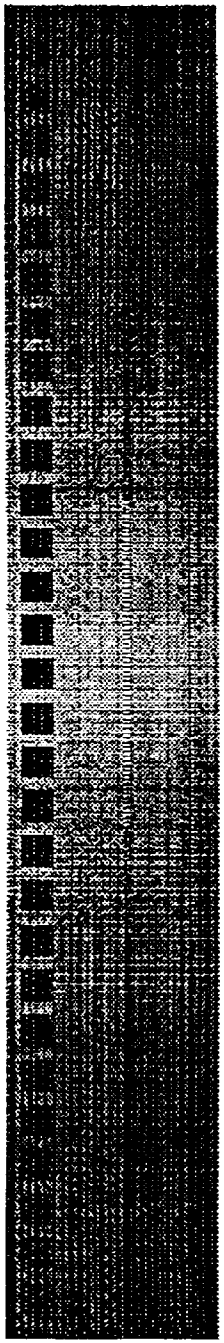
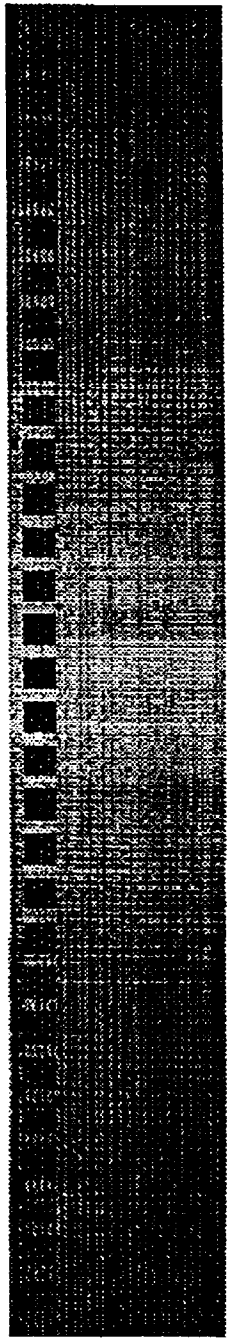


Evolutionary Development of the **Si**mulation **by** **L**ogical Modeling System (SIBYL)

Helen Wu

Rocketdyne Division, Rockwell International



What is SIBYL?

- Consisted of Hardware and Cost
  - SIBYL/Hardware is re-engineered from the IBM mainframe based Long-Term Hardware Projection Model (LHPM)
  - SIBYL/Cost is evolved from SimPOP, Lotus 1-2-3 Spreadsheet.

What is /SIBYL?

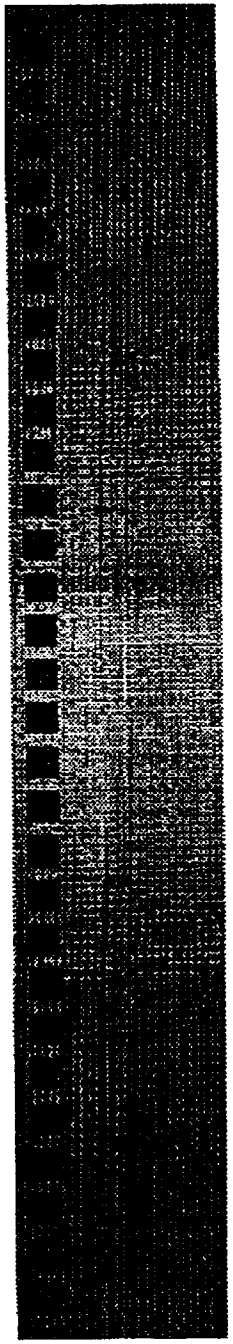
(continued)

- SIBYL/Hardware - Validated in FY93 and used in developing FY 94 & 95 SSME Program Operating Plan (POP)
- SIBYL/Cost V. 1 - Released in Dec. 94
- SIBYL is now the primary modeling tool for developing SSME Logistics proposals and POP for NASA and Divisional Marketing studies

What is SIBYL/Hardware?

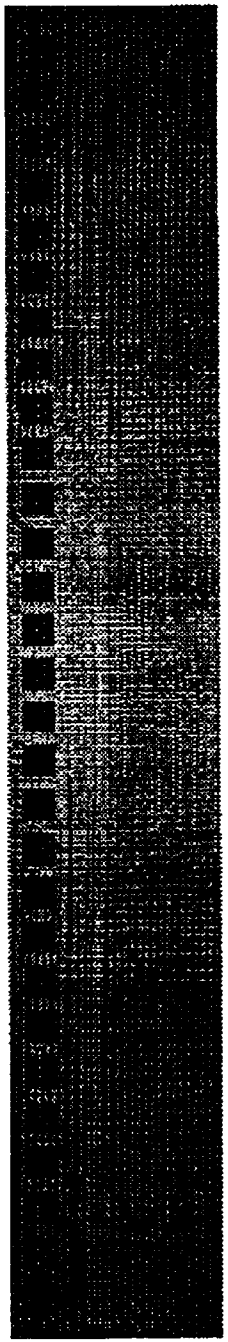
- Long-Term Hardware Projection Model for SSME. It is a Stochastic Simulation Model that takes inputs such as:
  - Mean Time Between Failure (MTBF)
  - Component Life Limit
  - Initial Conditions (i.e. # of available comp.)
  - Flight Schedule, etc.

And projects hardware requirements over 10 years.



What is SIBYL/Cost?

- Financial Planning Tool that Projects Cost of Labor and Hardware Requirements for:
  - SSME Spares Proposals
  - SSME Program Operating Plans (POP)
  - Special Engine Cost Studies
- SIBYL Users
  - SSME Logistics and Financial Analysts
  - SSME Teams
  - NASA



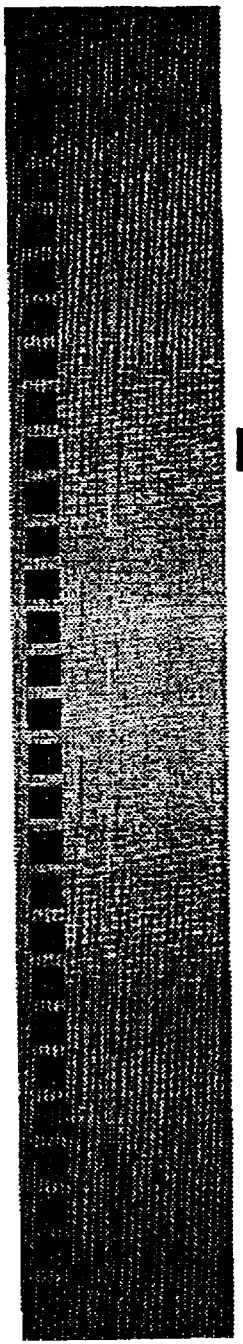
SIBYL

- Long-Term Hardware Projection Model (LHPM) vs. SIBYL/Hardware
- Lotus 1-2-3 vs. SIBYL/Cost
- Development
  - Process
  - Tools
- Summary

LHPM vs. SIBYL/Hardware

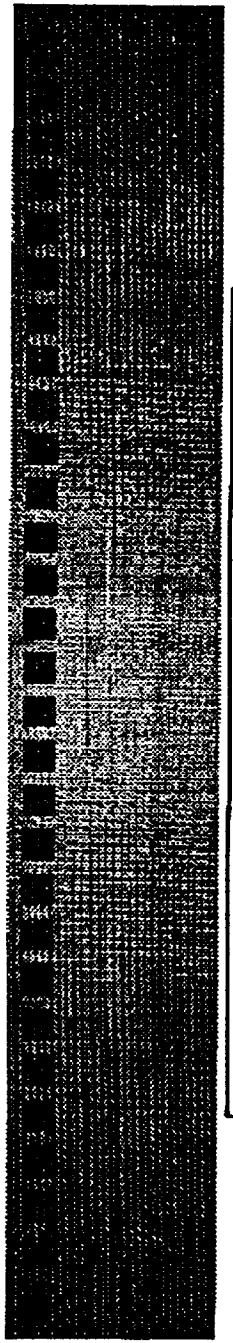
- LHPM
  - Platform: IBM Mainframe
  - Developed in 1985 - 1987 in PL/1
  - 20,000+ lines of legacy code
  - Well documented and structured

- SIBYL/Hardware
  - Platform: IBM PC
  - LHPM Converted to C-language in a 9-month period from Aug. 1991 through April 1992.
  - Added the front-end processor that runs under Windows
  - Better performance at no additional cost



LHPM vs. SIBYL/Hardware
(continued)

- The Front-End Processor
  - Generates the user input file that feeds into the Model.
  - Runs under Microsoft Windows
  - Eliminated many human errors such as
    - spelling
    - duplicate names
    - inconsistencies in data, etc.

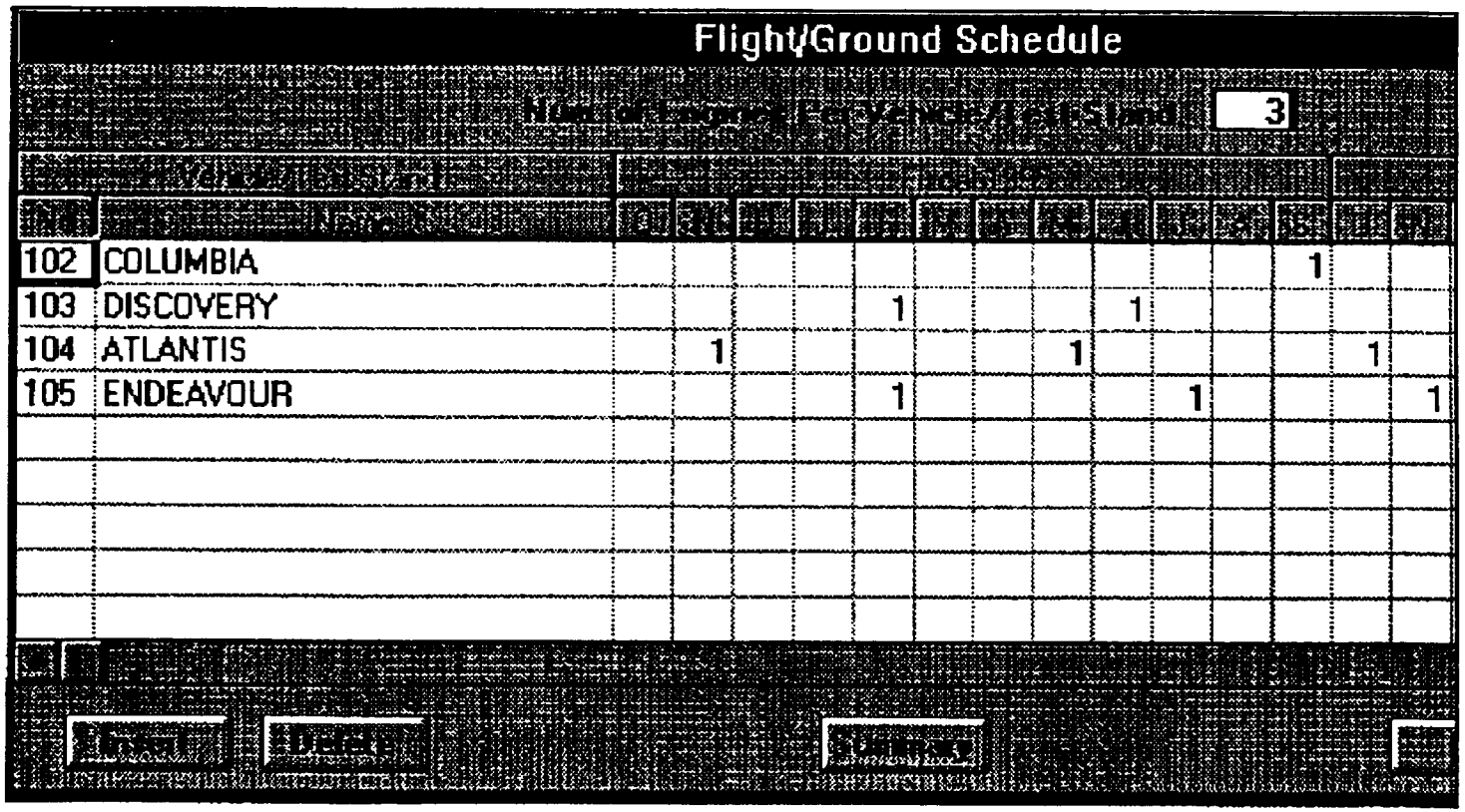


LHPM Input - Flight Schedule

VEHICLE
IDENTIFICATION
TABLE
102, COLUMBIA
103, DISCOVERY
104, ATLANTIS
105, ENDEAVOUR
END

FLIGHT SCHEDULE	
104,	11/94
103,	02/95
105,	02/95
104,	05/95
103,	06/95
105,	07/95
102,	09/95

SIBYL/Hardware

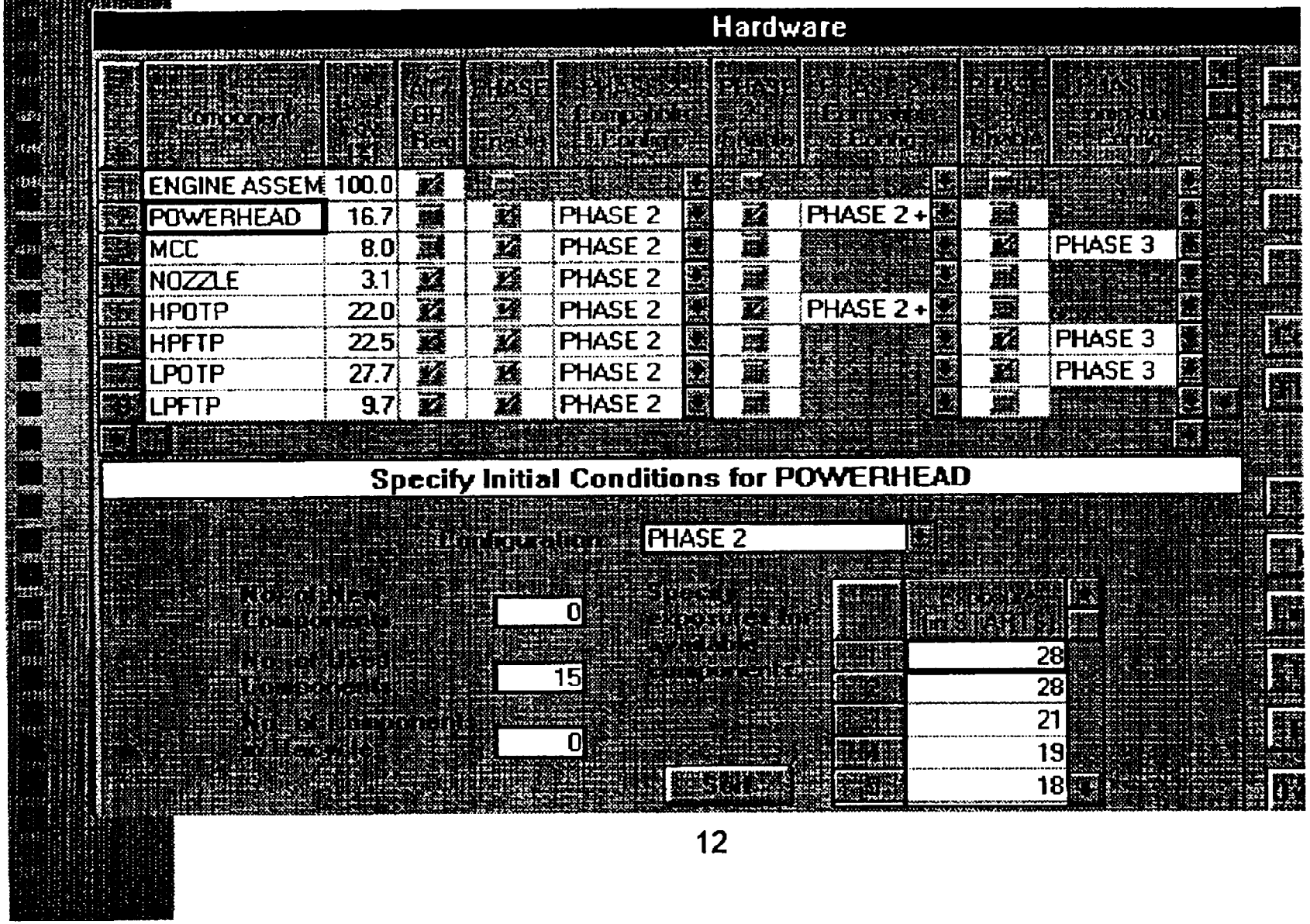


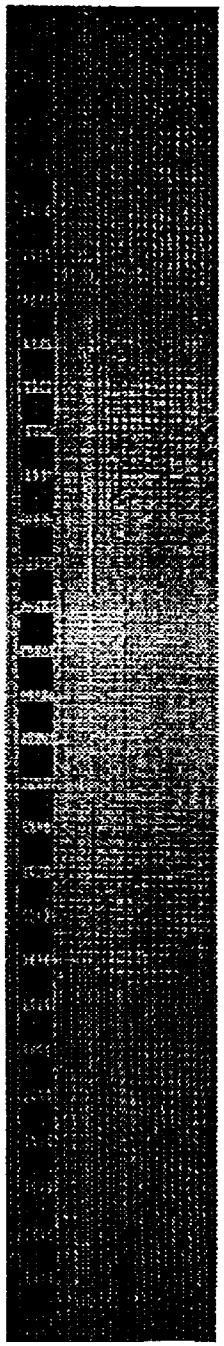
LHPM Input - Component Information

COMPONENT NAMES, AVG EQUIV & GREEN RUN REQUIREMENT (YES/NO)		
POWERHEAD,	0.167,	'0'B
MCC,	0.080,	'0'B

CONFIGURATION IMPLEMENTATION			
PHASE 2,	10/89,	09/97,	'1'B, '1'B, '1'B, '1'B, '1'B, '1'B, '1'B,
-			'1'B
-			'1'B

SIBYL/Hardware





Lotus 1-2-3 vs. SIBYL/Cost

	Lotus 1-2-3	SIBYL/Cost
Development Duration	4 months, 2 heads	1 year, 1.5 heads
Req. Data Storage	7M Bytes	200K ~ 2M Bytes
Speed (Initial Loading)	17 min on PC-386 1 min on Pentium	30 sec on PC-386 10 sec on Pentium
Training	1 month	1 week

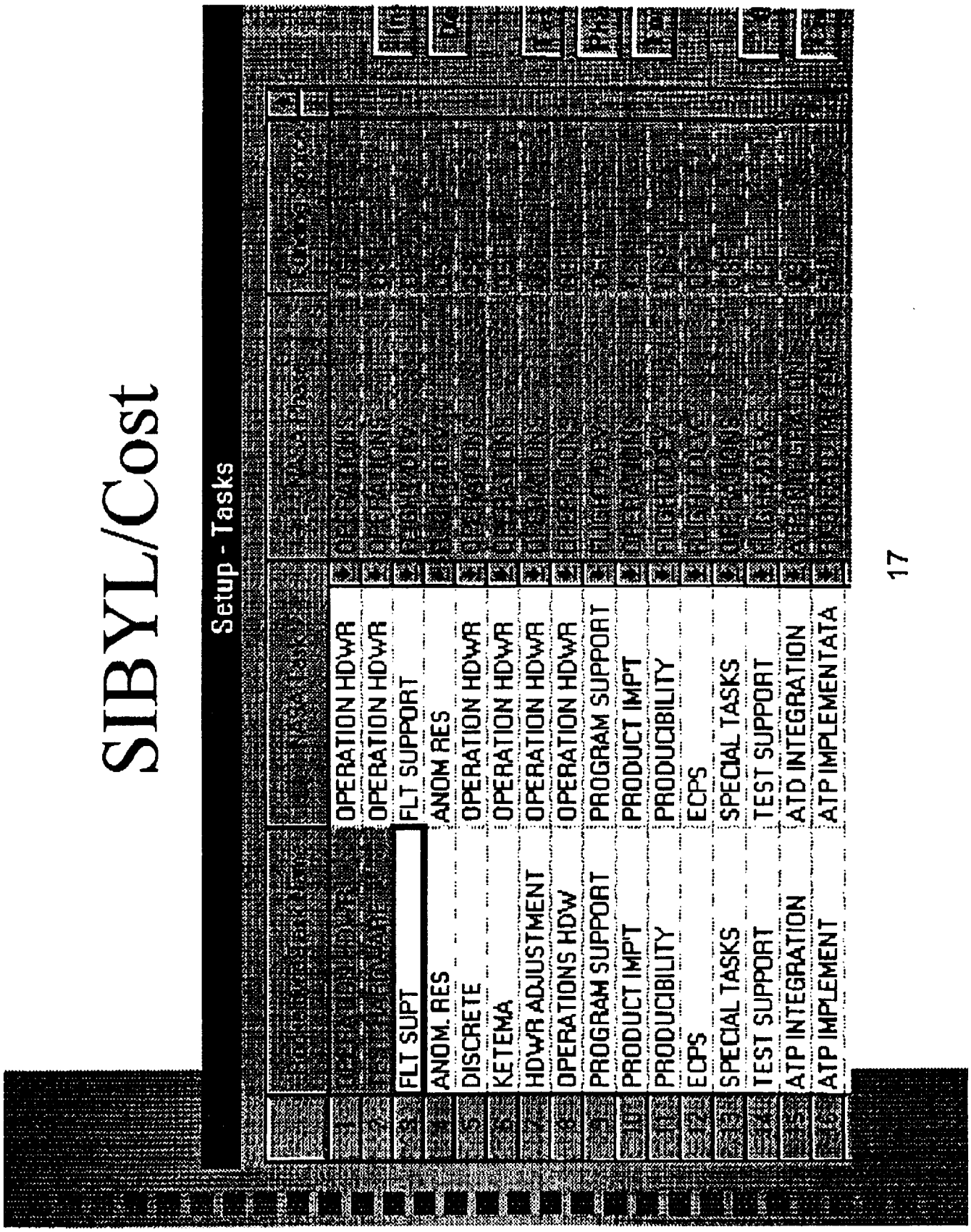
Lotus 1-2-3 vs. SIBYL/Cost
(Continued)

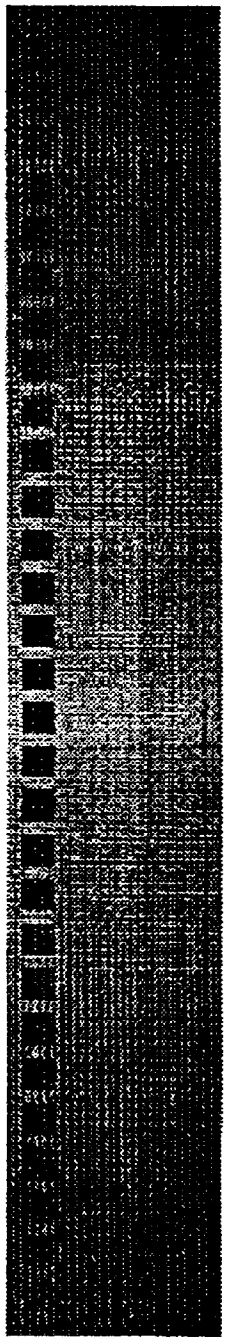
	Lotus 1-2-3	SIBYL/Cost
Flexibility	Limited by RAM	♦Allows Teams to work at more detail level. ♦Allows more components. ♦Allows variety of reports for projected cost visibility.

Lotus 1-2-3 vs. SIBYL/Cost
(Continued)

	Lotus 1-2-3	SIBYL/Cost
Maintenance	Poor in conventions or guidelines	
Data Entry	Menu provided the security, but flexibility was lost.	♦ Provides same look and feel as spreadsheets in entering numbers. ♦ Provides data security and integrity.

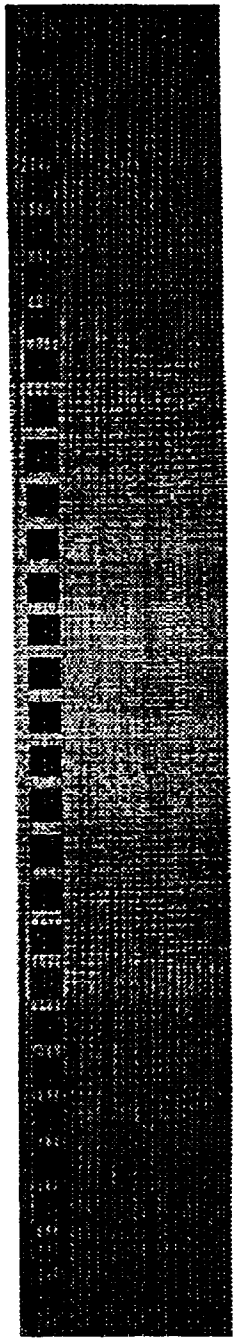
SIBYL/Cost


SIBYL/Cost
Setup - Tasks
OPERATION HDWR
OPERATION HDWR
FLT SUPPORT
ANOM RES
OPERATION HDWR
OPERATION HDWR
OPERATION HDWR
PROGRAM SUPPORT
PRODUCT IMPT
PRODUCIBILITY
ECPS
SPECIAL TASKS
TEST SUPPORT
ATD INTEGRATION
ATP IMPLEMENTATA
FLT SUPT
ANOM. RES
DISCRETE
KETEMA
HDWR ADJUSTMENT
OPERATIONS HDW
PROGRAM SUPPORT
PRODUCT IMPT
PRODUCIBILITY
ECPS
SPECIAL TASKS
TEST SUPPORT
ATP INTEGRATION
ATP IMPLEMENT



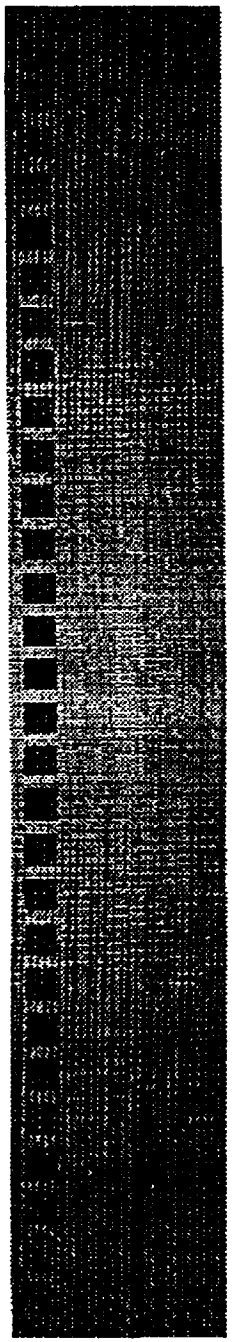
Development Process - Goals

- SIBYL/Hardware
  - Port LHPM to PC
  - Provide User Friendly Interface
  - Provide support and training
- SIBYL/Cost
  - Provide core functions to project cost and prepare reports
  - Provide seamless data transfers from SIBYL/Hardware, Contract & Pricing to SIBYL/Cost and within SIBYL/Cost
  - Provide financial analytic features



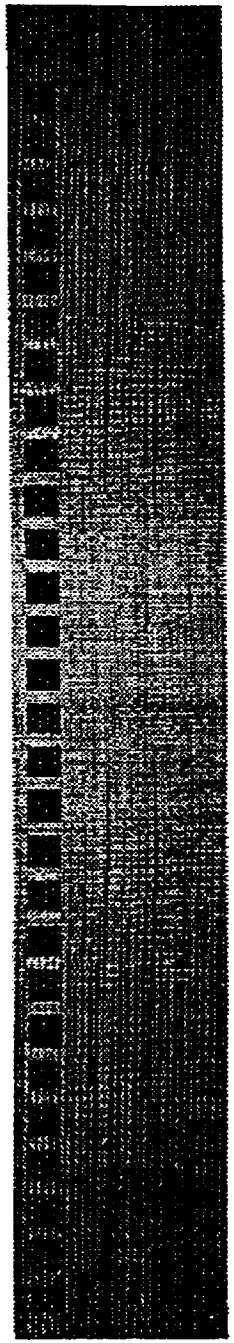
Development Tools

- Software Development Kit (SDK) by Microsoft
- Visual C++ by Microsoft
- SpreadVBX by FarPoint
- Btrieve for Windows
- RoboHelp
- Intel C Code Builder by Intel Corp.



SDK or Visual C++ ?

- Learning Curve
  - Takes longer to get started with Visual C++, but definitely cost-effective for rapid development
- Third-Party Tools
  - VBX Controls are seamlessly integrated in Visual C++
- Development Platform
  - Recommend 486 or higher with 16M RAM for Visual C++



Summary

- Through evolutionary development of the SIBYL, we have:
  - re-engineered expensive and complex IBM mainframe based LHPM to a robust cost-effective computer based mode that is easy to use
  - achieved significant cost reductions
  - improved productivity in preparing long-term forecasts of Space Shuttle Main Engine (SSME) hardware and cost objectives