

**“Impact of Silicon-on-Sapphire on
Small Mainframe Performance”**

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**Sponsoring Organization:
International Information Technology Institute**

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**SMALL
SYSTEMS
POWER**



"Impact of Silicon-on-Sapphire on
Small Mainframe Performance"

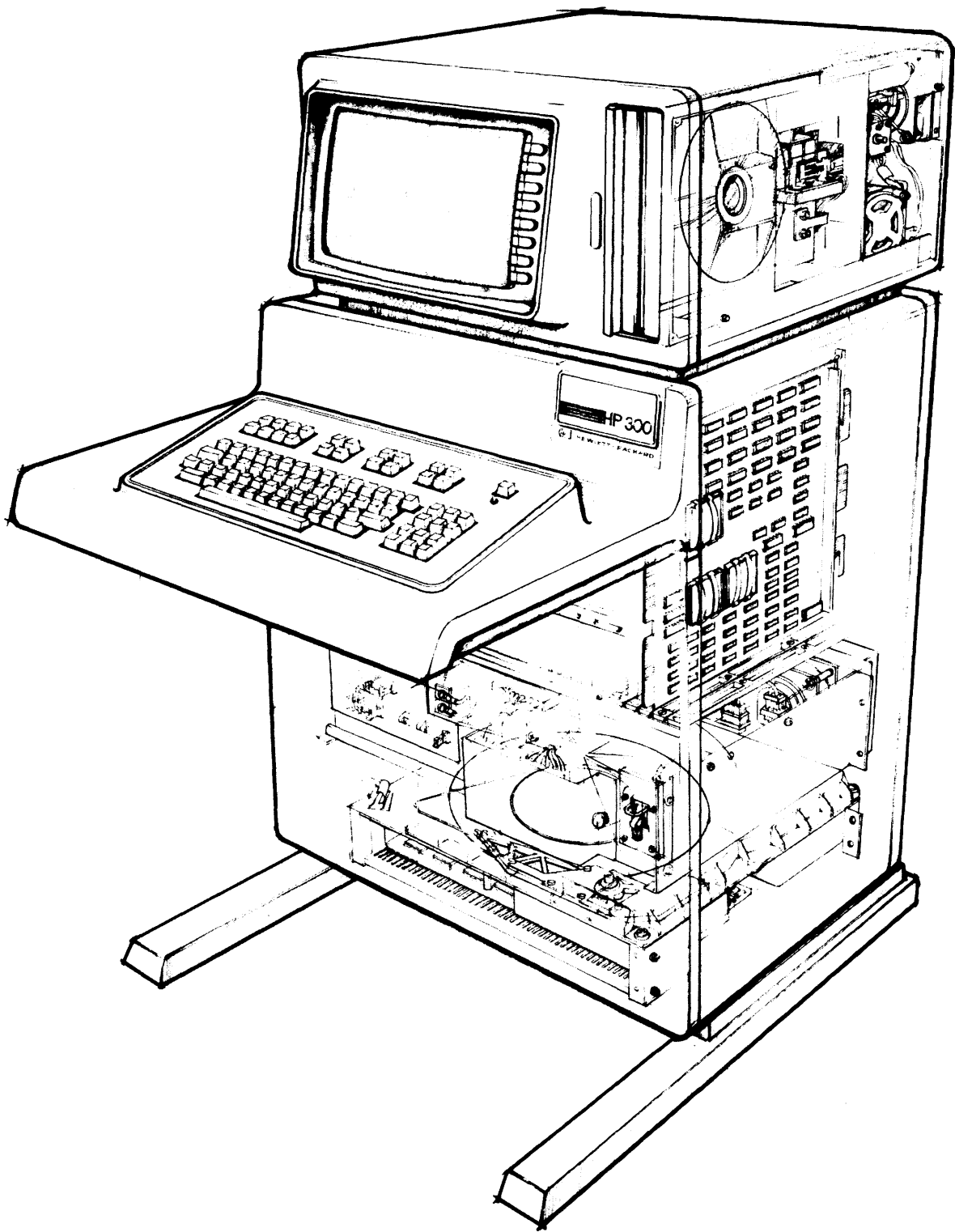
Dr. E. David Crockett
Manager, H-P 300 Product Line

Hewlett-Packard
5303 Stevens Creek Blvd.
Santa Clara, CA 95050

DR. E. DAVID CROCKETT, Program Manager, Advanced Computer Systems (HP300) for Hewlett-Packard is responsible for development, manufacturing and marketing of the HP300 Product Line. During 1975 and 1976, as Engineering Manager, Advanced Computer Systems, Dr. Crockett was responsible for the system definition and initial development of the CMOS/SOS LSI technology for the HP300. Previously, he was Product Manager for the HP3000 with responsibility for development, manufacturing and marketing for the introduction of that system. Dr. Crockett holds a B.E.S. from Brigham Young University, an M.S. from Stanford University, and a Ph.D from the University of Illinois.

MAJOR HP 300 CHARACTERISTICS

- "Large System" Capability
- Sophisticated System Display
- Data Management
- Multiterminal Transaction Processing
- Dependability
- Interactive Software Development
- Expandability



SILICON ON SAPPHIRE

- ADVANTAGES

LOW POWER

HIGH SPEED

HIGH DENSITY

CIRCUIT FLEXIBILITY

EASY LOGIC DESIGN

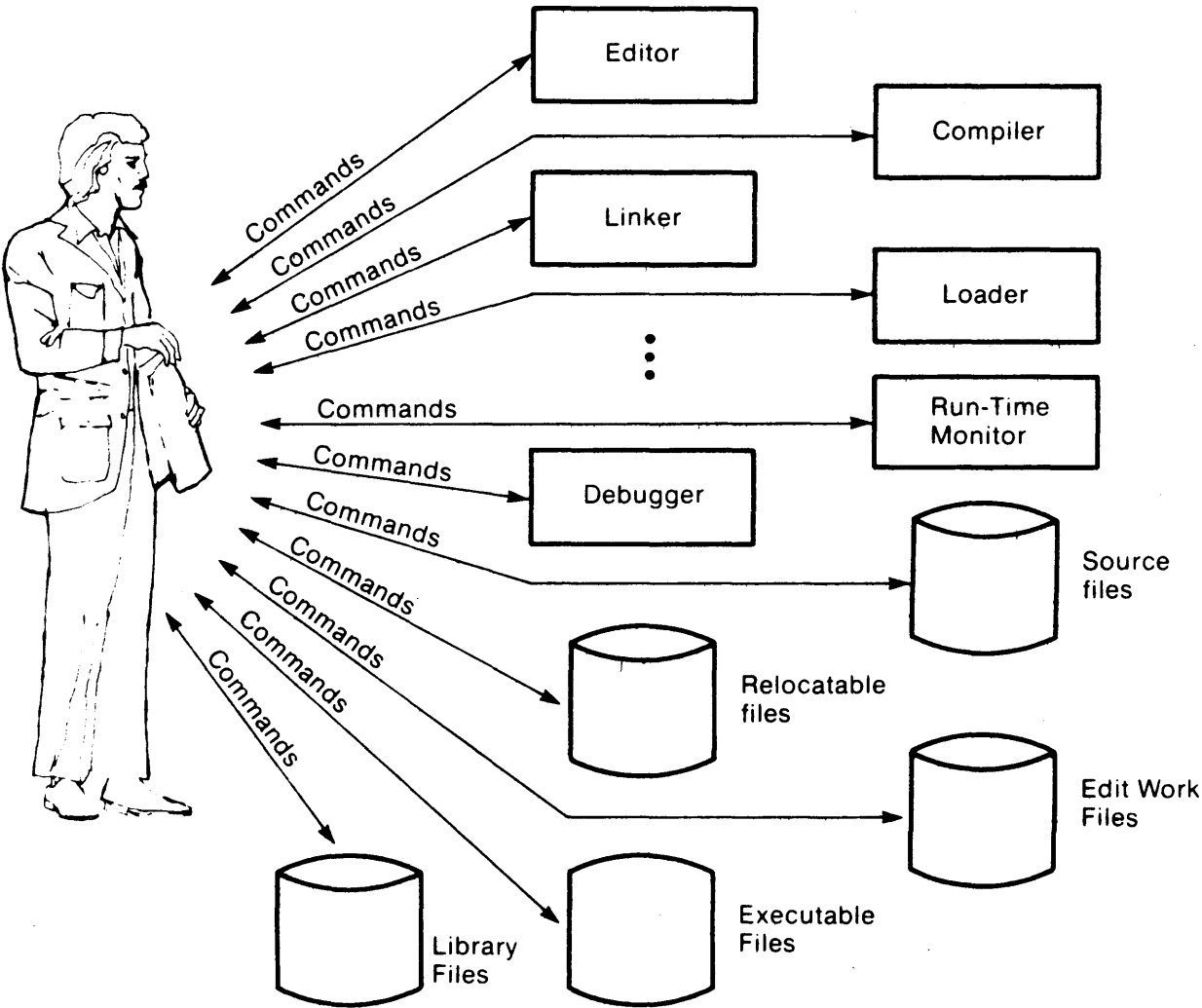
GOOD YIELDS

- DISADVANTAGES

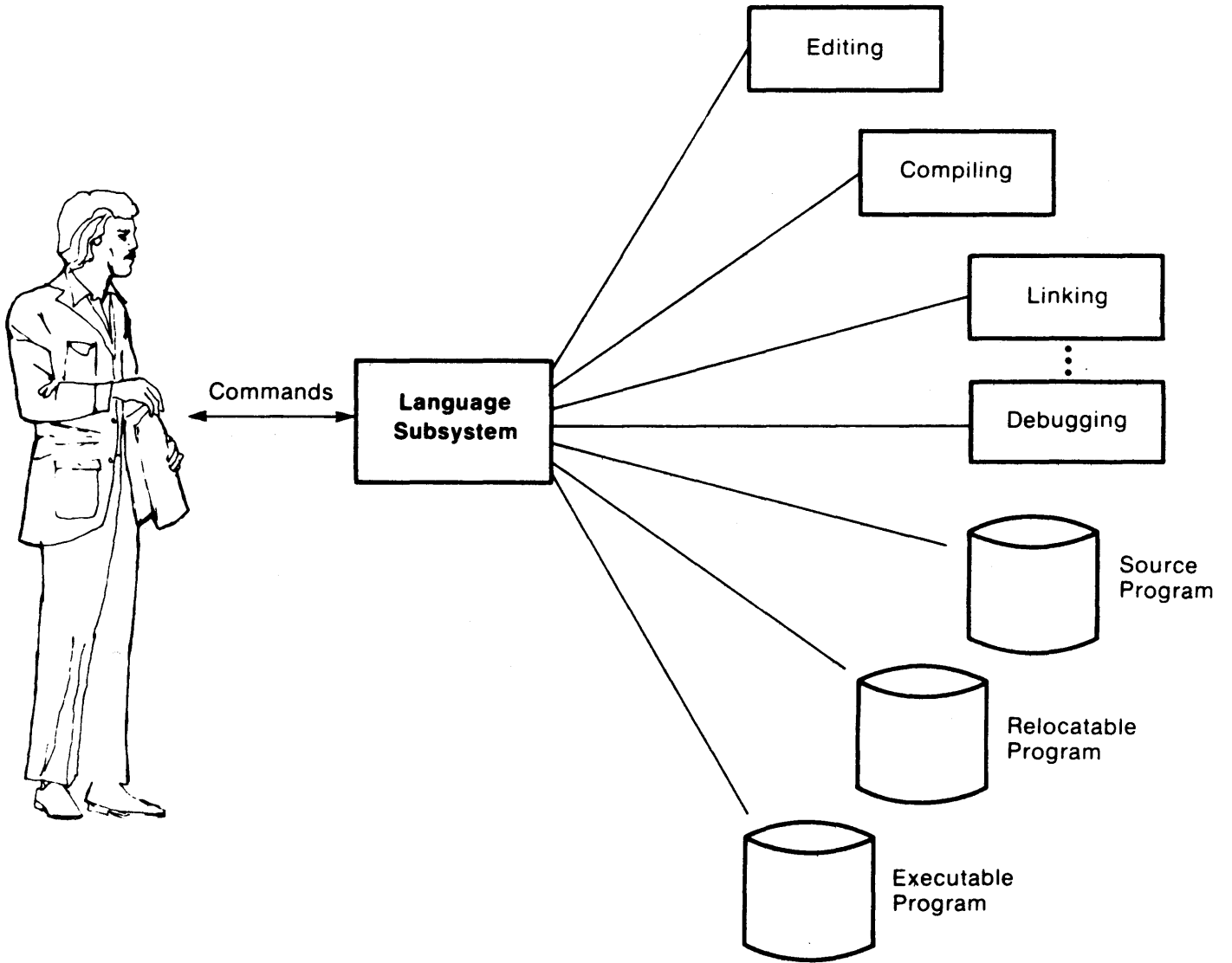
INABILITY TO EMPLOY DYNAMIC CELLS

HIGH SAPPHIRE WAFER COST

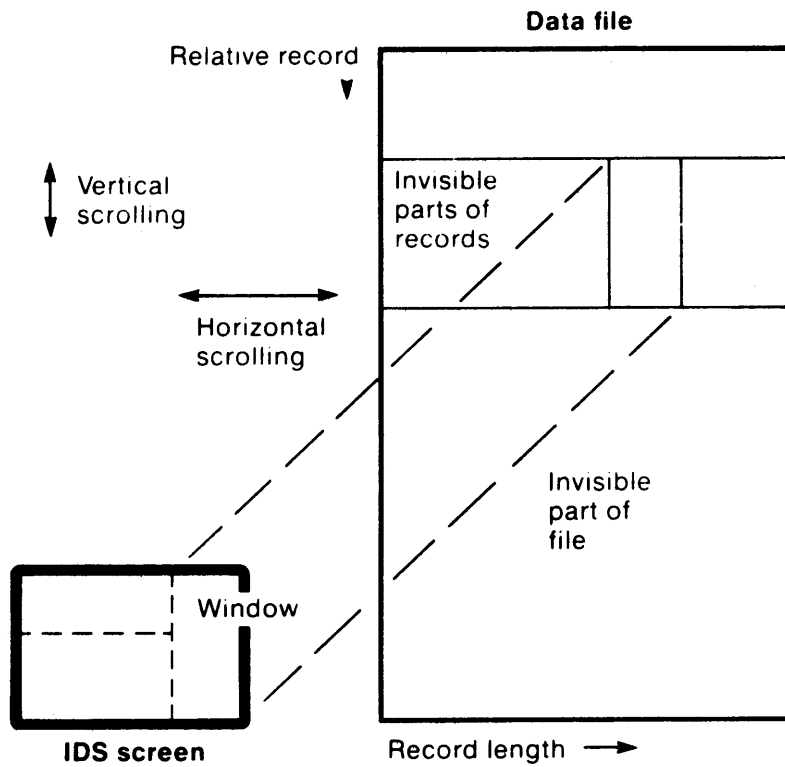
"TRADITIONAL" PROGRAM DEVELOPMENT



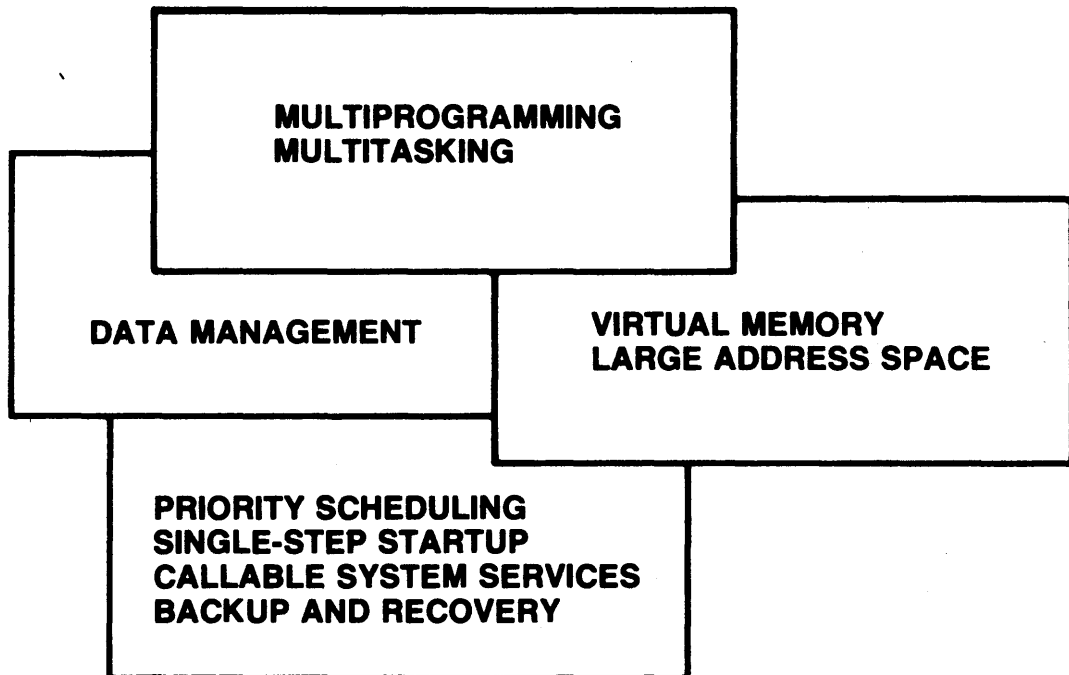
HP 300 PROGRAM DEVELOPMENT



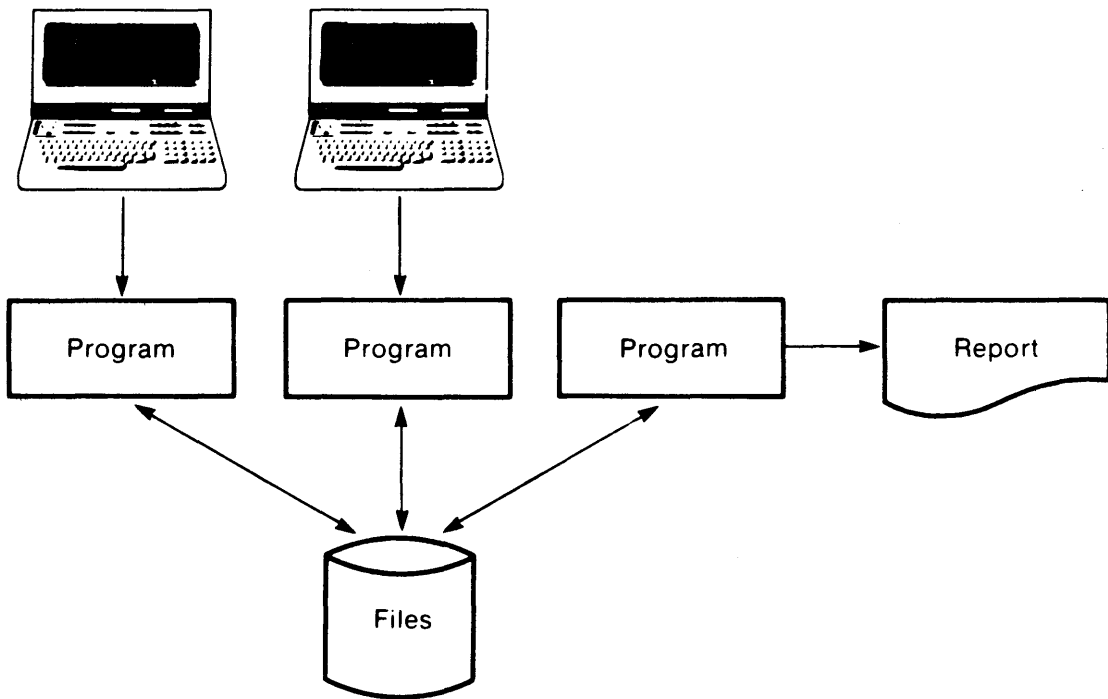
WINDOWS/FILE ATTACHMENT



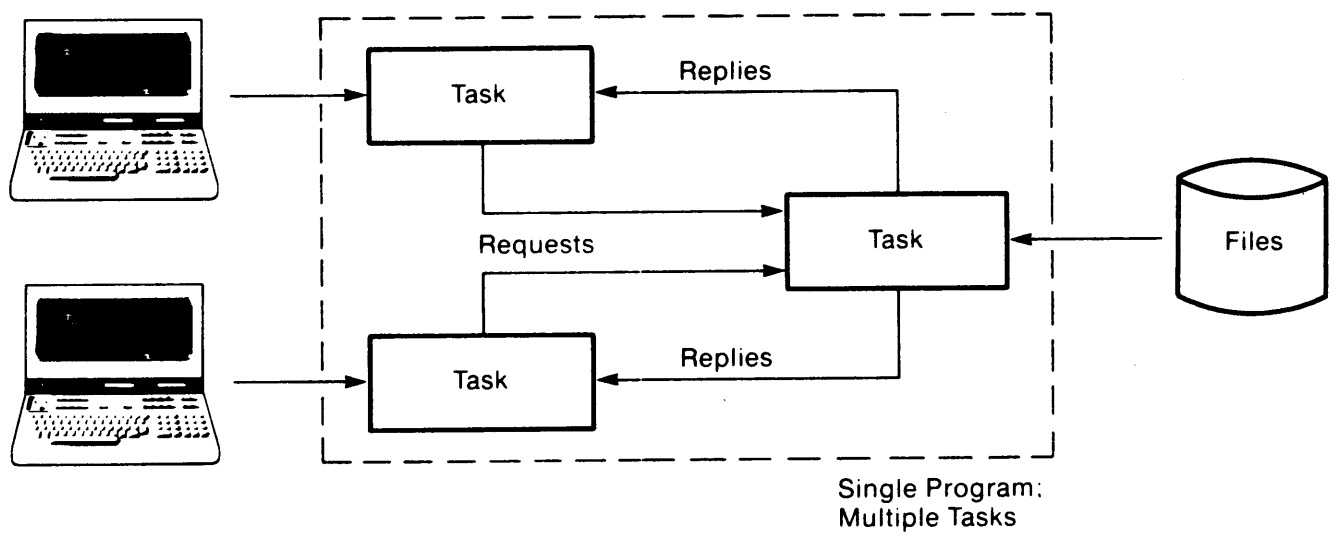
AMIGO/300 OPERATING SYSTEM



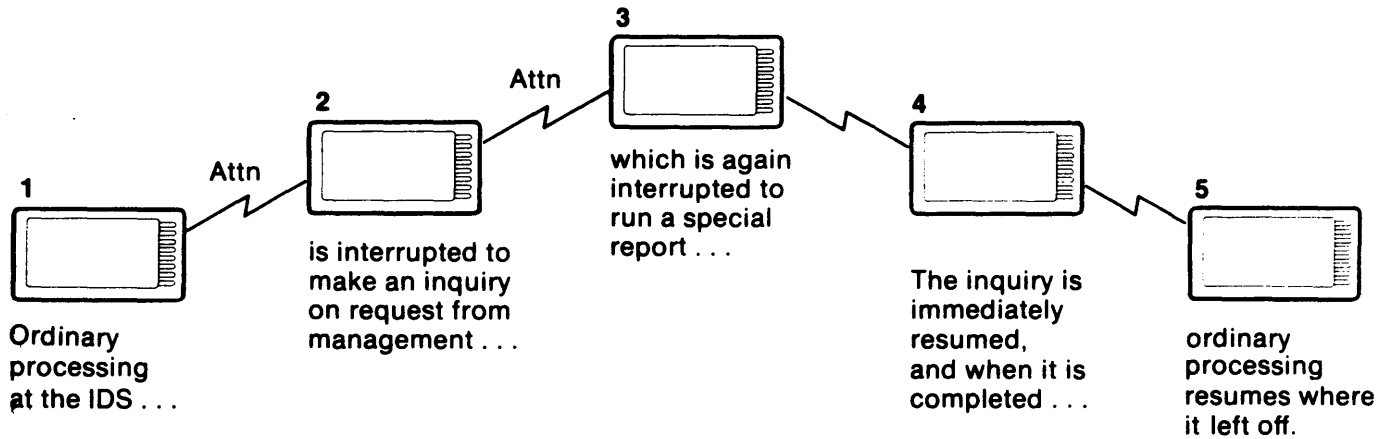
MULTIPROGRAMMING



MULTITASKING

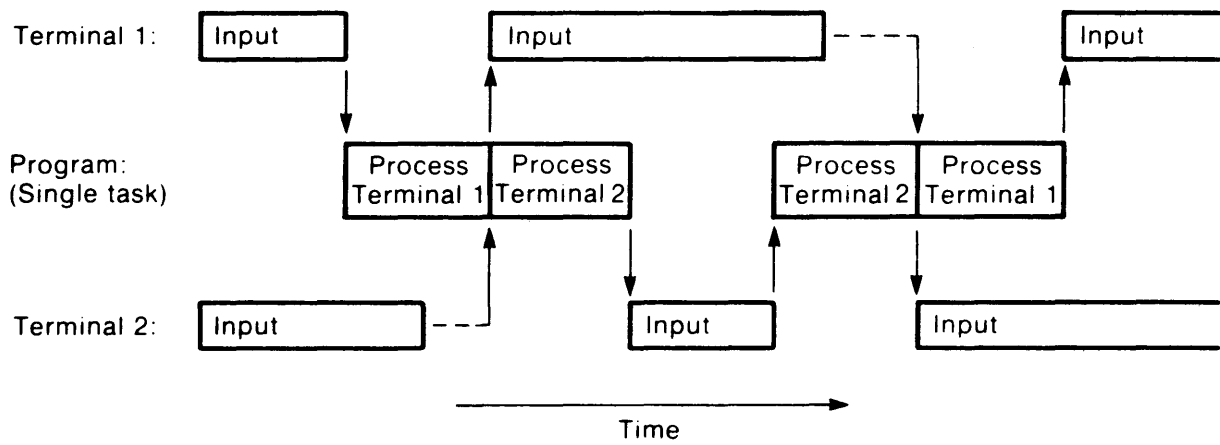


SHARING THE IDS: THE ATTENTION FUNCTION



EVENT-DRIVEN PROCESSING

No-wait Input/Output: An Example

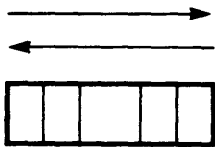


SCHEDULING

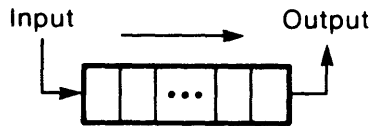
- Priority scheduling on a task-by-task basis
- Programmable control:
 - Task priorities
 - Time quanta
 - Round-robin within priority levels
 - Priority degradation

FILE ORGANIZATIONS

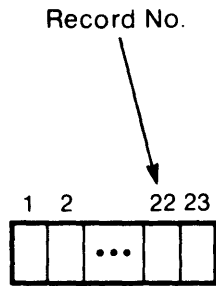
Sequential



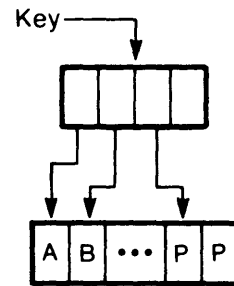
Memory



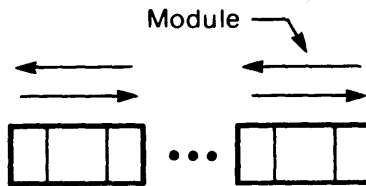
Relative



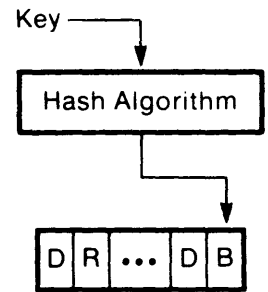
Keyed Sequential



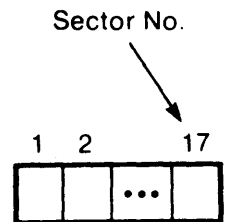
Library



Direct

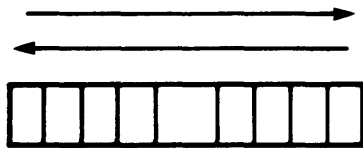


Primitive

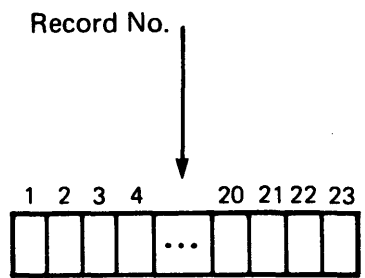


IMAGE/300 ACCESS METHODS

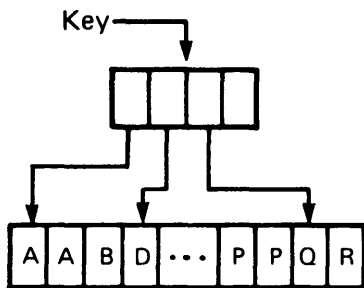
Serial Access



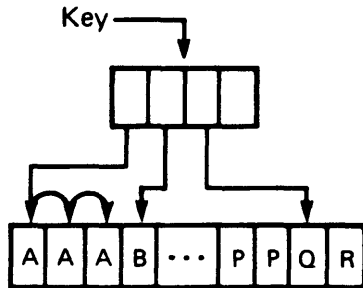
Directed Access



Calculated Access

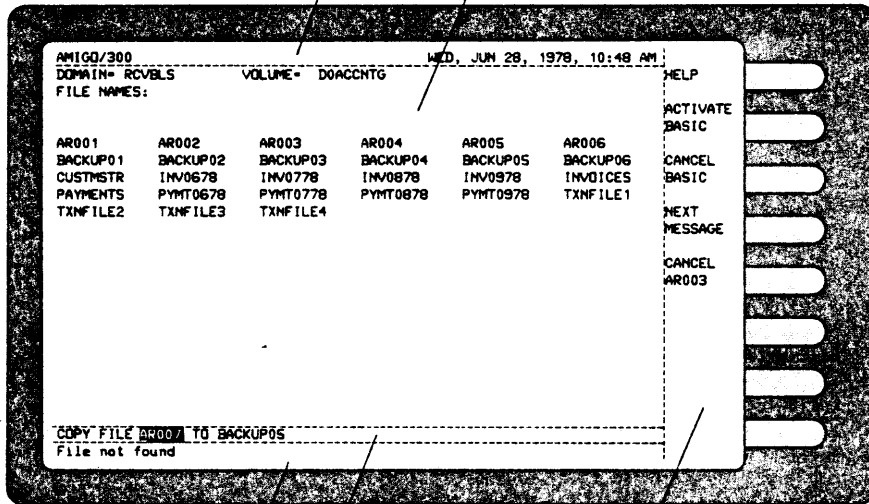


Chained Access



The ENVIRONMENT window tells you the date, time, and the part of the HP300 system you're talking to.

The DISPLAY window is used to display general data like this list of files.



The ERROR window reports errors to you.

The SOFTKEY LABEL window tells you the function of each softkey.

Commands are entered into COMMAND window.

```

AMIGO/300                                MED. JUN 26, 1978, 10:54 AM HOW TO
-----
CREATE FILE                               USE HELP
Initiates a display dialogue to
obtain the attributes required to
create a file of the specified file
structure. A physical filename is
specified.

Syntax:  CREATE filestructure FILE name

To create files in domains other than
the current domain, filename
qualifiers are required. Refer to FILENAME
for details.

Environment:  Amigo/300
Reference:    Operating System Reference

-----
CREATE SEQUENTIAL FILE                     SHOW
                                           INDEX
                                           FOR...

                                           EXIT
                                           HELP

                                           SAVE
                                           ****
                                           THIS

```

```

AMIGO/300                                MED. JUN 26, 1978, 10:54 AM HOW TO
-----
COPY A MODULE TO A FILE, HOW TO           USE HELP
COPY A PROGRAM OR DOCUMENT WORKSPACE, HOW TO
COPY A WORKSPACE TO A FLEXIBLE DISC, HOW TO
COPY A WORKSPACE, HOW TO
COPY COMMAND
COPY KEY
COPY SOURCE CODE TO A FILE, HOW TO
COPY THE SYSTEM DISC VOLUME TO FLEXIBLE DISCS, HOW TO
CPU
CREATE A DATABASE, HOW TO
CREATE A FILE, HOW TO
CREATE A PRIVATE DOMAIN, HOW TO
CREATE A SEGMENT LIBRARY, HOW TO
CREATE A VOLUMELABEL, HOW TO
CREATE COMMAND
CROSS-REFERENCE LISTING OF CALLS, HOW TO DISPLAY
CRT
CTRL KEY
CURRENT DOMAIN
CURRENT INCREMENT, HOW TO DISPLAY
CURSOR
-----
                                           SHOW
                                           INDEX
                                           FOR...

                                           EXIT
                                           HELP

                                           SAVE
                                           ****
                                           THIS

```

```

TYPIST: LETTERS  MODULE FORM2             A.01.01
-----
                                           HELP
                                           SPLIT
                                           SCREEN

Mr. A. J. Leighton, President
Leighton Distributing Company
4476 Rosecranz Blvd.
Santa Clara, CA 57692

Dear Mr. Leigh

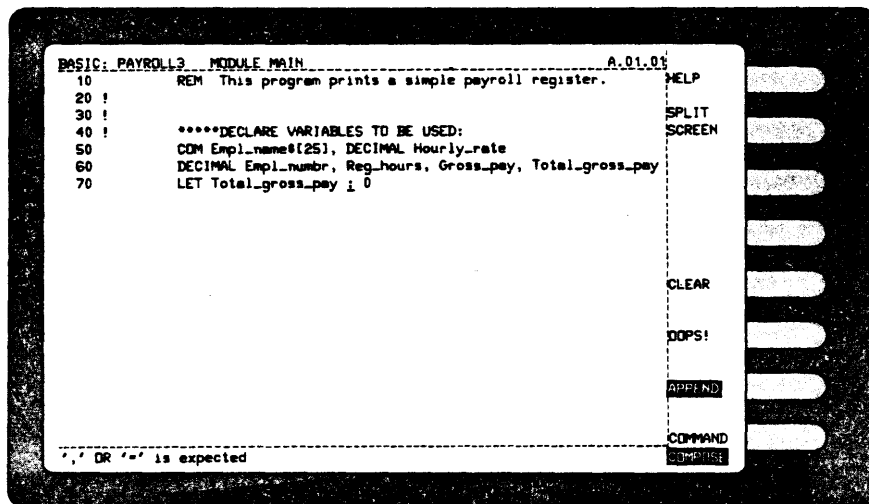
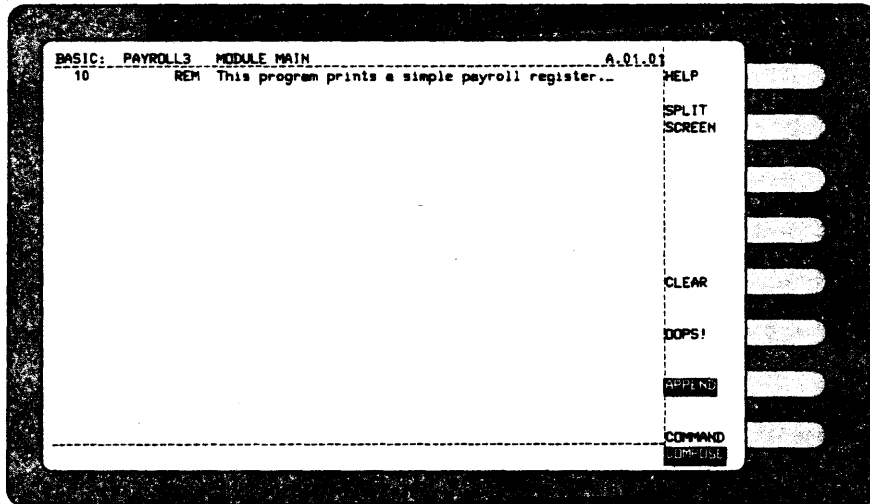
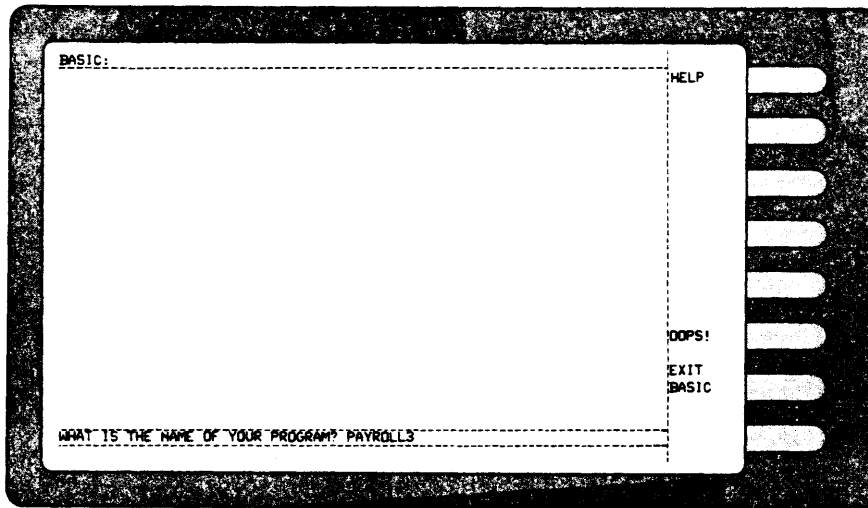
Thank you very much for your recent inquiry about our
Johnson Manufacturing distributor's program. I am enclosing
a brochure that describes the details of the program, and
the benefits to your firm of becoming a Johnson's distributor.
Based on the information you supplied, we can extend your
firm the following credit terms:

* INCLUDE HERE TERMS1, TERMS2, OR TERMS3, AS NEEDED. *

-----
                                           RESEQ
                                           CLEAR
                                           DOPS!
                                           APPEND

                                           COMMAND
                                           COMPOSE

```



```

BASIC: PAYROLL3  MODULE MAIN  A.01.01
10 REM This program prints a simple payroll register.
20 !
30 !
40 ! *****DECLARE VARIABLES TO BE USED:
50 COM Empl_name$(25), DECIMAL Hourly_rate
60 DECIMAL Empl_numbr, Reg_hours, Dt_hour, Gross_pay, Total_g
70 LET Total_gross_pay = 0
80 !
90 ! *****PRINTER OUTPUT FORMATS:
100 Detail: IMAGE 3X,25A,3X,M0DD,6X,M0DD,3X,DD.DD,3X,M0DCDDDD.DD
110 Total: IMAGE //29X,"Total Gross Wages = ",M0DCDDDD.DD
120 !
130 !
140 ! *****OPEN FILES AND PRINT HEADING:
150 ASSIGN #1 TO "TIMECRDS"
160 ON END #1 GOTO End_of_report
170 PRINT " Name Reg Hrs O/T Hrs Ra
180

```

HELP
SPLIT SCREEN
TEST
CLEAR
DOPS!
APPEND
COMMAND
COMPOSE

```

BASIC: PAYROLL3  MODULE MAIN  A.01.01
10 REM This program prints a simple payroll register.
20 !
30 !
40 ! *****DECLARE VARIABLES TO BE USED:
50 COM Empl_name$(25), DECIMAL Hourly_rate
60 DECIMAL Empl_numbr, Reg_hours, Dt_hours, Gross_pay, Total_g
70 LET Total_gross_pay = 0
80 !
90 ! *****PRINTER OUTPUT FORMATS:
100 Detail: IMAGE 3X,25A,3X,M0DD,6X,M0DD,3X,DD.DD,3X,M0DCDDDD.DD
110 Total: IMAGE //29X,"Total Gross Wages = ",M0DCDDDD.DD
120 !
130 !
140 ! *****OPEN FILES AND PRINT HEADING:
150 ASSIGN #1 TO "TIMECRDS"
151 -
160 ON END #1 GOTO End_of_report
170 PRINT " Name Reg Hrs O/T Hrs Ra

```

HELP
SPLIT SCREEN
TEST
CLEAR
DOPS!
APPEND
COMMAND
COMPOSE

```

BASIC: PAYROLL3  MODULE MAIN  A.01.01
FORMATS:
,6X,M0DD,3X,DD.DD,3X,M0DCDDDD.DD
ross Wages = ",M0DCDDDD.DD

PRINT HEADING:
DS"
EE"
f_report
Reg Hrs O/T Hrs Rate Gross Pay"-

GET EMPLOYEE INFO, & PRINT REPORT LINE:
, Reg hours, Dt_hours
fo(Empl_numbr, #2)
rs = 1.5*Dt_hours) * Hourly_rate
tel_gross_pay + Gross_pay

```

HELP
SPLIT SCREEN
TEST
CLEAR
DOPS!
APPEND
COMMAND
COMPOSE

```

BASIC: PAYROLL3  MODULE MAIN                                A.01.01
10 REM This program prints a simple payroll register.      HELP
20 !
30 !
40 ! *****DECLARE VARIABLES TO BE USED:                SINGLE
50 COM Empl_name$(25), DECIMAL Hourly_rate                SCREEN
60 DECIMAL Empl_numbr, Reg_hours, Ot_hour Gross_pay, Total_g SCROLL
70 LET Total_gross_pay = 0                                LOWER
80 ! Total_gross_pay = Total_gross_pay + Gross_pay
90 ! *****PRINTER OUTPUT FORMATS:
100 Detail: IMAGE 3X,25A,3X,M0DD,6X,M0DD,3X,DD,DD,3X,M0DCDDDD,DD TEST
110 Total:  IMAGE //29X,Total Gross Wages = .,M0DCDDDD,DD
320 SUB Get_employee_info(DECIMAL Empl_number, #2)
330 ! *****THIS SUBPROGRAM READS THE INDEXED EMPLOYEE FILE &
340 ! PASSES THE EMPLOYEE'S NAME & RATE BACK THROUGH COMMON CLEAR
350 COM Empl_name$(25), DECIMAL Hourly_rate
360 DIM Addr1$(30), Addr2$(30)                             OOPS!
370 READ #2, Empl_nr; Empl_name$, Addr1$, Addr2$, Hourly_rate EXIT
380 SUBEND                                                  BASIC

```

```

BASIC: PAYROLL3  MODULE MAIN                                A.01.01
180 !
190 !
200 ! *****READ TIMECARD, GET EMPLOYEE INFO, & PRINT REPORT LINESPLIT
210 Do next_employee:                                     SCREEN
220 READ #1; Empl_number, Reg_hours, Ot_hours
230 CALL Get_employee_info(Empl_number, #2)              SCROLL
240 Gross_pay = (Reg_hours + 1.5*Ot_hours) * Hourly_rate LOWER
250 Total_gross_pay = Total_gross_pay + Gross_pay
260 GOTO Do_the_next_employee
270 !
280 !
290 End_of_report:
300 PRINT USING Total; Total_gross_pay                    CLEAR
310 END
320 SUB Get_employee_info(DECIMAL Empl_number, #2)
330 ! *****THIS SUBPROGRAM READS THE INDEXED EMPLOYEE FILE &
340 ! PASSES THE EMPLOYEE'S NAME & RATE BACK THROUGH COMMON OOPS!
350 COM Empl_name$(25), DECIMAL Hourly_rate              EXIT
360 DIM Addr1$(30), Addr2$(30)                             BASIC
370 READ #2, Empl_nr; Empl_name$, Addr1$, Addr2$, Hourly_rate
380 SUBEND
FIND "Gross_pay" IN LINES 200-310

```

```

BASIC: PAYROLL3  MODULE MAIN                                A.01.01
10 REM This program prints a simple payroll register.      HELP
20 !
30 !
40 ! *****DECLARE VARIABLES TO BE USED:                SPLIT
50 COM Empl_name$(25), DECIMAL Hourly_rate                SCREEN
60 DECIMAL Empl_numbr, Reg_hours, Ot_hours, Gross_pay, Total_g
70 LET Total_gross_pay = 0
80 !
90 ! *****PRINTER OUTPUT FORMATS:
100 Detail: IMAGE 3X,25A,3X,M0DD,6X,M0DD,3X,DD,DD,3X,M0DCDDDD,DD TEST
110 Total:  IMAGE //29X,Total Gross Wages = .,M0DCDDDD,DD
120 !
130 !
140 ! *****OPEN FILES AND PRINT HEADING:
150 ASSIGN #1 TO TIMECRDS
151 ASSIGN #2 TO "EMPLOYEE"                                OOPS!
160 ON END #1 GOTO End_of_report
170 PRINT Name Reg Hrs O/T Hrs ReEXIT
180 !
190 !
200 ! *****READ TIMECARD, GET EMPLOYEE INFO, & PRINT REPORT LINE
210 Do_next_employee:                                     COMMAND

```

```

BASIC: PAYROLL3  MODULE MAIN                                A.01.01
ERROR IN LINE 260 OF MODULE MAIN
Label Do_the_next_emp is not in this program unit

270 !
280 !
290 End_of_report:
300     PRINT USING Total; Total_gross_pay
310     END
320     SUB Get_employee_info(DECIMAL Empl_number, #2)
330 !     *****THIS SUBPROGRAM READS THE INDEXED EMPLOYEE FILE &
180 !
190 !
200 !     *****READ TIMECARD, GET EMPLOYEE INFO, & PRINT REPORT LINE
210 Do_next_employee:
220     READ #1; Empl_number, Reg_hours, Dt_hours
230     CALL Get_employee_info(Empl_number, #1)
240     Gross_pay = (Reg_hours * 1.5 * Dt_hours) * Hourly_rate
250     Total_gross_pay = Total_gross_pay + Gross_pay
260     GOTO Do_the_next_employee_
270 !     *****READ TIMECARD, GET EMPLOYEE INFO, & PRINT REPORT LINE
280 !

```

HELP
SINGLE SCREEN
SCROLL UPPER
NEXT ERROR
CLEAR
DOPS!
APPEND
COMMAND
COMPOSE

```

BASIC: PAYROLL3  MODULE MAIN                                A.01.01
10     REM This program prints a simple payroll register.
20 !
30 !
40 !     *****DECLARE VARIABLES TO BE USED:
50     DIM Empl_name$(25), DECIMAL Hourly_rate
60     DECIMAL Empl_number, Reg_hours, Dt_hours, Gross_pay, Total_
70     LET Total_gross_pay = 0
80 !
90 !     *****PRINTER OUTPUT FORMATS:
100 Detail: IMAGE 3X,25A,3X,MDDD,6X,MDDD,3X,DD.DD,3X,MDDCDDD.DD
110 Total:   IMAGE //29X,"Total Gross Wges = ",MDDCDDD.DD
120 !
130 !
140 !     *****OPEN FILES AND PRINT HEADING:
150     ASSIGN #1 TO "TIMECRDS"
151     ASSIGN #2 TO "EMPLOYEE"
160     ON END #1 GOTO End_of_report
170     PRINT "      Name                Reg Hrs   O/T Hrs   Ra
180 !
190 !
200 !     *****READ TIMECARD, GET EMPLOYEE INFO, & PRINT REPORT LINE
210 Do_next_employee:
COMPIATION IN PROGRESS

```

HELP
SPLIT SCREEN
TEST
CLEAR
DOPS!
BASIC
COMPOSE

```

BASIC: PAYROLL3  MODULE MAIN                                A.01.01
ERROR IN LINE 260 OF MODULE MAIN
Label Do_the_next_emp is not in this program unit

270 !
280 !
290 End_of_report:
300     PRINT USING Total; Total_gross_pay
310     END
320     SUB Get_employee_info(DECIMAL Empl_number, #2)
330 !     *****THIS SUBPROGRAM READS THE INDEXED EMPLOYEE FILE &
180 !
190 !
200 !     *****READ TIMECARD, GET EMPLOYEE INFO, & PRINT REPORT LINE
210 Do_next_employee:
220     READ #1; Empl_number, Reg_hours, Dt_hours
230     CALL Get_employee_info(Empl_number, #1)
240     Gross_pay = (Reg_hours * 1.5 * Dt_hours) * Hourly_rate
250     Total_gross_pay = Total_gross_pay + Gross_pay
260     GOTO Do_the_next_employee_
270 !     *****READ TIMECARD, GET EMPLOYEE INFO, & PRINT REPORT LINE
280 !

```

HELP
SINGLE SCREEN
SCROLL UPPER
NEXT ERROR
CLEAR
DOPS!
APPEND
COMMAND
COMPOSE

RPG: MAILIST MODULE MAIN FORM TYPE : J A.01.01

4*									
10H				S					
12*									
20INPUT	IPE	F	10		CONSOLE				
25CUSTOMERIC	F		128R	GAI	2				
30OUTPUT	O	F	80		OF	PRINTER			
35*									
40INPUT	NS	01	1	C1					
45I					1	1	RID		
50I					2	7	NUM		
60CUSTOMERNS	02		1	NC					
70I					2	70	CNUM		
80I					8	27	CNAME		
90I					28	47	CADDR1		
100I					48	67	CADDR2		
110I					68	87	CADDR3		
120I					88	97	CPHONE		

SEQ # FORM PACKED/BIN FROM POS TO POS DEC POS FIELD NAME CONTROL LEV

50 J 1 10 128R GAI 2 1 1 2 70 CNUM

MTCH/CHN FLD CODE FIELD REC REL PLUS IND MINUS IND ZERO/BLK IND COMM

HELP
SELECT LINE
COMPACT
TEST
CLEAR
DELETE
APPEND
END

RPG: MAILIST MODULE MAIN A.01.01

4*									
10H				S					
12*									
20INPUT	IPE	F	10		CONSOLE				
25CUSTOMERIC	F		128R	GAI	2				
30OUTPUT	O	F	80		OF	PRINTER			
35*									
40INPUT	NS	01	1	C1					
45I					1	1	RID		
50I					2	7	NUMBER		
60CUSTOMERNS	02		1	NC					
70I					2	70	CNUM		
80I					8	27	CNAME		
90I					28	47	CADDR1		
100I					48	67	CADDR2		
110I					68	87	CADDR3		
120I					88	97	CPHONE		

CHANGE "INVT." TO "NUMBERS" IN LINES 20-30

HELP
SPLIT SCREEN
TEST
CLEAR
OOPS!
EXIT
RPG
EDIT

RPG: MAILIST MODULE MAIN FORM TYPE : J A.01.01

ERROR IN LINE 40 OF MODULE MAIN
File name not defined. All specification lines for file ignored.

45I					1	1	RID		
50I					2	7	NUMBER		
60CUSTOMERNS	02		1	NC					
70I					2	70	CNUM		
80I					8	27	CNAME		
90I					28	47	CADDR1		

4*									
10H				S1					
20NUMBERS	IPE	F	10		CONSOLE				
25CUSTOMERIC	F		128R	GAI	2				
30OUTPUT	O	F	80		OF	PRINTER			
35*									
40INPUT	NS	01	1	C1					
45I					1	1	RID		
50I					2	7	NUMBER		

SEQ # FORM FILENAME AND/OR SEQUENCE NUMBER OPTION REC ID IND

40 1 INPUT 10 128R GAI 2 1 1 2 70

POS NOT C/Z/D CHAR POS NOT C/Z/D CHAR POS NOT C/Z/D CHAR CGAR COMM

HELP
SCROLL UPPER
COMPACT EXPAND
CLEAR
BYPASS
QUIT

WELCOME TO THE MULTITERMINAL INTERACTIVE DATA SUBSYSTEM

01-01/19/78

You will be prompted for names of the terminals to be activated. You may:

1. Enter a terminal name (CONSOLE for the system console) and the dialogue will continue, or
2. Type DONE to terminate the dialogue, or,
3. Suspend the dialogue by not answering the prompt.

Terminal name?

TERM1_

INVOICE PRINT & EDIT MENU

Select a softkey to display, edit, or print invoice information ----->

(If you are printing invoices, enter the starting invoice number here:)

INVOICE FILE STATUS	
Total invoices on file	579
Number ready to print	342
Amount ready to print	\$51,975.57
Number overdue	21

Display Invoices ----->

Edit Invoices ----->

Invoice Summary Statistics ---->

Print All Invoices ----->

Print Selected Invoices ----->

Return to Main Menu ----->

Customer Data Inquiry ----- 6/28/78 1:48 PM

Enter Customer Number here:

Name & Address Markham Distributing Co.
4395 Merrimack Way
Ft. Compton MD 95748

Phone: (497) 345-5674

Contact: Mr. J. K. Ellis

Class.: 8E Tax rate: 4.5%

Salesman: H. Johnson

Discount: 5.5%

**** FOR DETAILED INFO. ABOUT THIS CUSTOMER, SELECT A SOFTKEY ****

SHIPMENT STATUS

Order #	Date	Status	Comments
0473873	05/31/77	Shipped 06/14/78	
0497382	06/12/78	BACKORDERED	Awaiting 2037A Flanges
0499345	06/16/78	Awaiting Shipment	Do not ship before 7/15
0529473	06/25/78	Shipped 06/27/78	
0530384	06/19/78		

CREDIT SUMMARY

CREDIT STATUS

PAYMENT HISTORY

ORDER STATUS

ORDER HISTORY

SHIPMENT STATUS

PRINT

RETURN TO MENU

LOADING DOCK STATUS
(Last change: 2:59 PM)

DOCK NR	STATUS	START TIME	EST. STOP TIME	TRUCK-ID
J1	Loading	2:01P	3:00P	JMF0314792
J2	Loading	2:30P	4:00P	IFH2494
J3	Unloading	1:47P	2:45P	JMF0942791
J4	FREE			
M1	Loading	2:00P	2:45P	BDH0213946
M2	CLOSED			
M3	CLOSED			
R7	FREE			
R8	On Break	2:30P	4:00P	JL0732
R9	Loading	2:39P	3:15P	BDH3490271

DISPATCH

Enter Inquiry # for window below:

DETAIL INQUIRY FOR DOCK #: M1

<u>Truck-ID</u>	Due to Start:	1:45P
BDH0213946	Actual	2:00P
	Load Time:	0:45
	Due to Depart:	2:30P
	Est'd Depart:	2:45P

<u>Packing List #</u>	<u>Ship-to-Customer #</u>
3459638J	345863

<u>Next Operation</u>	<u>Next Truck-ID</u>
Unload	JMF0934862