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DESIGN REQUIREMENTS FOR SRB PRODUCTION CONTROL SYSTEM

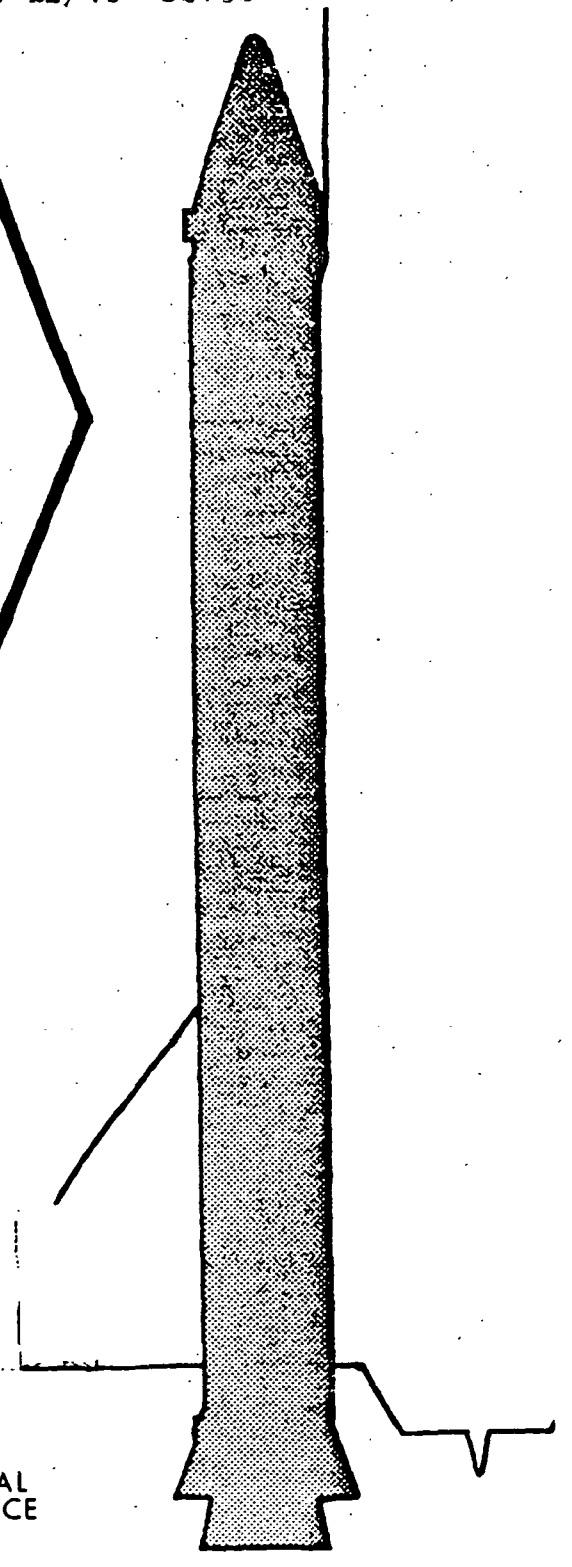
FINAL REPORT

VOLUME III

PACKAGE EVALUATION, MODIFICATION AND HARDWARE

SUBMITTED BY:

A.T. KEARNEY, INC.



DESIGN REQUIREMENTS FOR THE SRB PRODUCTION CONTROL SYSTEM

VOLUME III

PACKAGE EVALUATION, MODIFICATION AND HARDWARE

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VI - SOFTWARE PACKAGE EVALUATION

The software package evaluation phase of this study was designed to analyze commercially available, field-proven, production control or manufacturing resource planning management technology and software packages. The analysis was conducted by comparing SRB production control software requirements and conceptual system design to software package capabilities.

The following sections will explain the methodology of evaluation and the findings at each stage of evaluation. These sections are:

- Vendor Listing.
- Request for Information (RFI) Document.
- RFI Response Rate and Quality.
- RFI Evaluation Process.
- Capabilities versus Requirements.

VENDOR LISTING

Kearney compiled a listing of commonly known, nationally marketed MRP software packages. This listing was assembled from the following five sources:

1. Brian D. Wakefield - "MRP Software Suppliers List", published in Production, December 1978.

2. Darryl Landvaten - Manufacturing Software Systems, Inc. - MSSI Software Standard.

3. Oliver W. Wight - "MRP Survey", published in Datamation, October 1980.

4. APICS - MRP articles and presentations.

5. A. T. Kearney - research files.

The compiled list identified 74 software suppliers and 79 packages. A request for information (RFI) was sent to each. Twenty-one responses were received.

The vendor listing, shown in Exhibit VI-1, identifies the following:

1. Vendor name and address.

2. Software package name.

3. Initial vendor contact.

4. Response to RFI.

REQUEST FOR INFORMATION DOCUMENT

The request for information (RFI) was developed after a detailed analysis of the SRB production control needs was conducted. These needs were compared with currently used MRP techniques, and then a conceptual system was developed. This conceptual system was reviewed with NASA/MSFC, NASA/KSC, USBI/HSV and USBI/KSC. Based on those discussions with NASA and USBI, the RFI was developed.

The detailed analysis of the SRB production control needs included:

1. Determination of functions and activities being performed and understanding of their objectives.

2. In-depth analysis of:

   (a) Production shop floor activity.

   (b) Requirements of production operations.

   (c) Management decisionmaking needs and information support.

   (d) Requirements of management.

3. Distillation of current information flow requirements into an "Information Flow Overview" (see Figure IV-21).

4. Review of "Information Flow Overview" with NASA/USBI management.

5. Distillation of production operations requirements.

6. Distillation of management control requirements.

The currently used MRP techniques were primarily derived from Kearney's collective experience. Research into MRP theory was also conducted to further enhance the development of the SRB production control systems conceptual design. This research included:

1. Production and Inventory Management in the Computer Age, Oliver Wight.

2. Material Requirements, J. Orlicky.

3. Production and Inventory Control Handbook, Green.

4. Material Management Systems, R. Brown.

5. Production and Inventory Control: Principles and Techniques, Plossl and Wight.

6. APICS - Master Production Schedule Reprints.
7. APICS - Capacity Planning Reprints.
8. APICS - MRP Reprints.
9. APICS - Shop Floor Control Reprints.
10. APICS - Inventory Planning Reprints.

The conceptual overview (see SRB/Production Control Systems Overview, Figure IV-1) was designed to fit MRP techniques into the SRB production and production management environment. The MRP techniques were kept sufficiently intact so that the core logic maintained an "Integrated Production Planning and Control System". Integration capabilities of MRP are one of the potentially beneficial characteristics for NASA and USBI.

This conceptual overview was presented to USBI at both the Huntsville and KSC locations and to NASA/MSFC. Feedback from these presentations and a further in-depth analysis into software package logic was incorporated into the RFI development.

The RFI expanded the conceptual overview into a detailed questionnaire (see Appendix A). The RFI and introductory comments were disguised to prevent vendor identification of NASA. Although the questions do not all seem to directly relate to the SRB production control environment, they are directed at system logic needs for the SRB production control environment.

RFI RESPONSE RATE AND QUALITY

The RFI was sent to 74 software vendors who distribute a

total of 79 software packages. There were 21 respondents (or greater than 25%) to the RFI; Kearney considers this to be a good response, since the software vendor list was not prescreened for applicability. We believe that most vendors who did not respond did not do so because of their inability to respond positively to most of the questions in the RFI.

RFIs received were generally of good quality. No RFIs were rejected because of illegibility or misunderstanding. Four RFIs were not scored (see footnotes to the MRP Software Packages Vendor Listing, Exhibit VI-1, at the end of this section). Seventeen RFI responses are summarized in the Software Vendor RFI Evaluation Screen (see Exhibit VI-2, at the end of this section).

RFI EVALUATION PROCESS

The vendor RFI responses were evaluated in a three-step process. These were:

1. Score vendor RFI responses.
2. Determine the vendor rank.
3. Classify by package completeness.

(a) Score Vendor RFI Responses

Vendor RFI responses were summarized on the "Software Vendor RFI Evaluation Screen" (Exhibit VI-2). Software relevant RFI questions were listed for each module and responses indicated. The number of positive responses were totaled by module, a hurdle score was set to reflect the level of response required, and

scores above the hurdle were ranked.

(b) Determine the Vendor Rank

Vendor RFI response scores are summarized in the "Software Vendor Ranking Screen" (Figure VI-1). This screen uses the "Software Vendor RFI Evaluation Screen" rank by module multiplied by a module relative importance weighting to give a package ranking score.

(c) Classify by Package Completeness

The vendor software package completeness is determined by the number of modules exceeding the hurdle score. Three categories were identified. These are:

1. Class A, vendor software packages exceeding hurdles in all nine SRB/APC modules.

2. Class B, vendor software packages exceeding hurdle in seven or eight of the nine SRB/APC modules.

3. Class C, vendor software packages not exceeding hurdles in six or more of nine SRB/APC modules.

The package ranking score within each class determines the relative "Software Vendor Rank" (Figure VI-2).

Figure VI-1

Software Vendor Ranking Screen

VENDOR	R.F.I. SECTION									CLASS	RANK	SCORE
	GENERAL INFORMATION	MASTER SCHEDULING	MRP	CRP	SHOP FLOOR MANAGEMENT	OPERATIONS	INVENTORY CONTROL	BOM CONTROL	ROUTING CONTROL			
(Weighting Factor)	2	2	3	3	3	3	2	3	1	-	-	-
M.M.	4	2	4	4	2	1	4	2	2	A	2	43
MRM	-	2	3	-	-	-	-	-	-	-	-	-
DATA 3	-	2	-	3	-	2	-	-	3	-	-	-
STSC	-	1	3	2	1	-	-	-	3	-	-	-
SMI	3	4	3	-	-	3	3	-	-	-	-	-
NCR (IMS II)	4	-	-	-	-	3	3	-	-	-	-	-
FORM	-	-	-	-	-	-	-	-	-	-	-	-
APPLIED	4	2	2	4	-	-	-	-	-	-	-	-
HONEYWELL	2	1	5	3	2	3	3	-	-	B	2	39
INTERACTIVE	4	-	-	2	4	3	4	-	-	-	-	-
SOFTWARE INT	-	3	-	-	3	-	-	-	-	-	-	-
BOEING	4	-	2	-	-	-	-	-	-	-	-	-
TL & A	2	2	1	1	1	1	-	1	1	B	1	68
ARISTA	3	1	4	-	3	4	4	1	-	B	3	28
R & S	2	1	3	2	1	1	1	1	3	A	1	67
NCR (MISSION)	4	3	-	-	-	3	4	3	3	-	-	-
UNISA 1100	1	2	4	4	4	1	2	2	1	A	3	42

Legend

A - Class A vendors exceed all hurdle requirements.
B - Class B vendors are deficient in no more than two hurdle requirements.

Figure VI-2

Software Vendor Rank

Class A

1. Rath and Strong (PIOS).
2. Martin Marietta (MAS-E).
3. Univac (UNIS 1100).

Class B

1. Thomas Laguban and Associates.(1)
2. Honeywell.(2)
3. Arista.(3)

Notes:
(1) Thomas Laguban and Associates had used Sciaky Bros. Inc. as an endorsement, but this company is no longer using this software. They switched to IBM/COPICS, and still have only moderate success.
(2) Honeywell has had some software design and manufacturing system support personnel relocate to Rath and Strong.
(3) Arista has had some software design and manufacturing systems support personnel relocate to Martin Marietta.

This software vendor ranking was reviewed with NASA/MSFC and USBI/HSV representatives and a general concurrence was reached. This was that further in-depth analysis of software should concentrate on Class A software packages. These were:

1. Rath and Strong (PIOS).
2. Martin Marietta (MAS-E).
3. Univac (Unis 1100).

CAPABILITIES VERSUS REQUIREMENTS

The analysis of software package and vendor capabilities versus the SRB production control requirements followed a six-step procedure. The three "Class A" software packages were submitted to this procedure. The steps are:

1. Vendor Briefing.
2. Vendor Software Presentations.
3. Vendor Customer Software Endorsements and Customer Site Visits.
4. Summary of Vendor Strengths and Weaknesses.
5. Vendor Software Evaluation Criteria Scoring.
6. Vendor Final Selection Scoring.

(a) Vendor Briefing

Vendor briefings of four to six hours were conducted to prepare vendors for the NASA/USBI presentations. These presentations were to give vendors the opportunity to show the strengths and applicability of their software package in the SRB production control environment.

The vendor briefings were conducted on January 14, 15 and 16. Both Rath and Strong on January 14 and Martin Marietta on January 15 had one representative at the briefing. Univac on January 16 had five representatives at the briefing. The briefing followed the outline shown in Figure VI-3.

Figure VI-3
(Page 1 of 3)

MRP Software Vendor Briefing
(January 14, 15 and 16, 1981)

1. Introduction.

   (a) Study Background.

      (1) NASA Mandate.

      (2) Shuttle Program Overview.

      (3) NASA/USBI Relationship.

      (4) SRB Production Environment (Fact Book).

      (5) The Role of A. T. Kearney, Inc.

      (6) SRB Automated Production Control Study Progress to Date.

      (7) Next Steps.

   (b) Briefing Objectives.

      (1) To Orient Vendors to the SRB/APC Requirements.

      (2) To Convey Presentation Objectives and Format.

2. Overview of SRB Production Control Requirements.

   (a) SRB/APC Conceptual Design.

      (1) Review Flowcharts, Module by Module.

      (2) Discuss Conceptual Design Rationale.

      (3) Discuss SRB/APC Unique Requirements.

   (b) Review RFI Responses.

   (c) Explain SRB/APC Issues.

      (1) Government Orientation.

Figure VI-3
(Page 2 of 3)

(2) Manned Flight Implications.

(3) Aerospace PC Environment.

(4) Vandenberg.

(5) MBAC/KBAC.

(6) Master Scheduling at Two Levels.

(7) Resource Planning over Five Years.

(8) Engineering Change Process.

(9) Change Control by Flight Effectivity.

(10) Refurbishment Materials Planning.

(11) Attrition Bills of Material.

(12) Manufacturing BOM versus Engineering BOM.

(13) Complex Work Routing and Routing Constraints.

(14) Work Authorization Document Comparison to Process Sheet.

(15) Preventive Maintenance Scheduling.

(16) Serialized Part Tracking.

(17) Part Life Cycle Monitoring.

(18) Effectivity Control.

(19) Part Flightworthiness Status Control.

(20) Subcontractor and GSE Integration Requirements.

(21) Work Center and Labor Skill Certification Capacity Planning and Work Loading.

(22) Resource Assignments.

Figure VI-3
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(23) Refurbishment of Major Assemblies.

(24) Rework of LRUs.

(25) Hazardous Operations.

(26) Standard Costing versus Machine-Generated Standards.

(27) Labor Control (nonincentive).

(28) Configuration Management.

(29) Performance Monitoring System.

(30) Product Costing versus Government-Oriented Budget Tracking.

3. Vendor Presentations to NASA/USBI.

(a) Objectives.

(1) To Present Software Package Capabilities.

(2) To Identify "Estimated" Enhancements Required To Meet SRB/APC Requirements.

(3) To Respond to NASA/USBI and Kearney Questions on Software and Installation Support Capabilities.

(b) Format Suggestion.

(1) Brief MRP Introduction (one hour).

(2) Software Capabilities (two to four hours).

(3) Question Period (two to three hours).

(b) Vendor Software Presentations

The vendor software presentations were made in Huntsville to NASA and USBI representatives. Univac presented their package on January 26; Martin Marietta presented their package on January 27; and Rath and Strong presented their package on January 28.

Kearney requested that NASA and USBI become involved in the evaluation of these vendor presentations and subsequent vendor customer site visits. NASA/MSFC decided not to participate in this evaluation on the final vendor selection. NASA/MSFC requested that Kearney compare each vendor's software capabilities to SRB/APC requirements and conceptual design, and that this comparison be conducted independent of NASA and USBI.

Presentations were evaluated using two evaluation techniques.

1. Identification of Vendor Strengths and Weaknesses.
2. Scoring of Vendor Software Evaluation Criteria.

Both of the above techniques were further refined as a result of vendor customer site visits and vendor interviews. These evaluation techniques, and the results, are discussed in subsections (d) and (e), which follow the presentation of the results of our on-site visits to software users.

(c) Vendor Customers' Software Endorsements and Customer Site Visits

Software vendor customer sites were visited for the purpose of supporting or rejecting identified vendor strengths and weaknesses and refining vendor software evaluation criteria scores.

Each vendor was to select two of the "best" installations using its software. If possible, aerospace customers or customers having "similar" production control requirements as USBI were requested. The findings of these site visits are summarized in Figure IV-4.

In addition, the following hypotheses were tested and determined to be true.

1. Rath and Strong is consulting oriented, and software development has been customer-site fitted.

2. Rath and Strong software package technologies are directed at the aerospace industrial sector. This is directly related to their aerospace site development efforts.

3. Both Martin Marietta (MAS-E) and Univac (UNIS 1100) have been designed for a broad application to a generalized manufacturing environment.

4. Martin Marietta has a strong installation support capability.

5. Martin Marietta has a strong training or user education capability in Orlando, Florida.

Figure VI-4

Vendor Customer Site Visit Findings(1)

Vendor	Rath and Strong		Martin Marietta		Univac	
Customer	Unit RIG	Bell Helicopter	American Gulfstream	Blackstone	Best	United Pump
Software Evaluation Elements(2)						
1. State of implementation	3	4	1	2	4	2
2. Degree system complexity	4	5	2	2	2	2
3. Aerospace commonality	4	5	3	1	1	1
4. Part serialization	4	4	-	-	-	-
5. Effectivity engineering change	5	5	-	-	-	-
6. Configuration "as built" buildup	4	4	-	-	-	-
7. Vendor installation support	4(3)	4(3)	1	4(3)	1	1
Raw Score	28	31	7	9	8	6
Vendor Rank	1		2		3	

Notes: (1) Evaluation scores in each category are on a scale of 5 (best) to 1 (worst).
(2) Software evaluation elements include only unique SRB/APC requirements which are not satisfied by all or any of the vendor packages.
(3) Vendor installation support in these cases constitutes site development or major modification of software.

6. Univac has a strong relationship with USBI/HSV. This is through previous work on ACMS and ADRS.

7. Each vendor appeared to have a specific sales orientation:

(a) Rath and Strong is oriented to client site software modification and installation.

(b) Martin Marietta is oriented to software package sale and service bureau support.

(c) Univac is oriented to computer hardware sales.

(d) Summary of Vendor Strengths and Weaknesses

Vendor and vendor software package strengths and weaknesses were developed to summarize major observations resulting from vendor software presentations, and refined based on information received in the vendor customer site visits.

The summaries which are attached (see Figures VI-5 to VI-7) confirm the software package ranking of:

1. Rath and Strong.
2. Martin Marietta.
3. Univac.

Rath and Strong's MRP software technology and aerospace site development experience puts their software ahead of the others.

Although Martin Marietta has considerable strength in its training and service bureau support at Orlando, Kearney believes that Rath and Strong is capable of meeting the training and service bureau needs of this system.

Univac's relative weaknessess result primarily from the nonaerospace orientation of their MRP software and their organizational emphasis on hardware sales rather than successful MRP software installation.

Figure VI-5
(Page 1 of 3)

Rath and Strong (PIOS)

Strengths and Weaknesses

STRENGTHS

1. Has strong aerospace application experience and FAA inspection requirements experience.

2. Has customer site development experience.

3. Has software developed in DOD environment.

4. Has software which accommodates USG 7000.2 C-Spec logic and Mil-Spec 100.

5. Has tentative plans to convert the system to Univac and DMS 1100.

6. Can run on multiple data bases.

7. Has resource planning capabilities which accommodate long-term facilities and resource planning requirements.

8. Has assembly component location identifier (find) cross-referencing on assembly drawings which ties to the bills of material.

9. Uses work files to update BOM changes on-line, with later batch updates to active files. This allows authorization of changes prior to update of active files.

10. Has engineering change control by launch effectivity.

11. Has open purchase and shop order search capability for tracing of engineering change impact.

Figure VI-5
(Page 2 of 3)

12. Has physical change logic which accommodates part effectivity management needs. Effectivity changes will change part numbers through a physical change suffix to the part number. Furthermore, materials requirements planning logic will search the base part number, then scan and select an effectivity.

13. Has part serial number tracking capability from receipt from vendor through inventory to "as built" configurations.

14. Has full level pegging capabilities.

15. Discrete/discrete logic allocates a specific part to a specific assembly. This has part life cycle management capability to preassign a specific part to a specific assembly order, in a primary or backup position as indicated by a drawing part location code.

16. Has configuration management capabilities (Order Bill Concept).

17. Has a fractional "quantity per" capability in BOM component records.

18. Uses offset lead times in the BOM to accommodate multiple release of picking lists for a shop order.

19. Uses a manufacturing BOM to explode material requirements and to time phase shop orders.

20. Temporary changes to the BOM and routing are tied to a specific launch's shop orders. This is the "as built" configuration buildup capability.

Figure VI-5
(Page 3 of 3)

21. Has elements needed to track purchase order planned receipts.

22. Has installed distributed shop floor management systems.

23. Uses the "Critical Ratio" concept of shop floor prioritization.

WEAKNESSES

1. Does not have two-level master scheduling.

2. Requires a rewrite of master scheduling logic, so that it will accommodate the assignment of new or refurbished major assemblies to specific launches.

3. Does not load both work centers and labor skills at the same time.

4. Does not have a tools control subsystem.

5. Does not use actual material costs (uses standard costs).

6. Does not automatically trigger rework orders to upgrade part effectivities to the effectivity required by a shop order.

7. Does not automatically trigger rework orders to upgrade parts needing repair to reach flightworthy status.

8. Does not presently accommodate shift and hourly dispatch schedules. However, will provide update priority for each work center.

Figure VI-6
(Page 1 of 3)

Martin Marietta (MAS-E)

Strengths and Weaknesses

STRENGTHS

1. Has aerospace applications experience. Although MAS-E is not installed in aerospace environment, previous MAS systems have been. Also, other aerospace packages are in use.

2. Has strong training and installation support capabilities.

3. Has service bureau support capabilities near KSC for system modifications and testing. This service has no software charge while run on their service bureau.

4. Has resource planning capabilities which accommodate long-term facilities and resource planning requirements.

5. Has a fractional "quantity per" capability in BOM component records.

6. Uses offset lead times in the BOM to accommodate multiple releases of picking lists for a shop order.

7. Uses a manufacturing BOM to explode materials requirements and to time phase shop orders.

8. Has a purchasing module to track purchase order planned receipts.

9. Has tools and process files separated from, but linked to, routings.

10. Has date effectivity changes for routing changes.

Figure VI-6
(Page 2 of 3)

WEAKNESSES

1. Requires a rewrite of master scheduling logic, so that it will accommodate the assignment of new or refurbished major assemblies to specific launches.

2. Does not have configuration management capabilities.

3. Does not have engineering change control by launch effectivity. Uses date engineering change effectivity only.

4. Does not have component location identifier (find) cross-reference on assembly drawings which ties to the bills of material.

5. Does not have logic which accommodates part effectivity management needs. Effectivity changes will change part numbers, but often earlier effectivities are upgraded. MRP must be able to identify upgradable effectivities as usable parts.

6. Does not have part serial number tracking capabilities from receipt from vendor through inventory to "as built" configuration.

7. Does not capacity load both work centers and labor skills.

8. Does not automatically trigger rework orders to upgrade part effectivities to the effectivity required by a shop order.

9. Does not automatically trigger rework orders to upgrade parts needing repair to reach flightworthy status.

Figure VI-6
(Page 3 of 3)

10. Does not presently accommodate shift and hourly dispatch schedules.

11. Does not use the "critical ratio" concept of shop floor prioritization.

12. Does not have the ability to capture actual material costs.

Figure VI-7
(Page 1 of 3)

Univac (UNIS 1100)

Strengths and Weaknesses

STRENGTHS

1. Has hardware compatibility to USBI Huntsville development efforts such as ADRS and ACMS.

2. Has good local support for hardware and systems software in Huntsville. (As the hardware mainframes should be located at KSC, this strength is minimal.)

3. Has a strong existing relationship with USBI.

4. Has an inexpensive software package.

5. Has a fractional "quantity per" capability in BOM component records.

6. Has open purchase requisition and shop order search capabilities for tracing of engineering change impact.

7. Has routing operations network structure capability.

WEAKNESSES

1. Has little aerospace production control application experience.

2. Has a primary emphasis on hardware sales. Has reputation of delivering UNIS to customers who do the installation themselves with minimal support from Univac.

3. Has software which was not developed for use in the government and DOD environments; i.e., to accommodate features such as C-Spec, PMS, and MIL-Spec 100.

Figure VI-7
(Page 2 of 3)

4. Requires a rewrite of master scheduling logic, so that it will accommodate the assignment of new or refurbished major assemblies to specific launches.

5. Requires a separate system to accommodate configuration "as built" data buildup.

6. Uses software which runs on a Univac hardware configuration. In the KSC area, qualified staffing is mostly IBM oriented. Staffing is usually approximately 50% of a data processing center's costs, but hardware costs usually run approximately 35%.

7. Uses gross capacity planning by work center only.

8. Does not use offset lead times in the BOM to accommodate multiple release of picking lists for a shop order.

9. Does not have engineering change control by launch effectivity. Uses date engineering change effectivity only.

10. Does not have explicit pegging.

11. Does not have component location identifier (find) cross-reference to assembly drawings which ties to the bills of material.

12. Does not have pseudo bill of material logic.

13. Does not have logic which accommodates part effectivity management needs. Effectivity changes will change part numbers, but often earlier effectivities are upgradable. MRP must be able to identify upgradable effectivities as usable.

parts.

Figure VI-7
(Page 3 of 3)

14. Does not have part serial number tracking capabilities from receipt from vendor through inventory to "as built" configuration.

15. Does not have a purchasing module.

16. Does not capacity load both work centers and labor skills at the same time.

17. Does not have a tools control subsystem.

18. Does not automatically trigger rework orders to upgrade part effectivities to the effectivity required by a shop order.

19. Does not automatically trigger rework orders to upgrade parts needing repair to reach flightworthy status.

20. Does not presently accommodate shift and hourly dispatch schedules.

21. Does not use the "critical ratio" concept of shop floor prioritization.

(e) Vendor Software Evaluation Criteria Scoring

Vendor software evaluation criteria scoring (Figure VI-8) was developed to be a quantifiable comparison of information gathered to this point. Sixty-nine evaluation criteria were used. Each software package was scored from 1 to 5, with 1 being the lowest possible score, 3 being acceptable, and 5 being very good.

These criteria were summarized in the vendor final selection scoring matrix (Figure VI-9).

Figure VI-8
(Page 1 of 4)

SRB/Production Control System

Vendor Software Evaluation Criteria

Software Evaluation Criteria	Package Score (1) Univac UNIS(2)	Martin Marietta MAS-E	Rath & Strong PIOS
A. Refurbishment			
1. Ability to plan materials	3	3	3
2. Ability to schedule labor	2	2	3
3. Ability to schedule work centers	4	4	4
4. Ability to track actual labor and materials	3	5	4
B. Master Scheduling			
1. Two-level master schedule	3	3	3
2. Gross capacity planning	2	5	5
C. Materials Requirements Planning			
1. Forecasted refurbishment BOM	3	3	3
2. BOM/engineering changes	2	2	5
3. Time-phased release of materials	1	4	4
4. Inventory allocation	4	4	4
5. Pegging requirements to orders	3	5	5
D. Inventory Management and Control			
1. Multiple locations	5	5	5
2. Locator systems	5	5	5
3. Serial number control	3	1	5
4. Work-in-process control	4	4	4
5. Part activity listing	4	2	4
6. Cost buildup	1	3	3

Figure VI-8
(Page 2 of 4)

Software Evaluation Criteria	Package Score (1) Univac UNIS(2)	Martin Marietta MAS-E	Rath & Strong PIOS
E. Capacity Requirements Planning			
1. Routing summarizing WADs	3	4	4
2. Inclusion of process constraints	3	1	1
3. PERT/CPM concept	1	1	1
4. Inclusion of preventive maintenance WADs	1	4	4
5. Refurbishment routing buildup	2	2	2
6. Scheduling of work center level	2	4	4
7. Reporting labor certification requirements	1	1	3
8. Reporting GSE schedule requirements	1	4	4
9. CRP includes WIP	4	4	4
F. Shop Floor Management			
1. Reverifies inventory available	5	5	5
2. Reverifies labor and GSE available	1	1	1
3. Produces expedite reports for shortages	5	5	5
4. Produces expedite reports for scarce resources	1	1	1
5. Produces job dispatch package	3	4	4
6. Allows inventory prekitting	3	3	4
G. Operations Control			
1. Maintains perpetual status of WIP	3	3	3
2. Accumulates detail transactions for WIP	3	4	4
3. Produces exception reports for:			
- late operations	4	4	4
- labor variance	2	4	1
- materials variance	3	3	4

Figure VI-8
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Software Evaluation Criteria	Package Score (1) Univac UNIS(2)	Martin Marietta MAS-E	Rath & Strong PIOS
H. Performance Reporting			
1. Produces performance reports for			
- work center productivity	3	4	4
- labor certification productivity	1	1	1
- schedule complaince	4	4	5
- routing deviations	2	3	3
- cost variance analysis	2	4	4
2. Provides costing capabilities			
- for SRB, standard and actual	2	4	4
- SRB cost performance	4	4	4
- department cost performance	2	2	4
- work center cost performance	3	4	4
- labor certification cost performance	1	1	1
I. Other Features			
1. Accommodates MIL SPEC 100	3	3	5
2. Accommodates Vandenberg Operations	4	4	4
3. Operations budgeting	1	2	3
4. Preventive maintenance scheduling	2	4	4
5. Attrition forecasting	1	1	1
6. Design engineering	4	2	5
7. Purchasing	1	4	4
8. Shop floor data collection	4	4	4
9. Configuration management	4	2	5
10. Effectivity management	1	1	5
J. Support			
1. Systems design for modifications	3	5	5
2. Systems development	3	4	4
3. Training at management level	2	5	5
4. Training at supervisory level	2	5	4
5. Implementation	2	5	5
6. Maintenance support	3	5	5

Figure VI-8
(Page 4 of 4)

Software Evaluation Criteria	Package Score (1) Univac UNIS(2)	Martin Marietta MAS-E	Rath & Strong PIOS
K. Hardware			
1. System upward expandable	4	4	4
2. Univac interface	5	1	1
3. Performance/reliability	4	4	3
4. Utilizes data base	4	3	4
5. Local Huntsville support	5	1	1
6. Local KSC support	3	4	2

Notes: (1) Scoring based on 5 (best) to 1 (worst).
(2) Integration of ACMS and development of ADRS is assumed to be completed when required.

Figure VI-9
(Page 1 of 3)

SRB/Production Control System

Vendor Final Selection Scoring Matrix

Factor	Weight(2)	Package Score(1) Univac UNIS	Martin Marietta MAS-E	Rath & Strong PIOS
Software Features(3)				
A. Refurbishment	10	6	7	7
B. Master scheduling	4	2	3	3
C. Materials requirements planning	8	4	6	7
D. Inventory management and control	6	4	4	5
E. Capacity requirements planning	8	4	4	5
F. Shop floor management	8	5	5	5
G. Operations control	8	5	6	5
H. Performance reporting	6	3	4	5
I. Other				
- effectivity management	10	1	1	10
- configuration management	8	6	3	8
- operations budgeting	6	1	2	4
- PM scheduling	6	2	5	5
- design change	8	6	3	8
Software Score (Base 1 x wt.)	10	3.9	4.1	6.3

Figure VI-9
(Page 2 of 3)

Factor	Weight(2)	Package Score(1) Univac UNIS	Martin Marietta MAS-E	Rath & Strong PIOS
Implementation Capability(3)				
A. System design for modifications	8	5	8	8
B. Systems development	8	5	6	6
C. Training at management level	10	4	10	10
D. Training at supervisory level	10	4	10	8
E. Implementation support	8	3	8	8
F. Maintenance support	4	2	4	4
Implementation Score (Base 1 x wt.)	8	3.2	6.5	6.2
Hardware(3)				
A. System upward expandable	4	3	3	3
B. Univac interface	8	8	2	2
C. Performance/reliability	8	6	6	5
D. Utilities data base	8	6	5	6
E. Local Huntsville support	10	10	2	2
F. Local KSC support	10	6	8	4
Hardware Score (Base 1 x wt.)	4	2.8	1.8	1.5

Figure VI-9
(Page 3 of 3)

Factor	Weight(2)	Package Score(1) Univac UNIS	Martin Marietta MAS-E	Rath & Strong PIOS
Other Factors Influencing Selection(4)				
A. Existing Univac relationship	+8	8	-	-
B. Vendor orientation	-2	2	-	-
C. Aerospace experience	10	1	6	8
D. Hands-on implementation experience	8	4	6	8
E. Degree of modifications needed	8	4	6	8
F. Vendor implementation history	-2	-	2	-
G. Remote computing services	10	4	10	8
H. Development status of standard package	-2	-	-	2
Other Factors Score (Base 1 x wt.)	10	4.5	6.6	7.5
Relative Ranking(5) (maximum of 10)		4.5	5.9	6.7(6)

Notes:
(1) Score is based on percent feature times weighting.
(2) Weighting is based on 1 to 10 scoring.
(3) Factor subheadings sections represent a grouping of related factors. Each grouping is weighted based on 1 to 10 weight.
(4) Other factors' weighting is based on -10 to +10 scoring.
(5) Relative ranking is a weighted average of subheading sections converted to a 1 to 10 score.
(6) Primary choice.

On the basis of the selection criteria and relative importance of scoring factors, the Rath and Strong package was selected.

(f) Vendor Final Selection Scoring

The vendor final selection scoring matrix (Figure VI-10) is designed to summarize vendor software criteria scores into a vendor relative ranking. This ranking was used as the basis for selecting a software vendor.

Figure VI-10

Vendor Software Relative Ranking

Vendor	Rank out of 10	Status
Univac (UNIS 1100)	4.5	Rejected
Martin Marietta (MAS-E)	5.9	Rejected
Rath and Strong (PIOS)	6.7	Primary Recommendation

MRP SOFTWARE VENDOR	PACKAGE NAME	CONTACT	RESPONDED TO R.F.I.
American Software Inc. 443 East Paces Ferry Road Atlanta, Georgia 30305	Manufacturing Management Systems	Ms. Bonnie Malstrom	
A. O. Smith - Data Systems Division 8901 North Kildeer Court Brown Deer, Wisconsin 53209	Manufacturing Data Systems	Mr. Ed Sabiszak	
Applied Information Development Inc. 823 Commerce Drive Oak Brook, Illinois 60521	AID - Manufacturing Control System	Mr. Lloyd Buckholz	X
Artista Manufacturing Systems Division of Xerox Corporation 2300 North Mayfair Road Suite 550 Wauwatosa, Wisconsin 53226	Arista Manufacturing Systems	Mr. Harlow Bomstad	X
Arthur Anderson and Company 32 West Monroe Chicago, Illinois 60603	MAC-PAC RPG MAC-PAC Cobol	Mr. Dwight Dowdell Mr. John Primorac	
ASK Computer Systems 907 North Elm Hinsdale, Illinois 60521	Manman	Mr. Paul Coffrey	
Associates for Management Services 12611 Northup Way Bellevue, Washington 98005	Manufacturing Management & Control	Mr. Paul Kanzer	
Boeing Computer Service 360 Corporate Drive Tukwild, Washington 98188	PMS/Production Management Systems	Mr. Tim Bull	X
Bristol Information Systems 84 North Main Street Fall River, Massachusetts 02720	Manufacturing Systems	Ms. Jenny Turchetta	
Burroughs Corporation Burroughs Plaza Detroit, Michigan 48232	PCS III	Mr. Jim Page	
Business Controls Corporation 507 Boulward Elmwood Park, New Jersey 07407	MIN-MACS (Manufacturing Inventory and Materials Control System)	Mr. Dave Reiss	

MRP SOFTWARE VENDOR	PACKAGE NAME	CONTACT	RESPONDED TO R.F.I.
Cincom Systems Incorporated 2300 Montana Avenue Cincinnati, Ohio 45211	MRPS (Manufacturing Resources Plannings System)	Ms. Laura Larson	
Compudata Systems Inc. 772 Post Road East Westport, Connecticut 06680	Manufacturing System for IBM Series I	Mr. Bob Steinis	
Computer Covenant Corporation 790 Farmington Avenue Farmington, Connecticut 06032	Integrated Manufacturing System	Mr. Dave Martin	
Computer Methods Inc. 125 Windsor Drive, Suite 110 Oak Brook, Illinois 60521	PROFIT	Mr. Don Fitzpatrick	
Computer Systems Engineering 16 Second Avenue Burlington, Massachusetts 10803	Total Manufacturing System	Mr. Charlie Beddoe	
Computer Technology Inc. 11101 Northeast 8th Street Suite 238 Bellevue, Washington 98004	MCS (Manufacturing Control Systems)	Mr. Woody Price	
Analyst International Corporation 1111 Plaza Drive, Suite 640 Schaumburg, Illinois 60195	MCS (Manufacturing Control Systems)	Mr. John Usedom	
Consero Corporation 1385 Mendota Heights Road Mendota Heights, Minnesota 55120	AMAPS (Advanced Manufacturing Accounting Production System)	Mr. Rick Bowles	
Data 3 Systems Incorporated P.O. Box 441 Santa Rosa, California 90806	MRPS 34/38	Mr. Doug Licciani	X
Data Systems for Industry 3450 East Spring Street Long Beach, California 90806	COP, JCP, SFP, MM/3000, and MFG/3000	Mr. Donald Whipple	
Digital Business Systems Incorporated 95 Main Street Reading, Massachusettes 01867	Part of TAG Distribution Accounting System	Ms. Leslie Rogers	

MRP SOFTWARE VENDOR	PACKAGE NAME	CONTACT	RESPONDED TO R.F.I.
Decision Sciences Corporation 528 Fox Pavilion Jinkinton, Pennsylvania 19046	SPARS	Mr. Richard Pitman	
Digital Equipment Corporation 5600 Apollo Drive Rolling Meadows, Illinois 60008	LOTS (Labor & Operations Trucking System)	Ms. Janean Bowersmith	
EDS Compusource Corporation 750 Presidential Drive Richardson, Texas 75081	Distribution Manufacturing	Mr. Mike Bresliom	
ESCOM-Division of Anacomp 12838 Southeast 40th Place Bellevue, Washington 98006	MMC (Manufacturing Management and Control)	Mr. Art Broden	
Factory Systems - Division of Rolfe Associates Inc. 2264 Silas Deane Highway Rocky Hill, Connecticut 06067	TRAC 80	Mr. John Donovan	
Far West Data Systems 178-41 Fifth Avenue Irvine, California 92714	MAC-PAC/HP	Mr. Gordon Clark	
Formation Inc. 823 East Gate Drive Mount Laurel, New Jersey 08057	FORMAN	Mr. George Kolesar	X
Gains Systems Group 2021 Spring Road Oak Brook, Illinois 60521	General Adaptive Inventory System	Mr. Ken Wright	
Hewlett-Packard 19447 Pruneridge Avenue Cupertino, California 95014	Materials Management 3000	Mr. Larry Hartge	
Honeywell Information Systems Incorporated 120 South Riverside Chicago, Illinois 60606	HMS	Mr. Jim Greenup	X
ICL Incorporated - Distributive Systems Division 415 East Airport Freeway Irving, Texas 75062	Extended SAFES (Small Factory Systems)	Mr. Harry Giese	
IBM Data Processing Division IBM Plaza Chicago, Illinois 60611	COPICS (See Note 1)	Mr. Joe Safirstein	X

MRP SOFTWARE VENDOR	PACKAGE NAME	CONTACT	RESPONDED TO R.F.I.
Informatics, Incorporated - Manufacturing Systems Division 701 Lee Street Des Plaines, Illinois 60016	Manufacturing Systems	Dr. Harold Josephson	
Information Management Technologies 180 North Michigan Avenue Chicago, Illinois 60601	MACS	Ms. Debbie Reynolds	
Integral Business Computing Inc. 1440 West Pacific Cost Highway Harbor City, California 90710	Manufacturing Management System	Mr. Jim Gajniak	
Interactive Incorporated 9787 Aero Drive, Suite A San Diego, California 92123	Infoflo	Mr. Mike Baker	
Itel Corp. One Embarcadero Center San Francisco, California 94111	MFG 80		
Interactive Applications Incorporated 510 Oakmead Parkway Sunnyvale, California 94086	MRP Command System	Mr. Rod McKim	
Interactive Information Systems 10 Knollcrest Drive Cincinnati, Ohio 45237	Interactive Management Control System	Ms. Kim Sheridan	X
Interactive Management Systems Inc. 375 Concord Avenue Belmont, Massachusetts 02178	MRP	Mr. Mike Carabetta	
Jacobsen & Associates, Incorporated 10229 Lower Arjusa Road Temple City, California 91780	Manufacturing Control Systems	Mr. Jerry Parker	
Automation Co. Box 516 St. Louis, Missouri 63166	AIMS	Mr. Douglas McDonnell	
Management Technology Inc. A-4562 64th Street Holland, Michigan 49423	MIPS	Mr. Jerry Carter	
Mandate Corporation 300 East Ohio Building 1717 East Ninth Street Cleveland, Ohio 44114	Manufacturing Management System	Mr. George Tomko	

MRP SOFTWARE VENDOR	PACKAGE NAME	CONTACT	RESPONDED TO R.F.I.
Manufacturing Resources Management 10721 West Capital Drive Milwaukee, Wisconsin 53222	PACS	Mr. S. J. Kohn	X
Martin-Marietta Data Systems 6301 Ivy Lane, Suite 300 Greenbelt, Maryland 20770	MAS-E, MAS-II, and MAS-I MAS-H	Mr. Donald McCullough Mr. Jim Lewis	X (MAS-E)
Metasystems Inc. 2632 Charney Road University Heights, Ohio 44118	IMPACS (Interactive Manufacturing Planning and Control System)	Ms. Jill Brown	
Microline Corp. 1751 Langley Avenue Irvine California 92705	MMCS		
Mid-America Computer Corporation Thorndale at York Road Bensenville, Illinois 60106	MACE	Mr. Jack Peterson	
Mitral-Operation of General Electric Information Service Company One New England Executive Park Burlington, Massachusetts 01803	MIMS	Mr. Allen Boynton	
NCA Corporation 388 Oakmead Parkway Sunnyvale, California 94086	MS-II Manufacturing System	Ms. Norma Alzona	
NCR Commercial/Industrial Systems Marketing Main and K Streets Dayton, Ohio 45479	IMCS II MISSION	Mr. Penrod Mr. Don E. Rosser	X X
Optimum Systems Incorporated 2801 Northwestern Parkway Santa Clara, California 95051	Manufacturing Inventory Control System	Mr. Don Fanzo	
Praxa Corporation 26 Springdale Road Cherry Hill, New Jersey 08003	MRP and Capacity Planning Systems	Ms. Connie Chillemi	
Professional Computer Resources Inc. 2021 Midwest Road Oak Brook, Illinois 60521	Resources Management System	Mr. Larry Roches	
Rath and Strong 4835 LBJ Freeway Dallas, Texas 75234	PIOS	Ms. Linda Smith	X

MRP SOFTWARE VENDOR	PACKAGE NAME	CONTACT	RESPONDED TO R.F.I.
R.A.I.R. Inc. 465 Castro Street Mountainview, California 94041	MADIC		
Remote Business Services, Incorporated 9 Bitteswood Road Norwalk, Connecticut 06851	Manufacturing Systems for DED System	Mr. Bob Steinis	
The Service Bureau Company 500 West Putnam Avenue Greenwich, Connecticut	MFG/PLUS	Mr. Bill Huther	
Systems Management Incorporated 10400 West Higgins Road Rosemont, Illinois 60018	Manufacturing Control System	Ms. Jeanine Christiano	X
Thomas Laguban & Associates, Incorporated Box 523 Barrington, Illinois 60018	E-TAPS	Mr. Gene Thomas	X
Tymshare Incorporated 20705 Valley Green Drive Cupertino, California 95014	Manufacts	Mr. Bill Mulert	
U.S.S. Engineers and Consultants Incorporated Division of U.S. Steel 600 Grant Street, Room 2470 Pittsburgh, Pennsylvania 15230	Production Planning and Control System	Mr. A. L. Comm	
Williams Assoicates 626 Al-Hill Drive San Luis Abispo, California 93401	IMP-Interactive Manufacturing Planning	Mr. Robert E. Williams	
Xerox Computer Service 935 Oak Lawn Avenue Elmhurst, Illinois 60126	Manufacturing Services	Mr. Jeff Lundeen	
De Bugge Computer Service 77 Brandt Avenue Clark, New Jersey 07066	PRO III	Mr. Ed Murphy	
SESA Incorporated 89 State Street Boston, Massachusettes 02109	SESAP	Mr. Jack Cavagharo	

MRP SOFTWARE VENDOR	PACKAGE NAME	CONTACT	RESPONDED TO R.F.I.
Software International 1011 East Touhy Suite 420 Des Plaines, Illinois 60018	Manufacturing Resources Planning System	Mr. Paul Kanzer	X
Software Management Systems, 1011 East Touhy Suite 420 Des Plaines, Illinois 60018	Manufacturing Management and Control	Mr. Paul Kanzer	
Sperry Univac P.O. Box 500; B34 4M Blue Bell, Pennsylvania 19424	UNIS 1100 UNIS 90 (See Note 2) MANMAN (See Note 3)	Mr. Gary Inforzato	X X X
STSC Incorporated 462 Boylston Street Boston, Massachusettes 02116	CMCS	Mr. Jim Brown	X
Systemation Incorporated Two Commerce Park Square 23200 Chagrin Boulevard Cleveland, Ohio 44122	MRP System	Mr. Bill Stilson	X
Martin Marietta Michoud, Louisiana	IPPS (See Note 4)	Mr. Bob Swanson	

Notes: (1) COPICS was excluded from further consideration due to:
- Software development targeted at broad industrial use is not specific enough for aerospace.
- IBM direction is to user-developed software.
- Few subsystem modules operational.

(2) UNIS 90 was excluded from further consideration due to:
- Hardware size. UNIS 1100 was considered for further evaluation.

(3) MANMAN (Univac) was excluded from further consideration due to:
- Hardware size. UNIS 1100 was considered for further evaluation.

(4) IPSS was excluded from further consideration due to:
- Software is designed to be an integration of many independent modules (a patchwork system).
- System is not deemed capable of handling SRB refurbishment.
- System does not follow current production management technologies; therefore, will not benefit from synergies of this technological base.

SOFTWARE VENDOR R.F.I. EVALUATION SCREEN

PCS PACKAGE EVALUATION MATRIX General Information	MM	MRM	DATA 3	STSC	SMI	NCR (IMCS II)	FORM	APPLIED	HONEYWELL	INTERACTIVE SOFTWARE INT	BOEING	TL & A	ARISTA	R & S	NCR (MISSION)	UNIS 1100
1. Was first installed pre-78	+	+	-	+	-	-	-	+	+	+	+	+	+	+	+	+
2. Has twenty or more installations	+	+	-	+	+	+	-	-	+	+	+	-	-	+	+	+
3. Has five or more Class "A" users	⊖	+	-	-	-	+	-	-	-	+	-	+	+	-	+	⊖	+
4. Identified six Class "A" users	⊖	+	-	⊖	+	⊖	-	-	⊖	+	-	+	+	-	+	⊖	+
5. Provides software maintenance	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
6. Uses a data base management system	+	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+
7. Provides software support in:																	
- Systems engineering	+	+	+	-	+	+	+	-	+	+	+	+	+	+	+	+	+
- Data base engineering	+	+	+	-	+	+	+	+	+	-	+	+	+	+	+	+	+
- Programming	+	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+
- Systems implementation	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
8. Programmed in COBOL	+	-	-	-	+	+	-	+	+	-	+	-	+	+	+	+	+
9. Provides customers with source code	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+
10. Allows modifications to programs and data base	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+
11. Provides documentations in:																	
- Systems design	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+
- Programming	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+
- Operations	+	+	+	+	+	+	+	+	+	+	-	+	+	+	-	+	+
- User	+	+	+	+	+	+	+	+	+	+	-	+	+	⊕	+	+	+
- Implementation	-	o	+	+	+	+	+	+	+	+	-	+	+	+	⊕	+	+
12. Package is:																	
- Net change	o	-	-	+	-	-	+	+	+	-	+	+	o	+	+	-	+
- Both net change and regenerative	+	-	-	+	-	-	+	+	-	-	-	+	+	+	+	o	+
- Bucketless	+	-	-	-	+	+	+	+	+	-	+	+	+	⊕	+	-	+
- On-line	o	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+
- Combined on-line and batch	+	+	+	+	+	-	-	+	+	+	-	o	o	+	+	+	+
- Distributed processing	o	-	-	-	+	+	+	+	+	+	-	+	+	+	-	+	-
13. Maintains detail transaction history	+	+	+	-	+	+	-	+	+	+	+	-	+	+	+	+	+
14. Has transaction audit trails	+	+	+	-	+	+	+	+	+	+	+	-	+	+	+	+	+
TOTAL SECTION SCORE	21	19	16	17	22	21	16	21	23	21	16	21	23	22	23	21	25
RANKED (over 80% hurdle)	4	-	-	-	3	4	-	4	2	4	-	4	2	3	2	4	1

SOFTWARE VENDOR R.F.I. EVALUATION SCREEN

Master Scheduling	MM	MRM	DATA 3	STSC	SMI	NCR (IMCS II)	FORM	APPLIED	HONEYWELL	INTERACTIVE	SOFTWARE INT	BOEING	TL & A	ARISTA	R & S	NCR (MISSION)	UNIS 1100
1. Has a master scheduling module	+	+	+	+	+	⊕	-	+	+	-	+	⊕	+	+	+	+	+
2. Is separate from detailed requirements planning	+	+	+	+	+	⊕	+	+	+	-	+	⊕	-	+	+	+	+
3. Can master schedule at two levels	-	+	+	+	+	⊕	-	+	+	+	+	⊕	+	+	+	-	+
4. Backs off second level based on lead times	+	+	o	+	+	⊕	-	+	+	+	+	-	+	+	+	+	+
5. Allocates inventory and production	+	+	+	+	+	⊕	+	+	+	+	+	⊕	+	+	+	+	+
6. Reschedules planned orders	+	+	+	+	-	-	-	-	+	-	-	⊕	+	+	+	-	+
7. Can suppress rescheduling in favor of expediting or deexpediting	+	+	+	+	+	⊕	+	+	+	+	+	⊕	+	+	+	+	+
8. Expedites or deexpedites W.I.P.	+	+	+	+	-	⊕	+	+	+	+	+	⊕	+	+	+	+	+
9. Has pegging	+	+	+	+	+	⊕	+	+	+	+	+	⊕	+	+	+	+	+
10. Has gross capacity planning	+	+	+	+	+	⊕	+	+	+	-	+	-	+	+	+	+	+
11. Produces operations budget projections	+	-	+	+	-	-	-	+	+	-	-	⊕	+	+	+	+	-
TOTAL SECTION SCORE	10	10	10	11	8	0	5	10	11	6	9	0	10	11	11	9	10
RANKED (over 60% hurdle)	2	2	2	1	4	-	-	2	1	-	3	-	2	1	1	3	2

SOFTWARE VENDOR R.F.I. EVALUATION SCREEN

Material Requirements Planning	MM	MRM	DATA 3	STSC	SMI	NCR (IMCS II)	FORM	APPLIED	HONEYWELL	INTERACTIVE	SOFTWARE	BOEING	TL & A	ARISTA	R & S	NCR (MISSION)	UNIS 1100
1. Uses MRP and back schedules	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
2. Can use a two level master schedule	-	+	+	+	+	+	-	+	+	+	+	+	+	+	o	-	+
3. Uses multiple level BOM	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
4. Can handle 12 or more levels in BOM	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	o	+
5. Uses low level code	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+
6. Uses planning (fractional) BOM	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
7. Has customers using planning BOM	+	+	o	+	+	⊖	⊖	+	⊖	o	+	+	+	o	+	+	+
8. Uses pseudo or phantom BOMs	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+	o	-
9. Has customers using pseudo BOMs	+	+	o	+	+	⊖	-	+	⊖	o	o	+	+	o	+	+	+
10. Translates requirements into manufacturing or purchase orders	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+	+
11. Do orders reflect inventory policy?	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-
12. Has substitution logic	-	+	-	+	⊕	-	+	-	-	-	-	+	+	-	+	-	-
13. Has customers using substitution logic	-	+	-	o	-	-	⊖	-	-	o	o	+	+	-	+	-	-
14. Can make one-time manual overrides for:																	
- Component substitution	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+
- Component addition or deletion	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+
- Change of cycle time	+	+	?	+	+	+	+	+	+	+	+	+	+	+	+	-	+
- Change of lot size policy	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	-	+
- Creation of artificial requirements	+	o	+	+	+	+	+	+	+	+	o	+	+	+	+	-	+
15. Has different classes of manufacturing and purchase orders	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
These include:																	
- Planned orders	+	+	+	+	+	o	+	+	+	+	+	+	+	+	+	+	+
- Firm orders	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
- W.I.P.	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+
16. Produces exception notices rather than rescheduling firm orders and W.I.P.	+	+	+	+	+	+	+	+	?	+	+	+	+	+	+	+	+
17. Reserves inventory against requirements	+	+	+	+	+	-	+	+	+	+	-	+	+	+	+	+	+
18. Allocates planned receipts against requirements	+	+	+	-	+	-	-	+	-	-	-	+	+	+	-	+	+
19. Uses pegging to allocate	+	-	-	-	+	-	+	+	+	-	+	+	+	+	+	+	+
20. Produces exception message reports for:																	
- Expediting and deexpediting	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
- Manual overrides	-	-	o	+	-	+	-	+	+	+	-	-	+	+	-	+	+
- Orders having no requirements	+	+	+	+	+	-	+	+	+	-	o	+	-	+	+	+	+
21. Dampens rescheduling trigger by use of a tolerance factor	+	+	-	+	+	+	-	+	+	-	+	-	+	+	+	-	+
TOTAL SECTION SCORE	26	27	22	27	27	21	20	28	24	21	20	28	29	26	27	19	26
RANKED (over 80% hurdle)	4	3	-	3	3	-	-	2	5	-	-	2	1	4	3	-	4

SOFTWARE VENDOR R.F.I. EVALUATION SCREE

Capacity Requirement Planning	MM	MRM	DATA 3	STSC	SMI	NCR (IMCS II)	FORM	APPLIED	HONEYWELL	INTERACTIVE	SOFTWARE INT	BOEING	TL & A	ARISTA	R & S	NCR (MISSION)	UNIS 1100
1. Uses CRP	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
2. Does finite loading	-	-	-	+	-	-	+	-	-	-	-	-	-	-	-	-	+
3. Recommends rescheduling action	-	-	-	+	-	+	+	-	+	-	+	-	+	o	+	o	+
4. Does not require that MRP and CRP run together for rescheduling	+	+	+	+	-	+	+	+	+	+	-	+	+	-	+	+	+
5. Can hold schedule changes for periodic update of MRP or CRP	+	+	+	+	+	+	+	+	+	+	+	+	+	o	+	+	+
6. Uses net change logic in CRP	-	-	-	+	-	-	+	-	+	+	-	-	+	-	-	-	-
7. Links CRP and MRP net change logic	-	-	-	+	-	-	+	-	+	-	-	-	+	+	+	-	+
8. Does not use bucketed time periods	+	-	+	-	+	-	+	+	+	+	-	+	+	-	+	-	-
9. Can do both labor and work center capacity loading	+	-	-	+	-	-	+	+	+	+	+	-	+	+	+	+	-
10. Has customers doing both labor and work center loading	o	-	o	o	+	-	+	+	-	-	o	-	+	o	+	o	-
11. Can schedule tools and GSE	-	-	+	+	-	-	+	+	-	+	+	-	+	-	+	-	-
12. Identifies tool time required	-	-	+	+	-	-	+	+	-	+	+	-	+	o	o	o	-
13. Incorporates P.M.	+	-	+	+	-	+	+	-	-	-	+	+	+	-	-	-	-
14. Schedules nonmaterial driven work for:																	
- Work center maintenance	+	-	+	-	-	+	+	-	-	+	+	-	+	-	+	+	-
- Labor skill training	+	-	+	-	-	+	+	-	-	+	+	-	+	-	+	+	-
- Support equipment maintenance	+	-	+	-	-	+	+	-	-	+	+	-	+	-	+	+	-
15. Handles routing deviations for:																	
- Rework	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+
- Alternative routings	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+
- Additional operations	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+
- Extended time in an operation	+	o	+	+	+	+	+	+	+	+	+	+	+	+	o	+	+
- Optional routings	-	-	+	-	-	-	+	+	-	-	-	-	o	+	-	+	+
16. Adjusts CRP and MRP for routing deviations	+	+	+	+	o	+	+	+	+	+	+	-	+	+	+	+	+
17. Has on-line schedule adjustments	-	-	+	+	+	+	+	+	-	+	+	-	+	-	+	+	+
18. Links routing operations to work centers	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
19. Uses net change logic to identify impact of changes	+	-	+	+	-	-	+	-	-	+	-	-	+	+	-	-	+
20. Supports a bill of work network	-	+	o	-	-	-	+	-	+	+	+	-	+	-	+	-	+
21. Has Pert or CPM	-	-	-	-	-	-	+	-	-	+	-	-	-	-	-	-	-
TOTAL SECTION SCORE	16	8	18	19	15	10	0	15	16	18	19	8	24	11	19	14	16
RANKED (top 50%)	4	-	3	2	-	-	-	-	4	3	2	-	1	-	2	-	4

SOFTWARE VENDOR R.F.I. EVALUATION SCREEN

Shop Floor Scheduling	MM	MRM	DATA 3	STSC	SMI	NCR (IMCS II)	FORM	APPLIED	HONEYWELL	INTERACTIVE	SOFTWARE INT	BOEING	TL & A	ARISTA	R & S	NCR (MISSION)	UNIS 1100
1. Schedules shop floor by hour or shift	+	-	⊕	-	-	-	⊕	-	+	+	-	-	+	+	-	-	+
2. Can be distributed from the main system	+	+	-	+	+	+	⊕	-	+	+	+	+	-	+	+	+	-
3. Is on-line interactive	+	+	+	+	+	+	⊕	-	+	+	+	+	+	+	+	+	+
4. Performs prerelease requirements check for:																	
- Inventory on-hand	+	+	+	+	+	+	⊕	-	+	+	+	+	+	+	+	+	+
- Tools availability	-	-	⊕	+	+	-	⊕	-	-	-	+	-	+	-	+	-	-
- Labor skills availability	-	-	-	+	-	-	⊕	-	-	-	-	-	+	-	+	-	-
5. Reports exceptions for prerelease checks	+	+	+	+	-	+	⊕	-	+	-	+	+	+	+	+	-	+
6. Uses a priority logic	+	+	-	+	+	-	⊕	-	+	+	+	+	+	+	+	+	+
7. Notifies the dispatcher of exceptions automatically	+	-	+	+	-	+	⊕	-	+	+	+	-	+	-	+	-	+
8. Uses net change logic to identify impact of changes	+	-	+	+	-	-	⊕	-	+	+	-	-	+	+	+	-	+
9. Releases job documents such as:																	
- Routing information	+	+	+	+	+	+	⊕	-	+	+	+	+	+	+	+	+	+
- Labor tickets	+	-	+	+	-	+	⊕	-	+	-	+	+	+	+	+	-	-
- Materials requisitions	+	-	+	+	+	+	⊕	-	+	+	+	+	+	+	+	+	+
- Supplies requisitions	+	-	+	+	-	+	⊕	-	+	-	+	+	+	+	+	+	+
- Tools requisitions	+	-	+	+	-	-	⊕	-	+	+	+	-	+	+	+	-	-
10. Maintains job status for W.I.P. and order held pending requirements	+	+	+	+	+	+	⊕	-	+	+	+	+	+	+	+	+	+
TOTAL SECTION SCORE	14	7	0(1)	15	8	10	0	0	14	11	13	10	15	13	15	8	11
RANKED (over 80% hurdle)	2	-	-	1	-	-	-	-	2	4	3	-	1	3	1	-	4

SOFTWARE VENDOR R.F.I. EVALUATION SCREEN

Operations Tracking	MM	MRM	DATA 3	STSC	SMI	NCR (IMCS II)	FORM	APPLIED	HONEYWELL	INTERACTIVE	SOFTWARE INT	BOEING	TL & A	ARISTA	R & S	WCR (MISSION)	UNIS 1100
1. Logs W.I.P. activity to each order	+	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+
2. Has on-line data entry	+	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+
3. Is both on-line and batch data entry	+	o	-	+	-	+	+	-	+	o	-	-	-	+	+	+	+
4. Maintains detailed transactions on file	+	+	+	-	+	+	+	-	+	+	+	+	+	+	+	+	+
5. Includes the following transactions:																	
- Materials released to each order	+	+	+	-	+	+	+	-	+	+	+	+	+	+	+	+	+
- Exception materials released	+	+	+	-	+	+	+	-	+	+	+	+	+	+	+	+	+
- Tools used by time used	-	-	-	-	-	-	+	-	-	-	-	-	+	-	-	-	-
- Supplies used	+	o	+	-	-	+	+	-	-	+	+	+	+	+	+	+	+
- Rework operations	+	+	+	-	+	+	+	-	+	+	+	+	+	+	+	+	+
- Alternate routings	+	+	+	-	-	+	+	-	-	+	-	-	+	+	+	+	+
- Operations appended to routings	+	+	+	-	+	+	+	-	+	+	+	-	+	+	+	+	+
- Labor time by skill and operation	+	+	+	-	+	+	+	-	+	+	+	-	+	+	+	+	-
6. Produces exception reports	+	+	+	-	+	+	+	-	+	+	+	-	+	+	+	+	
7. Includes the following exceptions:																	
- Unplanned materials usage	+	+	+	-	+	+	+	-	+	+	+	-	+	+	+	+	+
- Materials not released that should have been	+	+	+	-	+	+	+	-	-	+	+	-	+	+	+	+	+
- Late operations	+	-	+	-	+	-	+	-	+	+	+	-	+	-	+	+	+
- Missed operations	+	+	+	-	+	+	+	-	+	+	+	-	+	-	+	-	+
- Additional or unplanned operations	+	+	+	-	+	+	+	-	-	-	+	-	+	-	+	-	+
- Labor skills over plan	+	-	-	-	+	o	+	-	+	-	+	-	+	-	+	-	-
- Wrong labor skill	+	-	-	-	-	-	+	-	-	-	+	-	+	-	+	-	-
8. Updates job status from transaction data	+	+	+	-	+	+	+	-	+	+	+	+	+	+	+	+	+
TOTAL SECTION SCORE	20	15	17	3	16	16	0	0	16	16	13	8	20	15	20	16	16
RANKED (over 80% hurdle)	1	-	2	-	3	3	-	-	3	3	-	-	1	4	1	3	3

SOFTWARE VENDOR R.F.I. EVALUATION SCREEN

Performance Monitoring	MM	MRM	DATA 3	STSC	SMI	NCR (IMCS II)	PORM	APPLIED	HONEYWELL	INTERACTIVE	SOFTWARE INT	BOEING	TL & A	ARISTA	R & S	NCR (MISSION)	UNIS 1100
1. Produces performance reports	+	+	+	+	+	+	⊕	-	+	+	+	+	+	+	+	+	+
2. Summarizes performance for each manufacturing order when it is closed	+	+	+	+	+	+	⊕	-	+	+	+	+	+	+	+	+	-
3. Includes the following performance reports:																	
- Labor productivity	+	+	+	-	+	+	⊕	-	+	-	+	+	+	+	-	+	-
- Work center capacity utilization	+	-	+	-	+	+	⊕	-	+	+	+	+	+	+	+	+	+
- Schedule performance	+	-	+	+	-	+	⊕	-	+	-	+	-	o	+	+	-	+
- Cost variance reports	+	+	+	-	+	+	⊕	-	+	+	+	-	+	+	+	+	+
- Exception summaries	+	+	-	-	-	+	⊕	-	-	-	+	-	-	+	+	+	+
4. Maintains summarized transaction information after close of each order	+	+	+	-	+	+	⊕	-	+	+	+	-	+	+	+	+	-
5. Maintains only exceptions to plan as summary information	-	-	-	-	-	-	⊕	-	-	+	-	o	-	+	+	+	-
6. Interfaces performance information with operations budgeting	-	-	-	+	-	-	⊕	-	+	-	-	+	-	-	-	o	-
TOTAL SECTION SCORE	8	6	7	4	6	8	0	0	8	6	8	5	5	9	8	8	5
Not a Critical Function	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

SOFTWARE VENDOR R.F.I. EVALUATION SCREEN

Inventory Management and Control	MM	MRM	DATA 3	STSC	SMI	NCR (IMCS II)	FORM	APPLIED	HONEYWELL	INTERACTIVE	SOFTWARE INT	BOEING	TL & A	ARISTA	R & S	NCR (MISSION)	UNIS 1100
1. Records all receipts and disbursements	+	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+
2. Has a locator system	+	-	+	+	+	⊕	+	-	+	+	-	+	+	+	+	+	+
3. Has holding areas excluded from MRP netting	+	+	+	+	+	+	-	-	-	+	+	+	+	+	+	+	+
4. Produces daily transaction activity reports	+	+	+	+	+	+	-	-	+	+	+	-	+	+	+	+	+
5. Has cycle counting which:																	
- Uses a two-step procedure	-	-	-	+	+	+	-	-	+	+	-	+	o	+	-	+	+
- Triggers cycle count requests	-	-	-	+	+	+	-	-	+	+	+	+	+	+	+	-	+
6. Has inventory policy features such as:																	
- Lot size	+	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+
- Specific requirements recorder method	+	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+
- Minimum/maximum	+	+	+	+	+	+	-	-	+	+	+	+	+	+	+	+	+
- Two-bin Reorder method	+	+	-	+	-	-	-	-	+	+	-	-	+	+	-	+	+
- Safety stock lead time coverage	+	+	+	+	+	+	+	-	+	+	-	+	+	+	+	+	+
7. Can be distributed	+	+	-	+	+	+	+	-	+	+	+	+	-	+	+	-	-
8. Has on-line inquiry	+	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+
9. Has on-line update	+	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+
10. Can handle both serialized parts as well as inventory locator	+	-	+	-	-	⊕	-	-	+	+	-	+	o	-	+	-	-
11. Uses empty location transaction	-	-	+	-	-	-	-	-	-	+	-	-	+	-	-	+	+
12. Produces exception reports	+	+	-	+	+	+	-	-	+	-	+	+	+	+	+	+	+
13. Included the following exception reports:																	
- Below zero inventory balances	-	+	+	-	+	+	-	-	-	-	+	-	-	+	+	+	+
- Over maximum balances	+	-	-	-	+	+	-	-	+	-	+	-	-	o	+	-	-
- No movement items	+	-	-	-	+	+	-	-	+	-	+	+	-	o	+	-	+
- No movement locations	-	-	-	-	-	+	-	-	-	-	-	-	-	o	+	-	-
- Not in assigned location items	-	-	+	-	-	-	-	-	-	-	-	-	-	o	+	+	+
14. Tracks items at outside vendors	+	+	+	+	+	+	-	-	+	+	+	+	+	+	+	+	+
15. Chains inventory items to:																	
- Requirements	+	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+
- Manufacturing and purchase orders	+	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+
TOTAL SECTION SCORE	19	16	17	18	20	20	10	0	20	19	17	18	17	19	22	19	21
RANKED (over 75% hurdle)	4	-	-	-	3	3	-	-	3	4	-	-	-	4	1	4	2

SOFTWARE VENDOR R.F.I. EVALUATION SCREEN

Bill of Material	MM	MRM	DATA 3	STSC	SMI	NCR (IMCS II)	FORM	APPLIED	HONEYWELL	INTERACTIVE	SOFTWARE INT	BOEING	TL & A	ARISTA	R & S	NCR (MISSION)	UNIS 1100
1. Maintains parent-component relationships	+	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+
2. Controls ECN effectivity by:																	
- Date effectivity	+	-	⊕	+	+	+	+	-	+	+	+	-	+	+	+	+	+
- Inventory depletion effectivity	-	-	⊕	+	-	-	+	-	-	-	+	+	+	+	o	+	-
- Production model run effectivity	-	-	⊕	-	-	-	?	-	-	+	-	-	-	-	+	o	-
3. Controls ECN status categories by:																	
- Planned not approved	+	-	-	-	-	-	⊕	-	-	-	-	-	+	+	+	+	+
- Approved by effectivity	+	-	-	-	-	+	⊕	-	+	-	-	-	+	+	+	+	+
- Active	+	-	-	-	-	+	⊕	-	-	+	-	-	+	+	+	+	+
- Inactive	+	-	-	-	-	+	⊕	-	+	-	-	-	+	+	+	+	+
4. Maintains where-used chains	+	+	+	+	-	+	+	-	+	+	+	+	+	+	+	+	+
5. Reports all W.I.P., planned orders and inventory impacted by an ECN	+	-	-	+	-	o	⊕	-	+	+	-	-	+	+	-	-	+
6. Can maintain both a planning BOM and a manufacturing BOM	+	-	⊕	-	+	-	⊕	-	+	+	+	-	+	+	+	+	+
7. Can use a temporary BOM for a specific order	+	+	⊕	-	-	+	+	-	-	+	+	+	+	+	+	-	+
TOTAL SECTION SCORE	10	3	2	5	3	7	5	0	7	8	6	4	11	11	11	9	10
RANKED (over 80% hurdle)	2	-	-	-	-	-	-	-	-	-	-	-	1	1	1	3	2

SOFTWARE VENDOR R.F.I. EVALUATION SCREEN

Routing	MM	MRM	DATA 3	STSC	SMI	NCR (IMCS II)	FORM	APPLIED	HONEYWELL	INTERACTIVE	SOFTWARE INT	BOEING	TL & A	ARISTA	R & S	NCR (MISSION)	UNIS 1100
1. Records each operation to process an item	+	+	+	+	+	+	⊕	-	+	+	+	+	+	+	+	+	+
2. Identifies labor skills needed for each operation	+	+	-	+	-	+	+	-	+	+	+	-	+	-	-	+	+
3. Identifies time required by skill for each operation	+	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+
4. Identifies tools and equipment required to support each operation	+	+	+	+	+	-	+	-	+	+	+	-	+	+	+	+	+
5. Controls methods ECNs by:																	
- Date effectivity	-	-	⊕	-	-	-	+	-	-	+	-	-	+	-	+	+	+
- Production model run effectivity	-	-	⊕	-	-	-	+	-	-	o	-	-	-	-	+	o	-
6. Controls ECN status categories by:																	
- Planned not approved	-	-	-	-	-	-	+	-	-	o	-	-	+	-	-	-	+
- Approved by effectivity	-	-	-	-	-	-	+	-	-	o	-	-	+	-	-	-	+
- Active	+	-	-	-	-	-	+	-	-	o	-	-	+	-	-	-	+
- Inactive	+	-	-	-	-	-	+	-	-	o	-	-	+	-	-	-	+
7. Identifies the work center where each operation is performed	+	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+
8. Maintains work center where used chains	+	+	+	+	+	-	+	-	-	+	+	+	+	+	+	+	+
9. Maintains alternative routings	+	+	+	+	-	-	+	-	-	+	+	-	+	-	+	+	+
10. Supports P.M. operations sheets	+	-	+	-	-	-	+	-	-	-	+	-	+	-	-	+	+
11. Reports W.I.P. and planned orders impacted by an ECN	-	-	+	+	-	+	+	-	-	-	-	-	+	-	-	-	+
12. Can append optional operations to the standard routing	+	+	+	+	+	-	+	-	+	+	+	+	+	+	+	+	+
13. Can combine routings to form one manufacturing order	+	-	+	+	-	-	+	-	+	-	+	-	+	o	+	-	+
TOTAL SECTION SCORE	12	8	10	10	6	5	0	0	8	9	9	5	16	6	10	10	16
RANKED (over 60% hurdle)	2	-	3	3	-	-	-	-	-	-	-	-	1	-	3	3	1

SOFTWARE VENDOR R.F.I. EVALUATION SCREEN

Purchasing	MH	MRM	DATA 3	STSC	SHI	NCR (IMCS II)	FORM	APPLIED	HONEYWELL	INTERACTIVE	SOFTWARE INT	BOEING	TL & A	ARISTA	R & S	NCR (MISSION)	UNIS 1100
1. Has purchasing module	+	+	+	+	+	⊕	+	-	-	+	+	+	+	+	⊕	+	-
2. Includes the following features:																	
- Planned and open P.O. status reporting	+	+	+	+	+	+	+	-	+	+	+	+	+	+	⊕	+	-
- Milestone follow-up notices	+	+	-	+	⊕	+	-	-	-	-	+	+	+	+	⊕	+	-
- Receiving interface to open P.O.'s	+	+	+	+	+	+	+	-	-	+	+	+	+	+	⊕	+	-
- Vendor performance analysis	+	-	-	-	⊕	+	-	-	-	+	+	+	+	+	⊕	+	-
TOTAL SECTION SCORE	5	4	3	4	3	0	3	0	1	4	5	5	5	5	0	5	0
Not a Critical Function	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

SOFTWARE VENDOR R.F.I. EVALUATION SCREEN

Standard Costing	MM	MRM	DATA 3	STSC	SMI	NCR (IMCS II)	FORM	APPLIED	HONEYWELL	INTERACTIVE	SOFTWARE INT	BOEING	TL & A	ARISTA	R & S	NCR (MISSION)	UNIS 1100
1. Has standard costing	+	+	⊕	+	+	+	⊕	-	+	+	+	-	+	+	+	+	+
2. Includes the following cost elements																	
- Materials	+	+	+	+	+	+	⊕	-	+	+	+	-	+	+	+	+	+
- Labor by operation	+	+	+	+	+	+	⊕	-	+	+	+	-	+	+	+	+	+
- Supplies	+	o	+	+	-	-	⊕	-	-	-	+	-	+	+	+	+	-
- Tools or GSE usage	-	-	+	+	-	-	⊕	-	-	-	-	-	+	-	+	-	-
TOTAL SECTION SCORE	4	3	0	5	3	3	0	0	3	3	4	0	5	4	5	4	3
Not a Critical Function	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

SOFTWARE VENDOR R.F.I. EVALUATION SCREEN

Simulation	MM	MRM	DATA 3	STSC	SMI	NCR (IMCS II)	FORM	APPLIED	HONEYWELL	INTERACTIVE	SOFTWARE INT	BOEING	TL & A	ARISTA	R & S	NCR (MISSION)	UNIS 1100
1. Has simulation capabilities	-	+	+	+	+	-	⊕	+	+	+	+	+	+	+	+	-	+
2. Simulates material requirements	-	+	+	+	-	-	+	+	+	+	+	+	+	+	+	-	-
3. Simulates work center capacity loads	-	+	+	+	-	-	+	+	+	+	+	+	+	+	+	-	+
4. Simulates manpower loading	-	-	-	+	-	-	+	+	+	+	+	-	+	+	+	-	-
TOTAL SECTION SCORE	0	1	3	3	1	0	0	4	4	4	4	3	4	4	4	0	2
Not a Critical Function	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

VENDOR CODES

M.M.	-	Martin Marrietta Data Systems	HONEYWELL	-	Honeywell Information Systems Incorporated
MRM	-	Manufacturing Resource Management	INTERACTIVE	-	Interactive Information Systems Inc.
DATA 3	-	Data 3 Systems Incorporated	SOFTWARE INT	-	Software International
STSC	-	STSC Incorporated	BOEING	-	Boeing Computer Services
MSI	-	Systems Management Incorporated	TL & A	-	Thomas Laguban & Associates
NCR (IMCS II)	-	NCR	ARISTA	-	Arista Manufacturing Systems
FORM	-	Formation Inc.	R & S	-	Rath and Strong
APPLIED	-	Applied Information Development Inc.	NCR (Mission)	-	NCR
			UNIS 1100	-	Sperry Univac

LEGEND

+ = Yes

- = No

o = No Answer

⊕ = Planned for 1981

⊖ = Proprietory or Confidential

VII - REQUIRED SOFTWARE MODIFICATIONS

INTRODUCTION

Modifications are required to tailor the Rath and Strong (R and S) aerospace production control software package to the unique requirements of the SRB business systems environment. Although the R and S system is a field-proven and site-developed software package, it must be strengthened to provide the SRB contractor with information tailored to fit his business system requirements.

The business system requirements are predominantly a result of the SRB refurbishment needs as well as the manned space flight business philosophy. These requirements have been described in detail in Section III, "Business System Requirements". Some of these requirements include:

1. Aisle transfer scheduling.
2. Refurbishment scheduling.
3. Allocation of new or refurbished major assemblies to a specific launch.
4. Facilities and resource planning over a five-year (or more) planning horizon.
5. POP's preparation and revision.
6. Materials planning for refurbishment over a two- to three-year planning.
7. Facilities work loading.
8. Manpower planning.

9. Production scheduling.
10. Integration scheduling.
11. Engineering documents control.
12. Configuration management.
13. Data pack analysis.
14. Design effectivity management and control.
15. Part life cycle management and control.
16. Attrition management.
17. Part flight worthy status management and control.
18. WAD complexity and buy point sign-off requirements.
19. Preventive maintenance.
20. Shop floor priority management.
21. Data pack information accumulation.
22. Labor performance reporting.
23. Resource and facilities productivity reporting.
24. Standard cost and variance analysis reporting.
25. PMS information needs and reporting structure.
26. Operations budgeting.

Software modifications required to satisfy these business system information support needs are summarized in Exhibit VII-1, "Software Package Required Modifications". These modifications are described in this section under the following headings:

- Required Modifications to Business Systems Functions.
- Required Modifications for Unique Features.
- Required Modification ROM Cost Summary.

Automated production control system software package modifications are documented by module and specific modification. Synergies will develop from making all data base modifications and all modifications to one module at one time. This could lower the estimated level of effort for making the modifications described in this section.

BUSINESS SYSTEM FUNCTIONS

The business systems functions requiring modification are divided into two categories:

- Mainstream System Modules.
- System Support Modules.

The mainstream system and system support module modification requirements are summarized in this section.

(a) Mainstream System Modules

There are six mainstream system modules. The modifications to each will be described separately.

1. Master Scheduling/Resource Planning. The sole objective of this module is to produce an achievable master production schedule. To accomplish this in the SRB environment the following system modifications are required:

   (a) Develop a recovery, cleaning and disassembly, and refurbishment scheduling submodule based on launch schedules.

   (b) Develop an aisle transfer scheduling submodule which assigns refurbished or new build-up major assemblies to the SRB final assembly for a specific launch. This module will generate a two-level master schedule.

(c) Modify the resource planning module to validate the master schedule.(1)

(d) Develop an operations budgeting module to interpolate resource availability plans and to schedule operations milestones and productivity assumptions into an operations budget.(2)

2. Material Requirements Planning. The primary objectives of this module are to determine the materials requirements over a two- to three-year planning horizon and to establish an "as designed" configuration.

To accomplish this in the SRB environment the following system modifications are required:

(a) Add drawing find numbers to bills of materials, shop order material requirements records and picking lists.

(b) Add capability to preallocate parts by serial number to shop order material requirements records.

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(1) These resource planning modifications are a rough approximation of changes to Rath and Strong's "Master Resource Planning" module which is scheduled for completion in early 1982. The module in development will satisfy most USBI resource planning needs. The "Tech Tran" study recommendations should be reviewed relative to master schedule validation needs.

(2) The development effort noted for operations budgeting (Exhibit VII-1 is a rough approximation. These approximations should be refined based on the "Tech Tran" study and P.M.S. detail requirements. This operations budgeting module will fill POP's and PMS requirements in a fully integrated system.

(c) Develop materials requirements planning effectivity management logic. This requires a scan of all upgradable effectivities of parts and the allocation of specific parts based on a LIFO or FIFO technique. For part effectivities requiring upgrade in effectivity, a rework shop order would be scheduled to be completed when the upgraded effectivity is required.

(d) Develop materials requirements planning part flight worthiness status management logic. This will allow parts of a non-flight ready, but repairable, status to be allocated to a shop order requirement. For parts requiring repair, a rework shop order would be scheduled to be completed when the upgraded effectivity is required.

(e) Develop refurbishment requirements analysis logic. This will include:

(1) Comparisons of "as built" configurations of planned receipts of spent major assemblies to the "as designed" configurations of the planned refurbishment shop order. This can be accomplished as soon as the major assembly "as designed" configuration is firm.

(2) Report delta lists identifying design structure changes, part changes, effectivity changes and part life disassembly requirements (based on projected spent status).

(3) Print part disposition tags for disassembly and refurbishment activities. These tags will indicate parts and part installation kits needing replacement and what disposition they should have (e.g., return to stock as retest status, return to vendor for rework, rework, etc.)

(4) Update the specific refurbishment attrition shop order with improved refurbishment requirements information.

(f) Modify rescheduling logic to produce reschedule notices for firm planned orders needing rescheduling. The system will not automatically reschedule firm orders.

(g) Modify purchase requirements reports to (optionally) report by part commodity class, class grouping, or by subsystem.

3. Capacity Requirements Planning. The primary objectives of this module are to schedule production to meet launch requirements and to distribute production resource needs among the resources available. To accomplish this in the SRB environment the following system modifications are required:

(a) Modify capacity requirements planning module logic and routing structures to:

(1) Perform capacity loading for both work centers and labor certifications.

(2) Identify routing operation requirements of supplies. These supplies are linked to the inventory system. Supplies picking lists will be produced as needed for operations about to start.

(3) Identify routing operation requirements of tools and test equipment. These requirements are linked to the inventory system. Time required for use will facilitate tools scheduling. Tool status and a requirement may initiate a tool maintenance shop order.

(4) Identify routing operation requirements of GSE and subcontractors. These requirements will identify a request schedule time for shared resources. When scheduled, the shop order operation schedule will be frozen based on the shared resource schedule.

(b) Develop capacity requirements planning module logic and routing structure to support a modularized refurbishment routing which facilitates capacity loading and resource requirements scheduling. This modularized routing will be linked to a specific refurbishment shop order's BOM, which will contain attrition rates (quantities per) for assembly components. The modularized routing will multiply the routing operation's resource requirements by the associated attrition rate to get the capacity load factors. This logic will allow refinement of capacity loading as the refurbishment order becomes firmed up. For example, planned refurbishment shop orders will project capacity based on probabilities of replacing a component. However, because of effectivity and part life cycle knowledge, some parts of the shop order become certain. As a result of testing the spent major assembly, the total shop order becomes certain.

(c) Modify capacity requirements planning module logic and routing structures to accommodate routing operations network structures.

This will facilitate parallel operations of different engineering groups, or of different rework activities. This will also facilitate blocking of work centers near hazardous operations.

(d) Modify capacity reporting to indicate both practical and theoretical capacity limits. This will facilitate capacity leveling decisions where theoretical capacities could be achieved by some special effort such as overtime.

(e) Modify work center queuing logic to allow fixing the schedule priority. This is required to:

(1) Schedule preventive maintenance to be mandatory (do next), to be done on a specific day, or to be done during work center idle time.

(2) Schedule shared resources such as GSE or subcontractors. Timetables for these resources would freeze an operations date. Critical ratio logic would set previous operation priorities based on that shared resource date.

(f) Develop departmental resource summary capability. This will report labor certification and work center capacity load information grouped by the department responsible for each.

(g) Modify routing change logic to accomplish the following:

(1) Cross reference engineering order numbers.

(2) Allow date effectivity of engineering changes to the routing.

(3) Allow date effectivity changes to resource planned capacities.

(h) Develop logic to compare "as planned" routing detail for an assembly effectivity to the "as built" routing detail information. This detail will be saved as data

pack detailed information. The "delta" reports will identify:

(1) WADs not bought off.

(2) Uses of alternate work centers.

(3) Excess time at a work center.

(4) Alternate labor skills used.

(5) Labor standards variances.

(6) Operations not worked.

(7) Operations added.

(8) Engineering orders incorporated.

(9) Problem reports.

(10) Additional installations

(i) Modify capacity requirements planning module logic and routing structures to select from alternative routings depending on the shop order type. For example, alternative types of routing for one part would include:

(1) New build routings.

(2) Refurbishment routings.

(3) Effectivity routings to upgrade the previous effectivity.

(4) Rework routings to return a part to flight worthy status.

(j) Modify routing structure and data to accommodate dispatching and operations control of:

(1) Hazardous operation identification.
(2) WAD cross reference numbers.
(3) Drawing cross reference numbers.

4. Shop Floor Management. The primary objectives of this module are to schedule work to the shop floor (dispatching) and to handle scheduling exceptions resulting from shop floor problems. To accomplish this in the SRB environment, the following system modifications are required:

(a) Modify the dispatching submodule to allow a specific shop order which falls within the dispatch planning horizon. This will require creation of job progress (routing operations) records prior to shop order release to the shop floor.

(b) Customize the shop order job packet to meet SRB production control needs by type of shop order. These order types will include:

(1) Refurbishment shop orders.

(2) Rework (back shop) shop orders.

(3) Effectivity upgrade shop orders.

(4) Final assembly shop orders.

(5) Recovery shop orders.

(6) Clean and disassemble shop orders.

The types of data included in the shop order job packet are:

(1) Shop order routing information (e.g., Shop order description, due date, operation sequence, operation process descriptions, operation work center, operation labor certifications, operations special resources).

(2) Work center logs.

(3) Labor certification logs.

(4) Supplies picking lists.

(5) Materials picking lists.

(6) Special resource logs.

(7) Move tags to track shop order status.

(c) Develop specialized integration reports and system interfaces to hand off integration information and accept schedule commitments or changes. Integration requirements will include:

(1) Hazardous operations management.

(2) Shared GSE scheduling.

(3) Subcontractor scheduling.

(d) Customize dispatch expediting capabilities to meet SRB production control needs. This will facilitate communications of schedule priority needs for the following:

(1) Labor skill certification needs not yet assigned a clock number.

(2) Tools not available when needed.

(3) Shared GSE needs without a schedule commitment from the integration authority.

(4) Subcontractor needs without schedule commitment from the integration authority.

(5) Hazardous operation needs without schedule approval from the integration authority.

(6) Material shortages.

(e) Develop capability to purge the SRB production control system for recovery losses. This will require the following actions:

(1) Cancellation of associated recovery, clean, disassembly and refurbishment shop orders.

(2) Trigger replanning of master scheduling, materials requirements planning and capacity requirements planning.

(3) Purge inventory and part life cycle data for the total "as built" configuration.

(4) Purged data would be reported to quality assurance for final analysis, and to the program office for cost analysis.

5. Operations Control. The primary objectives of this module are to communicate current priorities to shop floor supervisors and to react to problems as quickly as possible. To accomplish this in the SRB environment, the following system modifications are required:

(a) Customize shop floor operations exception reporting to meet SRB production control needs and quality control supervision needs. These exceptions will signal dispatching and quality assurance as soon as the exception occurs. These exceptions include:

(1) Operations completed with WADs not bought off.

(2) Use of alternate work centers.

(3) Operations completed out of sequence.

(4) Operations added (e.g., PRs).

(5) Operations deleted.

(6) Wrong labor skill certification logged on an operation.

(7) Excess or insufficient labor time logged against an operation.

(8) Special notes explaining action taken or decisions made during shop floor operations (e.g., supervisor notes, inspection notes, test results reports, PRs, DRs).

(b) Develop capabilities to update refurbishment shop order BOMs and routings based on test results. These results will likely be in the form of a matrix identifying LRU disassembly requirements and disposition. Entry of this data will trigger:

(1) LRU installation kit picking lists.

(2) Spent LRU disposition tags.

(3) Routing operations (firmed up) for disassembly and reinstallation.

(c) Customize data entry transactions to meet SRB production control needs. Some types of data entry transactions will include:

(1) Operation work center start/stop times.

(2) Operation labor certification clock on/off.

(3) Operation tools logged on/off.

(4) Operations supplies released.

(5) Operations sequence changes.

(6) Operations added or deleted.

(7) Issuance of non-picking list material to refurbishment or reinstallation operations.

(8) Installation exceptions to picking list find number drawing location for a serial numbered part.

(9) Log work centers to nonavailable status (e.g., out of operation).

(10) Record PR/DR information as narrative linked to a routing operation and allow a hold on work for the operation.

(11) Record production, test or quality assurance supervisor notes to be linked to a routing operation. These notes will facilitate data pack buy-off without requiring all the paperwork currently used.

6. Performance Analysis. The sole objective of this module is to provide performance information to all levels of management. To accomplish this in the SRB environment, the following system modifications are required:

(a) Structure resource master records to be compatible with operations budgeting and PMS requirements. For example, employee clock number master records would be grouped under a department. Further, labor skill certifications would be grouped under a skill group. This will facilitate labor reporting by department or by skills required. Similar groupings would be used for:

(1) Inventory.

(2) Tools.

(3) Supplies.

(4) GSE.

(5) Subcontractors.

(b) Develop variance analysis reporting capabilities to conform to PMS and operations budgeting needs. This will track actual performance to plan. Reporting will include:

(1) Schedule compliance.

(2) Productivity and utilization performance versus planning assumptions.

(3) Cost variance analysis (price/volume variances).

(c) Develop specialized performance reports. These will include:

(1) "As built" configuration build-up performance.

(2) Work center utilization.

(3) Labor skill certification productivity.

(4) Labor department utilization (time on standard measured work).

(5) "As built" configuration cost variance analysis. Actual cost versus standard at the time of build up. Actual cost versus current standards.

(6) Low productivity workers.

(7) Integration schedule compliance.

(8) Work stoppage due to:

(a) Materials shortage.

(b) Scarce labor.

(c) Work center down.

(d) Integration schedule non-compliance, etc.

(b) System Support Modules

There are six major system support modules. Although most modifications to these modules have been identified in the mainstream system module modifications, any additional changes are described here.

1. Bill of Material Maintenance. The primary objectives of this module are to provide a communications link between design and manufacturing engineering, to provide the basis for materials planning, and to provide a critical path network for scheduling and resource planning.

To accomplish this in the SRB environment the following system modifications are required, in addition to the modifications described in the mainstream system.

(a) Modify bill of materials maintenance to accommodate a single bill with both engineering and manufacturing structure. This will provide for three types of engineering changes, one for engineering bill changes only, one for manufacturing bill changes only, and one for both. System functions requiring the manufacturing bill only will select only bill records coded as manufacturing or both manufacturing and engineering.

(b) Tailor maintenance routines.

(c) Customize reports.

2. Inventory Control. The primary objectives of this module are to maintain accurate inventory status information, and to facilitate ease of data handling.

To accomplish this in the SRB environment the following system modifications are required, in addition to modifications described in the mainstream system:

(a) Modify inventory control module logic to perform the following:

(1) Capture all inventory errors for inventory performance reporting.

(2) Change offset lead times to operation schedule dates. This will facilitate release scheduling of multiple picking lists for the same routing. This will also facilitate dispatching or work control station initiated release of a picking list.

(3) Separate picking lists by the inventory segregation area sourcing the parts.

(4) Facilitate cycle counting by inventory segregation area zone counting. This is needed to find mislocated serialized parts.

(5) Link parts to closed purchase orders. This will facilitate lot control traceability.

(b) Tailor maintenance routines.

(c) Customize reports.

3. Purchasing. The primary objectives of purchasing are to acquire materials per requirements and to communicate planned due dates for materials.

To accomplish this in the SRB environment the following system modifications are required, in addition to modifications described in the mainstream system:

(a) Modify purchase requirements reports to be grouped by inventory classification (buyer) and subsystem.

(b) Tailor maintenance routines.

(c) Customize reports.

4. Preventive Maintenance. The primary objectives of this module are to identify and communicate preventive maintenance requirements, and to schedule maintenance in the least disruptive manner.

To accomplish this in the SRB environment the following systems modifications are required, in addition to modifications described in the mainstream system:

(a) Modify maintenance routines to maintain P.M. numbers in the item master. P.M. shop orders will have routings similar to other shop orders. This will facilitate P.M. scheduling and resource loading.

(b) Tailor system maintenance routines.

(c) Customize reports.

5. Routing and WAD Maintenance. The primary objectives of this module are to communicate production process information, to plan resource requirements needed to meet a production schedule, and to serve as a benchmark for production operations exception analysis.

To accomplish this in the SRB environment the following system modifications are required, in addition to modifications described in the mainstream system:

(a) Modify maintenance routines to more easily accommodate routing modifications and update engineering order and WAD cross reference numbers.

(b) Tailor maintenance routines.

(c) Customize reports.

6. Configuration Management. The primary objectives of this module are to provide a benchmark for the actual "as built" comparison to "as designed" engineering, and to provide the basis for refurbishment upgrade requirements.

To accomplish this in the SRB environment the following

system modifications are required, in addition to modifications described in the mainstream system:

(a) Develop specialized configuration management reports. These will include:

(1) Delta reports comparing "as built" to "as designed" when the shop order was released.

(2) Delta reports comparing "as built" to the current "as designed" engineering data.

(3) Data pack delta reports comparing planned routings data (including standards) to "as built" shop order information (including actual times).

(4) Delta reports with change authorization reports approving the delta. These change authorizations would include TPSs, PRs, DRs, effectivity substitution approvals, and reinstallation inspection notes.

(b) Provide data requirements to meet weight and balance management needs.

(c) Reactivate and renumber "as built" configurations which will be rebuilt.

(d) Microfiche "as built" and "as designed" data pack information for backup and history retention.

UNIQUE FEATURES

There are fourteen unique features of the SRB business system environment. These are:

1. Effectivity control.

2. Part life cycle management.

3. Part attrition planning.

4. Shared GSE integration.
5. Subcontractor integration.
6. Hazardous operations control.
7. Quality control and inspection.
8. Sign-off control.
9. Engineering documentation control.
10. SRB effectivity hybrid weight and balance control.
11. Spares risk management.
12. Operations budgeting.
13. Performance monitoring systems.
14. Launch mission compliance risk analysis.

Of these fourteen, five unique features require modifications to the software package.

(a) Unique Features

The five major unique features are described separately below.

1. Effectivity Control. The sole objective of effectivity control is to manage the implementation of evolutionary design changes where effectivities may be upgraded or substitutable.

To accomplish this in the SRB environment the following system modifications are required in addition to modifications described in the mainstream system:

(a) Develop customized reports.

(b) Tailor maintenance routines.

It should be noted that the R and S system physical change part number suffix is designed to accomplish effectivity control logic.

2. Part Life Cycle Management. The sole objective of this module is to control the usage and reuse of parts which have a life expectancy limitation.

To accomplish this in the SRB environment the following system modifications are required, in addition to modifications described in the mainstream system:

(a) Develop a part life cycle management subsystem to control part history and update life constraints records in the part serial number record.

(b) Develop maintenance routines.

(c) Customize reports.

3. Part Attrition Planning. The primary objectives of this module are to facilitate refurbishment materials planning, and to facilitate spare part and safety stock determination.

To accomplish this in the SRB environment the following system modifications are required, in addition to modifications described in the mainstream system.

(a) Develop an attrition bill of material maintenance submodule to record attrition rates in the "quantity per assembly" field in the refurbishment bills of material.

(b) Develop a refurbishment analysis report to compare actual attrition and replaced component disposition, to the attrition bill. Also, maintain actual attrition data in the part master record.

4. Engineering Document Control. The sole objective of this module is to monitor the development of engineering paperwork through stages of resolution design, authorization, and implementation.

To accomplish this in the SRB environment the following system modifications are required:

(a) Develop a milestone tracking capability for standard engineering document authorization procedures and implementation steps. This will be accomplished through an administrative routing for each document type, and the document number will be contained in the item master and serial number records. This will facilitate priority scheduling and work loading of engineering and authorization functions. This will include such engineering documents as:

(1) Engineering changes (orders).

(2) PRs.

(3) DRs.

(4) TPSs.

(5) Disposition action requirements.

(6) Others.

(b) Modify materials requirements planning and capacity requirements planning to produce special expedite reports for incomplete engineering paperwork required by shop orders scheduled to be released.

(c) Develop maintenance routines.

(d) Customize reports.

5. Performance Monitoring System (PMS). The sole objective of this module is to provide contract progress visibility on costs and progress against plan.

To accomplish this in the SRB environment the following

system modifications are required, in addition to modifications described in the mainstream system.

(a) Modify and customize performance reports to meet PMS reporting needs.

ROM COST SUMMARY

The rough order of magnitude (ROM) costs for the software package and modifications is approximately $1.5 to $2.5 million dollars. (See Exhibit VII-2, "Summary of Automated Production Control System Software Package Modifications").

These cost estimates have been developed by summing the time required for each modification. Significant synergies will develop from grouping modifications to each module. These synergies are believed to provide a suficient contingency for any new modifications which may be desired later.

The timing estimated for each modification is conservative, and will provide time for:

1. Review of overall conceptual specifications.
2. Review of relevant policy and procedures.
3. Development of system specifications.
4. Development of program specifications.
5. Programming.
6. Testing and debugging.
7. System installation (not user installation).

A more accurate and detailed cost estimate will require a detailed system specification to identify the level and complexity of modifications. For this reason, it might be reasonable to let a staged contract, which will break out each stage of modification for each module. For example:

1. Stage 1: Review Overall Conceptual Specifications (at an overall system level).

2. Module Stage 2: Review Policies and Procedures (by module).

3. Module Stage 3: Develop Systems Specifications (by module).

4. Module Stage 4: Program, Test and Debug (by module).

5. Module Stage 5: Install (by module).

6. Stage 6: Perform System Integration Tests and Fine Tuning (at an overall system level).

AUTOMATED PRODUCTION CONTROL SYSTEM

SOFTWARE PACKAGE REQUIRED MODIFICATIONS

MODIFICATIONS	BUSINESS SYSTEM MAJOR FUNCTIONS AFFECTED: MASTER SCHEDULING/RESOURCE PLANNING	MATL'S REQMTS PLANNING	CAPACITY REQMTS PLANNING	SHOP FLOOR MANAGEMENT	OPERATIONS CONTROL	PERFORMANCE ANALYSIS	BILL OF MAT'L MAINTENANCE	INVENTORY CONTROL	PURCHASING	PREVENTIVE MAINTENANCE	ROUTING & WAD MAINTENANCE	CONFIGURATION MANAGEMENT	EFFECTIVITY CONTROL	PART LIFE CYCLE MANAGEMENT	PART ATTRITION PLANNING	ENGINEERING DOCUMENT CONTROL	R/M'S	DATA BASE	PROGRAM	TYPE OF MODIFICATIONS: CHANGES — PROGRAM	CHANGES — REPORT	CHANGES — INQUIRY SCREEN	NEW DEVELOPMENT — MAINTENANCE SCREEN
MASTER SCHEDULING / RESOURCE PLANNING																							
DEVELOP RECOVERY/REFURBISHMENT SCHEDULING SUBMODULE	X																	Y		2	1	1	
DEVELOP AMLE TRANSFER SCHEDULING SUBMODULE	X																	Y		2	2	3	1
MODIFY RESOURCE PLANNING MODULE	X		X															Y(m)	6	3	3	2	2
DEVELOP OPERATIONS BUDGETING MODULE	X																X	Y(m)		10	10	5	5
MATERIAL REQUIREMENTS PLANNING																							
ADD DRAWING AND NUMBERS		X			X		X	X			X		X						3				
ADD DATA FOR ALLOCATION CAPABILITY		X						X					X	X					3				
DEVELOP MRP EFFECTIVITY MANAGEMENT LOGIC		X						X					X					Y	5	2		1	1
DEVELOP MRP PART FLIGHT WORTHINESS STATUS MANAGEMENT LOGIC		X						X						X				Y	5	2		1	1
DEVELOP REFURBISHMENT REQUIREMENTS ANALYSIS LOGIC		X					X	X			X	X	X	X				Y(m)		10	4	4	2
MODIFY RESCHEDULING LOGIC		X																	1		1		
MODIFY PURCHASE REQUIREMENTS REPORTS		X						X	X									Y	2			4	1
CAPACITY REQUIREMENTS PLANNING																							
MODIFY CRP MODULE LOGIC AND ROUTING STRUCTURES			X								X							Y(m)	6				3
DEVELOP REFURBISHMENT MODULARIZED ROUTING LOGIC			X				X				X							Y	5	3	1	1	1
DEVELOP ROUTING OPERATION NETWORK STRUCTURE CAPABILITIES			X	X	X						X							Y	3				
MODIFY CAPACITY REPORTING			X								X							Y	3				
MODIFY WORK CENTER QUEUEING LOGIC			X	X	X				X		X							Y	4				1
DEVELOP DEPARTMENTAL RESOURCE SUMMARY CAPABILITY			X								X							Y				4	1
MODIFY ROUTING CHANGE LOGIC			X												X			Y	4				
DEVELOP LOGIC FOR "AS PLANNED" ROUTING COMPARISON WITH "AS BUILT" ROUTING			X			X					X	X		X				Y	2	8	3	3	
MODIFY CRP MODULE LOGIC TO HANDLE ALTERNATIVE ROUTINGS			X								X							Y	2	4			4
MODIFY ROUTING STRUCTURE AND DATA			X	X	X						X							Y	3				4
SHOP FLOOR MANAGEMENT																							
MODIFY THE DISPATCHING SUBMODULE TO ALLOW ROUTING MODIFICATIONS			X	X	X						X								3	3		3	3
CUSTOMIZE THE SHOP ORDER/JOB PACKET				X	X														6		12	3	6
DEVELOP SPECIALIZED INTEGRATION REPORTS				X	X																3		
CUSTOMIZE DISPATCH EXPEDITING CAPABILITIES				X	X	X		X	X	X					X	X			8		2		6
DEVELOP ARC PURGE CAPABILITY FOR RECOVERY LOSSES	X			X	X						X					X		Y	3	1	1	1	3
OPERATIONS CONTROL																							
CUSTOMIZE SHOP FLOOR OPERATIONS EXCEPTION REPORTING				X	X	X					X	X	X		X				6		3		
DEVELOP UPDATE CAPABILITIES FOR REFURBISHMENT SHOP ORDERS			X	X	X						X		X	X				Y	2	2			1
CUSTOMIZE DATA ENTRY TRANSACTIONS				X	X	X					X		X					Y	6		1	3	12
PERFORMANCE ANALYSIS																							
STRUCTURE RESOURCE MASTER RECORDS						X											X	Y(m)	8	8	8		
DEVELOP VARIANCE ANALYSIS REPORTING CAPABILITIES						X											X		4	4	4		
DEVELOP SPECIALIZED PERFORMANCE REPORTS						X															12		
BILL OF MATERIAL MAINTENANCE																							
MODIFY BOM MAINTENANCE																		Y(m)	6	6	2	1	4
INVENTORY CONTROL																							
MODIFY INVENTORY CONTROL MODULE LOGIC				X	X	X		X			X								10	12	6	6	4
PURCHASING																							
MODIFY PURCHASE REQUIREMENTS REPORTS									X										2				
PREVENTIVE MAINTENANCE																							
MODIFY MAINTENANCE ROUTINES										X									2	2	2		4
ROUTING AND WAD MAINTENANCE																							
MODIFY MAINTENANCE ROUTINES											X								4	2			4
CONFIGURATION MANAGEMENT																							
DEVELOP SPECIALIZED CONFIGURATION MANAGEMENT REPORTS												X						Y	6	6	2	2	6
PROVIDE DATA REQUIREMENTS TO MEET WEIGHT & BALANCE MANAGEMENT NEEDS												X						Y	2				2
REACTIVATE AND RENUMBER "AS BUILT" CONFIGURATIONS					X	X						X						Y	3				3
MODIFY BOM "AS BUILT" AND "AS DESIGNED" DATA PACK												X							2		2		
EFFECTIVITY CONTROL														X									
DEVELOP SPECIALIZED REPORTS														X					2		4	2	2
PART LIFE CYCLE MANAGEMENT																							
DEVELOP PART LIFE CYCLE MANAGEMENT SYSTEM								X				X		X				Y	6	4	2	1	6
PART ATTRITION PLANNING																							
DEVELOP AN ATTRITION BOM MAINTENANCE SUBMODULE							X					X							2		1		3
MODIFY A REFURBISHMENT ANALYSIS REPORT					X							X								4	2		
ENGINEERING DOCUMENT CONTROL																							
DEVELOP MILESTONE TRACKING CAPABILITY																X			10	6	6	4	6
MODIFY MRP AND CRP TO PRODUCE SPECIAL EXPEDITE REPORTS		X	X													X			2		2		
PERFORMANCE MONITORING SYSTEM																							
MODIFY PERFORMANCE REPORTING CAPABILITIES																	X		2		2		
TOTALS																		21Y 6Y(M)	164	106	104	55	102

LEGEND: X = BUSINESS SYSTEMS MAJOR FUNCTION AFFECTED BY SOFTWARE PACKAGE MODIFICATIONS

Y = MINOR DATA BASE MODIFICATIONS

Y(M) = MAJOR DATA BASE MODIFICATIONS

1 = NUMBER OF MODIFICATIONS NEEDED

EXHIBIT VII-1

SUMMARY OF AUTOMATED PRODUCTION CONTROL SYSTEM SOFTWARE PACKAGE MODIFICATIONS

The software modifications identified in this section are an initial evaluation of the modifications in the Rath and Strong PIOS system which will be required to meet the SRB production control business system requirements. The modifications will require approximately eighteen man-years of systems development effort, if synergies from combining modifications are not considered. A synopsis of this modification and development effort is shown in the table below.

Software Modifications

Type	Number	Man-Weeks/ Modification	Total Man-Weeks
Major Data Base Changes	6	4	24
Minor Data Base Changes	21	1	21
Program Changes	164	1	164
New Programs	106	2	212
New Reports	104	2	208
New Inquiry Screens	55	2	110
New Maintenance Screens	102	2	204
		Total	943 Man-Weeks
			18 Man-Years

The system software modification costs will approximate $90,000 to $100,000 per man-year. In addition, the software package purchase costs will be between $250,000 and $300,000.

Therefore, the total software system development price will be between $1,870,000 and $2,100,000.

This ROM cost estimate therefore has a high confidence factor for the range of $1.5 to $2.5 million.

VIII - HARDWARE REQUIREMENTS

INTRODUCTION

The business design specifications (Section IV) and computer system design (Section V) are analysed in this section in terms of the hardware requirements required to support the system. These are discussed under the following headings:

- Network Architecture. A discussion of generic hardware requirements to support the system.

- Input/Output Media and Locations. The identification of each field peripheral and its location, function, and estimated volume.

- Hardware Requirements/Volume Estimates. An identification of the hardware size requirements based on processing volume estimates.

- Hardware Selection. A specific IBM configuration which will satisfy the hardware requirements.

NETWORK ARCHITECTURE

Figures VIII-1 and VIII-2 depict the conceptual hardware and communications design. Some of the major features of the design are discussed below:

1. Mainframe Computers. Dual mainframe computers are depicted, for back-up capabilities (although it is anticipated that both would be operational to improve processing capability). The mainframes are linked channel to channel for high speed communications.

2. Disk Storage. Dual disk controllers are depicted, each with a channel link to each mainframe. This configuration minimizes the possibility of disk inaccessibility due to hardware failure and spreads the disks out for multiple accesses. Three disk units are attached to each controller.

3. Tape Storage. Dual tape control units are depicted, each linked to both mainframes for back-up and reliability purposes. Six tape drives are shown for file back-up, transaction logging, and optional input and output.

4. Card Punch and Card Reader. These units are included as an optional input/output medium.

5. Communication Controllers. Dual communication controllers are depicted to provide back-up capability. In actual operations, both controllers would be used to spread the communication requirements over the two mainframe computers. A switch unit between the two controllers provides the capability to switch any one of six lines to either controller.

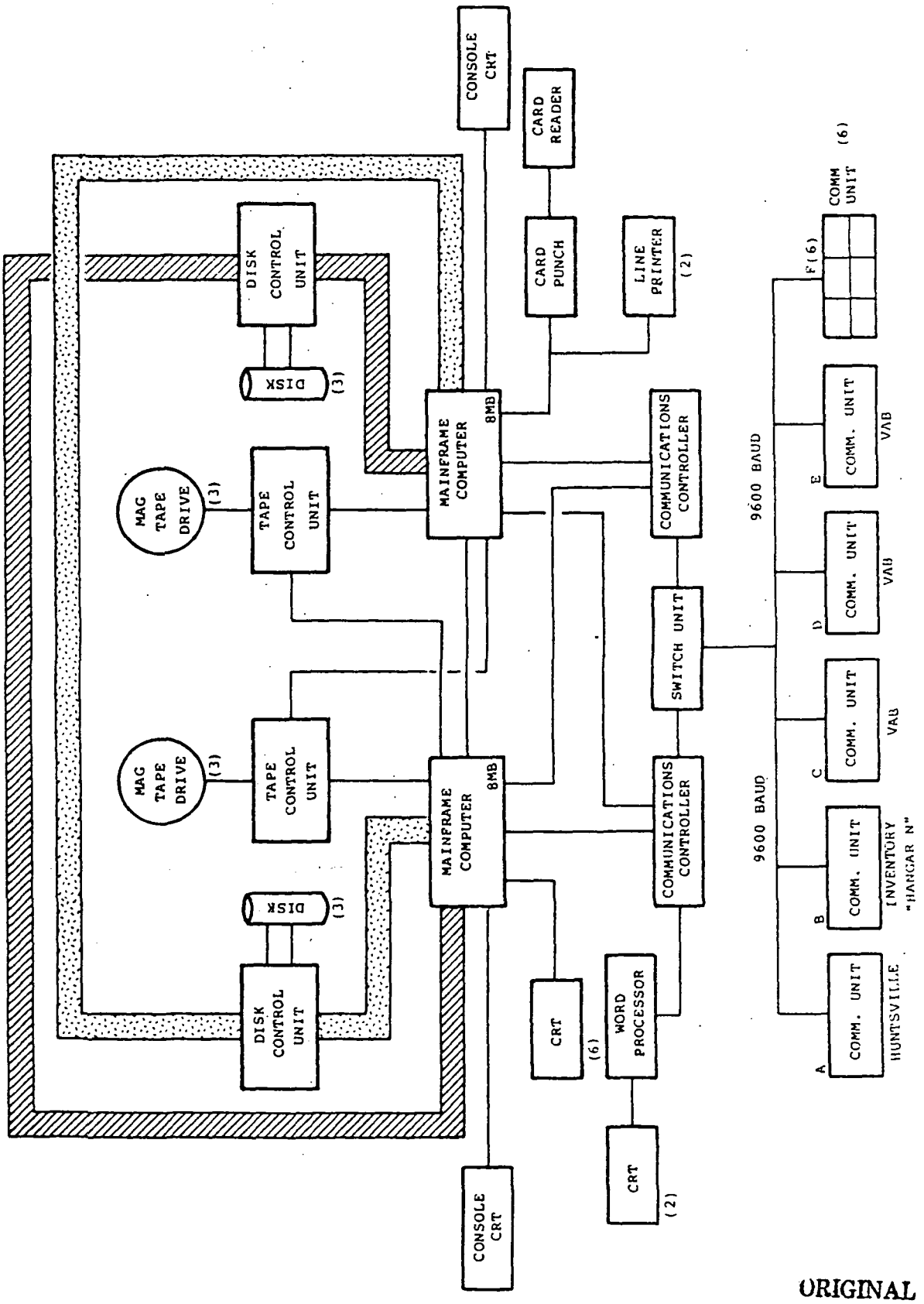
6. Line Printers. Two high speed (i.e., greater than 1,000 lines per minute) printers are depicted in the central site to handle large print jobs and system outputs.

7. Console CRTs. One for each mainframe to accommodate operator control and intervention.

8. Communication Units. Five large communication units (A-E) are depicted (at the bottom of Figure VIII-1 and at the top of Figure VIII-2) to provide the concentration and switching

Figure VIII-1

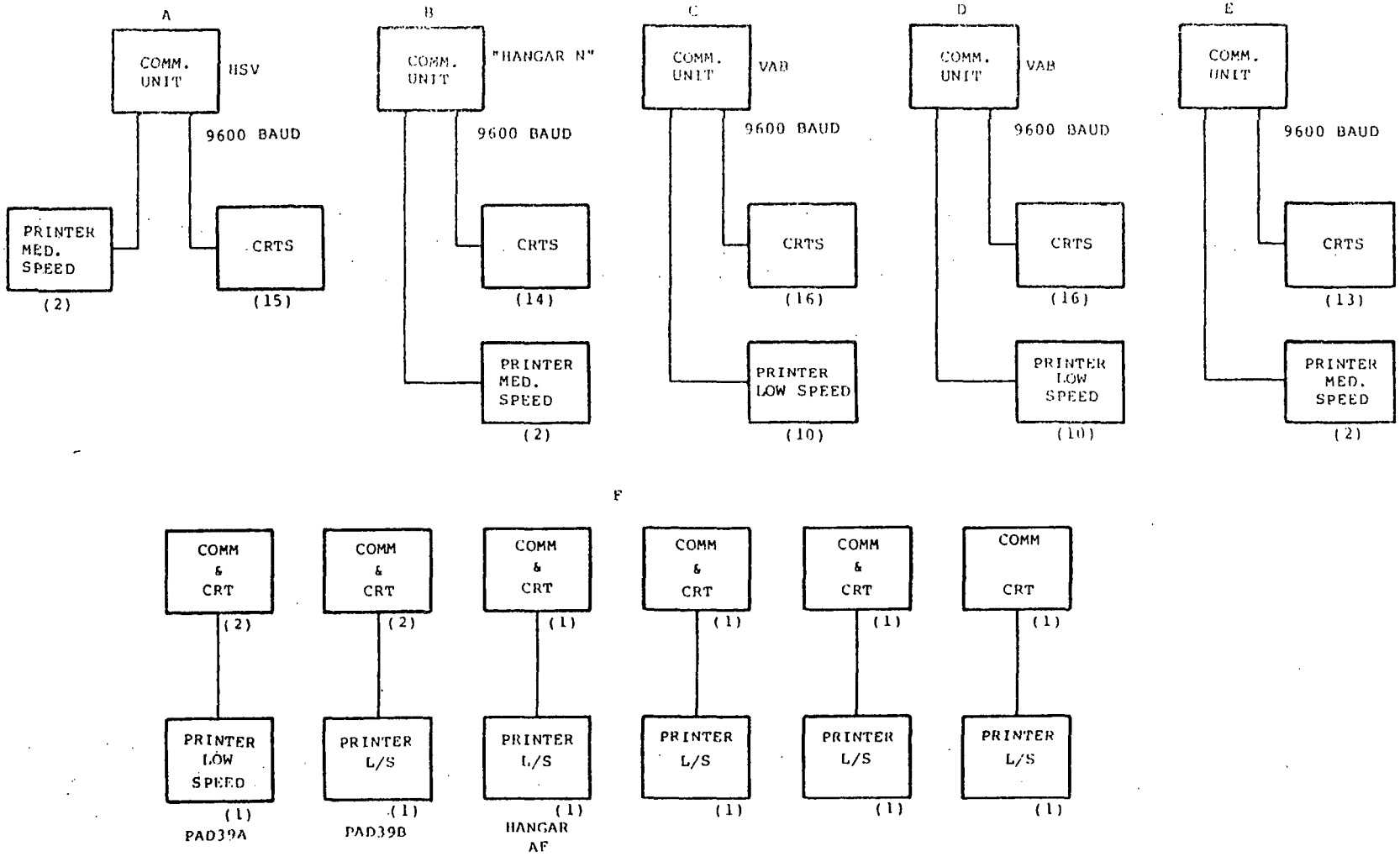
AUTOMATED PRODUCTION CONTROL SYSTEM
CENTRAL COMPUTER CONFIGURATIONS



ORIGINAL PAGE IS
OF POOR QUALITY

Figure VIII-2

AUTOMATED PRODUCTION CONTROL SYSTEM
PERIPHERAL CONFIGURATION



functions to the terminals and printers located in the field. Communication unit F is actually six smaller communication units handling two to three devices each. Each of the eleven communication units is responsible for managing field peripherals in a geographic area (e.g., Huntsville, VAB, Hangar AF).

9. Word Processor. A word processor is shown to accommodate the work authorization document text processing.

10. CRT. Six CRTs are depicted in a local mode to the mainframes to accommodate ongoing systems enhancement and maintenance.

11. Field Peripherals. 82 CRTs and 32 printers are depicted in Figure VIII-2 to support the field input/output functions. The following section describes the location, function, and volume for each peripheral.

INPUT/OUTPUT MEDIA AND LOCATIONS

The input/output media and locations are presented in Tables VIII-1 and VIII-2. The first table shows the location, function, designator, frequency and record volume for each CRT. The second table provides the location, function, designator, frequency and page volume for each printer.

Table VIII-1

CRTs

Location	Function	Designator	Frequency	Volume
:I/HSV Resource Planning	Major Scheduling	A1	As Required	As Required
:I/HSV Design Engineering	Maintain Manufacturing BOM	A2	As Required	As Required
:I/HSV Quality Assurance	Maintain Manufacturing BOM	A3	As Required	As Required
:I/HSV Purchasing	Inventory Inquiry and Maintenance	A4-A5	Daily	200
:I/HSV Purchasing	Purchasing Transactions	A4-A5	Daily	25
:I/HSV Provisional	Inventory Inquiry and Maintenance	A6	Daily	20
:I/HSV Other	Miscellaneous	A7-A15	Daily	As Required
ntral Computer Site	Systems Development and Maintenance	B1-B6	As Required	As Required
BI/KSC Process Engineering	Maintain Manufacturing BOM	K1	As Required	As Required
BI/KSC Inventory Control	Inventory Transactions	K2-K12	Daily	12,800
BI/KSC Inventory Control	Inventory Inquiry and Maintenance	K13-K15	Daily	300
BI/KSC Process Engineering	Exception Process Documents	K16	Daily	25
BI/KSC Process Engineering	Process Constraints	K16	Daily	25
BI/KSC Preventive Maintenance	P.M. Work Order	K17	Daily	5
BI/KSC OPNS Control	Shop Floor Operations	K18-K59	Daily	8,000
BI/KSC Process Engineering	Routings Maintenance	K60	Daily	As Required
BI/KSC Process Engineering	Work Center Capacities	K60	Daily	As Required
BI/KSC Process Engineering	Resource/Skill Capacities Inquiry	K60	Daily	As Required
BI/KSC Dispatching	Shop Order Rescheduling	K61-K65	Daily	As Required
BI/KSC Operations Budgeting	Operatings Budgeting	K66	As Required	As Required
BI/KSC Performance Reporting	Performance Reporting	K67	As Required	As Required

Table VIII-2
(Page 1 of 2)

Printers

Location	Function	Designator	Frequency	Estimated Page Volume
USBI/HSV Resource Planning	Major Assembly Gross Requirements	P1	As Required	240
USBI/HSV Resource Planning	Major Assembly Manufacturing Orders	P1	As Required	240
USBI/HSV Resource Planning	Master Schedule	P1	As Required	240
USBI/HSV Design Engineering	Master Schedule	P1	As Required	Included Above
USBI/HSV Resource Planning	Gross Capacity Exceptions	P1	As Required	200
USBI/HSV As Required	Gross Capacity Exceptions	P1	As Required	Included
USBI/HSV Logistics	Inventory Reports	P1	Daily	?
USBI/HSV Purchasing	Net Requirements	P1	Daily	40
USBI/HSV Purchasing	Expedite Reports	P1	Daily	10
USBI/HSV Purchasing	Manufacturing Orders	P1	Daily	40
USBI/HSV Resource Planning	Performance Analysis Reports	P1	Weekly/ Monthly	To Be Determined
USBI/KSC Production Control	Major Assembly Gross Requirements	P2	As Required	240
USBI/KSC Production Control	Major Assembly Manufacturing Orders	P2	As Required	240
USBI/KSC Production Control	Master Schedule	P2	As Required	240
USBI/KSC Process Engineering	Master Schedule	P2	As Required	240
USBI/KSC Production Control	Net Requirements	P2	Daily	40
USBI/KSC Production Control	Expedite Reports	P2	Daily	10
USBI/KSC Production Control	Manufacturing Orders	P2	Daily	40

Table VIII-2
(Page 2 of 2)

Location	Function	Designator	Frequency	Estimated Page Volume
USBI/HSV Production Control	Capacity Requirements Planning Reports	P2	Weekly	800
USBI/KSC Production Control	Operations Control Reports	P2	Daily	40
USBI/KSC Inventory	Inventory Reports	P3-P4	Daily	?
USBI/KSC Inventory Control	Net Requirements	P3-P4	Daily	40
USBI/KSC Inventory Control	Expedite Reports	P3-P4	Daily	10
USBI/KSC Inventory Control	Manufacturing Orders	P3-P4	Daily	40
USBI/HSV Inventory	Material Requirement	P3-P4	Daily	1,000
USBI/KSC Inventory Control		P3-P4	Daily	40
USBI/KSC Dispatching		P5	Daily	40
USBI/KSC Operations Control		P5	Daily	40
USBI/KSC Dispatching	Performance Analysis Reports	P5		
USBI/KSC Operations Control	Performance Analysis Reports	P5		
USBI/HSV Operations	Back-Up Printer	P6	As Required	As Required
USBI/HSV OPNS Control	Dispatch Package and Resource Requisitions	P7-P32	Day	1,500
Central Computer Site	As Required	P33-P34	As Required	As Required

HARDWARE REQUIREMENTS/ VOLUME ESTIMATES

Tables VIII-1 and VIII-2 depicted estimated volumes for the field peripherals. This subsection presents estimated volumes on the centralized computer hardware network. It should be recognized that the development of specific system volumes as part of a functional requirements definition lends itself to gross estimates only. These estimates should be refined during the detailed technical design phase. The hardware and network requirements could then be more specifically identified and justified during that phase.

(a) Mainframe Computers

It is recognized from industry experience that the mainframe processors will have to be large-scale computers in the IBM 370 equivalent class or larger. Cost performance improvements by the data processing industry have improved CPU speeds and main memory sizes, while reducing costs. The final mainframe selection should concentrate on hardware that will support the application software, processing requirements, and field peripherals in the most cost-effective manner while permitting upgrades to larger, more cost-effective new mainframe products in the future.

As a rough estimate, the CPU should be capable of processing at least one million instructions per second.

(b) Main Memory Requirements

While it is not possible to specifically state main memory requirements during the functional requirements phase, industry experience leads us to believe that four megabytes of main memory will not be adequate due to the consumption by operating, teleprocessing, and data base management systems, as well as the high number of field peripherals being driven by the central computer. Eight megabytes would appear to be an appropriate estimate, which could be refined during the technical design phase.

(c) Disk Storage

Nearly 700,000,000 bytes of disk storage requirement were specifically identified in Section V. Allowance for undefined file volumes would increase this requirement to one billion bytes. In addition, rough estimates of disk storage should be added for the contingency requirements noted below:

Table VIII-3

Disc Storage Contingency Requirements

Contingency	Bytes
Undefined Data Elements	750,000,000
System Software	250,000,000
Additional Files (e.g., ACMS, ADRS)	750,000,000
Back-Up/Sort	750,000,000
Total	2,500,000,000

Therefore, total disk capacity requirements are approximately

3.5 billion bytes. A more refined estimate should be generated in the detailed technical design phase, including capacity, access time, and multiple access requirements.

(d) Tape Storage

Tape storage requirements are defined by the frequency and volume of back-up processing to store files off-site, the need to maintain large amounts of historical data and logging transactions, and their use as optional input/output devices to interface with other systems. These detailed requirements should be identified in the detailed technical design phase. Our estimate at this time is that approximately six tape drives will be required.

(e) Communication Controllers

Four high-volume, geographically segregated processing areas were identified during this study:

1. USBI, Huntsville.
2. KSC Inventory Segregation Area.
3. VAB Operation Control.
4. VAB Process Engineering, Dispatching, etc.

A communications controller was assigned to each area and its peripherals. Due to the large peripheral requirements of VAB Operations Control, two controllers were assigned to this area. In addition, six distributed locations were identified (e.g., launch pads, Hanger AF, parachute area, etc.) and six smaller communication controllers/terminals were configured for those areas.

(f) Communication Speeds

A network requirement of 9600 Baud between the controllers and communication units was configured based on estimated requirements. This estimate should be refined during the detailed technical design phase. Based on the proposed configuration, the network is estimated to handle 1.43 input transactions of a 77-byte record length and .56 output transactions of a 476-byte record length for each communication controller, at 50% line utilization, per second.

HARDWARE SELECTION

Based on the selected software and the generic computer architecture described in this section, a specific manufacturer's hardware line was selected to provide the required computing capacity. The recommended vendor is IBM, based primarily on the IBM orientation of the Rath and Strong software.

The following sections describe the specific hardware configuration and peripheral equipment locations, functions, and volumes.

HARDWARE REQUIREMENTS

1. Main processing computer.

   (a) Type: IBM 4341 Model Group 2 (two each).

   (b) Memory: 8 MB each.

(c) Processing speed: 1.2 million instructions/second.

(d) Communications protocol: SDLC.

(e) Executive system requirement: MVS.

(f) Data base management system requirement: IDMS.

(g) Teleprocessing monitor: CICS.

2. Disk storage.

(a) Type: IBM 3375 DASD (six each).

(b) Storage capacity: 750 MB each.

(c) Average seek time: 9.6 MSEC.

3. Communications controllers.

3.1 (a) Type: IBM 3705-II (two each).

(b) Communication speed: channel (50KB).

(c) Line interface: Network Control Program (NCP).

3.2 (a) Type: IBM 3274 (five each).

(b) Communication speed: 9600 Baud.

(c) Line control: SDLC.

3.3 (a) Type: IBM 3276 (six each).

(b) Communication speed: 9600 Baud.

(c) Line control: SDLC.

(d) Multidrop requirements: yes.

(e) Total of eight IBM 3276 terminals and six IBM 3287 printers.

4. Data set requirements.

(a) Type: IBM 3865 Modem (17 each).

(b) Speed: 9600 Baud.

5. Terminal requirements.

5.1 (a) Type: IBM 3278 display console (82 each) with security keylock.

(b) Display: 24 lines x 80 characters each.

5.2 (a) Type: IBM 3276 display console (six each) with security keylock.

(b) Display: 24 lines x 80 characters each.

6. Printer Requirements

6.1 (a) Type: IBM 3203 Line-Printer (two each).

(b) Speed: 1,200 LPM.

6.2 (a) Type: IBM 3289 Model 2 Line-Printer (six each).

(b) 400 lines per minute.

6.3 (a) Type: IBM 3287 Model II printer (26 each).

(b) Speed: 120 characters/ second.

7. Card I/O Requirements

(a) Type: IBM 1442 card read punch (one each).

(b) 400 cards/minute.

8. Tape Requirements

8.1 (a) Type: IBM 3420 tape unit (six each).

(b) Speed: 1,250 KB.

(c) Density: 1,600/6,250 BPI (two each); 6,250 BPI (four each).

8.2 (a) Type: IBM 3803 tape controller (two each).