] forces, including [illegible] of individual [illegible] to designated [illegible].

c. [illegible] shall have responsibility for [illegible] operations requirements for air defense [illegible] and [illegible] in the [illegible]. [illegible] development and procurement of air [illegible] and [illegible] systems to [illegible] with [illegible] [illegible] by [illegible] should be prepared in accordance with [illegible] Department of the Army and Air Force procedures.

* * * * * * * * * * * * * * * * * * * *

[illegible]

To: Lt. Colonel [illegible], Plans, Western Hemisphere Branch.

1. Your attention is invited to paragraph 2 of the attached [illegible] which [illegible] recommendations for the development of the [illegible].

2. [illegible] should be prepared [illegible] in a manner to permit [illegible] [illegible] and [illegible] of [illegible] and [illegible] [illegible].

[illegible]

SECRET

DISPOSITION FORM

SUBJECT

TO | FROM | DATE | COMMENT NO. 1

MEMORANDUM FOR THE CHIEF OF STAFF, U. S. AIR FORCE

SUPPORTING DOCUMENT NO. 11

SUBJECT: Operational Control of Weapons Systems in Continental Air Defense (JCS 1899/257)

1. BACKGROUND. By memorandum (Tab 2), dated 2 Feb 56, the Sec Def referred to a material procurement request from the Department of the Army (for [illegible] sets of AN/FCS-1 Fire Control Systems), and requested that the JCS provide him with an interpretation of operational control assignment for weapons in Continental air defense. He indicated, specifically, that guidance was needed as to whether the operational control assignment clearly delineates the responsibility to CINCONAD for control of all Continental U. S. antiaircraft defense. Subsequently, the separate views of the Army and the Navy in one view and the Air Force in the other were transmitted to the JCS Secretariat for forwarding to the Secretary of Defense.

2. CURRENT CONSIDERATIONS. The paper under consideration (Tab 1) is a memorandum from the Chairman of the JCS wherein he advises that he does not entirely agree with either the majority or the minority view in this matter. He points out that the Sec Def has referred to a problem concerning operational control of weapons systems in the continental U. S. and has asked for guidance regarding CINCONAD's terms of reference in this regard. The Chairman states that he has reviewed CINCONAD's terms of reference (Tab 3) which in his view should be clarified so as to remove the question of CINCONAD's responsibility and authority in respect to the problem under consideration. Insofar as the specific problem of AN/FCS-1 [illegible] concerned, he recommends [illegible] Development of the AN/FCS-1 [illegible] should be continued for use in the CONUS as a [illegible]

SUPPORTING DOCUMENT NO. 11

[illegible] (Tab 4). The [illegible] tion, except as they pertain to development of the AN/FSG-1, are most desirable. Even those recommendations can be accepted with the understanding that development, as opposed to procurement, is being accepted. A check with the USAF action officer in Admiral Radford's office reveals that "development" was used intentionally, and that the Admiral had no intention of approving procurement at this time. USAF acceptance of the Chairman's recommendations in this regard would have to take into consideration that: (a) The Sec AF has advised the Sec Def that there was no requirement for AN/FSG-1 in connection with SAGE (Tab 5); (b) CINCONAD has, in stating his requirements for the employment of NIKE in the SAGE area, told the C/S, USAF, that there is no requirement for the AN/FSG-1 (Tab 6); (c) the USAF position now under consideration by the Chairman argues very well that there is no requirement for the AN/FSG-1 (Tab 7); and (d) the matter under consideration by the Sec Def has to do with procurement--not development.

4. RECOMMENDATION. It is recommended that you accept the Chairman's recommendations (Tab 1) (if this will facilitate sending a more solidly unified position to the Sec Def) with the understanding that you are making a clear distinction between development and procurement, and that any combined development must be conducted jointly by the Army and the Air Force for the purpose of securing compatibility within the SAGE and BADGE systems. A purple has been prepared (Tab 8) to accomplish this.

[illegible] Adp/5011
[illegible] 1956

AFCCS-3,

JOINT CHIEFS OF STAFF.

SUPPORTING DOCUMENT NO. 11

on

[illegible]

Reference: [illegible]
JCS 1069/252
JCS 1077/251
JCS 1069/257

1. I have reviewed JCS 1069/257 and concur therein with the understanding that any continued development of the AN/TPS-1 must be conducted jointly by the Army and Air Force for the purpose of ensuring compatibility within the [illegible] radar family.

[illegible] consists of ____ pages.

[illegible] ____ of ____ copies.

SUPPORTING DOCUMENT NO. 12

12

SUPPORTING DOCUMENT NO. 12

SUPPORTING DOCUMENT NO 12

SUPPORTING DOCUMENT NO. 12

Mr. Secretary, I will describe the SAGE system and explain how it is intended to provide for the control of all air defense weapons. In particular, I will discuss SAGE's contribution to the control of NIKE. Finally, I will [illegible] the need for unified direction and the authority to carry out currently assigned functions.

This chart shows the areas of responsibility to be in effect upon completion of the SAGE program. It is to include CONUS [illegible] and regional areas assigned to the three Joint Air Defense Force Headquarters.

The area breakdown is into 5 sectors, each controlled by a numbered Joint Air Defense Division. Each sector Control Center, indicated by a square, is equipped with a computer for supervision of the air battle.

The basic area consists of 32 sub-sectors each to be operated by a Joint Air Defense Wing. Each of the 32 sub-sectors will have a direction center (indicated by the triangles), equipped with a SAGE computer, to conduct the air defense battle in the sub-sector area.

We have noted the 32 SAGE sub-sectors. Also shown are [illegible] sub-sectors which are not programmed for SAGE — [illegible], Florida and Colorado.

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E.0157

SUPPORTING DOCUMENT NO. 12

SUPPORTING DOCUMENT NO. 12

Although the NIKE system will have many radar inputs (the AN/FPS-6, 7, 8, 29, etc.) which will furnish radar data to the NIKE computer, initially these can be considered for the purpose of this discussion as one radar. Let us consider why this is so. For airborne radar intercept equipment for the manned interceptors and BOMARC has certain time limitations and therefore it [illegible] been necessary to improve the accuracy of our ground radar equipment. Lincoln Laboratory developed what is called the Fine Grain Data Flow Addition Equipment (AN/FPS-2). This "Phase-detection" equipment basically does just that. The unit first determines when a series of returns from a target begin, accumulates the number of returns, determines when the returns end, and reporting the azimuth of the target as the center of the series of returns. In addition, the FGA discriminates between signals and noise and provides a better response so that flow of target data is smoothed for more efficient use of telephone circuits. This equipment thus helped our problem for data accuracy. The Department of the Army, in a letter of requirements of June, 1954, stated their accuracy requirements for data to be fed to the NIKE batteries from NIKE. Displayed on the chart in [illegible] are the requirements stated by the Army for that accuracy: 1000 yards in azimuth for 80 miles from the NIKE site, 1500 yards at 90 miles. You will note from the [illegible] that the accuracy to be gotten from NIKE

E-0157

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[illegible] in actuality 1000 yards in [illegible] yards in range. This [illegible] of accuracy is obtained at a [illegible] of 200 miles from [illegible] radar site. Of actuality, the Air Force's [illegible] for accuracy was more stringent than that of the Army because of the necessity required to place the unmanned [illegible] type on target by the GCI company; whereas, the accuracy required for the [illegible] weapon [illegible] only be sufficiently accurate to place [illegible] weapon within [illegible] range of the target. The [illegible]'s own electronic tracking radar, target tracking radar - both short range [illegible] accurate - and computer at the site then take over for the final guidance of the missile to the target.

[illegible], for a pilot, describe the Army AICC system [illegible] the accuracy inquiry. The principal component of [illegible] is the [illegible]-1, at the AICC, which collects, [illegible] distributes coordinates of aircraft, to present such information as height, location, and identity of [illegible], using electronic displays. The Army states that to collect this information the [illegible] radar system will [illegible] to be supported by its own organic Army surveillance radar, and by one of the ground/height-finding radars necessary to support this system." What are these radars? [illegible] the Air Force chart [illegible] [illegible] radar and [illegible] radar. The [illegible] that to date

E-0184

SUPPORTING DOCUMENT NO. 12

Here is that the Army is purchasing the FPS-6 search radar less any "beam splitting" equipment, and therefore the potential data accuracy for the FPS-6, based on a 2.5° beam-width, will not be anywhere near as accurate as the data from SAGE. This point will be discussed later.

0187

SUPPORTING DOCUMENT NO. 12

Now I would like to give a brief description of the BACC computer. The digital computer is the heart and brain of BACC. As you all know, computers, both analog and digital, are widely used throughout the country for a variety of purposes, commercially and militarily. As indicated above, even the TALOS-BIRD requires a computer to compute guidance information for its missile to intercept the target. Adapting a computer for the BACC task was, to be sure, a complex problem, but as other computers have been adapted for their specific tasks, so has BACC. Within the BACC computer, a track can be described in terms of its position, speed and direction at any instant. Weapons can be described in terms of their home or launcher locations, speed, range, and other characteristics. The Direction Center is capable of maintaining 400 tracks simultaneously. This 400 track capacity was based on war-gaming experience that indicated that such a capacity would be the maximum required for each sub-center. If future war gaming indicates that for later time periods this capacity is not adequate, the capacity of the computer can be increased. Developments are underway at the Lincoln Laboratory to minimize the computer and storage equipment so the capacity of the computer can be increased with a minimum amount of additional equipment. In addition to the 400 tracks, simultaneously up to 100 tracks can be received through the automatic links from the adjacent sub-center computers. The equipments of BACC battery are able to handle tracks at the rate of 48 per minute, and in addition, all data are transmitted automatically

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EE.018 7

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Consequently, no defensive weapon system could function at [illegible] efficiency without adequate early warning, co-ordination [illegible] under unified command...a complete system of [illegible] is clearly necessary. Equally necessary is an [illegible], a system of communication [illegible] to coordinate their [illegible] control [illegible] efficiency from them.

[illegible]...the following [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

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SUPPORTING DOCUMENT NO. 12

E.E. 0187

SUPPORTING DOCUMENT NO. 12

EE 0187

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[illegible] Company [illegible] Air Force circuits are equally vul-
[illegible] breakdown and/or sabotage. Further DCS circuits
[illegible] for terminating on that such circuits, in
[illegible] either a circuit in broken or a DCS Direction
[illegible] dealt with. Both [illegible] of the distances involved
[illegible] the proposed Navy AUTOVON system. I
[illegible] to handle the Pentagon-Davis [illegible]
[illegible] - one of the Bridgeport [illegible] is located [illegible] the
[illegible] Island Tower on Long Island. The Navy Station [illegible] to permit
[illegible] to engage a maximum number of trunks without
[illegible], it is necessary to provide the DCS Military Communications with
[illegible] DCS Extension in the Pentagon.
[illegible] information in the Pentagon-Bridgeport
[illegible] requires backhaul of [illegible] extension lines to
[illegible] Bridgeport. As it is not only a requirement for
[illegible] but this is [illegible] inherent disadvantage
[illegible] in the AUTOVON system. They both require [illegible]
[illegible] which is most expensive to procure and
[illegible]

[illegible] Tower [illegible] preparation
[illegible] will be [illegible]. Data is [illegible] heading. You will
[illegible] the [illegible] DCS [illegible] have [illegible]
[illegible] Tower [illegible] Island [illegible] proposed to alleviate
[illegible] the Pentagon [illegible] the Pentagon trunking [illegible].

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[illegible] precision data [illegible] accuracy and reliability [illegible] Army requirements. This is not true. This will [illegible] data [illegible] Army in [illegible] presentation, that the [illegible] is a touch-[illegible]-screen system that processes [illegible] precision data in plotted into the electronic [illegible] "[illegible]" and then [illegible] over [illegible] data in, to the batteries and between batteries through the Missile Master. As indicated before, [illegible] the Army requirements for data accuracy and these results have been proven as result of tests for the previous months.

In a recent memorandum (17 February 1966) from the Assistant Secretary of Defense ([illegible]) to the Assistant Secretary of Defense ([illegible]), two questions posed by the [illegible] (DCS) on SACDS were answered officially as follows:

Question: Has the Air Force SACDS System been developed with a technical capability to provide fire direction control and advance warning to NIKE batteries?

Answer: The SACDS System has an inherent capability of providing the warning and target assignment functions required for coordinated fire direction of NIKE batteries.

Question: If SACDS has not yet developed sufficiently to provide fire direction control and advance warning to NIKE units, are there any insurmountable technical difficulties to providing this capability direct from SACDS centers as proposed by [illegible]?

EE-0187

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Answer: We have no "insurmountable technical difficulties" in providing the necessary target warning and target discrimination functions to the NIKE batteries from the [illegible] system.

The Air Force concurs completely with the technical people of the Office of the Secretary of Defense on this subject, and therefore feel that NIKE can and must be integrated into the centralized semi-automatic weapon control system (SAGE) if we are to maximize the effectiveness of all weapons employed in the continental U.S., while minimizing the cost to the U.S. taxpayer. I would again like to point out that the Air Force has no argument against the good data on the NIKE site, i.e., the target tracking radar, the missile tracking radar, the [illegible] level [illegible] on the computer. These are essential to both SAGE and NIKE operation.

EE-1157

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GPS-1-3
GPS-1-7
GPS-1-8
GPS-1-20
GPS-1-68

GP-218-7

SUPPORTING DOCUMENT NO. 12

SECRET

SUPPORTING DOCUMENT NO. 12

DIRECTION
CENTER

SECRET

SUPPORTING DOCUMENT NO. 12

SECRET

SUPPORTING DOCUMENT NO. 21

SECRET

SUPPORTING DOCUMENT NO. 12

ALLEGATION	REFUTATION
1. SAGE only accurate to two miles.	
2. SAGE cannot discriminate to 75 meters - NIKE radar can.	
3. ECM--SAGE more vulnerable.	
4. SAGE cannot control across subsectors.	
5. SAGE is more vulnerable to communications breakdown.	

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ALLEGATION	REFUTATION
NIKE Tracking Radar has an 'A' Scope Presentation - SAGE does not	
The IFF has an Emergency Back-up the AN/GPA-29	

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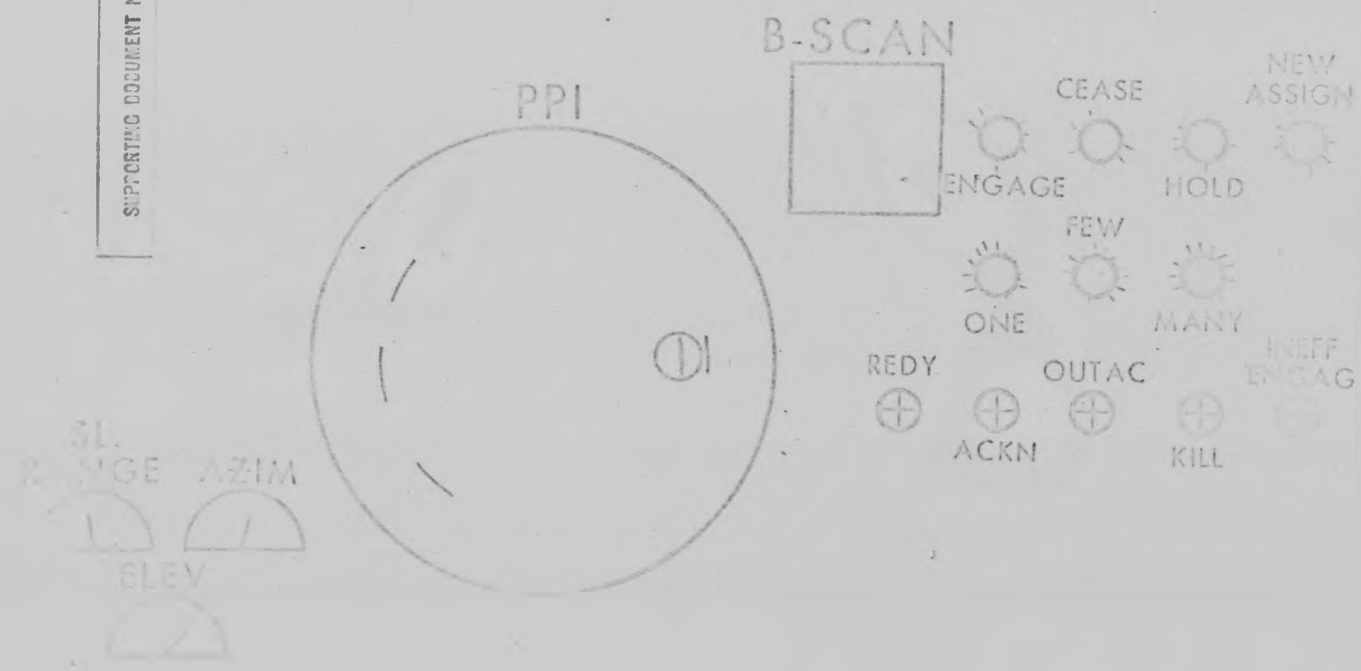
BATTERY CONTROL DISPLAY



SUPPORTING DOCUMENT NO. 12

LARSON

GREAT FALLS

GRAND FORKS

DULUTH

PENDLETON

STEAD

WYOMING

SIOUX CITY

GRAND-VIEW

SCOTT

SIN CALO

ENGLAND

CARTER

LACK-LAND

SUPPORTING DOCUMENT NO. 12

Plans of Reference and Letter of ....

CINCONAD

"THE COMMANDER IN CHIEF, WILL EXERCISE OPERATIONAL CONTROL OVER ALL FORCES ASSIGNED OR OTHERWISE MADE AVAILABLE BY THE JOINT CHIEFS OF STAFF OR OTHER PROPER AUTHORITY FOR DEFENSE OF THE CONTINENTAL UNITED STATES AGAINST AIR ATTACK."

"WILL DIRECT THE CONDUCT OF THE TACTICAL AIR BATTLE INCLUDING THE ENGAGEMENT AND DISENGAGEMENT OF AIR DEFENSE WEAPONS."

"TO IMPLEMENT THE OPERATIONAL CONTROL ASSIGNED, [illegible] WILL PASS THE OPERATIONAL CONTROL OF [illegible] ASSIGNED [illegible] TO [illegible] DEPLOYMENT TO TACTICAL AIR DEFENSE POSITION."

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SUPPORTING DOCUMENT NO. 12

AIR SURVEILLANCE

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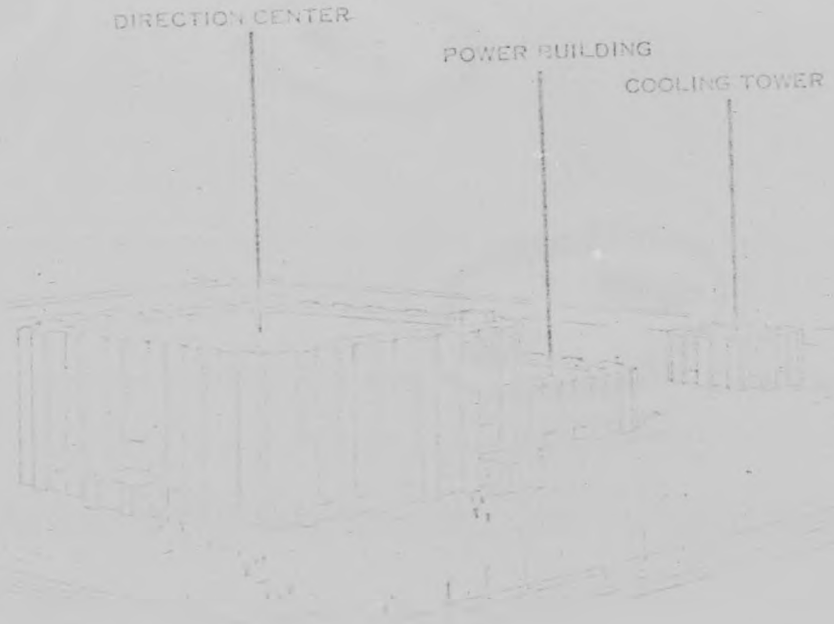
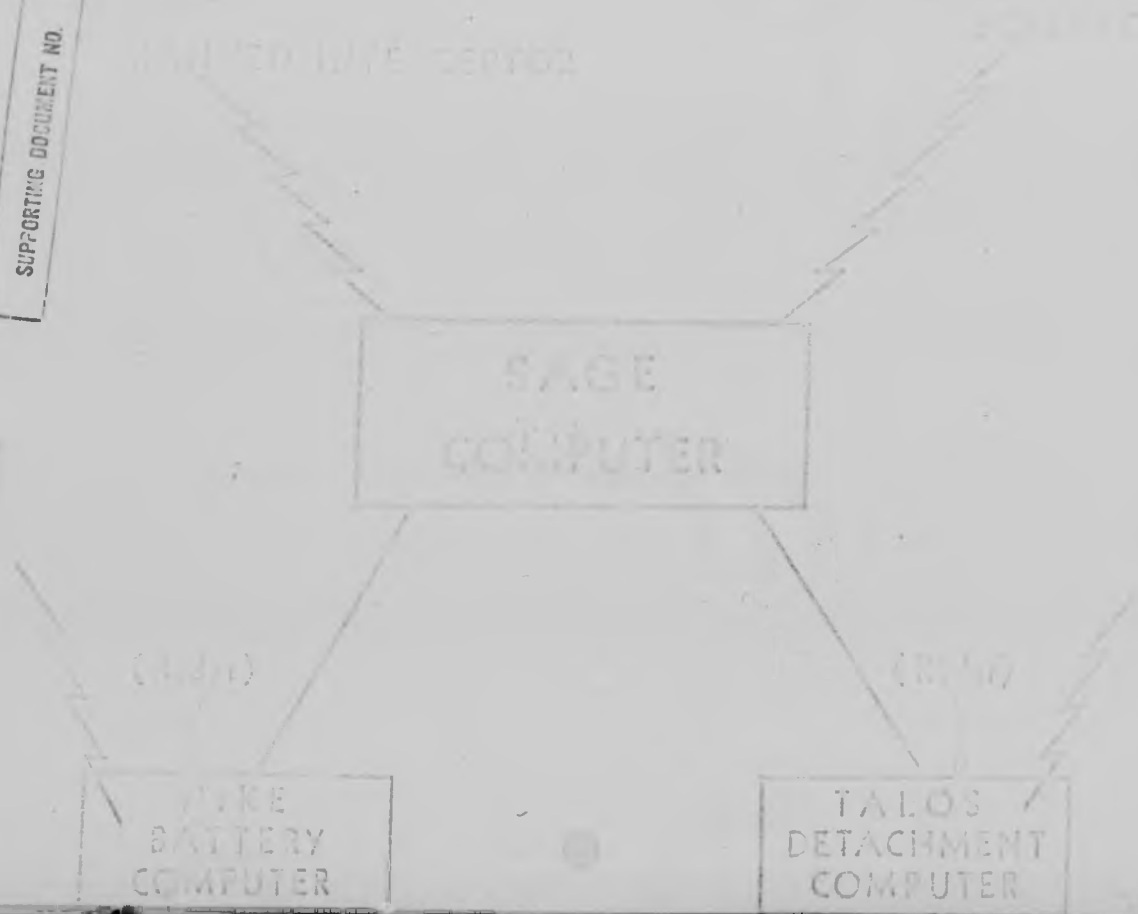
IDENTIFICATION

IDENTIFICATION

SUPPORTING DOCUMENT NO. 12

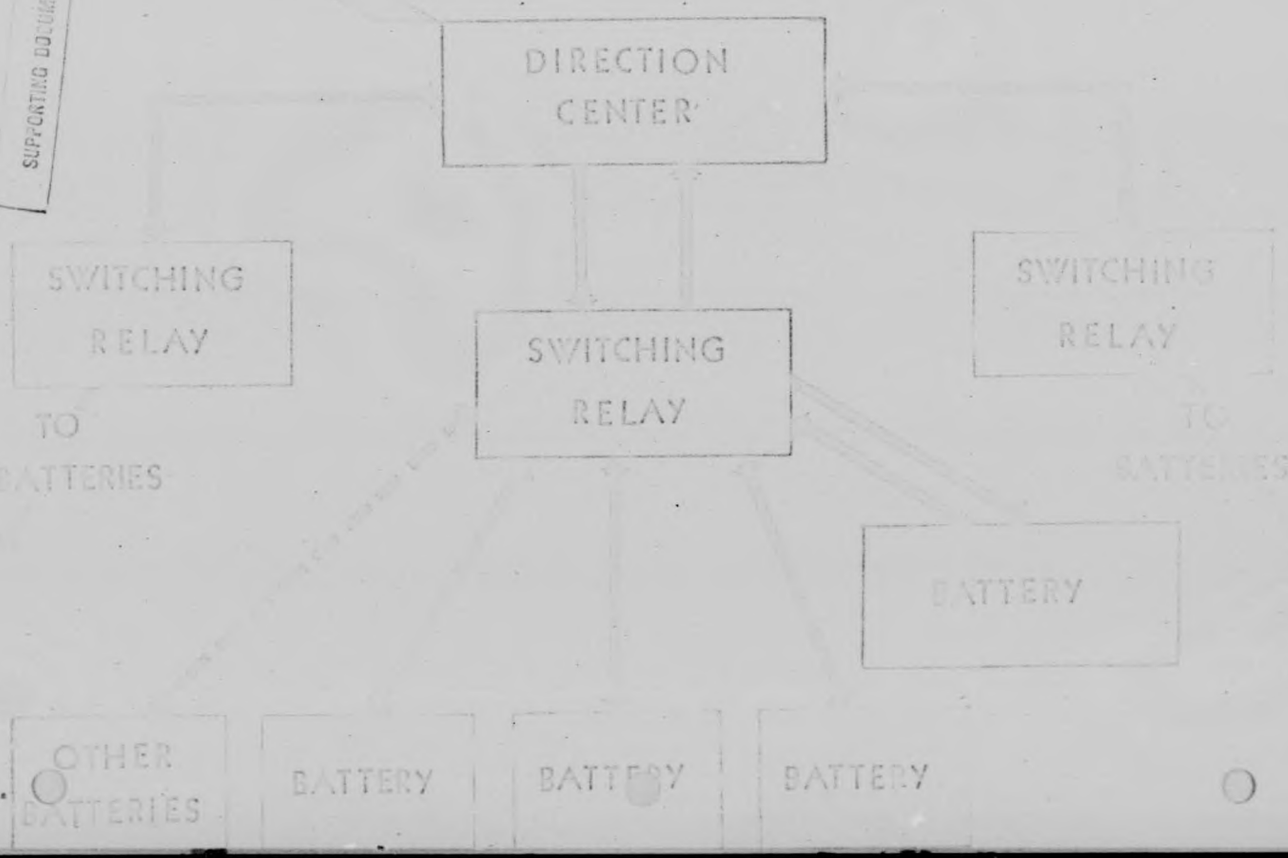


SUPPORTING DOCUMENT NO. 12



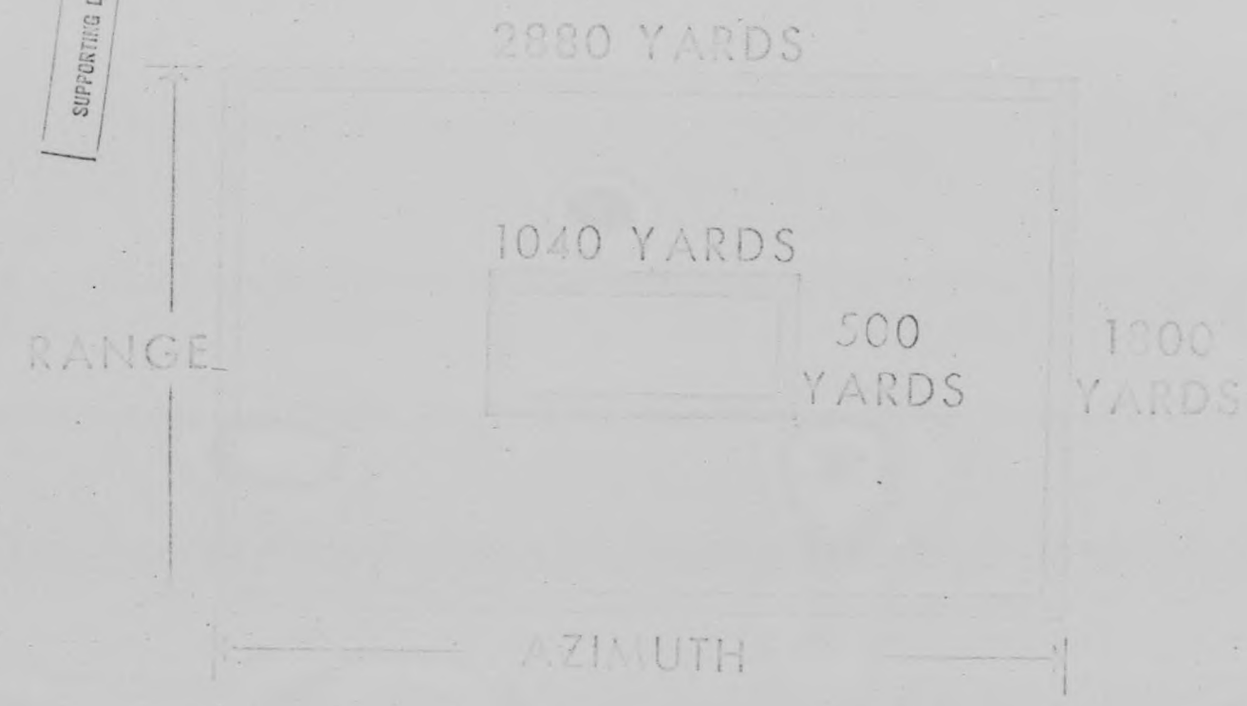
SUPPORTING DOCUMENT NO. 12

TRANSMISSION OF OPERATIONAL DATA



SUPPORTING DOCUMENT NO. 12

DATA ACCURACY



DEPARTMENT OF THE AIR FORCE
OFFICE OF THE CHIEF OF STAFF
UNITED STATES AIR FORCE
WASHINGTON D. C.

SUPPORTING DOCUMENT NO. 18

10 July 1956

SUBJECT: (Unclassified) Continental Air Defense

TO: Commander-in-Chief
Continental Air Defense Command
Ent Air Force Base, Colorado

1. References are:

a. JCS 1899/252

b. JCS 1899/265, Page 1027, Paragraph 4

c. JCS 1899/264

d. Memorandum for Secretary Air Force from Secretary Defense, 21 June 1956, w/Attachment

e. JCS 1899/274

2. Reference is made to the recent Joint Chiefs of Staff and Armed Forces Policy Council considerations of SAGE and AN/FSG-1 in Continental Air Defense. As a result of those considerations, two separate aspects of the problem have been identified: (a) command arrangements and operational control, and (b) technical aspects, each of which is being treated with separately. In regard to the latter, the Secretary of Defense has concurred in views of the Chairman, Joint Chiefs of Staff, (contained in JCS 1899/264) and requests that CINCONAD submit a program for testing the feasibility and operational desirability for the centralized control of antiaircraft batteries through an economical implementation of the SAGE System and Missile Master System, or some modification thereof, for the effective utilization of the antiaircraft units in Continental Air Defense.

3. Copies of the memorandum from the Secretary of Defense (see reference d above) are inclosed for your review. The above references correspond to and clarify the references in the Secretary's memorandum. Pertinent Joint Chiefs of Staff papers are being made available through normal channels. Specifically attention is invited to the Secretary of Defense decision on command arrangements and operational control (JCS 1899/265 and 1899/274).

SUPPORTING DOCUMENT NO 13

LAT 10 CH/CONAD, subj: (Uncl) Continental Air Defense (contd)

1. Attention is invited to the suspense of 15 September 1956 established by the Secretary of Defense. It is requested that your reply be transmitted so as to arrive in this Headquarters not later that 31 August 1956. Your reply should not refer to Joint Chiefs of Staff actions by number.

JACOB E. SMART
Major General, US Air Force
Assistant Vice Chief of Staff

1 Inclosure
Memo for Sec AF
dtd 21 Jun 56

C O P Y

HEADQUARTERS
CONTINENTAL AIR DEFENSE COMMAND
ENT AIR FORCE BASE
COLORADO SPRINGS, COLORADO

SUPPORTING DOCUMENT NO. 14

23 July 1956

MEMORANDUM FOR COMMANDING GENERAL, ARAACOM

1. The Department of the Air Force, acting as executive agency for the Joint Chiefs of Staff, has forwarded the attached memorandum from Secretary Wilson to this command for appropriate action. Briefs of the various documents referenced therein are attached hereto, and the complete papers are available for your review, if desired.

2. I have reviewed the decisions and proposals set forth in these documents, and desire that the following action take place at the earliest practical date:

A SAGE/NIKE integration conference be convened to define the details of NIKE employment in SAGE Modes I, II, III and IV as outlined in the CONAD Operational Plan for Employment of AA Weapons in the SAGE Era, dated 15 March 1956. This conference will be conducted by a CONAD group composed of officers primarily from ARAACOM Headquarters and Headquarters Air Defense Command. Authoritative representatives of Bell Laboratories, Lincoln Laboratory and other development and production agencies concerned with SAGE, Missile Master and NIKE must attend as working members. The conference will have the dual purpose of preparing an employment document for NIKE with SAGE and recommending a program for testing the operational desirability and technical feasibility of this employment.

3. The CONAD group to direct this conference will be selected from the most experienced and knowledgeable officers available. Colonel Oris B. Johnson, Director of Systems Integration, Air Defense Command, will act as conference chairman. Names of members from your headquarters who are to participate should be furnished to Colonel Johnson as soon as possible.

4. It is necessary that conference results and recommendations be published and in my hands on or before 24 August 1956. The place and dates of the conference, therefore, must be selected immediately, and all Army, Air Force, and civilian agencies involved must be notified at once. Unless other arrangements appear more desirable, Bell Laboratory will be requested to act as conference host and 3 August will be

SUPPORTING DOCUMENT NO. 14

[illegible] the [illegible] date. Colonel Johnson will coordinate with appropriate staff agencies as required to insure [illegible] adequately informed of conference [illegible] necessary preparation. In addition, he will [illegible] other required conference arrangements.

[illegible] request your acknowledgement and comments as soon as [illegible].

E. E. PARTRIDGE
General, USAF
Commander in Chief

COPY

ARMY ANTIAIRCRAFT COMMAND

SUPPORTING DOCUMENT NO. 135

AAOAA 413.44A 27 July 1956

SUBJECT: Integration of SAGE and Missile Master

TO: Commander in Chief
Continental Air Defense Command
[illegible] Air Force Base
Colorado Springs, Colorado

1. I acknowledge receipt of your Memorandum of 23 July 1956, which was delivered by your Staff to me on 26 July 1956.

2. Prior to forwarding comments concerning the details of a conference on the subjects covered in Memorandum for the Secretary of the Air Force from the Secretary of Defense, dated 27 June 1956, subject: "Continental Air Defense", it is necessary that the directive be fully understood.

3. With reference to the subparagraph of paragraph 2, your Memorandum, the first sentence is subject of an interpretation which I do not believe was intended. In limiting the employment of NIKE employment to the SAGE Modes outlined in the included Memorandum of 15 March 1956, a strict interpretation would lead to the precluding of any use of the AN/FSG-1 center. Rather than to refer to SAGE Modes I, II, III and IV of this document, I suggest that your directive require the conference to examine the details of NIKE employment in a SAGE/AN/FSG-1 integration under several tactical situations which might be met, such as (a) SAGE is fully operative, (b) the adjacent subsector of SAGE is in control, (c) operational control is delegated to one of the radar sites, and (d) when none of the systems described in (a), (b), or (c) is operational.

4. The following officers will represent this headquarters in the conference: Colonel E. D. Light, Lt Colonel S. T. Jacks, and Major R. E. Hamilton.

s/ S. R. MICHELSEN
S. R. MICHELSEN
Lieutenant General, USA
Commanding

UNREADABLE - POOR ORIGINAL

SUPPORTING DOCUMENT NO. 16

SUPPORTING DOCUMENT NO. 17

[illegible] Missile Master

[illegible] Staff
[illegible] Air Force
[illegible] Liaison Officer for COMAD
[illegible]
[illegible] 25, D. C.

1. [illegible] Headquarters USAF letter, Subject: (U) [illegible] Air Defense, dated 10 July 1956 and inclosures.

2. [illegible] to test the integration of SAGE and the [illegible] been completed as requested, and is [illegible] as Inclosure 1. This test program was [illegible] group, consisting of members of the [illegible] Tactical Command and Air Defense Command staffs. [illegible] basis for formulating the program, this group [illegible] the operational procedures required to [illegible] both Missile Master and SAGE, a [illegible] is attached as Inclosure 2.

3. [illegible] plan for testing an integrated SAGE-F3G-1 [illegible] the requirements for testing the technical [illegible] and operational desirability criteria.

[illegible] and detailed study and tests will be needed to [illegible] where duplication of functions and facilities will [illegible] necessary modifications of the F3G-1 are re- [illegible]. Such a program will also provide a basis for deter- [illegible] of the number of F3G-1 units required.

4. Another consideration that also must be pointed out [illegible] of computer programming. The initial computer [illegible] not being designed to assign targets direct to AA [illegible], but rather to assign targets to manual AAOCs. A [illegible] computer program for SAGE is planned that will inte- [illegible] new air defense weapons, including Bomarc, Talos, new [illegible] and the F3G-1. The modified SAGE computer program [illegible] to assign targets direct to batteries as out- [illegible] of a centralized control concept. Con- [illegible] difficulties now being encountered in programming, [illegible] effort at a rate of progress far greater than is [illegible] believed is necessary to integrate the AA/F3G-1 (and [illegible]) [illegible] earliest date when AA facilities will be avail- [illegible] diversion of available programming effort for this [illegible] will undoubtedly result in further delay of conversion [illegible] as a whole, and cannot be [illegible].

[illegible]

Col O. [illegible] Johnson
Dir, [illegible] Integration

SUPPORTING DOCUMENT NO. 17

[illegible] the following recommendations are submitted:

a. The accelerated reliability test should be [illegible] [illegible] for incorporating the SAGE computer, [illegible] in the proposed test program.

b. The operational feasibility and desirability [illegible] should be conducted when the SAGE computer program has [illegible] to operate with the F8C-1 system in an operational [illegible]. Proposed dates for these tests are also [illegible] in the test program.

c. The F8C-1 should be procured in limited numbers for the interim period, prior to its integration with SAGE.

Incls
1. [illegible] Test Program
2. Concept for Employment of AI Weapons

E. E. PARTRIDGE
General, USAF
Commander-in-chief

SECRET

SUPPORTING DOCUMENT NO. 17

SUMMARY OF A CONCEPT OF CENTRALIZED CONTROL FOR THE EMPLOYMENT OF AA WEAPONS BY THE INTEGRATION OF MISSILE MASTER AND SAGE

I. METHOD OF OPERATION.

1. The method of employment of AA weapons in the SAGE era will be the assignment of designated targets to individual AA batteries by the SAGE Direction Center through the AN/FSG-1 (Missile Master) or some modification of the AN/FSG-1 system.

2. The AN/FSG-1 will act as a "back-up" for the SAGE System in the event of temporary degraded control capability of the SAGE System.

3. The primary mode of operation in the semiautomatic air defense environment will be centralized control of the entire family of air defense weapons to insure optimum utilization of all available weapons. The SAGE Direction Center with its AN/FSQ-7 computer will receive inputs from all data sources having information on friendly and hostile airborne targets, and will then select and assign individual targets to individual weapons. For weapons with their own separate guidance and control systems, (such as NIKE), the technical components of the basic data gathering environment, SAGE and the guidance and control systems will be interconnected. This interconnection and the related detailed operational plans will be designed to permit maximum weapon

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effectiveness, and to prevent duplication of facilities. The weapon-target pairing of AA weapons will be performed automatically by the FSQ-7 computer, and the Antiaircraft Weapons Director in the SAGE Direction Center will monitor the assignment. Targets within AA weapons range will automatically be assigned to the AA batteries unless manual intervention by an Antiaircraft Weapon Director occurs. This insures, as an example, NIKE employment on all hostile targets within NIKE range unless a negating tactical decision is made and followed by positive action by a human being to override an automatically generated series of commands.

4. To insure reliability and continuity in the primary mode of operation, the AN/FSQ-7 computer will be duplexed. In addition, critical communication circuits, both digital and voice, will be also duplexed and separately routed. Additional back-up capability for the SAGE System is available within the basic components that support the system. The various methods of air defense operation which range from fully centralized control by the primary Direction Center to autonomous weapon operation are described as Modes of Operation. The alternate modes can be implemented either for tactical reasons or because of equipment failures. However, centralized control to the maximum extent possible is the prime operational objective.

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5. The delineation of modes of operation of the air defense system is dependent upon the degree of control that can be exercised by the SAGE Direction Center or by the supporting facilities of the overall air defense system. Basically, these modes of operation are defined as follows:

a. Mode I (Primary Mode). The Joint SAGE Direction Center will make the target assignment for all air defense weapons including long range and medium range interceptors, Bomarc, Talos, NIKE and other weapons which may be available. Control of all air defense weapons is vested in the Joint Subsector Commander of the SAGE subsector in which the weapons are located. Target assignment for Antiaircraft weapons will be made at the Joint SAGE Direction Center. Weapon status, air surveillance data, target assignment and operational engagement status will be passed directly between the SAGE Direction Center through the Missile Master System to the Antiaircraft weapons. The FSG-1 will be used in Mode I conceptionally as a switching and communications central. The commitment of Antiaircraft weapons against available targets in adjacent subsectors will be by request of the adjacent direction center and approval of the direction center having operational control. Where two or more Antiaircraft defense systems exist in the same subsector, coordination of target assignment will be accomplished by the AN/FSQ-7 computer program under the supervision of the

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Antiaircraft Weapons Directors ~~in the SAGE Direction Center.~~

The functions of monitoring, supervision and coordination for Antiaircraft weapons will be accomplished at the Joint SAGE Direction Center by the Antiaircraft Officer, the Antiaircraft Weapons Directors and the Antiaircraft Weapons Directors' Assistants. The Antiaircraft Officer advises the Joint Subsector Commander, or his representative, and coordinates matters concerning the employment and capabilities of Antiaircraft weapons within the subsector. The Antiaircraft Weapons Director and the Antiaircraft Weapons Director's Assistant comprise an Antiaircraft Weapons Direction team similar to the Weapons Direction Teams for Bomarc, Talos and manned interceptors. The Antiaircraft Weapons Direction Team accepts target assignments directly from the Senior Weapons Director. The computer program automatically makes target to fire unit assignments, based on optimum operational procedures. The AA Weapons Directors monitor computer assignments and may override or modify such assignments as the situation dictates. Individual targets may be designated for assignment to AA weapons by the AA weapons Director through the use of intervention switches on his console.

The fire unit will receive the target assignment information via automatic data link. The Fire Unit Commander will implement and monitor the target-weapon assignment and the actual interception of the target by the NIKE missile.

The Fire Unit will forward to the Joint SAGE Direction Center, by digital data link, the weapon engagement status. A voice circuit will also be available for operational coordination of target or weapon information, as well as for the dissemination of states of preparedness, conditions of warning and states of fire and for reporting long-term weapon availability status.

The primary mode (Mode I) of operation will be the most effective means of conducting the air defense mission and every effort will be made to maintain this mode of operation.

b. Mode II. In the second mode of operation AA weapons located in the primary subsector will be controlled by an adjacent subsector. Under this mode of operation the AA Directors of the adjacent subsector(s) accept responsibility for target assignment to designated AA weapons located in the disabled subsector, insofar as each particular AA Fire Direction Center is concerned. The assignment of specific targets to AA batteries will be through the FSG-1 and the FSG-1 will function as a switching relay between the adjacent SAGE Direction Center and the AA batteries. The computer program of the adjacent subsector(s) will be designed to accept these additional inputs and provide data for the assignment of targets to fire units in disabled subsectors. The second mode of operation will be inferior to Mode I in two respects. The low altitude capability will be

degraded due to the loss of gap filler radars which are not connected to adjacent direction centers. The degree of degradation will vary, depending on the low altitude capability of the long range radars in that particular area. The second limitation is an undetermined factor which will vary in each subsector. The computer may reach its maximum capacity more quickly if it must assume responsibility for an adjacent area as well as its normal SAGE subsector area. Thus, the adjacent SAGE Direction Center may suffer some degraded control capability. This possibility will depend entirely upon the tactical situation existing at the time that a SAGE computer must take on the responsibility for an adjacent area. Voice circuits between the adjacent direction center and designated weapons in the disabled subsector, will be available for operational coordination of target or weapon information, as well as for the dissemination of states of preparedness, conditions of warning, and states of fire.

c. Mode III. This mode of operation would normally result from the loss of the automatic data link between SAGE Direction Centers and the Antiaircraft Fire Direction Center, necessitating the transmission of reference data by voice communication to the AA Fire Direction Center. The AA Weapons Director in the SAGE Direction Center has available to him the overall air situation for the subsector

and can recommend target assignment based on the overall air defense picture. It is also possible that communications, both automatic and voice, might become inoperative between the SAGE Direction Center and the AA Fire Direction Center. If this should occur, reference data is transmitted to the AA Fire Direction Center from the ADC long range radar connected to it. The radar squadron commander will be responsible for the designation of friendly aircraft, based on the air situation and identity available to him, and/or for designating hostile tracks, particularly with regard to priority. He has the authority to impose the temporary restriction "Hold Fire" on designated tracks.

d. Mode IV. This mode of operation results from complete loss of communications from SAGE Direction Centers and ADC long range radars (digital data, video, and voice) to the AA Fire Direction Center. This mode of operation also results from the loss of voice communications only from the ADC long range radar when the FSG-1 is operating only with inputs from the long range radar (video still operating). In either case, AA weapons will operate autonomously. The following are examples of these conditions:

(1) Loss of video from the radar sites. In this event the FSG-1 system can coordinate target-battery pairing by using the battery data link.

(2) Loss of video from the radar and loss of the battery data link (BDL). The batteries will operate completely autonomously in this case.

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PROPOSED CONAD PLAN OF TEST

CENTRALIZED CONTROL OF ARMY AA WEAPONS BY SAGE

1. Purpose. To test the feasibility and the operational desirability for the centralized control of Antiaircraft Batteries through an economical implementation of the SAGE system and the Missile Master system, or some modification thereof, for the more effective utilization of the Antiaircraft units of the Army in Continental Air Defense.

2. General. The initial SAGE computer program is not being designed to assign targets direct to AA Batteries, but rather to assign targets to manual AAOC's or FSG-1 Fire Direction Centers. A modified computer program for SAGE is planned that will integrate all new air defense weapons, including BOMARC, TALOS, new interceptors and the FSG-1. The modified program will be designed to assign targets direct to AA Batteries. Considering the difficulties now being encountered in computer programming, extra-ordinary effort at a rate of progress greater than is now being achieved is necessary to integrate the FSG-1 (and NIKE) as soon as the early SAGE subsector becomes operational. Such a diversion of available programming effort for this purpose will undoubtedly result in further delay of operation for SAGE as a whole, and cannot be accepted.

3. Objectives.

a. To determine the technical feasibility of

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utilizing an AN/FSQ-7 SAGE Direction Center to make primary assignments of targets directly to AA fire units through the AN/FSG-1 Antiaircraft Defense System.

b. To determine the operational feasibility of centralized control of all Army AA fire units utilizing AN/FSQ-7 Direction Centers and AN/FSG-1 Antiaircraft Defense Systems.

c. To determine the operational desirability of centralized control of all Army AA fire units utilizing AN/FSQ-7 Direction Centers and AN/FSG-1 Antiaircraft Defense Systems.

d. To determine the most economical integration of the SAGE and Missile Master Systems through the elimination of unnecessary duplication of functions and facilities.

4. Test Program. In order to accomplish the above objectives fully, it is considered necessary to conduct a series of tests as follows:

a. First, the technical feasibility of the concept outlined in 1 above can be tested by preparing a computer program, connecting the AN/FSQ-7 Direction Center to an AN/FSG-1 Antiaircraft Defense System (including AA fire units) and requiring the system to perform in a manner which could be expected to exist under battle conditions. This operation would be considered a laboratory type test conducted largely by engineer personnel, and employing a high degree of

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simulation. From this test we might expect to determine answers to the following questions:

(1) Can the computer be programmed to make target assignments to AA fire units?

(2) Are targets selected by the computer and assigned to AA fire units in an optimum manner under all likely conditions of attack?

(3) Are accurate displays of computer selection presented on necessary consoles in the SAGE Direction Center?

(4) Can manual override decisions be applied to these target assignments by responsible Army individuals in the AN/FSQ-7 Direction Center.

(5) Can the target assignments be transmitted with acceptable time delays and with sufficient accuracy to permit rapid target acquisition by AA fire units?

(6) Can all necessary data be exchanged between the two systems with acceptable timings and accuracy?

It is estimated that this test could be conducted at SAGE ESS (Lincoln Laboratory) during 1958.

b. Secondly, the feasibility test of the operational concept should be designed to determine whether or not the principles of centralized control which were demonstrated to be technically feasible on a comparatively limited scale can be extended to control, under all modes of operation, all AA fire units normally found within an operational

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SAGE subsector. This test can be accomplished by employing the SAGE Direction Centers in two adjacent subsectors, at least two Missile Master Systems in each subsector, at least one manual fire direction center in one or the other of the two SAGE subsectors and all AA fire units located within these SAGE subsectors. The test should provide for AA defenses which overlap SAGE subsector boundaries. The tests should be conducted as complete air defense system tests employing simultaneously all available air defense weapons.

(1) Single aircraft, and multiple tracks of single objects and small formations, attacking at different altitudes.

(2) Multiple tracks of sufficient density, and altitude variation, to permit the simultaneous employing of all available Army AA weapons.

(3) At least one saturation type attack in which the full capacity of the entire air defense system is utilized requiring the simultaneous employment of all air defense weapons enumerated above.

(4) ECM attacks interspersed with all of the tests in the three subparagraphs above.

The operational feasibility tests would be expected to determine whether or not the target-to-fire unit assignment made by the SAGE Direction Center for all AA weapons are

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accomplished in the optimum manner and in sufficient time to permit engagement at maximum weapons range. It is estimated that this test could be conducted at McGuire and Stewart Subsectors in 1959.

c. Thirdly, in order to determine the operational desirability for the centralized control of Antiaircraft Fire Units it is believed necessary to have a standard for comparison. If the foregoing tests prove that centralized control provides effective operation there can be little doubt of its validity. However, to conclusively determine that centralized control is the best method of operation a comparative test of the Army's decentralized mode of operation is required. At the present time the Army is developing the Missile Master System to operate in either a centralized mode or a decentralized mode. However, as each SAGE Direction Center becomes operational with an AA program in the computer, the Missile Master systems in that subsector would be regarded as complementary rather than primary fire direction systems for AA weapons. After the first two adjacent SAGE Direction Centers become operational with AA programs in their computers, the operational feasibility tests described above for centralized control could be conducted and, for comparison, the Army mode of operation also could be tested. Only as a result of such a comparative test can the operational desirability of one mode over the other be

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Amarillo, or a combination of both developed to function as required under varying conditions of attack.

5. Instrumentation and Records.

a. General administration and supervision should be administered by an agency of the Department of Defense.

b. Data collection and reduction should be accomplished by a joint organization comprised of approximately equal representation from both Services.

c. Detailed plans and procedures will be developed after approval of the forces and general concept and plans.

6. Recommended Test Agencies.

a. The USAF agencies responsible to provide USAF test participation should be AFSC and ARDC with support by SAC and AFC.

b. The Department of Army agencies responsible for test should be CONARC Board 4, Department of Army R&D, with support provided by AMSAGMA.

c. Such Department of Defense agencies as recommended by Secretary of Defense.

ANNEX B SUPPORTING DOCUMENT NO. 17

PROCEDURES FOR INTEGRATING MISSILE MASTER
into the
MANUAL ENVIRONMENT

1. General. This annex covers a brief description of the procedures to be used and the facilities required for the integration of the Missile Master into the manual environment. At present, there are no means in the Air Defense System to exercise effective centralized control of AA weapons as ADC Direction Centers are separate from Army Anti-Aircraft Operation Centers (AAOC). Combining these two facilities to function as a joint Direction Center is in consonance with the CONAD objective. Co-location of the FSG-1 and the Manual Direction Center Equipment (DRA-37) is accepted as a fundamental requirement for the procedures outlined herein.

2. Integration of FSG-1 in a specific area.

a. A specific example for the geographical area - Philadelphia and New York - has been selected to describe the method of integration. The procedures to be used and the facilities required in this area will apply to all regions in which the FSG-1 is located.

b. The attached map (No. 3) shows the existing and planned radar facilities for the Philadelphia-New York area. The five radar direction centers in this region (Ft. [illegible], P-[illegible], P-[illegible], TF-[illegible] and TF-[illegible]) will be equipped with the DRA-37 Tracer Computer Group for the control of interceptors. The [illegible] complexes in Philadelphia

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and New York will require FSG-1 for control of NIKE.

c. NIKE and Air Force weapons are deployed in this region such that both can be employed in the same air space. The integrated use of all available weapons can be achieved by use of a suitably located centralized facility that has available the complete air surveillance picture and the capability for control of all weapons. The two locations best suited for establishing the Joint Manual Direction Centers in this area are at or near New York City and Philadelphia. See Map 3.

d. The radar direction center at Highlands, New Jersey (P-9) meets the requirement for a Joint Manual Direction Center in the vicinity of New York City. There is, however, no AMC radar station suitably located to meet the requirements for the Philadelphia AA weapons complex. A new radar site near Philadelphia would meet AA needs and could also fill the requirements for the use of other weapons in this area. The operational requirements for surveillance and weapon control facilities could best be met in this area by: (1) establishing P-9 and a new site near Philadelphia as Joint Direction Centers, each being equipped with FSG-1 and the normal equipment used at a Manual Direction Center, (2) reducing P-34 to gap filler status or limiting its control capability; (3) maintaining P-35, TT-3 and TT-4 as radar Direction Centers; and (4) changing the deployment of gap filler radars to provide 360° coverage to the maximum range of NIKE units.

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c. With this arrangement, the Joint Manual Direction Center at P-9, and at the new location at Philadelphia, would be responsible for all action pertaining to the gathering of air surveillance and identification data and the commitment and control of all available weapons in the defined geographical area. Data on the air situation outside the assigned area would be by cross-tell from adjacent radar Direction Centers and/or the Air Division Combat Center.

3. Integration of the FSG-1 in Continental Air Defense System.

a. Further detailed study will be required for the Philadelphia-New York area and for the eight additional areas in which the FSG-1 will be located. Similar study will be required for other areas as additional FSG-1 and/or modified Missile Master Systems for small AA complexes may be established as CONAD requirements.

b. A tentative study has been made for the first ten proposed FSG-1 locations in the same manner as that made for the Philadelphia-New York area. This study indicates that Joint Manual Direction Centers will be required in the priority indicated.

	Missile Master	Manual Direction Center
1.	Ft Meade, Md.	New Facility
2.	New York	P-9 Highlands, N.Y.
3.	Detroit	P-20 Selfridge AFB
4.	Niagara-Buffalo	P-21 Lockport AFB
5.	Seattle	P-1 McChord AFB

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	Direction Center	Manual Direction Center
6.	Boston	New Facility
7.	Chicago	New Facility
8.	Philadelphia	New Facility
9.	Los Angeles	New Facility
10.	Pittsburg	New Facility

Eight of the joint facilities could be used jointly with CAA in addition to meeting the military requirements. The eight are: Detroit, Buffalo, Seattle, Boston, Chicago, Philadelphia, Los Angeles and Pittsburg.

c. There are possibly four present Manual Direction Centers (P-31, P-54, P-15 and P-63) which could be deleted or reduced to gap filler status if new facilities are activated to meet the Joint Manual Direction Center criteria. Certain of the currently planned ADC gap fillers should be deleted or redeployed to insure solid 500' coverage in those areas where NIKE can be employed. The changes mentioned above in the overall U. S. ADC radar deployment are shown on the attached Map 4.

4. Joint Facility Description.

a. Initially, the method of combining the FSG-1 and the GPA-37 will be to locate all operating positions (surveillance, tracking, identity, and control) for both equipments in the same operations room. Duplicating functions will be deleted or combined. The separate storage and computing components of the FSG-1 and GPA-37 will be [illegible] housed in building annexes to the joint operation room. The attached chart #5 shows a

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propo[illegible] of Joint Manual Direction Centers. This chart also shows the general layouts of operations rooms of a [illegible] Master, and a standard ADC Direction Center with GPA-37 for comparison with the joint facility. A cost analysis of these facilities is outlined in Annex D.

b. The Joint Manual Direction Center with the FSG-1 for control of NIKE and GPA-37 to control interceptors provides considerable potential for further combination of facilities and functions. The GPA-37 and the FSG-1 both contain radd aided tracking, analogue conversion and identity equipments. Manual functions such as tracking, identity, surveillance and command are duplicated in both systems. A composite system which incorporates all these functions and facilities into one system can be achieved at a Joint Manual Direction Center which includes an FSG-1. A technical study by Research and Development Agencies will be required to determine the degree to which this can be accomplished.

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NEW YORK CITY - PHILADELPHIA AREA
(McGUIRE SUBSECTOR)

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ADC RADAR DEPLOYMENT

HEAVY RADAR SITES

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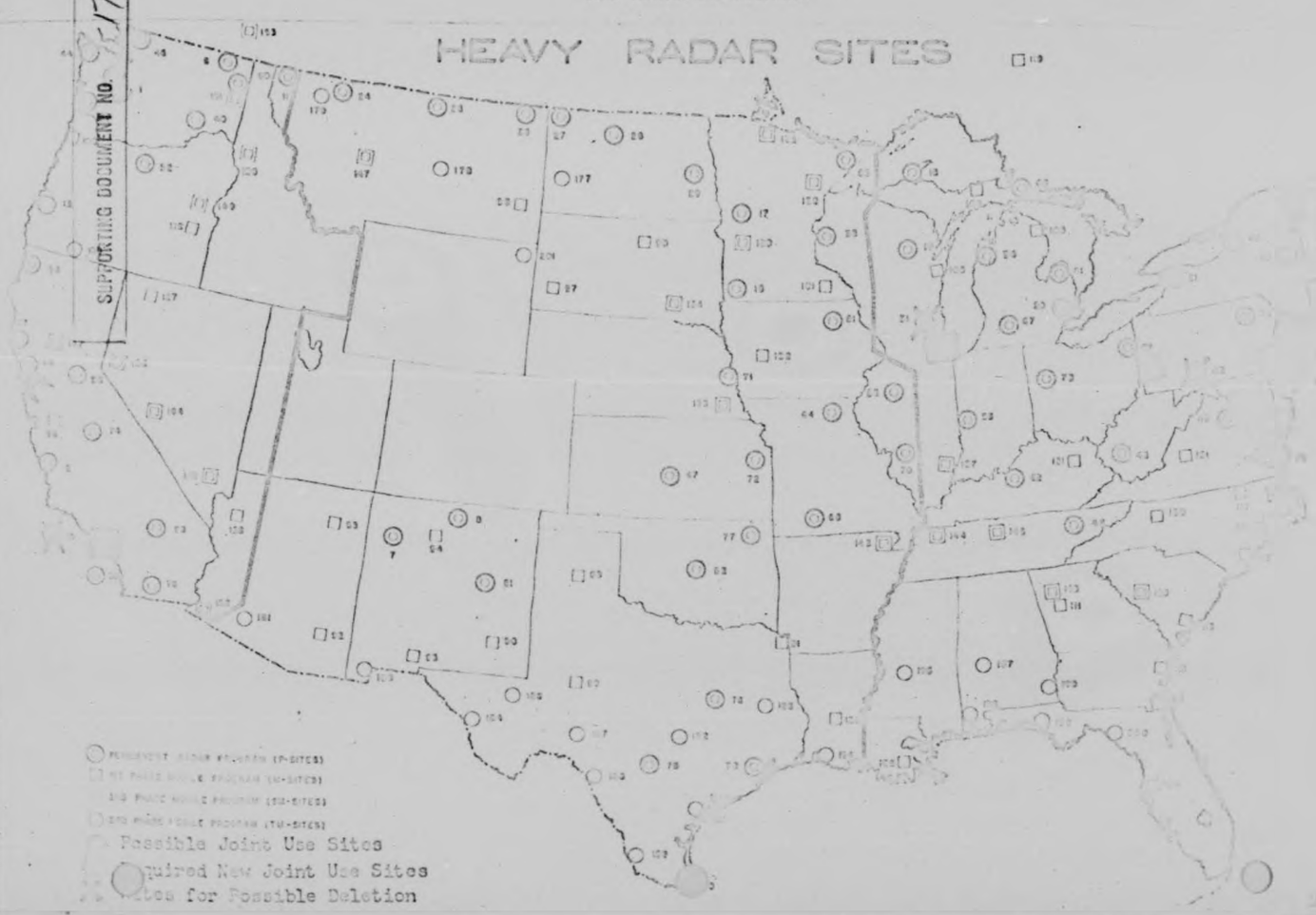

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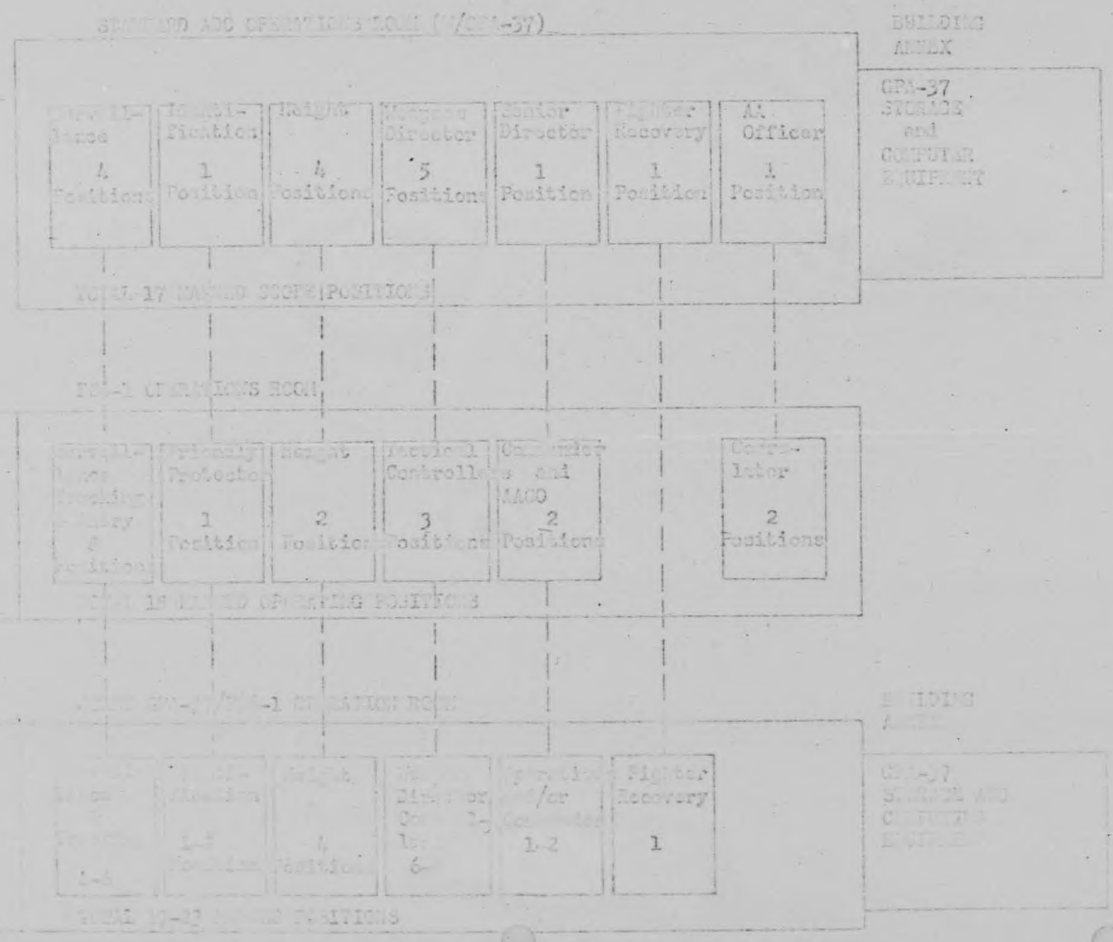

COMPARISON OF GPA-37 AND FSC-1 FACILITIES WITH A PROPOSED JOINT FACILITY

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[illegible] MISSILE MASTER IN THE SAGE ERA

1. The [illegible] of AA weapons in the SAGE [illegible] designated targets to individual [illegible] by the SAGE Direction Center through the AN/FSG-1 Missile Master.

2. The AN/FSG-1 will [illegible] support the SAGE system and serve as "back up" [illegible] in the event of temporary degraded control capability of the SAGE system.

3. The primary [illegible] operation of the semiautomatic air defense [illegible] will be centralized control of the entire family of air defense weapons to insure optimum utilization of all available weapons. The SAGE Direction Center with its AN/FSG-7 [illegible] will receive inputs from all data sources [illegible] friendly and hostile airborne targets [illegible] will then select and assign individual targets to individual weapons. For weapons with their own separate guidance and control systems, (such as NIKE), the technical [illegible] of the basic data gathering environment, SAGE and the [illegible] and control systems will be inter-connected. This [illegible] and the related detailed operational plan will be designed to permit maximum weapon effectiveness, [illegible] duplication of facilities. The weapon target [illegible] AA weapons will be performed automatically [illegible], and the Antiaircraft

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Weapon Director in the SAGE Direction Center will monitor the [illegible]. Targets within AA weapons range will automatically be assigned to the AA Batteries unless manual intervention by an Antiaircraft Weapons Director occurs. This insures, as an example, NIKE employment on all hostile targets within NIKE range unless a negating tactical decision is made and followed by positive action by a human being to override an automatically generated series of commands.

4. To insure reliability and continuity in the primary mode of operation, the AN/FSQ-7 computer will be duplexed. In addition, critical communication circuits, both digital and voice, will be also duplexed and separately routed. Additional back-up capability for the SAGE system is available within the basic components that support the system. Weapon control facilities, such as the GPA-37 for control of interceptors and the FSG-1 for control of AA weapons, will be located at ADC radar sites. The air situation will be available at this location and the air battle can be fought at this location in the event of degradation of the SAGE system. The radar site/FSG-1 complex will be referred to as a Manual Direction Center in this Annex. The various methods of air defense operation which range from fully centralized control by the primary direction center to autonomous weapon operation are described as Modes of Operation. The alternate

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areas can be isolated either for tactical reasons or because of equipment failures. However, centralized control to the maximum extent possible is the prime operational objective. The modes of operation describe a degradation of centralized control effectiveness, but operation in alternate modes of operation does not necessarily mean an equal degradation of air defense effectiveness.

5. The delineation of modes of operation of the air defense system is dependent upon the degree of centralized control that can be exercised by the SAGE Direction Center or by the supporting facilities of the overall air defense system. Basically, these modes of operation are defined as follows:

a. Mode I (Primary Mode). The Joint SAGE Direction Center will make the target assignment for all air defense weapons including long range and medium range interceptors, BOMARC, TALOS, NIKE and other weapons which may be available. Control of all air defense weapons is vested in the Joint Subsector Commander of the SAGE subsector in which the weapons are located. Target assignment for Antiaircraft weapons will be made at the Joint SAGE Direction Center. Weapon status, air surveillance data, target assignment and operational engagement status will be passed directly between the SAGE Direction Center through the Missile Master system to the Antiaircraft weapons. The FSC-1 will be used

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in Zone 1 conceptionally as a switching and communications center. The commitment of Antiaircraft weapons against available targets in adjacent subsectors will be by request of the adjacent direction center and approval of the direction center having operational control. Where two or more Antiaircraft defense systems exist in the same subsector, coordination of target assignment will be accomplished by the AN/FSQ-7 computer program under the supervision of the Antiaircraft Weapons Directors in the SAGE Direction Center.

The functions of monitoring, supervision and coordination for Antiaircraft weapons will be accomplished at the Joint SAGE Direction Center by the Antiaircraft Officer, the Antiaircraft Weapons Directors and the Antiaircraft Weapons Directors' Assistants. The Antiaircraft Officer advises the Joint Subsector Commander, or his representative, and coordinates matters concerning the employment and capabilities of Antiaircraft weapons within the subsector. The Antiaircraft Weapons Director and the Antiaircraft Weapons Director's Assistant comprise an Antiaircraft Weapons Direction Team similar to the Weapons Direction Team for BOMARC, TALOS and manned interceptors. The Antiaircraft Weapons Direction Team accepts target assignments directly from the Senior Weapons Director. The computer program automatically makes target to fire unit assignments, based on optimum operational procedures. The AA Weapons Directors monitor computer

nments and may override or modify such assignments as the situation dictates. Individual targets may be designated for assignment to AA weapons by the AA Weapons Director through the use of intervention switches on his console.

The fire unit will receive the target assignment information via automatic data link. The Fire Unit Commander will implement and monitor the target-weapon assignment and the actual interception of the target by the NIKE missile. The fire unit will forward to the Joint SAGE Direction Center, by digital data link, the weapon engagement status. A voice circuit will also be available for operational coordination of target or weapon information, as well as for the dissemination of states of preparedness, conditions of warning and states of fire and for reporting long-term weapon availability status.

The primary mode (Mode I) of operation will be the most effective means of conducting the air defense mission and every effort will be made to maintain this mode of operation.

b. Mode II. In the second mode of operation AA weapons located in the primary subsector will be controlled by an adjacent subsector. Under this mode of operation the AA Directors of the adjacent subsector(s) accept responsibility for target assignment to designated AA weapons located in the disabled subsector, insofar as each particular

AA Fire Direction Center is concerned. The assignment of aerospace targets to AA Batteries will be through the FSG-1 [illegible] will function as a switching relay between the adjacent SAGE Direction Center and the AA Batteries. The computer program of the adjacent subsector(s) will be designed to accept these additional inputs and provide data for the assignment of targets to fire units in disabled subsectors. The second mode of operation will be inferior to [illegible] in two respects. The low altitude capability will be degraded due to the loss of gap filler radars which are not connected to adjacent direction centers. The degree of degradation will vary, depending on the low altitude capability of the long range radars in that particular area. The second limitation is an undetermined factor which will vary in each subsector. The computer may reach its maximum capacity more quickly if it must assume responsibility for an adjacent area as well as its normal SAGE subsector area. Thus, the adjacent SAGE Direction Center may suffer some degraded control capability. This possibility will depend entirely upon the tactical situation existing at the time that a SAGE computer must take on the responsibility for an adjacent area. Voice circuits between the adjacent direction center and designated weapons in the disabled subsector, will be available for operational coordination of target of weapon information, as well as for the dissemination of states of

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[illegible] conditions of warning, and states of fire.

c. Mode III. The facility which will be available to assume the responsibility for weapon control in Mode III is the Manual Direction Center (an ADC radar site - FSG-1 complex). This mode of operation would normally result from loss of the automatic data link circuitry between SAGE Direction Centers and the Manual Direction Center or the complete ineffectiveness of the SAGE Direction Centers to exercise centralized control. In the former case, and if voice communication circuits still exist between the two facilities, the AA Weapons Director in the SAGE Direction Center has available to him the overall air situation for the subsector and he can recommend target priority to the Manual Direction Center. The SAGE Direction Center can designate the states of fire for AA weapons (Weapons Tight, Weapons Free, Hold Fire) if voice circuit exists. In either case in this mode of operation, the target-weapon assignment will be made at the Manual Direction Center. The Manual Direction Center Commander will be responsible for the designation of friendly aircraft, based on the air situation and identity available to him.

d. Mode IV. This mode of operation is autonomous operation by the AA Batteries. The Battery Commanders make the target-weapon assignment. An SOP will aid in providing economical distribution of fire among the AA Batteries.

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The SOP will insure as near a uniform target-weapon assignment as is possible under this mode of operation. If a voice circuit is in being between Batteries and the Manual Direction Center, states of fire can be designated by the Manual Direction Center.

6. This paragraph describes the various conditions under which a shift from one mode of operation to another may be required. Whenever a change in mode of operation is made, it is operationally desirable to return to a more effective mode of operation as soon as time and capability will permit. It is possible to foresee tactical situations which may be more effectively handled by a shift in operation, such as, sharing the conduct on an air battle in one subsector with its adjacent neighbors. Computer programs and SOP's will be required to insure that such changes in operation will provide the most effective control system at any time. For simplicity the many variables have been divided into two broad categories - Planned and Orderly Implementation and Automatic Implementation by SOP.

a. Planned and Orderly Implementation.

(1) General. When a condition arises (whether it be for tactical reasons or equipment failure) that can be corrected by directing a shift in modes of operation, such a decision can be made and carried out while the communication capability still exists to do so in an orderly manner.

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The operational effectiveness of the direction center to control air defense in a subsector is directly related to the effectiveness of the components and communication supporting system. The basis for change from one mode to another will depend on the degree of control effectiveness that can be exercised by the direction center. Partial or major loss of control capability will determine whether control remains with the primary direction center (Mode I) or is shifted to another agency (Mode II, III, or IV).

(2) Flexibilities of Mode I. There is considerable flexibility in Mode I for the employment of all weapons. The capability inherent in the SAGE system and the components thereof (Manual Direction Center) provide the subsector commander with many alternative methods of weapons employment. Consequently, the subsector commander need not necessarily shift the entire subsector to a less effective mode simply because of a partial loss of capability of the system. For example, a partial loss of capability might occur if the digital data circuit between the primary direction center and a Manual Direction Center (radar site FSC-1) became inoperative. However, target priority could still be made by the AA weapon Director by voice communication. In addition, "Condition of Warning" and "States of Fire," based on the current air situation, could be passed to the Manual Direction Center by the SAGE Direction Center.

The integrated target assignment function for all weapons would again be assumed by the SAGE Direction Center when the main circuit was restored. Should the control function be further deteriorated by the loss of digital data circuits to large numbers of weapon units, consideration should be given to a shift from Mode I to Mode II.

(3) Shift from Mode I to Mode II. There is also flexibility in the overall SAGE system based on the mutual support of one subsector by the adjacent subsectors. The subsector commander can exploit this capability in the event of a major loss of capability in the primary subsector, such as:

(a) Both Computers Out, Communication Operational.

1. The loss of both computers in the primary SAGE Direction Center would be a major loss of capability in that subsector. If communication existed to the batteries and to the adjacent direction center, the subsector commander could direct the shift from Mode I to Mode II.

2. The procedure for shift from Mode I to Mode II would be as follows: The AA Weapon Director of the primary SAGE Direction Center will direct the Battery Commanders to switch to the second mode of operation and accept target assignment from the adjacent direction center.

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At the same time the adjacent direction center would be requested by the primary direction center to take control of the AA batteries in the primary subsector.

(4) Shift from Mode I to Mode III. The emergency capability of the Manual Direction Center (radar site/FSG-1 complex) provides additional flexibility which is available to the subsector commander. This shift might be directed in such cases as:

(a) Primary SAGE Direction Center Computers Operational, Communication (Data) Out to Manual Direction Center.

1. Even though the computers are operating in the primary subsector, the data circuit necessary for target assignment to a Manual Direction Center could be inoperative. In addition, the use of voice circuit for designation of target priority might be unsatisfactory because of numbers of targets and speed of transmission of information. In this case it might be desirable to shift the Manual Direction Center to Mode III and the SAGE Direction Center designate the states of fire for the area supervised by the Manual Direction Center.

2. The decision to shift or remain in Mode I would be made by the SAGE Subsector Commander based on the tactical situation and on the capabilities of the direction center.

SUPPORTING DOCUMENT NO. 17

(b) Computers Out at Primary and Adjacent Direction Center, Communication Operational.

1. In the event of loss of computers at both the primary and adjacent direction center, the primary direction center will direct a shift to Mode III operation.

b. Automatic Implementation by SOP.

(1) General. When a condition arises that can be corrected by shifting mode of operation, but the capability does not exist to do so in an orderly manner, an alternate mode of operation must be adopted automatically through SOP by the unit affected.

(2) Communication Loss. In general, the conditions which require an automatic shift in mode of operation are those where complete loss of all communication occurs. These conditions, loss of communications, could occur during any mode of operation which had been orderly implemented. Automatic shift to the next best mode of operation for which a capability exists will be accomplished by the Weapon Commander (Manual Direction Center or Battery Commander) who has been cut-off from his control authority.

(3) Shift to Mode IV. Complete loss of communications to a higher control element will require that the AA weapon unit immediately shift to Mode IV, autonomous operation, regardless of which former mode it had

been operating under. The state of fire will be immediately adopted consistent with the condition of warning existing at the time of communication loss.

(4) Procedure. When complete communication loss occurs, the commander who has lost control will immediately attempt to re-establish some means of communication to the weapon unit. Likewise, the AA Weapon Unit Commander who has been cut-off from his control authority will attempt to re-establish communication with any or all of his designated control authorities (Mode I, II, or III).

CONFIDENTIAL

UNITED STATES AIR FORCE
AIR MATERIEL COMMAND
ELECTRONICS DEFENSE SYSTEMS DIVISION
ADES PROJECT OFFICE
220 CHURCH STREET
NEW YORK 13, NEW YORK

107.1

SUPPORTING DOCUMENT NO. 18

In Reply Refer to:
MDPYB

15 July 1957

SUBJECT: SACE Phasing Group Meeting 10 July 1957

TO:

1. Attached are the minutes of subject meeting held at 220 Church Street, New York City, to be used for your information, guidance or action as appropriate. As is customary a briefing was given by Western Electric on the items normally covered by the Status and Progress meeting. The problem areas are covered in the individual items of these minutes.

2. The funding required to continue Schedule #6 or to complete sectors already started under previous schedules may offer serious difficulties. This is a particularly serious problem in the construction area. Some items of construction are required in the early sectors, that unless immediately funded, will cause slippage in the first module of two DCs and a CC. The total problem of construction is treated in some detail in item 4-57-1. We can easily find ourselves in the position of having spent many millions of dollars for a system from which the expected air defense improvement can not be realized as scheduled for lack of a relatively small number of dollars for small but essential items.

3. Those items remaining open in the attached minutes will constitute the agenda for the next Phasing Group Meeting to be held 14 August 1957 at 1000 hours. Representatives of concerned organizations should be prepared to report current status at this next meeting. Additional notice of the next meeting will not be sent unless new agenda items arise in the interim in which case each organization will be advised.

Dale R. Tidball
DALE R. TIDBALL
Lt Colonel, USAF
Deputy Chief, ADES Project Office

J Incl
n/a

"This document contains information affecting the national defense of the United States within the meaning of the Espionage Laws, Title 18 U. S. C., Sections 793 and 794. Its transmission or the revelation of its contents in any manner to any unauthorized person is prohibited by law."

not classified when attachment removed

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SUPPORTING DOCUMENT NO. 16

MINUTES OF

SAGE SYSTEM PHASING GROUP

10 JULY 1957

Chairman: Lt. Col. D. R. Tidball
ADES Project Office
Electronics System Division, AMC

and

Co-Chairman: Mr. E. J. O'Connell
Air Defense Engineering Services
Western Electric Company, Inc.

SUPPORTING DOCUMENT NO 16

SPECIAL ITEM: Effectiveness of Weapons System Phasing Groups.

This Project Office is in receipt of a letter dated 15 February 1957, signed by Lt General Irvine, Deputy Chief of Staff, Materiel, HQ USAF, on the subject of effectiveness of Weapons System Phasing Groups. Based on participation by personnel of [illegible]/M in large numbers of phasing group meetings, a list of observations has been formulated, which if carefully followed, should make this phasing group and all others more effective. These observations are listed below:

1. Group effectiveness is greatly affected by lack of agressive follow through action on the part of participants. This is often true on items involving joint responsibility of several agencies.

2. Unpreparedness of participants to furnish timely and comprehensive answers to questions pertaining to their areas of responsibility is often apparent. This is true despite prior notice being given on specific items requiring attention.

3. Inaccuracy of information is often a source of major difficulty. Agencies often tend to be optimistic. This over optimism frequently precludes establishment of special "get well" actions and results in serious program slippage.

4. Continuity is often lacking. Some commands unnecessarily rotate personnel attending WSPG meetings, thus reducing the overall effectiveness. Some agencies do not provide regular representation commensurate with the importance of a particular weapons system.

5. In many cases unnecessary time is spent on unimportant problems. This reduces the amount of time remaining for important problems.

6. While some groups publish and disseminate meeting minutes expeditiously, others require excessive time. Deadlines should be established.

7. Minutes often do not point the finger at a specific individual or organization responsible for the action on particular items. Meetings close without making it crystal clear who must take specific action.

8. Many groups do not keep abreast of combat readiness rates on their respective weapons systems. This information is readily available and should be reviewed at each meeting.

9. In assigning responsibility, minutes frequently fail to reflect a deadline for certain necessary action or at least a target date.

10. Some representatives leave the meetings before the conclusion because they feel that they are only responsible for or interested in one or several specific items. Yet after leaving, items often arise in their areas of responsibility.

11. Discussion on important problems is often deferred or in some cases not even tabled. This is particularly true on items being studied or considered by a higher authority. In numerous cases discussion by the group and resultant recommendations to higher authority would have been most valuable.

12. Minutes often lack an overall statement explaining the resultant impact on combat readiness imposed by the detailed problem. Personnel often in a position to assist with the problem are many times not sufficiently familiar with the specialized technical details to realize the impact.

13. Groups dealing with weapon systems which directly affect other weapon systems are often not adequately familiar with mutual problems and resultant joint impact. More thorough cross coordination between such groups could increase effectiveness.

14. Some organizations have personnel who must cover several related weapons systems as several fighter and bombardment types. This should be considered in establishing meeting dates.

15. Serious problems often exist, yet they are not introduced to the group by agencies who should be aware of such situations.

CONFIDENTIAL

SUPPORTING DOCUMENT NO. 18

OPEN ACTION ITEMS

ITEM NO. [illegible]-55-7C (Unclassified)

A. Problem Presented

Intended locations of required radio buildings must be checked against antenna separation criteria so that construction may proceed on schedule.

B. Action Agencies

ADC, AFIR, Rome ARD, AMA's

C. Action Being Taken

In a presentation made by Col. Huey of Hq. ADC it was stated that site concurrence letters had been sent to the AFIR's for all ground-to-air radio sites through Sector 12 (Grand Forks). However, actions by Hq. USAF, AFOIE-CS have caused unnecessary delays by requiring resurveys in accordance with RADD criteria. These actions were contrary to Hq. USAF ADOCE-EE message 13624, 25 March 1957 and have caused funding to be deferred by Hq. USAF. Col. Huey has made a complete investigation of all known factors affecting funding and construction schedules of SAGE ground-to-air radio sites through FY 1958, copies of which have been made available to ADES and the ADES Project Office. This information has not been included in its entirety as intended due to the uncertainties of FY 58 funding.

D. Forecast Completion of Action

Indeterminate (Construction depends on release of funds by Hq. USAF, see also Item No. 3-57-2)

E. Impact on Program

If SAGE ancillary facilities, such as ground-to-air radio are not available on schedule, huge Air Force investments will not be fully utilized and the operational date of SAGE sectors delayed. It is imperative to complete on schedule those sectors which have been started.

CONFIDENTIAL

SUPPORTING DOCUMENT NO. 16

CONF NO. [illegible] (Confidential)

A. Problem Presented

Integration of new weapons into the SAGE-equipped Air Defense Environment.

B. Action Agencies

Hq. USAF, ADC, ARDC, APGC and AMC

C. Action Being Taken

Approval has been given by Hq. USAF for the revised employment plan and schedules for weapons testing in the Montgomery ADS. A task group has been formed to monitor the progress of the Montgomery tests and point out critical problem areas to the responsible planning groups. The group, chaired by ADC (Lt. Col. Higgins), met during the third week of June and will meet again 23 July 1957.

The study group chaired by Lincoln has approved IBM's proposal for manufacture of Time-Division and BOMARC output section on a schedule compatible with the installation of the enlarged memory. Lincoln Laboratory will forward TER #1-200 to the ADES Project Office enclosing specifications for the output sections and an IBM cost memorandum which will enable the ADES Project Office to extend contractual coverage to IBM for these output sections. The employment plan for time-division data link was issued by ADC on 15 June 1957.

ADES study of tentative data communication requirements for BOMARC and AAOC has been completed and was forwarded to the ADES Project Office on 28 June 1957.

CONAD has established a joint Army/Air Force group to formulate a test plan for SAGE Missile Master Integration.

Col. Carter is in command of the SAGE Weapons Integration Group (SWIG) at Lexington. The Weapon Contractor's representatives for this group have completed their training program and have been assigned definite tasks in the computer programming for the Century series of Interceptors. It is expected that their work will be completed in October 1957; the cut-off date for computer program revision.

SUPPORTING DOCUMENT NO 16

ITEM NO. 75-36-3 (Cont'd) (Confidential)

D. Forecast Completion of Action

15 July 1957 (Issuance of TIR 1-200)

E. Impact on Program

Unless SAGE/Weapons Integration is accomplished on a timely basis optimum utilization of new weapons in Air Defense will be delayed.

ITEM NO. 12-56-1 (General) (Unclassified)

SUPPORTING DOCUMENT NO 18

A. Problem Presented

Status of SAGE Personnel and Training Actions. (This is carried as a general item for the Phasing Group to assist in resolution of any problems which may be beyond the purview of the P&T Committee).

B. Action Agencies

USAF, ADC, ATC and ADES Project Office

C. Action Being Taken

Status of SAGE Personnel and Training actions will be regularly reported to the SAGE Phasing Group. The Personnel and Training Committee will normally meet on Thursday following the SAGE Phasing Group Meeting and minutes of that conference are issued to all interested agencies. A SAGE Personnel-Training Committee meeting was held at 220 Church Street, 13 June 1957 and the next meeting will be held 15 August 1957.

One of the major items confronting the committee is a decision on the proposal made by Lincoln Laboratory to transfer the AN/FSQ-7 computer training of Direction Center operators from the XD-1 computer to some other location due to a shortage of computer time at ESS. At meetings on 11 June and 13 June 1957 to discuss the proposal, it became evident that the problem involved overall computer time allocations and shortages. Accordingly a working group of major computer users has been formed to appraise all computer-time requirements as related to overall SAGE needs and meetings were held on 25 and 26 June 1957. Lincoln reported at these meetings that computer time at XD-1 was over committed even if ATC training was eliminated. Computer users were requested to investigate and appraise their own requirements for the use of the XD-1 computer. The results of the studies made by the individual agencies will be discussed at a conference on 11 July 1957 and methods of allocating computer time will be explored. Information from this conference and studies of alternative training plans being made by ATC will be discussed at ADC 30 July 1957 in the hope of resolving the problem.

D. Forecast Completion of Action

Will be reported upon at the next Phasing Group Meeting.

E. Impact on Program

Unless adequately trained personnel are furnished in accordance with SAGE requirements, the air defense capability for which the system was designed cannot be realized.

ITEM NO. [illegible]-1 (Unclassified)

SUPPORTING DOCUMENT NO. 11

A. Problem Presented

Air conditioning at SAGE annexes does not furnish reliable cooling and humidity control for the AN/FST-2.

B. Action Agencies

ADC, C of E, ADES Project Office, Burroughs

C. Action Being Taken

In order to assure reliable air conditioning at long-range radar sites USAF has issued IECM57-9 (230.1) dated 13 March 1957. This IECM, which gives certain criteria that must be followed in the design and installation of the AN/FST-2 air-conditioning system, has been given to the C of E. The C of E will adhere to the IECM at all future long-range radar sites, and if possible at those sites which are now under construction.

At the early sites Burroughs is making control modifications to the system and the C of E is making permanent modifications. The latest schedule for this work is as follows:

Site		Completion of Burroughs' ECP	Permanent Modification Completion Date
P-9	Highlands	complete	8/30/57
P-21	Lockport	complete	8/30/57
P-45	Montauk	complete	8/30/57
P-49	Watertown	complete	8/30/57
P-50	Saratoga	complete	8/30/57
P-54	Palermo	complete	8/23/57
P-30	Benton	complete	9/ 1/57
P-55	Quantico	*	8/30/57
P-56	Cape Charles	8/ 7/57	7/22/57
P-13	Brunswick	complete	complete
P-10	No. Truro	complete	complete
P-63	Claysburg	*	no schedule available
M-117	Roanoke Rapids	to be scheduled	no schedule
M-103	No. Concord	*	indeterminate (no funds)
P-14	St. Albans	7/20/57	7/14/57

*Installation Discrepancy. Burroughs cannot make their modification until this is corrected.

SUPPORTING DOCUMENT NO 16

ITEM NO. 3-57-1 (Unclassified)

C. Action Being Taken (Cont'd)

At a meeting held in the MIPO office after the SAGE Phasing Group Meeting; it was agreed that:

1) Burroughs will not make any control modifications at those sites, where the IECM has been adhered to.
2) Burroughs will submit a request for authorization to increase the scope of work contained in their control modification ECP. The authorization will allow Burroughs to enter a maximum of six more sites to make necessary modifications.
3) At all sites Burroughs has made their control modifications on the basis of a split modification by the C of E. However, at some sites it was necessary for the C of E to modify but not split the system. Therefore, Burroughs will also request authorization to return to the unsplit sites and make further control modifications.
4) Before undertaking any modifications outlined in 2 and 3 above, Burroughs will obtain the approval of Hq. ADC.

D. Forecast Completion of Action

1) Burroughs' submission	19 July 1957
2) Burroughs' Control Modification	As Scheduled
3) C of E Permanent Modification	As Scheduled
4) ADES PO Approval of Burroughs' Submission	31 August 1957
5) ADES PO to ascertain where IECM will be followed	31 July 1957

E. Impact on Program

The air conditioning systems must be operative at all SAGE annexes for the satisfactory performance of the AN/FST-2 as required for SAGE use.

SUPPORTING DOCUMENT NO. 18

CONFIDENTIAL

ITEM [illegible] (Confidential)

A. Problem Presented

The Current Financial Plan for the FY 1957 MCP did not include certain radio buildings and gap-filler radar sites required in accordance with SAGE Schedule No. 6 and release of FY 1958 funding may be delayed.

B. Action Agencies

Hq. USAF, ADC and AFIR

C. Action Being Taken

Advertising and award of construction contracts for SAGE radio buildings and other SAGE construction requirements have been frozen since 1 July 1957 through orders of Hq. USAF. The seven radio sites (P-31, P-47, P-53, P-61, P-64, P-81 and P-85) for which FY 57 funds were not available have been deferred to FY 58 funding. In addition, sites P-31 and P-63 must be relocated to support Missile Master. A review is being made by the office of Director of Installations (Mr. Valeri) of all SAGE construction requirements so that available funds can be allocated to permit SAGE to be implemented with the least loss of capability. Mr. Valeri will advise the ADES Project Office by 1 August 1957 of the funds available for SAGE construction or of the official probabilities for funding. (See also Item No. 11-55-7C) Siting of radio buildings in the first twelve sectors has been accomplished so that Hq. USAF can release funds as soon as they are available.

D. Forecast Completion of Action

1 August 1957 (receipt of report on funds available for construction)

E. Impact on Program

Lack of radio and radar buildings in accordance with SAGE requirements will require rescheduling of affected Air Defense Sectors.

CONFIDENTIAL

ITEM NO. 4-57-1 (Confidential)

SUPPORTING DOCUMENT NO. 18

A. Problem Presented

AGE and construction funds have not been received as scheduled.

B. Action Agency

Hq. USAF

C. Action Being Taken

On 20 June 1957 ADES recommended to the Air Force that the scheduled operational date of the Sault Ste. Marie ADS be deferred from 15 April 1957 to 15 May 1957 to reflect the delay in receipt of construction funds. Approval of ADC has been requested by the Project Office. Construction Funds for the Pendleton ADS should have been released to ADES on 21 June 1957 but have not been received. Supplemental Title I coverage for San Francisco and Pendleton is also required by ADES but has not been received. The Chief of Staff, USAF, has instructed all major Commands and AFIR's, effective July 1, 1957, not to award contracts for work where bids already have been solicited nor to solicit new bids until USAF has evaluated all FY 58 funding needs.

The representative of Director of Installations, Hq. USAF, Mr. Valeri, made a presentation on the problems and probabilities of funding the deficiency item from FY 57, as well as the construction required in FY 58. It was his prediction that funds would not become available earlier than October and possibly later. The Chairman pointed out that several items should have been funded in FY 57 MCP to allow operation of SAGE sectors now in progress. For example, five radio sites are required in the Chicago ADS none of which has been funded. Mr. Moore, Project Manager for ADES made a strong plea that the funds required to complete the early sectors and sectors now in work be made available. He pointed out that the money required to do this is small when compared to the total SAGE investment and the lack of timely funding of these comparatively small items would severely limit or prevent use of the facilities now being built.

The ADES Project Office requested that Mr. Valeri, Hq. USAF furnish a realistic view of the status of FY 58 funding for DC-CC buildings, auxiliary and support buildings by 1 August 1957 in order that the necessity for rescheduling the SAGE program may be evaluated.

SUPPORTING DOCUMENT NO 18

ITEM NO. A-57-1 (Confidential) (Cont'd)

D. Forecast Completion of Action

1 August 1957 (For USAF's funding information to ADES Project Office)

E. Impact on Program

Major rescheduling may be necessary if required funds are not released promptly also use of the large sum of money already spent on SAGE will be seriously limited or precluded for lack of funding of some relatively small items.

SUPPORTING DOCUMENT NO. 18

ITEM NO. A-[illegible] (Unclassified)

A. Problem Presented

Power supplies at long-range radar sites are inadequate for SAGE equipments.

B. Action Agencies

ADC, AFIR, ADES Project Office, EADF, ADES

C. Action Being Taken

Representatives of EADF, AFIR, ADES Project Office and ADES met on 10 June and determined the limits of a survey of power supplies available at long-range radar sites. ADES will visit approximately 19 long-range radar sites with EADF representatives and it is estimated that the survey will be completed by the end of August 1957. During the course of visits to P-9 and P-54 the week of 1 July 1957 it was determined that the available commercial power is sufficient to satisfy present requirements.

The schedule for the completion of the Electrical Distribution and Emergency Power systems at sites in the AFIR North Atlantic Region is as follows:

Site	Contract Award Date	DOD
M-121 - Bedford	3 April 1957*	December 1957
P-30 - Benton	28 June 1957 *	January 1958
P-56 - Cape Charles	14 June 1957 *	December 1957
P-9 - Highlands	21 June 1957 *	March 1958
P-21 - Lockport	(funds withdrawn)	Indefinite
P-[illegible] - Montauk	20 August 1957**	June 1958
P-54 - Palermo	13 June 1957 *	February 1958
P-[illegible] - Quantico	25 June 1957 *	February 1958
P-50 - Saratoga	(funds withdrawn)	Indefinite
P-49 - Watertown	21 June 1957 *	March 1958

*awarded
**award may not be made due to USAF "freeze"

The award of contracts for modifications of the Cummings generators and modification of the power distribution systems has been stopped by Hq. USAF due to lack of funds.

SUPPORTING DOCUMENT NO. 18

ITEM NO. 4-57-4 (Unclassified) (Cont'd)

D. Present Completion of Action

31 August 1957 (Completion of EADF and ADES survey)
As indicated on schedule (Completion of Electrical Distribution and Emergency Power Systems)

E. Impact on Program

Failure to provide adequate power at sites P-45, P-50 and P-21 will prevent operation of first three sectors as scheduled.

ITEM NO. 5-57-1 (Confidential)

SUPPORTING DOCUMENT NO. 18

A. Problem Presented

Requirements for test aircraft must be established and their availability ensured.

B. Action Agencies

Hq. USAF, SAC, TAC, ADC and ADES

C. Action Being Taken

Hq. USAF in their message AFOOP-OC-F/357796 dated 2 July 1957 directed the following commands to provide aircraft for SAGE tests through FY 58.

Command	Hours	Type
ADC	610	I
SAC	350	I
TAC	112	I
SAC	136	II
ADC	28	III

Also Hq. USAF requested the following information:

1. Can Type II aircraft be substituted for Type I.
2. Can B-25-type aircraft be utilized for Type I.
3. Can F-101 aircraft be used for Type II.

On 19 July 1957 a meeting will be held at ADES Project Office with Hq. USAF, ADC, SAC, TAC and ADES to outline the task to be performed and provide information on which firm planning for use of assigned aircraft hours can proceed.

D. Forecast Completion of Action

19 July 1957 (meeting to clarify responsibilities)
19 July 1957 (obtain basis for reply to Hq. USAF message)

E. Impact on Program

If requirements for test aircraft are not met, SAGE System Testing cannot be continued.

SUPPORTING DOCUMENT NO. 18

ITEM NO. 6-57-1 (Confidential)

A. Problem Presented

A comprehensive review of trigger delay amplifier requirements is necessary so that quantity procurement action may be undertaken.

B. Action Agencies

AFCRC, RADC, RAFD and Lincoln Laboratory

C. Action Being Taken

A task assignment was issued to the Hallicrafter Corporation on 1 March 1957 to produce 16 trigger delay amplifiers for radar sites in the first module. These units are required to solve a range calibration problem at the long-range radar sites. The first four units, which were to have been delivered by 15 July 1957, will not be available until 27 July due to a delay in obtaining components. A breadboard model has been completed and is being checked by Lincoln at the Bath long-range radar site in ESS. The ADES Project Office (Mr. H. Ernst) will investigate and determine whether Hallicrafter or Burroughs should install and maintain the first 16 units.

AFCRC has not completed their review of Lincoln Laboratory TIR #1-206 (Memo 2M-0681) dated 4 June 1957 which recommended a long-term solution to the range calibration problem. Lincoln recommended that the trigger delay amplifiers be provided as part of the long-range radars. AFCRC (Mr. W. Smith) will complete their review after receipt of additional data and cabling diagrams from the Hallicrafter Company and forward AFCRC recommendations to the ADES Project Office by 31 July 1957. If approval is given by AFCRC, RADC will then initiate action to provide specifications to RAFD so that procurement action may be undertaken to provide a long-term solution.

Since the present contract satisfies requirements only through October 1957, AFCRC will recommend interim procurement during the period required to change the radars.

D. Forecast Completion of Action

22 July 1957 (complete AFCRC review and forward TIR #1-206 to RADC)
31 July 1957 (Recommendation by AFCRC for interim procurement)
Indeterminate (Complete specifications and final procurement for trigger delay amplifiers)

E. Impact on Program

Without trigger delay amplifiers the accuracy of SAGE radar data will be inadequate.

SUPPORTING DOCUMENT NO. 18

NEW ITEM

ITEM NO. 7-57-1 (Confidential)

A. Problem Presented

Use of AN/FPS-20 radars has been limited because rotary antenna switches in the antenna circuits have burned out.

B. Action Agencies

RAFD

C. Action Being Taken

Mr. Maddaloni (RAFD) will check to assure that Bendix has been authorized to correct this difficulty in the minimum time through ECI action.

D. Forecast Completion of Action

15 July 1957 (Mr. Maddaloni to advise ADES Project Of Bendix action).

E. Impact on Program

Subsystem tests involving AN/FPS-20 radars will be delayed with possible effect on sector operational dates.

ITEM NO. 7-57-2 (Unclassified)

A. Problem Presented

There are apparent discrepancies in radar and beacon site coordinates.

B. Action Agencies

4620th ADW, ADES

C. Action Being Taken

The 4620th ADW is responsible for establishing site coordinates to be used in SAGE orientation and computer programming. However, ADES in reviewing the site coordinates has found apparent discrepancies which cause orientation errors. This has hindered radar orientation in the Boston ADG. This matter is being investigated by the radar orientation committee and Col. Huey of ADC will take action to assure coordinates are available in accordance with SAGE requirements.

D. Forecast Completion of Action

15 July 1957 (for review and correction of coordinates by 4620th).

SUPPORTING DOCUMENT NO. 18

NEW ITEM

ITEM NO. 7-57-2 (Unclassified) (Cont'd.)

E. Impact on Program

Subsystem testing will be delayed and tracking by SAGE computer program impossible if site coordinates are not available in accordance with accuracy outlined in TIR #1-81, issued by Lincoln Laboratory 6 July 1955.

ITEM NO. 7-57-3 (Unclassified)

A. Problem Presented

Interference with the AN/FPS-3 radar at P-9 is being encountered from off-base radars.

B. Action Agencies

ADC (New York ADS), MAAMA

C. Action Being Taken

New York ADS has accepted the responsibility to clear radar interference at P-9 and have requested the assistance of MAAMA. Col. Silance of ADES Project Office will assure that prompt and adequate assistance is being provided by MAAMA so that immediate action can be taken to correct this situation.

Addendum:

AFCRC has also been advised of this problem and they have agreed to investigate the matter to determine if it cannot be solved in the manner found to be satisfactory in the Experimental SAGE Sector.

D. Forecast Completion of Action

21 July 1957

E. Impact on Program

Subsystem tests will be delayed if this interference is not cleared by 21 July 1957.

SUPPORTING DOCUMENT NO. 18

CLOSED ITEM

ITEM NO. 7-57-3 (Unclassified)

A. Problem Presented

Water supply at Duluth must be increased to meet SAGE requirements.

B. Action Taken

On 28 June 1957 the City of Duluth approved the plan for the installation of a new water main to serve the base. Hq. USAF approval was obtained 1 July 1957. A contract will be awarded on or about 15 July 1957, with completion expected by 1 July 1958 provided funds are made available by Hq. USAF.

On 14 June 1957 the height limitation was waived by the City authorities for the elevated water tank on-base.

The complete sanitary sewerage system is now under construction and will be installed by October 1957. Therefore, the Air Force will not be required to provide a septic tank as a temporary measure as previously reported.

ITEM NO. 7-57-4 (Unclassified)

A. Problem Presented

Lack of cables has delayed installation of RHI consoles in SAGE annex required for SAGE height-finder tests.

B. Action Taken

WRAMA has furnished General Electric Company cable to prepare kits for initial four sites. General Electric Company has obtained cable for installation of RHI consoles for the first four SAGE annexes from MAAMA. RAFD has issued C-E schemes for use of other AMA's who will fabricate and install the cables and RHI consoles in their areas. Mr. Maddaloni of RAFD assured the Phasing Group there will be no further delays.

SECRET

Register No. 82166- 113

UNITED STATES AIR FORCE
AIR MATERIEL COMMAND
ELECTRONICS DEFENSE SYSTEMS DIVISION
ADES Project Office
220 Church Street
New York 13, New York

SUPPORTING DOCUMENT NO. 19

In Reply Refer to:
MCTYE

21 August 1957

SUBJECT: SAGE Phasing Group Meeting 14 August 1957

TO:

1. Attached are the minutes of subject meeting held at 220 Church Street, New York City, to be used for your information, guidance or action as appropriate. As is customary a briefing was given by Western Electric on the items covered by the Status and Progress Meeting as well as a status report on the first few sectors and are summarized in these minutes. The problem areas are covered in the individual items of these minutes.

2. Those items remaining open in the attached minutes will constitute the agenda for the next Phasing Group Meeting to be held 11 September 1957 at 1000 hours. Representatives of concerned organizations should be prepared to report current status at this next meeting. Additional notice of the next meeting will not be sent unless new agenda items arise in the interim in which case each organization will be advised.

Dale R. Tidball

DALE R. TIDBALL
Lt Colonel, USAF
Deputy Chief, ADES Project Office

1 Incl
a/s

SECRET

Register No. 82166

SECRET

SUPPORTING DOCUMENT NO. 19

MINUTES OF SAGE PHASING GROUP MEETING

14 August 1957

SUPPORTING DOCUMENT NO. 19

REVIEW OF SAGE PROGRESS BY ADES

I. Division and Sector Status

II. Funding

III. ESS Activities

IV. Preparation and Checkout of Computer Programs

V. AN/FSQ-7 and AN/FSQ-8 Combat Direction and Control Centrals

VI. AN/FSH-2 Coordinate Data Transmitting Set

VII. DC-CC Buildings

VIII. Communications

SUPPORTING DOCUMENT NO 19

I DIVISION AND SECTOR STATUS

NEW YORK AIR DEFENSE SECTOR

Direction Center

Kelvin-Hughes Projector:

Installation of the Kelvin-Hughes recorder-reproducer by IBM has been completed and these two equipments, undergoing final tests, are available for ADES Test Team use.

Air-Conditioning:

The high relative humidity of the air furnished to cool the AN/FSQ-7 equipment previously reported at McGuire has been substantially corrected in all areas except those associated with the display consoles. ADES and IBM engineers are continuing to work very closely to achieve the minimum relative humidity condition possible with the presently installed air-conditioning system. Although the 50% limit set by IBM is not being met in the console area, IBM has agreed to continue operation while corrective action is being taken.

Long Range Radar Sites

Five long-range radar sites in the New York Air Defense Sector are now operational; P-10 being operational on 21 July 1957, 5-1/2 months later than originally scheduled. P-10 is supplying data to the Boston and New York Air Defense Sectors. Although these five sites are reported as operational, difficulties reported at previous SAGE Phasing Group meetings continue to exist at each site in the New York Air Defense Sector.

The problems which hamper efficient test of the SAGE System fall into the following broad categories:

1. Excessive down-time of air-conditioning equipment at the sites.

2. Late availability of height-finder radars.

3. Radar interference between sites.

4. Delay by IRAN teams in completing radar performance tests which have been specified by AFCRC.

5. Operational problems resulting from an attempt to operate the manual system while SAGE testing is continuing.

6. Lack of prompt maintenance, adequate spare parts and maintenance instructions and personnel.

SUPPORTING DOCUMENT NO. 19

Air-Conditioning:

At P-45 the air-conditioning system has been operating for the last month with only one compressor. The replacement for the other compressor, which went out of service on June 27, is in New York City and will be installed in the near future. At P-9 the AN/FST-2 was inoperative due to air-conditioning failures on 2, 3, 5, 8, 9, 17 July and 2 August. Breakdowns have occurred at other sites, but to a lesser degree.

Operations at long-range radar sites began around 1 February 1957. Since that time, ADES has reported to the Phasing Group monthly that air-conditioning problems existed which prevented use of the AN/FST-2 and, likewise, delayed test progress. Although some action has been taken as a result of these reports, the hoped-for progress was not made because of lack of funds, incomplete engineering information and other reasons. ADES suggested a more aggressive program to correct the air-conditioning systems.

Height-Finder Radars

Very little progress has been made in subsystem tests of height-finder radars. Last month it was reported that only one thing was delaying the use of the height-finder radars - RHI cables and that several months had been lost in the procurement of these cables. When cables were made available to the site and connected in accordance with the available C & E scheme, it was found that the height-finder would not operate in accordance with SAGE needs. It had previously been agreed that four RHI consoles would be modified, with two retained for manual operation and two installed in the SAGE Annex for SAGE testing. It develops that SAGE final systems testing cannot be done with such an arrangement, since the computer program has been written to function only if the two AN/FPS-6 radars at the site are connected to the four RHI consoles in the SAGE Annex.

At P-45 this has been corrected and all four consoles have been installed and cabled in the SAGE Annex and both AN/FPS-6 radars are functioning at this time. At P-9 console modifications are proceeding and the Test Team has height-finder capability for preliminary subsystems testing. Plans are being forwarded to P-9 for connection of the AN/FPS-6 radars to the four RHI scopes in the SAGE Annex, as at P-45. At P-54 the test team has height-finder capability, but the connections must be modified and plans are being provided to effect the necessary rearrangement at this site.

If the remainder of the RHI consoles are modified for SAGE on a timely basis by the General Electric Co., and if cable changes are made promptly to allow the installation of four RHI scopes in the SAGE Annex the height-finder problems in the New York Air Defense Sector will be solved. Cables, RHI console modifications and corrected schemes must be made available in subsequent sectors in accordance with SAGE schedules if this condition is to be eliminated.

Gap-Filler Radar Sites

Gap-filler sites P-45A and P-45B have been out of service, about one week and one month respectively. Reliability testing at these sites has been discontinued until they are operating. P-9A is operating on one channel because of a defective magnatron and defective trigger amplifier. (See system testing)

Radio Sites

P-45 and P-54 ground-to-air radio sites are operational and working satisfactorily for present test requirements. The McGuire AFB radio site, however, continues to present problems. On 24 October 1956 promises from all agencies involved indicated that an operational date of 15 June 1957 would be met. Since that time there have been a series of delays in completion of the buildings. The radio transmitter building was completed the week of 9 August 1957 and the transmitter building is promised to be completed 2 September 1957. Installation of telephone and radio equipment must proceed immediately or the Sector operational date will be seriously jeopardized.

1 January 1958 is the latest that this site can be operational and be included in the final system test.

P-54 radio, which is being used in the New York ADS until the McGuire radio site is operational, is scheduled to be cutover to the Washington ADS. Based upon the forecast completion of the McGuire radio building promise, this could occur on 1 February 1958, which will meet the requirements in the Washington ADS.

ADES Test Status

Long-Range Radar Subsystems

A. Test Progress

a) The prove-in of the test methods and test equipment has been completed.

b) All sites have been tested to these procedures.

c) Each site has been used to gather data to determine what tolerances or limits can be expected and should be achieved.

d) Each site has demonstrated that it can meet these tentative requirements.

e) This effort will be completed as of 19 August 1957.

SUPPORTING DOCUMENT NO. 19

B. Equipment Status

a) P-9 The most serious problem currently at this site is radar interference from external sources. The AMA has stated that the problem is beyond their scope. The interference is apparently caused by several sources:

1. Sandy Hook - 27 AN/TPS-2's operating intermittently
2. Ft. Monmouth
3. Idlewild, Floyd Bennett and LaGuardia Airports
4. Shipboard navigational radars

It is believed high level Air Force action will be needed to resolve this problem.

b) P-30 All tests have been successfully performed.

c) P-45 The FPS-20 was accepted by the AF but there have been intermittent failures of the rotary coupler, power circuit breaker and blocking oscillator transformer. In addition the A-1 data circuit failed twice during the past two weeks, but the trouble was found and corrected.

d) P-54 The FPS-20 has been operating satisfactorily. The AN/FST-2 caused a loss of 12 hours of test time due to failure in the digital analog conversion section. This has been corrected.

C. No % utilization figures for the long-range radars are currently available as the verification testing of these radars has only recently begun. Integration of these subsystems into the initial system effort is progressing satisfactorily.

Height-Finder Radar Subsystems

The testing of this equipment has only recently begun. There have been extreme delays in the implementation of the SAGE height-finder equipments and the problems are not all resolved as of this date. For example, three different cabling plans for RHI consoles were encountered at the first three sites (P-9, P-45, P-54). This situation is currently being investigated.

The ADES test teams will work as rapidly as possible to prove in the testing procedures, run flight verification tests and begin height-finder verification reliability tests. ADES expects to complete subsystem tests by 1 September 1957 but this can be accomplished only if all installation incompatabilities are resolved. Any delay in the completion of these tests will delay the system test in NYADS since lack of height information is delaying tests using the Air Surveillance portion of the Computer Program.

SUPPORTING DOCUMENT NO. 19

Gap-Filler Radar Subsystems

A. Test Progress

a) The prove-in of the test methods and test equipment has been completed.

b) All sites have been tested to these procedures.

c) Each site has been used to gather data to determine what tolerances or limits can be expected and should be achieved.

d) Each site has demonstrated that it can meet these tentative requirements.

e) This effort was completed as of 1 August 1957.

B. Equipment Status

a) P-9A Was usable 22% of the scheduled test time for the two week period ending 9 August 1957. Reasons for low performance were the following:

Azimuth Pulse Generator failed
Magnetron failed
MTI Comparator failed
Trigger Amplifier failed
Pulse network was inoperative
Hi-Voltage Transformer on the FST-1 failed

b) P-45A Was usable 44% of the scheduled test time during the same two weeks. Reasons for low performance were the following:

Commercial power failure
Trigger Amplifier section failed on Channel A
Trigger Amplifier section failed on Channel B

c) P-45B Was usable 0% of the scheduled test time during these two weeks. Reasons for lack of performance were the following:

Power failure
Faulty north marker generation
Trigger Amplifier section failed
The write-order section of the FST-1 failed
The motor bearings on the PPI monitor burned out.

C. With this very low capability it is extremely difficult to start initial system tests or to have any confidence in the reliability of these subsystems to perform on a continuous basis. It has been proved that the subsystems can perform in accordance with the specifications but continued operation over any reasonable period cannot as yet be achieved. The low "use" factors listed above are caused predominantly by lack of spare parts and the immediate availability of maintenance personnel. ADES will continue the verification of the gap-filler subsystems so that a satisfactory level of performance will be reached for integration into the systems test.

Other Subsystems

The Ground-to-Air Voice. Ground-to-Air Data Link, Automatic Teletype, Crosstell and Voice Communications subsystems are either proceeding on schedule or are to be performed at a later date. Any slippage of current schedules for their availability will seriously jeopardize the testing capability and possibly the operational date.

Verification Testing

Reliability or verification testing is extremely important to the ultimate operation of SAGE as effective system testing can be performed only on a reliable system. ADES, in establishing verification or reliability procedures, is limited to insuring the ability to perform the system tests. The data and procedures developed will be made available to the Air Force for their analysis and possible utilization after the operations date.

System Testing

The first draft of the SAGE System Test Specification was released by ADES on 30 July 1957 for review by interested engineering organizations. Its content is practically identical to the SAGE System Testing Concept submitted to Lincoln Laboratory earlier in July. These documents are being used by ADES in the preparation of system test methods and the compatibility of these documents with the Air Surveillance package of the computer program is being resolved by ADES. The release of the D package of the computer program by Lincoln-Rand on 15 September 1957 will expand test activities to include Weapons Direction functions.

After the early release of the Air Surveillance computer program (package B), ADES set up a special ADES committee to prepare interim test methods. These were intended to make immediate use of the Air Surveillance program, provide training for ADES and Air Force people and serve as a basis for permanent test methods. From 1 June to 15 July, B package was shaken down using simulated data, and both ADES and Air Force personnel were given extensive training in its use. Since 15 July and until 1 September the computor

program procedures have been and are being checked out using live data from the various long-range radar sites in the sector. Completion of this effort is contingent upon satisfactory conclusion of subsystem tests of height-finder equipment.

Future testing plans:

1. During September and October it is planned to integrate P9, P54 and P54A in formal initial system tests.

2. During November and December P45, P45A and P45B will be added in the integration process.

3. During January P10 and P30 will be added.

4. During February and March, Crosstell, G/A Voice (with CUG) and G/A Data Link Subsystems will be added and Duplex Functions will be checked out.

5. During April, May and June, final system testing will be performed.

During the above program of integration many tasks inherent in testing will be performed. These include:

1. Test Method prove-in.

2. Determination of specification limits, i.e. baromaters and figures of merit.

3. Program compatability testing.

4. Duplex switching and other design testing.

5. Data reduction program prove-in and implementation.

The success of this endeavor is primarily dependent on release of the equipments as scheduled the prompt resolution of engineering problems, immediate correction and repair of equipment and expeditious solution of program difficulties. A falldown in any one of these operations will jeopardize the testing program in the New York ADS.

Summary - New York ADS

A number of equipment design and maintenance problems, as well as some operational difficulties have been encountered in the New York ADS. The net effect of these has resulted in a loss of approximately 4 to 5 months of test effort since the beginning of subsystem testing in the New York ADS.

SUPPORTING DOCUMENT NO. 19

This does not necessarily mean that the New York ADS operational date will not be met, but it definitely does mean that the date is in serious jeopardy and further delays resulting from the types of problems enumerated become increasingly more difficult to absorb.

The major cause of delay seems to be the inability to effect immediately repairs or modifications to equipments due either to lack of personnel, or spare parts. The ADES Project Office is proposing to AMC that resident AMA coordinators be sent to the various ancillary sites to work with ADES and assist in breaking bottlenecks which appear to be delaying the correction of difficulties. The ADES Project Office is also making a strong effort to eliminate operational misunderstandings at the sites so that priority of equipment use will be given to SAGE testing and that suitable counter-measures will be effected within the Air Force to continue the manual mission by other means.

BOSTON AIR DEFENSE SECTOR

Direction Center

Problems with high relative humidity of the air at the Boston ADS Direction Center are the same as at the New York ADS Direction Center and the same remedial action will be instituted.

Communications:

The miscellaneous modifications and additions to the communications equipment are proceeding on schedule.

Long-Range and Gap-Filler Radar Sites

All five long-range radar sites in the Boston Air Defense Sector are operational. No air-conditioning problems are being encountered at P-10. At P-50 the permanent split of the system is scheduled for completion 25 September 1957. The AN/FPS-3 at P-50 has been converted to an AN/FPS-20. The 120 hour test started 6 August and was complete 11 August 1957, and the radar was accepted by the Air Force on 12 August 1957.

Four of the five gap-filler radars are now operational, and the fifth will be operational on the scheduled date of 1 February 1958.

The continued operation of the long-range and gap-filler radars assumes that maintenance and spare parts availability will be improved.

Height-Finder Radars

Of the two AN/FPS-6 height-finders at P-10, and P-50, one and at each site is operational while second at these sites will be operational 13 August 1957 and 31 August 1957, respectively.

SUPPORTING DOCUMENT NO. 19

Cables for RHI Scopes at P-50 have not been received, but are promised during August 1957. Two of the four RHI scopes have been modified and kits are at site for the remaining. Subsystem testing of height-finders is scheduled to complete 1 December 1957.

Radio Sites

At P-10, the Collins multi-couplers were received 5 August 1957, but could not be installed due to lack of racks and connectors which are required for mounting.

At P-50, Radio equipment has been installed but power cords have not been received and are promised for delivery 31 August 1957. Power cords for two channels necessary for tests at P-50 will be borrowed from the Stewart on-base radio site.

It is estimated that by 19 August 1957, two radio channels will be ready at all Boston ADS radio sites for preliminary test and line-up. The subsystem tests of ground-to-air voice radio are estimated to complete 8 September 1957, while the ground-to-air data link tests will be completed approximately 28 February 1958.

Subsystem Testing

Progress of subsystem testing activity in the Boston Sector has been good. Cap-filler radar tests, excluding flight tests, at four of the five sites will be completed by 1 September 1957. Completion of the orientation flights is planned by 1 December 1957. The fifth site, P-50B, is not scheduled to be operational until 1 February 1958. Testing of the long-range radar subsystem is also proceeding satisfactorily. All tests are scheduled to be completed by 1 September 1957, except orientation flights which will be complete by 1 December 1957. An exception to this schedule is P-10 where testing is not expected to be complete until 1 March 1958. It is hoped to complete height-finder subsystem tests 1 December 1957 so that integration may start simultaneously with the delivery of the Air Surveillance ("B") package of the DC active program.

SYRACUSE AIR DEFENSE SECTOR AND 26th AD COMBAT CENTER

AN/FSQ-7 and AN/FSQ-8

Installation of all frames for the AN/FSQ-7 and equipments is complete and tests of both computers are proceeding according to schedule.

All display consoles for the AN/FSQ-7 and AN/FSQ-8 are on site.

SUPPORTING DOCUMENT NO. 17

DC and CC Buildings

Installation of communications equipment is proceeding on schedule in both buildings.

Ancillary Equipment

There are six long-range radar sites and five gap-filler sites planned for the Syracuse Air Defense Sector. No difficulties are foreseen in meeting the operational dates of the gap-filler sites.

There are four radio sites planned for this sector. At this time it appears as if the operational dates of these sites will be met.

WASHINGTON AIR DEFENSE SECTOR

Direction Center

Computer installation in the Ft. Lee Direction Center is proceeding in accordance with plans. On 1 September 1957, the computer will be available for computer program checkout. As reported at the last meeting, there is a shortage of display consoles for the AN/FSQ-7 and the latest promise from IBM for complete console installation is 15 October 1957. Approximately 50% of the consoles are at the Ft. Lee Direction Center, and [illegible]al wiring is in progress. Present indications are that the 15 October date will be met.

Installation of internal communications at the Direction Center is proceeding in accordance with plan and no difficulties are anticipated in meeting required dates.

Ancillary Sites

There are four prime long-range radar sites associated with the Washington Air Defense Sector. All of the buildings at the radar sites have been completed and accepted by the Air Force and there appear to be no difficulties.

There are five overlap radar sites for the Washington ADS scheduled to be available on the operational date of the Washington Sector. Two of these are P-54 and P-9 from New York which are currently operating and will present no problem. P-63 from the Syracuse Sector and M-116 from the overlap Raleigh Sector are currently estimated to meet the Washington required dates. M-115 will provide overlap coverage when an AN/FPS-7 radar is installed; the schedule for this action is too late to be included in this site in ADES testing.

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There are six gap filler sites scheduled for the Washington ADS; the buildings at these sites are completed and accepted by the Air Force and we foresee no problems in this area.

Radio Sites

There are four radio sites scheduled for Washington ADS. One of these, P-54, is currently in use in the New York ADS. On or around 1 February 1958, this should be made available for cutover into the Washington ADS. Buildings for P-56 and P-55 are under construction and forecast completion dates are in line with schedules.

At M-111, however, this building has not been started due to lack of funds. The best estimate at this time is that completion can not be achieved until 1 June 1959 which makes it too late to meet the Sector operation date of this Sector.

OTHER AIR DEFENSE SECTORS

In addition to the above Sectors, installation work is in progress at the Direction Centers for Bangor and Detroit sectors and the combined DC-CC for the Chicago ADS and 30th AD.

Beginning with the Bangor Sector, delays in the completion of buildings at ancillary sites will be experienced as a result of design and siting problems and delays in funding. At Bangor the Topsham and M-110 radio buildings will be 12 and 7 months late respectively, and the SAGE annex at M-110 will be delayed 4 months. Although it is early to forecast the full impact of this delay, it is estimated that the Sector operational date may be delayed by four months unless ADC will accept this sector as operational without these delayed facilities.

The situation in the Detroit and Chicago Air Defense Sectors is worse. There will be construction delays at five radio sites, two of the gap-filler sites and one overlap radar site in the Detroit Sector because construction did not start in time. It looks as if the operational date of the Detroit Sector will be delayed 7 months or until 1 November 1959.

In the Chicago Air Defense Sector, two out of six long-range radar sites will be delayed. Six out of seven gap-filler sites will be delayed and four out of five radio sites will be delayed. A postponement of the operational date of this Sector of at least five month appears to be the best current estimate.

SUPPORTING DOCUMENT NO. 19

Completion of the Kansas City sector for its initial use for programming and training purposes may be delayed unless temporary radio facilities can be improved and provided by the Air Force to take the place of the P-47 and Grandview radios which will be delayed, the former by 7 months and the latter indefinitely.

SUPPORTING DOCUMENT NO. 19

II FUNDING

A considerable sum of money has been spent or obligated for the procurement of costly Direction Center buildings, computers, AN/FST-2's, radars, and ancillary buildings, and the like. To date this amounts to $686 million. Full use of this investment in Air Defense is being delayed by the lack of approximately $19 million.

III ESS ACTIVITIES

Fourteen tests were conducted in the Experimental SAGE Sector during July. Five of these were live tests during which a total of 32 interceptors were scrambled. During the month the first successful live interception under ground-to-air data link control was accomplished and one intercept director successfully vectored two voice-controlled interceptors simultaneously, with final phase for the two intercepts occurring within two or three minutes of each other. In addition, intercepts were conducted in which both target aircraft and interceptor were Raydist equipped, yielding valuable data for system analysis. The Fort Banks AAOC was successfully integrated into the system, demonstrating successful operation of the output to the AAOC.

The mission of 26 July was an example of one of the better tests conducted during the month. On this mission there were five strike aircraft making nine penetrations and ten interceptors were scrambled successfully. Seven of the nine strike aircraft penetrations were intercepted and two interceptors made successful re-attacks on the same target, making a total of nine successful interceptions.

IV PREPARATION AND CHECKOUT OF COMPUTER PROGRAMS

In the New York ADS the air surveillance program is being maintained by Lincoln-Rand for ADES testing. The balance of the DC Active Program is now being tested and will be released 15 September for ADES use. The duplex features will be added by 1 October 1957 while the complete program including cross and forward telling will be released 1 January 1958.

The air surveillance program for the Boston ADS is being tested and will be released to ADES on 1 December as scheduled. The balance of the computer program for the Boston ADS and programs for the other sectors are being prepared on schedule. Checkout teams for the Syracuse ADS and Washington ADS will report on site 19 August 1957.

Testing of the Combat Center computer program will begin at the 26th AD Combat Center at Syracuse on 1 September 1957. Work is proceeding satisfactorily and the forward-tell portion of this program will be available in January 1958.

V AN/FSQ-7 and AN/FSQ-8 COMBAT DIRECTION CENTERS and CONTROL CENTRALS

SUPPORTING DOCUMENT NO. 19

IBM reported that the new method of reporting computer reliability is working well. "Mean time to failure" and "computer efficiency" figures have shown a steady increase in the reliability of the computers. For example - the "A" computer at McGuire from 28 July to 4 August showed an increase of "mean time failure" from 6.97 hours to 15.22 hours while the "computer efficiency" increased from 95.4% to 96.9%. IBM will have a comprehensive report on reliability ready in 30 - 60 days.

IBM's efforts to improve console deliveries are bearing fruit. Current production rates are 30 units per month over scheduled requirements. This additional output will make up the difference between past deliveries and requirements. IBM expects to be back on schedule beginning in January.

The AN/FSQ-8 computer at the 26th Air Division Combat Center, at Syracuse, will be ready for the Air Force Acceptance Tests scheduled during the period September 19-25, 1957. The "A" computer at Bangor is installed and will be available for one shift usage 15 August. The Detroit "A" computer is being readied for shipment the end of this month.

Engineering, production, and procurement of components for the 65,000 register core memory are on schedule and established delivery schedules will be met.

VI AN/FST-2 COORDINATE DATA TRANSMITTING SET

Four simplex equipments are installed and operating; one is undergoing dynamic testing at Burroughs' Paoli plant prior to delivery to Patrick AFB and the sixth will be delivered according to instructions issued by AFCRC within the next ten days.

Burroughs is satisfactorily maintaining their production schedule of duplex equipments at the rate of two per month. By early October, 1957, a total of 24 units will have been delivered to the Air Force, thus completing the initial production contract. Production and delivery schedules indicate the second production contract will be completed by July 1958. A lead time of 10 months from the date of contract issuance to the delivery date of the first unit is required for equipment production. Although they have not received an official Air Force request, Burroughs is now preparing quotations for contractual coverage for an additional 18 AN/FST-2 equipments.

At a meeting held 13 August 1957 Burroughs and Air Force representatives agreed to extend Burroughs' maintenance contract for the simplex units at South Truro and Montauk. This extension will authorize Burroughs to maintain these two simplex units for one additional fiscal year, up to June 1958. It is understood that AFCRC has the funds available for this extension.

VI AN/FST 2 COORDINATE DATA TRANSMITTING SET (Cont'd)

Burroughs maintenance contracts will be extended to cover the maintenance of the duplex equipments up to the sector operational date. In order to train full year maintenance personnel to maintain the equipment at P-30 Burroughs will require contractual coverage by August 28, 1957. It is understood that RAFD will provide this coverage by this date as funds are available from 230 money.

VII DC-CC BUILDINGS

On 31 July 1957 the DC-CC installation at Truax AFB (Chicago ADS - 30th AD) was transferred to the Air Force. During the past month construction was started on two more Direction Centers: Sault Ste. Marie and Spokane. To date, seven sites have been transferred and eight are under construction.

The buildings at Montgomery and Grand Forks are still somewhat behind schedule but the BOD's should be met. At Kansas City it appears there may be a chance of improving the BOD of 24 January 1958. A meeting will be held on-site 16 August to discuss a new date. The BOD last reported for Duluth, 31 October 1957, actually represented the contract completion date. BOD has now established as of 20 November 1957, due to a late delivery of air handling supply fans. ADC will provide a skeleton crew of M&O people to maintain the building until the start of pre-installation activity on 31 March 1958. Construction schedules at all other sites, up to Spokane, are being met.

VIII COMMUNICATIONS

Criteria had been published by RAFD for the location of microwave towers at long-range radar and ground-to-air radio sites. Pending revision of this criteria which RAFD is developing, ADC has agreed to accept a variation of a few degrees from these standards. Problems in siting these towers are being reviewed and resolved through the joint efforts of ADC, the A.M.A. (Air Material Area), RAFD and the telephone companies--The tower at P-56 (Cape Charles, Va.) was sited recently through this joint effort.

The American Telephone and Telegraph Co. is continuing action to locate and suppress noise in the SAGE data services being provided by the telephone companies and to reduce impulse noise from gap-filler radars. No difficulties are seen in providing satisfactory SAGE data service.

SUPPORTING DOCUMENT NO. 19

VIII COMMUNICATIONS (Cont'd)

Revised external circuit requirement sheets (ADC form 290) are being issued by ADC for New York, Boston, Bangor, Detroit, Sault Ste. Marie, Duluth, Chicago and Montgomery Air Defense Sectors. A meeting will be held in the near future to review the New York and Boston requirements and it is hoped to firm these so that future changes can be held to a minimum. External circuit requirements for the Combat Centers must be revised and this information is required by the telephone companies in the near future for the 26th Air Division, 30th Air Division and the 25th Air Division so that communications will not be delayed.

SUPPORTING DOCUMENT NO. 19

OPEN ACTION ITEMS

SUPPORTING DOCUMENT NO. 19

ITEM NO. 11-55-7 (Unclassified)

A. Problem Presented

Intended locations of required radio buildings must be checked against antenna separation criteria so that construction may proceed on schedule.

B. Action Agencies

ADC, AFIR, Rome ARD and AMA's

C. Action Being Taken

ADC (Col. Huey) stated at the previous meeting that site concurrence has been obtained for all ground-to-air radio sites through sector 12 (Grand Forks). However, it was learned by ADC that the AFIR's had not received or were not acting on the site approval letters in every case. Also specific exceptions to certain siting had been taken to previous siting by Oklahoma City AMA. It was stated by Col. Huey that ADC advised every AFIR during July of the site concurrence and advised them to proceed with design and construction. In addition, AFIR (Lt. Bach) was informed by Col. Huey of ADC on 14 August 1957 that ADC has approved the siting of these buildings and that contracts should be awarded for the required buildings as soon as the availability of funds permits. (See Item No. 4-57-1)

Col. Huey advised that ADC in July 1957, directed the Air Defense Forces to provide them with the siting information on future sites in accordance with a schedule formulated to meet SAGE requirements. This information will be transmitted to the AFIR's without delay.

D. Forecast Completion of Action

Indeterminate

E. Impact on Program

SAGE ancillary facilities, such as ground-to-air radios have not been made available on schedule. Huge Air Force investments will not be fully utilized and the operational date of SAGE sectors will be delayed. Lack of timely siting and site concurrence has contributed to this delay.

SUPPORTING DOCUMENT NO. 19

ITEM NO. 10-56-2 (Confidential)

A. Problem Presented

Integration of new weapons into the SAGE-equipped Air Defense Environment.

B. Action Agencies

Hq. USAF, ADC, ARDC, APGC and AMC

C. Action Being Taken

The study group chaired by Lincoln has approved IBM's proposal for the manufacture of time-division data link and BOMARC output sections for the AN/FSQ-7 on a schedule compatible with the installation of the 65,000 register core memory. The ADES Project Office has received both TIR #1-200 enclosing specifications for the output sections and an IBM cost memorandum from Lincoln Laboratory and will initiate contractual action.

The SAGE/AAOC battery data link study group is preparing a report which will recommend a method for supplying NIKE battery information to the SAGE Direction Centers.

D. Forecast Completion of Action

Indeterminate

E. Impact on Program

Unless SAGE/Weapons Integration is accomplished on a timely basis optimum utilization of new weapons in Air Defense will be delayed.

ITEM NO. 12-56-1 (Unclassified) (General)

A. Problem Presented

Status of SAGE Personnel and Training Action. (This is carried as a general item for the Phasing Group to assist in resolution of any problems which may be beyond the purview of the Personnel & Training Committee).

B. Action Agencies

USAF, ADC, ATC and ADES Project Office

SUPPORTING DOCUMENT NO. 19

Item No. 12-56-1 (Unclassified) (General) (Cont'd)

C. Action Being Taken

Status of SAGE Personnel and Training actions will be regularly reported to the SAGE Phasing Group. The Personnel and Training Committee will normally meet on Thursday following the SAGE Phasing Group Meeting and minutes of that conference are issued to all interested agencies. A SAGE Personnel-Training Committee meeting was held at 220 Church Street, 13 June 1957 and the next meeting was held 15 August 1957. Col. Dahlberg briefed the meeting on the results of the computer time allocation study. Lack of sufficient time on the AN/FSQ-7 (XD-1) computer in ESS had caused a review to be made of computer time allocation and ATC's plans for operator training. After meetings of the major computer users during June and July 1957, to review requirements for computer time, ATC, ADC, Lincoln Laboratory, Lincoln Project Office, ADES Project Office and ADES met on 30 July 1957 to review computer time allocation and the manner of training Air Force operators.

ATC had planned 120 hours of "live computer" training on XD-1 and after review of the forecast results, ADC determined that 72 hours of "live computer" training would provide the minimum ability that could be accepted for SAGE operators.

ADC reached the decision that the importance of the first module (the first two sectors and the first Combat Center) in proving the SAGE System to be the proper system for Air Defense require the best qualified personnel available. Therefore, XD-1 computer time must be made available to assure continuity of training for Class No. 4 which will consist of the remaining complement for New York ADS, balance of the normal load for Boston ADS and the initial completion (full load 27 people) for the 26th AD (Syracuse) Combat Center. In view of the possible impact this would have on the 1959 computer program revision and Lincoln's research and development work, the requirement for XD-1 computer time has been reduced from 120 hours to 72 hours for this class. ADC's final decisions outlined in their message of 2 August 1957 were as follows:

> TTAF Class No. 4 will be conducted by ATC at Murphy Army Hospital utilizing 72 hours of XD-1 computer time. ADC, with the assistance of Rand Corporation, will continue operator training on-site to bring the skill level up to that which was originally anticipated utilizing 120 hours of XD-1 computer time. ATC will be requested to provide academic and simulator training at Murphy Army Hospital and 72 hours of on-site computer training for all personnel beginning with the Syracuse Direction Center and continuing until the training facility in the Kansas City ADS is available. Air Defense Command will provide the additional on-site training required.

ITEM NO. 12-56-1 (Unclassified)

C. Action Being Taken (Cont'd)

TTAF is studying the decision to determine instructor requirements and other cost factors. ADES is reviewing the decision to determine the impact on test efforts of the assignment of 72 hours of on-site live computer training. Lincoln Laboratory has been informally informed of the proposed action and official notification will be sent by ADES Project Office.

D. Forecast Completion of Action

Will be reported upon at the next Phasing Group Meeting

E. Impact on Program

Unless adequately trained personnel are furnished in accordance with SAGE requirements, the Air Defense capability for which the system was designed cannot be realized. Reducing the computer training time from 120 hours to 72 hours on XD-1 reduces the proficiency level, however, the probability of obtaining the desired FY 1959 computer program is improved.

ITEM NO. 1-57-1 (Unclassified)

A. Problem Presented

Air conditioning at SAGE annexes does not furnish reliable cooling and humidity control for the AN/FSP-2.

B. Action Agencies

ADC, C of E, ADES Project Office and Burroughs

C. Action Being Taken

On 9 August 1957, Burroughs (Field Service) transmitted a request to the Air Force through Burroughs Corporation (Detroit office) for authorization to modify the air conditioning controls at a maximum of six additional sites and to return to modify the controls of a maximum of eight of the sites which were modified rather than split. The ADES Project Office has not yet received this request. Burroughs' modification work is continuing satisfactorily at the first fifteen long-range radar sites as authorized by ECP action on 4 February 1957.

FST No. 3-57-1 (Unclassified)

C. Action Point Taken (Cont'd)

The latest completion dates of the C of E and Burroughs' modifications are as follows:

Site	Completion of Burroughs' ECP	Permanent Modification Completion Date
P-9 Highlands	Complete	10/24/57 *
P-21 Lockport	Complete	9/25/57 *
P-49 Homer	Complete	10/24/57 *
P-49 Watertown	Complete	9/25/57 *
P-50 Saratoga	Complete	9/25/57 *
P-54 Palermo	Complete	8/23/57
P-59 Benton	Complete	9/ 1/57
P-55 Quantico	8/30/57	8/30/57
P-56 Cape Charles	9/ 2/57	Complete
P-13 Brunswick	Complete	Complete
P-10 North Truro	Complete	Complete
P-65 Claysburg	9/28/57	No schedule available
M-117 Roanoke Rapids	8/30/57	No schedule available
M-103 No. Concord	9/19/57	Indeterminate (no funds)
P-65 Charlestown	9/27/57	No schedule available

* Change from last report

A compressor failed on the air conditioning system at P-56 which was completely modified by 21 July 1957. This is now being repaired by the Corps of Engineers.

ADES test teams have lost considerable time at several SAGE annexes due to air conditioning system failures. As a result every effort is being made to satisfactorily complete the permanent modifications where work has already started and to shorten the interval to completion at those sites where the systems are not yet under construction.

The ADES Project Office has informally requested Burroughs to appraise the feasibility of furnishing an air conditioning system which would be part of the minimum equipment of the AN/FST-2.

D. Forecast Completion of Action

31 August 1957 (Air Force approval of Burroughs' request)
As scheduled (Burroughs' Control Modification)
As scheduled (C&E Permanent Modification)

E. Impact on Program

The air conditioning systems must be operative at all SAGE annexes for the satisfactory performance of the AN/FST-2 as required for SAGE use.

SECRET

SUPPORTING DOCUMENT NO. 19

ITEM NO. 4-57-1 (Secret)

A. Problem Presented

ABM and construction funds have not been received as scheduled for:

(a) SAGE technical buildings
(b) Radar annexes
(c) Radio transmitter and receiver buildings
(d) Support buildings

B. Action Agency

Hq. USAF

C. Action Being Taken

The ADES Project Office has received notification from Hq. USAF that the FY 58 MCP would not be funded before 1 October 1957 and has been asked to prepare a modified Schedule 6 based on 1 October construction funding.

(a) Construction and Title II funds for the Pendleton ADS were to be released to ADES in June 1957. Similarly, Title I funds for the Minot Sector were to be released on 29 July 1957. Construction funds, under Schedule 6, were required for the Los Angeles and San Francisco installations on 20 September 1957, and Title I funds were required for the San Bernardino Sector on 2 October 1957. Schedules are being reviewed to consider revisions where necessary. Inasmuch as the delay in receipt of funds for Pendleton will carry the start of construction into the winter months, the Project Office believes that the severe winter weather will delay the start of construction until 1 March 1958, thereby causing a six month delay in the operational date of the sector. On 12 July 1957 Hq. ADC approved ADES recommendation that the operational date of Sault Ste. Marie be deferred from 15 April to 15 May 1960 to reflect the two month delay in receipt of funds.

(b&c) Owing to delays in funding coverage for ancillary sites, each of the following sites will experience delays in schedules, in some cases affecting sector operational dates. (The delays quoted below are predicated on receipt of funds on 1 October 1957).

SECRET

SUPPORTING DOCUMENT NO. 19

ITEM NO. 4-57-1 (Secret)

C. Action Being Taken (Cont'd.)

New York, Boston, and Syracuse Sectors

Operations at ancillary sites are threatened by inadequate power as the permanent power augmentation required has been delayed by lack of funds. (Specific sites are P-45, P-50 and P-21).

Washington ADS

M-121 Radio will slip five months. As a result, M-121 Radio will not be available for inclusion in ADES testing but in itself is not considered sufficient reason for changing the operational date of this sector.

Bangor ADS

BOD of Topsham Radio will be delayed one year, M-110 Radio seven months and M-110 SAGE Annex four months. As a result, the sector operational date may be deferred by four months. However, ADC will review the possibility of operating the sector less two radio and one radar sites.

Detroit ADS

Five radio sites (P-20, P-62, P-67, P-73, P-61) will be delayed by periods of from six to eight months; two gap-filler sites (P-20B & P-67D) will slip three months; and P-34 (overlap from Sault Ste. Marie) will slip six months. Accordingly, the sector operational date must be deferred seven months.

Chicago ADS

Two long-range radars (P-81 & P-34) will slip four months; six of the seven gap-fillers will slip from two to five months; and four of the five radio sites will slip from one to seven months. The sector operational date must therefore be delayed approximately five months.

Kansas City ADS

The two radio sites required for Rand's programming activities will be delayed. Richards-Gebaur Radio has not been sited and the operational date is indefinite. The operational date of P-47 Radio will slip seven months. In addition, one of the two gap-fillers will slip two months. (The operational date for programming use is 1 November 1958) As neither of the two radio sites will be operational at this time, use of the sector for programming purposes may be provided only if radio coverage is made available by temporary facilities. Col. Huey of ADC has undertaken the task of obtaining the Rand needs and will advise the Project Office of their proposal.

SUPPORTING DOCUMENT NO. 19

ITEM NO. 4-57-3 (Secret)

C. Action Being Taken (Cont'd.)

Duluth ADS

The operational date of P-35 Radio will be delayed by three months. However, this in itself is not reason enough to change the sector operational date.

Lt. Col. Tidball of the ADES Project Office stated that the Project Office and ADC had furnished USAF with a list of specific sites requiring funding and the sequence in which these funds are needed. Funds released since 1 July 1957 have not been in accordance with the required sequence. This should be continually reviewed by Hq. USAF and ADC in order that the best possible use of funds may be made.

(d) All support facilities for 57 MCP have been funded and are in varying stages of construction. No further information has been released on the funding of support facilities required under 58 MCP.

D. Forecast Completion of Action

1 September 1957 (Determination of Rand radio requirements at Kansas City)

21 August 1957 (Release of modified Schedule No. 6 by Project Office)

1 October 1957 (Release of funds)

E. Impact on Program

Further rescheduling will be necessary if funds are not released promptly as forecast. In addition, full advantage of the large sums of money already spent will not be realized if the additional money required to complete the early sectors is not funded.

ITEM NO. 4-57-4 (Unclassified)

A. Problem Presented

Power supplies at long-range radar sites are inadequate for SAGE equipments.

B. Action Agencies

ADC, AFIR, ADES Project Office, EADF and ADES

SUPPORTING DOCUMENT NO. 19

ITEM NO. 4-57-4 (Unclassified)

C. Action Being Taken

Representatives of EADF and ADES have been visiting AC&W sites to determine the capability of existing power facilities to satisfy test requirements as well as ultimate SAGE requirements, and what emergency measures, if any, must be taken. Mr. Olver, EADF, advised that sites surveyed from 1 July 1957 through 25 July 1957 were: P-9 Highlands, N. J.; P-54 Palermo, N. J.; P-45 Montauk, N. Y.; P-50 Saratoga, N. Y.; P-14 St. Albans, Vt.; M-103 No. Concord, Vt.; P-65 Charleston, Me.; P-80 Caswell, Me.; and P-13 Brunswick, Me. A report has been prepared by EADF outlining interim measures to be taken at each site until permanent modifications to distribution systems, commercial and diesel power have been made. At P-80 and P-65 it is imperative that additional interim power be made as soon as possible to minimize shutdowns.

Mr. Olver advised that during the survey it became evident that in view of the limited capacities of diesels, transformers and wire sizes, it would be impractical to supply interim back-up power for SAGE Systems testing. Col. Huey, of ADC, stated that in case of power outage, the site commander will determine procedures affecting SAGE tests and give SAGE testing precedence except in emergency conditions.

The survey of the remaining sites in EADF will be completed by 31 August 1957. It is expected that authorization will be granted for additional surveys in the Central and Western regions.

Because of the number of modifications and additions to power supplies planned at each site, the chairman requested that Col. J. A. Cowan, of AFIR-ZIPO, coordinate and schedule this modification work between AFIR and the Corps of Engineers in accordance with ADC and ADES test requirements. AFIR-ZIPO accepted this task. Funds for the Electrical Distribution and Emergency power at P-21, P-45 and P-50 will not be available until after 1 October 1957.

D. Forecast Completion of Action

31 August 1957 (Completion of EADF and ADES survey)

E. Impact on Program

Failure to provide adequate power at ancillary sites will delay testing and jeopardize sector operational dates.

SUPPORTING DOCUMENT NO 19

ITEM NO. 5-57-1 (Confidential)

A. Problem Presented

Requirements for test aircraft must be established and their availability assured.

B. Action Agencies

Hq. USAF, SAC, TAC, ADC and ADES

C. Action Being Taken

On 19 and 22 July 1957 meetings were held with interested Air Force agencies to discuss SAGE aircraft requirements for 1957-1958. At these meetings agreement was reached on the following allocations for test aircraft support in 1957:

(1) The Type I aircraft required for all subsystem testing at the New York ADS and Boston ADS for the period 15 August through 31 October will be provided by SAC. This will amount to 350 hours of aircraft support.

(2) ARDC will provide all the Type I aircraft required for subsystem and initial system testing at the Boston ADS for the month of December 1957. This amounts to 112 hours.

(3) All of the remaining Type I requirements for 1957 will be fulfilled by EADF with the 551st AEW & Con. Wg. assigned to the BADS and the 4713 REVFLT to the NYADS.

(4) TAC will provide the Type II aircraft requirements for 1957.

Hq. USAF furnished ADES on 27 July 1957 with a complete listing of the types of aircraft that will be in the USAF operational inventory for the 1958-1962 period. ADES is evaluating the aircraft listed to determine the feasibility of their use as substitutes for those types that are presently programmed as Type I aircraft. In this same study ADES will determine whether F-101 aircraft can be used for Type II aircraft. USAF had also requested that ADES provide them with an estimate of SAGE aircraft requirements for the 1959-1962 period. This study was completed by ADES and the requested information was transmitted to the ADES Project Office on 9 August 1957.

D. Forecast Completion of Action

30 August 1957 (ADES to complete study)

E. Impact on Program

If requirements for test aircraft are not met as scheduled, SAGE System Testing will be delayed at a cost of $2,000 per day per test team.

SUPPORTING DOCUMENT NO. 19

ITEM NO. 6-57-1 (Confidential)

A. Problem Presented

A comprehensive review of trigger delay amplifier requirements is necessary so that quantity procurement action may be undertaken.

B. Action Agencies

AFCRC, RADC, RAFD and Lincoln Laboratory

C. Action Being Taken

The Hallicrafter Corporation is producing 16 trigger delay amplifiers for radar sites in the first module. These units are needed to solve a range calibration problem at the long range radar sites. Lincoln Laboratory TIR #1-206, (Memo 2M-0681), recommended a long-term solution to the range calibration problem by having the trigger delay amplifiers provided as part of the long range radars. Mr. W. Smith advised AFCRC has reviewed this TIR but has delayed issuance of their recommendation pending the results of tests of the trigger delay amplifier to be conducted at P-45, Montauk. This unit was delivered 12 August 1957, and testing is in progress. From these tests AFCRC will also determine if one unit duplexed through wiring changes will be sufficient at each long range radar site in place of the two per site presently programmed. AFCRC is expected to forward their recommendations to the ADES Project Office by 31 August 1957.

Based on the recommendations of AFCRC, RADC will initiate action to provide specifications to RAFD so that procurement action can be initiated to provide a long-term solution. AFCRC will also recommend a basis for interim procurement of quantities required for action during the period required to change the radars.

RAFD is negotiating with Burroughs to provide installation and maintenance for the first 16 trigger delay amplifiers and letters of intent have been issued to Burroughs for the first two units.

D. Forecast Completion of Action

31 August 1957 (AFCRC recommendation on TIR #1-206 and feasibility of using one unit for each site)

Indeterminate (Complete specifications and final procurement for trigger delay amplifiers)

E. Impact on Program

Without trigger delay amplifiers the accuracy of SAGE radar data will be inadequate.

SUPPORTING DOCUMENT NO. 17

ITEM NO. 7-57-1 (Confidential)

A. Problem Presented

Use of AN/FPS-20 radars has been limited because rotary antenna switches in the antenna circuits have burned out.

B. Action Agencies

RAFD

C. Action Being Taken

An ECP was issued by Bendix on 29 July 1957 calling for a change in the type of spring behind the carbon isolating rods which will eliminate the arcing and the burning of the antenna switches. The ECP will be reviewed by RAFD Modification Review Board on 20 August 1957. Bendix can ship eight replacement switches by the end of August for installation by Bendix Field Engineers if shipping instructions are provided by RAFD

D. Forecast Completion of Action

20 August 1957 (approval by Modification board)

E. Impact on Program

Subsystem tests involving AN/FPS-20 radars will be delayed with possible effect on sector operational dates.

ITEM NO. 7-57-2 (Unclassified)

A. Problem Presented

There are apparent discrepancies in radar and beacon site coordinates.

B. Action Agencies

4620th ADW

SUPPORTING DOCUMENT NO. 19

ITEM NO. 7-57-2 (Unclassified)

C. Action Being Taken

The 4620th ADW is responsible for publishing site coordinates for use in SAGE radar orientation and computer programming. The accuracy of the surveys is the responsibility of the agency which surveys and designs the site. ADES had found apparent discrepancies in site coordinates which caused orientation errors, and after review of the gap-filler beacon coordinates, Col. Brooks advised that EADF has requested the AC&W sites to reconcile their figures and if necessary, resurvey. It was determined that errors in long-range radar beacon coordinates were, in some cases, due to using inaccurate coordinates of the radar sites for reference. ADES has received the latest Corps of Engineers surveys for these sites and beacons, and these have been provided the Boston ADS test teams. EADF established a procedure for obtaining correct beacon site azimuth data, which will satisfy SAGE orientation requirements, and following completion of the study, ADC will forward a report to the 4620th ADW. Col. Brooks advised that criteria now available has been furnished the Detroit ADS and subsequent sectors to prevent difficulties in these sectors and will be used to correct errors which may be found in the earlier sectors.

D. Forecast Completion of Action

15 August 1957 (ADC's report to 4620th ADW)

E. Impact on Program

Subsystem testing will be delayed and tracking by SAGE computer program impossible if site coordinates or beacon azimuth and range information are not available in accordance with accuracy outlined in TIR #1-61, issued by Lincoln Laboratory 6 July 1955.

ITEM NO. 7-57-3 (Unclassified)

A. Problem Presented

Interference with the AN/FPS-8 radar at P-9 is being encountered from off-base radars.

B. Action Agencies

ADC (New York ADS), AMC, MAAMA and EADF

SUPPORTING DOCUMENT NO. 19

ITEM NO. 7-57-3 (Unclassified)

C. Action Being Taken

Representatives from MAAMA, RAFD and AFCRC have investigated and studied the radar interference at P-9. The information compiled indicates that the interference is caused by several sources: Sandy Hook - 27 AN/TPS-2's operating intermittently; Ft. Monmouth; Idlewild, Floyd Bennet & LaGuardia Airports; Shipboard navigational radars. Since the problem affects Army, Navy, Air Force, marine and CAA equipments, MAAMA considers the problem beyond the purview of their organization and has recommended to AMC that a committee be formed to further investigate the interference and resolve the problem. Lt. Col. Silance of the ADES Project Office will assure that prompt action is taken. Mr. W. Smith of AFCRC advised that they had investigated the problem, but, because of the multiplicity of causes of interference, determined the problem to be beyond their scope.

Meanwhile, the C and E organization of the New York ADS is attempting to procure test equipment that will aid in obtaining additional information on the sources of interference.

D. Forecast Completion of Action

1 September 1957 (Review and recommendation by committee)

E. Impact on Program

Subsystem tests and use of P-9 as a SAGE input will be delayed until the interference is cleared.

ITEM NO. 7-57-4 (Reinstated) (Unclassified)

A. Problem Presented

Lack of cables has delayed installation of RHI consoles in SAGE annex required for SAGE height-finder tests.

B. Action Agencies

RAFD, AMA's, ADES Project Office

SUPPORTING DOCUMENT NO. 19

ITEM NO. 7-57-4 (Reinstated) (Unclassified)

C. Action Being Taken

At the last meeting this problem was considered to be solved. However, the ADES Project Office had determined that as of 2 August 1957 RAFD had not initiated procurement of the cable which has a six month lead time before delivery. Mr. Maddaloni will check Air Force assets to assure the availability of this cable until procurement can be completed. Mr. Maddaloni also advised that all the AMA's had been notified they were to fabricate the kits and will check to assure that the proper C&E scheme is available since three different schemes were used at P-9, P-45 and P-54 in the New York ADS. Col. Silance of the ADES Project Office advised that RAFD schemes were available for relocation of the RHI consoles in the Washington ADS, and material for these schemes had partially shipped. Col. Silance will continue to work with Mr. Maddaloni to resolve this problem.

D. Forecast Completion of Action

22 August 1957 - (Mr. Maddaloni to advise ADES PO status of cable assets and procurement)

2 September 1957 - (Mr. Maddaloni to check all AMA's to assure proper C&E schemes received)

E. Impact on Program

SAGE testing of Height-Finder subsystem cannot be programmed until four RHI consoles, properly connected, are installed in the SAGE annex.

SUPPORTING DOCUMENT NO. 19

NEW ITEMS

SUPPORTING DOCUMENT NO. 19

ITEM NO. 8-57-2 (Confidential)

A. Problem Presented

A plan for the acceptance of each Air Defense Sector must be developed so that each sector can be turned over to ADC on the operational date, as systems tests indicate that operational specifications are met.

B. Action Agencies

ADC, AMC, ARDC, RAG, ADES Project Office and ADES

C. Action Being Taken

Major Worley, the Project Office representative on the Requirements Advisory Group (RAG) will initiate action to develop procedures for the acceptance of Air Defense Sectors by the Air Force. Col. Silance of the ADES Project Office will report monthly on the progress being made in the development of these procedures.

D. Forecast Completion of Action

11 September 1957 (First report by Col. Silance)

E. Impact on Program

Possible delay in planned use of test teams in subsequent sectors.

SECRET

SUPPORTING DOCUMENT NO. 19

CLOSED ITEMS

SECRET

SUPPORTING DOCUMENT NO. 19

ITEM NO. B-57-1 (Unclassified)

A. Problem Presented

Information is not available concerning far-end terminations required for SAGE operation at interceptor bases, AAOC, AMIS, ARTCC, etc.

B. Action Taken

ADC has advised the Defense Communications Manager (DCM) of the AT&T Company and the Army CONAD representative at Colorado Springs of the communication facilities required at AAOC sites in the first two sectors. In addition, on 22 July 1957 and 24 July 1957, ADC advised CAA of SAGE requirements and requested information on the type of facilities needed at AMIS and ARTCC locations to meet these requirements and be compatible with equipment presently installed. This will be forwarded to the DCM when received. Information will be forwarded to the telephone companies by 23 August 1957 by Bell Telephone Laboratories concerning the facilities required to terminate voice scramble circuits and interceptor bases. After receipt of the above information the telephone companies will advise ADC through the DCM of any difficulties in meeting these of future SAGE requirements.

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J. Dechovitz	1
W. R. [illegible]	1
D. L. Doherty	1
J. F. Feeley	1
C. H. Fickinger	1
D. M. Gallagher	1
H. [illegible] Gray	1
I. D. Gruber	1
[illegible] D. Gruman	1
J. H. Hagany	1
P. M. Halpern	1
[illegible] A. Hamel	1
S. D. Hayes	1
J. T. [illegible]	1
C. H. Jones	1
H. K. Jones	1
J. M. Kitchens	1
E. H. Kurre	1
H. B. LaForce	1
[illegible] D. Lanford	1
J. R. Leighton	1
R. G. Luckey	1
I. [illegible]	1
H. J. McGill, Jr.	1
R. L. Macomber	1
J. C. Meyer	1
J. H. Moore	1
L. W. Moran	1
C. E. Morrow	1
J. L. Mudrock	1
R. W. [illegible]	1
G. H. Needham	1
E. J. O'Connell	1
M. D. O'Keefe	1
J. D. O'Neill	1
D. A. [illegible]	1
J. Pickell, Jr.	1
T. N. Poole	1
E. C. [illegible]	1
W. E. Schmidt	1
E. [illegible]	1
W. Seymour	1
F. Simon	1
S. B. Stalwell	1
M. L. Taliaferro	1
R. Taylor	1
K. A. Taylor	1
J. C. Timmerman	1
W. J. Walsh	1
D. P. Wilkes	1
W. E. Central Files	1
W. E. Library	25
	40

SECRET

Register No. 92461-57

UNITED STATES AIR FORCE
AIR MATERIEL COMMAND
ELECTRONICS DEFENSE SYSTEMS DIVISION
ADES Project Office
220 Church Street
New York 13, New York

In Reply Refer to:
MCPYB

25 November 1957

SUBJECT: SAGE Phasing Group Meeting 13 November 1957

TO:

SUPPORTING DOCUMENT NO. 20

1. Attached are the minutes of subject meeting held at 220 Church Street, New York City, to be used for your information, guidance or action as appropriate. The ADES Status and Progress Meeting was held on 12 November 1957 and a summary as contained in the first part of these minutes was given by Western Electric ADES. The problem areas are covered in the individual items on these minutes.

2. A new plan for the conduct of future Phasing Group Meetings was discussed and agreement was reached that the next three meetings should be conducted at locations other than 220 Church St., New York. The next meeting will be convened at 1000 hours on the 11th and 12th of December at Griffiss AFB, Rome, New York, in the conference room of their Supply Headquarters. The general purpose of the meeting will be to discuss in much greater detail than normal those items for which Rome ARDC and other elements of Air Materiel Command have prime responsibility for solution. The meeting in January is planned to be held at Ent AFB, Colorado Springs, with the agenda aimed at those items primarily the responsibility of ADC. The February meeting is planned to be held at Hqs USAF to discuss those items within the immediate purview of that headquarters. Detailed agenda will be provided to the major command headquarters and to selected participants during the week of 25 November for the meeting to be held at Rome ARDC.

1 Incl.
a/s

DALE R. TIDBALL
Lt Colonel, USAF
Deputy Chief, ADES Project Office

H-48437

SECRET

SECRET

SUPPORTING DOCUMENT NO. 20

Register No. 82461-

MINUTES

SAGE PHASING GROUP

MEETING

13 NOVEMBER 1957

"This document contains information affecting the national defense of the United States within the meaning of the Espionage Laws, Title 18 U. S. C., Sections 793 and 794. Its transmission or the revelation of its contents in any manner to any unauthorized person is prohibited by law."

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SECRET

SUPPORTING DOCUMENT NO. 20

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The meeting was opened with some general remarks on the purpose and objectives of the phasing group meeting made by Col. Gugliotta, Chief of the Air Project Office. It was suggested that since most of the problems coming before the group can be placed into three major categories, it would be desirable that the location of the next three phasing group meetings be held at locations where these problems could most effectively be resolved. The problem areas were given as (1) supply and support to maintain reliability at the ancillary sites, (2) the operational capability of personnel at the sites and (3) funding. It was, therefore, proposed, and subsequently agreed to by those in attendance, that the locations and general subjects for discussion at the next three phasing group meetings would be as follows:

11 and 12 December 1957 - Rome Air Force Depot, Rome, New York - Supply and support problems, particularly as applied to the operations of radars in SAGE. It is also proposed that the Air Defence Systems Management Office (ADSMO) present a report on the status of data-link implementation in SAGE. The agenda for this meeting is expected to be distributed by 25 November 1957.

15 and 16 January 1958 - Colorado Springs, Colorado - Air conditioning at ancillary sites, retrofit programs, improvement of reliability within the maintenance program in being, proposal for acceptance of Air Defense Sectors on the operational date.

12 and 13 February 1958 - Washington, D.C. - Funding for the remainder of FY 58 and for FY 59, test aircraft availability.

ADMS REVIEW OF SAGE STATUS

SAGE Reschedule (Secret)

A new SAGE Schedule (No. 7) was approved by Hq. USAF on November 1, 1957. The reschedule was made necessary because of the delay in receiving construction funds for three DC buildings and approximately 30 ancillary buildings, the decision not to accelerate the production rate of AN/FSQ-7 and AN/FSQ-8 computer production beyond one every two months and the ADC SAGE Redeployment Plan. The following assumptions were used in preparing the new schedule:

1. Construction funds for the Reno, San Francisco and Los Angeles DC's would be available to the contractor by February 1, 1958, and funds for the Great Falls DC and the Phoenix and Minot DC-CC's would be available to the contractor by April 1, 1958.

SAGE Reschedule (Cont'd.)

2. Funds for five radio buildings would be available by November, 1957 and the remainder of the ancillary buildings by April, 1958.

3. Gap-filler availability would not be a limiting factor.

4. Computer production would be uniform at the rate of one unit every two months.

5. Funds for FY 59 and subsequent years would be available to carry out the remainder of the program.

As rescheduled, the operations dates of all sectors beginning with the 6th (Detroit ADS) slip by periods ranging from 1 to 16 1/2 months. Slippages in sectors Detroit through Spokane are due to the unavailability of construction funds for the ancillary buildings and at later sites due to the unavailability of construction funds for DC & CC buildings as well as the revised computer production program. The overall effect of the reschedule is to delay the completion of SAGE System until September 15, 1963.

Implementation Activity In Early Sectors (Secret)

A review of the status of the New York ADS is as follows. With the exception of the difference in "time-phasing" the problems in other sectors are similar to those in the New York ADS. It is expected that problems in later sectors can be resolved in the same manner as those in the New York ADS.

Direction Center

The introduction of an interim SAGE System Training Program (SSTP) at the Direction Center necessitates changes to the AN/FSQ-7 computer and internal communications prior to 1 March 1958. IBM equipment changes have been approved and were contractually covered by the Air Force on 21 October 1957. These changes to the display system will be made by IBM during the last two weeks of December, with a completion date scheduled for 1 January 1958. Funds for the required building changes have been provided by ADC Headquarters through EADF to the New York ADS site commander. Drawings have been provided by ADES to the commander and bids are currently being secured from local contractors with a scheduled completion date of 15 December 1957. Engineering of communications changes required to accommodate SSTP is being done on an emergency basis by ADES and Bell Telephone Laboratories. Installation and test of this equipment to be shipped 11 January 1958 is estimated to require six weeks.

Direction Center (Cont'd.)

Rand has indicated that computer program Model 1, a modification to the computer program to be delivered 1 January 1958, will be released to ADES in the New York ADS on 1 April 1958. This date is coincident with the start of final systems tests and a conference to review the effect on system tests will be held 18 November 1957. All equipment changes required for the operation of the 1 April 1958 computer program will be accomplished during the last two weeks of December, at the time of the SSTF changes.

Although an emergency ECP procedure is being used in all cases where changes are contemplated which might result in interruptions to the test effort, a sufficient number of mandatory changes to the AN/FSQ-7 are planned to be almost coincidental with the beginning of final systems tests. It is expected that some adverse reaction will be felt during the early stages of final systems test effort as a result.

An engineering change proposal for modification of the air conditioning system in the New York ADS Direction Center has been approved by the Air Force and contracts are under discussion. Work is scheduled to begin 6 January 1958 and complete no later than 15 March 1958. On completion of this work, it is expected that the high humidity experienced in the Direction Center fourth floor console area will have been corrected. Similar changes will be made to the air conditioning system at all other Direction Centers and/or Combat Centers in which it is required.

In general, the situation at the Direction Center is good. Although some of the work has been tightly scheduled, with an exerted coordinated effort it can be accomplished.

Long-Range Radar Sites

Reliability of the equipments at the ancillary sites continues to be the major problem in the New York ADS. Although improvements were identified during September, the situation grew worse during October. As examples, P-9, Highlands, N.J., had trouble with one or more equipments on 28 of the 31 days of the month. The AN/FPS-8 radar was out of service for a total of 260 hours during the month, or approximately 1/3 of the time. One AN/FPS-6 height-finder was out of service continuously for ten days and on 22, 23 and 24 October, the site was completely inoperable as two height-finders and the search radar were out of service.

Long-Range Radar Sites (Cont'd.)

At P-54, Paterson, N.J., the situation is similar in that 40 troubles were experienced during October. This site was out of service for approximately 1/3 of the time during the month.

At P-45, Montauk, N.Y., this site was completely out of service for [illegible] testing from 30 September to 25 October and until 8 November it was marginal with only one air conditioning compressor operating. This was the result of splitting the air conditioning system. Although it was originally estimated that this was a two-week job, after a full month shutdown only 1/2 of the system was operational. No testing was accomplished at P-45 for approximately one month, as a result of this outage. Splitting of the air conditioning at P-9, is scheduled to start 14 November.

Gap-Fillers

Operation of the gap-filler equipment has continued to be unreliable as previously reported. P-9A failed 13 out of the 31 days of October, with a duplex channel outage of nine days. P-45B was out of service five days during the month of October. At P-45A, one channel was out of service for 21 days during October. At P-45B, seven days were required to repair one defect. At P-45A, 14 days were required to repair one defect. As this would indicate, maintenance of these gap-filler sites remains critical. Due to these difficulties, the testing capability in the New York Air Defense Sector during October was extremely poor.

Radio Sites

Installation of voice receiving and transmitting equipment is now proceeding satisfactorily at the McGuire Radio Site after approximately a six month delay. The data link equipment, however, was not shipped from Rome to P-45 until 8 November and will not be shipped to McGuire radio site until 20 November. NAAMA will arrange for installation at both sites. Data Link at P-45, scheduled for operation on 15 November, will be delayed until 1 December. As previously reported, P-45 and P-54 voice radio is being used to control aircraft in the test effort, but some equipments needed for SAGE operation are still missing.

Height-Finders

AN/FPS-6A radars are being installed in place of previously scheduled AN/FPS-6 radars. Although AN/FPS-6A radars have been available for installation at SAGE sites since June 1957, there are no spare parts available for the support of these radars. Based on previous experience, no height-finding capability will exist unless the support problem is corrected immediately. The ADES Project Office has advised RAFD to ship AN/FPS-6A radars to sites previously scheduled to receive AN/FPS-6 radars and recommended that extraordinary action be taken immediately to make spare parts and maintenance materials available at the earliest possible moment. It is obvious that if SAGE capability is to exist in those sectors equipped with AN/FPS-6A radars spare parts must be made available.

Ground-to-Air Voice and Data Link Radio Subsystems Tests

As yet, the test team has not had a complete SAGE radio installation with which to work; use of operational radio installations has been limited to voice control of test aircraft. McGuire voice radio is six months late and no data link equipment is operating in the New York ADS. Unless the missing equipments are made available by 1 January 1958, the New York ADS cannot be tested in accordance with specifications prior to the operational date.

Other Subsystem Testing

Testing of the gap-filler, long-range and height-finder subsystems is essentially complete in the New York ADS. Additional subsystem testing will be performed to prove-in parameter changes, verify the adequacy of new issues of test methods and to verify equipment performance.

Crosstelling subsystem tests between the New York ADS and Boston ADS Direction Centers have been completed and these satisfy test requirements.

Teletypewriter installations are still only partially complete and subsystem testing of this equipment has just started. Preliminary results indicate that these subsystems will probably not present major problems or delays.

Initial System Testing

The first of six system tests using aircraft flying controlled flight paths was conducted on 10 October. Although the results of the test on 10 October were good, the five additional tests during the month were not successful. On 16 October, equipment failures in ancillary equipment

Initial System Testing (Cont'd.)

forced the cancellation of the test at about the half-way mark with no useful data collected. Abort of both test aircraft cancelled a test on 18 October. An aircraft abort plus failure of all scheduled AN/FPS-6 radars on 21 October accounted for essentially no test results. Tests on 23 October and 25 October were somewhat better, although certain ancillary equipment which was scheduled for use were not available.

Controlled input tests designed to integrate the radar subsystems at P-54, P-9, P-45 and all associated gap-fillers are scheduled to continue during the month of November and December. These tests will be primarily concerned with the functions of air surveillance. The functions of weapons direction are being utilized on a limited basis during November, but this effort will be accelerated during December. It is presently planned to conduct weapons direction testing with the use of live interceptors on a very limited basis by late December or early January.

The results of combined systems testing effort to date indicates that SAGE equipments are able to perform the functions of air surveillance. However, more data must be obtained to determine a qualitative measure of these functions.

Summary

Seven months remain in which several major and complex equipment changes must be accomplished and integration and final system testing completed in the New York Area.

Many problems have been encountered; however, subsystem and initial systems testing has progressed well. The subsystems which have been tested do meet SAGE test specifications and will continue to do so as long as equipments perform reliably. The first results from initial system testing are encouraging but interruptions due to equipment failures or aircraft aborts have prevented optimum utilization of the test capability.

An operational date of 1 July 1958 for the New York Air Defense Sector is realistic and a SAGE air defense capability will be available as of that date, providing the Air Force takes action to rectify the various support problems which are contributing to poor equipment reliability. The Air Defense capability which will exist on 1 July 1958 will be directly proportional to the reliability of all the data-gathering subsystems as well as the proficiency of the maintenance and operating capability of the personnel at both the radar sites and the Direction Center.

SUPPORTING DOCUMENT NO. 70

Preparation and Checkout of Computer Programs

Programming activity at the air defense sectors is on or ahead of schedule with the possible exception of that portion allowing data link capability. At New York, Model 0, the complete computer program, will be available by 1 January 1958. Checkout of this program to date has indicated the major functions common to the DC active program, D-2 package, are operating properly. At Boston, testing of the air surveillance portion of this program is being operated with simulated inputs to introduce personnel of the Boston ADG to SAGE operation. Model 0 for Boston was received on-site and is now being tested.

At both the Syracuse and Ft. Lee Direction Centers, check-out of the utility program was completed and check-out of the air surveillance portion of the D-2 package is going well.

At Topsham, the utility program is about 40% checked-out and some preliminary testing has begun on the DC active program.

Coding of the Combat Center active program for the 26th Air Division is almost complete and assembly testing is proceeding satisfactorily.

The Rand Program Development Group (PDG) has essentially completed their move from Lexington to Santa Monica and is now engaged in producing the first revised program, known as Model 1. Good progress is being made by Rand in Santa Monica and Rand is very satisfied with the performance of the AN/FSQ-7 at this location. The machine has achieved a reliability of over 90% since 30 September 1957 when Rand began using the machine 8 hours a day per simplex machine. On 1 November, IBM agreed to give Rand a full 16 hours a day per simplex machine, an improvement over the previously planned date of 1 January for 16 hours use.

It was previously planned that the detailed requirements for the revised program to work with the large memory would be available by 1 October 1957 and that a large checkout team would install the entire program in the field in late 1959. It is now planned to define the objectives of the revised program and to incorporate the improvements in a series of steps so that by late 1959 all the objectives will be included in the revised program. In September, Rand suggested to Lincoln Laboratory that it would be desirable to combine the work of minor corrections to the program with the major revisions or improvements in the program and deliver the minor corrections along with the revised program models on a quarterly basis.

SUPPORTING DOCUMENT NO. 70

Preparation and Checkout of Computer Programs (Cont'd.)

It is Lincoln's responsibility to define the changes to be included in the program and Rand's responsibility to produce the new program. Lincoln has stated that in January 1958 they will make available the detailed objectives of the revised program and the cost of each change on the system in terms of computation time, memory capacity, frame time, personnel and equipment and the effect on the systems' operational capability. In January Lincoln will also have an estimate of the dynamic track capacity of the revised program when used with the large memory.

AN/FSQ-7&8 Production, Installation and Operation (Secret)

Production, delivery, installation and testing of all AN/FSQ-7 & 8 computers are on schedule. The AN/FSQ-7 for the Chicago ADS was shipped to the site on November 1, 1957. The computer for the Kansas City ADS will be stored at the Master Spare Parts Depot in Kingston for approximately one month until the Direction Center is ready to receive it. Air Force installation acceptance tests on the AN/FSQ-7 computer at the Syracuse Direction Center were completed on October 24, 1957. The Rand computer at Santa Monica is scheduled to be accepted in mid-November and the Washington computer by November 22nd. Computer reliability figures for all machines installed demonstrate continuing improvement. IBM reported that they have not received complete funding for power equipment scheduled under FY 58 requirements and requested that prompt action be taken in order to avoid an increase in the manufacturer's price.

AN/FST-2 Production, Installation and Operation (Secret)

Production of AN/FST-2 machines continues at the rate of two per month. The simplex unit destined for Patrick AFB is still at Burroughs' Paoli Plant awaiting completion of the SAGE annex building. Additionally, a second unit is being held by Burroughs pending the release of shipping instructions by RAFD. Burroughs Product Improvement program at their Test Station in Paoli is well underway with the height-finder and search radars installed and scheduled for operation by December 1, 1957.

In the event Burroughs' maintenance contract is extended beyond the operational date of the sectors in which the FST-2 is located, Burroughs will require authorization from the Air Force to recruit and train additional maintenance personnel. As the period for recruiting and training is approximately eight months, Burroughs requires this authorization immediately in order to have men available in the New York sector when it becomes operational in July, 1958.

Col. Huey of ADC noted that a recommendation regarding AN/FST-2 maintenance had been submitted to Hq. USAF on November 2, 1957.

SUPPORTING DOCUMENT NO 20

DC and DC-CC Buildings (Unclassified)

Construction progress of Direction Center and Direction Center-Combat Center Buildings was reported as proceeding satisfactorily. The Duluth ADC Direction Center is scheduled to be transferred on November 20, 1957, the Kansas City ADC Direction Center on December 18, 1957 and the Montgomery ADC Direction Center on February 28, 1958. Excellent construction progress has been made at Grand Forks and Seattle and transfer of these buildings to the Air Force is now anticipated in advance of the previous MOD's.

Provided funds are released in accordance with the assumptions on which Schedule #7 is based, construction will start on the San Francisco DC on May 2, 1958, the Reno DC on May 16, 1958 and the Los Angeles DC on May 29, 1958, Minot DC-CC on June 16, 1958, Great Falls DC on August 15, 1958 and Phoenix DC-CC on September 15, 1958.

The first redesigned DC-CC will be at Minot. The plans for this site are in final stages of completion.

Communications (Unclassified)

The approval of Schedule No. 7 has meant that external circuit requirement sheets (ADC Form 290) must be revised for all SAGE Air Defense Sectors and Air Divisions after Bangor. Accordingly, circuit requirements for the Detroit and Chicago Air Defense Sectors are being revised and will be reviewed with ADC during the week of November 18, 1957. Also, ADC has advised the Defense Communications Manager of the AT&T Company that SAGE external circuit requirements are to be revised where changes occurred in SAGE boundaries as a result of the SAGE redeployment plan.

Since the test bays associated with CUG equipment must be modified, CUG facilities will not be available in the New York and Boston ADS until the operational dates of those Air Defense Sectors. However, final systems testing in those areas will not be affected. ADC has agreed with this installation arrangement.

The first SAGE Circuits to site P-21 in the Syracuse ADS may not be in service until February 1, 1958, a one month slip from the scheduled service date. When a new service date has been determined, ADC will be asked to concur. Meanwhile, a committee has been formed to resolve problems encountered in providing communication facilities at P-21.

SECRET

SUPPORTING DOCUMENT NO. 50

REVIEW OF AC&W PHASING COMMITTEE CONFERENCE (Secret)

Mr. Stumph, of RAFD, reviewed the results of the latest AC&W Phasing Committee Conference of 4-8 November 1957. A new AC&W phasing plan, through 1961, was developed at this conference using SAGE schedule No. 7 dates, building construction forecasts and the latest schedules for the five equipment subprograms (AN/FPS-6 and 6A, AN/GPA-27, AN/FPS-18, AN/GPA-37 and AN/FPS-7).

A brief summary of the status of the five subprograms was given by Mr. Stumph as follows:

AN/FPS-6 and 6A - All AN/FPS-6 and AN/FPS-6A radars that have not been installed were rescheduled in accordance with schedule No. 7 and the capacity of AMA installation crews (see 11-57-2 for AN/FPS-6A).

AN/GPA-27 - Installation is proceeding satisfactorily. Due to funding cutbacks, Hq. USAF directed RAFD to extend delivery schedules for this equipment. However, 5 or 6 additional units will be made available during the next 4 months. Ninety-six AN/GPA-27's are now programmed for ADC use.

AN/FPS-18 - There has been some slippage in this schedule due to equipment problems. This will be corrected by January 1, 1958.

AN/GPA-37 - Installation is proceeding satisfactorily.

AN/FPS-7 - This equipment has been re-programmed due to schedule slippages. Before approving the final program, ADC will investigate the frequency diversity radar program to determine if there will be an effect on the AN/FPS-7 program.

SECRET

SUPPORTING DOCUMENT NO. 20

OPEN ITEMS

ITEM NO. 11-55-7C (Confidential)

A. Problem Presented

Intended locations of required radio buildings must be checked against antenna separation criteria so that construction may proceed on schedule.

B. Action Agencies

ADC

C. Action Being Taken

During July 1957, ADC directed the AMA's to complete siting of ground-to-air radio sites where technical problems did not exist. ADC (Col. Huey) advised that OCAMA has since informed CADF that siting could not be completed at P-69 due to non-conformance with RAFD antenna separation criteria. On 8 November 1957 ADC advised OCAMA that variance from the RAFD criteria was permissable and that siting was to be completed. Hq. AMC (Mr. Selnick) agreed to instruct the AMA's to forward siting information to the AFIR's if technical problems were not considered by ADC to affect the operational use of the site.

Col. Huey reported that the current status of siting is as follows:

Site	ADC Site Concurrence Forwarded to AFIR
P-34	18 October 1957
P-35	7 August 1957
P-47	3 October 1957
P-69	Estimated November 1957 (Resited - submitted to CADF for approval on 10 August 1957)
M-99	22 October 1956 (RAFD clearance forwarded on 24 July 1957)
SN-132	30 August 1957

SUPPORTING DOCUMENT NO. 20

ITEM NO. 11-55-7C (Cont'd)

C. Action Being Taken (Cont'd)

Site	ADC Site Concurrence Forwarded to AFIR
SM-138	Estimated December 1957 (Resited)
SM-139	Estimated 1 December 1957
P-29	13 November 1957
Richards-Gebaur	TX 26 June 1957 RX 30 August 1957 (Revised Siting)
Grand Forks	16 May 1957

ADC will endeavor to supply temporary radio facilities at P-47 and Richards-Gebaur in order for these sites to be operational by 1 November 1958 to provide live outputs for use in the check-out of the revised 1959 computer program. This program is to be installed at the New York ADS Direction Center by September 1959 to be used in conjunction with the enlarged memory and provide capability for BOMARC, increased track capacity and use of later-design interceptors. Before the temporary facilities can be engineered, Rand must identify their requirements to ADC.

D. Forecast Completion of Action

As indicated.

E. Impact on Program

Construction funds will not be released by Hq. USAF for buildings that have not had final siting approval.

ITEM NO. 12-56-1 (Unclassified)

A. Problem Presented

Status of SAGE Personnel and Training Action (this is carried as a general item for the Phasing Group to assist in resolution of any problems which may be beyond the preview of the Personnel and Training Committee).

B. Action Agency

ATC

ITEM NO. 12-56-1 (Cont'd) (Unclassified)

C. Action Being Taken

At the 10 October 1957 meeting of the Personnel-Training Committee, it was decided ATC would provide the live-computer portion of the training for Air Force operators by means of on-site training classes until the Kansas City ADS becomes operational for complete training. Academic and simulator training would continue at Murphy Army Hospital in the interim period.

A meeting was held at Keesler Air Force Base, October 22-24, 1957 to plan details for the implementation of the on-site training. It was agreed that:

(1) The on-site training will be conducted at Boston, Syracuse, Washington and Bangor. Additional sectors may become involved when Schedule No. 7 has been studied.

(2) ADC will provide 49 personnel to ATC for the additional instructors required. These instructors will be trained in the January 1958 class. This is the only class which will receive live computer training at ESS on the AN/FSQ-7.

(3) TTAF will take action to provide for the logistic support of the training.

(4) ADC will insure that on-site computer operational and maintenance support is provided as required by ATC.

(5) ATC will require 40 hours, on a time available basis, for training tape generation. Eighty hours will be required, on the same basis, for tape check-out and script generation. An additional 40 hours will be scheduled for training classes.

On-site training will require that the Training and Battle Simulation Rooms be equipped for interim SSTP on the following dates.

On-Site Training Requirements	Previously Scheduled Dates for Interim SSTP
Boston - 30 April 1958	15 May 1958
Syracuse - 6 August 1958	15 September 1958
Washington - 17 September 1958	15 October 1958
Bangor - 29 October 1958	15 November 1958

ADES is coordinating this activity to assure the on-site training dates can be met.

SUPPORTING DOCUMENT NO. 70

ITEM NO. 10-56-1 (Cont'd) (Unclassified)

D. Forecast Completion of Action

Will be reported upon at the next Phasing Group Meeting.

E. Impact on Program

Unless adequately trained personnel are furnished in accordance with SAGE requirements, the Air Defense capability for which the system was designed cannot be realized.

ITEM NO. 3-57-1 (Unclassified)

A. Problem Presented

Air conditioning at SAGE annexes does not furnish reliable cooling and humidity control for the AN/FST-2.

B. Action Agencies

ADC

C. Action Being Taken

ADC requires that their approval be obtained for air conditioning modifications beyond those performed by the C of E and Burroughs at the first 15 AC&W sites. Col. Tidball stated the ADES Project Office will transmit to ADC by 20 November 1957 a list of air conditioning failures which occurred since September, a copy of Burroughs' contract AF 30(635)9371 dated 16 October 1957 for the study, redesign and rework as necessary of the air conditioning systems at 13 long-range radar sites in the first module and a statement supporting the need for the new contract.

Permanent modifications have been completed by the Corps of Engineers at all of the 15 authorized sites except P-45 and P-9. These will be completed by 22 November and 1 December 1957, respectively.

D. Forecast Completion of Action

20 November 1957 (ADES Project Office release of information to ADS)
1 December 1957 (Completion of C of E modifications)

E. Impact on Program

The air conditioning systems must be operative at all SAGE annexes for the satisfactory performance of the AN/FST-2 as required for SAGE use.

SUPPORTING DOCUMENT NO. 20

ITEM NO. 4-57-1 (Secret)

A. Problem Presented

A&E and construction funds have not been received as scheduled for:

(a) SAGE Technical buildings
(b) Radar annexes
(c) Radio transmitter and receiver buildings
(d) Support buildings

B. Action Agency

Hq. USAF

C. Action Being Taken

Lt. Col. Tidball of the ADES Project Office reported that Schedule 7 which was approved 1 November 1957 is based on the following assumptions regarding fund availability:

1. Funds for the Reno, San Francisco and Los Angeles technical buildings will be available to the contractor on 1 February 1958.

2. Funds for the Minot, Great Falls, and Phoenix technical buildings will be available to the contractor on 1 April 1958.

3. Limited funds for ancillary buildings will be released in October and November 1957.

4. Balance of funds for radio and radar buildings required in FY 57 & 58 to be released in February 1958.

5. Funds available in FY 59 and subsequent years on time and for the right things.

ADES is determining the actual dates on which ancillary buildings must be available under Schedule No. 7. This list will be completed and transmitted to the ADES PO by 20 November 1957. Col. Payne (ADC) reported that at Hq. USAF's direction ADC will hold an Ad Hoc meeting this week to review the 1958 and 1959 Military Construction Programs.

FY 57 funds for five (5) SAGE radio sites which were frozen as of 2 July 1957 were to be released in November, 1957. However, only Ft. Custer radio has been funded to date.

SUPPORTING DOCUMENT NO. 20

ITEM NO. 4-57-1 (Cont'd) (Secret)

C. Action Being Taken (Cont'd)

Col. Cowan (AFIRO-ZIPO) reported that he had learned from Hq. USAF Installations that apportionment action for TM198, Gunter and other critical radio buildings would be completed by 1 December 1957.

FY 58 funds for Support Facilities will be released in February 1958.

D. Forecast Completion of Action

20 November 1957 (List of ancillary site requirements based on Schedule 7)
1 December 1957 (Release of funds for 4 radio buildings)
January 1958 (Submission of reclama to include Minot, Great Falls, and Phoenix in the FY 58 MCP)
February 1958 (Release funds for three DC Buildings and remainder of FY58 ancillary buildings)

E. Impact on Program

Further rescheduling of SAGE will be necessary if funds are not released promptly as forecast.

ITEM NO. 5-57-1 (Confidential)

A. Problem Presented

Requirements for test aircraft must be established and their availability assured.

B. Action Agency

Hq. USAF

C. Action Being Taken

Test aircraft allocations for 1958 have not been made by Hq. USAF. The latest test aircraft requirements for 1958 were transmitted by ADES to the ADES Project Office on 29 October 1957. These requirements were in turn transmitted to Hq. USAF (Lt. Col. Paul) on 31 October 1957. The ADES Project Office (Col. Le Febre) is coordinating ADES test aircraft requirements with Hq. USAF, operations ADC, and other affected commands.

SUPPORTING DOCUMENT NO. 20

ITEM NO. 5-57-1 (Cont'd) (Confidential)

C. Action Being Taken (Cont'd)

Test aircraft support for the balance of 1957 is being supplied as needed. However, no decision has been made by the Air Force on the alternates to B-57 aircraft as type II test aircraft, which are needed at the New York ADS by the end of November, 1957. When ADES learned of TAC's intention to use B-57's as type II test aircraft, a study was made which concluded that B-57's and RB-66's would not be satisfactory as test aircraft because of their low effective radar cross-section. ADES informed the ADES Project Office in a letter dated 9 October 1957 that the TAC intention to use B-57 would require a re-establishment of support and that if no other aircraft can be provided it would be advisable to conduct a special test to determine the degree of usefulness of the B-57 in the SAGE testing effort. In the same letter of 9 October 1957 ADES also submitted to the Air Force the results of the most recent analysis of those types of aircraft that will meet the several testing requirements and that could be used as substitutes for those aircraft being phased out of the USAF operational inventory.

F-86L interceptors, which are equipped with ground-to-air data link equipment are being replaced with century series interceptors, which are not data-link-equipped. Aircraft with data-link are necessary for the SAGE testing effort and unless provision is made for these aircraft, the testing effort will be jeopardized.

D. Forecast Completion of Action

20 November 1957 (Decision on use of B-57 as test aircraft)
20 November 1957 (Test aircraft allocations for 1958)

E. Impact on Program

If requirements for test aircraft are not met as scheduled, SAGE System Testing will be delayed or degraded.

ITEM NO. 6-57-1 (Confidential)

A. Problem Presented

A comprehensive review of trigger delay amplifier requirements is necessary so that quantity procurement action may be undertaken.

B. Action Agencies

AFCRC, (Provides specifications)
WADD, (Procurement of equipment and spares)

SUPPORTING DOCUMENT NO. 20

ITEM NO. 6-57-1 (Cont'd) (Confidential)

C. Action Being Taken

RADC has recommended to the ADES Project Office that the trigger delay amplifiers not be incorporated into the basic radars. As a result, additional trigger delay amplifiers will be required by August, 1958. AFCRC, (Mr. W. Smith) is investigating the specifications for the trigger delay amplifiers to determine if changes are required. AFCRC will provide the specifications to RAFD by 1 December 1957 so that bids for additional procurement of trigger delay amplifiers may be solicited. RAFD requires a 90-day procurement cycle and 6 months production lead time.

Twenty-seven service-test trigger delay amplifiers are being produced by Hallicrafter. These units are now being provided with operational and depot spares.

D. Forecast Completion of Action

1 December 1957 (AFCRC complete specifications)

E. Impact on Program

Without trigger delay amplifiers the accuracy of SAGE radar data will be inadequate.

ITEM NO. 7-57-2 (Unclassified)

A. Problem Presented

Coordinates of radar sites must be verified to allow SAGE orientation to be accomplished.

B. Action Agency

ADC

C. Action Being Taken

No problems exist for beacon siting in the 26th Air Division, however, radar site coordinates are required to be verified through resurvey to assure they conform to SAGE accuracy. P-103 and M-116 have been resurveyed and ADC has requested the AFIR's to resurvey P-55F, P-56C, P-65A, P-80B and P-80C. ADC will publish a revised list of site coordinates by 15 December 1957.

SUPPORTING DOCUMENT NO. 20

ITEM NO. 7-57-2 (Cont'd) (Unclassified)

C. Action Being Taken (Cont'd)

Resurveys in other air divisions must be accomplished nine months prior to the site operational date to allow orderly processing of the data through Hq. ADC to the 4620th ADW for submission to Systems Development Corporation (Rand) for computer program adaptation and to ADES for test programs.

D. Forecast Completion of Action

15 December 1957 (Publication of revised coordinate list)

Nine months prior to each site operational date (resurvey to assure accuracy of coordinates)

E. Impact on Program

Subsystem testing will be delayed and tracking by SAGE computer program impossible if site coordinates or beacon azimuth and range information are not available in accordance with accuracy outlined in TIR #1-81, issued by Lincoln Laboratory 6 July 1955.

ITEM NO. 7-57-4 (Unclassified) (Revised)

A. Problem Presented

Cables for RMI consoles in SAGE annexes must be procured.

B. Action Agencies

RAFD

C. Action Being Taken

On 28 October 1957 a contract was awarded for the procurement of bulk cable that will satisfy the SAGE requirements. Of the two types of bulk cable being procured, the coaxial cable is scheduled for delivery by 12 January 1958. The multiconnection coupler cable is scheduled for delivery by 4 January 1958. RAFD, (Mr. Oxner), has indicated they will attempt to expedite the material. RAFD has also sent the necessary instructions to the local AMA's on fabricating the cable into kits, and requested Gentile AFD to check their inventory of the clamps and connectors and other minor hardware pieces also necessary for the kits.

ITEM NO. 7-57-4 (Cont'd) (Unclassified) (Revised)

SUPPORTING DOCUMENT NO 20

C. Action Being Taken (Cont'd)

The cable is necessary for the relocation of RHI's at P-55 and P-56 in WRAMA prior to the time the bulk cable will be available. Since P-80 and M-110 in MAAMA have been allocated the cable, but do not require it this early, the advisability of switching the cable was investigated by the ADES Project Office. However, it was found that the coaxial cable has already been fabricated for M-110 and P-80 and installing it at another site would be impractical. In addition, the cable has already been shipped to the sites. The time gained, if any, was not considered to be consistent with the cost incurred and the possible installation difficulties that may arise. If the procurement and fabrication of the kits is not expedited it may result in a delay in the relocation of RHI's at these sites.

D. Forecast Completion of Action

11 December 1957 (Report on RAFD effort to expedite cable and supply of hardware items)

E. Impact on Program

The use of height-finder equipment will be delayed until the cable is procured and installed.

ITEM NO. 8-57-2 (Confidential)

A. Problem Presented

A plan for the acceptance of each Air Defense Sector must be developed so that each sector can be turned over to ADC on the operational date, as systems tests indicate that operation specifications are met.

B. Action Agencies

ADES Project Office and ADES

C. Action Being Taken

The ADES Project Office and ADES are coordinating the development of an overall, comprehensive proposal for acceptance procedures, which will be submitted to ADC for their consideration by 25 November 1957.

D. Forecast Completion of Action

25 November 1957 (Coordinated position of ADES Project Office and ADES submitted to ADC.)

E. Impact on Program

Possible delay in planned use of test teams in subsequent sectors.

SUPPORTING DOCUMENT NO. 20

ITEM NO. 10-57-3 (Confidential)

A. Problem Presented

Determination of radar orientation procedures for SAGE.

B. Action Agencies

AFCRC, ADC, Lincoln, ADES Project Office and ADES

C. Action Being Taken

The Radar Orientation Committee will meet 4 December 1957 and a recommendation will be made as to the use of solar radiation and permanent echoes for SAGE radar orientation; Lincoln Laboratory will submit a report on sun orientation and ADES on permanent echo. Based on the recommendations of this committee as to the methods to be used for orienting long-range, gap-filler and height-finder radars and Mark X equipment, specifications will be prepared for which AFCRC approval is to be requested.

Because of the interval required to test the methods and prove-in the specifications, Byron-Jackson services and beacon trucks will be required at least six months beyond the present contract expiration date of 10 December 1957. The ADES Project Office will determine if the contract will be extended by Rome or Gentile. A letter requesting this action will be forwarded by EADF to Hq. ADC by 15 November 1957 requesting contract extension and Hq. ADC will apportion funds to AMC for this purpose.

D. Forecast Completion of Action

15 November 1957 (Letter by EADF to ADC)
20 November 1957 (apportionment of funds to AMC)
2 December 1957 (contract extension signed)
4 December 1957 (recommendation of orientation committee)

E. Impact on Program

If contractual service for beacon trucks is not extended, no approved method for radar orientation will exist.

SUPPORTING DOCUMENT NO. 20

ITEM NO. 10-57-5 (Unclassified)

A. Problem Presented

Site locations must be approved for the following sectors and Air Division areas which were affected by the recently approved SAGE boundary changes: Reno, Los Angeles, 28th AD CC, Albuquerque, San Antonio and Miami.

B. Action Agency

Hq. USAF

C. Action Being Taken

Col. Gambaugh reported that ADC had approved the following sites as the most economical and had requested Hq. USAF's approval -

Reno ADS at Stead AFB
Los Angeles ADS at Norton AFB
28th Air Division at Luke AFB
Albuquerque ADS at Kirtland AFB
San Antonio ADS at Lackland AFB
Miami ADS at Robbins AFB

Col. Prewitt, Hq. USAF Operations, was requested to follow this problem so that the required approval will be granted prior to 25 November 1957.

Col. Cowan reported Hq. USAF Installation had approved the start of design of Direction Centers at Stead, Beale and Norton on 27 September 1957 to prevent an undue loss of time while awaiting final site approval.

D. Forecast Completion of Action

25 November 1957

E. Impact on Program

If site approval is not received promptly, design and construction schedules will slip.

SUPPORTING DOCUMENT NO. 20

GENERAL INTEREST ITEM

Integration of new weapons into the SAGE-equipped Air Defense Environment.

Discussion

The ADES Project Office will request ADSMO (Air Defense Systems Management Office) to report at future SAGE Phasing Group on the status of integration of weapons with SAGE. ADSMO will be requested to report on the status of airborne data link at the 11 December 1957 meeting at Rome.

Projected late BOD's for TM-196, TM-198, M-129, TM-200 long range radar sites and TM-198 ground-to-air radio site due to funding delays necessitated a re-scheduling of BOMARC demonstration firings in the Montgomery Air Defense Sector. Under the assumptions used in developing Schedule #7 the demonstration would have commenced 15 August 1959 and completed 15 November 1959. As noted during the coordination of Schedule #7 at the meeting convened at Hq. USAF on 1 November, Schedule #7 could be improved to meet the required firing dates if immediate actions were taken to release construction funds.

Hqs. Air Defense Command have now advised Hqs. USAF by TWX that their approval of Schedule #7 was premised on the fact that actions would be taken to fund the required buildings to permit the June, July, August, 1959 BOMARC firings. To preclude unilateral actions based on original plan #7, a revised schedule is being prepared to show required dates for each action to get back to the BOMARC firing requirements under Schedule #6. Col. Shieley in the Office of the Assistant Chief of Staff for Air Defense, Hqs. USAF, advised that his office is following this matter to assure that BOMARC test facilities in the Montgomery Air Defense Sector will have the same funding priority as BOMARC (See Item 11-57-1 for action on funding).

During the (SABOCC) SAGE/BOMARC Compatibility Committee conference on 10 October 1957 comments were received from committee members concerning the demonstration test plan prepared by APGC for the Montgomery ADS. APGC is incorporating these comments into a second draft of the plan expected to be completed by 1 January 1958. The next SABOCC conference is to be held on 21 November 1957 at the ADES Project Office.

The Priorities of Programmed Units (OPU) does not give BOMARC its assigned priority. Col. Prewitt agreed to present this problem to the proper organizations in Hq. USAF for corrective action.

Col. Galbreath, ADC, advised that data link equipment was not available in century series interceptors, which would reduce the operational effectiveness of these aircraft in the air defense complex.

GENERAL INTEREST ITEM (Cont'd)

SUPPORTING DOCUMENT NO. 20

Discussion (Cont'd)

Col. Tidwell requested a review to assure that the 1959 revision of the computer program was correctly scheduled to allow efficient integration of new weapons, concepts, etc.

Impact on Program

Unless DMAR/Weapons Integration is accomplished on a timely basis, optimum utilization of new weapons in Air Defense will be delayed. Lack of construction funds for Kansas City and Montgomery Sectors are seriously threatening DONARC operational dates. Exact impact will be revealed when funds are actually released.

SUPPORTING DOCUMENT NO. 70

NEW ITEMS

ITEM NO. 11-57-1 (Secret)

A. Problem Presented

Funds must be released for ancillary sites in the Montgomery ADS in time to permit firing of Bomarc by 1 June 1959.

B. Action Agencies

Hq. USAF

C. Action Being Taken

Col. Galbreath stated that ADC deemed it mandatory that nothing be permitted to interfere with the beginning of Bomarc test firing in the Montgomery ADS on 1 June 1959. Col. Shiely, ARDC, reported that he had learned from Col. Kelly, Director of Installations, Hq. USAF, that apportionment action for the construction funds for the SAGE annex buildings at TM-196, TM-198, TM-200 and M-129 has not been started. These funds should be available to the Corps of Engineers by 1 December 1957 if Bomarc test firing is to begin by 1 June 1959. Col. Shiely advised that his office is following Hq. USAF Installations to obtain prompt apportionment action. By 22 November 1957, Hq. USAF will approve advertising for construction bids prior to receipt of funds.

Col. Cowan, AFIRO-ZIPO, stated that apportionment action for TM-198 Radio will be completed by 1 December 1957. Design of this building is scheduled to be completed in March 1958. Since this is too late to meet requirements, this work must be accelerated.

Extraordinary effort on the part of all Action Agencies is required to obtain the required funds, design the buildings, award the construction contracts and complete the buildings on time.

D. Forecast Completion of Action

22 November 1957 (approval of advertising in advance of funds)
1 December 1957 (apportionment of construction funds)

ITEM NO. 11-57-1 (Cont'd.) (Secret)

E. Impact on Program

If Doparc firing does not begin 1 June 1959, this weapon cannot be integrated into the New York ADS as scheduled.

ITEM NO. 11-57-2 (Confidential)

A. Problem Presented

Spare parts are required for the AN/FPS-6A height-finder radars so that continued operation of SAGE height-finding equipment can be assured.

B. Action Agency

[illegible]

Actions Being Taken

[illegible] height-finder radars, improved models of the AN/FPS-6, [illegible] installed at long-range radar sites [illegible] spare parts for the seven major components [illegible] AN/FPS-6. WADC [illegible] Owner [illegible] stated [illegible] are [illegible] requirements will be available in June [illegible] spares in January 1959.

[illegible] has directed AMC to take over depot [illegible] the AN/FPS-6 by 1 January 1959, but because of the [illegible] situation, Rome [illegible] requested AMC to extend contract maintenance until 1 [illegible] 1959. AMC has not yet changed their decision.

D. Forecast Completion of Action

Indeterminate

E. Impact on Program

Lack of spare parts for the AN/FPS-6A will delay subsystem testing and impair SAGE height-finding operation.

ITEM NO. 11-57-3 (Confidential)

A. Problem Presented

Action must be taken to minimize the effect of the long delay in the production of CU-547 multicouplers.

SUPPORTING DOCUMENT NO. 20

ITEM NO. 11-57-3 (Cont'd.) (Confidential)

B. Action Agency

RAFD

C. Action Being Taken

Early in October 1956, RAFD received a procurement directive from Hq. USAF for CU-547 multicouplers. The contract proposal was issued in November 1956 and the bids were opened in January 1957. A contract was let on 1 April to the Harvey-Wells Company for 714 units, with a promised delivery of 100 units by November 1957. The contractor has since indicated that he will be unable to fulfill the contract. No arrangements for a second source of multicouplers have been made and multicouplers are not expected to be available for at least six months. AT-197 stacked antennas can be substituted until the multicouplers can be procured. On 6 November 1957 the ADES Project Office informed all affected AMA's that the AT-197 antenna will temporarily replace the CU-547 multicoupler. A total of 3700 AT-197 antennas have been allocated for SAGE and 800 are now in stock at RAFD. Sufficient cable for the installation is also in stock at RAFD.

The ADES Project Office will expedite the procurement of FY 58 quantities of CU-547 multicouplers. The temporary substitution of AT-197 antennas is estimated to cast an additional 6 to 8 thousand dollars per site.

D. Forecast Completion of Action

1 December 1957 (Action by RAFD)

E. Impact on Program

The substitution of AT-197 antennas at SAGE radio sites inflicts additional costs upon the Air Force and lowers the expected system performance.

ITEM NO. 11-57-4 (Secret)

A. Problem Presented

Actions must be taken to improve reliability of SAGE ancillary equipment through adequate supply, maintenance and, where necessary, modification programs.

B. Action Agency

RAFD

SUPPORTING DOCUMENT NO. 30

ITEM NO. 11-57-4 (Cont'd.) (Secret)

C. Action Being Taken

ADMS is publishing a site operation log for each ancillary site in the first three sectors. These logs, published on a weekly basis, are distributed to all involved agencies for analysis and correction of recurring problems. An emergency routine has been established to obtain spare parts not available from on-site spares required to put the equipment back in operating order. SAGE has not caused a lower reliability of manual equipments now in use, but the centralized bookkeeping has made the breakdowns more apparent and the necessity for system-wide operation has required a higher degree of performance.

RAFD will be requested to review actions to be taken which will improve ancillary equipment reliability and report on their proposals at the SAGE Phasing Group meeting to be held at Rome in December 1957. Review will be made of actions being taken to improve the on-site maintenance program at the 15 January 1958 SAGE Phasing Group Meeting at Colorado Springs.

D. Forecast Completion of Action

11 December	1957	(Report by AMC)
15 January	1958	(Review of maintenance program in existence)
1 July	1958	(Achievement of adequate reliability so that ADC can accept New York ADS from AMC)

E. Impact on Program

If adequate equipment reliability is not achieved ADC cannot accept the New York ADS on 1 July 1958 for operational air defense purposes.

SUPPORTING DOCUMENT NO. 20

CLOSED ITEMS

ITEM NO. 7-57-3 (Confidential)

A. Problem Presented

Interference with the AN/FPS-8 radar at P-9 is being encountered from off-base radars.

B. Action Taken

Since 19 September 1957 the delay lines installed at P-9 have eliminated evidence of interference at the output of the AN/FST-2 equipment. Several checks of the equipment, under varying conditions, have been made and have indicated that although the interference exists at the input of the AN/FST-2 it has no affect on the sub-system performance.

On 17 October 1957 the ADES Project Office requested RADC to conduct tests with the AN/GPA-28 blanker device to determine if this equipment would be a more appropriate solution to the problem. In a letter to the ADES Project Office on 1 November, RADC indicated that they were performing tests with the blanker equipment, although an AN/FST-2 was not used in their experiments. Their results, showed that the blanker equipment had limitations and might not prove to be more satisfactory than the delay lines now installed at P-9.

At the present time no interference problem has been experienced at any other SAGE ancillary sites. ADES is closely monitoring other sites where AN/FPS-8 radars will be installed to identify any possible interference difficulty that might develop. Maj. Walmer advised that RAFD was making a survey of their existing stock of quartz delay lines to determine if the capability exists to change the pulse repitition frequency of additional AN/FST-8 radars. These actions should be sufficient to resolve future interference problems or allow time to find an alternate solution without effecting the SAGE implementation program.

ITEM NO. 10-57-1 (Confidential)

A. Problem Presented

A plan of priorities must be developed that will allow the AMA's to install radars, radio and other facilities on a basis compatible with SAGE schedules with the limited funds available for this purpose.

SUPPORTING DOCUMENT NO. 20

ITEM NO. 10-57-1 (Cont'd.) (Confidential)

B. Action Taken

The AC&W Phasing committee has developed a new program through 1961 based on the latest equipment delivery forecasts supplied by manufacturers, SAGE priorities and building construction schedules. Representatives of the ADES Project Office attended the latest AC&W Phasing conference on 4 November 1957 during which SAGE Schedule No. 7 dates and the latest funding information on ancillary facilities were supplied for inclusion into the AC&W program.

Col. La Frenz advised that the ADC priority list does not entirely take care of SAGE requirements. In order to correct the priority list the ADES Project Office will forward to ADC by 20 November 1957 a list of ancillary buildings required for SAGE in accordance with Schedule No. 7 and the approved redeployment plan. By 27 November 1957 the ADES Project Office will advise ADC of required equipment operational dates at these sites.

ITEM NO. 10-57-2 (Confidential)

A. Problem Presented

Transformer failures and a lack of spare parts for the AN/FST-1 are hampering operation and testing of the Gap-Filler radars.

B. Action Taken

Lewyt, the manufacturer of the AN/FST-1, issued an ECP on 30 October which is expected to eliminate the difficulty experienced with the transformers. The ECP was approved by the modification review board on 31 October. Funds have been allocated for the new transformer to be installed in all production models, and to be retrofited in all units now in the field.

EADF has reported that the spare parts provisioning for this equipment is not adequate. EADF is working with RAFD to solve this problem. With the resolving of the transformer problem, the lack of spares is not considered to be critical at this time.

ITEM NO. 10-57-4 (Unclassified)

A. Problem Presented

Technical data are required for new ancillary equipments to be used with SAGE.

SUPPORTING DOCUMENT NO. 20

ITEM NO. 10-57-4 (Cont'd.) (Unclassified)

B. Action Taken

RAFD (Capt. Wheeler) advised that preliminary technical data is being supplied by the contractors with each AN/FST-1, AN/FPS-20, OA-1163 and OA-947 as the equipment is shipped. However, Burroughs (Mr. Turner) reported that the data for the OA-1163 is not sufficient to permit proper maintenance. In order that necessary action can be taken, Burroughs will inform their contracting officer of the maintenance data required. The ADES Project Office will render assistance as required.

Some Technical Orders for the AN/FPS-20 and AN/FST-1 are available to the using organizations; the remainder will be made available during 1958. Technical orders for the OA-1163 will not be available until the latter part of 1958. RAFD has requested Lewyt to contact their subcontractor to obtain realistic delivery schedules for the OA-947 Technical orders.

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SUPPORTING DOCUMENT NO. 21

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SUPPORTING DOCUMENT NO 22

SUPPORTING DOCUMENT NO. 22

[illegible]	SUBJECT: Draft of CONAD Plan for Testing SAGE/ Missile Master
TO: [illegible]	FROM: [illegible]-D [illegible] 31 July 1957 COMMENT NO. 1 Major J. Schoenrel/[illegible]js/29

1. Missile Master is another high priority item, in the same category as the SAGE, which must be in the Revised SAGE Computer Program for 1 September [illegible]. Lincoln is working on the Missile Master program but the [illegible] the hardware for checkout of this program. Briefly, some of the major testing problems are:

a. [illegible] must make a decision on the equipment that will convert the SAGE [illegible] per second to the Missile Master 750 bit per second data rate. AF[illegible] has recently submitted a proposal to USAF for approval.

b. Lincoln and RAND must complete programming action for providing retrace capability of digital communication from SAGE DC to Missile Master by October 1958. Lincoln planned to provide this capability in a minor computer program revision available by 1 January 1958. Lincoln has stated that this can probably be accomplished by October 1958.

c. Lincoln Laboratory and Signal Corps Engineer Laboratory must resolve the digital message structure for SAGE DC and Missile Master operation. A committee from these agencies is now working on this problem.

d. A location for testing the computer program (1 September 1959 program), which will provide a capability to make target-weapon pairing at the SAGE DC, must be provided. Under the CONAD Plan, the Experimental SAGE Sector at Lincoln Laboratory and the Boston Missile Master are listed for this testing. The operational date for the Boston Missile Master has been changed from September 1959 to September 1960 and the check-out of this program at the Experimental SAGE Sector is therefore not possible. This has been brought to the attention of CONAD in Inclosure No. 2, paragraph 3.

2. The actions listed in paragraphs 1a, b, and c above must be accomplished before technical testing outlined in the CONAD plan can be started. The CONAD Test Plan calls for technical testing to be accomplished in the Washington sector using the Fort Meade Missile Master. This is the portion of the plan that will require immediate action. Headquarters ADC must insure that the facilities--AN/FSC-2, [illegible], computer program, etc.--are available in time for technical testing.

3. The main issues are the technical operability problem and the [illegible]. The answers to the operational suitability testing will not be difficult as the only requirement will be the scheduling of SAGE [illegible] facilities for testing when required.

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SUPPORTING DOCUMENT NO. 22

CORS-D, SUBJECT: Draft of CONAD Plan for Testing SAGE/Missile Master

4. The CONAD proposal calls for ADC, ARDC and Army commands to be assigned to CONAD as members of the CONAD Test Group. These people will be required until testing is completed, probably in early 1961. Our comments regarding people are that the CONAD Test Group not be assigned to CONAD. We are proposing that a committee be formed by CONAD and be composed of personnel from commands of USA and USAF. We contended that a committee would be more effective than a permanent group with less hardship to supporting commands. The CONAD requirement for ADC people is:

a. One Major - Operations Officer.

b. One Captain - Administrative and Logistics Officer.

5. Copies of the Testing Plan and ADC's comments will be sent to Headquarters USAF and Headquarters ARDC to apprise them of CONAD planning on the testing of SAGE/Missile Master. Their comments will be requested.

1 Incl
Proposed 1st Ind to CINCONAD,
Subj: Draft Plan for Testing
SAGE/Missile Master Integration.

SAMUEL C. GALBREATH
Colonel, USAF
Acting Dir of Rqrmts

SECRET

H-42766

CONFIDENTIAL

SUPPORTING DOCUMENT NO. 23

STUDY GROUP REPORT

"EXTENSION OF NIKE BATTERY DATA

LOOP TO THE SAGE DIRECTION CENTER"

1 SEPTEMBER 1957

#42766

CONFIDENTIAL

SUPPORTING DOCUMENT NO. 23

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LIST OF ILLUSTRATIONS

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AA	Antiaircraft
AAD	Antiaircraft Weapon Director in the Direction Center responsible for monitoring and overriding track assignments to the AA Fire Units.
AADA	Antiaircraft Weapon Director's Assistant
AACC	Antiaircraft Operations Center
ADDC	Air Defense Direction Center
Air Defense Direction Center (Manual)	Equipment and personnel, integral with selected long-range radar sites, possessing the capability for weapons direction.
Air Surveillance	The acceptance, organization and processing of all incoming data to provide up-to-date air situation information.
AN/FSG-1	Missile Master Antiaircraft fire direction system
AN/FSQ-7	SAGE System computer and associated Direction Center Equipment
AN/FSQ-8	Equipment similar to the AN/FSQ-7 but with less terminal and display equipment; used in Combat Center.
AN/TSQ-7,-8	Automatic digital data equipment which transmits and/or receives at 750 information bits/second.
Antiaircraft Officer (AAO)	Staff advisor to the Sector Commander on all matters pertaining to AA.
Auxiliary Console	A small console containing keyboard input switches and in some cases a digital information display tube.
BDL	The battery data system which provides for transmission of reference and designate data to each battery and status, engagement and target coordinate data from each battery to the AACC, adjacent AACC's and other batteries.
Charactron	A cathode ray tube used for situation display and containing a device for shaping the electron beam into clearly defined characters or symbols.
CC - Combat Center	The installation for control of a sector, the next higher level of control above a Direction Center; equipped with a modified AN/FSQ-7, designated AN/FSQ-8.
Cross-telling (X-telling)	The automatic passing of information from one Direction Center to another.

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Data Circuit	A telephone-line facility with characteristics permitting transmission of digital data pulses with minimum distortion.
DC - SAGE Direction Center	The AN/FSQ-7 equipped installation for control of air defense activities in a sector.
DDR	The digital data receiving unit of the A-1 Digital Data Signalling System.
DDT	The digital data transmitting unit of the A-1 Digital Data Signalling System.
ECM	Electronic Countermeasures
Fire Unit	Integrated AA fire control system together with associated weapon or weapons.
Gap Filler	Short range radar used to fill the gaps between long range radars.
Intervention Switches	Switches provided on the consoles to enable the operators to give the computer instructions or actions to be taken.
JMDC	Joint Manual Direction Center
LRI	Long Range Input - part of AN/FSQ-7
Manual Inputs (MI)	The portion of the computer that accepts manually controlled input data from keyboards, light guns, and card machines, and that presents these data to the computer directly or via a magnetic drum.
Missile Master	See AN/FSG-1
SAGE	Semi Automatic Ground Environment
Senior Director	The officer responsible for over-all supervision of the Direction Center.
Situation Display	Map-like presentation of tracks, identifying characters and geographical landmarks on a 19-inch charactron tube.
Situation Display Console	A console containing a situation display tube, keyboard input switches, and in some cases a digital information display tube.
Sector	A geographical division under the control of a SAGE Direction Center
XTI	Crosstell Input - Part of AN/FSQ-7
PCM	Pulse Code Modulation.

SUPPORTING DOCUMENT NO. 23

PART I

Purpose

The Department of Defense, in its "Technical Plan For Integration of the Missile Master Into the Continental Air Defense Environment" directed the Air Force to form a study group including appropriate Army representation. The study subject was "the feasibility of extending the Nike Battery Data Loop to the SAGE Direction Center so that the AA Weapons Director at the DC will have available battery tracking and engagement information".

A study group was convened consisting of the following:

Major G. R. Johnston	ADES-PO
Major J. Schoonvel	Hq. ADC
J. P. May	MIT - Lincoln Laboratory
M. Epstein	USASEL
J. Silverstein	"
T. C. Viars	"
J. W. Hayne	The Martin Co.
G. P. Langelier	LPO-AFCRC
J. Carson	Rand
S. Spool	WE-ADES

Various other individuals from the above organizations and from ADSCD, IBM and USASADEA attended preliminary meetings of the group.

The recommendations and conclusions contained in this report are concurred in by the individuals who participated in the study.

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SUPPORTING DOCUMENT NO. 23

PART II

THE MISSILE MASTER SYSTEM

Description of AA Defense System AN/FSG-1

A. General

Antiaircraft Defense System AN/FSG-1 is an operations center system for monitoring and control of up to 24 Nike batteries. Functionally the system provides:

1. Automatic broadcast of SAGE and/or JMDC generated reference data to all batteries on up to 48 targets, or direct battery target designations by SAGE.
2. Transmission of battery tracking data from each battery to the AAOC and all other batteries in the system.
3. Transmission of battery tracking data to adjacent AAOC's and receipt of tracking data from the batteries of these AAOC's.
4. Monitoring at the AAOC of both the SAGE reference data and battery action data.
5. Facilities at the AAOC permitting specific target-to-battery designations..
6. Generation of reference data from local radars when SAGE data is unavailable.
7. Transmission of engagement status data and track channel availability data to SAGE.

Facilities for both centralized and decentralized weapon battery-to-target assignments are provided in the AN/FSG-1 system. In the centralized mode, SAGE reference data and/or locally generated reference data are either used by the Tactical Controllers at the AAOC to make weapon-to-target designations, or designation data and commands are provided by SAGE and are retransmitted by the AAOC, the batteries engaging targets only in accordance with these designations. In the decentralized mode, the same data plus battery action data from other batteries permit the Battery Commanders to make an intelligent selection of targets for engagement by their batteries.

Reference data from the SAGE ADDC on up to 48 tracks is received over an automatic data link and is retransmitted to all batteries in the system. At the battery the reference data places identity markers on the acquisition radar PPI which can be correlated with the video seen by the radar. At the AAOC the 48-track reference data is displayed on the Tactical Control, Friendly Protector, AAOO and Defense Commander Consoles. This includes height, size, direction, and battery assignment status of the track, in addition to identity and position.

When any battery is tracking a target, position data from its target tracking radar and battery status data are transmitted to the AACC. The position data is then broadcast simultaneously to all of the other batteries where it places a marker on the acquisition radar PPI video. Thus by means of this battery data link (BDL) each Battery Commander is aware of which targets are being engaged by other batteries. In the AACC the battery tracking position and status data are displayed on all tactical consoles and the tracking data can be displayed on the Surveillance and Entry and the Tracking consoles. Engagement status data is transmitted back to SAGE for each battery engagement.

Video from a local surveillance radar is displayed on the Tracking and the Surveillance and Entry consoles. Manual rate-aided tracking is provided so that operators at these consoles can take control of the track stores and generate tracking data on the local video. This data then becomes a part of the reference data transmitted to the batteries and displayed on the Tactical consoles. Two height-finding radars are also provided to introduce height data in the local tracking from these consoles.

The Tactical Controllers, AACO, and Defense Commander may monitor all battery actions with respect to tracks in the reference data, and with respect to battery action of adjacent systems. When a track is designated, the reference data and battery tracking data are cut off from the selected battery. Instead a command signal and a single position marker are transmitted, pointing out the target to be engaged on the battery PPI. When the Battery Commander acknowledges the command, designation data is cut off and the reference data and battery tracks are then displayed on his PPI until another command is transmitted.

B. The Battery Data System

The battery data system provides for the transmission of Reference and Designate data to all batteries, and for the receipt of battery data (BDL) from each battery to the AACC where it is rerouted to all other batteries. The data system is initiated and controlled by the master synchronizer which causes each battery to be interrogated in sequence as to its activity. The remaining discussion will pertain only to the Battery Data Link portion of the battery data system.

An Interrogate signal developed by the master synchronizer which causes each battery in turn to transmit its BDL message. (The period between interrogate signals is 100 milliseconds. The BDL data rate from each battery is therefore 2.4 seconds for a Missile Master system containing 24 fire units). The interrogated battery's answer is received on the BDL line and routed by the master synchronizer to the BDL receiver where the PCM data is decoded and sent to the battery stores. The received PCM data is also amplified and routed by the BDL receiver through the master synchronizer to

a line amplifier, back to the master synchronizer and then transmitted to all remaining batteries and adjacent AACC's over their respective PDL lines.

The decoded output of the PDL receiver is entered into the battery analog stores and the battery auxiliary stores. From the analog store battery track position data is routed through the Tactical Display Equipment's data converter to the AAOO, Friendly Protector, and Tactical Control Consoles for display. The PDL coordinate data is also fed directly from the battery analog stores to the Battery Data Computer to display battery tracks on the Tracking and Surveillance and Entry Consoles. Data from the auxiliary stores is used to control status indicators on the various consoles and also provides status output data to SAGE.

PART III

SUPPORTING DOCUMENT NO 23

SAGE System - AA Function

The way that the Direction Center operates can be described with reference to Chart 1. Air defense information is provided as inputs to the computer from many sources as shown on the left hand side of the chart. This information is furnished in two primary ways, automatically and by teletype and voice. As the information flows into the electronic storages and memories, the computer program begins the millions of operating functions that are required to develop a complete air defense picture in three-dimensional form. The actions of the computer are supervised by military operational people of three broad categories: Air Surveillance, Identification, and Weapons Direction. The Direction Center is capable of maintaining 400 tracks simultaneously.

The output orders from the Direction Center go to the various weapons systems shown on the right hand side of the chart. Through data link, voice and teletype communications, these orders are either relayed via radio or go directly to the weapon systems and to Federal and Civil agencies as warning information. Of the 400 tracks being maintained in the Direction Center, half may be interceptor aircraft or missiles on mission whose guidance orders are being calculated by the computer. In addition, detailed assignment instructions may be sent to other weapons, such as the TALOS and NIKE type, to engage remaining tracks requiring action.

All or any part of the information in the electronic storage of the Direction Center equipment may be sent forward to the Combat Center in detail, as well as in summarized and condensed form. The Direction Center can receive simultaneously up to 50 tracks, in addition to the 400, through the automatic links from adjacent Direction Centers. Another capability shown at the bottom of the chart is the ability to expand the geographical area under the responsibility of a Direction Center, since carefully chosen radars and weapons have been cross-connected.

The aim of air defense, destruction of an attacking force, can best be accomplished by the efficient allocation and commitment of all weapons. In order to achieve this objective the allocation and commitment of each type of weapon must be made considering the use of all others in the given geographical area. The SAGE System provides this capability under one commander through the facility of the SAGE Direction Center.

The SAGE Direction Center will control all air defense weapons, including target assignment to weapons (NIKE and TALOS) with their own guidance systems. Target assignment for any weapons will be accomplished taking cognizance of all other air defense weapon-target pairings within the entire subsector. Thus, air defense weapon employment will be completely integrated at the SAGE Direction Center.

The SAGE System provides the capability for assigning targets for all weapons from one control source. The control capability of the SAGE Direction Center must be degraded considerably before an emergency method of weapons control will be required. The computers are duplexed and designed so that one computer will automatically take over the data processing for the Air Defense Battle if the operating computer should break down. In addition, dual communications routing will exist for all critical inputs and outputs to the SAGE Direction Center. Both sets of communication routes must be inoperative before the SAGE Direction Center is unable to effectively employ weapons. However, since communications or both computers could fail, alternate methods must exist for the control of weapons. The SAGE System itself provides the first alternate capability. The remaining components of the air defense system, which ordinarily support the SAGE System, also have a limited independent manual control capability. There are four basic modes for Air Defense. These, with respect to AA weapons, are briefly described below.

Mode I

This will be the normal mode of operation in the SAGE era. Each SAGE Direction Center will be responsible for, and will exercise complete control over the conduct of the air battle within its normal sector boundaries. Normally under this mode all target assignments within a SAGE sector will be made by that sector's SAGE Direction Center. However, any SAGE or Manual Direction Center with a surveillance and control capability within the sector may be requested to undertake the engagement of targets within a specified air space within the sector, and to provide the necessary tactical control of weapons employed in such engagements.

Mode II

If a SAGE Direction Center becomes inoperative, adjacent SAGE Direction Centers will accept full air defense responsibility and authority over specified portions of the disabled sector. These Direction Centers will conduct the air battle in their assigned portions of the disabled sector in the same manner, and with the same responsibilities and authority as apply within their own sector boundaries, but all operations which they conduct within the boundaries of the disabled sector will be classified as Mode II.

Mode III

In the event of two adjacent Direction Centers becoming inoperative, or of any other situation developing as a result of which there is an area in which neither Mode I nor Mode II can be employed, Mode III will be adopted. In this mode, responsibility for conducting the air battle will be assumed by JMDC's (Joint Manual Direction Centers) or Air Defense Direction Centers (Manual). Within their areas of responsibility these

centers will assume full operational control, coordinate all air defense actions, make target assignments and coordinate weapon commitment to the maximum extent consistent with the tactical situation.

Mode IV

In the event that any air defense weapon system or unit loses all contact with the Direction Center (SAGE, Joint Manual or Air Defense Manual) under whose control it was previously operating, it will at once go into Mode IV. Under this mode all weapons systems and/or units will operate autonomously, under such local control as may be operative within the system or unit, and responsibility for control will be assumed by the local unit or weapons system commander.

The mode of operation under which a sector is operating may be dictated either by equipment capabilities existing at a given time - or by the tactical considerations of the air battle. Varying modes of operation can apply to individual air defense weapons at a given time.

There are approximately 27 director positions in Weapons Direction room as shown in Chart 2. The groupings represent four weapons direction teams composed of a Weapons Director and five Intercept Directors. In addition TALOS Directors and AA Weapon Directors are a part of this operational team. (The actual numbers of the latter may not be as shown on the chart). In the center of the room on a raised dais are the overall supervisors of the weapons direction crew. These are: Senior Director, Senior Weapons Director and the Air Tactics Officer.

The Senior Director is responsible for the overall conduct of the air battle in the subsector. The Senior Weapons Director is the Senior Director's primary assistant during high load conditions and either the Senior Director or Senior Weapons Director may allocate weapons to the Weapons Direction Teams. Depending on deployment of weapons with the sector, one or more console may be specifically designated for TALOS, or AA weapon directors. Other consoles are devoted to control of manned interceptors and BOMARC.

The supervisory function of the AA Weapon Directors in a SAGE Direction Center are carred out from a position equipped with facilities as shown in Chart 3. A situation console is shown on the left and an auxiliary console on the right.

The AA Weapon Directors' situation console has a 19" tube called a charactron tube in the center of the console and a smaller 5" typotron tube located at the upper right. The charactron tube is for display of the air situation and the typotron tube is used for detailed information such as weapon status, track status, etc. Various special displays are available on the situation console to give the AA Weapon Directors the data necessary to perform his assigned functions.

The auxiliary console is provided for technicians or assistants to aid the AA Weapon Directors in carrying out instructions to the computer. The auxiliary console is identical to the situation console with the exception that the former has no situation display tube. Both consoles are equipped with computer controls, called intervention switches, and direct voice communications with the JMDC are available for each individual AA Weapon Director or his assistant.

The number of AN/FSG-1 systems located in a sector will generally determine the number of AA Weapon Directors' consoles required. Based on preliminary estimates, it is planned to use one situation display console for two AA Weapon Directors who will be responsible for one AN/FSG-1. Separate communications for each Director would be available, but they would both use the same situation display console.

A typical situation display for an AA Weapon Director is depicted in Chart 4. This chart represents a 19" charactron tube and is a display of a simulated tactical situation at one particular time in an air battle. This is only a typical display and does not actually show existing or planned deployment of batteries.

The batteries are shown as small dots and beside or below the battery position is the battery number, 02, 03, 12, etc. On the next line the battery status is given.

Chart 5 is a Digital Display on the typotron tube on which the AA Weapons Directors can request specific information on track status, battery status, etc. In this case the column on the left is hostile track status and the column on the right is the status of one battery. Several other such fire unit designations may be shown as required.

Chart 6 illustrates, in simple form, a part of the over-all air defense system. It depicts the SAGE Direction Center, Air Defense Surveillance Radars, AN/FSG-1, and various AA weapons and communication lines between them.

The Fire Units provide current weapon status to the SAGE DC by means of a digital data circuit. Weapon status is an automatic input into the Computer. The current status includes such items as readiness and engagement status of a Fire Unit. The number of missiles available, types of warheads, launchers, etc., are also forwarded on a long term basis and the FSQ-7 does the required bookkeeping to keep this status continually up to date.

The SAGE DC passes target assignments and/or reference data by digital data circuits to the Fire Units through the FSG-1.

The FSG-1 will be used conceptionally as a switching and communications central when targets are being assigned directly to batteries from the SAGE DC. It will provide storage and linear extrapolation of target

position data for transmission to the Fire Units at a high information rate.

The message format used for providing status from the FSG-1 to the FSQ-7 is shown on Chart 7.

AAD and Computer Actions at SAGE DC for Direct Target Assignment to Batteries

In the following description, SAGE direction of Nike is used as an example of centralized control under Mode I.

I. Single Thread - Nike as employed against a single track composed of one object in track.
   A. Actions at the SAGE Direction Center
      1. Automatic actions by FSQ-7 computer
         a. Determine the potential hostile tracks for assignment to Nike.
            (1) Eliminate friendlies from consideration.
            (2) Select those hostiles that are approaching the effective range of the Nike weapons.
         b. Determine the absolute priority according to which selected tracks should be engaged by Nike.
         c. Determine the number of fire units that should be assigned to each track in order of its precedence.
            (1) Normally the computer will assign one fire unit for each track. (This criterion will be readily changeable).
            (2) Latest experience available regarding Nike kill potential will be used to adjust this normal ratio as required.
         d. Computer will determine which Nike fire units can engage the hostile. This will be determined on the basis of the location of the fire units.
            (1) Those fire units within the subsector.
            (2) Those fire units within an adjacent subsector.
            (3) Consideration of fire units in both subsectors.
         e. Request fire from adjacent Direction Center if fire units in that subsector can engage hostile track.
            (1) This is based on target priority.
            (2) Full information on these tracks will automatically be crossfeed to adjacent SAGE Direction Centers so as to include priority of each track.
         f. Select fire units for assignment to specific tracks according to following criteria:
         g. Select type of warhead.
         h. Fire unit or units will be selected in sequence and the process will be repeated until all tracks have fire units assigned or no batteries are available.
         i. Make up and transmit fire unit assignment message. (Update track position).

Although this automatic function has been rather simply described, the magnitude of the task requires that every fire unit be considered for every potential target according to the standing operating procedure. The entire process takes less than one-half second of the computer time cycle, and would be repeated approximately every 15 seconds. New assignments of Nike batteries can be made to hostile tracks at the rate of approximately 50 per minute.

2. Human action of Nike Director
   a. Any hostile track approaching the effective range, or area for consideration for commitment, of Nike, will automatically be assigned to the Nike battery or batteries. The Nike director has a capability to override or modify automatic computer actions. Examples of these are as follows:
      (1) Adjust priority assigned to a particular hostile track.
      (2) Adjust the number of fire units to be assigned per object.
      (3) Adjust the number of fire units to be assigned to a particular hostile track.
      (4) Change or override an individual target fire unit assignment.
      (5) Change type of warhead associated with a given assignment.
      (6) Assign a particular target to an individual fire unit.

II. Multiples - Nike employment against single track composed of two or more objects in track (assume a flight size three - separation 2,000 feet).
   A. Actions for Assigning Tracks to Fire Units - Actions as described for single thread (one track and one object) are applicable in addition to following:
      1. FSQ-7 computer program will determine the fire units to be committed against the hostile track (three targets). SAGE would assign the hostile track to the fire units available and designate those fire units responsible for destroying the hostile track.

III. Multiple Tracks - Multiple Objects in each track.
   A. Action for assigning tracks from SAGE DC to fire units: Action prescribed under single thread will apply and in addition the following action will apply.
      1. SAGE can provide a secondary target assignment to the NIKE fire unit, which will be presented on the fire unit commander's acquisition scope. The secondary target will not be sent to the fire unit until the fire unit has fired its first missile at the primary target assigned.

2. Method of determining priority of targets for assignment to Nike fire units:
   a. Assign first priority targets to available fire units.
   b. If there are more targets than fire units, make tentative secondary assignment in the AN/FSQ-7 computer.
   c. Dump primary assignment at the AN/FSG-1 after first "fire" is reported.
   d. Make secondary assignment.
   e. If another fire unit becomes available - the hostile track is reassigned to that fire unit and the hostile track may possibly be dumped from consideration as a secondary target by the original battery. The battery is then reconsidered for secondary assignment by the computer program.
   f. When the fire unit commander is ready to engage a secondary target, he signals this fact by taking an acknowledge action.
   g. If any action other than "Fire" is required on secondary target, it is "dumped".
   h. If any information on the primary target must be provided by the SAGE DC (i.e., new command), the secondary target is dumped and the primary target is reinstated.

IV. Mass Tactics Against Mass Raids - (Objects Less Than 2 Miles Apart)

A. SAGE will generate synthetic tracks on the mass of targets. Synthetic aiming points for individual fire units will be generated by the FSQ-7 computer to obtain a pattern of fire on the mass. The synthetic aiming points will be passed to the fire units and each battery will correlate the synthetic aiming point with an actual track nearest this aiming point. The fire unit will accept this target as primary target for assignment.

SUPPORTING DOCUMENT NO 23

PART IV

Possible Operational Uses of BDL Information in the SAGE Direction Center

The possible operational uses of BDL information that have been considered by this group are listed below. These were determined by the group to be the major applications for which the BDL information could be used in the DC and it should not be implied that they are necessarily desirable or required.

A. Verification of SAGE Assignment of Targets to Battery
After a battery has received and acted upon a SAGE designation command, and upon interrogation, it reports this battery status information back to the Missile Master via the BDL. Missile Master consolidates this information (without X, Y and h coordinates) from the various batteries and reports to SAGE the status of each of the batteries actions (See Chart 7.)

If the complete Battery Data Link information were made available at the SAGE Direction Center, a correlation could be made of the target assignment and the actual battery track by the AA Weapons Director. (A facility exists in the Missile Master System to accomplish this function at the Tactical Controller Consoles).

B. Detection
1. It is possible, although not necessarily probable, that the battery acquisition radars may detect an aircraft which they think (or perhaps know) is not being carried as a SAGE track. An altitude criteria could be established to eliminate certain tracks, i.e., only tracks under 5,000' could be forwarded to SAGE. The track could be locked onto by the target tracking radar and then reported to the SAGE Direction Center and the SAGE identification procedures utilized to identify the track.
2. This function might serve as a "late warning" device to detect a sneak attacker, undetected by SAGE. If the battery is being used for this function, it will not be available for assignment to any other targets.

C. Supplementary Tracking for SAGE.
1. Since it is possible that in the Missile Master Defense Area a track may be spotted and lock-on achieved, the tracking radar at the battery could function as a SAGE tracking device by continually reporting the position of the track. This capability might be helpful under ECM conditions where SAGE radars have been jammed. The battery tracking radar can only track one target at a time.

D. Coordination Between JMDC and SAGE.
In any situation where the SAGE Direction Center is not making speci-

fic target to battery assignments the BDL information may be used to apprise SAGE of the targets under engagement by the missile batteries. It must be noted that this arrangement will not provide information about other weapons under JMDC direction.

SUPPORTING DOCUMENT NO. 23

PART V

Methods of Implementation

Various equipment configurations have been considered for sending and utilizing the BDL data at the SAGE D.C. The present equipment and computer program arrangement of interest to this report is illustrated in Chart #8. Five different methods have been considered from the viewpoint of complexity, manpower and time, hardware costs, and computer programming efforts. The adequacy of these methods for implementing the above operational possibilities is also included, see Chart #15. Chart #14 presents a summary of the costs necessary for implementation.

Method I

Extended BDL Circuit - Automatic Input to SAGE See Chart #9

Method I, as proposed, involves the transmission of the Battery Data Link Message to the SAGE Direction Center in the form that is used in the FSG-1 to transmit this data among the weapons batteries and AAOC's. This message format consists of a train of up to twenty-four AN/TSQ-8 battery data frames. Each frame originates from a different battery in the system in turn, at a nominal rate of 100 milliseconds per frame. This train of data is repeated continuously with an additional single frame space which leads to approximately a 2.5 second reporting interval for each battery. When the associated battery is tracking a target each frame contains target present position in rectangular coordinates referenced to the AAOC center of coordinates, as well as certain auxiliary data.

The equipment which would be required to send this information to the SAGE D.C. consists of an additional line amplifier at the Master Synchronizer in the AAOC similar to the type which is used to crosstell BDL data between adjacent AAOC's.

The tracking data (X, Y, and h) from the Missile Master Battery Data Link (BDL) would then be introduced to a 750/1300 bit per second converter. This converter would also add proper parity bits, produce sine waves, and generate a standard format (XTI or LRI) for transmission via the Bell "A-1" data service. The information would then be treated just as any other input by the AN/FSQ-7. The transformed BDL data would require a DDR. An input channel in the AN/FSQ-7 must be assigned for this purpose.

The BDL information can be entered into the AN/FSQ-7 machine through a crosstell input (XTI) channel or through a Long Range Radar Input (LRI) channel. Either method is technically feasible, but there are other considerations which may dictate which of these is the more desirable. The Cross-tell input section has capacity for a total of eleven input channels (not including one spare). If the requirement for the total number

of channels exceeds this count, it would be necessary to consider two possible solutions:

1. appending one or more additional XT channels to the existing XTI input section.
2. installing a complete additional XTI section.

According to the present employment plans, it is probable that the crosstell input section of some SAGE direction centers would be over subscribed.

The problem of oversubscription does not exist in the LRI element. The BDL data could be introduced through this element. However, one feature of the extended BDL, namely the ability to track through ECM may be lost. Jammed search radars may saturate the LRI drum, decreasing the probability of storage and causing much BDL data to be lost. The use of the LRI channel should be avoided for this reason if the counter ECM feature is to be retained. If a decision is made to enter through the LRI, it will not be necessary to design new equipment for the AN/FSQ-7. Approximately 12 pluggable units per channel would be required. The use of the LRI channel should also afford major simplification of the proposed 750/1300 converter since the LRI does not use an interleaved format.

Regardless of the means used to enter the AN/FSQ-7, the additional data would have the same impact on the program. If the data is to be used for display purposes only (no tracking), the design of the new program involved would require some 225 man hours and the resulting program is expected to contain 500 instructions. It would increase the machine frame time by 0.14 seconds. If the SAGE computer is to track targets from the data provided by the BDL, an additional 150 man hours of program design time and 50 more instructions would be required. Frame time increase would be insignificant (in the order of 0.01 seconds).

Of the four operational uses previously described, the following can be accomplished by this method:

1. Verification. (It would not be possible to verify specific target to battery assignments due to the absence of battery address. It would only be possible to determine whether targets being tracked had been assigned to batteries generally).
2. Detection.
3. Tracking. (This could be accomplished at the expense of additional program and program cycle time as noted in Chart #14.)
4. Coordination between JMDC and SAGE. (For this use, only Missile Master Battery information would be provided. It would be necessary to provide other communications for crosstell concerning other weapons).

Extended BDL Circuit - Automatic Input To SAGE See Chart #10

As described in Method I, the equipment which would be required to send the BDL information to the SAGE DC consists of an additional line amplifier at the Master Synchronizer in the AACC similar to the type which is used to crosstell BDL data between adjacent AACC's.

At the SAGE DC the information would enter a piece of equipment similar to a modified TSQ-8. With this method the form of the information from the BDL will be similar to that in Method I in the sense that it will be digital, will be received at the input to the AN/FSQ-7 computer on three lines (sync, data and timing) and will be 750 bits per second. The TSQ-8 would be modified to provide a digital output in place of the normal analog output. Additional circuitry could provide the proper waveforms and formats at 750 bps for SAGE Input. The incoming message will have no parity, nor will it be interleaved. Unless modifications are made to the particular channel used, the data from the modified AN/TSQ-8 receiver would be discarded because of the parity. It follows that, regardless of the type of input channel used (LRI or XTI) some action must be taken in the logic to disable the parity checking circuitry.

The factors which influence the choice of input type were discussed under Method I. They are essentially the weighing of crosstell oversubscription against the loss of counter ECM capability.

It was stated that the incoming message will <u>not</u> be interleaved. This of course presents no problem if the data is introduced through the LRI element, except for parity. However an interleaving problem, is presented if the XT element is used.

The XT input channel is designed to receive a message which is interleaved and present an uninterleaved message to the XT buffer drum. There are two approaches to the solution of this problem:

1. Change the equipment logic.
2. Let the program reassemble the message.

A modification of the input channel equipment to accept a word which is not interleaved and place it on the XT drum field without scattering the bits would require a modification of about 70% of the channel equipment. Here again a two year lead time would be required at an expense shown in Chart #14.

If the message rearrangement is to be done by the program, it will require approximately 10 instructions for each bit to be processed. This would add about 1.6 seconds or 9.15% to the frame time for <u>each</u> BDL extension to

be processed. Additional program time, above and beyond rearranging, for displays only or for displays plus tracking are of the same order of magnitude as for Method I. Furthermore, if the spare channel were inadvertently switched into this circuit it might cause serious difficulty. If, however, the channel equipment were not physically modified, an increase of almost 100% in the program time would be necessary for each such type input added.

Of the four operational uses previously described, the following can be accomplished by this method:

1. Verification. (It would not be possible to verify specific target to battery assignments due to the absence of battery address. It would only be possible to determine whether targets being tracked had been assigned to batteries generally).
2. Detection.
3. Tracking. (This could be accomplished at the expense of additional program and program cycle time as noted in Chart #14).
4. Coordination between JMDC and SAGE. (For this use, only Missile Master Battery information would be provided. It would be necessary to provide other communications for crosstell concerning other weapons).

METHOD III SUPPORTING DOCUMENT NO. 23

Extended BDL Circuit - Automatic Input to SAGE Chart #11

Method III would require equipment at the AACC similar to that described for Methods I and II. That is, an additional line amplifier would be required at the Master Synchronizer similar to the type which is used to crosstell BDL data between adjacent AACC's.

As indicated in Chart #11 Method III would require the design of a Digital Data Receiver similar to the one used on the Bell "A-1" Data Service, but which would operate at a data rate of 750 bits per second. It would deliver three lines, sync, data and timing to the AN/FSQ-7 input at the 750 bps rate. For this method it is proposed that a new input section be designed. The new section would be similar to the LRI input in that the incoming format would not be interleaved. The description of Method I discusses briefly the impact of adding an additional frame to the peripheral equipment in the AN/FSQ-7 computer. The time required to implement this new type input will be in excess of two years. Because of data rate and format, this new input would be uniquely a BDL input, and in view of the small number of these channels actually contemplated, the design of such a section would not be economical.

An additional complication arises from the fact that the AN/FSQ-7 computer has no provision to generate test messages for a 750 bit per second input.

If a separate input were designed, the program would be exactly as in Method I. This would require 225 man hours and 150 instructions and a frame time of 0.14 seconds for display and 150 man hours design time and 50 instructions in addition to this if tracking is desired. If however program reassembly of a scattered message is involved, the original frame time would be increased by some 10%.

Of the four operational uses previously described, the following can be accomplished by this method:

1. Verification. (It would not be possible to verify specific target to battery assignments due to the absence of battery address. It would only be possible to determine whether targets being tracked had been assigned to batteries generally).

2. Detection.

3. Tracking. (This could be accomplished at the expense of additional program and program cycle time as noted in Chart #14.)

4. Coordination between JMDC and SAGE. (For this use, only Missile Master Battery information would be provided. It would be necessary to provide other communications for crosstell concerning other weapons).

METHOD IV | SUPPORTING DOCUMENT NO. 23

BDL - Separate Display See Chart #12

Method IV would require the same type of line amplifier at the Master Synchronizer in the AACC as described for Methods I, II and III.

This proposal would place an AN/TSQ-8 receiver at the SAGE end of the BDL extension and would then display the BDL data independently on a unique console which bears no relation to SAGE other than the proximity thereto. Under these circumstances, there would be no impact on either the AN/FSQ-7 equipment or the program. The method would, however, have relatively limited capability, since it would be extremely difficult, if not impossible to correlate this display data with SAGE data. In addition to this, tracking would not be possible.

A modification to this proposal is to provide SAGE track information to this new console from the Display drums in the AN/FSQ-7 computer. This would permit correlation of data but still would not provide for battery target tracking at SAGE. It is estimated that very little difficulty would be encountered in providing this information to the new console, but that some relatively serious problems may be encountered at the console itself because of the extreme differences in data presentation:

SAGE	BDL extension
series input	parallel or broadside input
60 microsec. between targets	100 millisec. between targets

The control unit for this display would require two different types of decoders and a priority mechanism to guarantee that all data is displayed.

This method is limited to the following operational uses:

1. Verification. (Only general verification can be accomplished as described for previous methods if both SAGE and battery tracks can be shown on the same console).

2. Coordination between JMDC and SAGE. (As in previous methods, only Missile Master Battery information is presented).

SUPPORTING DOCUMENT NO. 23

METHOD V

BDL Data Via Presently Planned Status Circuit See Chart #13

Description of AACC Implementation

This method involves the use of the existing 1300 bit per second data link from the AACC to SAGE. As presently planned this data link to SAGE transmits battery status data derived from battery stores at the AACC. It is proposed to expand this message to include the Battery Data Link - X, Y, h target coordinates.

In this connection, several problems arise regarding data rate. At present, status data is sent only when a change occurs or there is a specific request for data. With the addition of BDL position data to the message, it would appear mandatory that data be sent periodically. The BDL data rate, which is 2.5 seconds, is required to be rapid because the information is generally used for "on the fly" display without intermediate storage. However, this data rate would appear redundant at the FSQ-7 where the input random access storage drum would tend to be overloaded. Although this requires detailed study, it appears that a reasonable solution exists.

One possible solution would be the transmission of every fourth or fifth BDL train to SAGE in addition to transmission of battery status whenever a change occurs.

The modified ADDC Data encoder would then function in the following manner:

(a) Transmission of channel and status information as in the present system.
(b) Interruption of (a) to transmit BDL position data with associated battery address for each tracking or firing battery.
(c) Transmission for (b) would occur only every 4th or 5th BDL cycle.

The programmer in the present ADDC Data Encoder would be modified to permit BDL position data with battery address to be transmitted in 3 spare words of the present AN/FSG-1 to AN/FSQ-7 message. BDL data in digital form would be obtained from the BDL receiver and stored in a BDL buffer storage which must be added to the ADDC Data Encoder. A battery address number in binary form could be derived from the programmer of the master synchronizer. Whenever a battery is tracking or firing, the programmer would interrupt the normal interrogation of the channel and battery status stores to permit the transmission of BDL position data. The shift register of the encoder must be expanded to accomodate the additional words to be encoded. By using every 4th or 5th BDL train to transmit position data, ample time would remain to transmit changes in channel and battery statuses. On the basis of preliminary estimates the additional equipment resulting from these changes would amount to about two racks.

Affect on SAGE

The data would thus arrive at the AN/FSQ-7 input either in the same sync frame as a status message (space is available) or under an independent, separate frame. In either case, the message would be received at 1300 bits per second, from a standard Bell DDR, with proper parity bits and with an acceptable address bit (all generated by the AN/FSG-1 "ADDC Data Encoder". With this method, the identity of the tracking battery could be transmitted with the target data.

Method V would require no equipment at the SAGE Direction Center which is not already provided for in present employment plans. The impact on the program would be approximately the same as for any of the earlier methods which do not require reassembly of scattered words by the program, i.e., undoing the scattering caused by introducing non-interleaved data to a crosstell channel. Thus, the program would require some 225 man hours of design time and 500 instructions for display only, increasing the frame time by 0.14 seconds. An additional 150 man hours of design time and 50 instructions would be required if tracking is specified, at an additional cost of 0.01 seconds of frame time.

It might be stated that neither the PDL extension nor the Status line is alone capable of efficiently utilizing a crosstell input channel. The channel can easily handle both types of data without difficulty.

This method would provide all the features available in any of the other methods proposed, in addition to providing a capability for verification of specific SAGE battery assignments (because of availability of battery identity information).

This method appears to be the most desirable for the AN/FSQ-7 computer, but it is realized that the impact on the ADDC Data Encoder at the JMDC would be severe.

All four of the operational uses can be accomplished with this method as described in Part IV.

SUPPORTING DOCUMENT NO. 23

PART VI

Conclusions

I. Operational Uses

A. Verification of SAGE Assignments of Targets to Batteries

This is the function of advising the SAGE DC that the battery has selected the specific target assigned and has taken the action indicated. This function is presently accomplished by providing the DC (via the Missile Master status circuit) the information pertaining to the action that has been taken by the batteries. In the present system it is assumed that the battery commander has selected the designated target and there is no confirmation by referencing to the coordinates of the target. The Missile Master system itself has provisions for verifying that the battery has in fact selected the specific target assigned to it.

If the PDL information is provided at the SAGE DC the X, Y, h, coordinates will probably be useful only in detecting gross errors made at the battery in the selection and engagement of the specific targets assigned. It is felt that gross errors of this type would be extremely unlikely to occur since they would be as easily detected at the battery or Missile Master as at the SAGE DC.

The gain to the Air Defense effort to be obtained by this type of verification is considered to be insignificant.

B. Detection

The use of the Nike tracking radar for the purpose of generating target position data does not appear to provide an effective method of detecting targets. It is not possible for the battery to know which of the targets appearing on the aquisition radar have not been detected by the SAGE System radars. The battery does not have knowledge of all the tracks being carried by SAGE. In addition, the only method of obtaining target altitude at the battery is by using the target tracking radar. Since in this case, altitude is a criteria for detecting targets, this would preclude using the tracking radar for any purpose other than detection (e.g. engagement).

C. Supplementary Tracking for SAGE

The battery tracking radar provides position data (X, Y and h coordinates) which could prove useful for SAGE tracking purposes in certain instances. The primary use of this data would be under ECM conditions. The capability of the battery tracking radar may enable it to provide position information which is denied to SAGE surveillance radars.

If accomplished effectively this would increase the Air Defense capability under ECM conditions.

D. Coordination Between JMDC and SAGE
In the situation where a portion of the Air Defense function is assigned to a JMDC, coordination with adjacent SAGE areas is required. Centralized control to the maximum extent practicable is a prime operational objective of the CONAD System. It is assumed that to have this control the complete knowledge of specific weapon engagements is required. It is then necessary, under the above condition of operation, for the SAGE DC to know not only status information but also target position coordinates. The BDL could be used to satisfy part of this function (i.e. provide status of targets engaged by Nike batteries as well as battery to target pairings).

II. Methods

The five methods described above can be divided into two basic groups. In Group I, Methods I, II, III and IV represent a literal extension of the BDL. Within this group Methods I, II, III utilize this information by insertion into the AN/FSQ-7. Method IV by passes the AN/FSQ-7 by means of equipment designed to display the BDL data only.

In Group II, Method V consists of a modification to the presently planned status reporting system to include the BDL position information.

Methods I, II and III are functionally identical. The differences are in the hardware and programming involved. Method I appears to be considerably more expensive than Methods II and III. All three of these require the assignment of an additional input channel and in some cases this may require the addition of a second input section in the AN/FSQ-7. The probability that these methods would make a contribution to the Air Defense effort appears small. At any rate they provide only a limited gain in the Air Defense capability and therefore do not justify the costs. Method IV does not provide a facility for improving the Air Defense capability.

Method V is the most expensive of the methods considered. However, it offers the greatest potential improvement for Air Defense capability. It permits maximum operational use of the BDL information.

Recommendations

It is technically feasible to extend the Battery Data Link to the SAGE DC. In this study various methods were considered as well as possible operational uses. Of the operational uses, those concerning supplementary tracking and coordination between the JMDC and SAGE appear to have the most merit. Of the methods, V seems to offer the maximum use although at the greatest cost.

In order to keep the scope of this study and report within bounds, the study group has considered only the BDL and therefore only the AA portion of the JMDC function. However, early in the investigation of this problem it became apparent that under those conditions of operation where it appears useful to send BDL information to the SAGE DC, there may be similar requirements for data from the augmented Manual Direction Center portion of the JMDC.

The study group believes that the possible requirements for data from the other portion of the JMDC is part of the same problem and recommends that it be considered as such before any decision is made to implement any of the methods discussed herein.

It is further recommended that a joint group be established to resolve problems associated with SAGE/Missile Master integration throughout the implementation period.

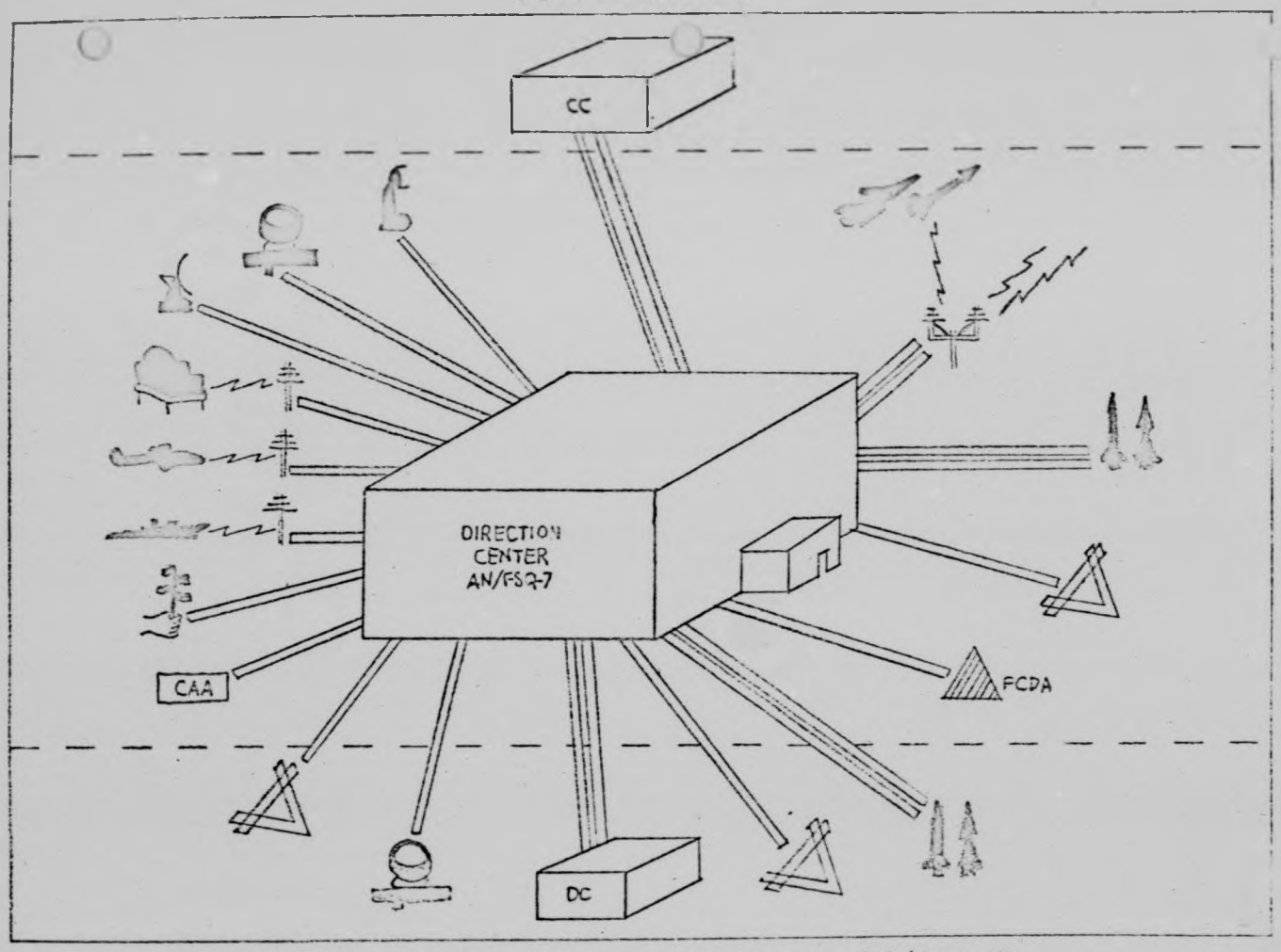


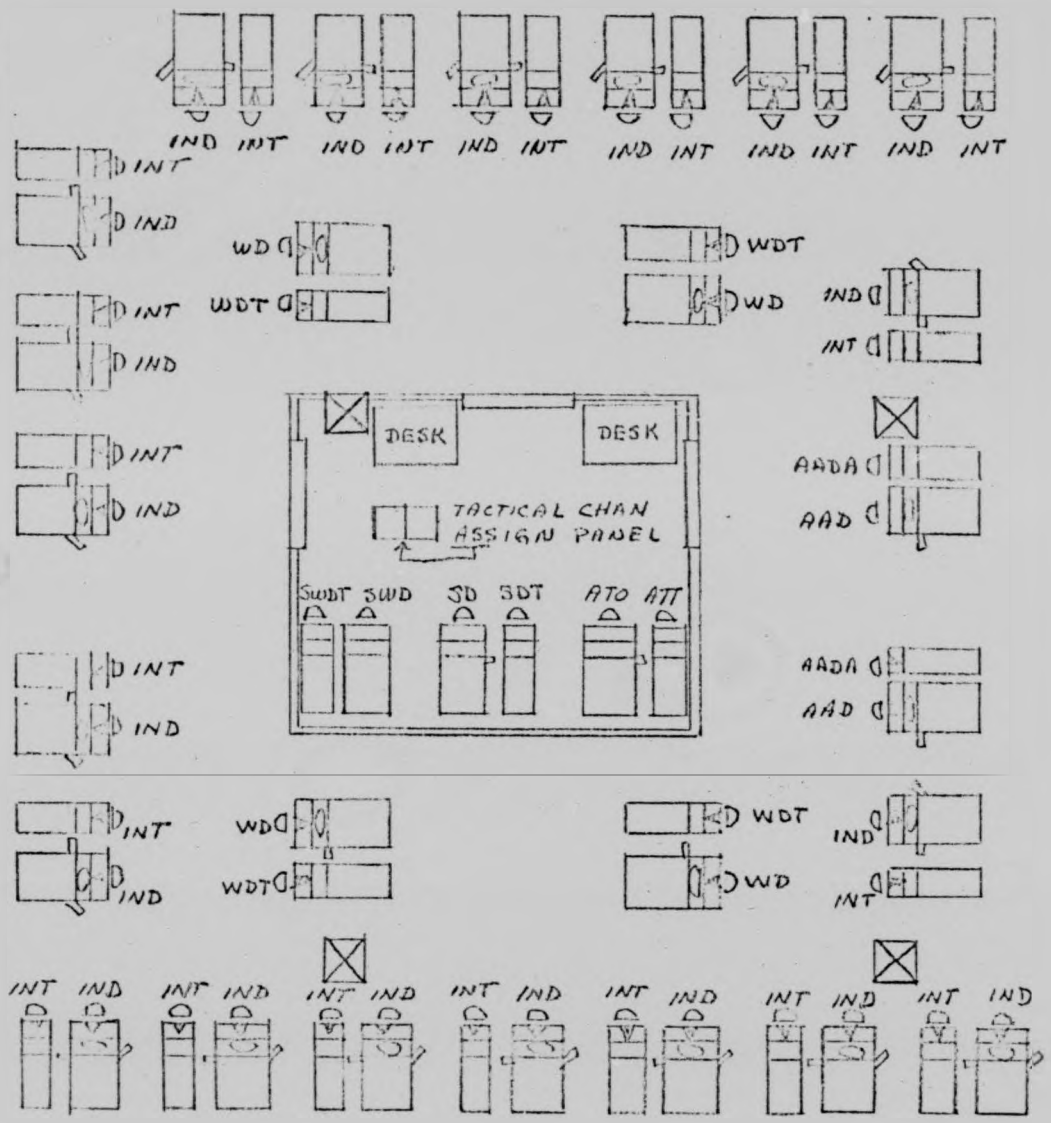
CHART 1 DIRECTION CENTER, AN/FSQ-7

SUPPORTING DOCUMENT NO. 23

CONFIDENTIAL

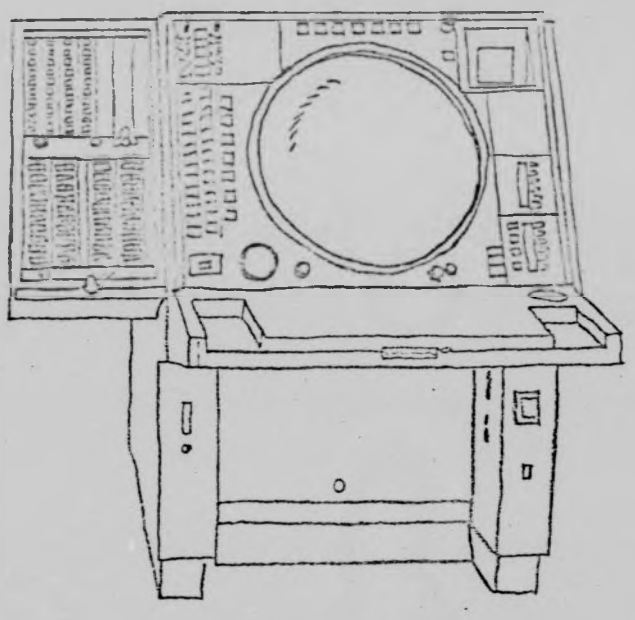
(WALL)

SUPPORTING DOCUMENT NO. 23

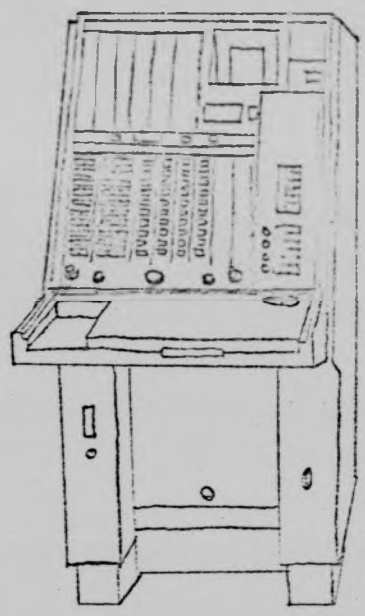


(WALL)

CHART #2 WEAPONS DIRECTION ROOM (SAGE DC)



SITUATION CONSOLE



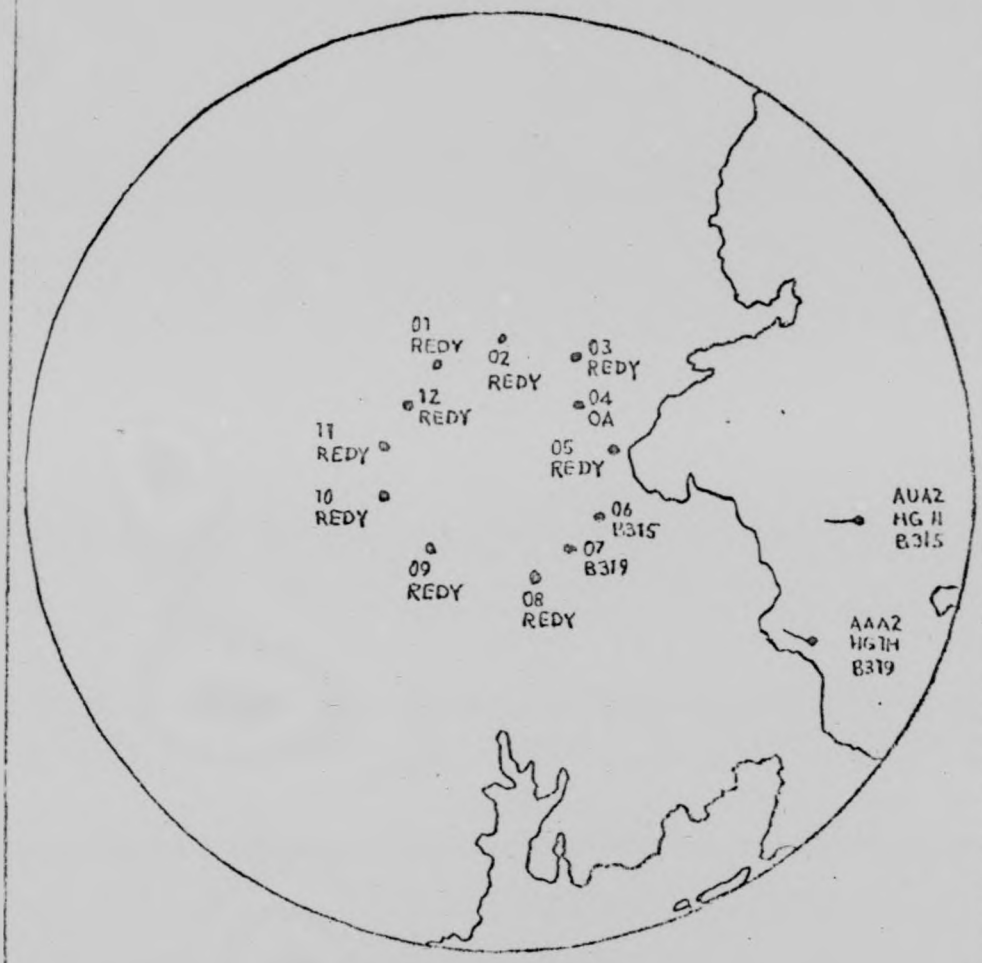
AUXILIARY CONSOLE

SUPPORTING DOCUMENT NO. 23

CHART 3 SITUATION AND AUXILIARY CONSOLES

CONFIDENTIAL

SUPPORTING DOCUMENT NO. 23



SCHEMATIC NIKE DEPLOYMENT

CHART #4, AA DIRECTOR'S SITUATION DISPLAY

CONFIDENTIAL

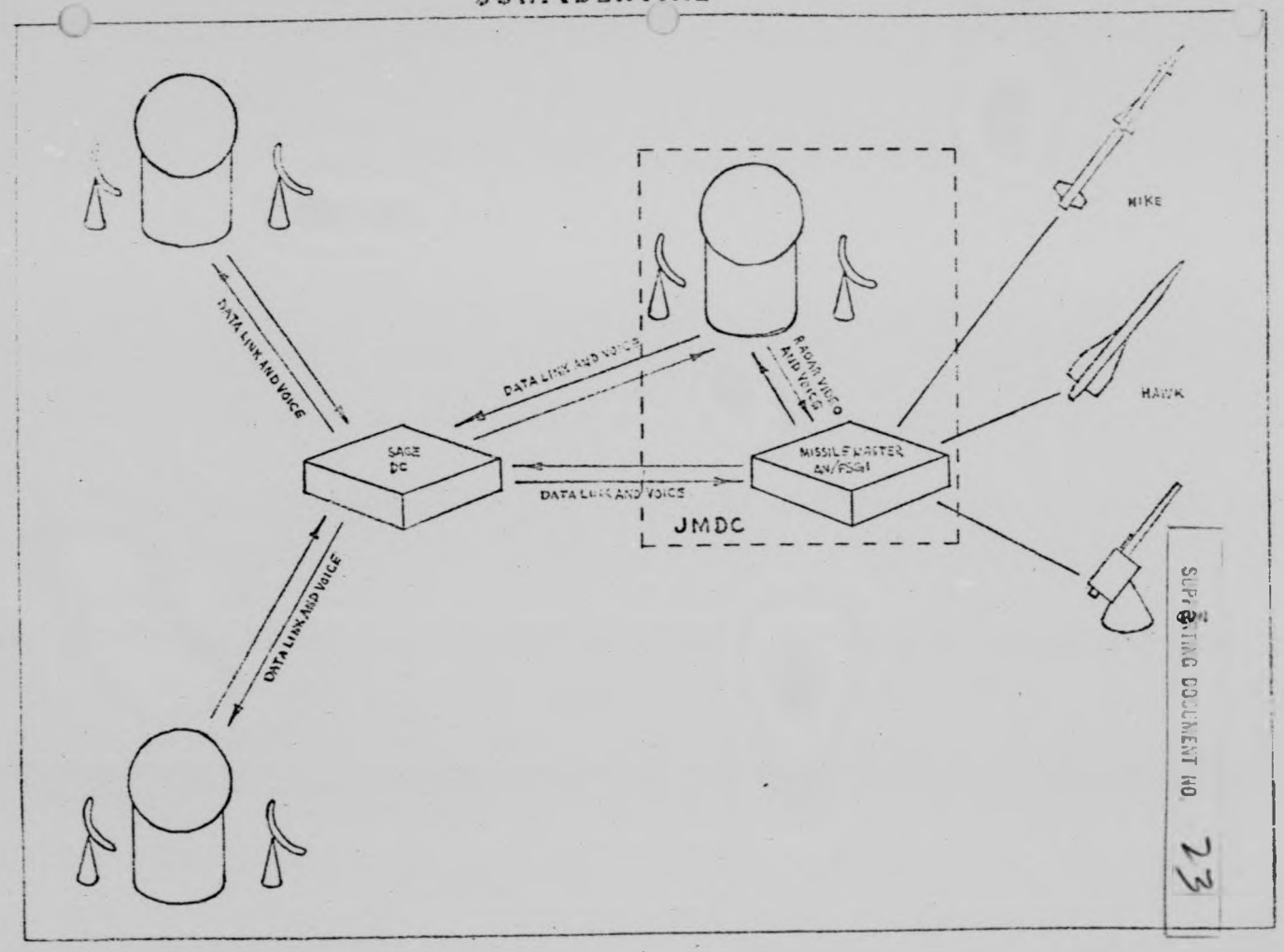
CONFIDENTIAL

SUPPORTING DOCUMENT NO 23

H	B319	A	B07
	G	O	REDY
A	4351	R	ATM
F	01	C	OPER
S	515	L	02
B	A2	E	B315
I	0000	M	36
N	0200	A	05
B	0000	F	11
T	0000	K	05
C	21		
f	B07		
	A21		

CHART 5 AA DIRECTOR'S DIGITAL DISPLAY

CONFIDENTIAL



SUPPORTING DOCUMENT NO. 23

CHART 6 SAGE/AA WEAPONS SYSTEM

CONFIDENTIAL

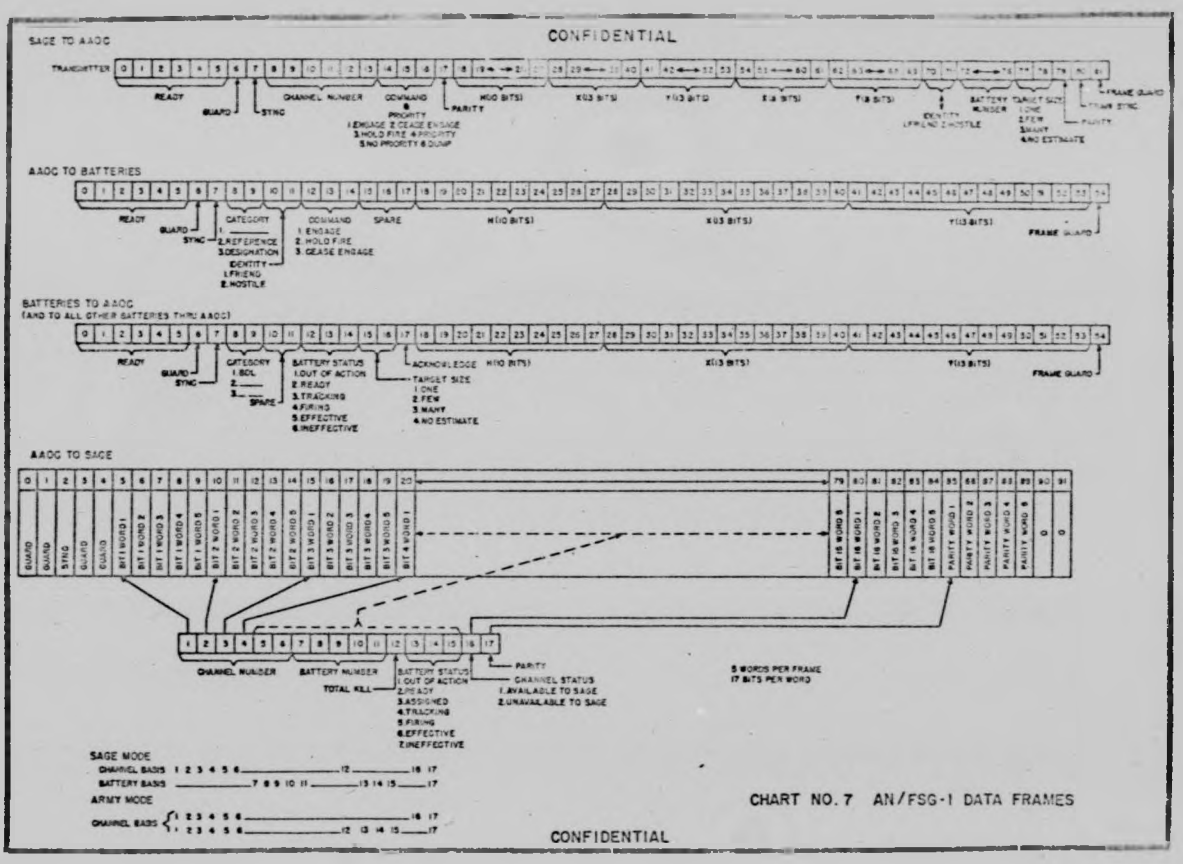


CHART NO. 7 AN/FSG-1 DATA FRAMES

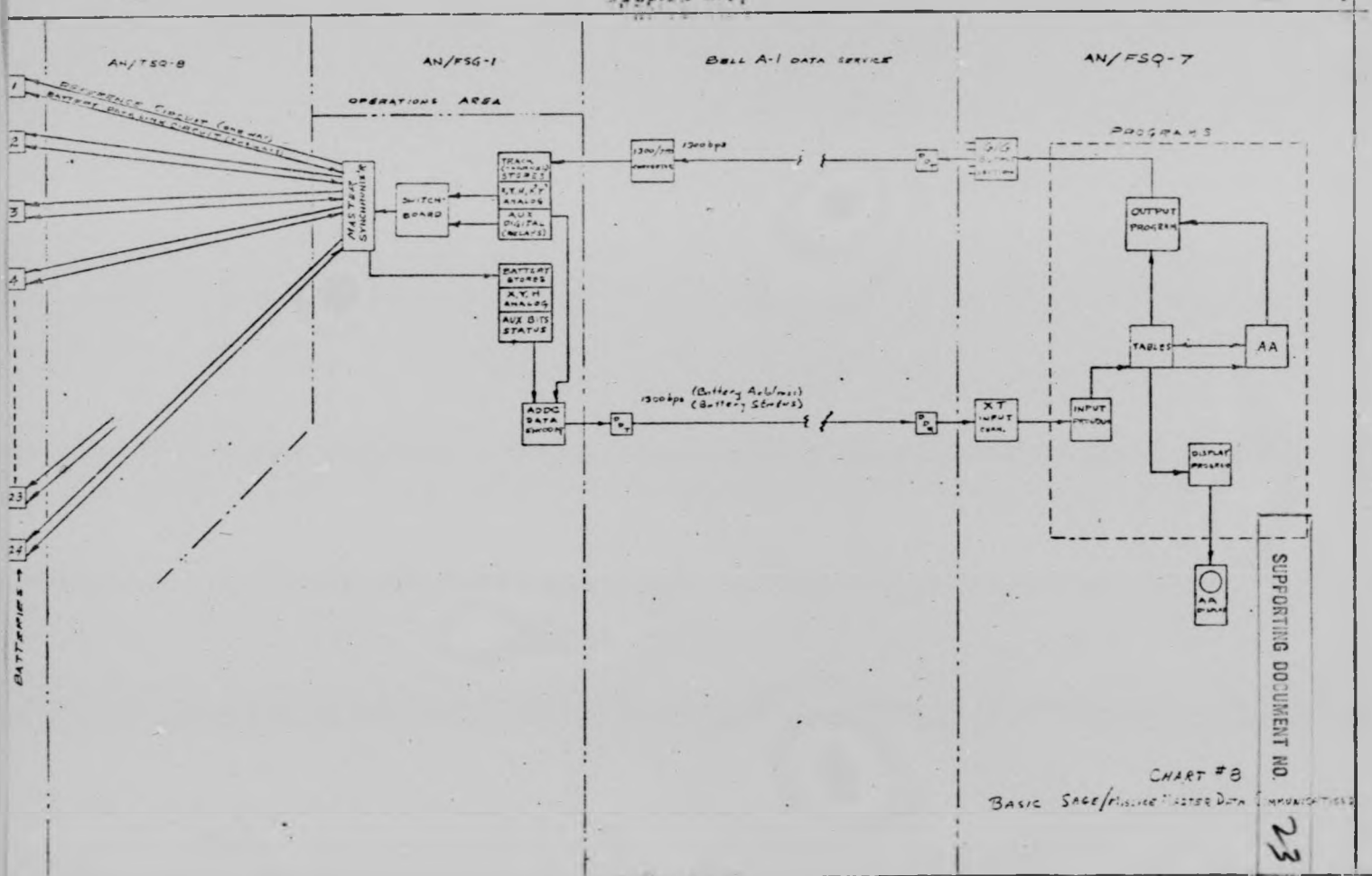
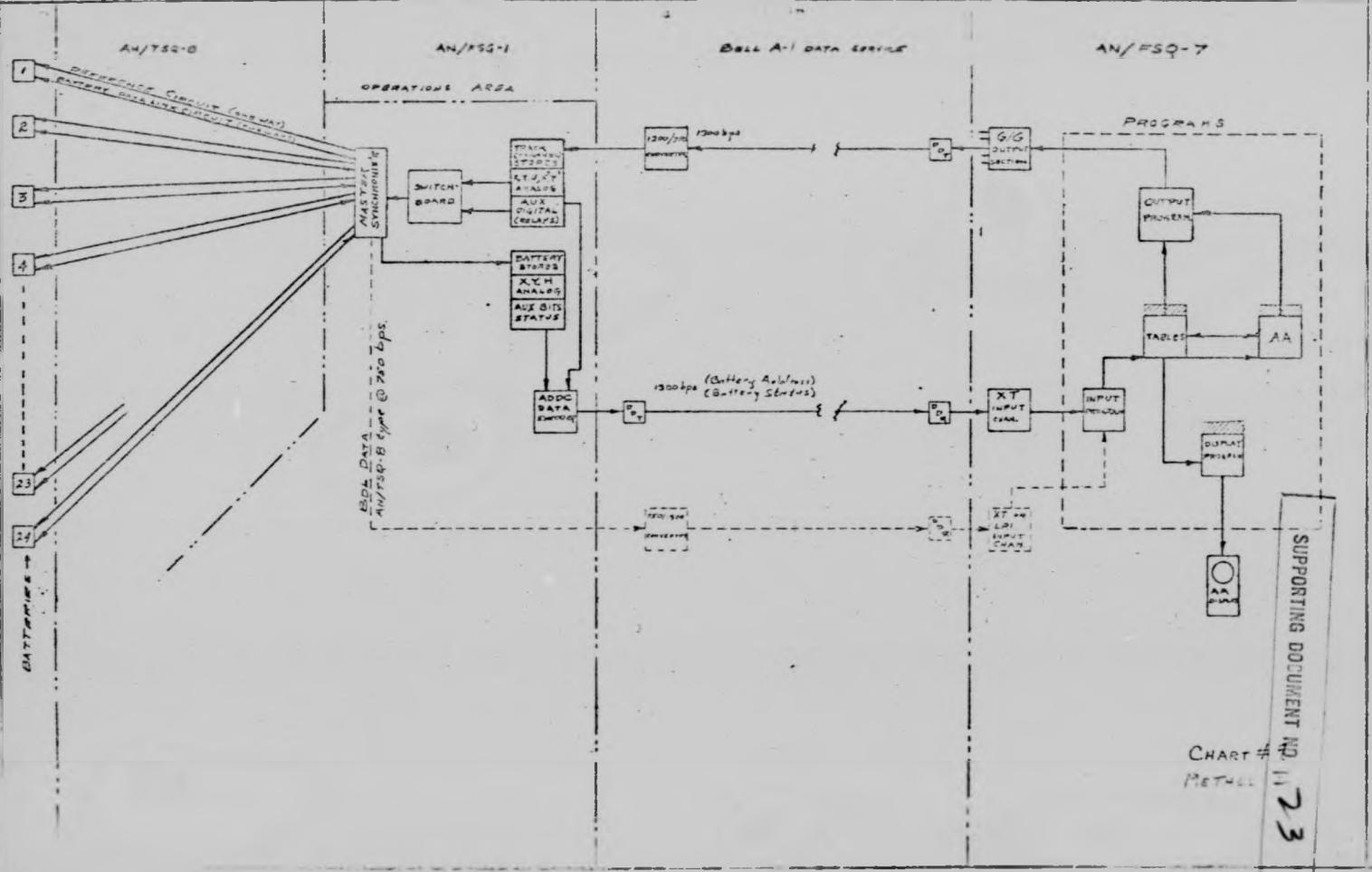


CHART #8

BASIC SAGE/Nike Master Data Communications

SUPPORTING DOCUMENT NO. 23

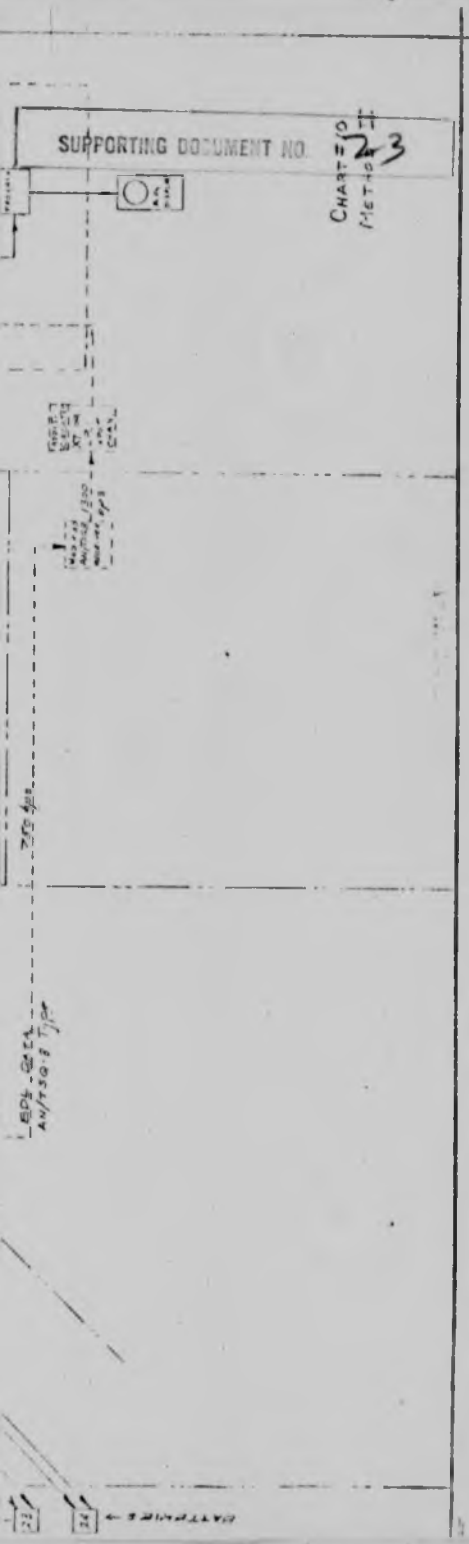


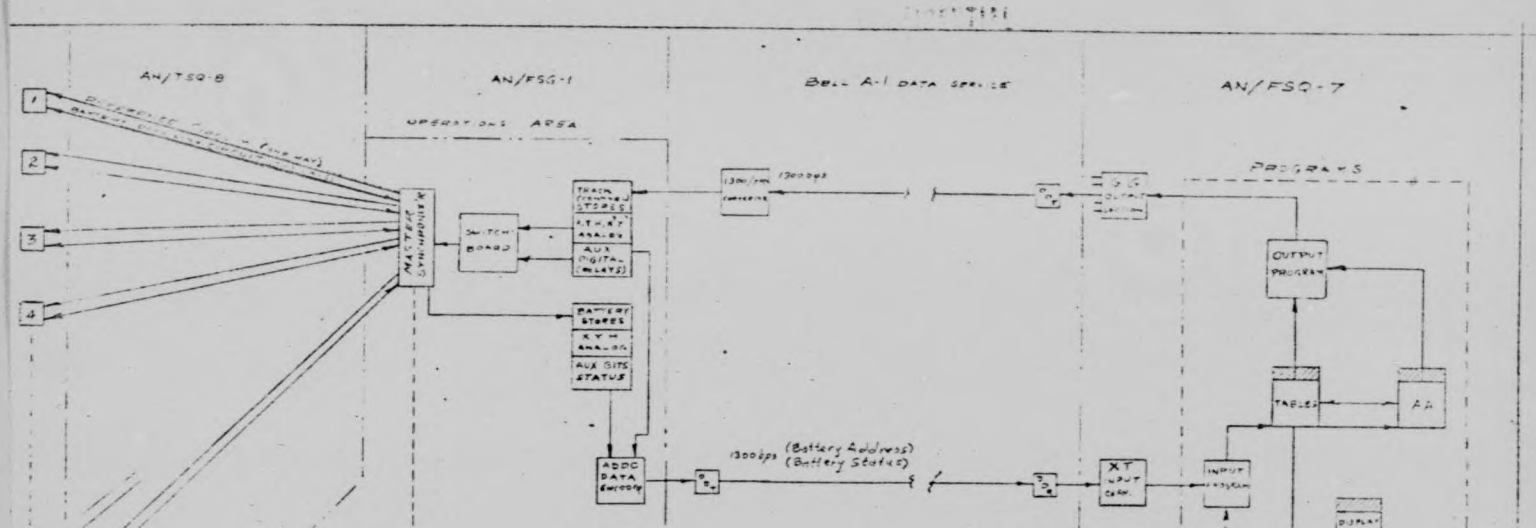
SUPPORTING DOCUMENT NO. 173

CHART # 4
METHL

SUPPORTING DOCUMENT NO. 23

CHART #10
METHOD #1




AN/TSQ-8
AN/FSQ-1
BELL A-1 DATA SERVICE
AN/FSQ-7
OPERATIONS AREA
PROGRAMS
1
2
3
4
MASTER SYNCHRONIZER
SWITCH BOARD
TRACK (CONVERTED) STORES
X Y H Y' ANALOG
AUX (DIGITAL RELAYS)
BATTERY STORES
X Y H ANALOG
AUX SITE STATUS
ADDC DATA ENCODER
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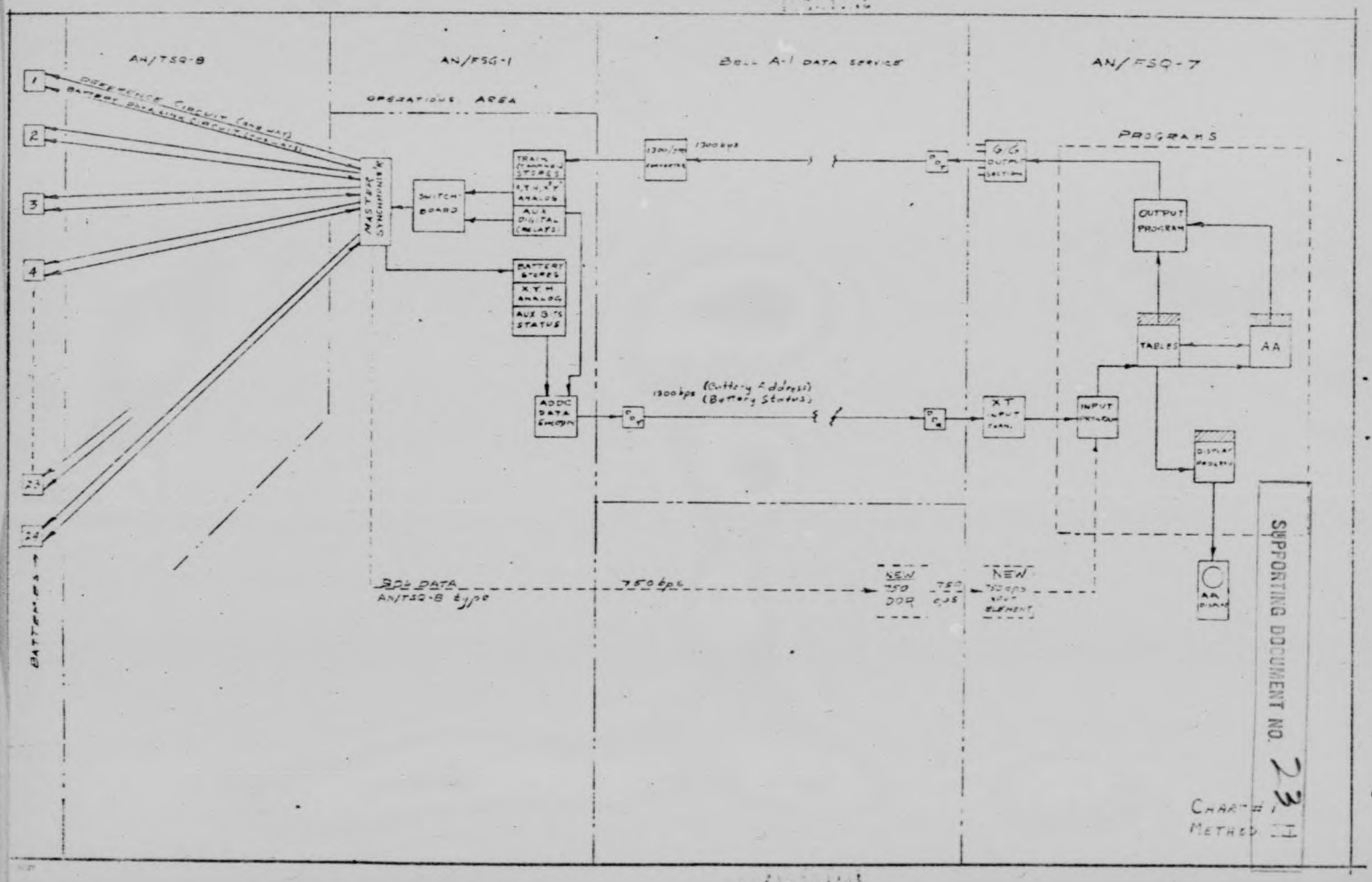
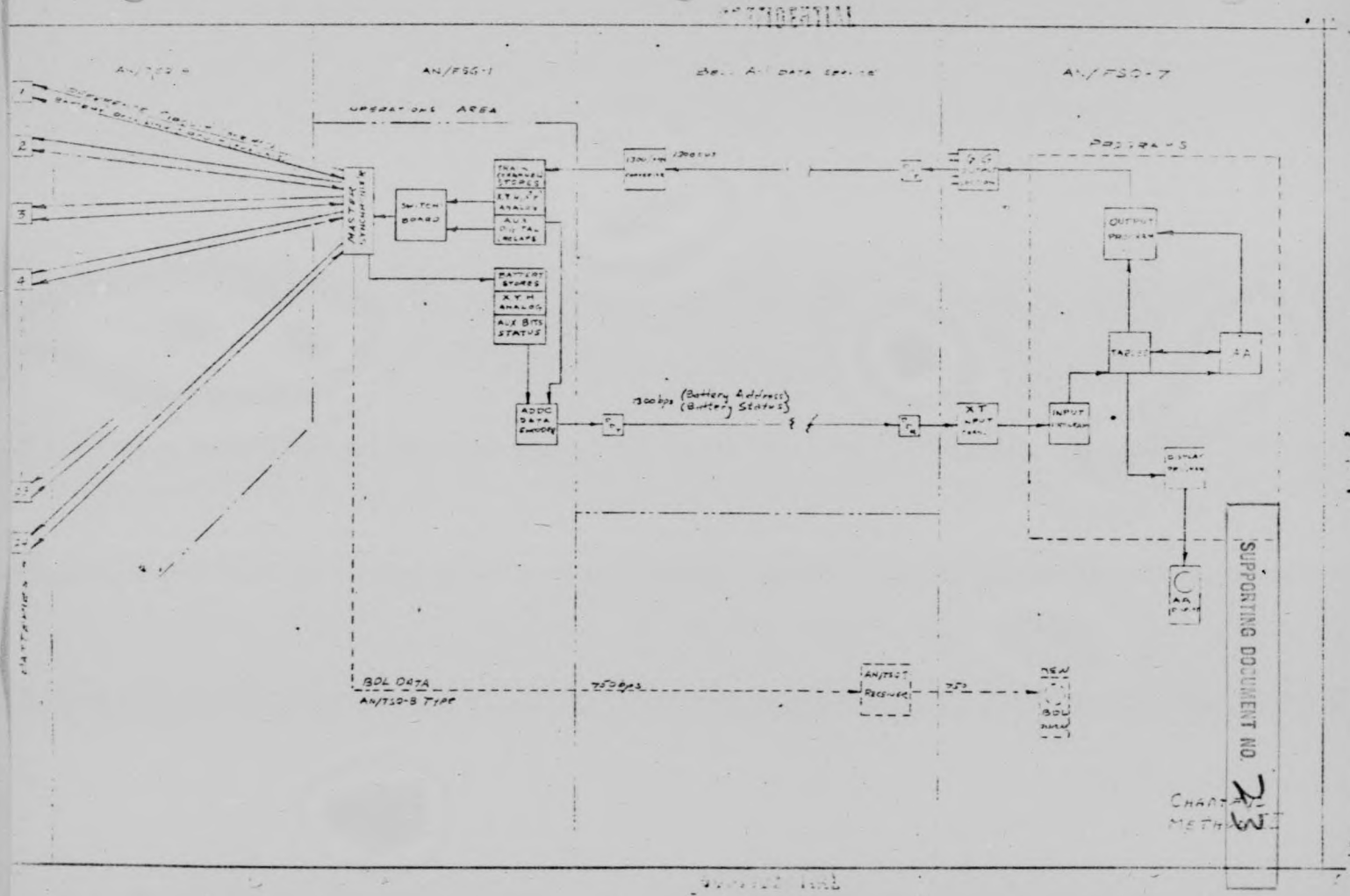
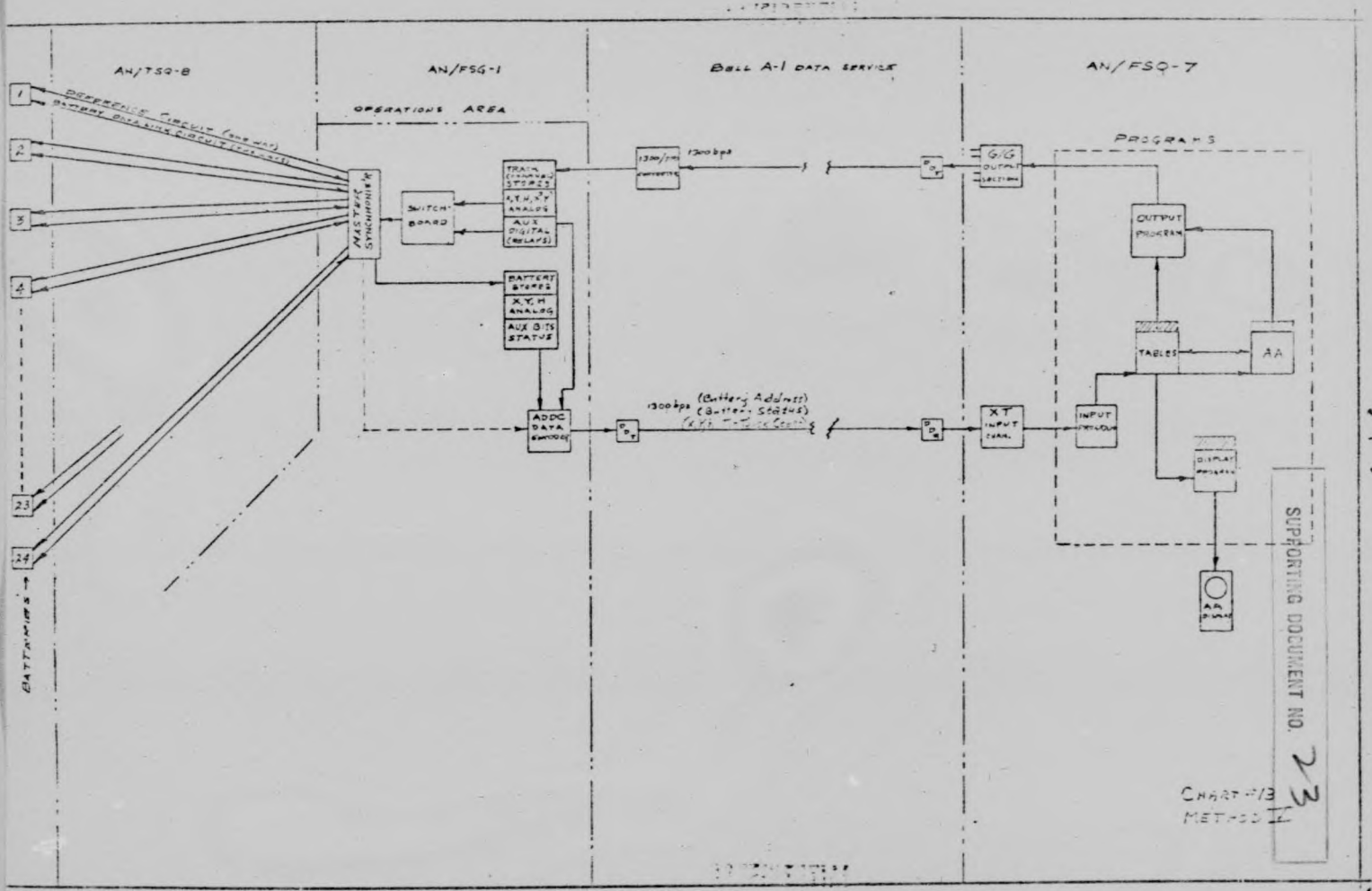
1300 bps
1300 bps (Battery Address) (Battery Status)
XT INPUT CONV
INPUT PROGRAM
OUTPUT PROGRAM
TABLES
AA


AN/TSQ-8
AN/FSQ-1
BELL A-1 DATA SERVICE
AN/FSQ-7
OPERATIONS AREA
PROGRAMS
1
2
3
4
23
24
BATTERIES
MASTER SYNCHRONIZER
SWITCH BOARD
TRAIN TRACKING STATUS
X.Y.H. ANALOG
AUX DIGITAL (RELAYS)
BATTERY STATUS
X.Y.H. ANALOG
AUX D.T.S. STATUS
ADDC DATA ENCODER
1300 bps
1300 bps (Battery Address) (Battery Status)
G.G. OUTPUT SECTION
OUTPUT PROGRAM
TABLES
AA
X.T. INPUT TERM.
INPUT
DISPLAY PROGRAM
BPS DATA
AN/TSQ-8 type
750 bps
NEW 750 DDR
750 CDS
NEW
SUPPORTING DOCUMENT NO. 23
CHART # 1
METHOD II




AN/TSQ-8
AN/FSG-1
Bell A-1 DATA SERVICE
AN/FSQ-7
OPERATIONS AREA
PROGRAMS
MASTER SYNCHRONIZER
SWITCH-BOARD
AUX DIGITAL (RELAYS)
BATTERY STORES
X,Y,H ANALOG
AUX BITS STATUS
ADPC DATA ENCODER
1300 bps
(Battery Address)
(Battery Status)
G/G OUTPUT SELECTOR
OUTPUT PROGRAM
TABLES
AA
XT INPUT CHANL
INPUT PROGRAM
DISPLAY PROGRAM
BATTERIES
SUPPORTING DOCUMENT NO. 22
CHART #13
METHOD II

CONFIDENTIAL

	METHOD I					METHOD II					METHOD III					METHOD IV					METHOD V				
	MH	T	H (K$)	I	CT	MH	T	H	I	CT	MH	T	H	I	CT	MH	T	H	I	CT	MH	T	H	I	CT
AAOC	200	1.5 MO	DEV 2 PROD 1	—	—	200	1.5 MO	DEV 2 PROD 1	—	—	200	1.5 MO	D-2 P-1	—	—	200	1.5 MO	D-2 P-1	—	—	35K	1.14	D-350 P-75	—	—
COMMUNICATIONS SEE NOTE II	1500	1 YR	DEV 275 PROD 73	—	—	1000	6 MO	D-20 P-83	—	—	1500	1 YR	D-9 P-61.6	—	—	—	—	58	—	—	—	—	—	—	—
SAGE EQUIPMENT																									
INPUT LRI	—	—	—	—	—	(2) 1500	8 MO	DEV 50 P-10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
INPUT OR XTI	— 200		— 4	—	—	— (1) 5000	— 2 YRS	— D-150 P-35	—	—	— 3000	— 2 YRS	— D-50 P-50	—	—	—	—	—	—	—	—	—	—	—	—
DISPLAY	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
M.I.V.	120	1 MO	1	—	—	120	1 MO	1	—	—	120	1 MO	1	—	—	—	—	—	—	—	120	1 MO	1	—	—
PROGRAM: A/A, DISPLAY, INPUT, TABLES	225	1 MO	—	500	.14	(1) DEINTERLEAVING 225	1 MO	—	1300	1.75	225	1 MO	—	500	.14	—	—	—	—	—	225	1 MO	—	500	.14
						(2) NO INTERLEAVING 225	1 MO	—	500	.14															
TRACKING	150	2 MO	—	50	.01	150	2 MO	—	50	.01	150	2 MO	—	50	.01	—	—	—	—	—	150	2 MO	—	50	.01
NEW EQUIPMENT	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1000	8 MO	D-50 P-15	—	—	—	—	—	—	—
TOTALS	2395	1 YR 3.7 MO	295	550	.15	(1) 6695 (2) 3195	2 YR 9.7 MO 17.7 MO	252.6 165.1	1850 550	1.9 .15	2695	2 YRS	165.6	550	.15	1200	9.5 MO	125.1	—	—	35.5 K	1 YR 2.2 MO	426		.15

NOTES:

P — PRODUCTION (PROD)
D — DEVELOPMENT (DEV)
MH — MAN-HOURS
T — TIME
H — HARDWARE (K $)
I — INSTRUCTIONS } COMPUTER PROGRAM
CT — CYCLE TIME (SEC) } COMPUTER PROGRAM
MIV — MANUAL INTERVENTION SWITCHES
K — X 10^3 (THOUSANDS)

NOTE I: ADDED DATA CIRCUIT COSTS INCLUDED UNDER H IN PRODUCTION COSTS & ESTIMATED AT 100 MILES & 10 YEARS.

CHART # 14
SUMMARIZED COSTS

SUPPORTING DOCUMENT NO. 23

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SUPPORTING DOCUMENT NO. 53

OPERATIONAL USES ⟶ / METHODS ↓	VERIFICATION T-3 ASSIGNMENTS	DETECTION	SUPPLEMENTARY TRACKING	COORDINATION BETWEEN JMDC AND SAGE
I	NO SPECIFIC VERICATION – POSSIBLY GENERAL INDICATIONS	YES AT COST OF INCREASED MANUAL OPERATIONS	YES ADDITIONAL PROGRAM COST,	LIMITED AAOC INFORMATION ONLY
II	NO SPECIFIC VERICATION – POSSIBLY GENERAL INDICATIONS	YES AT COST OF INCREASED MANUAL OPERATIONS	YES ADDITIONAL PROGRAM COST	LIMITED AAOC INFORMATION ONLY
III	NO SPECIFIC VERICATION – POSSIBLY GENERAL INDICATIONS	YES AT COST OF INCREASED MANUAL OPERATIONS	YES ADDITIONAL PROGRAM COST	LIMITED AAOC INFORMATION ONLY
IV	NO	NO	NO	NO
V	YES	YES	YES ADDITIONAL PROGRAM COST	YES AAOC INFORMATION ONLY

CONFIDENTIAL

CZ-19687

CHART # 15

OPERATIONAL USES VS METHODS

SECRET

OPS
F-19
2-2-7

SUPPORTING DOCUMENT NO. 24

COORD	REC	Write Last Name and Show Date Coordinated
COMOR		
VC		
CONFS		
ADJ		
	1	ADORO-D
	2	ADORO-D
	3	ADORO-D
	4	ADSCG-IP
	5	ADORO

ADORO-D

OCT 21 1957

SUBJECT: SAGE/AADCP Intercommunications

TO: Commanding General
U.S. Army Air Defense Command
Ent Air Force Base
Colorado Springs, Colorado

1. Reference is made to Army Air Defense Command teletype message 494 ADOAA-3 P&O which requested plans and schedules for installation of SAGE/AADCP intercommunication circuits.

2. Intercommunication installation schedules for those SAGE sectors to become operational through calendar year 1960 are provided in the inclosure hereto. The following comments apply to the inclosure:

a. The intent is that all AADCP's within a sector will be integrated with the corresponding SAGE direction center. Confirmation is requested that the AADCP locations listed in PART I of the inclosure are correct and that all existing or planned manual AADCP's within the listed sectors have been included.

b. The installation plans include provisions for two (2) voice circuits and one (1) teletype circuit between each manual AADCP and the corresponding direction center. The voice circuits are double routed.

c. Testing and training as necessary will be conducted during the six-to-ten month period between the operational date for the intercommunication circuit and the sector operational date.

3. Intercommunication between FSC-1 installations and the corresponding SAGE direction centers will include four data circuits in addition to the manual

This correspondence is classified SECRET per para 30.b., AFR 205-1, or for reason(s) stated.

WRITER (and typist's initials)	OFFICE CODE:	DATE:	TEL NO:	FANFOLD NUMBER AND SUSPENSE DATE:
Captain Donald O. Robb/d	ADORO-D	9-11-15 Oct 2930/2		

DC HQ FORM 18 MAR 57 11 PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE

MEMO FOR RECORD: NONE SEE REVERSE

SUPPORTING DOCUMENT NO. 24

ADORQ-D, SUBJECT: SAGE/AADCP Intercommunications

AADCP requirements. The schedule for intercommunication installation for the first ESG-1 site is shown as PART II of the inclosure.

FOR THE COMMANDER:

1 Incl
DC/AADCP Schedule,
2 cys.

HAROLD W. GRANT
Major General, USAF
Deputy for Operations

SUPPORTING DOCUMENT NO. 34

OPS S-19

SECRET

DIRECTION CENTER/AADCP INTERCOMMUNICATIONS
INSTALLATION SCHEDULE

PART I -- MANUAL AADCP LOCATIONS

Air Defense Sector	Oper Date	Manual AADCP Locations	Circuit Oper Dates 1 Voice & 1 Tele	1 Voice (Tentative)
New York	1 Jul 58			
		Ft Wadsworth, N.Y.	1 Oct 57	1958
		Swarthmore, Pa.	1 Oct 57	1958
Boston	15 Sep 58			
		Ft Banks, Mass.	15 Feb 58	1958
		New Britain, Conn.	15 Feb 58	1958
		Albany-Troy Area, N.Y. (tentative location)	1960	1960
Syracuse	1 Jan 59			
		Ft. Niagara, N.Y.	25 Jul 58	1 Jan 59
		Rochester, N.Y.	1960	1960

SECRET

CONFIDENTIAL

SUPPORTING DOCUMENT NO. 24

[illegible]
[illegible]
[illegible] CCIC

[illegible] CCIC (CCCMFER)

INFO: DCSOPSDA WASHDC

[illegible] WASHDC

CSLOGDA WASHDC

[illegible] C ET CITCC VA

[illegible] CCIC (CCCMFER)

[illegible] EMERGENCY FRELIMINARY

[illegible] FINDS, TEX

[illegible] ABCOA-3 [illegible]

1. This headquarters is in receipt of information which indicates that a voice/teletype circuit is to be installed between the Shortwave, Pa., ADOC, and McGuire AFB, Sage Direction Center, by 1 October 1957.

2. It is requested that you confirm this information and in addition apprise this headquarters of plans and schedules for similar installations of equipment. Information as to anticipated test schedules, operational dates, and other allied matters would be appreciated.

ABCOA-3 [illegible]

E. I. [illegible], Colonel/cu

2134 1 1

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SUPPORTING DOCUMENT NO. 24

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Air Defense Sector	Oper Date	Manual AADCP Locations	Circuit Oper Dates 1 Voice & 1 Tele	1 Voice (Tentative)
Washington	1 Feb 59			
		Norfolk, Va.	15 Aug 59	----
Bangor	1 Mar 59			
		Loring AFB, Me.	*	
		Dow AFB, Me.	*	
** Detroit	1 Apr 59			
		Cleveland, Ohio	*	
		Selfridge, Mich.	*	
		South Parts Mil Res, Va.	*	
Chicago	15 May 59			
		Arlington Heights, Ill.	*	
		Indianapolis, Ind.	*	
		Milwaukee, Wisc.	*	

SECRET

SUPPORTING DOCUMENT NO. 24

SECRET

Air Defense Sector	Oper Date	Manual AADCP Locations	Circuit Oper Dates 1 Voice & 1 Tele	1 Voice (Tentative)
Duluth	15 Oct 59			
		Minn-St Paul AFB, Minn	*	
		Duluth, Minn.	*	
Grand Forks	15 Nov 59			
		None		

* Circuit operational dates for these locations will be of similar phasing to respective sector operational dates as those above.

** Air defense sector operational dates shown are from ADES Schedule #6. A six month slip is anticipated in the case of the Detroit sector.

PART II -- FSG-1 LOCATIONS

LOCATION	TYP. CIRCUIT	CIRCUIT OPER DATE
Ft Meade, Md.	1/1 Data (ST)	1 Sep 58, Alternate 1 Feb 59
	1/1 Data (ST-STN)	1 Sep 58, Alternate 1 Feb 59
	1 TTY (ST-STN)	1 Sep 58
	1 Voice (OPN)	1 Sep 58
	1 Voice (OPN)	1 Sep 58

SECRET

UNREADABLE - POOR ORIGINAL

SUPPORTING DOCUMENT NO. 25

UNREADABLE - POOR ORIGINAL

SUPPORTING DOCUMENT NO. 25