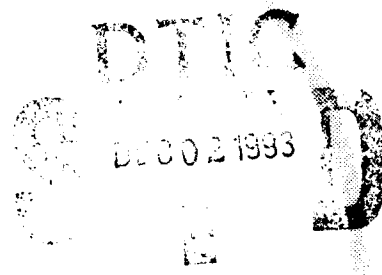AD-A273 351

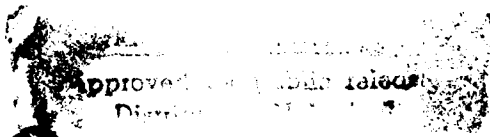**System Support Computer Complex-1 (SSCC-1): An FAA Technical Center Operations Concept Document**

Cheryl Williams

October 1993

DOT/FAA/CT-TN93/27

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16. Abstract

The purpose of the System Support Computer Complex (SSCC) Operations Concept Document is to provide a high-level overview and a broad understanding of the SSCC-1 portion of the Advanced Automation System (AAS). To achieve this purpose, the document defines the operational processes necessary to support the Initial Sector Suite System (ISSS) segment of the AAS. This includes identification of the users and their respective tasks, and definition of the procedures necessary to accomplish those tasks. It also identifies the diverse set of tools which will be used to provide the necessary software development, testing, and maintenance of the AAS.

This version of the SSCC Operations Concept Document discusses the SSCC-1 phase and operations aspects for the ISSS segment. As the various AAS segments are implemented, this document will be updated to provide the reader with information relative to the changes from the previous segment upgrade.

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EXECUTIVE SUMMARY

The System Support Computer Complex (SSCC), located at the Federal Aviation Administration (FAA) Technical Center, will provide centralized support for all Advanced Automation System (AAS) development, test, evaluation, deployment, and maintenance functions. The SSCC is evolved in four consecutive phases to support the implementation of the four different segments of the AAS. These segments are the Initial Sector Suite System (ISSS), Tower Control Computer Complex (TCCC), Terminal Advanced Automation System (TAAS), and the Area Control Computer Complex (ACCC).

This version of the SSCC Operations Concept Document discusses the SSCC-1 phase and operation aspects for the ISSS segment. As the various AAS segments are implemented, this document will be updated to provide the reader with information relative to the changes from the previous segment upgrade.

The Technical Center will be the support hub of management, maintenance, and testing of AAS software and hardware configurations for all AAS-equipped ATC facilities on a 24-hour-a-day, 7-day-a-week basis. The following Technical Center organizations play major roles in supporting the SSCC's mission:

a. ACN-300, Advanced Automation Systems Division. Provides continued support in the testing of new developments and requirements to be implemented in the AAS as approved system modifications.

b. ACN-400, NAS Facilities Software Engineering Division. Provides software development, Center systems maintenance, enhancement for aircraft target simulation systems, National Airspace System (NAS) operational support systems, and engineering computer systems.

c. ACN-500, NAS Facilities Hardware Engineering Division. Plans, manages, directs, and coordinates the technical, electronic, electrical, and digital engineering for the Technical Center laboratories and facilities. Also provided are the technical utilization, maintenance, modifications, and installation of diversified electronic systems and facilities.

d. ACN-600, NAS Facilities Operations Division. Provides for operation of the service's Automated Data Processing (ADP) laboratories, supporting facilities, and services at the Technical Center required by all Center organizations, AXD, contractors, and field support elements. Also performed are system management functions ensuring efficient use of equipment to meet the user-community requirements.

e. AOS-300/400, Operational Support Services. Provides problem resolution support and software maintenance services to the field sites.

As the Technical Center takes on a new role as the hub for centralized maintenance, the SSCC-1 will become the central repository for source logic and Sector Suite Adaptation Data for 20 Air Route Traffic Control Centers (ARTCC). The SSCC-1 will be available for scheduled use by all organizations conducting testing for NAS programs.

It is envisioned that the National Automation Engineering and Field Support Division (AOS) organization will have the requisite skills and resources to fulfill maintenance responsibilities after the expiration of IBM's maintenance contract. IBM will provide maintenance support at the sites for the first year on a 24-hour-a-day basis.

In AAS, there is still a unique and important role that cannot be performed by Technical Center personnel, and this is the maintenance of the local site adaptation data. The sites remain the experts and sole authority over their local adaptation data. They own the data, they are qualified in its use and understanding, and they are solely responsible for its continued maintenance and updating. The fact that the databases physically reside at the SSCC and do not reside at the sites in no way diminishes or limits field site responsibility for their maintenance. The Engineering, Test and Evaluation Service (ACN) and AOS organizations will continuously work together in the support of the field sites to maintain an efficient system.

The field site personnel have the capability to schedule the SSCC to test and maintain local adaptation data. Field sites are provided with remote access to SSCC resources. This remote SSCC access is used for problem reporting, adaptation data maintenance, hardware symptom/fix database inquiries, generation of appropriate site software products, and other related maintenance activities. Field sites will not have a site-resident software development environment and toolset to perform software development. Software maintenance will be performed by a site specialist by accessing the SSCC-resident databases and toolsets. A limited software modification capability will be site-resident, to be used in concert with the SSCC to address emergency corrections to ATC software logic.

The centralized software maintenance concept requires field site personnel to work in close partnership with AOS personnel to perform national adaptation data updates, and solve operational hardware and software problems. AOS personnel maintains the baseline and support software, and the national adaptation databases. AOS will be available 24 hours a day, 7 days a week to resolve field site problems. AOS will be responsible for updating national adaption data for all ARTCCs. Also, AOS is responsible for providing weekly adaptation updates to field sites.

The SSCC-1 will be able to logically replicate the ISSS configuration of any site. There will be two System Support Facilities (SSF), ISSS-1 and ISSS-2. The primary use of the SSFs is to replicate ISSS field sites in order to update, test, and modify source software logic and sector suite adaptation data changes. ISSS-1 and ISSS-2 resources will be available for scheduled use by all organizations who conduct testing for the NAS, which includes ARTCC personnel. The ISSS-1 and ISSS-2 will be maintained by ACN-400, scheduled as a resource by ACN-600. A new organization will be established for Configuration Management (CM) in the ACN Service.

The SSFs will enable the AOS personnel to replicate field site problems and aid in problem resolution and site-specific testing. Problems found and reported by the site-resident software specialist are communicated to the Technical Center for resolution. This is done informally via verbal communications, and formally through the creation of a problem AAS Change Instrument (ACI). Data is gathered by the site specialists to assist the AOS organization with problem resolution. Through the cooperative efforts of the site and AOS personnel, a proposed resolution is identified.

As required, a temporary fix or procedural work around is developed for the immediate use of the site. If the resolution requires modification to operational air traffic control (ATC) software, a logic release is created, introducing the fix as a source change at the SSCC. The modified source is then compiled and processed to produce an output product. Following the necessary binding and linking, a resultant load module is generated. Tests are run on the SSFs to verify the correctness of the source-based fix. Upon successful completion of SSCC testing, the logic release is packaged into a system release for site installation and is then made available for deployment (electronic deployment for small corrections and updates). Testing and certification must be performed at the site, before the new system release is made available for operational use via the applicable cutover procedures.

By the first ISSS Operational Readiness Demonstration (ORD), which is in Seattle, the SSCC will be able to support software functions, hardware functions, firmware, CM, and maintenance functions. These represent the minimum functional requirements necessary to support a fielded ISSS. The SSCC will at that time consist of two ISSS support facilities with Common Consoles (CCs) populated with Eagle processors. The HOST processors, Stand-Alone Simulators (SASs), and Peripheral Adapter Module Replacement Items (PAMRI) are shared by the two ISSSs. In addition, the AAS Job Shop will have been validated and available to perform SSCC support functions.

1. INTRODUCTION.

The System Support Computer Complex (SSCC), located at the Federal Aviation Administration (FAA) Technical Center, will provide centralized support for all Advanced Automation System (AAS) development, test, evaluation, deployment, and maintenance functions. The SSCC is evolved in four consecutive phases to support the implementation of the four different segments of the AAS. These segments are the Initial Sector Suite System (ISSS), Tower Control Computer Complex (TCCC), Terminal Advanced Automation System (TAAS), and the Area Control Computer Complex (ACCC). Table 1-1, SSCC Phased Implementation, shows the correlation of each AAS segment to each SSCC phase.

TABLE 1-1.   SSCC PHASED IMPLEMENTATION

AAS SEGMENT	SSCC PHASE
Initial Sector Suite System (ISSS)	SSCC-1
Tower Control Computer Complex (TCCC)	SSCC-2
Terminal Advanced Automation System (TAAS)	SSCC-3
Area Control Computer Complex (ACCC)	SSCC-4

This version of the SSCC Operations Concept Document discusses the SSCC-1 phase and operation aspects for the ISSS segment. As the various AAS segments are implemented, this document will be updated to provide the reader with information relative to the changes from the previous segment upgrade.

1.1 PURPOSE.

The purpose of the SSCC Operations Concept Document is to provide a high level overview and a broad understanding of the SSCC-1 portion of the AAS. To achieve this purpose, the document defines the operational processes necessary to support the ISSS segment of the AAS. This includes identification of the users and their respective tasks, and definition of the procedures necessary to accomplish those tasks. It also identifies the diverse set of tools which will be used to provide the necessary software development, testing, and maintenance of the AAS.

1.2 SSCC-1 MISSION.

The mission of the SSCC-1 is to centralize the management, maintenance, and support of the Air Route Traffic Control Center's (ARTCC) operational systems. This mission is accomplished by achieving the following objectives:

    a. Provide Configuration Management (CM) of both hardware and software
    b. Update and store all logic and Sector Suite adaptation data
    c. Develop, test, and distribute system releases
    d. Assist site software specialists in field problem resolution.

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The mission statement was development in accordance with the following FAA-ER-130-005H-AP, System Level Specifications (SLS):

    a. SLS 3.5.4.5.3.2.1. "The SSCC-1 will be the focal point for ISSS software maintenance ..."

    b. SLS 3.5.4.5.3.1. "Software maintenance at the ISSS ... shall be controlled and supported and configuration managed by the SSCC ..."

    c. SLS 3.7.3. "Online storage, access and national distribution of ... site adaptation ... to operational sites ..."

    d. SLS 3.5.4.4. "National Field Support Group (NFSG) located at the FAATC will act as "go team" for field sites ..."

Thus, the SSCC-1 is designed to provide the following in the fulfillment of this mission:

    a. Facilities and resources for the development and maintenance of software products

    b. Diverse configurations for testing, simulation, and research activities

    c. An interactive Job Shop environment comprised of an integrated set of Commercial Off-The-Shelf (COTS) products, Commercially Available Software (CAS), and contract developed software

    d. Networking services to a geographically dispersed user population.

1.3 SCOPE.

This document describes the SSCC functional areas at the process level while it defines the SSCC-1 objectives. The SSCC-1 operations and maintenance support to operational field sites are discussed in detail. Procedures and the functional flows necessary to provide centralized maintenance support to the ARTCC are identified.

Section 1 briefly describes the purpose and format of the Operations Concept Document while providing the reader with a cursory overview of the mission and history of the FAA's support maintenance role.

Section 2 identifies the documentation that was used as reference during the development of this document.

Section 3 provides the reader with detailed descriptions of the SSCC hardware and software configurations.

Section 4 describes the SSCC system operations and functions at the process level and how those functions fit into the centralized maintenance concept.

Section 5 provides an insight to the SSCC method of system maintenance.

Section 6 defines the manpower resource requirements necessary for FAA Technical Center SSCC-1 operations and describes the varied management and operator responsibilities.

Section 7 identifies the required training programs for the various positions required to function with the SSCC-1.

Detailed procedures and step-by-step operating instructions are referenced in the appendices and provided in the IBM PU series Contract Data Requirements Lists (CDRLs).

1.4 BACKGROUND.

The FAA Technical Center in Atlantic City, NJ, is chartered to provide system development and maintenance support to the field sites throughout the country on a 24-hour-a-day, 7-day-a-week basis. With the advent of SSCC-1, the entire development, testing, and deployment process for supporting field sites will undergo radical change. These modifications are briefly described in the following subsections, while more detailed explanations are provided in subsequent chapters.

1.4.1 Current System Support.

The present means of providing software maintenance support is based on the HOST Computer System (HCS). The HCS performs two primary system support functions which are:

    a. System development, testing, and deployment
    b. Field support.

Software consists of two parts: logic and adaptation data. Logic is the term used to denote the actual software coding. Adaptation data consists of the site specific parameters which are unique to each air traffic control (ATC) facility which are comprised of ARTCCs and airport traffic control towers (ATCT).

In the current system, the FAA Technical Center provides system maintenance to the ATC facilities, but the ARTCCs retain jurisdiction of the adaptation data and the repair capability. The adaptation data for each ARTCC is stored only at the respective site.

Normally, the FAA Technical Center does not have immediate access to a site's adaptation data, but they do have access to the configuration of the site logic. The FAA Technical Center can logically replicate the National Airspace System (NAS) and duplicate the logic of any site. FAA Technical Center adaptation is in the form of a generic set of adaptation data called a Universal Data Set (UDS). By using the UDS, the FAA Technical Center can perform field site problem analysis or conduct tests. The UDS does not replicate any particular site; however, it is the basis for the current methods of problem resolution and test activities.

Construction of the NAS operational system requires complete integration of the adaptation data with the logic, which results in a System Build. Since each site retains its own set of adaptation data, each site must build its own system. The FAA Technical Center does not have that capability.

Consequently, the FAA Technical Center does not have the capacity to conduct exhaustive system release testing, and each ARTCC is responsible for testing national logic with their site adaptation data.

The majority of the present application software logic is contractor-developed. The architecture of the software loads the application code into specific memory locations which provides the capability to correct a logic problem by "patching." Patching allows a site only limited ability to modify the software which results in the software logic varying from site to site. This process requires extensive CM and complicates problem analysis.

1.4.2 SSCC-1 System Support.

The Technical Center will be the support hub of management, maintenance, and testing of AAS software and hardware configurations for all AAS-equipped ATC facilities on a 24-hour-a-day, 7-day-a-week basis. The following Technical Center organizations play major roles in supporting the SSCC's mission:

a. ACN-300, Advanced Automation Systems Division. Provides continued support in the testing of new developments and requirements to be implemented in the AAS as approved system modifications.

b. ACN-400, NAS Facilities Software Engineering Division. Provides software development, Center systems maintenance, enhancement for aircraft target simulation systems, NAS operational support systems, and engineering computer systems.

c. ACN-500, NAS Facilities Hardware Engineering Division. Plans, manages, directs, and coordinates the technical, electronic, electrical, and digital engineering for the Technical Center laboratories and facilities. Also provided are the technical utilization, maintenance, modifications, and installation of diversified electronic systems and facilities.

d. ACN-600, NAS Facilities Operations Division. Provides for operation of the service's Automated Data Processing (ADP) laboratories, supporting facilities, and services at the Technical Center required by all Center organizations, AXD, contractors, and field support elements. Also performed are system management functions ensuring efficient use of equipment to meet the user-community requirements.

e. AOS-300/400, Operational Support Services. Provides problem resolution support and software maintenance services to the field sites.

As the Technical Center takes on a new role as the hub for centralized maintenance, the SSCC-1 will become the central repository for source logic and Sector Suite Adaptation Data for 20 ARTCCs. The SSCC-1 will be available for scheduled use by all organizations conducting testing for NAS programs.

It is envisioned that the National Automation Engineering and Field Support Division (AOS) organization will have the requisite skills and resources to fulfill maintenance responsibilities after the expiration of International Business Machine's (IBM) maintenance contract. IBM will provide maintenance support at the sites for the first year on a 24-hour-a-day basis. Table 1.4.2-1 contrasts the changes in support capabilities that will be introduced with the implementation of the SSCC-1.

TABLE 1.4.2-1.   SYSTEM SUPPORT CAPABILITIES COMPARISON

SUPPORT CAPABILITY	CURRENT SYSTEM	SSCC-1 SYSTEM
Adaptation Data Storage	Resident at ARTCC	Centrally located at FAA Technical Center
Site Software Fixes	Permitted at ARTCC	Prohibited at ARTCC
System Builds	Adaptation data intertwined w/software logic compilations	Software logic compilations independent of adaptation data
Software Logic Maintenance	Customized software maintained by ARTCC	All logic maintained at FAA Technical Center Extensive use of CAS
Transmission of Software	Tape distribution	Added Capability: Electronic transmission
Site Hardware Configuration	Configure on HCS	Configure two ISSSs simultaneously
Site Simulation	Limited capability at FAA Technical Center	Logically replicate any ISSS
ARTCC Remote Logon to Job Shop	Available but very limited functionality	New Capability: Permitted but controlled

In AAS, there is still a unique and important role that cannot be performed by Technical Center personnel, and this is the maintenance of the local site adaptation data. The sites remain the experts and sole authority over their local adaptation data. They own the data, they are qualified in its use and understanding, and they are solely responsible for its continued maintenance and updating. The fact that the databases physically reside at the SSCC and do not reside at the sites in no way diminishes or limits field site responsibility for their maintenance. The ACN and AOS organizations will continuously work together in the support of the field sites to maintain an efficient system.

The field site personnel have the capability to schedule the SSCC to test and maintain local adaptation data. Field sites are provided with remote access to SSCC resources. This remote SSCC access is used for problem reporting, adaptation data maintenance, hardware symptom/fix database inquiries, generation of appropriate site software products, and other related maintenance activities. Field sites will not have a site-resident software development environment and toolset to perform software development. Software maintenance will be performed by a site specialist by accessing the SSCC-resident databases and toolsets. A limited software modification capability will be site-resident, to be used in concert with the SSCC to address emergency corrections to ATC software logic.

The centralized software maintenance concept requires field site personnel to work in close partnership with AOS personnel to perform national adaptation data updates, and solve operational hardware and software problems. AOS personnel maintains the baseline and support software, and the national adaptation databases. AOS will be available 24 hours a day, 7 days a week to resolve field site problems. AOS will be responsible for updating national adaptation data for all ARTCCs. Also, AOS is responsible for providing weekly adaptation updates to field sites.

The SSCC-1 will be able to logically replicate the ISSS configuration of any site. There will be two System Support Facilities (SSF), ISSS-1 and ISSS-2. The primary use of the SSFs is to replicate ISSS field sites in order to update, test, and modify source software logic and sector suite adaptation data changes. ISSS-1 and ISSS-2 resources will be available for schedule use by all organizations who conduct testing for the NAS, which includes ARTCC personnel. The ISSS-1 and ISSS-2 will be maintained by ACN-400, scheduled as a resource by ACN-600. A new organization will be established for CM in the Engineering, Test and Evaluation Service (ACN).

The SSFs will enable the AOS personnel to replicate field site problems and aid in problem resolution and site-specific testing. Problems found and reported by the site-resident software specialist are communicated to the Technical Center for resolution. This is done informally via verbal communications, and formally through the creation of a problem AAS Change Instrument (ACI). Data is gathered by the site specialists to assist the AOS organization with problem resolution. Through the cooperative efforts of the site and AOS personnel, a proposed resolution is identified.

As required, a temporary fix or procedural work around is developed for the immediate use of the site. If the resolution requires modification to operational ATC software, a logic release is created, introducing the fix as a source change at the SSCC. The modified source is then compiled and processed to produce an output product. Following the necessary binding and linking, a resultant load module is generated. Tests are run on the SSFs to verify the correctness of the source-based fix. Upon successful completion of SSCC testing, the logic release is packaged into a system release for site installation and is then made available for deployment (electronic deployment for small corrections and updates). Testing and certification must be performed at the site, before the new system release is made available for operational use via the applicable cutover procedures.

A significant portion of the new software logic will be based on CAS. The Technical Center will be a central location to coordinate with the corresponding software vendors for corrections and updates.

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The SSCC will be able to support the field sites when:

    a. Software problems occur
    b. Hardware problems occur
    c. Firmware problems occur
    d. Site specific adaptation needs to be modified
    e. System releases are deployed
    f. During normal operations, on an interactive, as needed basis

By the first ISSS Readiness Demonstration (ORD), which is in Seattle, the SSCC will be able to support software functions, hardware functions, firmware, CM, and maintenance functions. These represent the minimum functional requirements necessary to support a fielded ISSS. The SSCC will at that time consist of two ISSS support facilities with Common Consoles (CCs) populated with Eagle processors. The HOST processors, Stand-Alone Simulators (SAS), and Peripheral Adapter Module Replacement Items (PAMRI) are shared by the two ISSSs. In addition, the AAS Job Shop will have been validated and available to perform SSCC support functions.

2. REFERENCE DOCUMENTATION.

The following documentation was used as reference information during the development of the SSCC-1 Operations Concept Document.

2.1 FAA DOCUMENTATION.

AAS Integrated Logistics Support Plan, Draft, 08/15/91

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NAS Terminal System Support Facility, Laboratory Handbook, 06/90

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IBM, System Support Computer Complex (SSCC-1) Operations Concept, Draft, 12/07/89

IBM (Internal Document) Logic Flow, 03/29/92

3. SSCC-1 SYSTEM DESCRIPTION.

The SSCC contains sufficient hardware, software, and interface resources to logically replicate the complete hardware and software configuration of any operational field site equipped with the AAS. The SSCC assists AOS personnel in replicating field site problems and resolving them. The SSCC also provides an environment for software development and testing, and for creating and deploying new system releases to the sites. By design, a significant portion of the new software logic is based on commercially available software.

The SSCC will evolve incrementally. In the end state, the SSCC will support the following functions:

a. The testing, implementation, centralized maintenance, modification, and enhancement of all AAS hardware and software.

b. The CM, quality assurance, performance assessment and adaptation data management, and static data management of all FAA sites which operationally implement AAS hardware and software.

c. The on-line storage, access and national distribution of bulk store flight plans, AAS documentation, site adaptation data, static data, and AAS software configuration items, to operational sites.

d. The development of system modifications, enhancements, upgrades, and extensions.

The SSCC also provides functionality for management of its resources to:

a. Control, partition, allocate, and validate its own resources.

b. Assist FAA management in planning and scheduling the allocation of SSCC resources.

c. Provide performance monitoring of itself.

The SSCC-1, which supports the ISSS, consists of three major subsystems:

a. AAS Job Shop
b. Facility and Simulation Control
c. ISSS System Support Facilities

Figure 3-1 illustrates the major functions performed at the SSCC and the relationship between the Job Shop and the ISSS sites. Each of the SSCC-1 subsystems is explained in this section. The details pertaining to SSCC-2, SSCC-3, and SSCC-4 will be included in future revisions of this document.

3.1 AAS JOB SHOP ARCHITECTURE.

The AAS Job Shop provides users with tools for software development and maintenance, test and verification, technical management, configuration management, and field support functions. It also provides access to users at operational field sites for adaptation data collection, problem reporting, and system distribution.

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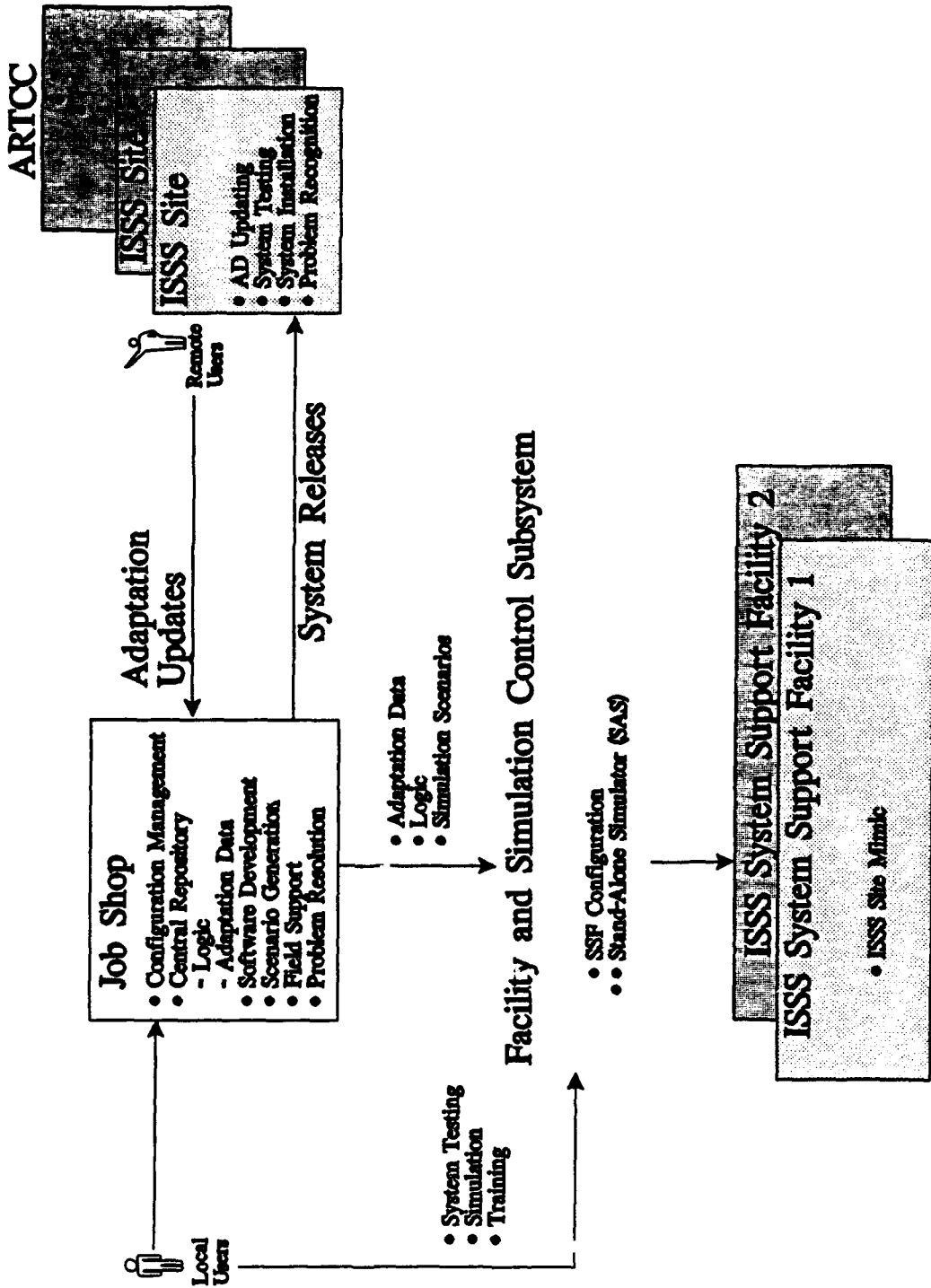
FIGURE 3-1. SSCC JOB SHOP FUNCTIONS AND ISSS SITE RELATIONSHIPS

3.1.1 Hardware.

The hardware configuration at the Job Shop is shown in figure 3.1.1-1. Table 3.1.1-1 lists the hardware subsystem which comprise the Job Shop.

TABLE 3.1.1-1.   AAS JOB SHOP HARDWARE DESCRIPTION

SUBSYSTEM	DESCRIPTION
IBM 3090 Model 600E Central Processor Complex	Central Processor Complex that supports the development, maintenance, enhancement, and continuous operation of the AAS facilities. It provides automated compilation and build control, and centralized CM for all developed software.
Communication Controller	Provides logon access to field sites for adaptation data collection, problem reporting, and system distribution.
Network Compilation Facility (NCF)	Provides the compilation environment to compile RISC System/6000 targeted Ada code.
Rational Computer System	Provides Ada support for developing software through functional unit test.
Intelligent Workstations (IWS)	Provides for unit testing Ada code.
Direct Access Storage Devices (DASDs)	Numerous large capacity storage devices that connect to the processor through a storage controller.
Tape Devices	Storage devices. Each tape storage unit consists of two tape drives and connects to the processor through a tape controller.
Display Terminals	Devices that are capable of sending and receiving information. Terminals are used by the document maintainer to log on to AAS and view or modify the documents.
Printers	Output devices for maintainers and software support.

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3090 Model 600E Processor

MVS/XA Side (4 or 6 Processors)	VM/SP Side (2 Processors)

I/O Subsystem

Direct Access Storage Devices (DASD)

Tape Devices

Printers

Interconnect Controllers

NCF

PS/2 Workstations

Local Terminals

Terminal Controllers

Communication Controllers

RISC 6000 System/ Workstations

Token Ring LAN

Modems

Gateways

Ethernet LAN

Remote Terminals

Rational Processor

FIGURE 3.1.1-1.   HARDWARE CONFIGURATION OF THE AAS JOB SHOP

The IBM 3090 Model 600E processor complex consists of:

    a. One IBM 3090-600E Processor Unit with the Processor Resource/Systems Manager (PR/SM) feature

    b. One IBM 3092-005 Processor Controller

    c. Two 3097-001 Power and Coolant Distribution Units

    d. Three IBM 3206-110 Display Stations

    e. Four IBM 3089-003 Power Units

3.1.1.1 Job Shop Ada Development Environment.

The AAS Job Shop Ada development environment configuration, as shown in figure 3.1.1.1-1, consists of an IBM 3090-600E central processing complex, an NCF, and a Rational R1000 Series 200 Model 40 Ada development system connected via a token-ring Local Area Network (LAN) to Common Console Processors (CCPs) and Personal System (PS) Intelligent Workstations (IWS).

The NCF consists of two Reduced Instruction Set Computer (RISC) System/6000 Model 950 machines to compile Ada code targeted for execution on RISC 6000s. The processing, compiling, and binding are performed under the control of Software Configuration Library Manager (SCLM) running on the AAS Job Shop processor (3090-600E). The Multiple Virtual Storage (MVS) partition on the IBM 3090-600E is the CM residence for the source code and the compiler outputs.

The Rational R1000 Series 200 Model 40 Ada development system consists of specialized processors, terminals, and software. The Rational R1000 system, which does not support the token ring, is connected to the token-ring LAN via a 7018-741 gateway.

The IWSs are PS/2s connected to the token-ring LAN via standard token-ring adapters. One of the PS/2s from the IWS pool is assigned as network manager.

The CCP workstations (RISC System/6000 Model 7018-740) provide the target environment for unit-testing Ada code. Ada support includes, at a minimum, an Ada compiler and symbolic debugger. The network supports a distributed file system for the CCP workstations. The IWS and CCP workstations are capable of serving as terminals to either the central processing complex or the Rational machines.
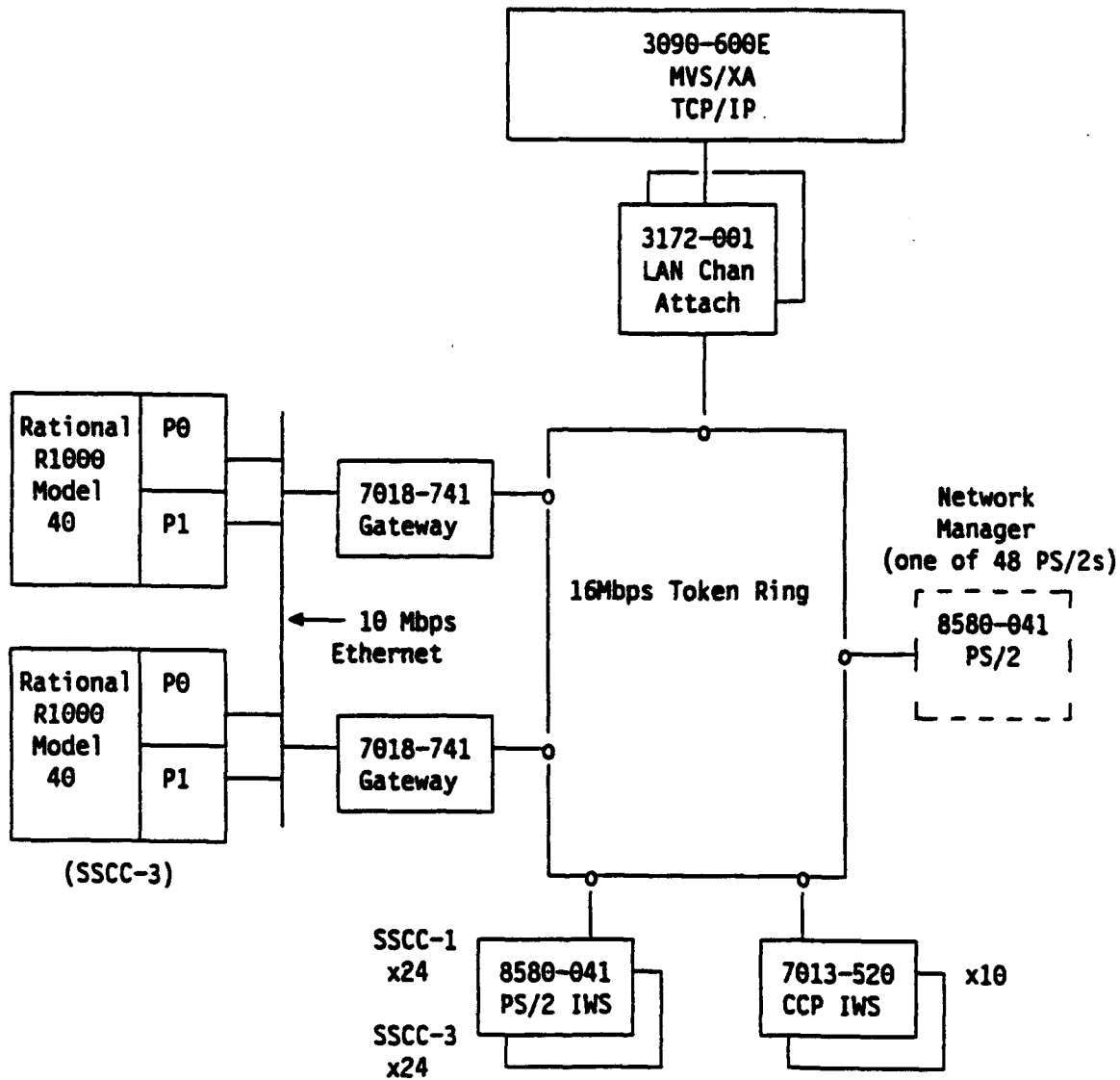
FIGURE 3.1.1.1-1.   ADA DEVELOPMENT ENVIRONMENT CONFIGURATION

The IBM RISC System/6000 system units are a second generation of computers using the architecture. They offer a full range of multiuser, multitasking, open-architecture workstations and servers. Four models of the IBM RISC System/6000 are used in AAS:

    a. Model 7018-741 is used as interface units and gateways. Examples are the Local Communication Network Interface Units (LIUs), Common Console Simulators (CCSs), and Enhanced Direct Access Radar Channel (EDARC) System Interface (ESI).

    b. Model 7018-740 is used in the CC as the CCP.

    c. Model 7013-520 is used as workstations in the Job Shop for software diagnostics and maintenance.

    d. Model 7015-950 is used in the Job Shop's Network Compilation Facility (NCF) to compile Ada programs targeted for RISC System/6000 processors.

3.1.1.2 AAS JOB SHOP PARTITIONS.

The AAS Job Shop 3090 system includes a hardware feature called Processor Resource/Systems Manager (PR/SM), which is used to partition the 3090 processors. The maximum number of partitions that can be simultaneously active for the IBM 3090 Model 600E is four. The AAS Job Shop is currently divided into the following four partitions:

    a. three processors allocated to Production
    b. one processor allocated to Test
    c. one processor allocated to Central Support
    d. one processor allocated to Software Development

Table 3.1.1.2-1 shows the functions performed in each partition.

TABLE 3.1.1.2-1.   AAS JOB SHOP PARTITION FUNCTIONS

Production	MVS/ Extended - Architecture (XA)	Software Development Environment - Change Tracking System - Configuration Management - Software Development Environment (Ada/370, Ada/6000, CSP, C/370, C/6000, ASM/370) - AAS Adaptation Data Maintenance - Documentation Maintenance - System Analysis Recorder (SAR) - Data Reduction and Analysis (DR&A) - Support Software Problem Determination - Support Software Unit, String, Integration, System Test - Ada/370 Unit Testing
Test	MVS/XA	- MVS CAS Product Administration - MVS CAS Product Regression Testing
Central Support (CS	Virtual Machine (VM)/ System Product (SP) - MVS/SP Guest	- NAS Software Builds - NAS Modifications for ISSS (NASM) Software Builds - Field Support - Info Management - Mail - HOST DR&A
Soft are Development (SD)	VM/ Extended System Architecture (ESA)	- NAS Software Development - NASM Software Development - NAS Software Test - NASM Software Test

3.1.2 Software.

A diverse set of users has access to the Job Shop. Software developers develop and test software and database updates. Document maintainers modify and create documentation. Field support personnel interrogate the system to resolve reported problems. Site personnel remotely access and update adaptation data to keep the data current and accurate. CM personnel maintain and control these processes to ensure integrity.

The software used to perform these Job Shop functions is a combination of CAS products, Computer Software Configuration Items (CSCIs), and tools. Figure 3.1.2-1, Support Software at the AAS Job Shop, shows the layers of support software residing on the IBM 3090 system. It also shows how some of the CSCIs and CAS products interrelate. The figure legend lists the CAS products. Site Data Collection (SITE), Environment Data Collection (ENVT) and Change Control and Build (CCAB) are AAS CSCIs.

3.1.2.1 Commercially Available Software (CAS).

Figures 3.1.2.1-1 and 3.1.2.1-2 show the Commercially Available Software (CAS) products residing on the IBM 3090 system for each operating system. The CAS products can be divided into four groups:

a. System Control Software - Software used to control the system and allocate resources to application programs, and software used to monitor the performance of the hardware and software.

b. System Configuration and Management Software - Software supporting the management of the system, including hardware and software CM, schedule management, and planning.

c. Program Development Support Software - Software supporting the development and testing of software.

d. Communications Support Software - Software to allow communications between terminals and the processor, between processors, and between facilities.

Tables 3.1.2.1-1 through 3.1.2.1-4 provides a brief description of each CAS product. Detailed descriptions are located in the PU series documents.

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FIGURE 3.1.2-1.   SUPPORT SOFTWARE AT THE AAS JOB SHOP

SSCC AAS Job Shop Processor (MVS Partition)

```
┌─────────────────────────────────────────────┐        ┌──────────┐
│                    MVS/XA                     │        │  DASD    │
├─────────────────────────────────────────────┤        │  Units   │
│                    RACF                       │        └──────────┘
├───────────────────────────────┬─────────────┤
│            TSO/E              │ DFP          │        ┌──────────┐
├───────────────────────────────┤ DF/DSS       │        │  Tape    │
│       ISPF and ISPF/PDF       │ DFHSM        │        │  Units   │
├───────────┬───────────────────┤ DFSORT       │        └──────────┘
│           │   CSP/AD          │ DSF          │
│           │                   │ DXT          │
│           │  ┌──────┐         ├─────────────┤
│  Ada      │  │ INFO │  AAS    │ TLCS         │
│  AS       │  ├──────┤ Software├─────────────┤   ┌──────────┐
│  ASMH     │  │ SCLM │ Subsystems│ ACF/VTAM  │   │ Terminal │ ──►
│  DCF      │  └──────┘         │ ACF/SSP      │   │ Control  │ ──►
│  BOOK     │                   │ NETVIEW      │   │ Units    │  Local
│           │  ┌──────────┐     ├─────────────┤   └──────────┘  Terminal
│           │  │  CSP/AE  │     │ FTP          │                 Network
│           │  │ ┌──────┐ │     ├─────────────┤   ┌──────────┐
│           │  │ │ DB2  │ │     │              │   │  Comm    │ ──►
│           │  │ └──────┘ │     │ SDSF OPC/A   │   │  Ctrl    │ ──►
│           │  └──────────┘     │ RMF  SMP/E   │   │          │ To Other
│           │  ┌──────┐         ├─────────────┤   │ ACF/NCP  │ Facilities
│           │  │SPSS-X│         │ PSF          │   └──────────┘
│           │  └──────┘         ├─────────────┤   ┌──────────┐
│           │                   │ TCP/IP       │   │  Page    │
└───────────┴───────────────────┴─────────────┘   │  Printer │
                                                   └──────────┘

                                          └─ to AAS Job Shop LAN ──►
```
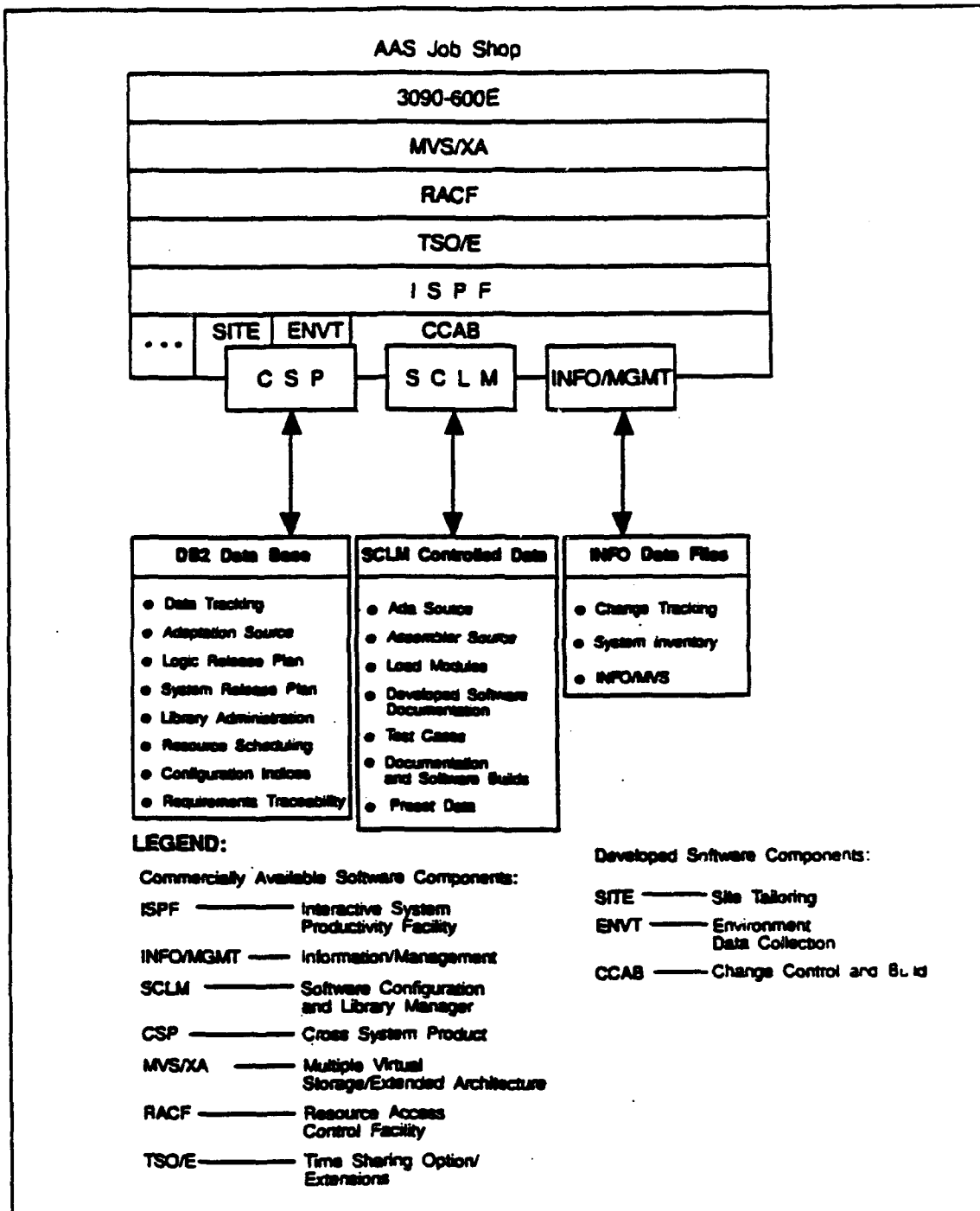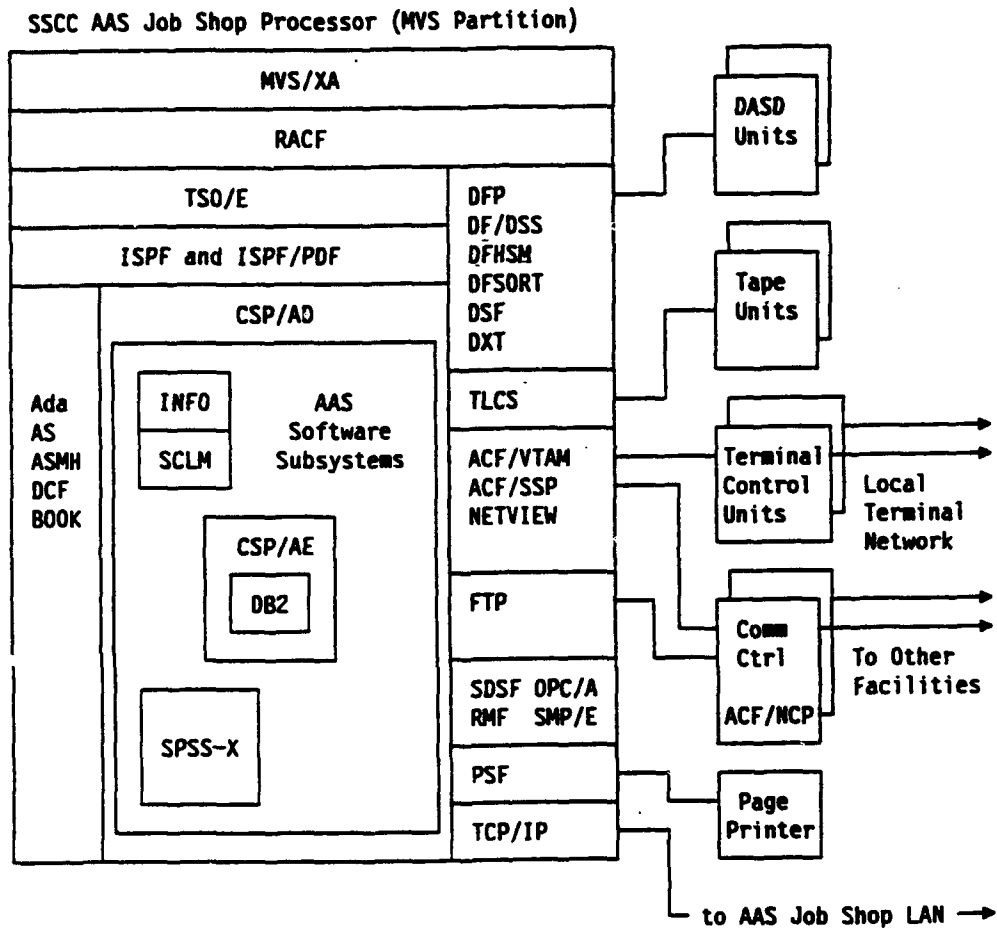
FIGURE 3.1.2.1-1.   IBM 3090 RESIDENT CAS PRODUCTS (MVS PARTITION)

SSCC AAS Job Shop Processor (VM Partition)

VM/SP w/HPO				DASD and Tape Units
RACF				
CMS			DIRMAINT RTM VMMAP	
ISPF and ISPF/PDF				
NASM Software (Support)	CS/SD Software (GFE)	PSL/PSA RSI SQL/DS	ACF/VTAM	Terminal Control Units — Local Terminal Network
			FTP PVM RSCS	Comm Ctrl — To Other Facilities

FIGURE 3.1.2.1-2.   IBM 3090 RESIDENT CAS PRODUCTS (VM PARTITION)

TABLE 3.1.2.1-1.   SYSTEM CONTROL SOFTWARE

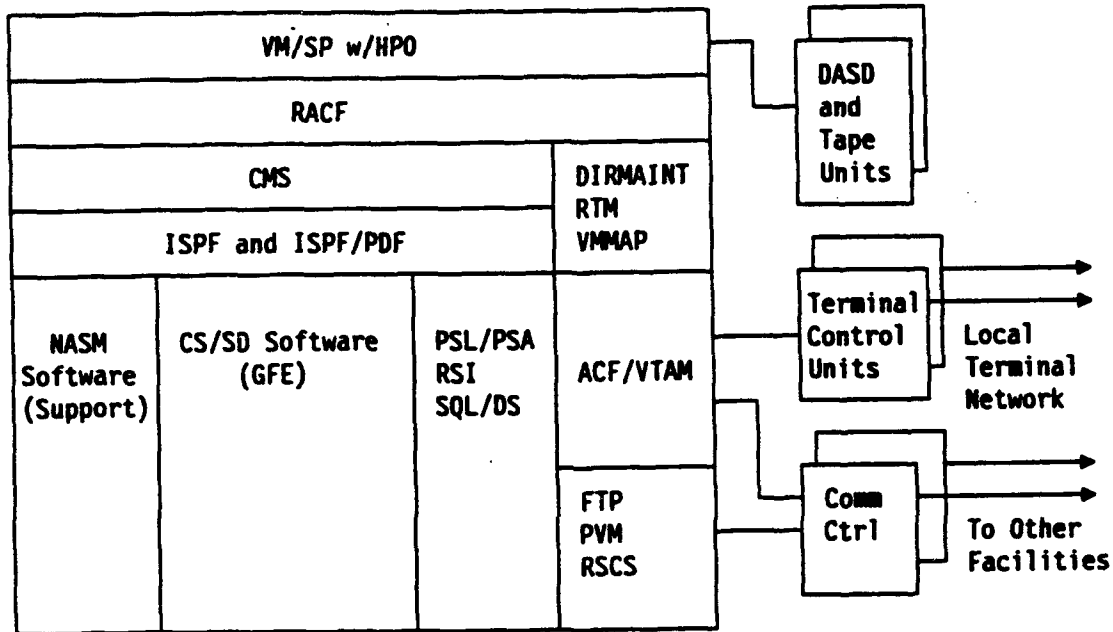| CAS PRODUCT	DESCRIPTION
Conversational Monitor System (CMS)	Operates under VM/ESA to provide interactive access to the various support functions.
Data Facility/Data Set Services (DF/DSS)	Assists MVS/XA users with protection and recovery of information on DASD.
Data Facility Hierarchical Storage Manager (DFHSM)	Manages and controls various data storage devices on MVS/XA. Provides functions such as automatic backup and recovery of data sets conversion of data sets across different device types, and archiving of less active data sets.
Data Facility Product (DFP)	Provides data management, device support, program library management, utility functions, and system catalog support.
Data Facility Sort (DFSORT)	A high performance sort for blocked or unblocked sequential data sets containing fixed or variable length records.
Device Support Facilities (DSF)	Supports the central processor attached DASD, and allows access to data during media maintenance processing.
Data Extract (DXT)	Allows the user to extract selected operational data and formats data for loading into Data Base 2 Data Base Application (DB2).
Multiple Virtual Storage/ Extended Architecture (MVS/XA)	The virtual storage operating system for all AAS central processors.
Resource Access Control Facility (RACF)	Provides a full-function access control system for the VM/ESA and MVS/XA environments.
Resource Measurement Facility (RMF)	Centralized measurement tool that monitors system activity to collect performance and capacity planning data.
Print Services Facility (PSF)	Provides device and resource management support for the 3820 Page Printer, under the MVS environment.

TABLE 3.1.2.1-1.   SYSTEM CONTROL SOFTWARE (Continued)

CAS PRODUCT	DESCRIPTION
System Display and Search Facility (SDSF)	A system management aid that provides users dynamic access to MVS system log and Job Entry Subsystem queues.
Statistical Package for the Social Sciences (SPSS-X)	SPSS-X a product of SPSS, Inc. General purpose statistical analysis program that is used in AAS for DR&A.
Time Sharing Option/Extensions (TSO/E)	Provides interactive users with additional function, improved usability, and improved performance. Operates under MVS/XA to provide interactive access to the various support functions.
VM/ESA with High Performance Option (VM/ESA w/HPO)	The virtual storage operating system for the HOST Computer System (HCS).

TABLE 3.1.2.1-2.   SYSTEM CONFIGURATION AND MANAGEMENT SOFTWARE

CAS PRODUCT	DESCRIPTION
Data Base 2 (DB2)	Provides a complete, full-function data base management system used in the implementation of the CM and adaptation management functions.
Operations Planning and Control/Advanced (OPC/A)	Provides a comprehensive software scheduling tool for the MVS environment. OPC/A plans, controls, and automates the batch production workload.
System Modification Program/Extended (SMP/E)	The basic tool for making software changes (new function, corrective, and preventive service, and user modifications) on MVS/XA.
Tape Library Control System (TLCS)	Provides an automated library system capable of controlling any number of tapes. Provides magnetic-tape management functions for MVS/XA.

TABLE 3.1.2.1-3.   PROGRAM DEVELOPMENT SUPPORT SOFTWARE

CAS PRODUCT	DESCRIPTION
Cross System Product/Application Development (CSP/AD)	Provides complete facilities for programmers to define and generate applications.
CSP/Application Execution (CSP/AE)	Executes the generated programs in a production environment.
Interactive System Productivity Facility (ISPF)	Provides dialogue-management services in the MVS/XA TSO and VM/CMS environments. These services provide the Computer Human Interface (CHI) for all AAS support functions in the form of menu-based dialogues that simplify using the application.
ISPF/Program Development Facility (ISPF/PDF)	An interactive application that provides common application development services to both MVS and VM users. Provides an editor to create and maintain both source programs and text data.
Software Configure and Library Manager (SCLM)	Part of ISPF/PDF. SCLM provides CM and build support for all AAS developed software.

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TABLE 3.1.2.1-4.   COMMUNICATIONS SUPPORT SOFTWARE

CAS PRODUCT	DESCRIPTION
ACF/System Support Programs (ACF/SSP)	A core requisite product providing a set of utility programs supporting the Advanced Communication Facility (ACF).
ACF/Virtual Telecommunications Access Method (VTAM)	Provides network management functions. VTAM supports concurrent execution of multiple telecommunications applications and controls sharing of resources among applications.
File Transfer Program (FTP)	General purpose program used to transfer files of all sizes between facilities, such as during the deployment of software and adaptation data.
Netview	Provides an enhanced set of network management functions.
Virtual Machine Passthru (PVM)	PVM allows VM/ESA users to interactively access applications in another system. PVM provides field site users with the ability to log on via 3270 devices to HCS support applications residing at the SSCC AAS Job Shop.
Remote Spooling Communication System (RSCS)	Supports the HCS component of ISSS. It provides file transfers between the HCS support element of the Job Shop and Host/ISSS field sites.
Transmission Control Protocol/Internet Protocol (TCP/IP)	Provides the AAS Job Shop user with the capability of accessing the AAS Job Shop Ada Development LAN.

3.1.2.2 Developed Software.

The Job Shop contains six CSCIs for SSCC-1. These are CCAB, ENVT, SITE, Recording, Analysis and Playback (RAAP), Man-Machine Interface (MMI) Training Support Software (MTSS), and NAS Modifications for ISSS (NASM). Although each CSCI has specific functions, the CSCI being used at any given time is transparent to the user. Table 3.1.2.2-1 shows the operating system relative to each CSCI.

TABLE 3.1.2.2-1.   SSCC-1 AAS JOB SHOP CSCIs

OPERATING SYSTEM	CSCIS
MVS/XA	CCAB, SITE, ENVT, RAAP, and MTSS
VM/ESA	NASM

The CCAB provides the Job Shop's CM tools for planning, controlling, and tracking changes to AAS. It maintains inventories of software components, hardware configurations, documentation, and SSCC resource schedules. The CCAB's database also supports Job Shop test functions by providing test scheduling and tracking capability, test requirements review capability, and site hardware and software inventory identification for site specific testing.

The ENVT supports the collection and maintenance of adaptation data as defined by the AAS software.

The SITE provides the tools needed to select data and translate it for use with a specific AAS logic release.

The SITE also prepares the logic and data for deployment.

The RAAP provides the central source of control to support the recording and playback of display data, and provides a central source of control to support the recording and analysis of ISSS unique nondisplay data.

The HOST and EDARC nondisplay recording and analysis are provided by Government Furnished Information (GFI) software.

The MTSS provides the CC with a Detached Console Training (DCT) capability for training purposes.

The NASM provides the necessary modification of NAS software to support ISSS requirements. NAS software existing prior to the ISSS implementation is provided as Government Furnished Property (GFP). This GFP NAS software, called the HCS software, consists of operational software, nonoperational software, and maintenance software.

3.2 FACILITY AND SIMULATION CONTROL (F&SC) ARCHITECTURE.

The Facility and Simulation Control (F&SC) subsystem controls the assignment of common resources between the SSFs and configures an SSF to emulate a site. The F&SC consists of a S/390 Model 9121-320 central processor, two Facility Configuration Consoles (FCC) for SSCC-1, two SASs, CCs, CCCs, Test Interface Units (TIUs), LANs, and LAN LIUs. The CCs and CCSs are a shared resource-pool that can be configured to emulate any ISSS operational configuration. The shared resources are accessed through the TIUs, the Local Communications Network (LCN), and the Backup Communications Network (BCN) by means of the FCC. Figure 3.2-1 is a overview diagram of the F&SC subsystem.
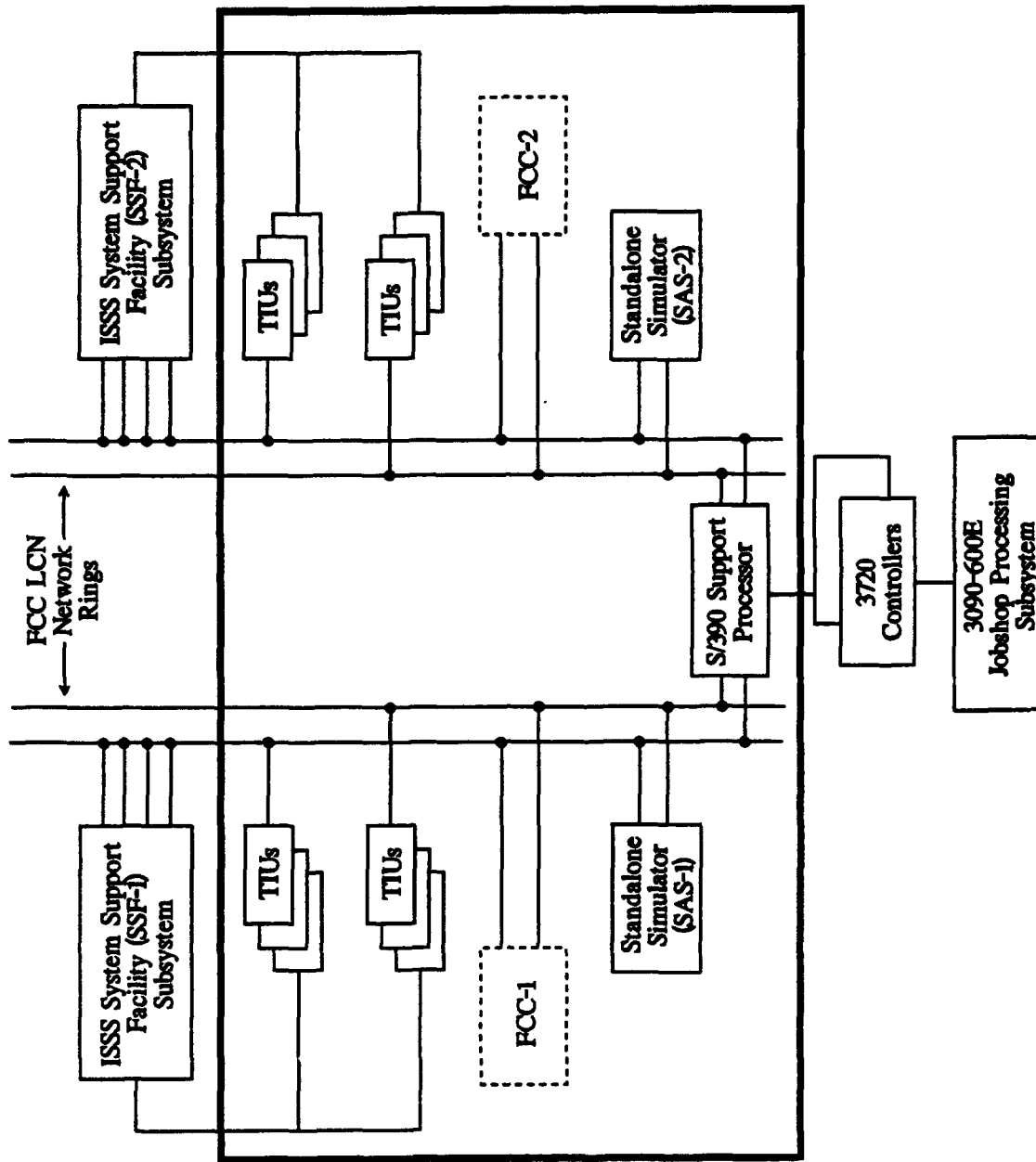
FIGURE 3.2.1. F&SC SUBSYSTEM OVERVIEW

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The following CSCIs support the F&SC:

    a. Common System Services (CXSS)
    b. Recording Analysis and Playback (RAAP)
    c. Display Management (DISP)

3.2.1 Facility Configuration Console (FCC).

The general mission of the FCC position in the SSCC-1 is to assist FAA Management in the configuration, monitoring, and management of SSCC-1 resources that are required by ISSS SSF users to perform system testing and verification activities. The FCC acts as a centralized position to coordinate the interfaces to the applicable SSCC-resident hardware subsystems, and to the operations personnel that support these subsystems on a continuous basis.

During SSCC-1, there are two CCs permanently assigned as FCCs. One CC will function as the FCC for each of the two specific ISSS SSFs. The two FCCs work independently of one another. In subsequent segments, a single CC at the FCC position will serve both SSFs.

3.2.1.1 Hardware.

The FCC position is pictured in figure 3.2.1.1-1. The two CCs that make up the FCC position suites are referred to as FCC-1 and FCC-2. FCC-1 is responsible for the LCN network that is dedicated to, and serves the simulation testing needs of SSF-1, and FCC-2 is responsible for the LCN network that is dedicated to, and serves the simulation testing needs of SSF-2.

In addition to its LCN network connections, the FCC position consoles are also connected to the BCN. Each FCC console contains an adapter to connect to its respective BCN, with FCC-1 connected to BCN-1 and FCC-2 connected to BCN-2. In turn, BCN-1 or BCN-2 can be switched to the EDARC subsystem when configuring an SSF for testing.

The FCC position suite also contains two additional pieces of hardware. The first is two hard copy printers, one dedicated to each of the two FCC CCs. They are used for hard copy outputs that are requested by the FCC console operators. The second piece of hardware is an interactive terminal or workstation that is connected via a Job Shop control unit to the AAS Job Shop processor and is shared by the FCC console operators. This terminal/workstation allows an FCC operator to logon to the Job Shop, and to access and input information relevant to the testing plans and configuration requirements of scheduled SSF users.

3.2.1.2 Software.

The FCC utilizes the same Network Manager software as the Monitor & Control (M&C) position of the operational ISSS SSFs.
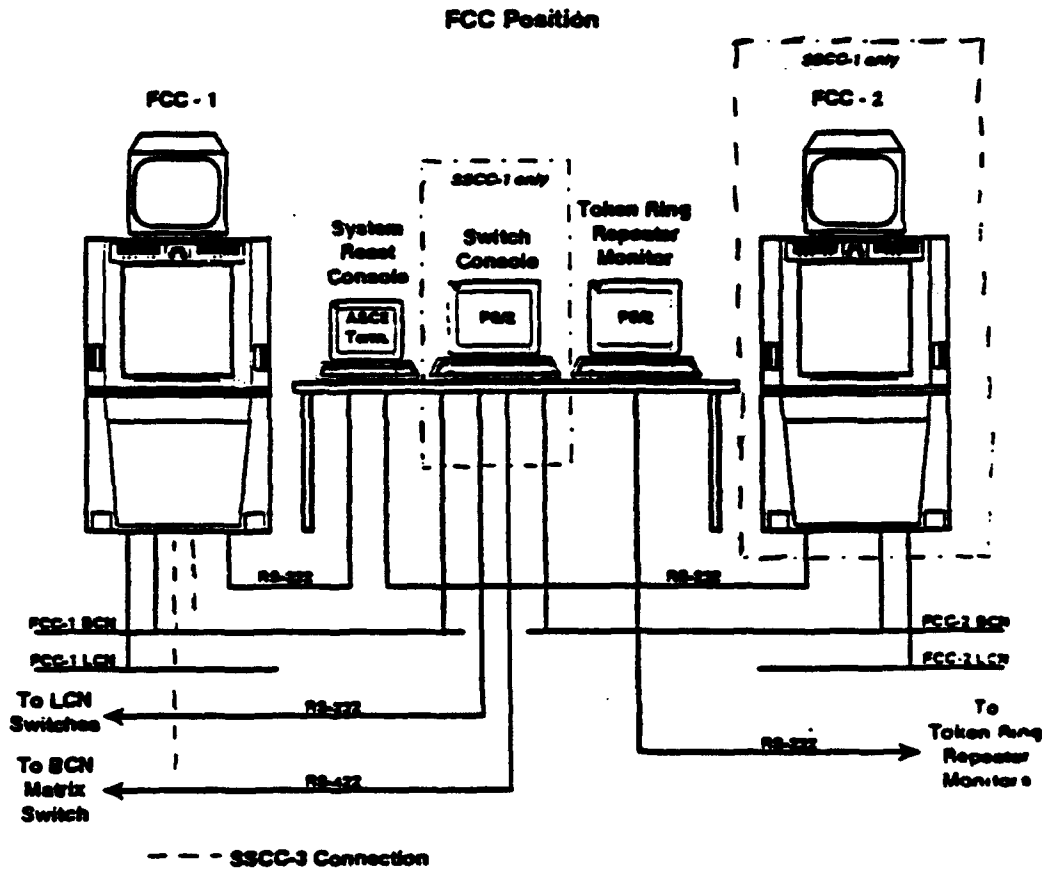
FCC Position

FIGURE 3.2.1.1-1.   SSCC-1 FCC POSITION

3.2.2 Stand-Alone Simulator (SAS).

The SAS function provides simulation services and test scenario generation for the SSFs. The purpose of the SAS is to support system testing and verification. It can provide continuous inputs for maximum stress and overload testing. It also provides for the execution and recording of existing HOST simulation capabilities (NASM) .з well as the scenario generation and execution of the simulation requirements of AAS.

Stand-alone simulation is performed using the F&SC 9121 processor with Adapter Units (AUs) dedicated both physically and logically to the SASs. Each SAS AU set is comprised of two AU rack assemblies. Each set has the AU adapter cards necessary to provide the associated ISSS SSF 35 interfacility input and output line pairs and 75 radar lines, which are the maximum stress inputs and outputs for ISSS.

The F&SC 9121 will have two partitions: one for MVS, the other for Virtual Machine/Extended System Architecture (VM/ESA). Under the VM/ESA partition, two copies of NAS Looped Sim Driver (SDR) could be executing simultaneously. The SDR is the software environment for the SAS, which will operate in native or VM mode on the 9121 platform.

3.2.3 Peripheral Adapter Module Replacement Item (PAMRI).

The PAMRI is an upgraded peripheral adapter for the AAS. It receives incoming signals from radar or LAN lines and is interfaced with the HOST computer system. Its purpose is to replace existing radar and communications interface equipment with newly designed equipment having greater capacity and improved supportability.

The PAMRI system consists of the following four major hardware components:

   a.   Adapter Units (AU)
   b.   Radar Data Distribution Units (RDDU)
   c.   Modem Splitters (MS)
   d.   Maintenance Consoles (MCs)

The PAMRI subsystem also contains four PS/2 Model 55SX computers which are used as maintenance consoles.

Data coming from interfacility and external communications equipment are sent to the PAMRI adapter units via the modem splitters. The MS direct the appropriate data to their respective output lines and transmit them to their next destination. The AUs process both the radar and nonradar data received from the modem splitters. Radar data only is routed to the RDDUs to distribute to other radar subsystems attached to the RDDUs that require radar data.

3.3 SYSTEM SUPPORT FACILITY (SSF) ARCHITECTURE.

The SSF is a collection of hardware resources used to replicate a field site configuration. There are two ISSS SSFs in SSCC-1, both of which are managed by an FCC position and are similar in configuration. These two separate physical token ring networks contain all the resources and processing hardware to logically replicate an ISSS site. The network composition of the two SSFs is summarized below:

a. A set of four separate token rings that interface with FCC-1 and FCC-2 to which the TIUs are connected, and to which LIUs are connected for the three F&SC S/370 processors that support simulation.

b. Four bridges on each of two of these four separate rings; these are required for interconnection to the two sets of SSF backbone rings.

c. Two central cluster access ring sets.

d. The bridges required for interconnection of backbone ring sets 1 and 2 to the two sets of central cluster access rings.

e. Six CC access ring sets (access ring sets 1, 2, and 3 are dedicated for SSF-1, and access ring sets 4, 5, and 6 are dedicated for SSF-2).

f. The bridges required for interconnection of backbone ring sets 1 and 2 to the six sets of CC access rings.

Within each of the processors of the two CCs for FCC-1 and FCC-2 resides the LCN Network Manager software function that is responsible for managing the SSF token ring networks. The FCC-1 copy of the network manager software handles the SSF-1 network and its other attached components (e.g., LIUs and TIUs), and the FCC-2 copy of the network manager software handles the SSF-2 network and its other attached components.

To be able to create and control its respective SSF network, each FCC network manager must own the bridges (four of them) that connect to the applicable SSF backbone ring set (one set dedicated for SSF-1 and the other dedicated to SSF-2). Each network manager must also be capable of issuing commands to these bridges to accomplish its network management responsibilities.

3.3.1 Monitor and Control (M&C) Cluster .

The Monitor and Control (M&C) is a collection of the following positions:

a. M&C position. Consists of four CCs, connected to the LCN and to the BCN. The M&C position provides the capability to monitor ISSS status and control the ISSS configuration.

b. Diagnostic and Repair (D&R) position. Consists of two CCs with the same connectivity and hardware functionality as the M&C position.

c. Display Recording and Playback (DR&P) position. Consists of four CCs and has the same connectivity and hardware functionality as the M&C position.

The System Engineer has access to all M&C views while the D&R and DR&P positions have access to subsets of M&C position views and commands.

3.3.2 HOST Computer System (HCS).

The HCS is furnished by the FAA and consists of an IBM Model 3083 central processor, a Model 3082 processor controller, Model 3087 cooling unit, and a Model 3089 power unit. There are two processing groups and redundant channel paths to the peripheral devices. This subsystem furnishes all prime channel interconnection to the external world, including radar interfaces and communication to other ISSSs and the SSCC.

The HCS will perform the air traffic computation functions with new controller workstations that replaced the Plan View Displays (PVDs). The new ISSS equipment is connected to the HCS using the LCN. The ISSS replaces the following components of the HCS:

    a.   Computer Display Channel (CDC)
    b.   Display Channel Complex (DCC)
    c.   Display Generators (DGs)
    d.   Plan View Displays (PVDs)
    e.   Flight Strip Printers (FSP)
    f.   Associated interfaces and cables

The ISSS completes the replacement of aging 9020 ATC equipment, which was started with the HOST program.

Two of the three HCS System Support Facilities at the Technical Center will be reallocated as follows: the HCS PAMRI Services Facility (PSF) will become part of ISSS-2, and the HCS Alternate Support Facility (ASF) will become part of ISSS-1.

3.4 INTERFACES.

3.4.1 HOST Interface.

The HOST interface includes the hardware and software in the LIUs. Each LIU consists of a S/370 channel adapter attached to the CCP, which is connected via token ring adapters to the LCN. Two LIUs are operated redundantly on each HOST processor.

3.4.2 EDARC System Interface (ESI).

The EDARC system is furnished by the government and consists of up to 14 display processors and 2 control processors with interface and control equipment to provide an alternate radar processing and tracking data path.

The ESI subsystem equipment is housed in a new dual-bay cabinet, with cables to the existing EDARC hardware. Individual Refresh Output Controllers (ROCs) Data Processor (RDP) circuit cards in the new cabinet attach to the EDARC Display Processors by a cable which taps the display refresh data stream. The processor in each RDP monitors the display data stream and performs comparisons to detect data changes. When a change is detected, the processor firmware formulates an update message, which is sent to the affected sector, via the Keyboard Communication Processor (KCP), the ESI processor, and the Backup Communications Network (BCN) Controller input messages are handled by the KCP and inserted in the EDARC input as if they were keyboard or cursor data from existing devices. Controller messages, which are composed in the CC and transmitted to the ESI via the BCN, are converted to "keystrokes" in the KCP processor. Lexical feedback to the controller is handled by the CC, as is cursor movement. When cursor position is needed in EDARC, the position is included in the message by the CC. This position is routed to EDARC by the KCP and the cursor operation is performed by EDARC. No software changes in EDARC are required. The only hardware changes to the existing equipment are the addition of the interface cables from the new cabinet and a Radar Controls Multiplexer (RCM) circuit.

3.4.3 Laboratory Signal Switching System (LSSS).

The Laboratory Signal Switching System (LSSS) switches digital and analog radar sources, and modem signals to the SSCC. The digital radar messages are switched to PAMRI modem splitters. The modem splitters route the radar messages to the F&SC or to one of the EDARC channels.

4. SYSTEM OPERATIONS.

4.1 AAS JOB SHOP OPERATIONS.

The AAS Job Shop provides a complete development and support environment as part of the SSCC at the Technical Center, including the capability to maintain, update, and generate adaptation data, system software, and documentation. This activity includes new system releases, software updates, adaptation data updates, and CAS product integration. The Job Shop's CM system effectively tracks all system modifications. All centers have remote logon capability to the Job Shop. Table 4.1-1 outlines the major Job Shop functions, users, and organizations responsible for support.

The support software that provides the functionality of the Job Shop is divided into CSCIs, each of which provides pieces of the puzzle. These CSCIs, and their associated functions, are listed in table 4.1-2, SSCC Support Functions and their related CSCIs.

4.1.1 Configuration Management (CM).

Approximately 2000 remote users at different levels of understanding and experience have access to the Job Shop. To ensure data integrity while allowing authorized access, extensive procedures and controls are in place to allow effective and efficient access. The Configuration Management (CM) process includes supporting future release plans as well as tracking all reported problems with and proposed changes to existing ones. The planning functions for adaptation data, logic, and system releases are based on the use of an ACI.

TABLE 4.1-1.   SSCC SUPPORT FUNCTIONS AND THE RESPONSIBLE ORGANIZATIONS

JOB SHOP FUNCTIONS	USERS	SUPPORT
Configuration Control and Management	ACN AOS Field Sites	ACN Config Team CCBs
ACI Process	ACN AOS Field Sites	ACN AOS
System Release Planning	AOS Field Sites	ACN AOS IBM (1st year)
Logic Release Planning	AOS	ACN AOS IBM (1st year)
Adaptation Data Maintenance	AOS Field Sites	AOS Field Sites
Software Development and Test	ACN AOS	ACN AOS IBM (1st year)
Documentation Maintenance	ACN AOS Field Sites	ACN AOS IBM (1st year)
Resource Scheduling	ACN	ACN
Hardware Maintenance	ACN AOS	ACN AOS IBM (1st year)
Problem Determination	AOS Field Sites	AOS IBM (1st year)

TABLE 4.1-2.   SSCC SUPPORT FUNCTIONS AND THEIR RELATED CSCIs

CSCI NAME	ACRONYM	SSCC SUPPORT FUNCTIONS
Change Control and Build	CCAB	Change Tracking and Control CSCI Document Tracking Hardware Symptom-Fix Data Inventory Management Job Shop Tools Integration Library Management Logic Release Archiving and Restoring Maintenance Report Generation Resource Scheduling Requirement Tracing Software Build Tools Version Description Document
Common System Services	CXSS	Network Configuration and Management for FCC SSF Configuration TIU/CCS Simulation
Display Management	DISP	FCC Input Command Processing Visual/Graphic CHI for FCC
Environment Data Collection	ENVT	Adaptation Data Collection Adaptation Data Configuration Management
MMI Training Support Software	MTSS	Author Lesson Creation Detached Console Training
NAS Modifications	NASM	Simulation Scenario Creation Stand-Alone Simulator (SAS) Functionality
Recording, Analysis and Playback	RAAP	Data Reduction and Analysis Display Recording and Playback Failure Reporting Analysis and Corrective Action System (FRACAS) SAR Recording
Site Tailoring	SITE	Product Construction Site-Specific Adaptation Data System Release Distribution System Release Planning
	TOOLS	Environment Support

4.1.2 AAS Change Instrument (ACI) Process.

All changes to SSCC-1 are tracked and documented by an ACI. The ACI is the single tracking instrument for all AAS problems and changes, including changes to hardware, software, adaptation data, and baseline documents that cover requirements, design, and testing. The ACI must be baselined, reviewed, tested, and approved before any changes become operational.

There are two kinds of ACIs: change ACIs and problem ACIs. Change ACIs are equivalent to Change Requests (CRs) in the HCS while problem ACIs are equivalent to Program Trouble Reports (PTRs) in the HCS. Both kinds of ACIs are employed by users of the AAS to document errors or deficiencies in its implementation, operation, or documentation.

In general, there is little difference between the CM life cycle of the two kinds of change instruments. However, there is a difference in the ACIs themselves. The change ACI is used when the operational system is functioning as required but may need to operate differently, and the problem ACI is used when the operational system is not functioning as required and needs to be fixed.

A user may open an ACI from any ARTCC by remotely logging on to the AAS Job Shop and selecting the Change Tracking option from the AAS ATC Operational Support and Tracking Menu. The resulting ACI resides in the database at the SSCC and is available for retrieval by authorized SSCC personnel who review the ACI and assign it to the appropriate analyst, organization, site, or other authority. Detailed information regarding the ten-step ACI life cycle is provide in appendix A, The Ten-Step ACI Life Cycle.

4.1.3 System Release Planning.

A system release is a collection of logic updates and/or adaptation data products packaged for a specific ARTCC. Each new system release is based on the previous system release. There are two kinds of system releases; base and delta.

A base system release is a complete, executable AAS segment system consisting of all software load modules and corresponding data products necessary to control air traffic at a particular ARTCC. Base system releases are distributed infrequently, approximately once per year.

A delta system release contains a subset of software load modules and is based on a system release which has been baselined. Delta system releases occur with some frequency and may or may not be coordinated nationally. The Technical Center generates logic changes and national adaptation changes. Delta releases resulting from these changes are national in scope and, therefore, are coordinated nationally. The ARTCCs handle local adaptation data changes and prepare delta system releases as dictated by local needs. A delta system release chains all the way back to the base system release.

A delta system release may consist of:

    a. Adaptation data products only
    b. Logic release data sets only
    c. Both logic release data sets and adaption data products

The relationship between a delta and a base system release is shown in figure 4.1.3-1, Relationship Between a Delta Release and a Base Release. For more detailed information regarding adaptation data products and logic release data sets, refer to appendix , Adaptation Data Update Procedures, and appendix C, Logic Update Procedures.

4.1.3.1 Planning a System Release.

The first step in preparing a system release is planning the system release by using the System Planning function of the AAS ATC Operational Support and Tracking software. The system release plan identifies which logic data sets and/or adaptation data products are to be included in a system release. A system release plan has two statuses, Pending and Baseline. Pending system release plans can be modified, baseline plans cannot. When a system release plan has a status of Baseline, no changes can be made and the plan can no longer be constructed.

4.1.3.1.1 Selecting a Logic Release.

When planning a system release, a logic release identification (ID) and a site ID must be specified. If the system release being used contains adaptation data only, then the logic release ID identifies the operational logic that must be used with the adaptation data products in the system release. The logic release must have been created previously using the Logic Release Planning functions and have a status of at least OPEN.

4.1.3.1.2 Specifying Selection Criteria for Adaptation Data.

Multiple versions of the same data may be stored in the database, therefore, the user must establish some criteria for selecting the correct version of the data to be used in the system release. Either the specific version of the data must be identified or some criteria must be specified to enable the software to choose the correct version of the occurrence.

There are several ways to determine which occurrences are to be used in the construction of the data products. General selection criteria such as the effective data, life cycle status, and occurrence purpose can be specified to influence the selection of occurrences during the construction process. In addition, individual occurrences can be marked for inclusion in or exclusion from the construction by specifying occurrence overrides. The user may use occurrence overrides to make single change while protecting the system release from any other changes. Furthermore, the data selection has the ability to show preference to occurrences created under certain ACIs for a particular system release.

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Base System Release

- All logic data sets
- All data products

Delta System Release

- Logic changes
- Changed data products

Delta System Release

- Logic changes
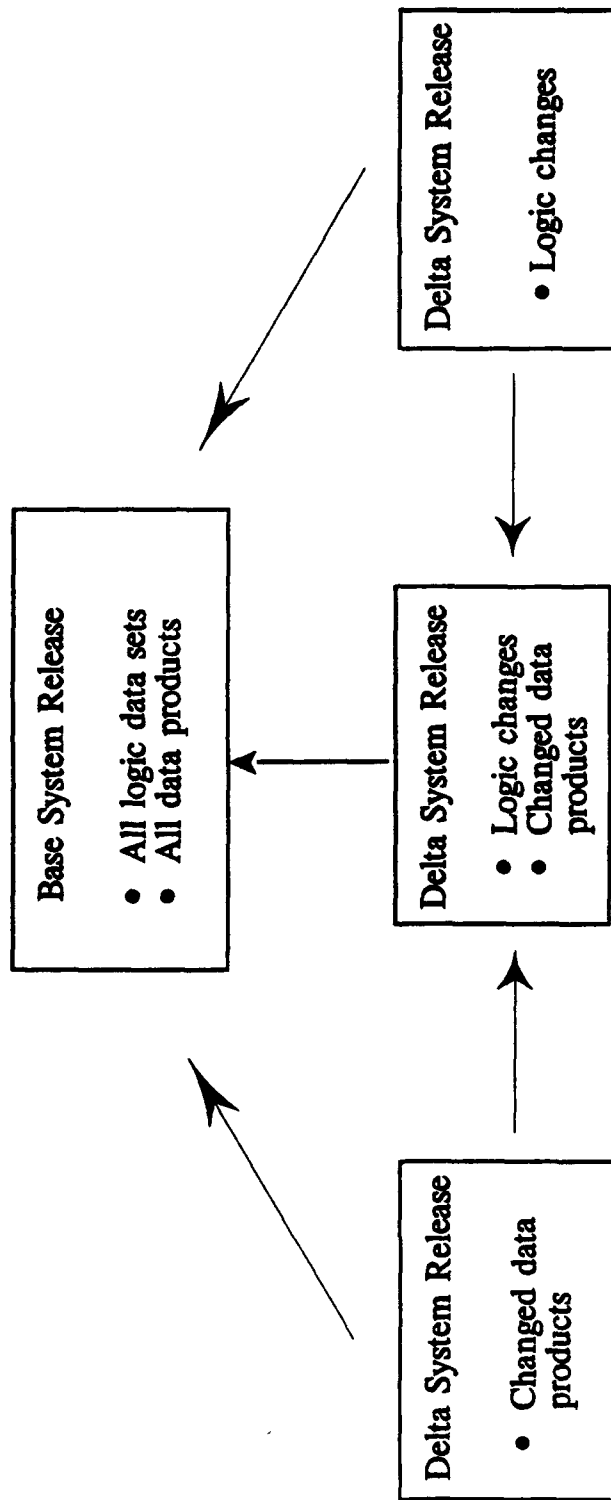
Delta System Release

- Changed data products

FIGURE 4.1.3-1. RELATIONSHIP BETWEEN A DELTA RELEASE AND A BASE RELEASE

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4.1.3.1.3 Specifying the Construction List.

After the data occurrences for a system release are chosen, the data is converted into data products, a computer readable form of data occurrences. A construction list is required in order to include adaptation data in a system release.

The construction list specifies which data products are to be constructed for the system release. The user may select the data products directly or indirectly. Either the user specifies directly which data products will be part of the system release, or the user specifies which categories of data or which ACIs are to be processed and allows the System Release Planning function to determine which data products to build.

When categories are selected for a system release, a predefined category to data product map is used to determine which data products to construct. When ACIs are selected for a system release, the software determines which categories are referenced by that ACI, and then uses the same category to data product map to determine which data products to construct. Only data products can be deployed to a center. Categories cannot be deployed to a center.

When a system release plan is created, it includes a construction list containing all of the data products for the specified logic release. For a base system release, there is a fixed number of data products and the system requires these data products in order to execute successfully. Thus, when a base plan is created, a construction list is automatically generated and cannot be changed. The user, however, must still identify the specific data occurrences to be used to construct the data products.

When a delta system release plan is created, the construction list is copied from the system release plan upon which the delta plan is based, or from another system release specified by the user.

4.1.3.1.4 Constructing Data Products.

Adaptation data as it is collected and stored is not usable by the operational software. Before the data can be used by the operational software at an ARTCC, it must be converted into data products. An adaptation data product is a constructed adaptation object file consisting of source adaptation data values that have been converted to the form required by the AAS real-time application software.

The sequential data sets that comprise the data products to be used with a system release are stored in MVS files. These data products are unique to each ARTCC.

Adaptation data products are defined by an Ada typing package. Because the data collector's view of the data is likely to be quite different from the way the operational software needs to access that data, a particular category does not necessarily correspond to only one data product.

Data construction is performed in the background because of the amount of processing time required for this task. The user may select a subset of the data products to be constructed for a system release. Constructing only a few data products at a time allows the user to check the results of the construction and correct any problems before continuing. This checking is important because if the construction of a data product fails, the subsequent construction of related data products may also fail.

4.1.3.2 Test Shipping a System Release.

Test shipping allows the user to ship a pending or baseline system release to an ARTCC or to the SSF for testing. This gives the user the ability to fully test the system release and to make any necessary changes before it is baseline. (A baseline system release cannot be modified, which means that any errors found in a baseline system release may be corrected only by creating another baseline system release.)

A test shipment may contain a subset of a system release's adaptation data or logic. Rather than ship a complete system release, the user may choose to ship a subset of the system release. The user selects the desired adaptation data or logic and ships it to the desired facility. This feature is useful because the system release has not been baselined and the logic release may not yet have been marked deployable. The deployment control file identifies the system release as a test shipment. No deployment record is created. Report receipt and report cutover cannot be performed, even if a complete system release is shipped.

4.1.3.3 Deploying a System Release.

The act of sending a complete, successfully tested system release from the Technical Center to the ARTCC is referred to as the deployment of the system release. The system release is deployed to the ARTCC by selecting the Deploy System option on the System Distribution Panel, which is an option on the AAS ATC Operational Support and Tracking Menu. A system release must meet several criteria before it can be deployed to an ARTCC for use as operational software:

a. The logic release associated with the system release must have a status of DEPLOY, even if the logic itself is not being deployed with the system release.

b. All data products must have been constructed successfully.

c. The system release plan must have been baselined. A baseline system release plan can no longer be modified. The selection criteria and construction list cannot be changed and the data products cannot be reconstructed for that system release.

When these standards are met, the system release is ready for deployment to the ARTCC. Base system releases and large delta system releases are deployed to the ARTCCs by loading the system release files onto tapes and physically shipping the tapes to the ARTCCs. An electronic link is used for deploying relatively small delta system releases.

There are two stages to the deployment process. The first stage verifies the existence of each data set to be distributed and tailors the distribution job via a background job. If there are no errors in the first stage, the distribution job is automatically submitted to perform the second stage. The second stage processing creates the deploy headers which contain information about each of the files that make up the system release, performs check sum processing to ensure that files were not corrupted during the deployment, and copies the required files to tape or transmits them over the electronic link, whichever is appropriate.

4.1.4 Adaptation Data.

According to the centralized software maintenance concept, all ARTCCs must use the same operational software for ATC. Since each ARTCC has different needs, it is necessary to have a method of customizing the software. To meet these needs, each ARTCC uses site specific sets of data. The term adaptation describes the process of making the operational software capable of performing ATC functions at a particular ARTCC. Adaptation of the logic is performed through this special set of data, and conversely, the operational software needs this adaptation data in order to provide ATC services at each ARTCC.

Many ARTCC-specific changes can be accomplished by updating only the adaptation data. For this reason, the operational software is designed to be table driven. The behavior of the software is dependent on certain data, stored in tables, that is kept separate from the logic so that the data can be changed, when necessary, in a relatively simple manner. This design eliminates the need to modify and retest the operational software each time a data change is made.

Adaptation data describes the geographical, physical, and operational environment within which an ARTCC operates. Geographical and physical data describe a particular center's environment while operational data alters how the operational software performs.

Geographical adaptation data includes static maps and text, airport and fix locations, and terrain (minimum safe altitude) information. Physical adaptation data describes computer hardware elements, aircraft characteristics, and radar characteristics. Operational adaptation data includes such data as ISSS display definitions, air space definitions, system parameters, and radar sort boxes.

Adaptation data can be divided into two categories: preset data and facility data. Preset adaptation data is built and tested as part of a logic release. Facility adaptation data tailors the operational software to the specific requirements of each ARTCC. Figure 4.1.4-1 shows the adaptation data types.

4.1.4.1 Preset Data.

Preset adaptation data, such as command formats and command-related error messages, is built and tested as part of a logic release at the Technical Center. It is the same for all ARTCCs and cannot be changed by those centers. The AOS software developers who modify the operational software use the SCLM development environment with special tools to prepare preset adaptation data. Site adaptation data specialists do not enter or maintain preset adaptation data.
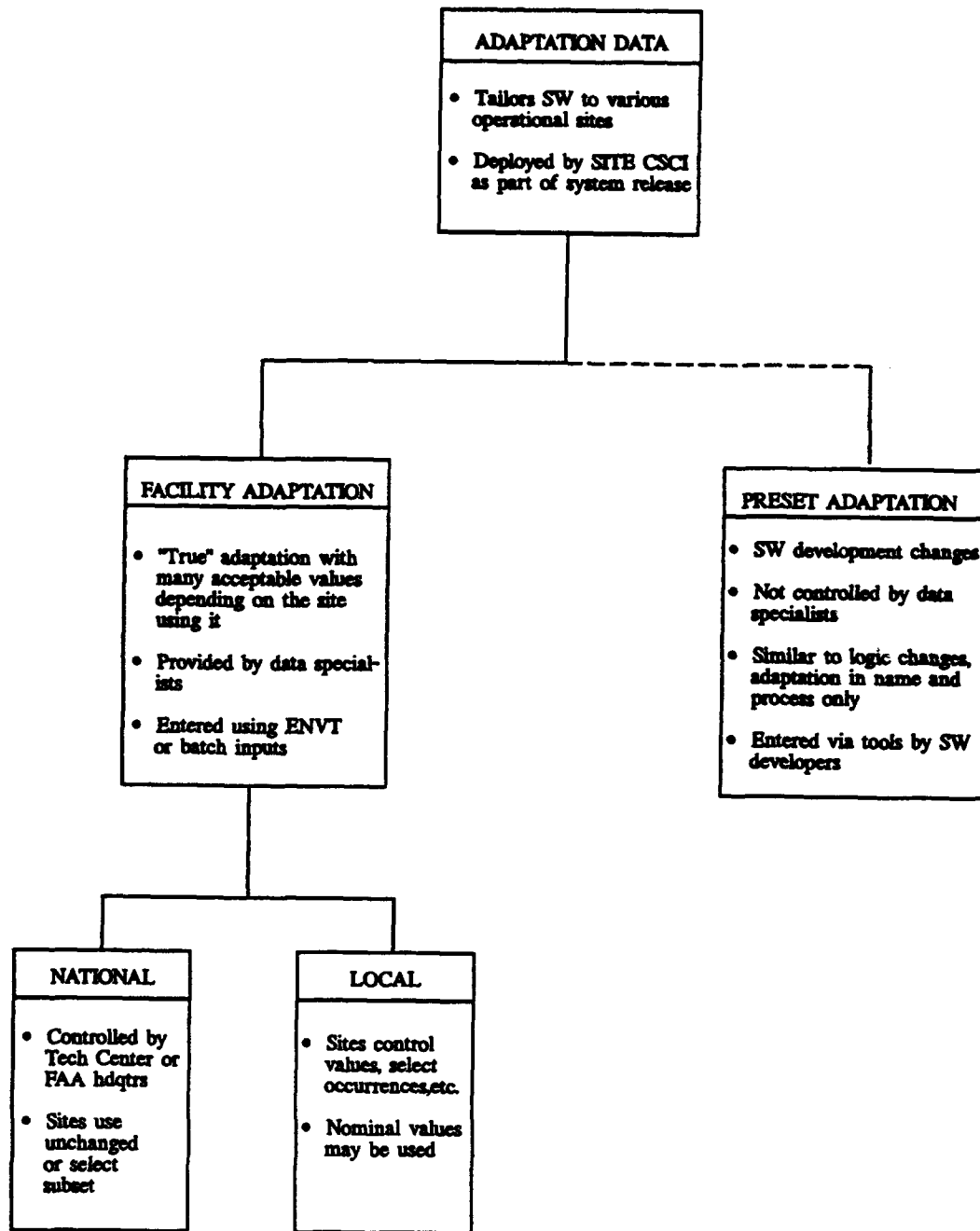
```
                    ┌─────────────────────┐
                    │   ADAPTATION DATA   │
                    ├─────────────────────┤
                    │ • Tailors SW to various
                    │   operational sites │
                    │                     │
                    │ • Deployed by SITE CSCI
                    │   as part of system release
                    └──────────┬──────────┘
                               │
           ┌───────────────────┴ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─┐
           │                                              │
┌──────────────────────────┐              ┌──────────────────────────┐
│   FACILITY ADAPTATION    │              │    PRESET ADAPTATION     │
├──────────────────────────┤              ├──────────────────────────┤
│ • "True" adaptation with │              │ • SW development changes │
│   many acceptable values │              │                          │
│   depending on the site  │              │ • Not controlled by data │
│   using it               │              │   specialists            │
│                          │              │                          │
│ • Provided by data special-            │ • Similar to logic changes,
│   ists                   │              │   adaptation in name and │
│                          │              │   process only           │
│ • Entered using ENVT     │              │                          │
│   or batch inputs        │              │ • Entered via tools by SW
└────────────┬─────────────┘              │   developers             │
             │                            └──────────────────────────┘
      ┌──────┴───────┐
      │              │
┌───────────┐  ┌───────────┐
│ NATIONAL  │  │   LOCAL   │
├───────────┤  ├───────────┤
│• Controlled by│ • Sites control
│  Tech Center or│   values, select
│  FAA hdqtrs │  │   occurrences,etc.
│             │  │
│• Sites use  │  │ • Nominal values
│  unchanged  │  │   may be used
│  or select  │  │
│  subset     │  │
└───────────┘  └───────────┘
```

FIGURE 4.1.4-1.   ADAPTATION DATA TYPES

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Because preset adaptation data is associated with a given logic release and is not changeable by each ARTCC, the CM requirements on preset adaptation data are different from those for other adaptation data. Once preset adaptation data is entered, the data is associated with the appropriate logic release and is moved into the data sets containing that logic release. These data sets are controlled using the SCLM.

4.1.4.2 Facility Data.

Facility adaptation data adjusts the operational software to suit the needs of a specific ARTCC, therefore, the data differs from one center to another. Facility adaptation data can be further subdivided into national and local data. FAA authorization procedures control whether data is classified as national or local. This classification limits who can enter or change the values of each type of data.

National facility adaptation data is data that is collected and maintained at the SSCC and used by all ARTCCs. National facility adaptation data cannot be modified by ARTCC personnel. The data is updated regularly by authorized AOS personnel in a cycle which is described in appendix B, Adaptation Data Update Procedures. Since a particular center does not necessarily use all of the national adaptation data, center personnel may select the data they wish to use. Static information charts and textual information such as the Airman's Information Manual are typical examples of national adaptation data.

Local facility adaptation data is completely defined and managed by each ARTCC. Local data consists of, for example, the hardware configurations, geographical boundaries, and sectorization data for a specific ARTCC. This data is generally meaningful only to the center that defines it.

4.1.4.3 Organization of Adaptation Data.

Adaptation data is subdivided and categorized so it can be stored and managed in self-contained units that are closely associated with the physical world and related personnel responsibilities. Adaptation data is organized according to a hierarchy consisting of data items, categories, occurrences, and families.

An adaptation data item defines one field in the adaptation record, such as a processor ID or a threshold value. Related data items that are to be collected and maintained as a unit are grouped into categories.

A category is a group of related data items organized around real-world objects. It is tailored to the data collector's view of adaptation data.

An occurrence is a particular, unique instance of a category in which values are provided for the data items in the category. Adaptation data items within a particular category are collected and maintained as an occurrence. An occurrence is the lowest level of granularity for adaptation planning, collection, and CM functions. Occurrences are also the lowest level of adaptation data that can be selected for a system release. A given category may require one or more occurrences for each ARTCC.

An adaptation data family is a collection of related categories. It reflects a knowledge set for which a data collector may be responsible and provides various processing paths for accessing the categories.

4.1.4.4 Nominal Values.

During development and testing of the operational software, certain values for some adaptation data occurrences have been identified as optimum, meaning that they worked well under many circumstances. These values are called nominal values and may be copied into new occurrences. Users may request a report that lists all nominal values.

4.1.4.5 Related CSCIs.

Adaptation data is processed by the ENVT and SITE CSCIs. The ENVT CSCI provides the user interface and supporting functions for collecting and maintaining adaptation data in DB2. The SITE CSCI provides the user interface and supporting functions for preparing system releases to run on the ATC computers at the ARTCCs. These functions allow the user to plan a system release, construct data products, and distribute a system release. Both ENVT and SITE interface with the CCAB CSCI, as well.

The CCAB provides ENVT with tracking information on adaptation data changes and on software changes associated with data changes, while ENVT provides CCAB with the status of adaptation data changes. The ENVT also maintains the authorization list that CCAB and SITE use to verify a user's authorization to perform a requested function.

The SITE uses CCAB to determine which logic release(s) are to be associated with a system release, and uses the data stored by CCAB to verify AAS logic release names. SITE provides CCAB with system planning information for reporting. The CCAB provides SITE with the list of logic data sets comprising a logic release and compatibility data used to control planning and constructing data products that will be used in the logic release.

4.1.4.6 Adaptation Data Update Procedures.

The ACI is the tool used to keep track of all changes to adaptation data. Once an ACI has been opened for an adaptation data occurrence, data may be added or modified using the Data Collection function of the AAS ATC Operational Support and Change Tracking software.

The term data collection is used to describe the process of entering new or modifying existing adaptation data. Adaptation data is collected and maintained at the SSCC as part of the centralized maintenance concept. This enables the personnel who are responsible for site adaptation of the AAS operational software to access it as needed. Center personnel log on to the SSCC remotely and enter or update adaptation data pertaining to their center by using the Data Collection function of the AAS ATC Operational Support and Change Tracking software.

Adaptation data may be entered or modified by many different users, at all times of the day or night, and for many purposes, including test, problem correction, and future planning. If unapproved data is selected, appropriate error and warning messages are generated to ensure that such selection is properly flagged. This CM step provides protection against inadvertent errors, da transmission errors, and outright attempts at sabotage. Strict conformance to CM guidelines is required to maintain system integrity.

Making changes to adaptation data involves a series of actions. The specific steps required to make a change to adaptation data depend on the circumstances and the particular adaptation task being performed. The general procedure for updating adaptation data is as follows:

    a. Open an ACI using the Change Tracking function of the Support Software.

    b. Add, maintain, and configuration manage adaptation data using the Data Collection function.

    c. Plan a system release incorporating adaptation data updates using the System Planning function.

    d. Construct data products from the adaptation data occurrences using the Data Construction function.

    e. Deploy the system release to an ARTCC using the System Distribution function.

These functions are illustrated in figure 4.1.4.6-1, Support Software Processing of Adaptation Data. Detailed information on making changes to adaptation data is provided in appendix B, Adaptation Data Update Procedures.

4.1.5 Logic Release.

A logic release is a set of related operational software used to generate a deliverable system. A logic release may be as small as a single software element. This allows the release of emergency corrections to resolve critical operational problems. The logic release may be a combination of several operational changes. Some possible items in a logic release are Ada source and executable load module(s), Job Control Language (JCL), MVS, and TSO commands in a Command List (CLIST).

A logic release plan is a collection of information about a logic release which includes a schedule for building and promoting a logic release and a record of all the ACIs and associated software and documents that are included in the logic release. A logic release plan is necessary to develop and deliver a logic release.

There are two types of logic releases; base and delta. A base logic release contains a full set of logic. A delta logic release contains a subset of the logic. A delta release is used when only a portion of the logic is being replaced and contains only the components to be replaced. A delta logic release chains back to the base logic release.
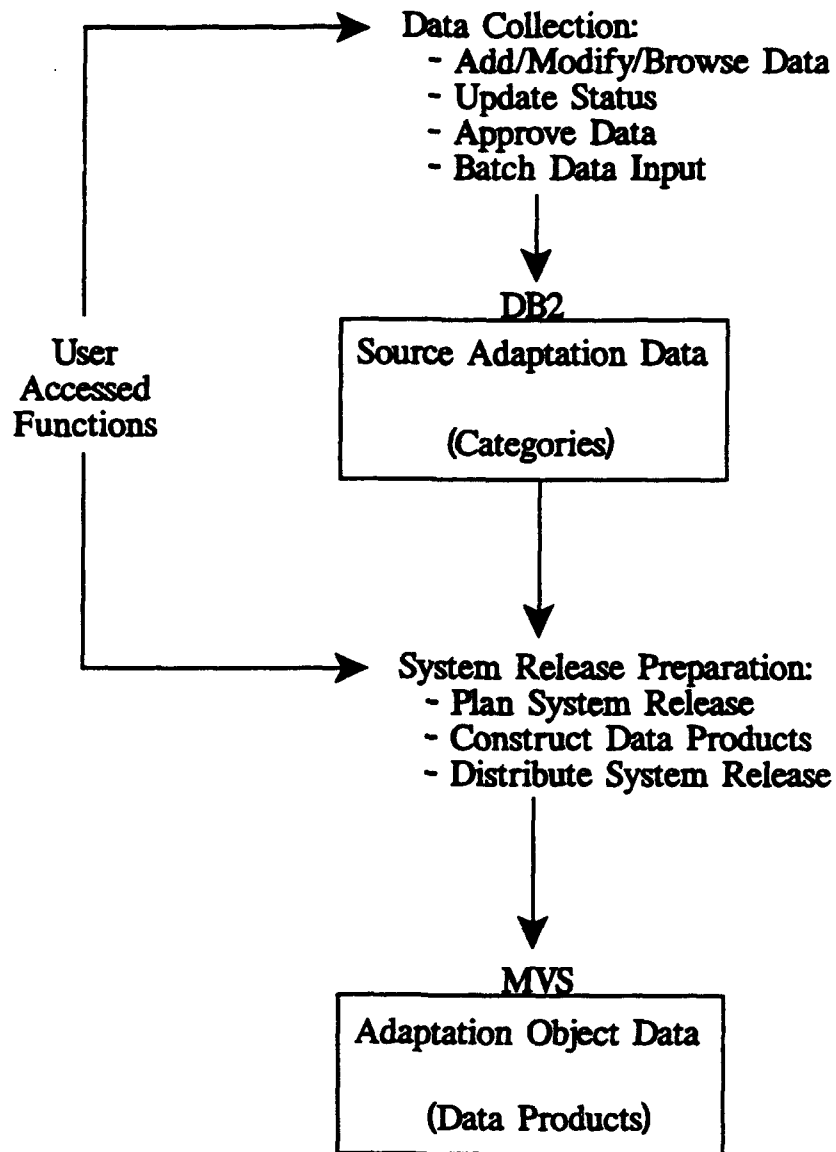
Data Collection:
- Add/Modify/Browse Data
- Update Status
- Approve Data
- Batch Data Input

User
Accessed
Functions

DB2

| Source Adaptation Data |
| (Categories) |

System Release Preparation:
- Plan System Release
- Construct Data Products
- Distribute System Release

MVS

| Adaptation Object Data |
| (Data Products) |

FIGURE 4.1.4.6-1.   SUPPORT SOFTWARE PROCESSING OF ADAPTATION DATA

Logic release files are the software components which comprise a logic release. The logic release plan identifies which logic release files will be included in a particular base or delta logic release. The user identifies which logic release is to be associated with the planned system release using the System Release Planning function.

The AAS-developed code and documentation is maintained in a hierarchical library management system, i.e., SCLM. The SCLM administrators are ACN-600 personnel. The SCLM administrators set up the library for a new release of documentation or code, allocates the necessary datasets, and defines the necessary library hierarchy. The hierarchy is defined with a SCLM project definition. This project definition identifies all library types and sections necessary for the development, testing, and deployment of the logic release. Once the SCLM project definition is defined, it must be assembled under SCLM using the Library Definition Translator provided by AAS. This creates the logic release plan with a status of NEW and the logic release plan is ready to be opened by the AOS software developers.

Operational logic is updated by AOS personnel using the AAS Operational Support and Tracking software. The revised logic, in the form of a logic release, is available for deployment to the ARTCC(s) according to a cycle which is outlined in appendix C, Logic Update Procedures.

4.1.5.1 Logic Update Procedures.

The ACI is the tool used to keep track of all changes to operational software. Once an ACI has been opened for the operational software, logic may be added or modified using the Logic Planning function of the AAS ATC Operational Support and Change Tracking software.

The procedure for updating operational software consists of several general functions, each of which has associated subfunctions. Although the general functions are required in order to make the changes, in many cases the specific tasks within a major function can be done in a somewhat different order or by a different organization.

The major steps for developing software are as follows:

    a. Open and process an ACI
    b. Assign the ACI to a logic release
    c. Develop the software
    d. Unit test the software
    e. Integrate and test the software
    f. Update documentation
    g. Install the new software into the production environment

Detailed information regarding the logic update procedures is provided in appendix C, Logic Update Procedures.

4.1.6 Software Development and Test.

All code will be developed and tested in the AAS Job Shop at the Technical Center. There are several software languages used in the AAS code. Ada is the primary language. Ada code can be developed and unit tested using the Rational R1000 system or the NCF. Other software languages used to interface with the commercial software products in AAS include Cross System Product (CSP), Assembler H (INFO), ISPF Language/SCLM Requirements File (REXX), CLIST, ISPF, and Assembly. These are languages for the support system, and they will be developed and unit tested on the Job Shop. All code is integration tested on the Eagle RISC-9000 processor. The Eagle RISC-9000 processor is the upgraded version of the RISC-6000 processor capability.

The central processing complex will provide the software development base. It will provide automated compilation, build control, and centralized CM for all developed software. The Rational R-1000, consisting of specialized processors, terminals, and software will provide dedicated Ada support suitable for the development of software through functional unit test. The programmable workstations will provide the eagle environment for unit testing Ada code.

The software maintainer uses SCLM to edit, build, and promote source code, such as Ada, stored in partitioned data sets on MVS. The SCLM build function is used to compile, link, and integrate software components. SCLM stores and makes available on-line two versions of the software for each operational AAS facility.

4.1.6.1 Software Development Procedures.

Under AAS, all system changes must be identified by ACIs. This includes modification of existing software and addition of new software functions. Logic Maintenance follows the steps outlined for a problem ACI. Logic update procedures are outlined in section 4.1.5, Logic Release.

4.1.6.2 Software Development Applications.

CAS products and AAS-developed computer software subsystems, will be used with the AAS Job Shop. Such program development support software includes compilers, assemblers, dialogue managers, application generators, editors, and documentation tools. Ada will be the primary language used for AAS software development.

4.1.6.2.1 Ada.

The IBM Development System for the Ada Language operates in the AAS Job Shop at the SSCC and provides High-Order Language (HOL) compilation support of AAS-developed software. It includes an Ada programming support environment, providing tools such as:

    a. Cross-referencing tools
    b. Interactive development support tools
    c. Debugging aids and testing tools
    d. Standard compliance and verification tools

The IBM Development System for the Ada Language System/370 provides an Ada compiler, a run-time library, a global optimizer, and a symbolic debugger for application development on the System/370 under MVS/XA.

The MVS Ada compiler both compiles and binds. The compiler processes Ada source files, producing, and storing object code in the Ada program library. The binder links the object code in the library to produce an object file. The compiler uses the MVS linkage editor, making the object file executable. The Ada source can be either an entire or a partial program. The Ada source file can include the following:

a. Main Program
b. Package Body
c. Package Specification
d. Other Ada compilation units

The use of compilation units allows the construction of large Ada programs from small, maintainable program portions. The compiler generates syntax and semantic error messages when necessary. If there are syntax and semantic errors, the compiler does not generate object code. The binder links together object code for compilation units which need to access each other during run time. When an entire Ada program executes, the compiler generates object code for the Ada main program, which is the compilation unit receiving control first. It then accesses the Ada program library and links together all object code generated for each compilation unit of the Ada program. The binder produces bound object code in the IBM System/370 object format which is then ready to be link-edited and executed.

The run-time libraries allow application execution on a System/370 processor other than the one used for development. The application's load module can be transferred to other machines where run-time library routines will be called during application execution. The IBM Ada Run-Time Environment S/370 operates in all AAS System/370 central processors, allowing execution of Ada applications compiled in the AAS Job Shop.

The Global Optimizer works in conjunction with the Ada compiler. The main job of the Global Optimizer is to make the Ada code more efficient. It optimizes global components of HOL to increase the performance of Ada code.

The MVS Symbolic Debugger allows users to examine the behavior of an executing Ada program as if the Ada source itself were executing. It is a source-level debugger because it allows users to work with Ada source construction units like lines of code and compilation units. It is also a symbolic debugger because it lets users work with Ada data objects using symbolic names instead of machine-code values.

4.1.6.2.1.1 Ada Support Environment Tools.

The MVS Ada Programming Support Environment (APSE) is an AAS-developed front-end to the IBM commercial product Interactive System Productivity Facility/Program Development Facility (ISPF/PDF) which allows user to analyze Ada source code, format it, and generate various output files based on the input of the Ada source code. Ada has several tools that provide this functionality. These tools are:

a. The Ada Debugger Interface Tool. Provides an ISPF/PDF panel that allows full-screen interaction between the MVS Ada Symbolic Debugger and the user. Before using the tool, the user must allocate a data set named DEBUG.LIBRARY with the user's USERID as the high-level qualifier. Users can run this tool in either foreground or background mode.

b. The Ada Complexity Tool. Provides an ISPF/PDF panel that allows the user to specify the name of one or more Ada source files for computing the complex number for all program units in the source code. The tool uses the McCabe complexity number as a standard, and provides a breakdown of splitting nodes and a normalized complexity number for the Ada source code the user wanted to measure. Users can run this tool in either foreground or background mode.

c. The Ada Source Counter Tool. Provides an ISPF/PDF panel that allows the user to specify the name of one or more Ada source files for computing sets of statistics with respect to the source code. The tool counts semicolons, Ada lines, comments, and Ada statements, and then categorizes Ada statements into executable, declarative, and directive functions. Users can run this tool in either foreground or background mode.

d. The Ada Source Formatter Tool. Provides an ISPF/PDF panel that allows the user to specify the name of one or more Ada source files for formatting to comply with all established AAS project standards and guidelines. The user can invoke the tool using the AAS-developed edit macro FORMAT while editing a partitioned data set under AASPDF. Users can run the panel interface version of this tool in either foreground or background mode.

e. The Ada Publisher Tool. Provides an ISPF/PDF panel that allows users to specify the name of one or more Ada source files for formatting to produce output that can be further processed using SCRIPT/VS or Bookmaster to yield attractive hardcopy output of source code. The document contains a title page, table of contents, and highlights Ada keywords in boldface type. Users can run this tool in either foreground or background mode. If the user runs the tool in foreground, the tool invokes EZPrint at the completion of processing to allow the user to print the formatted document.

4.1.6.2.1.2 Ada Maintenance Using the NCF.

The NCF allows the IBM 3090 to communicate with the RISC System/6000 for performing Ada compilations of RISC-targeted code. The source code and compiler outputs are configuration managed on the 3090 under SCLM. The compiles are performed on RISC/6000 processors via a networking mechanism invoked from the 3090. There are three types of commands that SCLM is able to request from the NCF:

a. Ada compile
b. Ada Bind
c. Ada Promote/Purge

The compile function is used to add or update an Ada compilation unit to an Ada sublibrary and generate its object code. When users invoke the compile function, SCLM determines what work needs to be done to compile the unit(s). This work is relayed to one of the dedicated NCF RISC Processors. Upon completion of the work, the NCF RISC sends back its results. The SCLM then scans the results for success or failure return codes and updates its database and files accordingly.

The bind function invokes the compiler binder and Advanced Interactive Executive (AIX) linker on a dedicated RISC and generates a RISC-targeted executable file which is retained under SCLM control. When the user invokes the bind function, SCLM determines what sublibraries are needed to perform the bind and creates an executable. The list of sublibraries and required linker system files are sent to one of the dedicated NCF RISCs. Upon completion of the work, the NCF RISC sends back its results and the executable code. SCLM then scans the results for success or failure return codes and updates its database accordingly. Results of the bind can be found in the MVS job queue output. The executable code can be found in the SCLM-controlled partitioned data set for executables.

The purge and promote functions allow for copy and removal of one or more RISC-targeted compilation units from their sublibraries as well as the copy/removal of their corresponding SCLM database records. When the user invokes the purge or promote function, SCLM determines what needs to be done to compile the unit(s). This work is relayed to one of the dedicated NCF RISCs. Results of compilation can be found in the MVS job queue output. The Ada sublibraries and archived object code containing data associated with the compiled unit(s) are updated under MVS third-level qualifier.

4.1.6.2.1.3 Software Development Tools.

Software development and maintenance tools for the RISC System/6000 are divided into two categories: IBM 3090-resident and RISC 6000-resident. The 3090-resident tools are:

a. Software Configuration and Library Manager (SCLM) is a CM tool that is used for logic development and maintenance. It is an extension of ISPF/PDF and has procedures for building, manipulation, and tracking data stored in the AAS project databases. The SCLM enables a user to build, promote, browse, create, edit, update, and delete data stored in a data library. These functions are automated under SCLM.

b. System Display and Search Facility (SDSF) is a useful tool on MVS. While using SDSF panels, users can hold, release jobs, cancel jobs, find out if jobs are being processed or waiting to be processed, view output before it is printed, print selected portions of a job's output, or purge a job's output.

c. Cross-Compiler and Cross-Linker C language code that resides on the IBM 3090 under MVS/XA is processed for use on the RISC System/6000 processor. The C compiler reads C source files and generates assembly language that the assembler translates to object modules. Once object modules are created, the IBM linkage editor, or loader, combines the object modules with appropriate members from the C library and generates an executable file.

d. Ada MVS Debugger Interface. This tool is an interface between the MVS Ada Symbolic Debugger and the IBM Ada/370 Debugger. It duplicates the functions of the product compiler invocation of the debugger. The debugger works only for programs written in Ada and compiled by the IBM/Telesoft Ada compiler for MVS-targeted code.

e. Assembler Language input to the assembler is called a source module. Assembler translates the source module into an object module. The object module is then read into the computer and processed by a linkage editor or loader. The linkage editor prepares a program for execution by creating a load module, then storing the program in a load module library. Once the program is included in a permanent load module library, it may be executed without assembling and link-editing.

When the IBM RISC System/6000 tools are used, all source code and outputs of that code are configuration managed on the 3090 Job Shop via SCLM. The term self-host refers to code that is both developed and maintained on the RISC System/6000 processors. The primary RISC System/6000-resident software development tools are:

a. Advanced Interactive Executive (AIX) Operating System. The AIX is used on the RISC System/6000 processor to allow users and application programs to interact with RISC System/6000 computers. Users can directly manage files on a disk, start application programs, and print files. AIX supports C, Assembler, and Ada programming languages. AIX comes with two full-screen editors, as well as a symbolic debugger that is used for debugging programs.

b. Ada/6000 Compiler (Self-HOST) occupies between six and seven megabytes (MB) of disk space. It occupies 30 MB if users include compiler executables, support files, and runtime libraries. The Ada compiler can be used under both AIX shell programs, sh and csh. The sh program is the default shell interpreter. Csh is a more advanced shell that provides command line recall and editing. To establish an environment, a user usually edits the shell program that is executed at login. These shell programs are contained in files in the default (login) directory. The files are named profile for the sh shell and login for the csh shell.

c. Symbolic Debugger For AIX Ada/6000 is a helpful tool for correcting errors in an Ada program. On the AIX operating system, the symbolic debugger may be used to debug programs written in Ada, C, and Assembler language. The symbolic debugger enables users to:

1. Debug programs at either the source language or assembler language level.

2. Run a program one line or one instruction at a time.

3. Examine the source text using simple search functions or the user's own editor.

4. Trace execution of a program by line, instruction, routine, or variable.

4.1.6.2.1.4 Ada Maintenance Using Rational R1000.

On the AAS project, the Rational processors are being utilized for AAS software development. These processors were obtained with the intent of mitigating risk associated with Ada software development. The Rational Development Environment is designed for improving the overall productivity associated with developing Ada software. The Rational environment has three main capabilities:

a. Command Line Interface. The interface to the environment for issuing system commands is presented as an Ada block. Within this block, it is possible to write detailed Ada programs using any Ada construct. The most common use of the command line interface is to invoke the Rational environment system commands. All Rational commands are represented as Ada subprograms that are invoked via the "declare block." This complete use of the Ada language in all aspects of the environment increases the user's awareness and knowledge of the Ada language.

b. Knowledge Based Editor. The task of developing Ada software on the Rational is greatly enhanced by the use of the Rational syntax directed editor. The editor can perform the mundane tasks that are typically left to the user. Chores such as insertion of redundant keywords, named association of procedure call parameters, and adjustment of indentation levels are a few of the items that can be handled automatically by the editor.

c. Compilation Facilities. The Rational environment provides an assortment of facilities for compiling Ada units. Within the Rational editor, syntax and semantic compilation can be invoked by pressing a single function key. The most innovative aspect of the Rational compilation facility is incremental compilation. Rational maintains object dependencies. If a given object is to be changed, Rational's compilation facilities can determine the dependent objects that would be affected. This allows functions such as editing comments specifications, or adding new subprograms to package specifications to be performed, without requiring recompilation of the dependent units. This feature alone can have tremendous benefits in reducing the compilation time associated with developing Ada software.

The Rational development environment is a viable alternative to creating new software on the 3090. When new software is created, the supporting software would need to be in existence on the Rational processor in a compiled state. For development of Ada software on the AAS project, using Rational processors for new development of large software modules through the unit test phase of the software is very essential. This requires Ada specifications and working bodies for the supporting common software. Unit testing on the Rational processors allow the developer to make use of the Rational facilities to verify that the logic paths within the software are correct.

4.1.6.2.2 Cross System Product (CSP).

Cross System Product (CSP) is a fourth-generation-language application generator designed to increase programmer productivity. It produces applications that are portable and easy to maintain. CSP is composed of two products:

a. CSP/Application Development (CSP/AD) which provides complete facilities for pro: ammers to define and generate applications.

b. CSP/Application Execution (CSP/AE) which executes the generated programs in a production environment.

The CSP, with its built-in DB2 interface, is used in the implementation of the support software operating in the AAS Job Shop. Portions of CCAB, ENVT, and SITE are implemented in the CSP language.

The Cross System Product Programmers Workbench (CPW) provides a complete CSP development environment that significantly improves the productivity of CSP application developers. The CPW provides a common interface to both the CSP/AD and CSP/AE products. The CPW tools allow application developers to interact with the CSP/AD and the CSP/AE products with a minimal amount of system knowledge. Many of the CPW tools provide an interface to CSP/AD batch commands, which allows the interactive session to continue while CSP processes jobs in the background. The CPW tools provide functions that supplement CSP, such as preparing applications for execution with DB2.

The CPW automates many CSP system administration functions:

    a. Creating, moving, and deleting Member Source Libraries (MSLs) and Application Load Files (ALFs).

    b. Maintaining MSLs and ALFs.

    c. Managing security authorization to restricted CPW functions and restricted MSLs and ALFs.

The CPW tools can operate multiple levels of products, such as CSP and DB2, and other environment-specific requirements, such as supporting multiple DB2 subsystems.

There are three methods that exist to test a CSP application:

    a. Write and immediately test. The code may be tested after the application is coded using CSP/AD.

    b. Code, generate, and test. Generate application, translating the source into an executable module stored in the ALF. Then test through CSP/AD.

    c. Generate module into ALF. Code under CSP/AD. Then generate using the test facility under CSP/AE.

After the CSP application is built and tested, the CPW promote tool is used to promote the application up the hierarchical levels.

4.1.7 Documentation.

The documentation maintenance system that resides on the AAS Job Shop, combines CAS products with AAS-developed software tools and panels to form a comprehensive procedure for managing documents.

Documentation changes are managed using the ACI process. A single ACI is used to control modifications to AAS documentation across multiple system releases. With documentation, the unit of tracking for the ACI is the document.

Whenever possible, CAS is used to develop and maintain AAS documentation. IBM's design stipulates the use of the BookMaster CAS product as the word processing language to produce the AAS technical manuals. FAA Documentation maintainers (ACN-600) plan to use a different CAS product, Interleaf, to maintain AAS documentation. A study performed by ACN-600 found Interleaf to be more compatible across government agencies and more versatile across the various computer platforms. ACN-600 plans to use a filter to convert AAS documentation from Bookmaster on the AAS Job Shop to Interleaf.

4.1.8 Resource Scheduling.

In order to assure the availability of resources within the SSCC, all potential users must request the use of facility equipment and support. The resource scheduling CAS product provides a means to manage resources and facilities, and their use. It provides for defining laboratory resources and scheduling time in the laboratories. Functions performed by the resource scheduling software include:

    a. Create request
    b. Modify request
    c. Browse request
    d. Delete requests
    e. Cancel requests
    f. Browse facility information
    g. Browse resource information
    h. Create schedule and usage reports
    i. Maintain facility schedules
    j. Maintain facility definitions

ACN-600 is responsible for coordinating the user requests and the management of SSCC resources. ACN-600 will use the resource scheduler information and reports to accommodate user requests.

The resource scheduling software is accessible by selecting the Resource Scheduling option on the AAS Administration and System Support Menu.

4.1.9 Remote Logon.

The site support maintenance team is responsible for ensuring that the AAS system operates correctly and that all related hardware components and software systems are operational. To achieve this goal, the site support personnel must establish and control the environment; recognize and report problems; test, verify and install new system releases and hardware equipment; and assist in the update of site adaptation data.

To support field problem resolution, AOS personnel have the capability to logon to the support processor at each field site. This capability enables AOS maintenance personnel to respond quickly to critical problems by accessing relevant data at the site for problem analysis.

Since the source version of the software and adaptation data will reside at the Job Shop, site software personnel must interact with SSCC personnel and Operational Field Support personnel to report problems, receive logic releases, or update their adaptation data. If communications with SSCC-1 are lost, the ARTCC will have the capability to perform emergency software maintenance autonomously.

4.2 FACILITY AND SIMULATION CONTROL (F&SC) OPERATIONS.

The F&SC subsystem, which encompasses the FCC and the SAS, provides resources for performing the following major functions:

a. Managing site configurations of the SSF for:

    1. Software modification support
    2. Hardware modification support
    3. System testing and verification support

b. Monitoring and controlling the configuration of SSCC resources

c. Initiating simulation scenarios

Managing site configurations involves coordinating with the requestor (e.g., software/hardware developers, testers, or trainers) to determine the specific demands for the SSF as well as physically configuring the SSF to logically replicate the desired field site. Coordination includes identifying the purpose of the request and scheduling the event. To physically reconfigure the SSF, the F&SC operator obtains the site configuration and accesses the software logic and adaptation data from the Job Shop subsystem. Via the FCC, the F&SC operator transforms the SSF into a logical replication of the desired site. Since only a limited number of CCs are located at the Technical Center, the SSF includes a substantial number of CCS which may be included in the SSF configuration. Upon completion of this configuration, the SSF is ready to perform the requested simulation.

The FCC performs the monitoring and controlling of the configuration of the SSCC resources. This is discussed in detail in section 4.2.1.

Simulation scenarios are developed and stored in the Job Shop. The F&SC operator retrieves the scenarios from the Job Shop and initiates their execution. Once the scenario begins, the SSF operates similarly to the site until the simulation is terminated by the M&C or FCC operator.

4.2.1 Facility Configuration Control (FCC).

The purpose of the FCC position is to provide a centralized location from which overall SSF scheduling, configuration, simulation, and testing activities can be coordinated. The role of the FCC position in SSCC-1 is synonymous with the role of the M&C position in ISSS. Thus, the system control responsibilities and status data display requirements for the FCC are similar to that of the M&C position.

Most commands and displays that are available at the M&C position are also available at the FCC console. The difference is that the FCC position does not require the use of some of the M&C operational commands, therefore, these commands are only available at the M&C position. Likewise, there are specific system support commands that are only functional from the FCC console. These commands are only available at the FCC position. The unique FCC commands are discussed in detail in paragraph 4.2.1.2.

The FCC operator performs the following major functions:

  a. Monitor SSCC resources
  b. Support SSF site configurations

4.2.1.1 Monitoring and Controlling the Configuration of SSCC Resources.

The FCC has the capability to view many different aspects of the configuration of the SSCC resources. Since individual operating requirements can differ, the FCC operator has the capability to arrange selected views to suit his/her individual configuration needs. The following are the core group of proposed views for the FCC:

  a. FCC System Summary View - Horizontal (FSH) and FCC System Summary View - Vertical (FSV)

  b. FCC Alert Status (FAS) View

  c. FCC LCN Status (LCN) View

  d. FCC Control Room (CRL) View

  e. FCC Area (ARL) View

  f. F&SC Central Processor (CNP) View

  g. FCC Facility Alert List (FAL) View

  h. Message Composition/Response (MC/RS) View

  i. FCC Key Information (FKI) View

  j. TIU-Processor Relationships (TPR) View

  k. FCC Transfer (TRN) View

The three FCC System Summary views are the FCC System Summary view - Horizontal (FSH), FCC System Summary view - Vertical (FSV), and FAS view. The FSH view is designed to be displayed in the Auxiliary Display (AUX). The FSV view is designed for use with other M&C views on the Main Display Monitor (MDM). The FAS view layout is identical to the layout of the FSH view.

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The purpose of these views is to present a summary of the resources controlled by the FCC in order to facilitate FCC operator identification of alerts and failures. When alerts occur, the summary icons will show a flashing color (red, yellow, etc.) to reflect where the alert has occurred. When the alert is acknowledged, the FSH and FSV views will stop reflecting this alert. The FAS view will continue to display the alert condition until it has been resolved. This is the only difference between the FSH and FAS views. It is the FCC operator's choice to determine which system summary view they would like to display.

The purpose of the LCN view is to present, in one view, the status of all the bridges and rings controlled by the FCC. This view was designed for use in the MDM.

The purpose of the FCC, CRL, and ARL views is to provide detailed processor level status for each CC, CCS, Dynamic Simulation (DYSIM) Pilot Workstation, Test Interface Unit, and LCN interface unit in the system. The ARL and CRL views collect the processors by LCN access ring, so there is a group of processor icons in the ARL and CRL views for each LCN access ring in the system.

This is also the same collection criteria for the summary icons on the FSH and FAS views, so there is a one-to-one mapping between processor summary icons on the FSH/FAS and a group of processor icons in the ARL and CRL views. Therefore, the FCC operator can use this relationship in order to determine which ARL or CRL view should be displayed on the FCC when an alert is being signaled by the FSH/FAS view. The only difference between the ARL and CRL views is the processor icons in the ARL view display application software status, as well as processor hardware status.

The purpose of the CNP view is to present the FCC operator with the status of the hardware elements for the 9121 Central Processor. This view is identical to the M&C Central Processor view, except there is only one Central Processor shown for the F&SC.

The FCC FAL view is the standard M&C FAL view. The purpose of the FAL view is to alert the user to system failures, degradations, recoveries, performance exceptions, processors (which are ready to join the system), and command response messages. The FAL view displays only the primary alerts followed by the secondary alerts.

The MC/RS view is the standard M&C MC/RS view. The purpose of the MC/RS view is to give the operator a place to type commands, or make command selections, and a place to display command completion messages and NAS acceptance messages.

The purpose of the FKI view is to display summary information about the SSF. This view will give the FCC operator a summary of the SSF status, the system release loaded, access ring status, and M&C position information.

The purpose of the TPR view is to show the relationship between the rack-mounted CCSs, and the TIU that is attached to those CCSs. (One TIU and up to four CCSs are mounted together in the same rack.)

The purpose of the TRN view is to give the FCC operator the capability to easily select any other available FCC or M&C view.

Each of the above mentioned views will assist the FCC operator in all aspects of monitoring and controlling the configuration of the SSCC resources. The FCC operator can simply use the TRN view to configure the MDM and AUX with the required views to assist the person in the specific monitoring function.

<u>4.2.1.2 FCC Support of Site Logical Replications</u>.

One of the most important tasks of the FCC position is to provide the necessary support for the preparation phase that precedes the operation of an SSF. The "preparation phase" is defined here as the set of coordinated actions and procedures, executed both before and during the SSF configuration process, which results in the creation of the required user-specified environment capable of being transferred to the SSF M&C position for further system initialization activities.

The following specific FCC commands are used to configure, initiate, support, and terminate a SSF:

    a. Reserve Mimic
    b. Configure Mimic
    c. Startup M&C Command
    d. Termination of the Mimic
    e. Reset Command
    f. Start FCC SCM/BGS Command

The following is a description of each of these commands, along with a description of the FCC operator's role:

    a. Reserve Mimic. The purpose of the Reserve Mimic command is to verify that a requested configuration can be supported with the SSF resources available, and to hold these resources until directed to release them.

While the Reserve Mimic command is executing, the FCC operator is given reservation status via alert message(s) posted on the FAL view. If a complete configuration is available, the resources are automatically reserved and the ARL, CRL, and FAL are updated accordingly showing the new status. The resources are held in reserve until a Reset or Terminate command is issued.

If one or more requested resources are not available, a message is posted on the FAL, and the ARL and CRL views are updated to reflect that status.

If the complete requested resources are not reservable, the operator has the option to accept or reject the limited configuration. The FCC operator will have an overall picture of the incomplete configuration upon which to base their decision. In addition to messages in the FAL view, the operator can verify details in the ARL and CRL views. If the FCC operator accepts the configuration, by entering the Reserve A(ccept) command, the resources will be reserved for the SSF. If the FCC operator rejects the configuration, the system defaults to its initial monitor status and resources will be available for another logical replication.

    b. Configure Mimic. The purpose of the Configure Mimic command is to perform the actual resource configuration actions on the SSF resources. If the configuration process is successful, the SSF is ready to start the SSF via the Mimic Startup. If the CCs have been reserved for the SSF, the appropriate adaptation data will be used to configure it.

If the configuration action on a processor or ring set fails, the FCC operator will be informed via a message in the FAL view, and the ARL and CRL views will be updated to reflect that status. The operator will then have the option to perform one of the following:

      1. Accept the configuration without the processor or ring set by entering the Configure Mimic command with the Accept parameter.

      2. Reject the configuration and start recovery actions by entering the Configure Mimic command with the "Reject" parameter.

When all actions are completed successfully or when the software has completed configurations with acceptance of failed or unavailable resources, the SSF is considered configured and the FCC operator receives a system message in the FAL view.

If the FCC operator chooses to cancel the process, the support software will attempt to deconfigure all resources that had been successfully configured before the failure. If the software cannot successfully recover, the FCC operator may issue M&C commands to recover FCC resources, and a Reset command to initialize the support software. The support software would then be capable of successfully executing a Reserve Mimic command for another user/tester.

      c. Start M&C Command. The purpose of the Start M&C command is to initiate the independent functioning of an acceptably configured SSF. This command initiates the full operation of the SSF M&C or an M&C group so that the SSF may be fully controlled from its M&C console(s) in the same manner as in a field facility.

This process is accomplished by starting a CC in the SSF configuration as the SSF M&C, and deactivating the bridge set that connects the F&SC support rings to the SSF backbone ring set. The CC designated to become the M&C must be a physical CC. No other bridge sets in the SSF are affected by this command.

During the Start M&C command process the software will generate the following commands:

      1. Issue a Defer Assign request to a CC in the SSF configuration in order to direct it to become the M&C of the SSF.

      2. Issue a request to warm-start the LGSM of the designated CC in order for it to become the M&C.

      3. Command the bridge set connecting the F&SC support rings to the SSF backbone LCN to inactive mode.

If either step 1 or 2 fails in this process, the FCC operator can issue another Start M&C command and the software will resume where it had previously failed. After the software completes the M&C warm-start and deactivates the F&SC bridge set, it will send a startup complete message to the FAL view.

If a "renegade" M&C is detected as starting to come up, there will be a ring failure condition. An error message is sent to the FCC operator, via the Facility Alert List, to "kill" the renegade M&C. Once the M&C condition is corrected, the FCC operator can issue a Terminate command or another Start M&C command. The FCC operator may issue a Terminate or Reset command if the Startup command does not execute properly.

    d.   Terminate Mimic. The purpose of the Terminate Mimic command is to deconfigure the hardware resources allocated to the SSF, leaving it in a state ready to accept a Reserve Mimic command for the next mimic. The following events are a result of the termination command:

        1.   The software activates the F&SC support ring bridge set.

        2.   The software issues commands to set resources in the SSF to diagnostic state. The FCC regains the capability to obtain and display resource status via the ARL and CRL views.

        3.   The SSF is available for the next logical replication.

If a reconfiguration action on a processor fails, the operator is notified via the Feedback area of the Message Composition (MC) view. Failures may be handled by the FCC operator using M&C commands executed at the FCC, after the software has completed its attempts at disconfiguring all resources.

    e.   Reset Command. Whenever the SSF is in an unknown or inde erminate state, M&C commands may be issued in order to initialize resources for another logical replication. At that point, execution of the Reset Command will permit the FCC operator to issue a Reserve Mimic command to initiate the steps necessary to start another SSF.

    f.   Start FCC SCM/BGS Command. This command is used to initiate the processing of SCM or BGS software at the FCC console. The command has the same functions as the M&C Start SCM/BGS command with one critical exception. In the SSCC-1, the FCC console has the responsibility for monitoring and controlling the resources on both the LCN and the BCN. The M&C consoles monitor either the LCN or the BCN; they never monitor both networks simultaneously at a site. However, simultaneous monitoring of these networks can be accomplished on the FCC, via use of this command.

4.2.2 Stand-Alone Simulator (SAS).

The SASs provide simulation services and test scenario generation for the SSFs. The SASs are connected to the F&SC 9121 processor with VM/ESA running on one of the 9121 partitions. Dedicated SAS AUs allow tests involving simulations to be run independently of the other SSFs, and also allows both SSFs to run separate tests involving simulation concurrently.

The SDR software runs in the SAS. The SDR aids the user in preparing simulated input to NAS from adjacent NAS and Automated Radar Terminal System (ARTS) centers, without knowledge of NAS assigned Computer Identifications (CIDs). This simulated input is sent to NAS over an Interfacility Input (INTI)/Interfacility Output (INTO) adapter set. In addition to providing data from a simulated adjacent NAS or ARTS center, SDR prints diagnostic listings and input message listings.

The SDR software will be modified for SSCC-1 because EDARC is not capable of handling input channel data rates greater than 2400 bits per second (bps). In order to accommodate this limitation, SDR will be changed to allow for the SAS radar data output for each simulated radar site to be distributed across three separate and unique channels. This will effectively reduce the SAS AU radar output data rate, causing the PAMRI and EDARC input data rates to drop from 7200 bps to 2400 bps. To accomplish this, SDR will be modified to map the simulated radar site data to the physical devices (SAS AU serial ports) based on the logical device number, rather than based on the radar site identifier.

4.3 SYSTEM SUPPORT FACILITY (SSF) OPERATIONS.

The SSF operates as a logical replication of a particular field site. It includes the site's software logic and Sector Suite adaptation data, the hardware configuration, and interfaces. The objective of the SSF is to increase the effectiveness of testing and training by systems support.

Testing includes both hardware and software components and ranges from the resolution of field problems to the examination of full system releases. Functional, as well as predeployment, testing can be conducted. Employing actual adaptation data, quantitative measurements against realistic environments can be achieved. Since the SSF can replicate any field site, complete and comprehensive system testing of any or all sites (including evaluations of site certification and cutover procedures) can be performed. Data from System Analysis Recorder (SAR) files can be extracted to create new scenario events which may serve to precisely tailor the scenario to a particular ARTCC. The anticipated outgrowth is quality improvement; the ability to distribute a system that was actually tested against a site replica.

Pools of CCs and CCCs are available on the LCN for connection to the SSFs. Sufficient resources are available to replicate the largest ISSS site or configure two distinct ISSS sites simultaneously.

4.3.1 Logical Replication of a Site.

The logical replication of a site can be used to support the following major functions:

    a. Testing of baseline and delta system releases
    b. Testing of hardware and software field problems
    c. Training of personnel (support and controller)

4.3.1.1 Testing of Baseline and Delta System Releases.

After the FCC operator has configured the SSF to logically replicate the desired site, with the new baseline or delta system release, the operator may then begin testing the new release. AT support personnel can run their standard equipment a environmental simulation tools, on the new release in the specified operational environment, to completely test the new release.

4.3.1.2 Testing of Hardware and Software Field Problems.

With the ability to replicate a site, the field support personnel are better able to provide a more thorough analysis of field problems. Since the simulation scenarios are repeatable, regression testing can be readily conducted to determine whether proposed solutions will have an impact on the problem. Through the use of the site replication, with extensive regression testing of the solution, the field support personnel can be confident that their fix will have no unforeseen impact on the specific operational site.

5. SYSTEM MAINTENANCE.

The SSCC-1 System Maintenance encompasses hardware, operational and support, and firmware maintenance. Based on the SSCC-1 centralized maintenance concept, AAS hardware and software at the ARTCC will be maintained using SSCC-1 resources.

The Advanced Automation Program (AAP) Office has provided contractor maintenance for the first year after equipment acceptance at each ARTCC. During this year, each ARTCC will evaluate their readiness to assume total maintenance responsibility for hardware components. If necessary, each ARTCC may extend contracted hardware maintenance on a year-to-year basis, not to exceed 9 years of maintenance. Operational software will continue to be contractor-maintained, centrally at the Technical Center, under AOS's control and guidance. Adaptation data will always be maintained by the ARTCC. Hardware and software certification will be performed by AOS at the Technical Center and FAA personnel at the ARTCC.

The critical and complex nature of the AAS dictates the need for a rigid set of maintenance requirements. Failures in the system could have a considerable negative impact on air traffic activity. An effective solution is required when the FAA is faced with an unexpected adverse situation. Based on the need for constant system availability and the critical operational environment of AAS, the following maintenance requirements apply to the AAS system:

   a. The FAA work force must be capable of ensuring that no compromise of safety, reliability, or availability exists throughout the AAS life cycle.

   b. FAA personnel must have the technical expertise to manage and control the AAS segments' equipment configurations, to direct restoration and to certify the system or its elements as appropriate.

   c. Should the loss of contractor support for mission-critical systems occur, the FAA must be capable of assuming full responsibility for the required system maintenance using FAA resources.

   d. FAA maintenance control centers must be staffed by FAA personnel to ensure immediate response to ATC needs.

   e. System restoration capability and support resources must be available continually for mission-critical elements of the system.

   f. Second-level engineering support must be available continually for mission-critical elements of the system.

Maintenance plans are structured to support high system availability. Support analyses have been correlated to the design of the system to guide in the planning, development, and implementation of logistic elements of support such as handbooks, support equipment tools, and distribution of documentation. These analyses and plans have also addressed the design, development, and production of the hardware and microcode modifications required to improve system performance, correct problems, and expand system capabilities.

5.1 HARDWARE MAINTENANCE.

Hardware maintenance is conducted on two levels in accordance with FAA Order 6000.30. In the SSCC-1 time frame, IBM will perform first-level maintenance involving the removal and replacement of defective or obsolete lowest replaceable units (LRUs). IBM will also be responsible for sending the removed articles to the appropriate second-level maintenance facility. All other maintenance actions are the responsibility of the second-level maintenance facility, either the FAA Logistics Center or the FAA Technical Center, whichever is appropriate. Other than required for on-site maintenance, interaction with vendors is accomplished through the second-level maintenance facility. Table 5.1-1 lists the matrix for structured hardware and firmware maintenance. The first year of maintenance will be full IBM maintenance support per the contract to include all spare parts. When structured maintenance starts, the designated elements (FAA or IBM) will be responsible for spare parts for those items they are maintaining per the following matrix:

TABLE 5.1-1.   MATRIX FOR STRUCTURED HARDWARE AND FIRMWARE MAINTENANCE

Item/Unit Name	1st Level Responsibility	2nd Level Responsibility
CCs	FAA	FAA
CTS	FAA	FAA
ESI	FAA	FAA
CENTRAL CLUSTER	IBM	IBM
HOST	IBM	IBM
LCN	FAA	FAA
LIU	FAA	FAA
BCN	FAA	FAA

When a hardware problem occurs, the first task is to reconfigure the system in order to isolate the problem area, ensuring that the system recovers into a functionally sound mode of operation. Once the system has recovered, the goal of hardware problem identification is to identify the specific LRU that has caused the problem, and initiate the repair activity associated with that element.

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The diagnosis of hardware problems may involve actions that alter the software state of a processor. Prior to taking such actions, steps are taken to preserve as much software status data as possible. This information is needed in cases where the hardware is not the root cause of the trouble.

The SSCC has maintenance features that complement system support activities to help achieve the goals of the maintenance concept. These features significantly reduce overall repair time by providing technicians with the ability to diagnose a malfunction rapidly, identify the failed unit, and replace it quickly. These maintenance features include:

    a. Internal, on-line diagnostics that identify a failed unit.

    b. Simplified removal and replacement maintenance methods which streamline the process for restoring equipment to an operable condition.

    c. Built-in test equipment to aid in fault isolation.

    d. Remote monitoring control and diagnostic capabilities to test and detect imminent failures.

5.1.1 Hardware Maintenance Levels.

As mentioned in section 5.1, there are two levels of hardware maintenance, first and second. First-level maintenance encompasses all maintenance activities which take place at the field site. The AOS organization accomplishes the field site maintenance effort as soon as it is practical to assume these tasks from IBM.

First-level maintenance usually consists of periodic checks of equipment, monitoring of performance, inspection, cleaning, servicing, and adjusting. It also includes troubleshooting and testing in accordance with the equipment manuals. The AOS organization is the single point of contact for all maintenance actions at the ARTCC.

Second-level maintenance support consists of those maintenance actions performed at the FAA Logistics Center or the FAA Technical Center. The FAA Logistics Center is responsible for depot level maintenance, ensuring sufficient spares are procured and maintained to support first-level requirements. This includes ensuring operational facilities receive replacement parts in a timely manner.

For second-level maintenance, reporting procedures concerning hardware problems remains the same regardless of the type of maintenance action being performed. Air Traffic (AT) and Airways Facilities (AF) organizations at the ARTCC will use the ACI to report technical problems. The ACI process ensures compatibility to existing FAA systems. Problems reported to the Technical Center are handled in accordance with the AOS and SSCC Operations Concepts, and prioritized based on criteria contained therein.

The AOS organization at the Technical Center is responsible for developing and distributing the certification and maintenance procedures for the system and controlling the maintenance handbook. This group generates necessary Site Technical Bulletins (STBs).

ACN-500 is responsible for receiving and implementing modifications to the SSCC-1 platform. As such, they analyze the changes, develop modifications to existing hardware to accommodate the changes, and, with approval of the appropriate CM group, implement the changes.

5.1.2 Hardware Maintenance Types.

There are three types of hardware maintenance, Corrective Maintenance, Preventive Maintenance, and Perfective Maintenance. These maintenance types apply to both system and subsystem hardware elements.

Corrective maintenance is any action performed to restore a failed system to an operational state. For first-level maintenance, this includes analyzing error conditions, removing and replacing failed LRUs and sending them to a second-level maintenance facility when required. While under contractor maintenance, first-level corrective maintenance is controlled by FAA personnel. Thereafter, it will be both controlled and performed by the FAA.

Second-level corrective maintenance includes analyzing error conditions and accomplishing repairs to failed components, and also ensuring sufficient replacements are available to satisfy both local and site requirements. Second-level corrective maintenance is controlled and performed by the Logistics Center and the Technical Center, as appropriate. The Logistics Center ensures repairs are made to failed LRUs while ensuring sufficient replacement LRUs are available to satisfy requirements.

Preventive maintenance encompasses all actions that are performed to retain the SSCC-1 platform in an acceptable operational condition. First-level preventive maintenance is routine scheduled maintenance designed to preserve the equipment or reduce the chance of failure. The responsibilities of the FAA and contractors for first-level corrective maintenance also apply to first-level preventive maintenance.

Second-level preventive maintenance includes inspection and calibration activities to preserve the equipment and to reduce the change of failure. The AOS organization is responsible for the generation and maintenance of the appropriate Maintenance Technical Handbook which identifies all preventive maintenance actions. The contractor is responsible for providing technical documentation to define recommended preventive maintenance, including procedures and timing.

Perfective maintenance covers those maintenance actions resulting in improved performance or maintainability of the system. Perfective maintenance actions may be initiated by the FAA, maintenance contractors or vendors, but are only performed under the guidelines of FAA CM.

For first-level perfective maintenance, the FAA is responsible for controlling the approval and implementation of all perfective maintenance efforts as they relate to SSCC-1 and ISSS.

For second-level perfective maintenance, AOS generated Electronic Equipment Modifications (EEMs) and STBs provide the FAA with authority to accomplish perfective maintenance actions. If a contractor is the initiator of a perfective maintenance action, AOS personnel provide guidance and recommendations concerning operational impacts and suitability. The contractor provides any engineering change information required for AOS to complete the EEMs and STBs associated with the maintenance tasks.

5.2 CENTRALIZED SOFTWARE MAINTENANCE CONCEPT.

The centralized software maintenance concept designates SSCC-1 as the focal point for software and adaptation database maintenance. The centralized approach differs significantly from the former approach to NAS software maintenance where individual ARTCCs owned both their operational software and their adaptation data.

Software maintenance is conducted on two levels in accordance with the Policy for Maintenance of the NAS FAA Order 6000.30. ARTCCs perform first-level maintenance involving conduct of local adaptation maintenance, problem identification and isolation, downloading, testing, and cutover of new releases. This effort holds true for all releases down to the Functional Group (FG) or Operational Unit (OU). All other maintenance actions are the responsibility of the second-level maintenance facility, the Technical Center. The AOS organization at the Technical Center will be responsible for all field site maintenance problems. Vendor interaction is the same as for hardware maintenance.

The concept of operations presented here is based on a cooperative working relationship between the individual ARTCCs and the Technical Center. Under this relationship, the ARTCC gathers data on the circumstances surrounding a software problem occurrence and develops a preliminary assessment based on this data. The level of involvement of the Technical Center in this process is determined by the severity of the impact that the problem presents. For minor problems, ARTCC-generated problem data is passed to the Technical Center for review by AOS and final resolution. This procedure is part of the normal ACI process.

For more severe problems, the AOS may use the ARTCC remote access facilities to participate in the ARTCC-level problem determination process. ARTCCs will have the capability of performing emergency software maintenance if communications are lost with the Technical Center. For some problems, the site data is collected and used to attempt the reconstruction of problems using the SSF at the Technical Center. The SSF is designed to provide a logical replica of the operational site. The SSF is loaded with ARTCC software, adaptation data, and problem-related data. The software development environment provides additional capability to analyze software problems. For persistent problem situations, the AOS can dispatch a troubleshooting team to the ARTCC.

Software elements include CAS products, AAS-developed application code and individual operational site adaptation data. When a software element failure occurs, the first task is to reconfigure the system and recover to a functionally sound mode of operation. The goal of software problem identification is to identify the failed software component. Sufficient data should be gathered to generate an ACI.

There are approximately 84 CAS products in the ISSS/SSCC-1 segments of the AAS. Along with these products, there is contract-developed software that is categorized as operational site real-time software, and operational site background support software. There is also SSCC-1 Job Shop support software.

Software maintenance is viewed as a continuation of the AAS software development process. The procedures used for software maintenance are similar to those used to develop the AAS. The toolset, development environment, and CM techniques are carried forward from AAS development to the maintenance program.

5.2.1 Software Maintenance Levels.

As mentioned in section 5.2, there are two levels of software maintenance. First-level maintenance includes all maintenance activities which take place at the field site. AOS will assume life-cycle maintenance support responsibilities after the first year after Contractor Acceptance Inspection (CAI). Reporting procedures concerning software for first-level maintenance are the same as those for second-level hardware maintenance.

Second-level maintenance is composed of those maintenance actions performed at the Technical Center. These activities encompass correcting defective software releases, introducing changes and modified code to accommodate perfective changes and those changes necessary to accommodate site adaptation requirements as a result of changing site configurations. This includes ensuring first-level facilities receive modified code, new releases, or delta releases in a timely manner. An allocated concept of FAA and contractor support has been determined to be the most beneficial to FAA long-term goals. Reporting procedures are the same as for first-level software maintenance.

AOS is responsible for developing and distributing the certification and maintenance procedures for the system. AOS personnel are also responsible for receiving and implementing CAS modifications. As such, they analyze changes, develop modifications to existing software to accommodate the changes, and obtain approval from appropriate CM groups for implementation of the changes. This group generates necessary Site Program Bulletins (SPBs). The changes are tested first at the Technical Center and key sites, and then released to field sites.

ACN-400 is responsible for developing, testing, and implementing modifications to SSCC-1 developed code and CAS products. ACN-400 will coordinate any changes that affect field-site resident support software with the AOS organization.

5.2.2 Software Maintenance Types.

SSCC-1 provides resources for three different types of software maintenance: Corrective Maintenance, Perfective Maintenance, and Adaptive Maintenance.

Corrective maintenance includes those maintenance actions required to correct errors in system performance. For first-level corrective maintenance, this includes analyzing error conditions, removing and reloading failed software and firmware, and providing information necessary for problem resolution to second-level maintenance facility when required.

First-level FAA responsibilities for corrective maintenance fall into two categories: problem identification, which is described in section 5.2.4, and problem correction. Site personnel perform all actions required for problem identification, while AOS performs actions required for problem resolution. This covers data collection and analysis, providing information to appropriate personnel at the Technical Center, initiating an ACI, and ultimately performing local test and verification of the corrections downloaded from the Technical Center. The contractor provides technical assistance for the extent of the service contract.

Second-level corrective maintenance includes analyzing error conditions, and, based upon available information, developing corrections to existing software releases. These corrections can be provided in the form of a full system release or a smaller delta release. If the problem cannot be resolved immediately, the second-level facility provides a workaround solution based on input from the first-level facility.

For second-level corrective maintenance, AOS is responsible for managing the software correction process and providing operational guidance and interpretation to the contractor performing the software modifications. They also design and conduct the testing effort at the Technical Center to ensure the solution is operationally suitable and solves the problem. The FAA is also responsible for all interaction with the CAS vendors to resolve CAS associated problems. The contractor is responsible for developing and performing all changes to software required for correcting deficiencies in the existing release. This includes conducting necessary testing to ensure the system does not fail. The exact manner for accomplishing this task is included in the AOS and SSCC Operations Concepts.

Perfective maintenance refers to the type of software maintenance that the SSCC-1 performs to eliminate inefficiencies, enhance performance and/or improve maintainability. Perfective maintenance actions may be initiated by the FAA, maintenance contractors, or vendors.

For first-level perfective maintenance, AOS is responsible for performing local test and verification of new releases. This includes the need to perform those necessary certification steps before bringing the release on-line to be operational. The contractor is responsible for informing the local FAA personnel of expected changes arising from perfective maintenance efforts undertaken by the contractor or it subcontractors. They also assist with local verification and provide information on any operational impacts.

Second-level perfective maintenance responsibilities for the FAA include providing the contractor and other vendors information to be used in performing perfective maintenance. In those instances where the contractor is the initiator of the perfective maintenance action, the Technical Center personnel provide guidance and recommendations concerning operational impacts and suitability. The contractor is responsible for developing the necessary code to integrate perfective changes into a new release and for developing the necessary test actions to ensure the newly developed code performs to required standards.

Adaptive maintenance refers to the type of software maintenance that is performed using the SSCC-1 to keep up with changes in data and processing environments. For first level adaptive maintenance, this includes those maintenance actions required to adapt releases to local conditions, which includes modifications required for both short- and long-term solutions.

Field site personnel are completely responsible for site adaptation, collecting information, selecting the local adaptation database, downloading, testing, cutover, and verification of new releases. Each site is responsible for instituting its own procedures and assigning responsibility for accomplishing this maintenance action in compliance with appropriate FAA orders. The contractor has no first-level responsibilities to perform adaptive maintenance.

Second-level adaptive maintenance includes all efforts to adapt the designed system to changing national and local environments. It includes those actions necessary to obtain the data for national data releases, and to conduct liaison with other government agencies and organizations, as well as those in the aviation industry to obtain the required information.

AOS collects the necessary information to develop and release the necessary adaptation data at the national level in accordance with FAA Orders and Regulations. The contractor is responsible for incorporating the information into new system releases in a timely manner.

5.3 FIRMWARE MAINTENANCE.

SSCC-1 firmware maintenance will follow a centralized maintenance concept identical to that of hardware and software maintenance. The second-level support organization (FAA Technical Center) will develop, test, document, and distribute all changes to firmware for SSCC-1 and ISSS. FAA Logistics Center will provide support by providing Erasable Programmable Read-Only Memory (EPROM) burn in. IBM will support the maintenance of firmware during the contractor maintenance period.

5.4 PROBLEM IDENTIFICATION.

Problem identification falls under the problem identification category of first-level software corrective maintenance. It is the process of establishing the source of an observed system problem or failure. The primary focus of problem identification is the engineering aspect relative to the tasks that are performed at the M&C position.

Problem identification begins when a degradation or failure is observed. Information and diagnostic capabilities provided by system monitoring are used to help isolate the source of the problem. The objective is to establish a baseline for hardware repair, software restoration, and the preparation of an ACI whenever applicable.

Each of the maintenance manuals for the AAS includes problem identification procedures associated with hardware and software components, developed specifically for the AAS application. Commercial handbooks supply similar maintenance information for all COTS hardware elements and CAS products that are used in the AAS.

Problem identification involves a combination of engineering, technique, and reporting disciplines. Engineering involves design of the system and establishment of fundamental processes that are based on anticipated problems; therefore, engineering is a series of causes and effects.

The technique or approach to problem identification involves the appropriate and effective use of the tools provided by engineering. The day-to-day application of problem identification methods is often influenced by accumulated experience. Operators develop an understanding of the system that allows them to resolve problems without consulting the maintenance manual. This situation is a reflection of the fact that problem identification is usually an effect-cause process. Maintenance personnel must sort through a number of different, occasionally contradictory, clues in order to determine the cause of a problem.

The staffing levels, policies, procedures, and paper work associated with system problems involve problem reporting and tracking. One of the tasks of problem identification CM is to ensure that the lessons-learned of day-to-day experience are collected and incorporated into the problem identification engineering effort. This is accomplished by tracking reported problems and keeping a record (ACI) of the symptoms of and solutions to the problem. This record may prove helpful in providing solutions to problems that have been previously reported, and this information may reduce the time needed to restore the system.

5.5 SYSTEM PROBLEM RESOLUTION METHODS.

System problems result from the distributed nature of the AAS architecture. Trouble-free operation of the system requires that various software and hardware elements linked by LCNs support system processing threads. System performance problems fall into this category. System problems are sometimes complicated in nature. Initially, they often appear to be either hardware or software problems. In these cases, the goal of system problem identification is to identify the system configuration that creates the problem.

Resolving system problems requires an ability to reconstruct the sequence of events and processing flows that lead to the problem. These reconstruction efforts may require the coordinated use of several software and hardware problem identification tools.

Internal System Analysis Recording (SAR) data can be used to gather data on the data processing flow of a selected process. System operators can activate SAR gates associated with the collection of system debugging information. This data is used to determine the nature of the processing errors that are causing the problem condition.

External SAR of selected messages support the reconstruction of the sequence of events that led to the problem. The AAS distributed processing architecture is based on individual software elements exchanging data via Service Requests (SRs) and Service Request Responses (SRRs). The SRs and SRRs are labeled and time-tagged to support the calculation of system response times. This time-tagging information also allows system specialists to reconstruct system data flows.

The SAR performance data can play a role in the detection of system problems. Response time and device utilization information can be used to detect system processing bottlenecks. This information can be generated by Data Reduction and Analysis (DR&A) processing of SAR performance data.

6. SSCC-1 USER GROUPS.

The primary users of the SSCC-1 are: AOS Operational Support Services, the ACN Service, and field site personnel. The SSCC-1 platform is also available for use by other FAA organizations.

6.1 OPERATIONAL SUPPORT SERVICE USERS.

AOS personnel are functionally linked to ARTCC facilities and operations. Based at the Technical Center, AOS develops and controls operational system modifications, analyzes and corrects system-wide or national problems, and assists ARTCC staff in solving difficult site problems. AOS has direct access to SSCC resident operational software and to national and site specific adaptation databases. AOS will have the requisite skills and resources to fulfill maintenance responsibilities to support the fielded ISSS.

The following outlines major responsibilities of the AOS organization relevant to the use of the SSCC for providing support to the field sites. This list represents only a subset of responsibilities of the AOS organization.

a. Support the field with problem diagnosis.

b. Maintain operational software, documentation, and CAS products at the site.

c. Maintain site-resident hardware.

d. Maintain national adaptation databases.

6.2 ACN SERVICE.

ACN personnel support and maintain the hardware, software, and functional capabilities of SSCC-1 including COTS and CAS products. Within the ACN organization is the Build and Control (B&C) team, whose primary function is SSCC CM. The SCLM Administrator is an active member of this team. ACN responsibilities include, but are not limited to:

a. Providing SSCC-1 software problem diagnosis, software updates, and software maintenance.

b. Providing SSCC-1 hardware problem diagnosis, hardware engineering support, and hardware maintenance.

c. Ensuring the availability and proper configuration of SSCC-1 equipment.

d. Testing all new and upgraded SSCC-1 system-related software and hardware.

e. Operations of the AAS Job Shop, F&SC Subsystem, and the SSFs.

f. Configuring SSF equipment to replicate and emulate precisely
defined conditions at ARTCCs.

        g. Maintaining CM and library management.

ARTCC users of SSCC-1 have access to Job Shop resources through direct terminal
logon. Although they may be physically separated by many miles from the Technical
Center, they will be functionally integrated into the SSCC-1 operations.

6.3 FIELD SITE PERSONNEL.

The field site personnel ensure that all AAS-related hardware and software
components are operational at the ARTCC. The field site personnel must establish
and control the ARTCC software environment and diagnose and report any problems to
the Technical Center, via the ACI process. Through the SSCC-1 remote logon
capability, site adaptation data specialists update their own local adaptation
data. Site software personnel create, receive, test, verify, and install new
system releases. If communications with the SSCC-1 platform are lost, field site
personnel have the capability to perform emergency software maintenance.

7. TRAINING.

The SSCC-1 platform will be used to provide training to FAA personnel and support
contractors on SSCC-1 functions and the application of those functions to
operational areas.

SSCC-1 training will be developed for operations, software maintenance, hardware
maintenance, and system management support personnel. IBM will develop the SSCC-1
training curricula in accordance with the Contract Training Program FAA-STD-028
and the approved AAS contract modifications. Following initial contractor
presentations of each training course, life cycle training will become the
responsibility of the FAA. Only transition training will be provided to field
site users; long-term development training is the responsibility of the FAA.

Technical Center personnel will receive training specifically designed for the
SSCC-1 platform, and will be provided by IBM according to CDRL TR08. To implement
Technical Center requirements, training will be provided to Technical Center Test
and Evaluation (T&E) and AOS personnel, through contractor-delivered training
services, engineering support services, and applicable segments of training
developed for site personnel.

8. ACRONYMS AND ABBREVIATIONS.

AAP	Advanced Automation Program Office
AAS	Advanced Automation System
ACCC	Area Control Computer Complex
ACF	Advanced Communication Facility
ACI	AAS Change Instrument
ACN-300	Advanced Automation Division
AD	Application Development
ADP	Automated Data Processing
AE	Application Execution
AF	National Automation Field Support Division
AIX	Advanced Interactive Executive Operating System
ALF	Application Load File
AOS	National Automation Engineering and Field Support Division
APSE	Ada Programming Support Environment
ARL	FCC Area View
ARTCC	Air Route Traffic Control Center
ARTS	Automated Radar Terminal System
ASF	Alternate Support Facility
ASM	National Automation Engineering Field Support Division, Assembler H
ASMH	Assembler H
AT	Air Traffic
ATC	Air Traffic Control
ATCT	Air Traffic Control Tower
AU	Adapter Unit
AUX	Auxiliary Display
BCN	Backup Communications Network
B&C	Build and Control
bps	bits per second
CAI	Contractor Acceptance Inspection
CAS	Commercially Available Software
CC	Common Console
CCAB	Change Control and Build (CSCI)
CCB	Configuration Control Board
CCD	Configuration Control Decisions
CCP	Common Console Processor
CCS	Common Console Simulator
CDC	Computer Display Channel
CDRL	Contract Data Requirements List
CHI	Computer Human Interface
CID	NAS Computer Identification
CIU	Computer Interface Unit
CLIST	Common List
COMPOOL	Common Pool
COTS	Commercial Off-The-Shelf
CM	Configuration Management
CMS	Conversational Monitor System
CNP	F&SC Central Processor View
CPW	CSP Programmers Workbench

CR	Change Request
CRL	FCC Control Room View
CS	Central Support
CSCI	Computer Software Configuration Item
CSP	Cross System Product
CXSS	Common System Services (CSCI)
DASD	Direct Access Storage Device
DB2	Data Base 2 application
DCC	Display Channel Complex
DCT	Detached Console Training
DEV	Developmental integration level of the SCLM hierarchy
DF	Data Facility
DFHSM	DF Hierarchical Storage Manager
DFP	DF Product
DFSORT	DF Sort
DG	Display Generator
DID	Data Item Description
DISP	Display Processing (CSCI)
D&R	Diagnostics and Repair
DR&A	Data Reduction and Analysis
DR&P	Display Recording and Playback
DSF	Device Support Facility
DSS	Data Set Services
DXT	Data Extract
DYSIM	Dynamic Simulation
ECP	Engineering Change Proposal
EDARC	Enhanced Direct Access Radar Channel
EEM	Electronic Equipment Modifications
ENVT	Environment Data Collection (CSCI)
EPROM	Erasable Programmable Read Only Memory
ESI	EDARC System Interface
FAA	Federal Aviation Administration
FAL	Facility Alert List View
F&SC	Facility and Simulation Control
FAS	FCC Alert Status View
FCC	Facility Configuration Console
FG	Functional Group
FKI	FCC Key Information
FRACAS	Failure Reporting Analysis and Corrective Action System
FSH	FCC System Summary View - Horizontal
FSP	Flight Strip Printer
FSV	FCC System Summary View - Vertical
FTP	File Transfer Program
GFE	Government Furnished Equipment
GFI	Government Furnished Information
GFP	Government Furnished Property
GPI/O	General Purpose Input/Output
HCS	HOST Computer System
HOL	High Order Language
HOLC	HOST On-Line Certification
HPO	High Performance Option
IBM	International Business Machines

ICA	Interfacility Communications Adapter
ID	Identification
INT	Integration test level of the SCLM hierarchy
INTI	Interfacility Input
INTO	Interfacility Output
IP	Internet Protocol
ISPF	Interactive System Productivity Facility
ISSS	Initial Sector Suite System
IWS	Intelligent Workstation
JCL	Job Control Language
KCP	Keyboard Communication Processor
LAN	Local Area Network
LCN	Local Communications Network
LIU	Local Communication Network Interface Unit, Local Area Network Interface Unit
LRU	Lowest Replaceable Unit
LSSS	Laboratory Signal Switching System
MB	megabyte
M&C	Monitor and Control Position
MC	Maintenance Console
MC/RS	Message Composition/Response View
MDM	Maintenance Diagnostic Monitor
ME	Maintenance Engineering
MMI	Man-Machine Interface
MS	Modem Splitter
MSL	Member Source Library
MTSS	MMI Training Support Software (CSCI)
MVS/XA	Multiple Virtual Storage/Extended Architecture
NAR	NAS Action Request
NAS	National Airspace System
NASM	NAS Modifications for ISSS (CSCI)
NCF	Network Compilation Facility
NCP	NAS Change Proposals
NFSG	National Automation Field Support Division
OPC	Operations Planning and Control
ORD	Operational Readiness Demonstration
OU	Operational Unit
PAMRI	Peripheral Adapter Module Replacement Item
PDF	Program Development Facility
PR/SM	Processor Resource/Systems Manager
PS	Personal System
PSF	PAMRI Services Facility
PTR	Problem/Trouble Report
PVD	Plan View Display
PVM	Virtual Machine Passthru
RAAP	Recording Analysis and Playback (CSCI)
RACF	Resource Access Control Facility
RCM	Radar Controls Multiplexer
RDDU	Radar Data Distribution Unit
RDP	ROC Data Processor
REL	Release/formal test level of the SCLM hierarchy
REXX	ISPF language/SCLM Requirements file

RFSP	Replacement Flight Strip Printers
RISC	Reduced Instruction Set Computer
RMF	Resource Measurement Facility
ROC	Refresh Output Controller
RSCS	Remote Spooling Communication System
RTR	Release Tracking Record
SAR	System Analysis Recorder
SAS	Stand-Alone Simulator
SCLM	Software Configuration Library Manager
SD	Software Development
SDR	Simulation Driver
SDSF	System Display and Search Facility
SIMF	Simulation Facility (CSCI)
SITE	Site Data Collection (CSCI)
SLOC	Source Lines of Code
SLS	System Level Specification
SMP/E	System Modification Program/Extended
SPB	Site Program Bulletin
SPSS-X	Statistical Package for the Social Sciences
SR	Status Request
SRR	Status Request Response
SSCC	System Support Computer Complex
SSF	System Support Facility
SSMS	Support Software Mimic Suite
SSP	System Support Programs
STB	Site Technical Bulletin
TAAS	Terminal Advanced Automation System
T&E	Test and Evaluation
TBS	To be supplied
TBD	To be determined
TCCC	Tower Control Computer Complex
TCP/IP	Transmission Control Protocol/Internet Protocol
TIU	Test Interface Unit
TLCS	Tape Library Control System
TPR	TIU Processor Relationships View
TRN	FCC Transfer View
TSO	Time Sharing Option
UDS	Universal Data Set
VDD	Version Description Document
VM/ESA	Virtual Machine/Extended System Architecture
VTAM	Virtual Telecommunication Access Method
XA	Extended Architecture

APPENDIX A

THE TEN-STEP AAS CHANGE INSTRUMENT (ACI) LIFE CYCLE

FAA Order 1800.8F defines policy, delegates authority, and assigns responsibility for ensuring compliance with all National Airspace System (NAS) Configuration Management (CM) requirements. This ten-step ACI Life Cycle will compliment the operational support phase requirements described in that Order.

The first step in maintaining or developing an enhancement to the Advanced Automated System (AAS) is to formally identify the problem or change by opening an ACI. Currently, HOST Computer System (HCS) changes and problems are maintained using the INFO Management System. This INFO Management System will be merged with the AAS INFO Family. The ACIs will be used to track all modifications to the AAS and HCS. Users will utilize the Change Tracking function of the Operational and Support software to track all operational system problems and changes.

Users create new ACIs by entering basic information into the database through interactive panels. Once an ACI entry is created, it is assigned an unique number which is used for tracking the ACI and for referencing it in the future. Information contained in the ACI may be added or changed during this process.

When a problem is detected or a change is proposed at an Air Route Traffic Control Center (ARTCC), the controller fills out a NAS Action Request (NAR) form, as currently performed. The NAR is submitted to the site management team who determines the criticality of the problem or the necessity of the change. If the site management team decides that the problem must be fixed or the change should be implemented, then it is assigned to the NAS Automation Office. The NAS Automation Office personnel will be responsible for opening an ACI for the problem or change.

When a problem is detected or a change is proposed for System Support Computer Complex (SSCC) system components, the Federal Aviation Administration (FAA) Technical Center personnel, who detected the problem or proposed the change logs on to the Job Shop, opens an ACI, and follows the life cycle for the ACI outlined below.

An ACI can pass through ten different stages. In order to represent the status of an ACI within a life cycle stage, a secondary field called status modifier is used. The status modifier represents a course of action within a given ACI phase. For example, after an ACI is opened, it may be accepted, rejected, or held. Accept, Reject, and Hold are status modifiers. The combination of the status name and the status modifier determines the current status of the ACI and the next action performed in the life cycle.

Some status modifiers have associated disposition values which further explain the status modifier. A disposition value is a reason for the course of action. For example, if an ACI was opened and then rejected because an ACI had already been opened for that problem, the disposition value may be duplicate. Status modifiers and dispositions vary according to whether the ACI is a Problem ACI or a Change ACI.

The Ten-Step ACI Life Cycle is outlined in table A-1. Figure A-1, ACI Life Cycle Statuses, shows the relationship between each life cycle status.

TABLE A-1 TEN-STEP ACI LIFE CYCLE

| Step	Status	Status Modifier	Description
1	OPEN	Hold	goto SCREEN
2	SCREEN	Pass Reject	goto ASSIGN goto VERIFY
3	ASSIGN	Section Active Reassign Hold	FAA section manager goto RESOLVE goto SCREEN await assignment
4	RESOLVE	Change Reject Ncbuild Hold Patch	goto BUILD goto VERIFY goto TEST or VERIFY wait goto BUILD
5	BUILD	Request Pass Fail	FAA activity goto TEST return to ASSIGN
6	TEST	Pass Fail Notest Hold	goto TRANSMIT or INTEGRAT return to ASSIGN goto TRANSMIT or INTEGRAT wait
7	TRANSMIT	No Status Modifiers	
8	INTEGRAT	Request Pass Fail	FAA activity goto VERIFY return to ASSIGN
9	VERIFY	Pass Fail Hold	goto CLOSE return to SCREEN or ASSIGN wait
10	CLOSE	Shipped Noship Reject Hold	Input SPB Number AOS uses
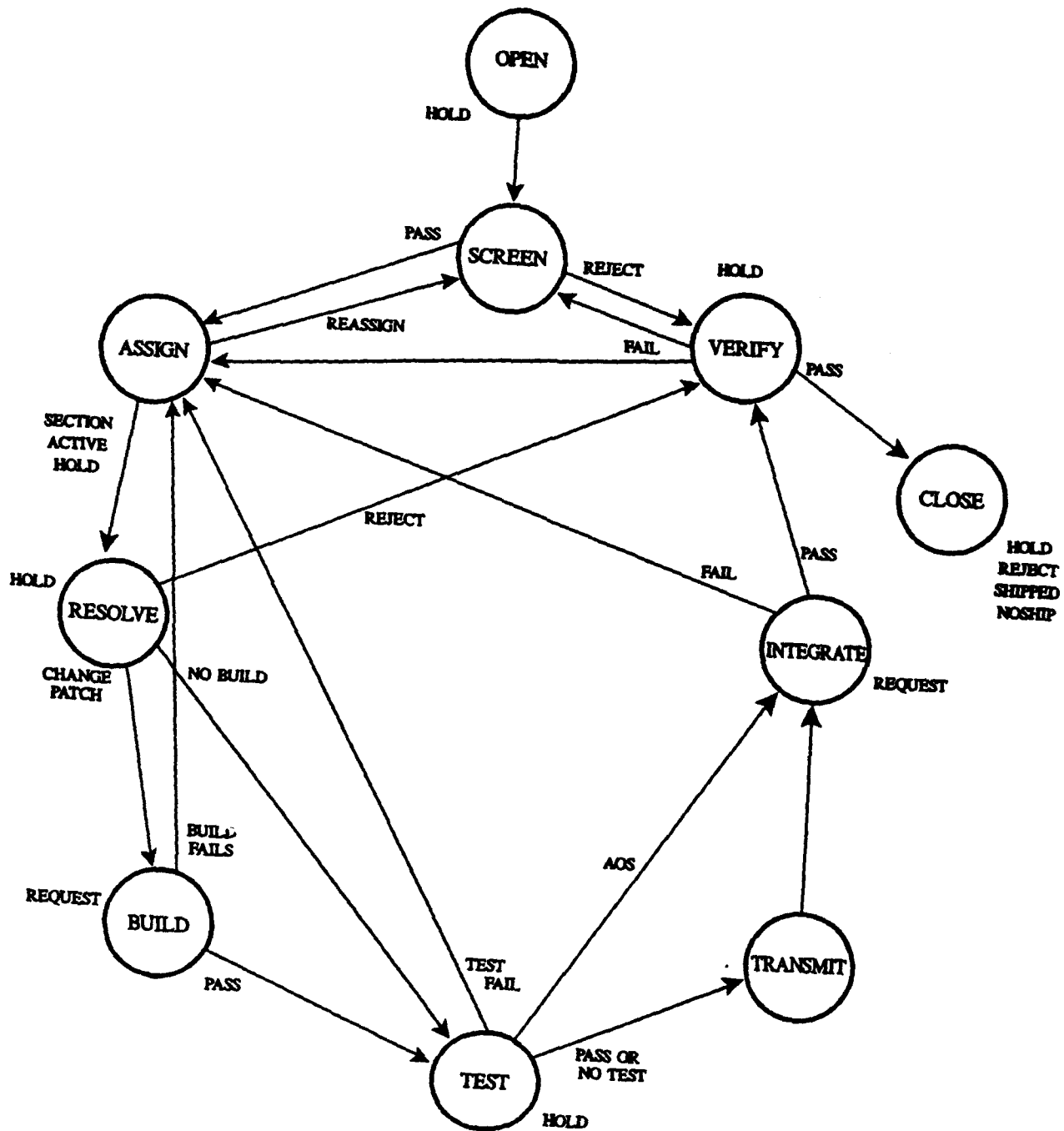
FIGURE A-1.   ACI LIFE CYCLE STATUSES

A-3

A.1 STEP #1> STATUS: OPEN.

The following paragraphs describe the Ten-Step Life Cycle of an ACI. Differences between Problem ACIs and Change ACIs are noted.

Any authorized Technical Center or ARTCC personnel may open an ACI by logging on to the AAS Job Shop. When an ACI is opened, the status is OPEN and the status modifier is automatically set to HOLD.

An ACI must indicate that adaptation data is affected to allow the user to collect adaptation data for that ACI via the Data Collection option. The adaptation data indicator is set on the Affected Areas Indicator panel of the AAS ATC Operational Support and Change Tracking support software.

A.1.1 Status Modifier: Hold.

During the "OPEN, Hold" stage, the user is prompted to provide the following information for a Problem ACI:

a. Title of ACI
b. Originator name
c. Originator phone number
d. Originator organization
e. Origination location
f. Date occurred
g. Time occurred
h. Segment (i.e., SSCC-1)
i. General ACI type (enter a code for the severity of the problem)
j. Formal problem (Y/N)
k. Date the fix is Required
l. Reason for required date
m. List of keywords describing problem symptoms
n. Mode of operation (the mode of the system at the time of the problem)
o. System ID
p. Related ACI
q. Problem priority
r. Workaround available (Y/N)
s. Status modifier (this is automatically set to HOLD)
t. Disposition

The information for a Change ACI is somewhat different. The panel prompts the user to input the following items:

a. Title of ACI
b. Originator name
c. Origination location
d. Originator phone number
e. Originator organization
f. Change class (identifies the type of CR the ACI is written to)
g. General ACI type (enter a code for the severity of the change)
h. Status modifier (this is automatically set to HOLD)
i. Disposition

    j. List of keywords describing the change
    k. CR number
    l. Date of CR number
    m. Specification Change Notice (SCN)/Document Change Notice (DCN) number
    n. SCN/DCN date
    o. Change priority
    p. Baseline
    q. Significant category
    r. Preliminary (Y/N)

Once the ACI has been opened and all known information for the problem/change has been entered, the originator files the ACI into the database by selecting the "file record" option from the panel. The INFO/Problem Management System will automatically assign the next available ACI number to the ACI just filed into the database. This number identifies the ACI and is used to track its progress through the ACI life cycle. The ACI is now ready for screening. The screening (Step #2) life cycle phase begins with the ACI status at "OPEN, HOLD."

A.2 STEP #2> STATUS: SCREEN.

During this phase, the ACI origination data is reviewed to determine the validity of the problem or the criticality of the change. Screening is accomplished on a regularly scheduled basis by a screening team made up of at least one representative from each of the functional areas; i.e., AOS, ACN, and Field representatives. This team will review all new problems/changes which are in the open status to ensure the ACI information is accurate and complete.

When an ACI is opened and screened, it is determined whether or not that ACI affects a logic release. If it does, a Release Tracking Record (RTR) is created for that ACI. An RTR tracks one ACI in one logic release. If the ACI affects more than one release, an RTR must be created for each release in which that ACI is implemented.

The status of an RTR follows the same life cycle as an ACI, however, the status of the RTR is independent of the ACI. For example, an RTR may pass through the RESOLVE, BUILD, TEST, and INTEGRAT(E) phases while the base ACI remains at the SCREEN phase until the RTR is closed.

When the status of the ACI has been decided, the status modifier is updated to reflect these results.

A.2.1 Status Modifier: Pass.

If the ACI is approved, the status modifier is updated to "SCREEN, Pass." The ACI is moved from the SCREEN to the ASSIGN (Step #3) phase of its life cycle.

A.2.2 Status Modifier: Reject.

If the ACI is rejected, the status modifier is updated to "SCREEN, Reject," and a disposition reason is documented as follows:

Rejection Disposition	Disposition Reason
Nodata	The information provided is inadequate.
Duplicate	The proposed ACI is a duplicate of an existing ACI.
Usererror	The user submitted an error or an invalid condition.

The ACI status is moved to the "VERIFY" (Step #9) phase of its life cycle in order that the disposition can be discussed with the originator.

A.3   STEP #3> STATUS: ASSIGN.

When the ACI has accepted the Configuration Control Board (CCB) and assigns the problem/change to an organization for resolution. Problem priority and required fix date are key parameters used in the ASSIGN step.

A.3.1   Status Modifier: Section.

The Control Board assigns the ACI to the appropriate resolving organization. While the section manager of that organization is in the process of assigning the ACI to an analyst for resolution, the status modifier is set to "ASSIGN, Section." The manager provides a projected release availability date as part of the ASSIGN process.

When the resolution organization for the ACI has been selected, the status modifier is updated to reflect the decision.

A.3.2   Status Modifier: Active.

When the ACI has been assigned, the status modifier becomes "ASSIGN, Active." The section manager completes the Software Target Release entry for production control.

Upon becoming active, the ACI status is updated to RESOLVE (Step #4) phase of its life cycle.

A.3.3   Status Modifier: Reassign.

If the section manager determines that the problem or proposed change is out of the scope of their area, the status modifier is updated to "ASSIGN, Reassign." The ACI status returns to SCREEN (Step #2) phase of its life cycle.

A.3.4   Status Modifier: Hold.

If the problem or change does not have a required "fix" date for resolution, the status modifier is updated to "ASSIGN, Hold" until the ACI is assigned to a specific logic release. When the ACI is assigned to a logic release, the status modifier returns to "ASSIGN, Section."

A.4   STEP #4> STATUS: RESOLVE.

The assigned resolution organization studies the problem or proposed change and decides whether or not the problem requires a fix or the change needs to be implemented. If a modification is required, the resolution organization National Automation Engineering and Field Support Division ((AOS) for operational software modifications) decides how the problem will be fixed or how the change will be implemented.

Change processing for the operational system entails the processing of case files and NAS Change Proposals (NCP). The proposed changes are reviewed by pertinent personnel and approved/disapproved at the Maintenance Engineering (ME) or Air Traffic (AT) CCBs. Decisions are documented in a Configuration Control Decision (CCD). A CCD must be obtained to complete the RESOLVE (Step #4) phase of the ACI life cycle.

A.4.1   Status Modifier: Change.

If the suggested correction or update involves a change to source code requiring a software build, the status modifier is set to "RESOLVE, Change." This status modifier typically refers to a Problem ACI as opposed to a Change ACI. All source code changes are configuration managed through the logic release plan. Appendix C, Logic Update Procedures, provides details on the logic release plan.

The ACI status is updated to BUILD (Step #5) phase of its life cycle, with a status modifier of Request.

A.4.2   Status Modifier: Reject.

If the assigned organization is unable to make the required change, the status modifier is set to "RESOLVE, Reject." This condition may be caused by a number of disposition reasons. For example:

    a.   a duplicate ACI which was not identified previously
    b.   an ACI which does not identify a problem
    c.   an ACI with insufficient information
    d.   a change to documentation only

If the ACI is missing information or if the ACI is rejected altogether, the status returns to the VERIFY (Step #9) phase of its life cycle in order that the originator can fill in the information and review the ACI.

A.4.3   Status Modifier: Nobuild.

If the proposed modification does not affect software, as in the case of a change to adaptation data, the status modifier is set to "RESOLVE, Nobuild." This status modifier typically refers to a Change ACI as opposed to a Problem ACI.

If the solution needs to be tested, the status is updated to TEST (Step #6).
If the solution does not need to be tested, the status is updated to VERIFY (Step #9).

A.4.4 Status Modifier: Hold.

If the further evaluation of the resolution or modification is required, the status modifier is set to "RESOLVE, Hold." The resolution organization may elect to hold the resolution or modification until a subsequent system release is created. When the ACI has been resolved, the status modifier is updated to reflect this decision.

Management concurrence should be obtained to complete the RESOLVE phase.

A.4.5 Status Modifier: Patch.

New patches are not developed for ISSS; however, patches that have not been incorporated into the baseline operational system are still maintained in the National Patch Library and the local patch libraries. These libraries will exist until the replacement of the HOST Computer System. Software developers will still have the capability to write National and local patches to the HCS software.

The ACI status modifier is set to patch when the source is not provided at the time of the problem. A patch is developed to correct the problem until the source is released. The ACI status is updated to BUILD (Step #5) phase of its life cycle, with a status modifier of REQUEST.

A.5 STEP #5> STATUS: BUILD.

Problems assigned for resolution requiring a source change will be incorporated into a special build. The purpose of the build is to test assigned problems for compatibility and corrective action.

A.5.1 Status Modifier: Request.

When source code is modified, the software developer creates a software ild during this life cycle phase, then the status modifier is set to "BUILD, Request." When the software build is complete, the status modifier is updated to reflect the outcome of the build.

A.5.2 Status Modifier: Pass.

If the correction or update was successfully incorporated into a logic release plan, the status modifier is set to "BUILD, Pass." The ACI status is then updated to the TEST (Step #6) phase of its life cycle.

A.5.3 Status Modifier: Fail.

If the correction or update could not successfully be incorporated into the logic release, the status modifier is set to "BUILD, Fail." The ACI status returns to the ASSIGN (Step #3) phase of its life cycle.

A.6 STEP #6> STATUS: TEST.

The logic release or adaptation data change is tested with the correction or revision in place. Actual steps taken in this phase by the testing organization will vary for each organization.

A.6.1 Status Modifier: Pass.

If the logic and/or adaptation data was tested and the formal test and demonstration have been completed successfully, then the status modifier is set to "TEST, Pass." The ACI status is updated to the TRANSMIT (Step #7) phase of its life cycle.

A.6.2 Status Modifier: Fail.

If the formal test or demonstration failed, the status modifier is set to "TEST, Fail." If the ACI requires input from a different organization, the status returns to ASSIGN (Step #3). If the ACI can be resolved by the current organization, the status returns to RESOLVE (Step #4).

A.6.3 Status Modifier: Notest.

If the resolution or modification does not require testing or it cannot be tested at system level, the status modifier is set to "TEST, Notest." CCB approval is required for this case. The ACI status is updated to the TRANSMIT (Step #7) phase of its life cycle.

A.6.4 Status Modifier: Hold.

If the test results need further evaluation or FAA management defers the test until a prerequisite change is ready, the status modifier is set to "TEST, Hold." When the test has been completed, the status modifier is updated to reflect the outcome of the test.

A.7 STEP #7> STATUS: TRANSMIT.

The resolving organization formally submits the system release to the AOS organization for system integration.

Note: There are no status modifiers for the TRANSMIT phase.

A.8 STEP #8> STATUS: INTEGRAT(E).

All corrective actions received by the FAA for integration into an operational system is incorporated and baselined into the appropriate system release plan.

A.8.1 Status Modifier: Request.

The resolving organization successfully transmits the resolution or modification to the FAA. The FAA integrates the resolution into the system release plan and the status modifier is set to "INTEGRAT, Request."

When the integration is complete, the status modifier is updated to reflect the outcome of the integration.

A.8.2 Status Modifier: Pass.

The FAA integrates the correction or modification into the system release plan successfully. The system release plan is baselined, and the status modifier is set to "INTEGRAT, Pass." The ACI status is then updated to VERIFY (Step #9).

A.8.3 Status Modifier: Fail.

If the FAA is unable to integrate the correction or modification into the system release plan or is unable to baseline the system release plan, the status modifier is set to "INTEGRAT, Fail." The ACI status then returns to ASSIGN (Step #3).

A.9 STEP #9> STATUS: VERIFY.

The problem/change has successfully reached the baseline testing phase and is verified for corrective action. During this phase, the originator is consulted for final verification of the ACI's disposition. The ACI is assigned to an FAA tester. The FAA tester completes final testing of the resolutions and modifications, and the status modifier is updated to reflect the verification results.

A.9.1 Status Modifier: Pass.

When the resolution or modification has been verified with no degradation to the system, the status modifier is set to "VERIFY, PASS." The ACI status is then updated to CLOSE (Step #10).

A.9.2 Status Modifier: Fail.

If the problem correction did not test successfully, then the status modifier is set to "VERIFY, Fail." The ACI is returned to the resolving organization with an ACI status of ASSIGN (Step #3). If the ACI failed during the SCREEN phase of the life cycle, the originator then verifies the ACI information, and the ACI is returned to the SCREEN (Step #2) phase of its life cycle.

A.9.3 Status Modifier: Hold.

If the problem is placed on hold, pending further review, the status modifier is set to "VERIFY, Hold." FAA management may elect to hold an ACI until a subsequent system release has been created. When the ACI has been verified, the status modifier is updated to reflect the outcome of the verification.

A.10 STEP #10> STATUS: CLOSE.

Before an ACI can be closed, the adaptation data status is checked along with the status of any associated nonlogic components and RTRs. If an ACI affects adaptation data, the adaptation data status must be closed. This means that the associated adaptation data must be baselined. If the ACI has been reassigned to one or more logic releases, all associated RTR records must be closed.

Component tracking records are used to identify and track members in the library hierarchy, as well as commercial hardware and software changes. Normally, the person implementing the change creates the appropriate component tracking records for the change. A component record is associated with an ACI but not assigned to a logic release. If component records have been created for the ACI, the status of these components must also be closed.

All conditions must be satisfied before the ACI can be closed. The Software Configuration Library Manager (SCLM) software promotes the ACI to CLOSED status when all of the work for the ACI is complete. Once the ACI is filed with a status of CLOSED, the status cannot be changed.

If the revised system is scheduled to be deployed to the field, the CCB verifies that all of the Site Program Bulletin and Site Technical Bulletin events have occurred. These events include:

    a. Notification of a system release with changes,
    b. Preliminary Documentation, i.e., test scripts, training needed,
    c. Support Software which is executed with changes via remote logon,
    d. System Source Listings which provide insight into the logic,
    e. System Delivery of the Version Description Document (VDD) header files.

A.10.1 Status Modifier: Shipped.

If all procedures have been completed successfully and are available for deployment, the status modifier is set to "CLOSED, Shipped." The resolution or modification is deployed to the field as a source correction or update. The shipment should include the Site Program Bulletin (SPB) or Site Technical Bulletin (STB) number.

A.10.2 Status Modifier: Noship.

If the problem or change has been closed but the resolution or modification will not be shipped to the field, the status modifier is set to "CLOSED, Noship" and the ACI is closed.

A.10.3 Status Modifier: Reject.

If the problem or change has been rejected, the status modifier is set to "CLOSED, Reject" and the ACI is closed.

A.10.4 Status Modifier: Hold.

If a correction or revision is placed on hold pending the preparation of one or more documents, the status modifier is set to "CLOSED, Hold." The CCB may hold the implementation of a resolution or modification until a subsequent release has been created. When the ACI is ready to be shipped, the status modifier is updated to reflect the closing status of the ACI.

APPENDIX B

ADAPTATION DATA UPDATE PROCEDURES

Adaptation data is the set of data values used to adapt the functional behavior of the operational software to a certain center's needs. Site adaptation data specialists enter site-specific adaptation data, such as geographical data, installation data, and site-specific system parameters. National adaptation data specialists at the FAA Technical Center (AOS) enter adaptation data that applies to all centers, such as aircraft and static information data.

Adaptation data can be grouped into two general classes: environmental and nonenvironmental. Environmental adaptation data describes the geographical and physical characteristics of a given ARTCC and is subject to update activity based on real-world conditions or events. Nonenvironmental adaptation data consists of system control tables or other software oriented parameters which provide the flexibility and maintenance benefits of data-driven air traffic control (ATC) software. This class of data is updated along with incremental software enhancements or periodic tuning activities.

Environmental adaptation data occurrences are entered interactively through one or more data input panels, or in specific cases, via batch input files. The input panels supply default information and prompt the data collector for additional information. Nonenvironmental adaptation data occurrences are entered exclusively from batch input files. Once the data has been entered into the adaptation data databases, Configuration Management (CM) is performed following the same status and approval cycles by which all adaptation data updates are managed.

In general, the adaptation data specialist is responsible for determining what data needs to be updated. This specialist may have originated the ACI or may have been assigned to handle the data changes in an ACI from another source.

B.1 ADAPTATION DATA LIFE CYCLE.

The data collection software provides its own CM at the adaptation data occurrence level. This additional control is necessary because adaptation data is stored in DB2 tables and is not directly controlled by the INFO Family.

The data collection software maintains a life cycle status for each adaptation data occurrence. Possible status values are PENDING, FROZEN, TEST, and BASELINE.

a. PENDING. The initial status of an adaptation data occurrence is automatically set to PENDING. This data may be incomplete, with future updates to an occurrence pending completion. Only PENDING occurrences may be modified or deleted by authorized personnel. Upon completion of the occurrence data entry step, the user may "freeze" the data.

b. FROZEN. A FROZEN occurrence signifies that data updates for that occurrence are complete. FROZEN data is placed under configuration control and further updates are prevented during the review and approval process. When an occurrence is FROZEN, a list of reviewers for that occurrence is automatically created by the software.

c. TEST. TEST is a higher level of CM which may be used to indicate that data has been passed to a system test organization. However, testing of data may be performed at any point in its life cycle after incorporating it into a system release via the Plan System Release function.

Occurrences with a status of FROZEN or TEST must be demoted to PENDING status before updates can be made to the occurrence.

d. BASELINE. BASELINE is the highest level of CM. BASELINE occurrences can no longer be changed by the user. An occurrence should only be promoted to BASELINE when all changes and all testing for that occurrence are complete. One exception to this rule is the fact that certain CM data; e.g., last effective data, can be changed using the Data Collection utilities after the occurrence has been BASELINE.

To promote the status of a data occurrence to FROZEN, TEST, or BASELINE, the data must have a validation status of "valid," signifying the data has passed the Data Collection's contextual validation checks. The "valid" status implies that the data is syntactically correct and complete and is in compliance with the established category-specific occurrence definition.

The validation status can be changed only by the Data Collection software. An occurrence is determined to be "valid" when the Data Collection software indicates that the occurrence is complete and correct based on a set of predefined rules within the software. This determination is made when an occurrence is created and whenever changes to the occurrence are made.

B.1.1 Data Collection.

Prior to entering adaptation data, an ACI must be opened. Under AAS, all changes to adaptation data must be documented by ACIs. The "Open ACI" step in the ACI life cycle is described in detail in appendix A, The Ten-Step ACI Life Cycle.

Adaptation data is entered by the personnel or organization responsible for the real-world object or state described by the data. The data may be entered interactively or in batch mode, depending on the category. Generally, when data is batch input, the occurrence merely points to the data set that contains the data.

The data entry panels of the AAS ATC Operational Support and Change Tracking software prompt the user to enter appropriate data that describes an occurrence of a particular category. The prompting panels request and then store the parameters that correctly describe the occurrence. For categories that require a variable-length list of values, the user is prompted for multiple entries in the list until the user indicates that the list is complete.

The adaptation data management system has the capability to initialize the parameter value fields for a new occurrence with values from an existing occurrence. This capability allows an existing occurrence to be used as a template for the entry of similar occurrences. Once the new occurrence has been initialized, the user may then modify parameters to create the new occurrence.

As data is being entered, constraint checking is performed at two levels. First, as each individual parameter is entered, it is automatically checked against predetermined constraints for that parameter. These constraints may be format, dimension, or value constraints. Second, when the user specifies that ll values for an occurrence have been entered, the occurrence is automatically checked to verify that constraints involving more than one parameter are met.

Any failure of either type of constraint checking is recorded along with the occurrence unless the user corrects the values of the offending parameters. The user may invoke the display format adaptation data checking function at any stage of the entry process.

The source adaptation data which is collected during this step is used in the Construct System Release step in order to prepare the data products that are sent to each center.

The entry of adaptation data is complete when the user promotes the adaptation data to a status of FROZEN. This status change causes the occurrence to be stored in the adaptation database with indicators set that prevent any further attempt by the user to modify it.

To enter adaptation data, the Data Collection option is selected from the AAS ATC Operational and Change Tracking Menu.

B.1.2 Freeze Adaptation Data.

The user freezes an occurrence when they are certain that the entered modified data is complete and correct. After the occurrence has been frozen, no more changes may be made to the adaptation data. The user may freeze an occurrence only when the validation status of the occurrence is "valid" and the user is ready for the occurrence to be reviewed via the review/approve process.

To freeze adaptation data, the Data Collection option is selected from the AAS ATC Operational and Change Tracking Menu.

B.1.3 Review/Approve Adaptation Data.

"Freezing" an occurrence allows the ACI review process to begin, during which the proposed new or changed data is reviewed, tested, and approved. Updating, reviewing, and testing data changes are typically iterative processes. Since data occurrence values cannot be changed while in FROZEN or TEST status, the occurrence must be demoted to PENDING status in order to repeat the cycle.

Only the personnel with the proper review and approval authorization level can "thaw" the frozen occurrence and return it to the PENDING status for further user modification. This precaution assures that the data in the review cycle cannot be changed during the review, while at the same time it allows the submitter to make necessary corrections or changes.

Every occurrence must be reviewed and approved before it can be promoted to the BASELINE status. When an occurrence is promoted from the PENDING status to either the FROZEN or TEST status, the support software automatically generates a list of reviewers for that occurrence.

The support software generates the list of reviewers by searching its databases for the users that have the authority to access the "approve" function. This list can be tailored, via other Data Collection functions, to include only those users that are critical to the review of the particular occurrence. These reviewers may be adaptation specialists, informal test personnel, formal test personnel, management, etc.

Each reviewer is responsible for reviewing the occurrence for completeness and accuracy. The reviewers confirm that the occurrence is correct in relation to other occurrences in the category and any associated occurrences in other categories.

The Data Collection and System Release Plan Preparation functions of the support software assist the user in determining the validity of the occurrence values, but only the reviewers can be certain if the occurrence is correct for the situation and environment in which it will be used.

Review involves examination of displayed or printed images of a submitted occurrence. The purpose of the review activity is to make appropriate personnel aware of any and all proposed changes or additions to adaptation data. The examination may be made by the person who entered the data, that person's supervisor, appropriate personnel from related facilities, a central authority at the FAA Technical Center or FAA headquarters, or any number of other possible people, depending on the purpose of the submitted data. For data used only to support test cases, the review may involve only development personnel, while for data that will be used to describe actual ATC environmental or operational elements, the review may involve a broad spectrum of people, from operational to maintenance personnel.

The determination by the appropriate personnel that the changes are complete and correct is made category by category. Creation and submission of a new occurrence of a category makes the data available to the appropriate personnel. The software supporting the review operates through the SSCC and is available to users through interactive display panels specifically designed for this use.

Approval of a submitted occurrence is solicited from each reviewer, recorded, and saved as a part of the occurrence. Thus, the category contains information about each reviewer, including identity, the level of authority (absolute, advisory, or information only), and approval, rejection, or comment. The actual baselining of new or modified adaptation data occurrences is an event marked by the final approval of each occurrence.

The adaptation data category, in addition to providing prompting information for all required and optional data to be collected for each occurrence, provides a list of the reviewers to be notified whenever a new occurrence for that category type is submitted. The occurrence contains the actual data that defines the object, flags describing the purpose of the object (e.g., test, operations, etc.), and approval information from each reviewer. Progress during the review cycle can be determined by examining the approval fields.

To review/approve adaptation data, the Data Collection option is selected from the AAS ATC Operational and Change Tracking Menu.

B.1.4 Demote Data.

Once an occurrence is in the FROZEN or TEST status, no changes can be made to the occurrence. To make changes to an occurrence that has been promoted to FROZEN or TEST, the occurrence must first be "demoted" back to PENDING.

When an occurrence is demoted to PENDING, the list of reviewers for that occurrence is deleted. When the occurrence is then repromoted to FROZEN or TEST, the list of reviewers is recreated and the approval cycle starts again.

To demote adaptation data, the Data Collection option is selected from the AAS ATC Operation and Change Tracking Menu.

B.2 SYSTEM RELEASE PLAN PREPARATION.

After the adaptation data has been approved, the system release is prepared by specifying a system release plan. A separate system release is deployed to each center because a system release is tailored specifically for the center to which it is deployed. Once the system release plan has been completed, the adaptation data is converted into data products.

When a system release is prepared, the required adaptation data is extracted from the database, then the data is converted to the data product format and placed into data products for use with the operational software. A system release plan must be created before the data products can be generated. The system release plan is also required for integration and formal testing of operational logic releases.

There are two major components in a System Release: the logic release ID, and the constructed data products.

Once the system release has been deployed to the site, it is downloaded to the appropriate processors for final testing and cutover. These tasks are described in the ARTCC System Maintenance and Support Manual and the ARTCC System Management Manual.

B.2.1 Build System Release Plan.

To plan a system release, the System Planning option is selected from the AAS ATC Operational Support and Tracking Menu. The system release plan identifies the components of a system release, (i.e., which logic release and which data products are to be used).

B.2.1.1 Selecting a Logic Release.

Because adaptation data is so closely tied to the ATC Operational Software (logic release), each system release plan must specify the logic release with which the data is to be used. The logic release must already have been created using the Logic Release Planning functions, which are described in appendix C. The logic release must at least have a status of OPEN.

B.2.1.2 Constructing Data Products.

Once the system release plan is created, the adaptation data must be constructed into data products. During the data construction phase, the occurrences which are to be used for the data product are selected, any additional validation that was not performed in the Data Collection step is performed, and the occurrences are combined and reformatted into a computer readable format, or a data product.

The construction step may be run only when the system release contains adaptation data. If the system release contains only logic, there are no adaptation data products to construct, and this step is bypassed.

Since the construction step creates the data products that are used by the system release, the construct step must be run before the "test ship" or "deploy" steps.

To construct a system release, the Data Construction option is selected from the AAS ATC Operational Support and Tracking Menu.

B.2.2 Test Ship System Release.

The user may ship a constructed system release with a status of PENDING to a center or to the System Support Facility (SSF) for informal testing. This gives the user the ability to fully test the system release and to make any necessary changes to the system release before the system release is BASELINE. A BASELINE system release cannot be modified, which means that any errors found in a "baseline" system release can be corrected only by creating another system release.

The adaptation data products corresponding to the developed adaptation data are test shipped via tape or electronic link from the Technical Center to the center where they can be tested independently of the other contents of the system release.

Modifying data, construction, and testing of the system release will be an ongoing loop until the user is satisfied with the system release. The user constructs and tests the system release. The user then makes any necessary changes and constructs and tests the system release again. This process continues until all tests have been executed successfully and the user is satisfied with the constructed system release.

To test ship a system release, the System Distribution option is selected from the AAS ATC Operational Support and Tracking Menu.

B.2.3 Test System Release.

The test system release step is performed at the ARTCC or SSF that receives the test shipment. During this phase, the tester thoroughly tests the system release or partial system release, whichever is appropriate. Inputs required for testing include test scenarios and test versions of logic and adaptation data.

If the test is successful, the data update process continues with test shipment to key test centers or to other particular centers for further testing, as the situation demands. Otherwise, any problems, such as a logic error or an improper test configuration, must be analyzed and resolved before key center testing.

To completely test an operational logic release, it would have to be tested with every possible combination of site-specific adaptation data. The most appropriate strategy possible for SSF testing is using Universal Data Sets (UDSs) to test ACIs when it is impractical to test against a large number of different adaptation data sets. Consequently, the rigorous testing process at centers will still be required under ISSS as performed in the past.

B.2.4 Baseline Adaptation Data.

Once all of the adaptation data has been collected, reviewed, and successfully tested, it is ready to be BASELINE.

B.2.5 Baseline System Release Plan.

A system release plan can have a status of PENDING or BASELINE. The AAS software requires a system release to be baseline before it is deployed to a center. This is to ensure that a system release cannot be changed after it has been deployed. Baselining a system release freezes the data products so that they cannot be changed.

A system release is baseline only when it has been tested successfully and is ready for deployment to the center for certification and installation. Baselining a system release does not affect the source adaptation data that was used by that system release.

To baseline a system release plan, the System Planning option is selected from the AAS ATC Operational Support and Tracking Menu.

B.2.6 Deploy System Release.

The deploy function sends an AAS system release to a specific center. The deployed system release includes a specified set of constructed data products, static data, and logic release data sets. The contents of the deployed system release are determined by the user in the plan system release step.

The AAS software dic'ates that only BASELINE system releases can be deployed, and the associated logic release must have a status DEPLOY, even if the logic itself is not being deployed with the system release.

To deploy a system release, the System Distribution option is selected from the AAS ATC Operational Support and Tracking Menu.

B.2.7 Report Receipt.

Once the deployed system release has been received at the center, the site personnel report receipt of the system release. The CM rules dictate that a "report receipt" must be made before the "report cutover" step is performed.

Only a deployed system release may be reported as received at a center, the AAS software does not support the reporting of a "test shipped" system release.

B.2.8 Close Adaptation Data.

Once the adaptation data changes have been made and deployed to a center via the system release, the data portion of the ACI, used to track the changes, can be closed.

The adaptation portion of the ACI must be closed before the ACI can be closed. Once all of the occurrences that were created for the ACI are baseline, the ACI can be closed to adaptation data.

To close adaptation data, the Change Tracking option is selected from the AAS ATC
Operational Support and Tracking Menu.

B.2.9 Close ACI.

Closing the ACI is the last step to be performed. Closure of the ACI indicates
that all work related to the ACI is complete. Since the system release can be
installed at the center before the ACI is closed, this activity is of low
criticality.

When all centers have reported cutover to a system release, all release tracking
records for the logic release that have been deployed, are closed. The ACIs with
closed release tracking records will also be closed at this point.

To close an ACI, the Change Tracking option is selected from the AAS ATC
Operational Support and Tracking Menu.

APPENDIX C

LOGIC UPDATE PROCEDURES

NOTE: This section is written to address the procedures for updating operational software. These procedures could also be applied for updating AAS developed software.

A logic release is a set of related software used to generate a deliverable system. A logic release plan includes a schedule for building and promoting a logic release and a record of all the ACIs, and associated software and document components, that are included in the logic release. A logic release plan is necessary to develop and deliver a logic release.

The four CM statuses that a logic release plan can go through are NEW, OPEN, CLOSED, and DEPLOY.

a. NEW. The logic release plan is created and its status set to NEW when the project definition identifying the hierarchy for the release is built by the SCLM administrator. The only logic planning function available for a logic release with a status of NEW is to initiate (open) the plan.

b. OPEN. A status of OPEN indicates the planning and development functions for the logic release plan can begin. The ACIs may be scheduled for implementation in a logic release via the Change Tracking option when the plan has a status of OPEN.

c. CLOSED. A CLOSED status prevents ACIs from being scheduled for implementation in that logic release. The only changes that may be made to the plan are to set the status to DEPLOY and to modify the compatibility data. Compatibility data associates a support software logic release with one or more operational software releases. It is described more fully in a later section.

d. DEPLOY. A DEPLOY status is used after all development and testing of the logic release is complete. It allows the logic release to be deployed to a center. The logic release plan can only be set to deploy after the code and associated documentation has been promoted to the release level.

C.1 LOGIC RELEASE PLANNING.

The plan logic release function is used for all tracking functions pertaining to developing a logic release, from initiating the logic release plan to implementing the changes to delivering the code.

C.1.1 Create a Library Hierarchy for a Logic Release.

Operational code and documentation is maintained in a hierarchical library management system called System Configuration Library Manager (SCLM). There are three types of work associated with SCLM. The SCLM administrators (ACN-600) allocate datasets, maintain SCLM hierarchies, and provide the tools to support various types of files under SCLM like Ada, Bookmaster, and REXX.

To set up the library for a new release of operational code, AOS, or the organization modifying the software, will contact the SCLM to create the logic release plan. The SCLM administrator will allocate the datasets and define the library hierarchy for the logic release. The hierarchy is defined as a SCLM project definition. This project definition identifies all library types and sections necessary for the development, testing, and deployment of the logic release.

The hierarchy for the development of one logic release includes exactly one release level and one or more levels for formal test, integration testing, and development testing. One logic release and one library structure can be used to make many logic changes. Each maintainer would normally have an individual level, but they may be shared.

There are three user levels; (1) one Development Integration Level (DEV), (2) one Integration Test Level (INT), and (3) one Release/Formal Test Level (REL). Additional levels may be added to the hierarchy, depending on how many steps there are in the test procedures. For example, if there are three types of formal test, you may want to set up three different levels in the hierarchy for these three different test activities. This would allow each test organization to have its own isolated environment.

Library structures and logic releases have a one-to-one relationship. Each logic release is contained in one main library structure, but there may be several test library structures associated with that logic release. Each library structure can contain one and only one logic release. If the hierarchy is used to develop a delta logic release, there will be one or more base levels for prior releases above the release level for the current release. The code for the current release may not be promoted into the levels of the previous releases.

Once the SCLM project definition is defined, it must be assembled under SCLM using the Library Definition Translator provided by AAS. This creates a logic release plan with a status of NEW.

C.1.2 Initiate a Logic Release Plan.

When a logic release is created, the first planning function performed is the initiation of the logic release plan. During the initiate function, the user defines basic planning information for a logic release, such as the logic release title, purpose, and planned release date. Schedule information is added for builds and promotes for each library level in the library hierarchy and the status is set to OPEN.

Logic release plans may be subdivided into incremental plans. An increment is a testable subset of a logic release and is created to divide a large logic release into smaller, more manageable units for testing. An increment is not deployable. If a logic release is small enough to test as a whole, increments are not used. In general, increment plans are set up and used like logic release plans.

To initiate a logic release, the logic planning option is selected from the AAS ATC Operational Support and Tracking Menu.

C.1.3 Define the Contents of a Logic Release.

Once a logic release plan has been initiated, changes to the logic release are defined by assigning ACIs to the logic release. The ACIs and logic release plans have a many-to-many relationship. One logic release can consist of one or more ACIs, and one ACI can be assigned to one or more logic releases. This many-to-many relationship allows the user to handle more than one change in a logic release and to implement a change in multiple baselines. This is particularly useful when making an emergency fix in the field and incorporating that same change in the next regularly scheduled release.

When an ACI affects logic, it is assigned to a logic release when it has a status of SCREEN or RESOLVE.

In order to assign an ACI to a logic release, a release tracking record (RTR) must be created using the logic planning function. One RTR tracks one ACI in one logic release. If an ACI is implemented in more than one release, the RTR must be created for each release in which it is implemented. Note that the RTR tracks logic releases, not system releases.

Because the RTRs are used to track an ACI, they have the same CM statuses as an ACI. The status of the RTR allows the user to track each ACI within the logic release separately. When RTRs exist for an ACI, the status of the ACI normally stays at SCREEN or RESOLVE until all RTRs associated with it are closed. At that point, the original ACI is closed.

To assign an ACI to the logic release, the Change Tracking option is selected from the AAS ATC Operational Support and Tracking Menu.

C.1.4 Initiate Component Tracking Records.

Each component in the library hierarchy that must be edited to implement an ACI must be identified and tracked via a component tracking record. Component tracking records may also be used to track commercial hardware and software changes that may or may not be associated with a logic release. Normally, the person implementing the change would create the appropriate component tracking records for the change.

Four types of components can be tracked by the tracking function: (1) software, (2) hardware, (3) commercial off-the-shelf (COTS) software, and (4) documents. A component has a status of OPEN or CLOSED. A component's status is set to OPEN when a component tracking record is created.

The information in the component tracking record includes the ACI number, the logic release ID (if appropriate), scheduling information, a description of the work to be done on the component, the impact of the work (e.g., labor months, source lines of code), the person to whom the work is assigned, and other data that further identifies or describes the component.

In addition to tracking component development, component tracking data is used to produce discrepancy reports when a logic release or increment is promoted. This applies only to software and document components that are part of a logic release. For example, if a user tries to promote a logic release that includes a specific software component, but no tracking record has been created for the component, then a discrepancy report on the promotion is produced, identifying the extra component. The promotion is prevented if any discrepancies are found. The promotion can continue only if the requestor has special authority to override the discrepancy.

A closed component tracking record may not be modified. The CLOSED status indicates that all work on the component is complete. All components associated with a release must be closed before the associated RTR may be closed. All components not associated with a release must be closed before the ACI can be closed.

To initiate a component tracking record, the Component Tracking option is selected from the AAS ATC Operational Support and Tracking Menu.

C.2 DEVELOP AND TEST LOGIC.

After all planning functions are complete, the maintainer develops and tests the required logic in order to resolve the problems or implement the changes detailed in the ACIs.

C.2.1 Logic Development.

Logic development begins with the analysis of the ACIs by personnel who are already familiar with the operation and structure of the software. Generally, the outcome of this analysis is an estimate of the number of Source Lines of Code (SLOC) affected, requirements for new or additional documentation, and resources required for testing and training. For details regarding software development, see section 4.1.7, Software Development and Test.

The implementation of a change in software may also involve the addition or correction of adaptation data. Preset adaptation data is maintained AOS in the same way as operational logic. Other adaptation data is maintained by Site Adaptation Data Specialists.

The output of the development activity is the logic release, which consists of the load modules that were generated by compiling, link editing, and binding the developed logic. At the completion of this activity, the logic is ready for testing.

The SW Development option is selected from the AAS Administration and System Support Menu to edit, build, and promote code.

C.2.2 Unit Test the Software.

Once AOS has edited the software, the component for unit testing is built. Unit testing takes place at the Job Shop, within or outside of the SCLM tool. When the component has been tested, the developer will promote the component up to an integration level in the hierarchy.

C.2.3 Modify Compatibility Data.

Compatibility data is used to associate a support logic release with one or more operational logic releases that run at an ARTCC. This data identifies the version of the support software to be used to create the adaptation data products for the new release.

For example, when an Operational Unit (OU) requires a new adaptation data product, the new version of the support software that was created to produce the data product must be used to create the adaptation data for the new operational logic release. The compatibility data contains the necessary information for choosing the correct version of software to use.

As new system releases are created, a new operational logic release may require a change to the existing support logic release. Previous operational logic releases may then be compatible with the new support logic release. In that case, both the new operational logic release and any old operational logic releases still in use are marked as compatible with the new support logic release. This reduces the number of support logic releases that must be maintained.

Compatibility data is modified by the software maintainer or logic release planner for open, closed, or deployable releases.

To modify compatibility data, the logic planning option is selected from the AAS ATC Operational Support and Tracking Menu.

C.2.4   Update Release Tracking Status to "RESOLVE, Submit".

Once a change has been implemented, the appropriate release and the RTR associated with the ACI are updated with resolution information. The status is updated to "RESOLVE, Submit" to notify the integration test organization that the change is ready.

C.2.5   Promote Code to Integration Level.

After all changes for a release have been implemented, the Builds and Controls organization (ACN-600) is notified to build and promote the release to the INT. This provides a controlled, unmodifiable set of code to the integration testers for testing.

The SCLM software performs the promote function and generates a discrepancy report. This report contains a comparison between the logic release plan, including the ACI numbers and the components listed for each ACI, and the code that is about to be promoted. The SCLM identifies each component to be promoted and each ACI associated with that component. If SCLM tries to promote any component or ACI that is not in the logic release plan, a discrepancy is flagged. Likewise, if any components or ACIs in the plan are not in the SCLM list, the discrepancy is flagged. Any discrepancy will halt the promotion unless the person requesting the promotion has the authority to promote with discrepancies.

To promote code to the integration level, the Library Control option is selected from the AAS Administration and System Support Menu.

C.2.6   Initiate Test Tracking Records.

Test tracking data is information about a test that is run to verify the implementation of an ACI. Test tracking data is informational and has no effect on the ACI life cycle.

The information in the test tracking record includes the ACI number, logic release ID (if appropriate), and increment ID (if appropriate) associated with the test; scheduling and assignment information; a description of the test; and the test status.

To initiate a test tracking record, the Test Tracking option is selected from the AAS ATC Operational Support and Tracking Menu.

C.3 SYSTEM RELEASE PLANNING.

After the operational logic has been modified and is ready to be tested on the SSF, a system release plan must first be created. The system release plan combines the logic with constructed adaptation data products. The system release plan is test shipped to the SSF for testing. Appendix B describes the system release plan in detail.

C.3.1 Schedule a SSF.

The software developer schedules the SSF to test the system release. The SSF scheduling is performed using the Resource Scheduler CAS product. ACN-600 is responsible for the scheduling of SSCC resources. Section 4.1.8 provides resource scheduling information.

C.3.2 Create a Logical Replication for Simulation.

To create a site simulation, a cumulative system release must be constructed to include the modified software, the adaptation data which tailors the software, and test scenarios to exercise the software, among other parameters. The test scenarios will include tests to determine if the problem or change identified by the ACI has been fixed or updated as well as regression tests to ensure that the rest of the system is still intact.

The SSF Managers Organization is responsible for configuring SSCC resources to support simulation and testing. Once the software and hardware requirements for a SSF are determined, and a test organization makes a request for resources, the F&SC Operator can configure the hardware for a SSF. After the hardware configuration has been set, the F&SC Operator prepares the software configuration.

Many different support software and nonsupport software options are used to configure and manage the equipment and test systems.

C.3.3 Execute Integration Tests.

Once the SSF is configured, the logic release is downloaded to the support facility for integration. If any problems are found, new problem ACIs are opened and testing continues.

Any problem ACIs that are opened at this stage follow the normal ACI life cycle described in appendix A. They are screened and assigned to a logic release for implementation. If the ACIs are assigned to the current logic release, they will be folded into the next build of the system starting at the "Define the Contents of a Logic Release" task.

C.3.4 Test Completion.

When the integration tester is satisfied that the updates to the system are working, the test tracking record(s) associated with the ACI are closed, the status of the RTR is changed to "INTEGRAT, Pass." This lets the formal test organization know that the system is ready for formal testing.

C.3.4.1 Promote Code to Release Level.

When all RTRs for the logic release under test has a status of "INTEGRAT, Pass," Build and Controls organization can promote the code to the REL of the hierarchy. The release level is the same as the formal test level. A discrepancy report will be generated at this step. Any discrepancies found will prevent the promotion without special authority.

C.3.4.2 Close the Logic Release.

A logic release is closed and baseline. Closing the logic release sets the logic release status to CLOSED. Any open logic release plan may be closed except for operational logic releases, which may not be closed unless a compatible support software release has been identified by modifying the compatibility data. Once a logic release plan is closed, it may not be reopened, and can be modified only to the extent that compatibility data may be changed.

To close a logic release, the Logic Planning option is selected from the AAS ATC Operational and Change Tracking Menu.

C.3.4.3 Set the Logic Release Status to "DEPLOY"

After a logic release has been promoted to the release level of the hierarchy, is fully tested, and has a status of CLOSED, the logic release status is changed to DEPLOY. The logic release status must be DEPLOY before any system release that references this logic release can be deployed. If necessary, a logic release status may be changed back to CLOSED if it has not actually been deployed.

To set the logic release to DEPLOY, the Logic Planning option is selected from the AAS ATC Operational Support and Tracking Menu.

C.3.4.4 Generate the Logic Release VDD Reports.

The primary document that accompanies each logic release is the Version Description Document (VDD). This document is unique to each site that is to receive the release and includes information concerning the logic release, such as an inventory list of adaptation data products and ACIs associated with the release.

Once the logic release is complete, the reports related to the logic release are included in the VDD. These reports are saved for later inclusion in the VDD generated for a particular system release.