TAG YOUR TARGETS!

Twenty months ago in a staff report on alpha-numeric data display, we described some of the problems in bringing it to reality and posed the controller's question—"how soon can we get it?" Perhaps sooner than many people thought, it's here. This March, installation begins at Atlanta Tower for a system which opens the door to smoother ATC.

by Jay Rabb, Chief, Data Processing Branch, FAA

WHO IS WHERE? The accurate identity and location — in three dimensions — of each aircraft under his jurisdiction is the basic information every controller needs to provide effective and efficient control. A new electronic system, known as Advanced Radar Traffic Control System (ARTS), will provide this essential information. The initial installation, scheduled for the Atlanta Terminal area, will serve as a field trial facility to gain the necessary factual information for future operational models.

The new system has been designed and purchased by the Federal Aviation Agency's Systems Research and Development Service, and an Agency inter-Service group is now working out details on installation and procedures with representatives from the Southern Region and the Atlanta Tower. Installation and check-out will start in March 1964, with full operation scheduled for July 1964.

ARTS is a radar track-while-scan system that accepts inputs from a single radar-beacon combination (ASR-4 and ATCRBI-3), tracks the video, decodes the beacon, associates alpha-numeric tags (data blocks) with selected video targets on the controller's radar displays, and automatically maintains this association. The following functions and characteristics are incorporated:

- **Video tracking with priority on beacon video** if available: Tracking as used here is defined as the determination of present position of each target in radar coordinates and the predicted position on the next radar scan. Up to 100 selected targets can be simultaneously tracked.
- **Decoding of beacon replies:** The system will decode Mode C to provide altitude and up to 4096 codes in Mode A, if available, to provide identity.
- **Display formating:** An alpha-numeric data block is produced for each tracked target (see Figure 1 for a sample data block). Each block may contain:
  a. Up to 21 characters (3 lines of 7 characters each).
  b. Up to 4 "attention" symbols.
  c. A "leader" to unquestionably associate the block with the correct video.
- **Character generation:** Alpha-numeric characters are generated, mixed with radar video, and displayed in association with the video on the controller's display. Two types of displays and character generators will be used in Atlanta for comparison.
  - An RBDE-5 scan conversion display system with a TV character generator: By this means radar video is displayed with the normal "trails" while the alpha-numerics are inserted on the read side of the scan converter in TV video form, and are smear and flicker free.
  - ASR-4 indicators modified to use a direct view storage tube (DVST): A field modification kit is being produced to replace the CRT in the ASR-4 indicators with a "typotron" DVST. This tube has a bright surface on which video and characters are "stored." It also contains a metal stencil in the tube neck for controlling the electron beam to form the character shapes.
- Bright and flicker free displays: Both the RBDE-5 and modified ASR-4 displays have these characteristics.
- Positive radar hand-off from controller to controller.
- Data block and tracker controls:
  - Tracks and associated data blocks may be "held" in a fixed position on the display or

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figure 1

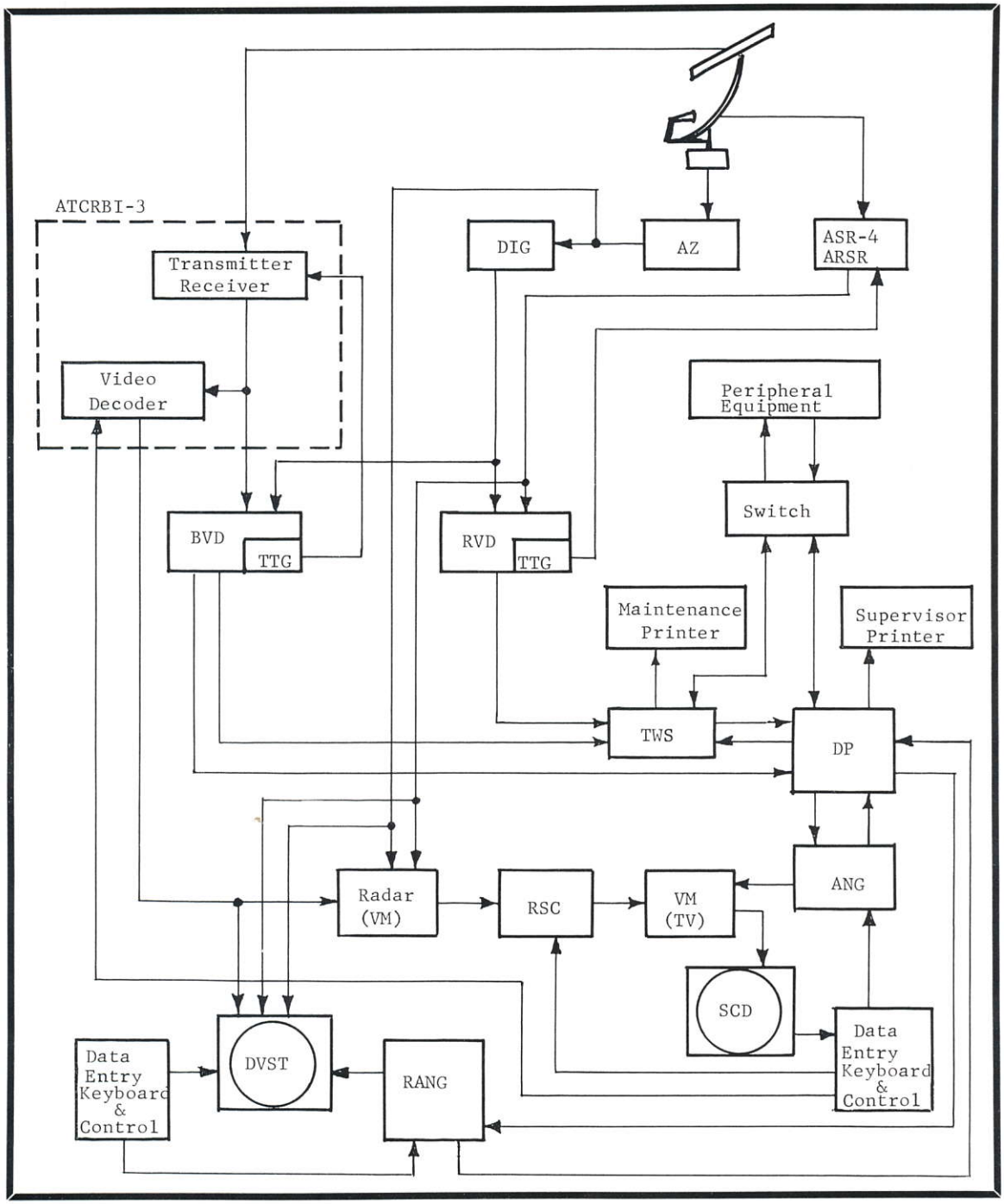
The Alpha-Numeric formats may contain a tracking symbol at the video position, as shown. The shape of the symbol (here a triangle) identifies the console having control of the track. There may also be a leader to associate the symbol with the correct alpha-numeric data block. Two bars may be employed above the data block, with varying configurations such as:

Top bar always solid—attention indicator (manually initiated for unusual situations)
Full dashed lower bar—handoff has been initiated
Solid left half, lower bar—track is in automatic coast mode
Solid right half, lower bar—track is in manually activated coast mode

In the format shown, the top line of the data block (field A) uses seven characters for aircraft identification. The middle data line uses the first four characters (field B) for assigned altitude and control symbol, and the last three (field C) for beacon altitude. Bottom data line uses first three characters (field D) for track number and special symbol to indicate that beacon code does not agree with assigned code, and last four (field E) for reported beacon code.

(note: the scope is for illustration, not necessarily actual scope to be used, and the alpha-numeric format is not to scale)

figure 2—functional element block diagram



IDENTIFICATION OF BLOCK DIAGRAM SYMBOLS

BVD	Beacon Video Digitizer	(Airborne Instruments Laboratory)
RVD	Radar Video Digitizer	(Burroughs Corporation)
TWS	Track-While-Scan Computer	(UNIVAC)
DP	Display Processing Computer	(UNIVAC)
ANG	Alpha-numeric Generator (TV)	(Hazeltine TDC)
DVST	Direct View Storage Tube	(Texas Instruments)
RANG	Alpha-numeric Generator (DVST)	(Texas Instruments)

Note: Displays, 5 SCD; 2 DVST

figure 3—UNIVAC 1218 Computer

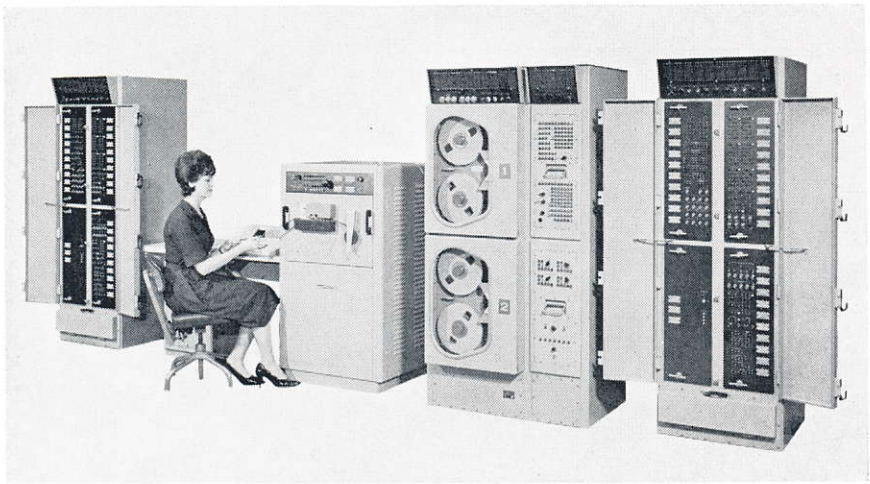
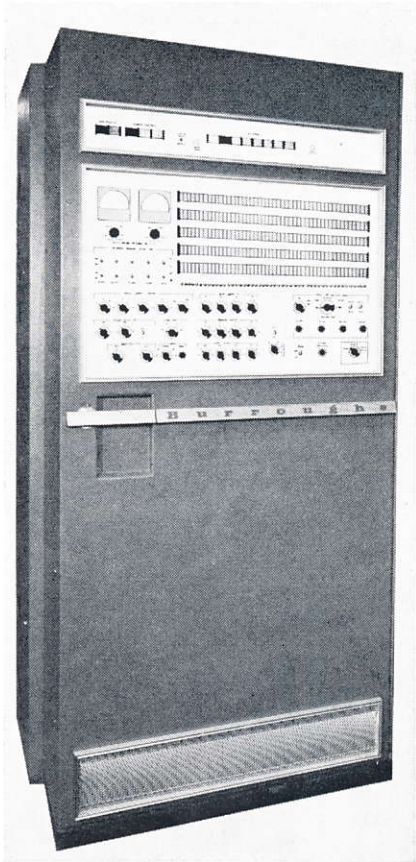


figure 4—Radar Video Digitizer



made to "coast" at the target's last computed rate and direction.

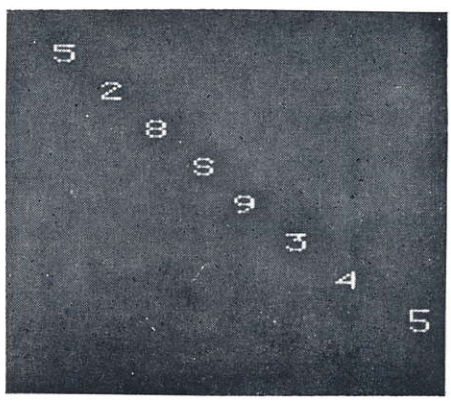
- Data blocks will "coast" automatically and alert the controller if videos from both beacon and radar are lost.
- Each data block can be inserted, altered, or inhibited by field (there are 5 fields in each block; one in the top line and two in each of the lower lines).
- Tracks may be initiated by:
  1. positioning a marker on the video target.
  2. entering the beacon identity code, provided there is only one aircraft assigned that particular code within range of the beacon system.

The track-while-scan computer and the display processor are Univac® 1218 Military Computers. Defense Operations of Univac, St. Paul, will tie all of the hardware elements together to form a system (systems integration and check-out) and will write the computer programs for the two general purpose computers.

The Agency is installing the first system to get field experience with this type of automation. Much design, experimentation, and simulation have preceded this step. Although controllers turned developers have contributed heavily to the system design up to this point, it is now imperative that the user have his say. Therefore, before any more systems of this type are installed, the operating controller is being asked to try it and give his opinions.

ARTS is primarily a terminal system. A similar system for beacon readout only will be installed in the High Altitude Positive Control Facility at the Indianapolis Center. This system called SPAN (Stored Program Alpha-Numeric Beacon System) will be described in a future article.

figure 5—Random characters on RBDE-5 display.



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