Vital IV SCENE DIGITIZER

The VITAL Scene Digitizer is an exclusive, optional feature which allows the user to more simply program a VITAL visual simulation system for any training scene required. As routes or missions change, the VITAL Scene Digitizer provides the capability to model training scenes for these changes more rapidly.

The basic VITAL IV visual simulation system is self-contained in that it includes provisions for generating new data bases that represent airports or military training scenes (Refer to page 4 for scene modeling description). This may be accomplished by the simulator technician using the peripheral equipment supplied with the system. Creation of the source program portion of data base generation may be accomplished when the visual system is in operation. Assembly of the source program must be done when the visual is not in use.

Figure 1. Valerie Stewart, computer programmer at McDonnell Douglas Electronics Company, programming a visual scene using the Scene Digitizer.

The VITAL Scene Digitizer option is offered as a means of simplifying the generation of new airport or military training scenes. This option applies a magnetically sensitive, 36" x 48" X-Y digitizing tablet with which map data is converted directly into digital format as illustrated in Figure 1. By using the digitizing tablet, along with a stored library of commonly-used scene elements, the tedium and errors of manual map coordinate measuring and tabulating are eliminated. Map data is translated directly into source format on the disk storage system with accuracy of 1/100 of an inch. A complete, new data base may be subsequently assembled from this source data. The printer/plotter then provides a hard copy listing (Figure 2) and plan views (Figure 3) of the digitized scene at a scale of from 30 to 30,000 feet per inch. The Scene Digitizer thus reduces the total time required for an initial data transfer into digital form from several weeks to several days. The time required to then complete the scene checkout varies with individual user preferences and subjective assessments involved.

Additional software has been developed specifically for the VITAL Scene Digitizer. It operates in the V-76 computer which is part of the basic VITAL IV system and includes the following:

a. Tablet Input (ENVG). Generates a source record in Environment Assembler format using inputs from the tablet.

b. Subscene Library Files. Consists of the source input statements for commonly used scene elements. Items included are standard approach lighting systems, various runway marking systems, numerals, stars, moon, etc.

c. Source Preparation (PREP). An On-line background program which permits creation, deletion, and joining of source records from the disk or Operator Console while the visual is in use for training.

d. Source File Merge (MERG). An On-line background program which permits selection, translation, rotation and rescaling of the Subscene Library Files, and merging of these files with the Tablet (or keyboard) generated source file(s) in the correct color sequence.

e. MDEC Source Editor (EDIT). An Off-line program to insert, merge, delete, modify, etc., source records. May be used to generate a source listing.

f. MDEC Environment Assembler (EASY). Converts the source records to the object format required by VITAL, and provides a hard copy listing.

g. Source List (LIST). An On-line background program used to generate a hard copy of the final listing at the Operator Console or printer.

h. Environment Plot (PLOT). Used to generate a plan view plot of the environment at scales from 10 thru 32,767 feet per inch.

All of these software elements reside in the VITAL disk storage system.

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ENV ASM 1.3 HOMESTEAD AFB. (WDO1LO27) F-4E          6FE0200    PAGE 1
#2      ***                   PRIMARY RUNWAY IS 5/23.
#3      ****          THE ORIGIN IS LOCATED AT RUNWAY 5.  WITH APPROACHES AT
#4      ****          BOTH ENDS.   THE TYPE OF APPROACH LIGHTING USED ON
#5      ****          THE MAIN RUNWAY IS THE ALSF-1 STANDARD AND THE TYPE
#6      ****          OF APPROACH USED ON RUNWAY 23 IS THE SALS APPROACH
#7      *
#8      $VITAL IV
#9      $MIX
#10     $ADDRESS 040000
#11     * ENVIRONMENT IDENTIFIER
#12     $DATA 0310
  040000  000310
#13     * SCALE FACTOR
#14     $DATA 0
  040001  000000
#15     * ENVIRONMENT HEADING          53'
#16     $DATA 022660
  040002  022660
#17     * RUNWAY HEADING           53'
#18     $DATA 022660
  040003  022660
#19     * RUNWAY FRONTCOURSE GLIDESCOPE ANGLE       2.5'
#20     $DATA 002625
  040004  002625
#21     * RUNWAY BACKCOURSE GLIDESCOPE ANGLE
#22     $DATA 002625
  040005  002625
#23     * LATITUDE OF LOCALIZER STATION        25' 29' N
#24     $DATA 011037,006254
  040006  011037  006254
#25     * LONGTITUDE OF LOCALIZER STATION      80' 23' W
#26     $DATA 0143326,052540
  040010  143326  052540
#27     * REFERENCE STATION TO THRESHOLD DISTANCE
#28     $DATA 0
  040012  000000
#29     * REFERENCE STATION   ELEVATION ABOVE SEA LEVEL      7FT.
#30     $DATA 007
```

Figure 2. Hard Copy Listing Example

OVERALL SCENE
SCALE 1" = 20,000'

AIRPORT COMPLEX
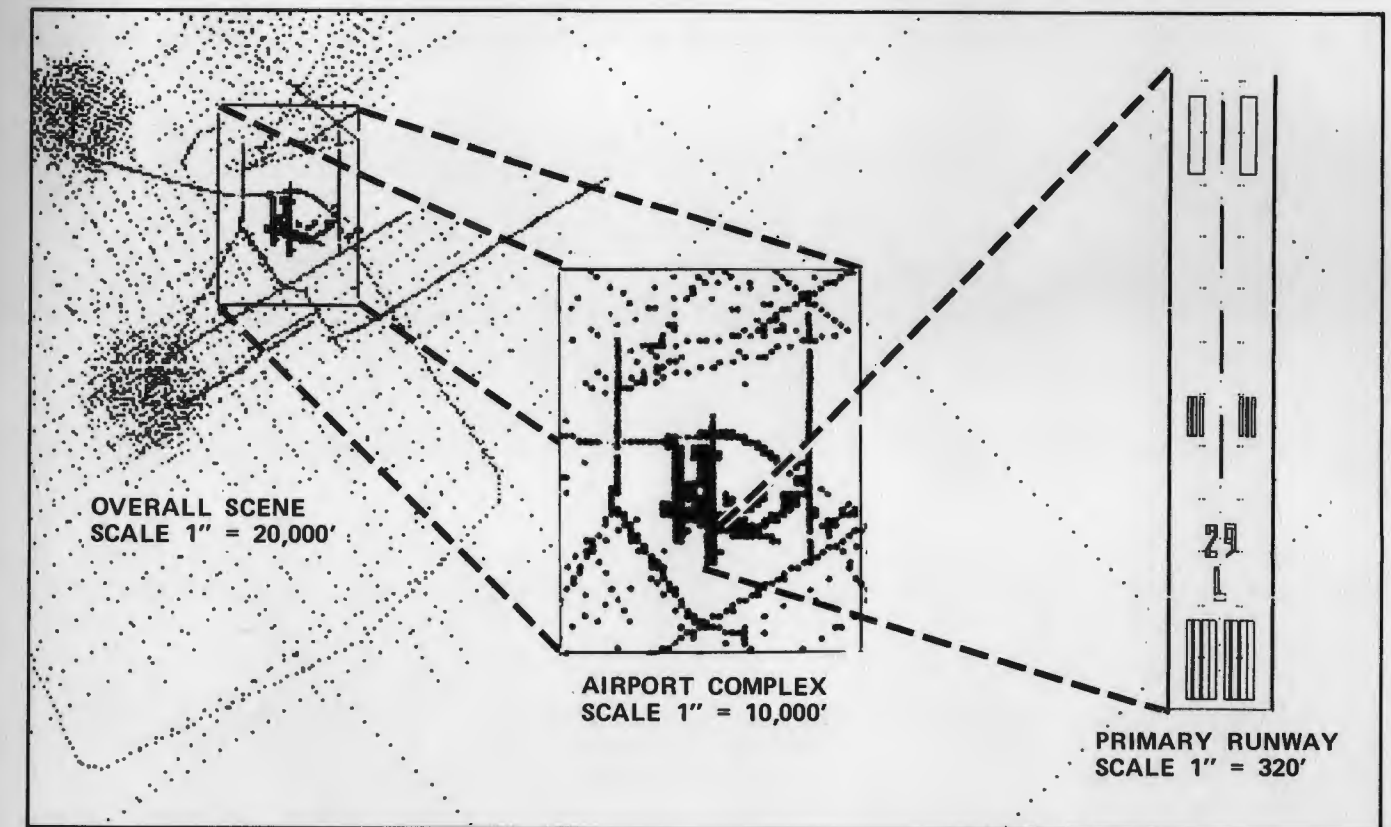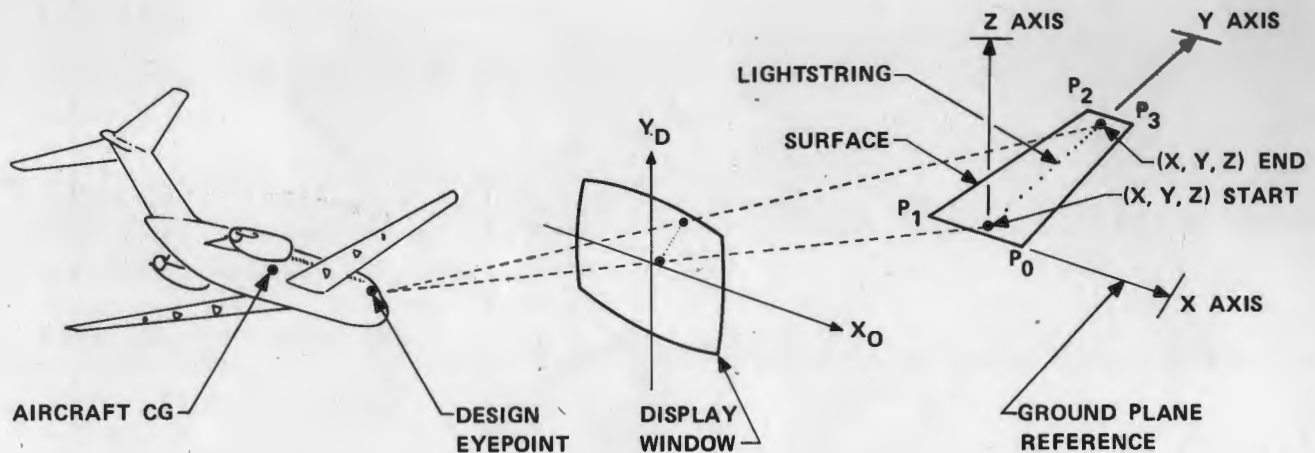SCALE 1" = 10,000'

PRIMARY RUNWAY
SCALE 1" = 320'

Figure 3. Plan View Plots

The VITAL Scene Digitizer may be added to any VITAL IV system in either of two configurations: off-line or on-line. Each option package is complete and comprehensive.

a. Off-Line VITAL Scene Digitizer. The Off-line Digitizer uses the standard VITAL V-76 memory configuration. It can be used for map digitizing any time the VITAL IV is not in use for pilot training. It is designed to create MDEC Environment Assembler source input data (a user oriented language) and to operate with the V-76 general purpose computer.

It includes:

o Digitizer Tablet

o Printer/Plotter

o Digitizer Software

o Documentation

o Operator Training

b. On-Line VITAL Scene Digitizer. The On-line Digitizer is similar except that it is configured for the digitizing process to take place in a background mode while the VITAL IV is in use for pilot training. This is achieved by adding the following to the Off-line package:

o 32K words of memory to the standard V-76 memory

o V-76 memory mapping

o Two additional disk drives, making a system total of four

The optional equipment may be selected either as part of the purchase of a new VITAL IV system or may be added later.

SCENE MODELING

Diagram labels: AIRCRAFT CG, DESIGN EYEPOINT, DISPLAY WINDOW, Y_D, X_O, Z AXIS, Y AXIS, X AXIS, LIGHTSTRING, SURFACE, P_2, P_3, P_1, P_0, (X, Y, Z) END, (X, Y, Z) START, GROUND PLANE REFERENCE

VITAL IV scenes are formed from a combination of lightpoints and surfaces. These two basic scene elements are used to represent features such as runways/taxiways, terrain, terminal buildings, vehicles, airport lights, beacons and city lights. Each visual scene is made up of data which defines in three dimensions the location of the lightpoints and surface vertex (corners) in relation to a known point of reference. For example, in an airport scene, if we define the point of reference as being the center of the runway at the threshold, then the location of all other surfaces and lightpoints in the scene can be determined by simply calculating their distance and elevation from this point of reference. In order to store this in a manner suitable for high speed digital processing, their locations in relation to the reference point are defined in a three dimensional X, Y, Z coordinate system. In addition to defining locations, other descriptors for color, intensity, directionality, etc., must be encoded.

Creating new scenes then, requires assimilating the source data (airport maps, city maps, engineering drawings, photos, etc.) by scaling and tabulating coordinate data for input into the VITAL system. Once tabulated by the individual generating the new scene, it is typed into the VITAL system; the system then assembles the numerical data into a form it can use. The completed data base is then transferred to magnetic disk for permanent storage.

The basic VITAL IV visual simulation system includes all the hardware and software required to accomplish this manual approach to scene generation. The VITAL Scene Digitizer is available as a VITAL system option to expedite and simplify generation of new visual scenes.

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