Attachment J-7

Management Information System Description

1.0 INTRODUCTION

As stated in the IS Plan, the vision for the ISSA-IS is that of a system consisting of a common, integrated data structure and a set of logically independent application modules that access the data as a shared resource. This vision encompasses the following architectural domains interacting through standards.

(D 1) **Applications**: In the target system, this component will consist of small, task-oriented modules. Each module will perform a well defined function. The goal is for no two modules to perform the same function and for each module to be logically independent yet complementary of the others. This will always remain the goal, even though it may never be completely realized in practice.

(D2) **Data**: In the target system, this component will consist of an integrated data structure through which the application modules share data. No non-key data elements should be duplicated, and all tables should to be normalized to the appropriate normal form. These criteria will be applied to all new database design activities in the ISSA-IS.

(D3) **Delivery Systems**: In the target system, this component will consist of the workstations, processors, low-level software, and the network infrastructure required to provide a flexible environment for the application modules and the integrated data structure.

This document deals with the architecture of the applications, data, and delivery systems domain.

The IS Plan also describes a strategy of phased migration from a baseline set of legacy systems to a new architecture for the future. A schematic representation of the target architecture is provided in Figure 1.0-1. Given the overriding objective of cost effectiveness, each opportunity to change the ISSA-IS configuration will be subjected to careful cost/benefit analysis. Those opportunities where the benefits outweigh the costs will be viewed as opportunities to make improvements to the architecture.

From an applications perspective, it is expected that the ISSA-IS configuration will evolve in the manner depicted in Figure 1.0-2. The four steps delineated in the figure should be understood as follows:

Step 1: Implement Available Best Fit.

During the transition from the Space Station Freedom Program (SSFP) to ISSA, the intent is to establish a fully functional information systems environment at minimum cost and within a very short time-frame. This is to be accomplished through the selection of systems that are available and do not require development.

The selection process will be undertaken by the Program Integrated Product Teams (IPTs) and Analysis and Integration Teams (AITs) and will involve the review of applications developed for SSFP's Technical and Management Information System (TMIS), as well as commercially available products, and products available from the various Program participants (e.g., the Boeing Defense & Space Group (D&SG)).

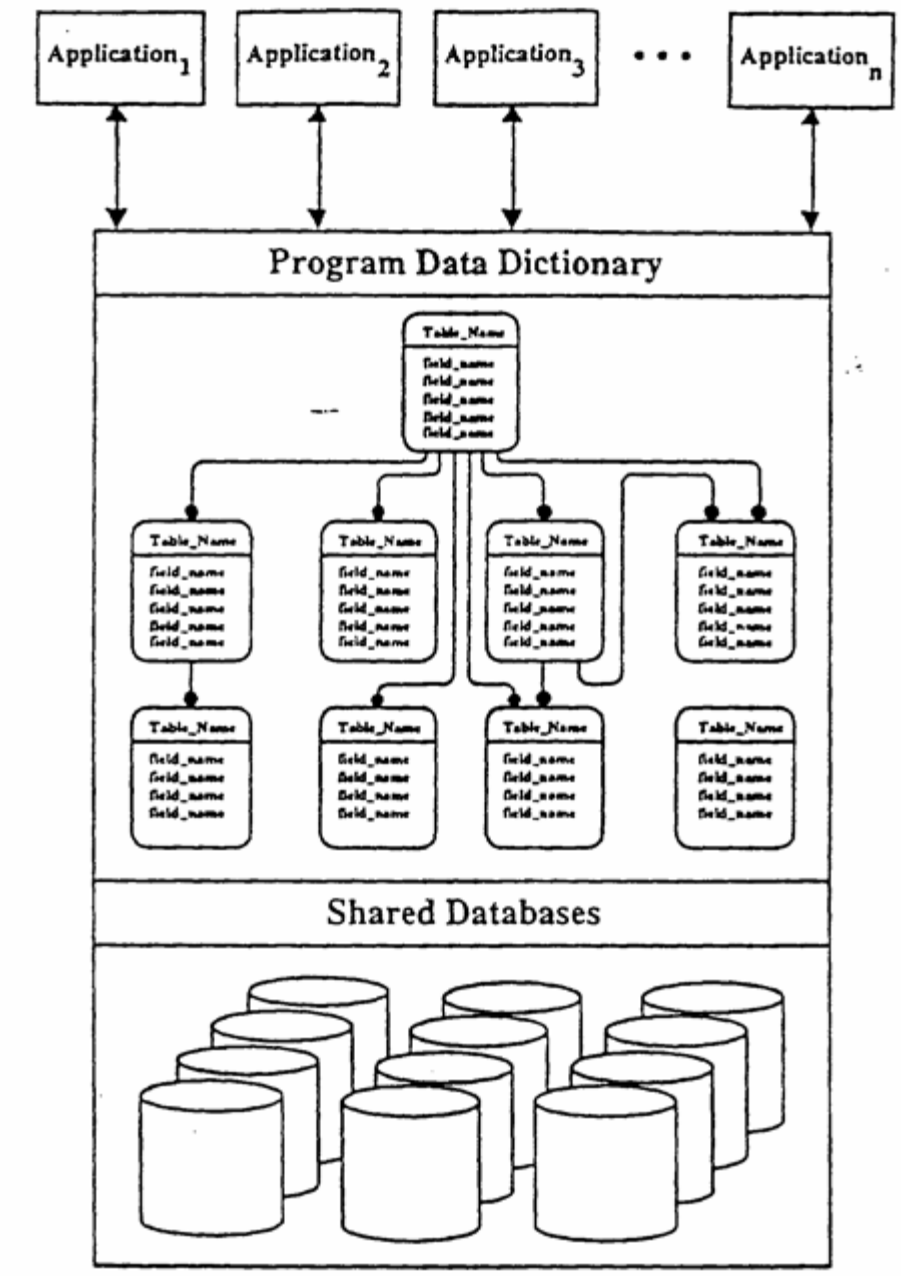

Figure 1.0-1: ISSA-IS Target Architecture

In some cases, the selected systems will be implemented with the knowledge that they will be have to be upgraded, replaced, or enhanced later in the Program.

Step 2: Adopt the DM2000 Concept

DM2000 is a data-driven information system that has been in use in the Boeing D&SG since 1990. DM2000 was developed from a top-down, enterprise-wide design perspective with explicit architecture principles in mind. It provides an enterprise-wide data model and an integrated data dictionary, and it supports data integration across multiple applications. In short, it is an instance of the type of system that was depicted in Figure 1.0-1.

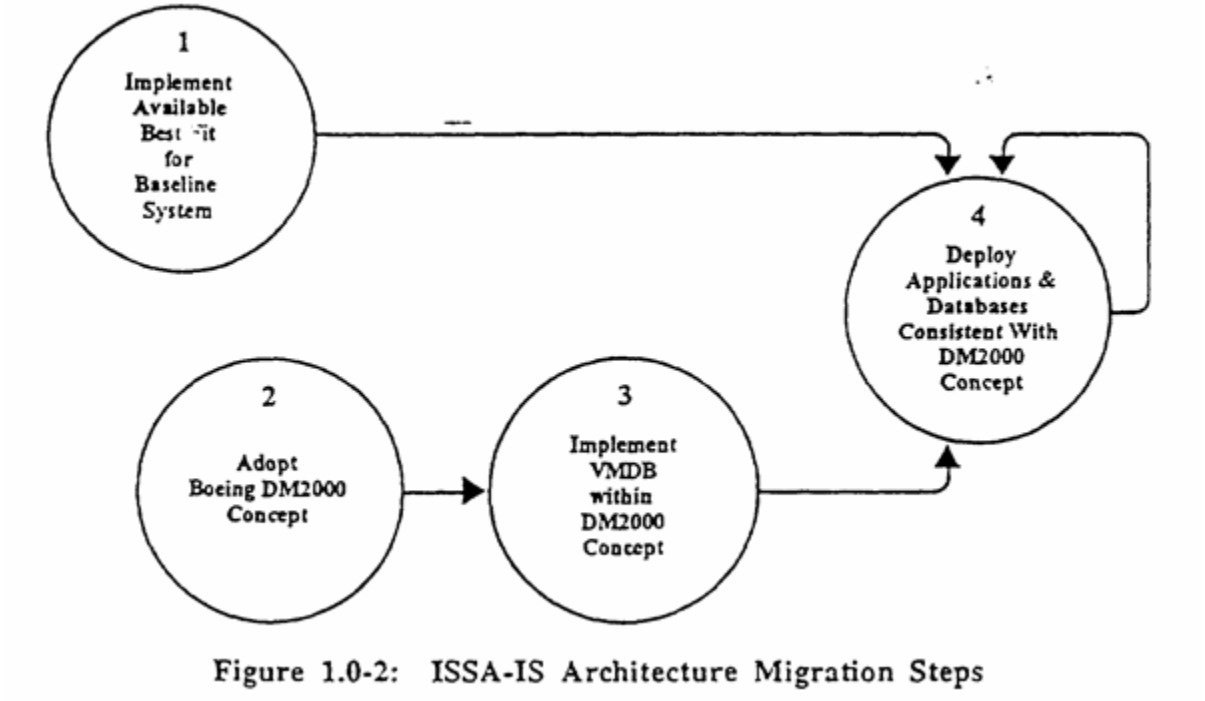

Figure 1.0-2: ISSA-IS Architecture Migration Steps

S**tep 3: Implement the ISSA Vehicle Master Database (VMDB) as an Instantiation of the DM2000 Concept**.

There is an opportunity to minimize development effort and achieve architectural compliance by using the DM2000 concept as the basis for the creation of the VMDB data structure.

Step 4: Acquire or Build Applications Consistent with Architecture Principles.

Once VMDB is in place and new applications are being added to the ISSA-IS and old ones are being replaced, the intent is to provide applications that will be compliant with the concept of DM2000.

From a Data Resource Management (DRM) perspective, it is expected that the ISSA-IS configuration will evolve as follows:

Step 1 Develop an ISSA enterprise model, a high-level information model of the Program as a whole.

Step 2 Adopt the DM2000 concept, including the high- and low-level data models, data dictionary, and database implementations.

Step 3 Map the ISSA enterprise model to the high- and low-level data models. Adopt all DM2000 concepts that can be used for ISSA. Initiate data modeling efforts for all ISSA enterprise areas.

Step 4 Leverage the results of Steps 1, 2, and 3 into a Program Integrated Data Model (PIDM). The PIDM will be a key-based model, fully attributed, with all many-to-many relationships resolved. It is recognized that the PIDM will continue to evolve throughout the life of the Program. In other words, this step will overlap with the steps enumerated below.

Step 5 Implement the Vehicle Master Database (VMDB) as an instantiation of the DM2000 concept.

Step 6 For each new application that must be developed, ensure that the following steps govern the design phase:

(a) Document the data requirements for the new application.

(b) Map these requirements to the PIDM.

(c) Ensure that the ISSA-PIDM serves as the database for the new application, In general, no application developed or sanctioned by the ISSA-IS organization should be supported by its own dedicated database. Exceptions must be thoroughly justified, carefully documented, and approved by the ISSA-IS Data Management organization.

If Steps 1 through 6 are followed, the ISSA-IS will evolve toward "data integration across multiple applications".

Step 7 As the ISSA-PIDM concept grows in scope, opportunities for retiring legacy database will arise. The opportunity for a retirement will exist whenever all (or most) of the data elements and relationships in a legacy database are found in the PIDM. When such an opportunity is identified, the legacy database should be retired as follows:

(a) Load the ISSA-PIDM from the legacy database and use the data for batch-oriented reporting functions. The frequency of the loads will be determined by the frequency of the batch jobs.

(b) Recode the data capture and input functions so that they feed the ISSA-PIDM directly, and provide logic for the ISSA-PIDM to feed the legacy database. Blockpoint and implement.

The ISSA-PIDM is now feeding the legacy database.

(c) Recode the online query and reporting functions so that they access the ISSA-PIDM rather than the legacy database.

The legacy database is no longer providing any service.

(d) Retire the legacy database

As stated in the IS Plan, a strategy of phased migration from a set of legacy systems to a more integrated architecture will be pursued over the life of the Program. Given the overriding objective of cost effectiveness, each opportunity to change the ISSA configuration will be scrutinized. Those opportunities in which the benefits outweigh the costs will be viewed as opportunities to make improvements to the architecture. Unlike the data and applications architecture, changes to the delivery system architecture may be initiated without explicit direction from user requirements. As advances are made in technology, cost effective modifications to the existing architecture may be undertaken by the ISSA-IS organization simply to improve the infrastructure and reduce costs.

To the extent that opportunities are presented, it is expected that the ISSA-IS delivery systems architecture will evolve along a path as follows:

- Implement the most readily available solution that can be agreed upon, spending as little money as possible.
- Minimize the number of solutions that satisfy the same set of requirements.
- Adopt open systems standards.
- Perform trade studies before purchasing delivery system components. Acceptable support must be available over the life of the product/component.
- Always consider using existing hardware resources.
- Focus on technologies that have a high probability of satisfying specific Program needs with a minimum of risk of impact on the existing computing environment.
- Ensure that delivery systems components will not inhibit the satisfaction of Program or contractual data security requirements.
- Buy delivery system components that are consistent with architecture principles and standards.

ISSA-IS will forecast and execute upgrades, improvements and additions to the computing resource base by utilizing the following:

- System utilization reports and utilization trends,
- Computing resource capacities, and
- Program goals and projections.

1.1 SCOPE

This document contains information for applications, data, and delivery systems that are necessary to support the activities of the ISSA Program Office (Boeing) and those applications, data, delivery systems that are Program-wide (support the entire Program). This document will not address the application, data, delivery systems environments of the Product Groups or International Partners except to the extent necessary to accurately describe the ISSA application architecture or the interfaces to the information systems of the participants.

1.2 PRECEDENCE

This document contains the requirements for ISSA-IS deliverables.

2.0 APPLICABLE DOCUMENTS

The following documents of the date and issue shown include specifications, models, standards, guidelines, handbooks, and other special publications. These documents were utilized in the development of ISSA-IS requirements, standards, and principles and are applicable to the extent specified herein. Inclusion of applicable documents in this list does not in any way supersede the order of precedence.

DOCUMENT NUMBER	TITLE
SSP 50013 July 1994	ISSA Information Systems Plan
D658-10283-01 July 1993	Information Systems Technical Reference Model
D684-10064-01 June 1994	ISSA IS Application Architecture
D684-10065-01 June 1994	ISSA IS Data Architecture
D684-10066-01 June 1994	ISSA IS Delivery Systems Architecture
NHB 2410.9A July 1993	NASA Automated Information Systems (AIS) Security Handbook
SSP 50020 TBD	VMDB Plan
D684-10017-01 April 1994	Software Development Plan
TSS 30551 No date	Space Station Freedom Program Office Data Naming Standards
MDC 91H0544, Rev C September 1993	JSC Data Support System (DSS) System Configuration Document

3.0 CURRENT APPLICATION CONFIGURATION

The baseline set of applications to be employed by ISSA consists of a heterogeneous set of legacy applications that were built to different sets of architectural ground rules and that reflect a variety of architectural orientations. This variety makes it difficult to describe the baseline ISSA-IS applications architecture and to organize its components into logical categories.

It is the intent of the ISSA-IS organization to implement architectural principles and standards over the life of the ISSA Program to minimize the variability of the configuration. The purpose of this is to introduce greater and greater consistency and thereby to increase flexibility and maintainability. Figure 3.0-1 illustrates the complexity of the current configuration and compares this with the simplicity and consistency desired for the future.

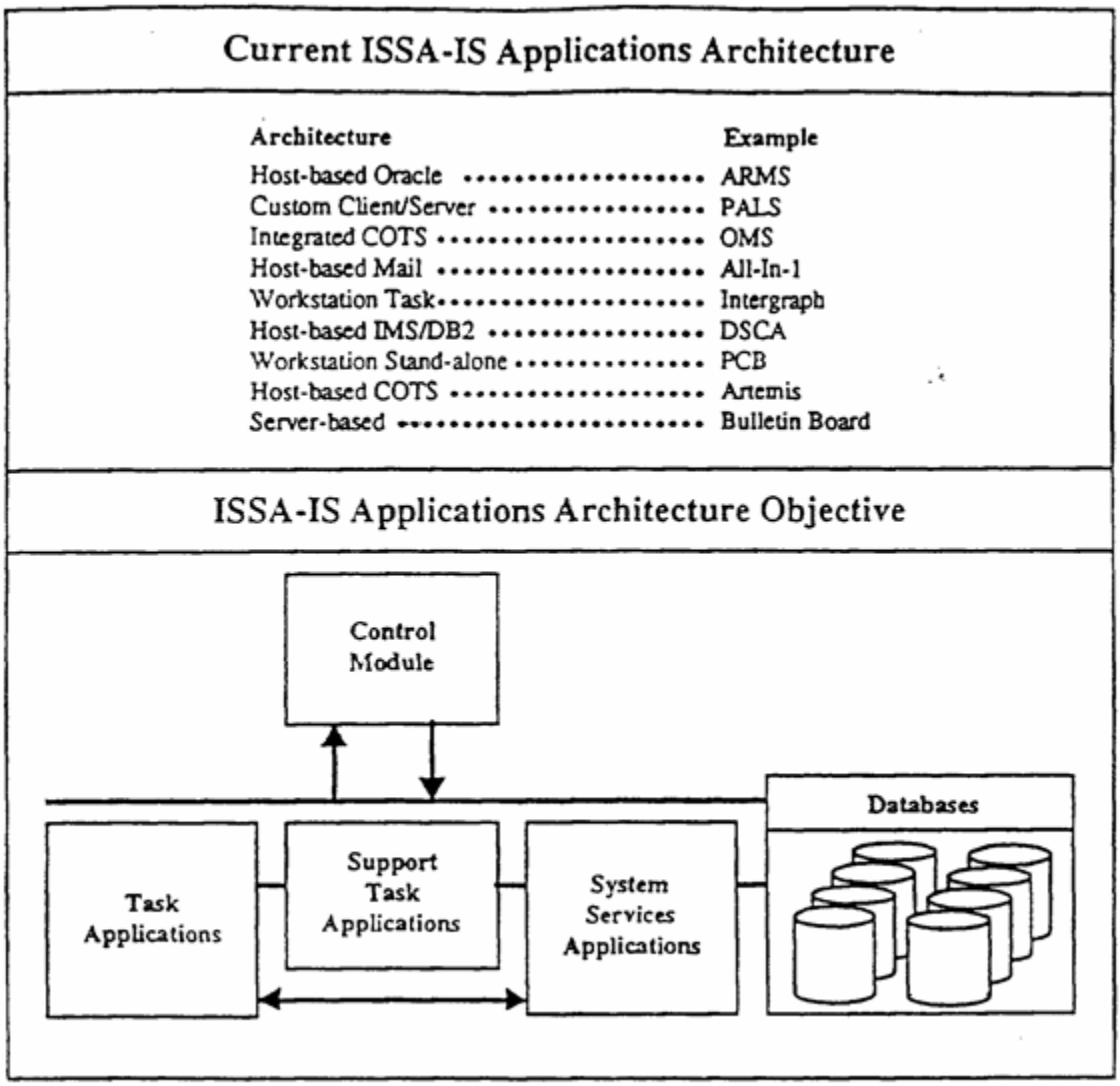

Figure 3.0-1: Current and Planned ISSA-IS Architecture

As the figure indicates, in the current configuration the applications are so tightly bound with the hardware and lower-level software that support them that they cannot be described without identifying these underlying elements. A major architectural objective is to separate the applications from these elements. When this is achieved, the applications can be described solely in terms of their functionality and structure, independent of the underlying components that support them.

3.1 LISTING OF CURRENT APPLICATIONS

Tables 3.1-1, and 3.1-2 identify the "current" and "baseline" applications. The "current" applications are in use by the Program today, during the transition phase. The "baseline" applications reflect the initial operational application environment for ISSA. When the current and baseline are the same, it implies that there are no major changes planned for this area. These tables will be updated as the configuration changes over time. A task sheet is found for each subject area identified in the tables. If the current system is

the same as the baseline system, the task sheet will identify the sustaining level of effort for the application. If the current system is different from the baseline, the task sheet will contain the cost and schedule for implementation of the baseline system. In addition, the change will be documented in Section 5.

Office automation (workstation) software is generally outside the scope of the application architecture. In those case where the workstation software is an integral part of the business process application (e.g., Interleaf), it will be included in this document; but standard Commercial-Off-The-Shelf (COTS) tools such as Microsoft Word and Excel will not be addressed.

As mentioned in the IS Plan, it is our intent to use the Host Center (JSC) standards whenever possible at the workstation and server levels to satisfy Space Station requirements. To the extent that a specific support structure is established to accommodate the implementation or maintenance of workstation applications, it will be addressed in this document.

3.1.1 Non-Boeing Program Office Applications

Non-Boeing Program Office applications are not the property of the Boeing Company and they support general Program Office functions. These applications are delineated in Table 3.1-1 and described in Section 3.2-1.

3.1.2 Program-Wide Applications

Program-wide applications are listed in Table 3.1-2 and described in Section 3.2-2. A Program-wide application is defined as an application that is supported by the ISSA-IS organization for use by some or all of the organizations participating in the Program.

As with Program Office applications, a task sheet is found for each subject area. If the current system is the same as the baseline system, the task sheet will identify the sustaining level of effort for the application.

If the current system is different from the baseline, the task sheet will contain the cost and schedule for implementation of the baseline system; and the change will be documented in Section 5.

3.2 DESCRIPTION OF APPLICATIONS

The following paragraphs contain brief descriptions of the applications identified in the preceding tables. The entries in this section are grouped as Boeing applications, non-Boeing Program Office applications, and Program-Wide applications. The entries within each group are organized alphabetically by acronym.

Program Office Application (non-Boeing)					
Subject Area	Responsible Manager	Requirements Interface	Current System	Baseline System	Task Sheet
Action/Issue Tracking	Padgett	BM-AIT	Various	ATA	1
Bulletin Board	Padgett	BM-AIT	BB	BB	2
Change Management	Wood	SS-AIT	AITS	CACTIS	4
Configuration Management	Wood	SS-AIT	SSE-CM	CACTIS	6
Correspondence Management	Wood	BM-AIT	CTS	CTS	8
Data Requirement	Padgett	BM-AIT	DRT	DRT	56
Design Analysis Environment	Morrow	V-IPT	RDD-100 CAFTA RPP RMA PLATO	RDD-100 TBD TBD TBD TBD PDS RBDA	57
Engineering Drawing Environment	Morrow	V-IPT	EMDB	CADSYS EDLS	58
Integration/Verification Environment	Morrow	V-IPT	RTM	RTM ICDSYS	59
Logistics	Wood	V-IPT	ALSTAR	SIMSYLS ALSTAR	20
Metrics Data	Padgett	BM-AIT	N/A	MDR	23
Micro-Gravity Environment	Morrow	V-IPT	NASTRAN TRASYS GRASP IDEAS IDEAS2	NASTRAN TBD TBD TBD TDB	60
Mission Build Environment	Morrow	V-IPT	None IDEAS2	MBF GRDS	61
Mission Planning & Operations Environment	Morrow	OPS-IPT	None	AAA MMPL TPS UMPL	62
Parts Management	Morrow	OPS-IPT	None	EPIMS EPSA	28
Program Management Tool	Padgett	BM-AIT	PCB OMS	PCB PFI PPI	33
continued					

Table 3.1-1: Non-Boeing Program Office Applications

Program Office Application (non-Boeing, continued)					
Subject Area	Responsible Manager	Requirements Interface	Current System	Baseline System	Task Sheet
Publishing	Wood	SS-AIT	ITPS	ITPS	35
Scheduling	Padgett	BM-AIT	Various	ISPA	39
SRM&QA	Wood	SS-AIT	None	PRACA RBDA CAFTA	40
Supplier Data Tracking	Padgett	BM-AIT	SDST	SDST	41
Tier III CUI	Wood	BM-AIT	TMIS CUI	ISSA CUI	44

Table 3.1-1: Non-Boeing Program Office Applications

Program-Wide Applications					
Subject Area	Responsible Manager	Requirements Interface	Current System	Baseline System	Task Sheet
Documentation Management	Wood	SS-AIT	PALS	PALS	50
E-Mail	Wood	SS-AIT	SSFPMail		51
Requirements Traceability	Padgett	SS-AIT	ARMS		108
Review Management (RID Tracking)	Wood	SS-AIT	ARTS	ARTS	53

Table 3.1-2: Program-Wide Applications

3.2.1 Non-Boeing Program Office Applications

3.2.1.1 AAA - Automated Assembly Assessment

The AAA uses the connectivity information of the Paths Data System (PDS), a rules-based fault propagation algorithm and the Mission Operations Directorate (MOD) Activation and Checkout (A&C) Procedures to provide assessment file listings for each A&C step and the faults which cause mission success or ISSA survival criteria not to be met.

3.2.1.2 ATA - Action Tracking Application

The ATA will be the primary application used for tracking and reporting Program Office action items. This application will be a modification of one of the existing action tracking application to integrate all SSPO requirements for action tracking into a single application. This integration will result in lower application maintenance costs by reducing the quantity of applications ISSA-IS is required to maintain. It will be a relational database application for actions assigned by organizations throughout the Program Office. ATA will be the single authoritative source for storage, retrieval, and progress reporting of action items. It tracks the point of origin, action description, due date, individuals assigned, closure date, current status, comments, etc. The application will include a set of reports accessible to all users that can be expanded as program requirements evolve. ATA will provide the capability for users to execute interactive queries on the data to request specific action items by number, date, organization, or assigned individual.

3.2.1.3 BB - Bulletin Board

The ISSA BB is the ISSA-IS implementation of MOSAIC. The MOSAIC toolset is a public domain, client server group of products that operate in a number of environments (UNIX, DOS, Macintosh etc.) to provide a system for information exchange. BB provides a tool to assist ISSA staff in the exchange and sharing of information in a bulletin board like environment. The information is grouped by subject and organized in a hierarchical manner. Products can be hyperlinked to other products in the bulletin board to provide expanded information on any subject without requiring the duplication of data. The server operation system and security systems are provided the JSC Information Systems Directorate (ISD).

3.2.1.4 CATIS - Change And Commitment Tracking Information System

CACTIS is a new application, still in the analysis stage, being developed for use by both the Program Change Management Group and the Configuration Management (CM) Group. The application is being developed using Oracle 7 and Oracle SQL *Forms 4.0. Oracle's Report Writer, Data Browser, Graphics, and Oracle Book will also be used. CACTIS will identify and track the engineering change data from assignment of the Space Station Change Number (SSCN) number through the completion of all actions for the directive.

The CACTIS Engineering Release is currently scheduled for late May 1994, on the Boeing Is RS-6000. Production release on the RS-6000 is expected in early August 1994, and transfer to a VAX platform will occur in September 1994.

3.2.1.5 CADYS - Computer Aided Design System

The CADYS is a toolset used to support Computer Aided Design (CAD) and drafting activities for mechanical, electrical and other systems for the ISSA. The toolset provides capabilities to design and develop mechanical and electrical systems, check interfaces, select standard parts and output drawings, design reports, indentured parts list, parts list for assembly and where used data. The underlying hardware and software for CADSYS is Intergraph. The Database Management System (DBMS) is Informix.

3.2.1.6 CAFTA - Computer Aided Fault Tree Analysis

The Safety Group within Safety, Reliability, Maintainability & Quality Assurance (SRM&QA) will be using CAFTA, a safety analysis tool that performs fault-detection, isolation, and recovery functions. The system is designed to identify top undesired events and the secondary events causing the top undesired events. The source of the data for CAFTA inclueds circuit designs, typing and instrumentation drawings, and data compiled by the safety analysis. CAFTA is a PC-based application.

3.2.1.7 CTS - Correspondence Tracking System

CTS is used to collect information about and maintain a record of certain types of contractual documentation such as Outgoing Correspondence, Incoming Mail, etc. By entering this correspondence data into an online Oracle database, current status information, assignment information, completion date information, etc. is available to all personnel.

3.2.1.8 CUI - ISSA Common User Interface

The ISSA CUI was developed to support the JSC standard PC configuration and to provide Space Station employees at JSC access to program applications through a standard, user-friendly interface. The CUI is Windows-based and icon-driven. The CUI supports scripts.

3.2.1.9 CUI - TMIS Common User Interface

The TMIS CUI was used on PC workstation at JSC thoughout the period of transition from SSFP to ISSA. The TMIS CUI was included with the equipment that the TMIS contract had provided for the SSPO. The TMIS CUI is currently being replaced at JSC by the ISSA CUI in order to utilize standard JSC supported PC Products.

3.2.1.10 DRT - Data Requirements Tracking System

Boeing Prime Contract data requirements are tracked and reported via the DRT application, a database application developed in the Artemis 9000/EX software. It provides Program Data Management the Capability to track Boeing Prime Contract data deliverables. The application provides storage, retrieval, and reporting of the due date, status, responsible management, and approval status. The DRT application offers a simple menu interface for entering/updating information, viewing information on-line, and printing pre-defined reports. DRT provides on-line data entry/update forms and allows on-line interactive queries.

3.2.1.11 EDLS - Engineering Drawing Library System

EDLS is a drawing raster viewing application program.

3.2.1.12 EMDB - Engineering Master Database

The EMDB allows for the viewing and management of top level assembly drawings. EMDB is currently used in the Engineering Drawing Environment to create interface control drawings. It sill be used during the transition period and eventually replaced by the Computer-Aided Design System (CADSYS).

3.2.1.13 EPIMS - Electrical, Electronic, and Electromagnetic (EEE) Parts Information Management System

The functionality of the EPIMS application, implemented on Ingress, can be grouped into three high-level categories:

- EEE Parts Reference Information,
- Analysis Tools - Cross referencing alerts, advisories, and problem reports to parts lists,
- Information Capture - Various types of parts lists.

3.2.1.14 EPSA - Electrical Power System Application

The EPSA application, implemented in the Oracle DBMS, was developed at Rocketdyne. The system provides engineering data, CM, EEE parts lists, and product assurance. A future release will also contain surveys, Non-Standard Part Approval Request (NSPARs), and failure analysis capability data.

3.2. 1.15 GRASP - Grumman Robotic Analysis Simulation Program

GRASP is a software simulation program that was used for analyzing the robotic arms on the SSFP. It is currently being considered for use on the ISSA Program.

3.2.1.16 GRDS - Ground Reconfiguration Data System

The GRDS will be a toolset to support the development, maintenance, and control of there configuration tables for the Multiplexer/Demultiplexers (MDMs). This toolset and tables will support production of flight software for test, simulations, training and flight. Current planning is to use the Oracle DBMS.

3.2.1.17 ICDSYS - Interface Control Document System

The ICDSYS will be a toolset of support the development, maintenance, and control of the ISSA software Interface Control Documents (ICDs). The toolset will consist of Teamwork, Interleaf and an Oracle database supported by appropriately configured server/workstations. The ICDSYS will interface with the VMDB and place documents in the Program Automated Library System (PALS).

3.2.1.18 IDEAS

IDEAS is a software for Computer Aided Model (CAM) development that is used in conjunction with NASA Structural Analysis (NASTRAN). The application is used to view solid models provided other applications in support of stress and load point analyses.

3.2.1.19 ISPA - Integrated Scheduling and Planning Application

ISPA is the application for integrated analysis, maintenance, tracking and status reporting of Program schedules. It supports the Program Planning & Control (PP&C) staff in the integration of the Product Group schedules with the Prime milestones and schedule to create the overall ISSA Program schedule. It performs critical path analysis on Program activities networked together by their interdependencies and forecasts future activity timelines based upon progress achieved. The ISPA provides a menu interface for access to reports (tabular and graphic), data entry screens, data review and update screens, and the execution of analytical computations. This application is based on the Artemis 9000EX software.

3.2.1.20 ITPS - Interleaf Technical Publishing Software

ITPS is an electronic publishing system that allows users to create, revise, illustrate, share, manage, and print professional-looking documents. It allows you to intersperse complex graphics and charts created in Interleaf or images scanned and incorporated into documents. It is used by the Space Station Program as the baseline documentation software. In Space Station at JSC, Interleaf is run off RISC6000 servers and can be accessed from any type of workstation including HP/Apollos, PCs and Macintoshes.

3.2.1.21 MBF - Mission Build Facility for Flight Software

The MBF will aid the Prime Contractor to achieve full breath integration to control flight software and data and to accept, integrate, and test flight software products from multiple sources. The MBF supports software and data for testing, training, and delta flight loads; supports building interfaces to Control Center Complex (CCC), Payload Operations Integration Center (POIC), Test, Checkout, and Monitoring System (TCMS), International Partners/participants, and Space Station Verification and Training Facility (SSVTF); provides sources of flight software, flight data, and SSVTF simulations and loads information for onboard data systems; and provides status, issues, impacts, and resolutions to participant organizations.

3.2.1.22 MDR - Metrics Data Repository

The ISSA Program Office requires a repository to integrate, store, retrieve, and report metrics data provided by the product groups. The MDR provides these functions and provides automated and manual loading of formatted metric data from throughout the Program (i.e., cost, schedule, quality, weight, power, etc.) into a relational DBMS. The MDR provides an easy to use menu driven system capable of reporting the information in hard copy, on line, and it exports defined sets of graphical reports for storage and viewing in the Program Control Book (PCB).

3.2.1.23 MMPL - Mission Management Plan

MMPL is the central repository for acquisition and storage of information required to support Space Station payload integration, tactical planning, operations summary document development, and logistics planning. The MMPL will be supported with a Mission Management database using Oracle products.

3.2.1.24 NASTRAN - NASA Structural Analysis

NASTRAN is a finite element analysis modeling software program that supports structural dynamics modeling and provides data and plot information based on the behavior of these models.

3.2.1.25 OMS - Office Management System

The OMS is an integrated suite of office tools to provide a simple user interface to workstation and server tools, electronic mail, server based hypercard stacks (database like entities), and databases. This tool was developed for the ISSA Program Office and is not a Program-wide tool. It automates the connection to ISSA host computers and servers, provides automated initialization of workstation software (word processors, spread sheets, etc.) for the user regardless of the location of the software (server or local), and provides the hypercard stacks for the SSPO physical file index, and the SSPO telephone directory, and the database for SSPO action items.

3.2.1.26 PCB - Program Control Book

The ISSA Program Office requires an application for authorized Space Station Program personnel to store and retrieve multi-media Program data via a graphical user interface. The PCB provides these functions. It employs integrated view tools to effectively display charts, drawings, text, and pictures on the computer video display. It provides on-line access and improved reconfiguration capability for Program data (i.e., management emphasis items, AIT and IPT activity, Program top-level schedules, etc.) used in the management of the Program. The PCB is designed to store the information currently displayed in hard copy format in the Space Station Program Office Management Information Center (MIC), located at the NASA/JSC.

3.2.1.27 PDS - Paths Data System

The PDS provides the capability to capture hardware/software connectivity information including wiring interconnects, fluid/gas plumbing, air ducts, network data and control connections and software interfaces. The PDS maintains needed data to support analyses and assessments of ISSA connectivity, logistics, fault tolerance, safety and mission assurance, and flight operations. The PDS will interface with the VMDB. PDS is implemented in 4th Dimension.

3.2.1.28 PLATO - Power Loads Analysis for Timeline Operations

PLATO is a software program that was used to support power loads and timeline analyses on the SSFP. It is currently being considered for use on the ISSA Program.

3.2.1.29 PRACA - Problem Reporting And Corrective Action

The PRACA database system was developed by TMIS to support the recording of design, manufacturing, and operational discrepancies and reportable problems identified during NASA Acceptance and Certification Testing throughout the life of SSFP.

As a reporting and corrective action system, PRACA allows problem reporting, action tracking, analysis, resolution, and trending. The application also provides a repository for nonconformance data.

Every problem input to PRACA must have a Responsible Center identified upon entry. This is the center with responsibility for problem investigation and closure. Users must report to one Responsible Center and one organization. They may view data that has been input from many sources. However, users may update fields that correspond with their privileges.

The PRACA process includes the following:

- Initiation of the nonconformance
- Automatic notification to the Responsible Center
- Comments and updates by authorized personnel
- Viewing and reporting by general users

3.2.1.30 RBDA - Reliability Block Diagram Analysis

RBDA has been requested by the Reliability Group of SRM&QA. The application is PC-based and requires a high-end Machine. The system performs reliability modeling using block diagrams with elements of functionality and failure rates being primary outputs. Input data such as mission length and varying scenarios can be varied by the user. RBDA is compatible with the PDS for hardware connectivity information.

3.2.1.31 RDD-100 - Requirements Driven Design

RDD-100 is a COTS product consisting of an Element/Relationship/Attribute database and tools to support integrated system and behavioral modeling for operational scenarios based on functional decomposition of requirements and specifications, dynamic verification modeling based on behavioral simulations, report generation capabilities and interface capabilities to Teamwork and Interleaf. RDD will also interface with RTM.

3.2.1.32 RMA - Reliability Maintainability Assessment

The RMA application supports maintainability allocations across the ISSA elements and the .assessment of these allocations. It works with the Reliability Prediction Program (RPP). It is currently being considered for use on the ISSA Program.3.2.1.33 RPP - Reliability Prediction Program RPP is a prediction model. It works with the reliability allocations from RMA. It is currently being considered for use on the ISSA Program.

3.2.1.33 RPP - Reliability Prediction Program

RPP is a prediction model. It works with the reliability allocations from RMA. It is currently being considered for use on the ISSA Program.

3.2.1.34 RT1VI - Requirements and Traceability Manager

RTM supports the traceability and connectivity of requirements through the various levels of specifications. RTM supports extension of this traceability and connectivity to test specifications, test procedures, and supports verification closure. RTM provides for partitioning of the database to support management of requirements from various sources and platforms. The RTM implementation architecture is depicted in Figure 3.2.1.35-1.

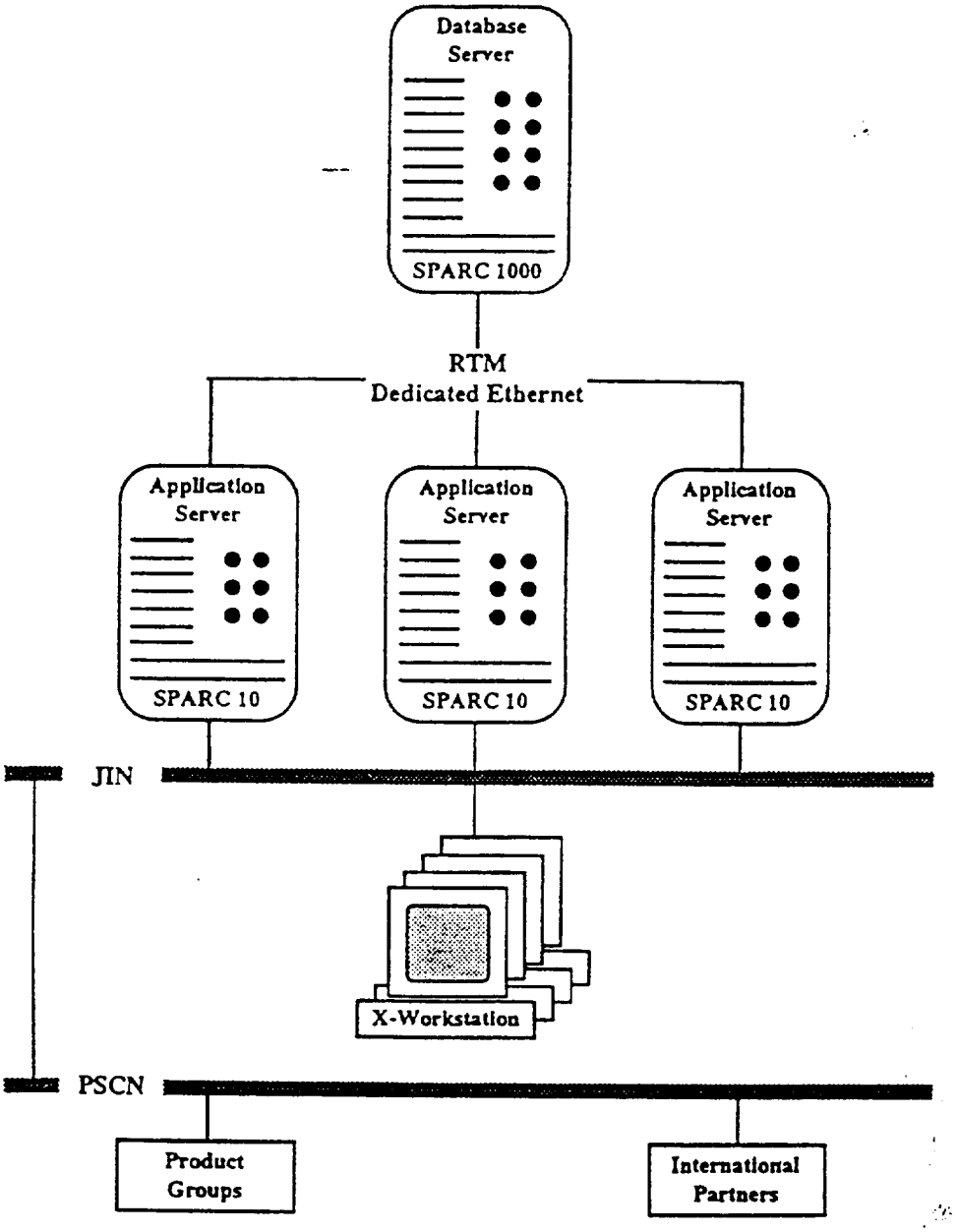

Figure 3.2.1.35-1: RTM Architecture

The implementation is based on a database server and three application servers. Remote access may be provided over the Program Support Communications Network (PSCN) for the Product Groups and the International Partners/Participants. If they so desire, Product

Groups and International Partners/Participants can install RTM at their sites; but they must do so at their own expense.

3.2.1.35 SDST - Supplier Data Sheet Tracking

Supplier data sheets are tracked and reported via the SDST application developed in the Artemis 9000/EX software. This application provides the Program Data Management organization the capability to track Product Group deliverables. The application provides storage, retrieval, and reporting of the due date, date received, and internal Boeing review/response date and item disposition. SDST provides a simple menu user interface for entering/updating information, viewing information on-line, and printing pre-defined reports. SDST provides on-line data entry/update forms and allows on-line interactive queries.

3.2.1.36 SIMSYLS - Simulation of Manned Space Station Logistics Support

The SIMSYLS application, which will [also] be used as a baseline system, is a simulation analysis tool used to model resupply/return demand and orbital operations during the Station acquisition stage. The model simulates operations which pertain to the on-board maintainability and logistics support adequacy of study data:

- Consumables: gases, fluids, and other expendable items during Space Station operation and maintenance,
- Experiments to be changed out on a scheduled basis,
- Scheduled maintenance information including task frequency and time and crew size required to perform a task,
- Mission parameters and requirements,
- Orbital Replacement Unit (ORU) information such as failure and repair rates, support resources, statistics, and criticality to success of the mission.

3.2.1.37 SSE-CM - Software Support Environment Configuration Management

The SSE-CM application will be used by the CM organization as the interim CM tool beginning March 21, 1994. The system will run on a Boeing IS-assigned VAX and be used for change tracking. The specifics of which portions of the application will actually be used are currently being defined.

3.2.1.38 TRASYS - Thermal Radiation Analysis System

The TRASYS application was used to support thermal radiation analysis on the SSFP. It is currently being considered for use on the ISSA Program.

3.2.1.39 UMPL - User Mission Plan

The UMPL provides payload tactical and strategic parameters and supports primary payload tactical integration functions leading to the development of utilization sequences, integration documentation, and payload inputs into the Tactical Operations Plan (TOP). The UMPL will be supported by a User Mission Database using Oracle products.

3.2.2 Program - Wide Applications

3.2.2.1 ARMS - Automated Requirements Management System

ARMS is an interactive system which manages Program requirements, allows traceability from the highest-level to the lowest and demonstrates conformance of lower to higher-level requirements. The primary objective of ARMS is to provide an interactive system which is easy to use and supports tracing and controlling functions without encumbering the requirements development process. The system incorporates menus, outline-style requirement selection, and custom report specifications.

3.2.2.2 ARTS - Advanced RID Tracking System

ARTS is the primary application used to create Review Item Discrepancies (RIDs), track RID dispositions, and track Review Board approved actions. The application provides users with the capability to create, submit, evaluate, disposition, and close RIDs and the capability to have online reporting and review stage traceability. The application also provides the electronic migration of Review Board assigned actions into Directives.

3.2.2.3 PALS - Program Automated Library System

PALS provides the Program with document management capability. PALS is used to store, search, and relieve files that have been placed in defined user collections within logical libraries. The PALS architecture is depicted in Figure 3.2.2.3-1

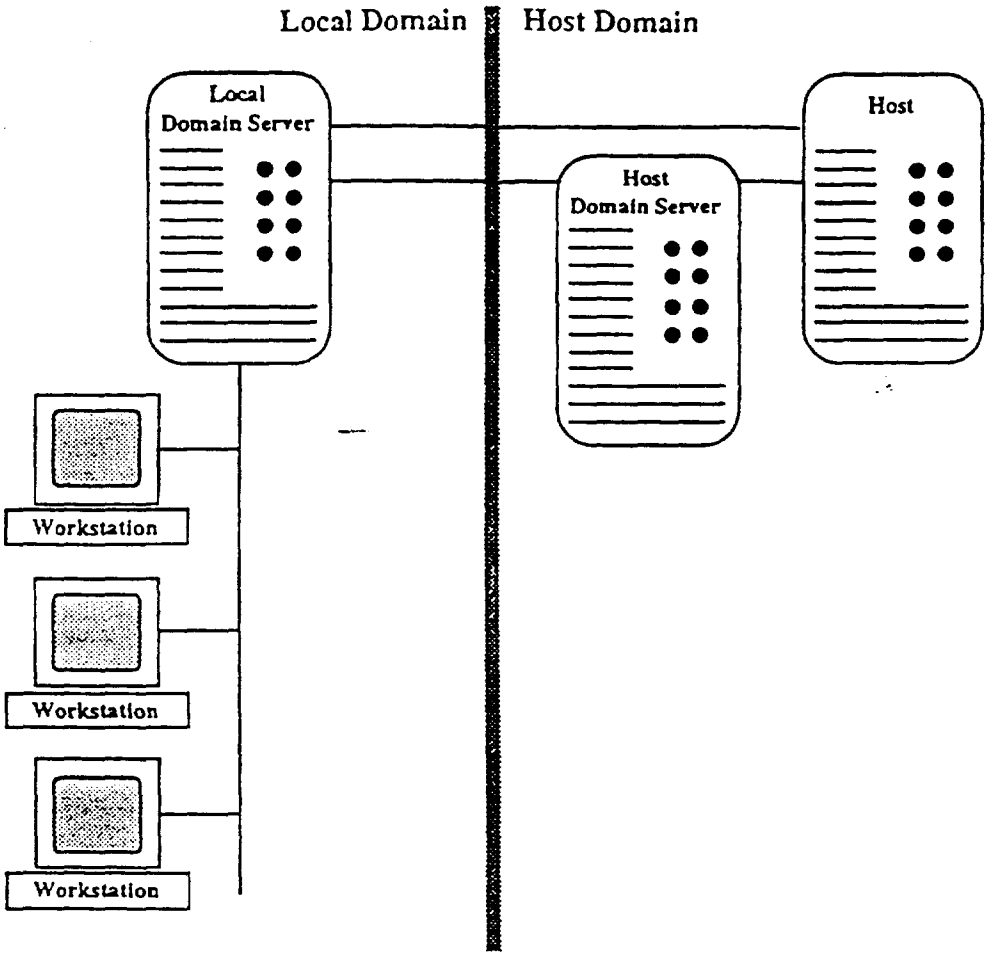

Figure 3.2.2.3-1: PALS Architecture

The architecture consists of a *local domain* for each site, and a central *host domain* for all sites. The local domain consists of user workstations, running either X-windows or character mode, and a local domain server (currently an RS6000). The local domain server supports the user interface via XVT and provides storage for local files. The local domain server can also communicate directly with the host via FTP. The host domain consists of a host domain server (currently an RS6000) and the host itself (currently an ES 9000). User requests for data typically go through the host domain server, which houses the search engine (search logic and indices) for the host. The host is used for actual document storage and security.

3.2.2.4 SSPMAIL - Space Station Program Mail

SSPMail is a program-wide electronic mail system that supports the exchange of information between all of the program's participants. SSPMail is a customization of the DEC All-in-1 product that provides for the creation, addressing, delivery, recipient, response, individual user distribution lists, automated delivery receipts and read receipts, mail forwarding, and it automatically maintains the user directory for All-in-1 users at ISSA SSPO, Product Groups 1, 2 and 3 (McDonnell Douglas, Rocketdyne, and Boeing), MSFC, and LeRC. SSPMail is currently operating as a single integrated E-Mail system for these locations.

SSPMail is currently slated for phase-out. It will be replaced in the Program Office environment by a COTS product, Microsoft Mail. There will be no Program-wide E-Mail application.

4.0 ARCHITECTURE PRINCIPLES AND STANDARDS

This section of the document will discuss the architecture principles and standards that will be followed when making changes to the current/baseline applications.

As described in the IS Plan, Section 5, architecture principles are statements of direction for application analysts developing or modifying IS applications. Principles are also used as decision rules in subject areas where competing but equally valid design solutions are available. Principles are intended to produce applications of consistent architecture which will support the architecture objectives of scalability, interoperability, and maintainability.

Standards, as defined in this document, are those international, industry, and proprietary standards, and in some cases product standards, that are adhered to in application development and maintenance.

4.1 ARCHITECTURE PRINCIPLES

4.1.1 Application Acquisition

As stated in the IS Plan, Section 4, a fundamental application strategy is to integrate existing applications rather than create applications. This leads to a fundamental principle: *Whenever possible, acquire application software; do not build from scratch.*

4.1.2 Hardware Independence

An major objective of the ISSA-IS is to be platform independent. The implementation of open systems by the hardware vendors will accomplish this over time. In the interim the following principle is required: *Buy, and if necessary, build software to be hardware independent.*

4.1.3 Separation of Applications and Data

Another major objective is to achieve independence of applications from specific data and data structures. The principle for achieving this is as follows: *Embed no data in applications and make applications independent of data structure.*

4.1.4 Non-Duplication of Data

Elimination of data duplication and inconsistency is another major goal. This implies the following principle: *Data elements should be entered once and used many times, and applications should interact with one another through shared databases.*

4.1.5 Office Automation Software

Workstation and office automation software is maturing and is being introduced rapidly. This leads to the following principle: *Buy office automation software.*

4.1.6 Utilize Current Program Inventory

Workstation software is rapidly becoming platform independent or being supplied to run on multiple platforms. This leads to the following principle: *Buy or build only software that executes on workstations in the Program inventory.*

4.1.7 Software Development Life-Cycle (SDLC) Methodology

Although it is expected that there will be minimal systems development, there will be some, leading to the following principle: *The Boeing D&SG software development methodology, defined in D658-10283-01, will be employed.*

4.1.8 Operating Systems

A major objective is to minimize the variability of the IS environment. Implementation of client/server applications will assist. In addition, the variability of the delivery system contributes to the complexity; therefore, the principle: *Do not introduce new operating systems at the server and host levels.*

4.1.9 Training

Any application that is put on a computer to be used must be supported by training of some sort; therefore, the principle: *If we provide the application, we will support the training.*

4.1.10 Derive Database Table Design From the PIDM

If database table design is driven by the requirements of particular application programs, a set of non-integrated, application-specific databases will result. This would be contrary to the long-range goals for ISSA-IS. On the other hand, if database table design is derived from the PIDM, integrated databases will result. This implies the following principle: *Derive database table design from the PIDM--not from the requirements of particular application programs.*

4.1.11 Avoid Data Duplication

If data are to be shared across multiple applications in a reliable, consistent manner, it is preferred that there be only one occurrence of each non-key data element. Otherwise, it will be possible for one application to update one occurrence of the data element and another application to update another occurrence in an inconsistent manner. This leads to the following principle: *Avoid duplication of non-key data elements in ISSA-IS databases.*

Decisions to duplicate data elements (e.g., to enhance performance) must be reviewed and approved by the ISSA-IS Data Management organization.

4.1.12 Normalize the Data

Poor database design can lead to the both loss of information and to the creation of redundant information during update operations. The so-called anomalies of deletion and insertion will occur in databases that are not designed in accordance with the rules of normalization. Therefore, *normalize ISSA-IS database tables to the appropriate canonical form.*

Decisions to de-normalize (e.g., to enhance performance) must be reviewed and approved by the ISSA-IS Data Management organization.

4.1.13 Strive for Platform Independence

A major objective for the ISSA-IS is to be platform independent. This implies the following principle: *Search for middleware that eliminates DBMS-platform coupling. In the absence of such middleware, select DBMS products that run in a wide variety of hardware platforms.*

4.1.14 Minimize the Variety of DBMSs

Another major objective of the ISSA-IS is to minimize the variability of the IS environment. Variability has a direct impact on maintenance, training, and staffing costs. The following principle will contribute to the minimization of variability: *Minimize the number of DBMS products in use.*

4.1.15 Delivery System Objectives

The delivery systems objectives for the ISSA Program are as follows:

- The delivery system will support the requirement for a flexible and scaleable solution.
- The delivery system will provide required levels of reliability, availability, accessibility, security, and cost performance.
- Future systems will be distributed, and based on client/server architecture when possible.
- Industry standards will be used for user interface components.
- The ability to replace individual delivery system components will not be constrained by other components.
- Variability will be minimized and unnecessary variety will be eliminated to limit costs.

4.1.16 Delivery System Strategies

The delivery systems strategies for the ISSA-IS are as follows:

- Ensure cost effectiveness through standards on workstations, LANs and servers.
- Use server-based software to limit procurement costs.
- Utilize ISD services and standards.
- Share devices and systems when possible.

4.2 APPLICATION, DATA, DELIVERY SYSTEMS STANDARDS

Standards will be employed during the life cycle of the applications developed or maintained by the ISSA-IS organization.

As of this writing, there are few, if any, industry or national standards that address the subject of applications. D658-10283-01, Information Systems Technical Reference Model, will serve as the source for direction for the design of new applications for ISSA. As applications standards are developed, they will be included in the Technical Reference Model and in this document.

Given the absence of industry-recognized standards, the ISSA-IS organization will employ product standards as a key strategy for posturing for future industry standards. Minimizing the variety of programming languages and DBMSs will provide a solid base for implementation of standards when they become available, and will minimize the training requirements of the IS organization.

- New information systems will implement an application client server model as documented in D658-10283-01.
- The Open Database Connectivity (ODBC) standard will be used for Database access.
- C will be the standard programming language for server-based and host-based applications.
- In the near term, the standard DBMS for new development will be Rdb.

4.2.1 The Relational Database Model

The relational database model is the standard high-level database model for ISSA-IS databases. All new database design will conform to this model.

4.2.2 Database Design and Implementation Procedures

Database Design: Data requirements for all new ISSA-IS application must be coordinated with the ISSA-IS Data Management organization. This organization will assist the application developers in the database design.

The data requirements for a new application will be mapped to the PIDM.

- If the requirements exceed the current scope of the PDM, the PIDM will be revised to accommodate them.
- For requirements that can be satisfied by existing PIDM database tables, those tables-will be used for the new application, and no new database design will be pursued.

If new database design is required, it will proceed from the top down: through the instantiation of the appropriate entities and associations documented in the PIDM

All ISSA-IS database designs will be documented in fully attributed data models with all many-to-many relationships resolved. These data models will be placed under configuration control.

Database Implementation and Maintenance: Database table definitions and Data Definition Language (DDL) source code will be under configuration control. All new tables will be created by the ISSA-IS Data Management organization, and initial loads will be coordinated by the ISSA-IS organization. All Database Administration (DBA) functions will be performed by the ISSA-IS Data Management organization.

New databases will be implemented as shared-resource database. In accordance with Section 1.0 above, newly developed ISSA-IS databases will not be owned by individual applications.

4.2.3 Naming Standards

Database names and fields names must meet the standards set forth in TSS 30551, Space Station Freedom Program Office Data Naming Standards.

4.2.4 Standard Products

4.2.4.1 DBMS

In the near term, the standard the standard DBMS for new development will be Rdb, to maintain consistency with existing PIDM databases. At the appropriate time, the ISSA-IS DBMS standard will be reviewed and, probably, revised.

4.2.4.2 Data Modeling

The standard tool for configuration controlled ISSA-IS data models is Oracle CASE*Designer. Prototyping may be clone with other tools (e.g., ERWin/ERX), but configuration controlled designs must be documented in CASE*Designer.

4.2.4.3 Data Dictionary

The standard data dictionary tool is Oracle CASE* Designer. The PIDM will be used to generate the Program Data Dictionary (PDD).

5.0 REQUIREMENTS AND IN-PROCESS/PLANNED CHANGES

This section of the document identifies the in-process and planned changes to the application configuration. There are separate subsections for Boeing applications, non-Boeing Program Office applications, and Program-side applications. Each subsection is arranged alphabetically by subject area.

This section also identifies the data-related activities that are either currently in process or planned for the near future. These activities fall into three categories: (1) DRM, (2) New Database Development, and (3) Data Interface Definition. A separate task sheet is provided for each of these categories.

The referenced task sheets will be the source for cost and schedule information.

5.1 NON-BOEING PROGRAM OFFICE APPLICATIONS

5.1.1 Action/Issue Tracking (ATA) -

In the first quarter of Fiscal Year (FY) 1995 ISSA-IS will integrate the requirements of the three existing action item tracking systems and select one of the three applications for modification such that it will satisfy all SSPO action tracking requirements. The modified application will be the ATA application. Data from the existing application will be transferred to the integrated system and the other systems will be discontinued. The ATA will meet specific SSPO requirements for: the assignment of actions to organizations and subsequent reassignment by the organizational manager to the appropriate individual; generic data entry/update screen forms; specific hard copy report formats; and identification of user roles and their associated write/delete privileges.

5.1.2 Bulletin Board (BB) -

The ISSA on-line BB is in the start up phase. The client and server products are public domain and available on the Internet. The client software requires compilation, linking, configuration, testing, and user IDs and password setup. This activity has been completed on a Unix platform and the initial BB is operational. These tasks are in process on the VMS host. Upon completion of the VMS setup and test ISSA-IS will select a host and, if the VMS host is selected, transfer the then current BB content The client software is in use on the PC and Macintosh platforms. The PC client requires some modification and reconfiguration to establish the program security requirements. The Macintosh client software is performing satisfactorily and no changes are in work or planned.

5.1.3 Change Management -

CM personnel require an action item tracking system, to be satisfied by the Action Item Tracking System (AITS); and they need to participate with CM to implement CACTIS. (See Section 5.2.4 below.) AITS will be maintained through FY 1994. In the first quarter of FY 1995, ISSA-IS will integrate the requirements of the three existing action item tracking systems and select one of these three applications for modification such that it will satisfy all SSPO action tracking requirements. Data from the existing application will be transferred to the integrated system and the other systems will be discontinued.

5.1.4 Configuration Management (CACTIS) -

The CM Group is in the process of redefining their baseline systems. The initial interim application of choice was Configuration Status Accounting System (CMSAS). In recent days a decision was made to move to the SSE-CM application while the new baseline system, CACTIS, is prepared for release. A decision is also forthcoming on the Automated Configuration Status Accounting System (ACSAS).

CACTIS is a new application, currently in the requirements gathering and analysis phase of development. CACTIS will be used by both the Program Change Management Group and the CM Group. The CACTIS application requirements will be evaluated against current DM2000 production capabilities

5.1.5 Correspondence Management -

Sustaining activity only.

5.1.6 Data Requirements -

Sustaining activity only.

5.1.7 Design Analysis Environment -

The Design Analysis Environment focuses on evaluation of the ISSA design and how that design will perform in an operational environment. The applications and processes provide for:

- Assessing design to specifications
- Fault tree analysis
- Reliability allocations
- Maintainability allocations
- Power loads timeline analysis
- Failure modes effect analysis
- Critical item identification analysis
- Operational effectiveness
- Connectivity analysis
- Parts management analysis

The environment consists of numerous applications. Some of these are stand-alone applications while others are integrated and share common Databases. The "assessment of design to specifications" will be supported by the COTS product RDD-100 and will interface to the COTS product RTM. "Connectivity analysis" will be supported by PDS. In other areas of the Design Analysis Environment, final selections for the baseline application has not been completed. Multigraph may be the desired product for "failure, modes effect analysis" or some other existing product such as the Mission Operations Directorate's (MODs) Failure Environment Analysis Tool (FEAT). Some other candidate tools for the Design Analysis Environment are:

- CAFTA
- RPP
- RMA
- PLATO

The Design Analysis Environment applications will be a user and provider of data in the VMDB and provide documents and reports to PALS.

Current effort is the procurement of the RDD-100 software product to replace those on loan to the ISSA and replacement of loaned equipment with equipment from the SSFP inventory. This product will be used by the Prime Contractor and the Product Groups for consistency of results. SSFP Licenses for this product are being reviewed for applicability. The product will be rehosted on HP equipment if available. Current budget estimates assume a complete buy of the RDD-100 product and processes are included in this effort

Another effort is the development of PDS currently being done by General Research Corporation (GRC) and transitioning this system to IS. Three releases of the PDS are planned with an option for a fourth release if needed. GRC is currently under contract to deliver this product.

Intermediate plans are to develop a more effective interface between RDD-100 and RTM, offload some of the Interleaf requirements to the Interleaf servers, continue improving print capabilities, balance the workload more efficiently and improve system administration processes, and continue identification and evaluation of tools to support the remaining functions of the Design Analysis Environment.

Future plans call for determining and establishing the interfaces to other systems such as CM in order to follow changes to specifications and design. Vendor upgrades of products supporting the Design Analysis Environment are planned on an annual basis occurring during the first quarter of each fiscal year. Hardware for this environment is expected to be replaced during the life-cycle of the ISSA.

In addition to the normal workforce assigned to this environment, it is supported by an Engineering Support Team responsible for backup and disaster recovery, use of nonstandard loads on workstations, including user assistance, quick resolution to problems, system administration of in-place Unix-based platforms, and assembly, load, and test of Unix platforms.

5.1.8 Engineering Drawing Environment -

The Engineering Drawing Environment consists of applications and processes to provide for:

- Drawing Creation
- Drawing Revisions
- Drawing Control
- Drawing Data Management
- Drawing Viewing
- Element Integration
- Integrated Schematics
- Design Interfaces
- Drawing Releases

The environment is a CAD tool set and databases providing interactive drawing capability, parts information, parts lists for assembly, indentured parts lists, "where used" information, and other drawing information.

Current efforts in this environment are the installation of the Intergraph servers and plotters, replacement of loaned equipment with equipment from SSFP, transference of the transition database from the Huntsville server to the Houston server, support for integrated schematics from the Prime Contractor, interfacing this environment with the EDLS for loading, unloading, and viewing of drawings, Intergraph system administration, and Informix database administration and programming.

Intermediate plans are to support a drawing release process for the Prime and to develop prototype processes for interfacing with the VMDB including viewing of drawings from Product Groups and other sources. Continue to support special request for drawings.

Longer range plans are to mature the interface and interaction with the VMDB, develop and provide reports as required, and support special request for drawings. Sustaining engineering will be provided and include system administration, database administration/maintenance and user support. Vendor upgrades are planned on an annual basis, generally during the first quarter of each fiscal year. It is expected that the Intergraph equipment will be replaced during the life-cycle of the ISSA.

In addition to the normal workforce assigned to this environment, it is supported by an Engineering Support Team responsible for backup and disaster recovery and quick resolution to printing and plotting problems.

5.1.9 Integration/Verification Environment -

The Integration/Verification Environment consists of applications and processes tracing requirements through the various levels of specifications, relating these to design and verification processes and supports verification closure. The environment provides for:

- Requirements Management
- Test Plan/Execution/Tracking/Reporting
- Verification Closure
- Interface Maintenance

The environment consists primarily of two major applications built around COTS products.

- RTM
- ICDSYS

Requirements management and verification closure will be supported by RTM. RTM depends on the Oracle RDBMS for Database management and Interleaf for report and document production. RTM will interface with RDD. Interface control and maintenance will be supported by a system built around Teamwork, Interleaf and an Oracle Database to manage Interface Control Documents. The Integration/Verification Environment will interface with the VMDB and PALS.

Current efforts in this environment include development of the RTM system. This requires replacement of loaned hardware and software with equipment from SSFP, acquisition of some additional hardware and the RTM software, development of the RTM servers for the Prime and the Product Groups, development of servers and engineering workstations. To support RTM, transitioning system administration to IS personnel, and development of the processes required for this database system to support the verification process effectively.

The procurement and installation of RTM product requires an initial buy of hardware in addition to procurement of the RTM product This initial buy is for two two-processor servers for the Prime Contractor's database server. These servers are planned to be upgraded to four-processor servers in the future and as loading increases. This initial buy also includes consulting services from the vendor which will be required as this system is being constructed from mixed SSFP equipment. Also included is training for the RTM product.

A recent effort is the development of the system to support the ISSA Software Interface Control Documents. This system will require Teamwork, Oracle products, Interleaf, and interface to VMDB and PALS. The Interface Control Document System (ICDSYS) will be built from existing SSFP HP hardware and software for which licenses exist. However, the HP platforms will require memory expansions and the addition of some tape drives to support backup and disaster recovery. These servers and workstations are planned to be replaced in later years.

Longer range plans require development of the interfaces and procedures between RTM and CM. Vendor upgrades to the products supporting the Integration/Verification Environment are planned on an annual basis, generally during the third quarter of the fiscal year.

In addition to the normal workforce assigned to this environment, it is supported by an Engineering Support Team. This team is responsible for backup and disaster recovery, nonstandard loads on workstations, user assistance, system administration of in-place UNIX-based platforms, and assembly, load, and test of UNIX platforms.

5.1.10 Logistics (SIMSYLS) -

SIMSYLS is a simulation analysis tool used to model resupply/return demand and orbital operations requirements. SIMSYLS is maintained and administered at KSC. SSPO personnel access SIMSYLS through Telnet and FTP via the existing PSCN environment. The ISSA-IS organization will support the use of SIMSYLS by coordinating network connectivity from JSC to the PSCN link.

5.1.11 Metrics Data (MDR)

MDR as a component of the overall ISSA-IS is required to meet the unique requirements of the SSPO metrics user Community. It is a flexible, segmented, expandable database developed on an RDBMS and is capable of operating on a Unix or VMS host. Metric data is created in a number of COTS products (Excel, MS Word, Lotus, etc.) and custom applications (ISPA, SDST, DRT, etc.) and the MDR is the repository for those metrics required by Program Management to the Program and the ISSA resources. The development effort is focused on delivering a prototype system, gathering user input relative to the prototype, and then updating the prototype in accordance with the use input. This development effort includes providing the capability to create graphical reports and exporting these graphics for storage in the PCB. The PCB retains the function of user viewing of the graphics. As stated in D684-10057-01, Performance Metrics Plan, the MDR will not include cost data.

5.1.12 Micro-Gravity Environment -

The Micro-Gravity Environment focuses on behavior of the ISSA in space. It consists of applications and processes for:

- Integrated Thermal Analysis
- Finite Element Modeling
- Solid Modeling
- EMI Analysis
- Acoustic Analysis
- Meteoroid/Orbital Debris Analysis
- Robotics Analysis
- On-Orbit Structural Loads & Vibrations

Some applications will support more than one of the areas identified above. Finite Element Modeling could be supported by NASTRAN and IDEAS. Thermal analysis could be supported by TRASYS. Many of the Micro-Gravity Environment applications will be users and providers of data in the VMDB. Results of analyses will be documents and reports to be stored in PALS.

The current effort in this environment is to deploy selected components from SSFP, including hardware, systems software, and applications. Analyses are being conducted as to where some of the larger applications such as NASTRAN should be hosted. Other applications are being evaluated to determine the "best fit" to the requirements.

The Micro-Gravity Environment is composed of equipment and software from the SSFP. It contains four RISC6000s, two DECStation 5000s, one DECStation 6000, and one Macintosh Quadra 950. Applications are assigned to specific platforms and are generally long running applications. These platform are expected to be replaced during the life-cycle of the ISSA. Vendor upgrades are planned on an annual basis for the second quarter of each fiscal year.

In additional to the normal workforce assigned to this environment, it is supported by an Engineering Support Team. The team is responsible for backup and disaster recovery, nonstandard loads on workstations, user assistance, system administration of the platforms, and assembly, load and test of the platforms.

5.1.13 Mission Build Environment

The Mission Build Environment consists of applications and processes to provide for:

- Simulation Software Builds
- Flight Software Builds
- Ground Reconfiguration Data

This environment supports the acceptance, integration and testing of flight software products from multiple sources. It provides software and data for simulations, testing, training, and interfaces with other facilities in preparing for final flight loads. As the MDMs are table driven, the configuration and loading of these tables for simulations, testing, training and mission with data to support each configuration will be provided by this environment. This environment interfaces with the VMDB for flight software information and reconfiguration information.

Current efforts in this environment are supporting definition, requirements, design and

implementation planning of the MBF; support sizing and compiler timing studies for development/integration/test of flight software supporting analyses of the software products required by the facility; and supporting analyses of interfaces to the VMDB and CM.

Intermediate efforts will be supporting the selection of the computer hardware and system software from the SSFP equipment inventory; supporting the design of the ground reconfiguration database supporting security administration in terms of risk analysis and risk management; and design of interfaces to the SSVTF.

Longer range plans are development and implementation of interfaces to the CM system; interfaces to the VMDB; interfaces to the SSVTF; development of user guides and system administration procedures facility operations: and sustaining engineering.

5.1.14 Mission Planning/Operations Environment -

The Mission Planning/Operations Environment consists of applications and processes to provide for:

- Resource planning/management
- Assembly sequence
- Payloads
- Launch packages/return cargo
- Crew planning/procedures
- Event Simulations
- Safety

The environment consists of applications focusing on space operations. The candidate applications to support this environment have not been completely identified at this time. It is anticipated that many of the applications developed and proven on the Shuttle Program can be used. Some candidate applications are:

- Shuttle Payloads System (SPS)
- SIMSYLS
- Crew Chief
- Simulation Activation Services (SAS)

This environment will also use some of the applications from other environments. PDS used in the Design Analysis can be expanded to include AAA and further expanded to interface with the MOD Activation and Checkout Procedures. The Mission Planning/Operations Environment will interface with the VMDB and provide documents and reports to PALS.

The Mission Planning/Operations Environment currently consists of two RISC6000s, three HP/Apollo 715s, and a Sun SPARC2. Vendor upgrades to software products are planned on an annual basis during the fourth quarter of each fiscal year. It is expected that the hardware platforms will be replaced during the life-cycle of the ISSA.

Current efforts in this environment are development of the MMPL, the UMPL, and the AAA. This includes bringing up the hardware and system software, development of the-system administration procedures and user guides, and incorporating approved changes to the applications.

Intermediate plans are to develop the necessary interfaces to the Design Analysis Environment to support operational scenarios and models, develop interfaces to the VMDB, and continue analysis of other applications to support the functions of this environment.

Longer range plans are to select and implement applications to support mission planning and operations and the program progresses toward launch and space operations. Continue to evolve applications toward the ISSA-IS data model, and sustaining engineering.

5.1.15 Parts Management-

The EEE Parts Management Group is currently in the process of reviewing two software applications for tracking parts.

5.1.15.1 CAFTA

CAFTA is a PC-based fault tree analysis tool. As the ISSA Program matures, CAFTA will be utilized by the safety engineering organization to analyze potential top-level undesired events and the secondary events contributing to the top-level undesired events. The ISSA-IS organization will coordinate the hardware and software maintenance required to support CAFTA.

5.1.15.2 EPIMS

The functionality of the EPIMS application, implemented on Ingress, can be grouped into three high level categories:

- EEE Parts Reference Information,
- Analysis Tools -- Cross referencing alerts, advisories, and problem reports to parts lists,
- Information Capture -- Various types of parts lists

The ISSA-IS organization will support the utilization of EPIMS by coordinating the system administration and maintenance activities.

5.1.15.3 EPSA

The EPSA application, implemented on the Oracle Database, was developed at Rocketdyne. The system provides engineering data, CM, EEE parts lists, and product assurance. A future release will also contain surveys, NSPARs, and failure analysis capability data. The ISSA-IS organization will support the installation and migration of future EPSA releases.

5.1.16 Program Management Tool -

5.1.16.1 PFI - Physical File Index

A requirement for a database to store, search, and report on the location and content of SSPO hardcopy files has been identified by the SSPO. When resources become available ISSA-IS will coordinate the detail requirements with the SSPO and implement the application.

5.1.16.2 PPI - Program Presentation Index

A requirement for a database to store, search, and report on significant Program Presentations has been identified by the SSPO. When resources become available ISSA-IS will coordinate the detail requirements with the SSPO and implement them in an RDBMS.

5.1.17 Publishing -

Sustaining activity only.

5.1.18 Scheduling -

ISSA-IS and PP&C began a joint development effort to produce the ISPA in November 1993. The schedule integration process and application requirements have been coordinated with the Product Groups and the Prime scheduling team. ISPA is being implemented in the ARTEMIS scripting language (Al) and therefore will only operate in the MVS/TSO/ESA environment in conjunction with the ARTEMIS 9000 Ex version 1.1.2 or greater product. The delivery system independence specified in Information Systems Architecture document (D684-10064) is not achieved in this application. ISSA-IS is working with the vendor and conducting a study to determine if a client-server application would be a cost effective alternative to the mainframe based application. The cost estimate and major schedule milestones for the mainframe system development effort and the study are included in the task sheet. The cost of this transition will be determined by the study and approval of the Business Management AIT is required prior to implementation.

5.1.19 SRM&QA-

5.1.191 PRACA

As a problem reporting and corrective action system PRACA facilitates problem reporting, action assignment, analysis, resolution, and trending. PRACA also provides a repository for non-conformance data. The ISSA-IS organization will maintain PRACA at JSC. The ISSA-IS organization will also test and implement PRACA and develop system interfaces as required with the Product Groups.

5.1.19.2 RBDA

RBDA will be utilized by the Reliability Engineering organization. REDA is a PC-based application. REDA performs reliability modeling using block diagrams with elements of functionality and associated failure rates being the primary outputs. The ISSA-IS organization will coordinate software installation, troubleshooting, and hardware/software maintenance activities to support RBDA.

5.1.20 Supplier Data Tracking -

The study described in section 5.2.18 includes the SDST application. If the study identifies a cost effective alternative to the mainframe ISPA then the SDST application will migrate to the same client-server system as the ISPA. The cost of this transition will be determined by the study and approval of the Business Management Air is required prior to implementation.

5.1.21 Tier III CUI -

The ISSA CUI was developed to allow utilization of the ISC standard PC configuration and to provide SSPO employees access to program applications through a standard user-friendly interface. CUI is Windows-based and icon-driven. CUI also supports scripts. The ISSA-IS organization is responsible for CUI maintenance and administration Enhancements and product upgrade development and testing will be performed in conjunction with the JSC Institutional Information Systems Contractor (JSC-ISC).

5.2 PROGRAM-WIDE APPLICATIONS

5.2.1 Documentation Management (PALS) -

Rehosting the PALS application to RS6000's is being reviewed as a cost savings move. If savings are achievable, the project will be implemented.

5.2.2 Electronic Mail - Task Sheet #51

E-Mail systems are rapidly changing throughout the ISSA Program. NASA and the ISSA contractors are migrating from large host based applications (PROFS & All-in-1) to smaller mail server applications (MS Mail, cc:Mail, Quick Mail, etc.). ISSA-IS will pursue this same approach. The NASA JSC standard E-mail application is Microsoft Mail (MS Mail). This product is provided on every PC and Macintosh workstation supplied and maintained by the NASA JSC ISD. MS Mail servers, software, administration, and operations are currently provided by ISD for the SSPO. ISD maintains the center-wide user ID look-up capability via the X.500 directory and ISD maintains the hardware, software, system administration and operations personnel for the SSPMail system. There is no technical requirement for two E-mail systems and maintaining both systems burdens the program with unnecessary costs. Therefore ISSA SSPO will migrate from SSPMail (All-in-1) to MS Mail. The transition period will be from May 1, 1994 through September 23, 1994. ISD will provide training and user support for MS Mail and ISD will continue to operate the SSPMail system until the transition is complete. Completion of this migration will eliminate the cost of maintaining hardware, software, system administration labor, and operations labor for the SSPMail system. ISSA-IS will coordinate connectivity issues, support the establishment of interfaces for external E-mail systems, and continue the All-in-1 application maintenance tasks until the transition is complete.

5.2.3 Requirements Traceability (ARMS) -

The Prime and the Product Groups have agreed to use RTM instead of ARMS. ARMS will continue to be used by Rocketdyne International. Usage by International Partners/participants is unknown at this time. If it turns out that Rocketdyne International is the only user of ARMS, ISSA-IS will undertake to transfer ARMS responsibility to them.

5.2.4 Review Management (ARTS)

ARTS will be maintained through the transition Program and discontinued after traction.

5.3 DATA RESOURCE MANAGEMENT (DRM) -

As stated in the IS Plan, the ISSA-IS organization strategy is to pursue a plan of phased migration from a baseline set of legacy systems to an integrated shared-data environment. Several tasks need to be completed before this course can be followed.

5.3.1 Documentation of the As-Is Architecture

In order to control the environment and plan effective changes to it, the current data architecture must be thoroughly understood and documented. Each of the databases currently in use must be modeled (reverse-engineer modeling), and all data entities, attributes, and relationships must be accurately documented. This will enable the ISSA-IS organization both to understand the current configuration and its physical implementation and to identify areas of data redundancy among the databases and process overlap among the applications.

5.3.2 Definition of the Enterprise (Enterprise Model)

An enterprise-level ISSA data model is required to document the nature of the business and provide a top-level definition of the data requirements for the ISSA-IS. Conceptually, the enterprise model will also serve as a bridge between the AS-IS architecture and the Target Architecture.

5.3.3 Definition of the Target Architecture (PIDM and PDD)

The key role of the PIDM is described in this document. In general, the PIDM will provide direction for all future database design and implementation activity. The PIDM will also be used to generate the Program Data Dictionary (PDD). Conceptually, the enterprise model will also serve as a bridge between the AS-IS architecture and the Target Architecture.

5.3.4 Strategic Planning

Based on the user's input and the analysis of the existing data architecture, a prioritized list of functional areas which require improvement will be maintained. The goal of this task is to facilitate continuous improvement of the data architecture by focusing on the high return items. This planning effort is critical in the existing environment where the Space Station integration effort cannot wait for the ultimate IS solution to be completed. A periodic review of the top priorities within the data architecture is necessary to provide adequate response to the needs of the ISSA-IS users.

5.3.5 Definition of Data - Related Processes

There are a wide set of processes which surround the data architecture. IS will participate in the definition of any processes which affect the data architecture. Sample processes include the following:

- Electronic data receipt from PGs, IPs, or Work Centers,
- Data delivery to data architecture users,
- Add, modify, or delete processes for data,
- Archiving of data, and
- Review and approval of data model changes.

The goal of this task is to create an orderly, defined, and documented environment without suffering from undue bureaucracy. Continuous improvement depends on the organization's ability to define a process and learn from mistakes.

5.4 NEW DATABASE DEVELOPMENT -

5.4.1 Vehicle Master Database (VMDB)

The VMDB will be the first implementation of the DM2000 concept. SSP 50020, VMDB Plan, contains the implementation plan and schedule for the VMDB.

5.4.2 Mission Build Facility Database (MBFDB)

The goal for the MBFDB is to provide the following data services:

- A central library for flight software and data,
- A central library for the ground reconfiguration data,
- Decision support data for accepting, validating, and promoting to a controlled state the flight software and data CSCI deliveries from the PGs.
- CM for the controlled versions of the central repositories,
- Reporting and distribution of information from the controlled libraries, including read-only and download access to configured items,
- Reporting of status, jeopardies, issues, impact, resolutions, and security incidents, to participating organizations and responsible management.

5.4.2.1 Central Software Library (CSL)

The CSL, previously called the Flight Software Repository, is the portion of the MBFDB that houses all flight software and data. The contents of the CSL are traceable to the information in the Central Data Library (CDL).

5.4.2.2 Central Data Library (CDL)

The CDL, previously called the Ground Reconfiguration Database, is the portion of the MBFDB that houses the data that can be reconfigured in orbit.

5.6 Host Processors -

5.6.1 Current Configuration

The current host architecture is dictated by current applications in use on the Program. It consists of both IBM mainframe and VAX hosts.

IBM Mainframe: An IBM ES9000 is host to the Program Automated Library System (PALS) applications. (For more detail, see the description of PALS in D684-10064-01, ISSA-IS Application Architecture.) The host is accessible to users via both SNA and TCP/IP protocols. The current configuration is delineated in Table 5.6.1.1-1.

Architecture Component	Platform	OS	Product
Host	IBM ES9000	MVS	Oracle IBM Telnet IBM FTP IBM TCP/IP IBM 327x IBM SNA

Table 5.6.1.1-1: Host Processors (IBM)

VAX Hosts: ISSA has two DEC VAX clusters. They host the Electronic Drawing Library System (EDLS) and will host the Vehicle Master Database (VMDB). They also host DEC's All-In-One as the E-Mail product with gateways to platforms using SMTP NBS or X.400. VAX host are accessible to users via both DECnet and TCP/IP. The configuration is delineated in Table 5.6.1.1-2.

Architecture Component	Platform	OS	Product
Host	TM0003 VAX Cluster DEC VAX 6420	VMS	DEC All-In-One X.400 DECnet TGV Multinet TCP/IP
	TMISL2 VAX Cluster DEC VAX 6320	VMS	X.400 DECnet TGV Multinet-TCP/IP
	PRVAX DEC VAX 6510	VMS	DEC All-In-One Oracle DECnet Wollongong TCP/IP
	DEVAX DEC VAX 7610	VMS	Oracle DECnet Wollongong TCP/IP
	DS1 DEC VAX 7610	VMS	DEC All-In-One Oracle DECnet DEC X.25 DEC LAT Wollongong TCP/IP Ungermmmmann-Bass XNS Appletalk
	DS2 DEC VAX 7610	VMS	DEC All-In-One Engineer Dwg Lab System (EDLS) DECnet DEC X.25 DEC LAT Wollongong TCP/IP Ungermmmmann-Bass XNS Appletalk
Micro-host	VAXstation VAXstation VAXstation VAXstation MicroVAX MicroVAX		Configuration TBD Configuration TBD Configuration TBD Configuration TBD Configuration TBD Configuration TBD

Table 5.6.1.1-2: Host Processors (VAX)

The All-In-One E-Mail product is currently being phased out and replaced by Microsoft Mail.

5.6.2 Future Strategies

Over the near term, studies will be initiated to determine what roles the current host systems will play as future architecture system components.

5.7 Servers -

5.7.1 Current Configuration

The ISSA-IS currently supports three types of servers: LanMan, Novell, and Unix. The basic server architecture is depicted in Figure 5.7.1-1.

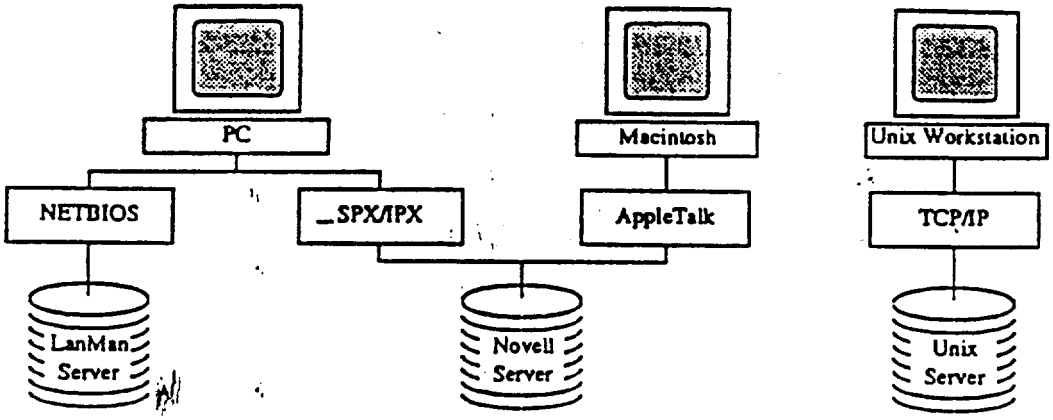

Figure 5.7.1-1: Basic Server Architecture

Servers are used both for applications and for file service.

Applications are made available to users via the network from centralized servers. This server monitors use and allocates the applications according to the number of licenses available. Currently, Novell platforms serve DOS and Macintosh applications, and RS6000 and Sun SPARC platforms serve Interleaf to X-terminals. The current application server configuration is delineated in Table 5.7.2.1-1. The file server configuration is delineated in Table 5.7.2.1-2. In addition, the ISC Data Support System (DSS) supports various Macintosh file servers. (See MDC 91H0544, Rev C, JSC Data Support System Configuration Document.)

5.7.2 Future Strategies

Strategies for the future include consolidating the types of servers to minimize variety and reduce the associated costs. Current plans include a move away from LanMan and NETBIOS. Decisions in this area will be influenced by the standards supported by JSC-ISD

Architecture Component	Platform	OS	Product
Application Server	Intel-based PC	DOS	Novell Netware MS Office IPX NLM Appletalk NLM
	Intel-based PC	OS2	IBM LANMAN MS Office
	RS6000	AIX	Interleaf Oracle IBM TCP/IP
	Sun SPARC	SunOS	Interleaf Oracle RTM TCP/IP
	DECstations	Ultrix	RDD-100 Micro-Gravity Applications TCP/IP
	Intergraph	UNIX	Informix Oracle TCP/IP

Table 5.7.2.1-1: Application Servers

Architecture Component	Platform	OS	Product
File Server	Intel-based PC	DOS	Novell Netware IPX NLM Appletalk NLM
	Intel-based PC	OS2	IBM LANMAN
	Apollo	DomainOS	NFS TCP/IP

Table 5.7.2.1-2: File Servers

5.8 Workstations -

5.8.1 Current Configuration

Several types of workstation configurations are supported, giving the users a choice of the operating system with which they are most comfortable. The current workstation-set is delineated in Table 5.8.1.1-1.

5.8.2 Future Strategies

The number of workstation configurations should be reduced over time, in the interest of minimizing variety and lowering maintenance costs. Decisions in this area will be influenced by the standards supported by JSC-ISD.

Architecture Component	Platform	OS	Product
Workstation	486-based PC	DOS Windows	MS Office Appletalk Spry Air TCP/IP
	Apple Macintosh	System 7	MS Office TCPConnectII MacTCP
	HP Workstation	DomainOS HP-UX	Interleaf HP TCP/IP
	Sun SPARC	Solaris	Interleaf RTM Sun TCP/IP
	Intergraph	Clipper UNIX	Engineering Modeling System EE Schematics Intergraph TCP/IP

Table 5.8.1.1-1: Workstations

5.9 COST ELEMENTS

The principal delivery systems cost drivers for ISSA-IS are as follows:

- MAC/PC/Printer Maintenance
- Hardware Maintenance
- Hardware Upgrades
- Software Maintenance
- Software Upgrades
- System Administration (Novell)
- Installation Support (Novell Clients)

5.10 CHANGE HISTORY

There is no Change History to record at the present time.

APPENDIX A
ABBREVIATIONS AND ACRONYMS

This appendix will be revised as required, and changes will be issued as replacement pages or by complete revision of the appendix as appropriate.

A&C	Activation & Checkout
AAA	Automated Assembly Assessment
ACSAS	Automated Configuration Status Accounting System
ACSS	Automated Cost and Schedule System
AEMIS	Automated Engineering Management Information System
AIT	Analysis and Integration Team
ALSTAR	Automated Logistics System for Tracking And Reporting
ARMS	Automated Requirements Management System
ARTS	Advanced RID Tracking System
ATA	Action Tracking Application
BB	Bulletin Board
CACTIS	Change And Commitment Tracking Information System
CAD	Computer-Aided Design
CADSYS	Computer-Aided Design System
CAFTA	Computer-Aided Fault Tree Analysis
CAM	Computer-Aided Modeling
CCC	Control Center Complex
CIL	Critical Items List
CM	Configuration Management
CMETS	Configuration Event Tracking System
CMSAS	Configuration Management Status Accounting System
CONTR	Contracts
COTS	Commercial off the Shelf.
CTS	Correspondence Tracking System
CUI	Common User Interface
D&SG	Defense & Space Group (Boeing)
DBMS	Database Management System
DEC	Digital Equipment Corporation
DRT	Data Requirements Tracking System
DSCA	Defense & Space Group Common Accounting System
EDLS	Engineering Drawing Library System
EEE	Electrical, Electronic, and Electromechanical
EMDB	Engineering Master Database
ENG	Engineering
EPIMS	EEE Parts Information Management System
EPS	Executive Processing System
EPSA	Electrical Power Supply Application
FEAT	Failure Effects Analysis Tool
FMEA	Failure Modes and Effects Analysis
FIN	Finance
FPS	Financial Planning System
FY	Fiscal Year
GRASP	Grumman Robotic Analysis Simulation Program
GRC	General Research Corporation
GRDS	Ground Reconfiguration Data System
HR	Human Resources
H/W	Hardware

ICBS	Integrated Contract Billing System
ICD	Interface Control Document
ICDSYS	Interface Control Document System
ICRS	IERS Customer Reporting System
IERS	Integrated Employee Records System
IPT	Integrated Product Team
IS	Information Systems
ISD	Information Systems Directorate
ISPA	Integrated Schedule and Planning Application
ISSA	International Space Station Alpha
ITPS	Interleaf Technical Publishing Software
JSC	Johnson Space Center
LSA	Logistics Support Analysis
MBF	Mission Build Facility
MDM	Multiplexed/Demultiplexer
MDR	Metrics Data Repository
MEAC	Management Estimate At Completion
MIC	Management Information Center
MMDB	Mission Manifesting Database
MMPL	Mission Management Plan
MOD	Mission Operations Directorate
MPS	Material Procurement System
N/A	Not Applicable
NASTRAN	NASA Structural Analysis
NSPAR	Non-Standard Part Approval Request
OCCS	Overhead Cost Control System
ODBC	Open Database Connectivity
OMS	Office Management System
OPS	Operations
ORU	Orbital Replacement Unit
OS	Operating System
PALS	Program Automated Library System
PAS	Property Accountability System
PCB	Program Control Book
PDD	Program Data Dictionary
PDS	Paths Data System
PFI	Physical File Index
PFMIS	Program Finance Management Information System
PLATO	Power Loads Analysis for Timeline Operations
POIC	Payload Operations Integration Center
PP&C	Program Planning & Control
PPI	Program Presentation Index
PRACA	Problem Reporting and Corrective Action
PSCN[I]	Program Support Communications Network [Internet]
RBDA	Reliability Block Diagram Analysis
RDD	Requirements Driven Design
RDBMS	Relational Database Management System
RID	Review Item Discrepancy
RMA	Reliability Maintainability Assessment
RPP	Reliability Prediction Program
RTM	Requirements Traceability Manager
SAS	Simulation Activation Services
SDLC	Software Development Life Cycle
SDST	Supplier Data Sheet Tacking

SIMSYLS	Simulation of Manned Space Station Logistics Support
SPS	Shuttle Payloads System
SRM&QA	Safety, Reliability, Maintainability, and Quality Assurance
SS-AIT	Space Station Analysis and Integration Team
SSCB	Space Station Control Board
SSCN	Space Station Change Number
SSE-CM	Software Support Environment Configuration Management
SSFP	Space Station Freedom Program
SSP	Space Station Program
SSPO	Space Station Program Office
SSVTF	Space Station Vehicle Test Facility
TCMS	Test, Checkout, and Monitoring System
TMIS	Technical and Management Information System
TOP	Tactical Operations Plan
TRASYS	Thermal-Radiation Analysis System
UMPL	User Mission Plan
V-IPT	Vehicle Integrated Product Team
VMDB	Vehicle Master Database