



# **An Interactive Console Operating as Background in a Large Computer System**

**S. SCHLESINGER,  
L. SASHKIN, and C. AUMANN**

*Aerospace Corporation, San Bernardino, California*

In order to fill the gap between small desktop calculators and conventional computer programming, an interactive console system has been developed to permit engineers and mathematicians to solve small scale problems with a simple algebra-like language, EASY (Elementary Algebraic Solutions for You). In order to achieve effective operation at low cost, the consoles (IBM 2260) are supported as a low level background function on an IBM 360 Model 40 computer Attached Support Processor (ASP), which is simultaneously supplying data processing capability to support multiple printers, plotters, card readers and punches, auxiliary storage devices, and the monitoring and job scheduling for an attached IBM 360 Model 65 computer (Fig. 1).

The program which interprets the EASY language resides in the auxiliary memory of the Model 40 system. It is brought into the high speed core memory only when needed for the support of console use. A console operator calls on this support by entering the word EASY on the keyboard of the 2260 console. If it is not in core memory, the EASY Dynamic Support Program (DSP) is transferred from disk to core memory by the resident console monitor and activated to service the user console. Subsequent EASY expressions and control statements are transmitted to the EASY interpretation program for scanning, evaluation, and the generation of a response which is then displayed on the cathode ray tube of the 2260 console. The allocation of core memory within the IBM 360 Model 40 ASP system is shown in Fig. 2.

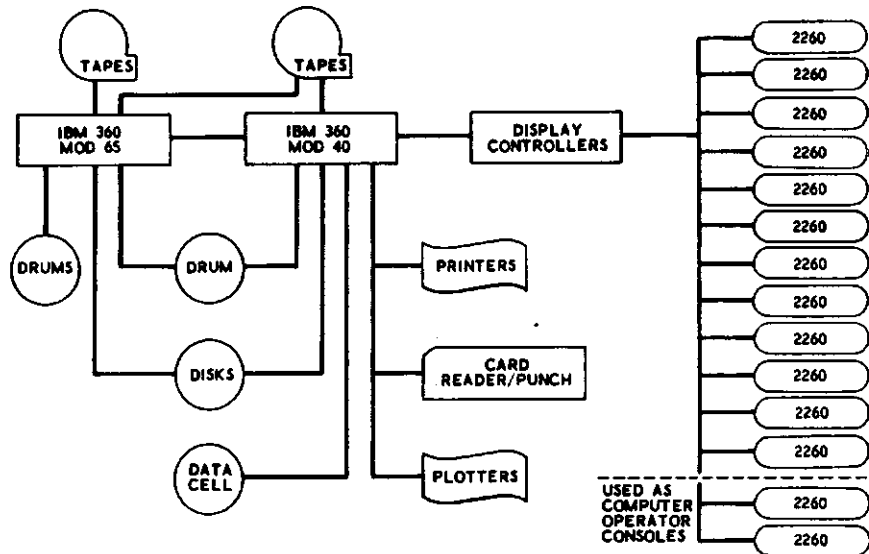


FIG. 1. IBM 360 65/40 ASP system configuration.

The language of EASY includes most of the convenient formula representation features of FORTRAN with enough logic to permit extensive iteration of operations and input/output statements which are appropriate to the 2260 console. A program can consist of up to 36 numbered expressions involving all of the 26 single letter variables named A through Z. Six elementary

OS 360	RESIDENT SYSTEMS
RESIDENT ASP MODULES	
RESIDENT CONSOLE MONITOR	
PRINT	DYNAMIC SUPPORT PROGRAM MODULES AND SUPPORTING DATA TANKS
PLOT	
MAIN SERVICE (94 or 360)	
EASY	
EASY DATA TANK (console 1)	
EASY DATA TANK (console 2)	
EASY DATA TANK (console 3)	
PRINT BUFFERS	"BUFFERS"
PLOT BUFFERS	
I/O BUFFERS	
MAIN SERVICE BUFFERS	

FIG. 2. IBM 360 Model 40 core layout.

functions may be referenced by their common three-letter abbreviations. Conditional and unconditional branching as well as repetitive control instructions with automatic parameter variation can be included in a program. Provision is also made for the definition of functions of one or two variables which can then be referenced in the context of EASY statements as function operators. Data ENTER and DISPLAY commands and a HALT instruction complete the repertoire of the EASY program instructions. In addition, control commands are available for viewing, changing, and deleting instructions, and for initiating an automatic program execution mode. An EASY program which exemplifies the evaluation of a function with automatic parameter variation is shown in Table I.

TABLE I

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01 ENTER A B C
02 DISPLAY A B C
03 EXECUTE TO 08 X = .1, .5, 1, 1.5, 2
04 IF (X > C) GO TO 07
05 Y = A * X + B * LOG (X + C)
06 GO TO 08
07 Y = A * X + B * LOG (X - C)
08 DISPLAY X Y
09 HALT

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The program is executed in several seconds by the EASY system and the answers are displayed (as they are evaluated) on the cathode ray tube of the 2260 console. Up to nine lines of output data, with four quantities per line, can be displayed before filling the display screen. If this occurs before the computation reaches a logical termination, the processing is interrupted and the user can review those data which are displayed before indicating that he wishes the computation to continue. The results of the example based upon input values of  $A = 1.5$ ,  $B = 2$ , and  $C = 1$  would be displayed as shown in Table II.

TABLE II

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$A = .15000000$	01	$B = .20000000$	01	$C = .10000000$	01
$X = .10000000$	00	$Y = .34062039$	00		
$X = .50000000$	00	$Y = .15609302$	01		
$X = .10000000$	01	$Y = .28862944$	01		
$X = .15000000$	01	$Y = .86370564$	00		
$X = .20000000$	01	$Y = .30000000$	01		

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The present EASY data and program storage areas are occasionally checkpointed to magnetic disk memory in order to enable automatic restoration of the information in the event of a major system failure. Future development will integrate EASY into a multiprogramming environment on the IBM 360 Model 65.

#### REFERENCE

- SCHLESINGER, S., SASHKIN, L., and AUMANN, C., An Interactive Console Operating as Background in a Large Computer System, Aerospace Rept. No. ATR-68(S8111)-1, August 1967.