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ATS ANALOG TO DIGITAL TRANSCRIBER SYSTEM

OPERATORS MANUAL

by

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INTRODUCTION

The purpose of this paper is to familiarize the reader with the capabilities, limitations, and method of operation of the analog to digital transcriber system. The system is made up of an analog tape recorder, which plays back analog data, the actual transcriber unit, which converts the analog signal into a series of digitized records, a digital tape recorder, which records the digital records on magnetic tape at LO density (200 B. P. I.), and an oscilloscope, which is used to monitor the system.

CAPABILITIES OF THE SYSTEM

The transcriber system can be used to convert both ATS-I and ATS-III analog data into digital data. In addition, the user can digitize whole pictures, as made available on analog tapes, or the user may selectively digitize rectangular areas of a picture defined by line and element numbers. The digitizing process can be initiated or stopped either manually or automatically. Every line, every other line, or every fourth line may be sampled and digitized.

The system allows the user to manually insert coded values for picture sequence number, day, and time into a digital data file via thumb wheel switches.

Incorporated into the system, are a number of aids which make it possible to use relatively bad analog recordings. A small red light called "missed decode" flashes when a line start pattern is missing in the analog data. Should the analog file in use be missing many line start patterns, the line start pulse can be detected and used as the timing reference instead of the line start pattern. Although the line start pulse is not as precise a timing reference as the start pattern, it provides a uniform line start before each line in the

digital file rather than random noise. Due to transcriber design, a "missed decode" results in the first record of each file and thus a documentation of all zero's is written. To enable the operator to witness a picture start, a small yellow light called "frame start" lights when a frame start is reached and remains on for 10 seconds. In addition, the generated line count counter returns to zero. Also available is a frame start override system. After the frame start for the file in use has been found this system may be utilized to prevent noise from triggering the frame start and causing the generated line count to return to zero.

Two counters enable the user to monitor the system. The "Decoded Line Count" counter decodes the line number from the NRZ pulse provided in the analog signal and thereby enables the operator to know exactly which line within the picture frame is being played by the analog recorder. In many cases, particularly in the earlier analog tapes, this line count is missing or inaccurate. To help the user determine which line is being played in such cases, the "Generated Line Count" counter is provided. This counter begins at zero when a frame start is reached and progressively counts upward until a new frame start is found. This count is generated within the counter and when started at the beginning of a frame should be the true line count. A manual frame start button is also provided to enable the user to insert a frame start anywhere in the digitized data and be able to return the "generated line count" counter to zero.

Following each file, an automatic end of file is written on the digital tape whether the system is being operated manually or automatically. Additional end of files may be manually inserted at any point by depressing the "End of File" button provided.

SYSTEM LIMITATIONS

The analog tape recorder is able to play only four tracks of the seven track analog tape. Because of this, only the odd numbered tracks on the analog tapes have data which is accessible to the system. A track 1 setting on the analog recorder track selection switch plays track 1 on the tape, track 2 on the switch plays tape track 3, track 3 on the switch plays tape track 5, and track 4 on the switch plays tape track 7. Since ATS-I has information recorded only on the odd tracks, all information is accessible. In the case of ATS-III color pictures, the analog recording method is different. Tracks 1, 3, and 5 have one picture frame recorded on them simultaneously. Track 1 has the green channel recorded; track 3, the red channel, and track 5, the blue channel of each line of the picture frame. Track 2 is the red channel of another picture, track 4, the green channel, track 6, the blue channel; and track 7 is left blank. Here again only the odd number tracks can be played by the analog recorder, and therefore only the one of the two pictures recorded (1/2 of the data) is accessible.

Due to transcriber design, the element start number must be greater than or equal to 300 and a minimum of 300 elements can be digitized.

Exact comparison of video signals between two separate data files is difficult for two reasons. The analog picture frames may be recorded at different gain settings (ie. relevant gain settings include spacecraft, ground station, analog recorder, playback recorder) and the transcriber unit gain must usually be separately adjusted for each file to insure proper decoding and digitizing. For these reasons video signals digitized on this system (should normally be compared) only within a file.

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The oscilloscope is used only to monitor the system. If the system was perfect, that is, if all analog tapes were recorded without fault and at the same gain settings and if the transcriber unit would be able to automatically adjust to the proper gain and offset settings, there would be no need for the oscilloscope. Since this is not the case, an oscilloscope is needed to set gain and offset and provide a visible image of the video signal to aid the user in monitoring the system.

OPERATION PROCEDURE

1. Turn on the main power switches of the two recorders and the oscilloscope. Allow at least 10 minutes of warming time.
2. Find the appropriate analog tape by looking at the listings in the ATS users catalog. A catalog is provided in the systems room for this purpose.
3. Obtain a blank digital tape and bulk erase it to remove all random noise.
4. Open the door of the analog recorder reel compartment and press the thread enable button.

NOTE: The doors of the two recorders should be kept closed as much as possible to prevent dust from reaching the recorder heads.

5. Thread the recorder as shown in figure 1 putting the silver marker on the tape over the post shown. If no silver marker is on the beginning of the tape go to step 6 otherwise go to step 7. Allow about eight inches of slack on each reel.
6. Place a small piece of the silver tape provided in the room on the tape over the top post as shown in figure 1 and a small piece on the tape reel to signify that the reel has a start mark.

NOTE: This system of marking tapes has only begun to be employed and should be continued to enable the user to find data files more easily.

7. Press the thread enable button.

NOTE: If a distressing noise comes from the recorder, immediately repress the thread enable button and give the reels more slack.

8. Set the footage meter on the analog recorder to zero and close the door.
9. Open the digital recorder reel compartment door and open the small door covering the tape head until it clicks into place.
10. Thread the digital recorder as shown in figure 2.
11. Set the silver start marker on the digital tape approximately at the top of the tape reel and pull the small door further to the left so that it releases and springs closed.
12. Turn the far left switch on the digital recorder to the READ position and press the DRIVE button and allow the tape to drive forward for about 2 seconds, until the silver start marker goes by the recorder head, then press the STOP button. The recorder should be at high speed.

NOTE: This switch should not be turned back to the write position until all recording on this digital tape is finished to prevent the head current from turning off and writing a row of "ones" which may be read as a record by the computer.

13. Turn the TIMING switch on the transcriber unit to the proper setting for the analog tape you are using.
14. If the tape you are using is an ATS-C tape, turn the far left hand switch on the digital recorder to the AUTOMATIC position and press the END OF FILE button once, turn the recorder switch back to the READ MANUAL position. If the tape you are using is an ATS-B tape go to step 15.
15. Set the switches on the analog recorder to the appropriate track number, local control, and 7 1/2 inches per second.

16. Press the forward button on the tape and allow it to run ahead until a signal is being played and adjust the oscilloscope until a good visual scan appears. See figure 3.
17. Thumb wheel in the appropriate settings on the transcriber unit. If the system is to be run automatically the line and element starts and stops must be wheeled in.

NOTE: Line and element starts and stops are the numbers shown times 100.

18. Find the appropriate spot on the analog tape by using the "footage meter", if the tape has been marked with a silver marker (values on the meter may be off slightly due to slippage). If not, start at the beginning of the tape and move forward thru each picture recording the footage at the start of each in the ATS catalog. Approximately 250 to 300 feet of tape is used between frame start of one picture and frame start of the next, including retrace. These can be seen by setting the FRAME START OVERRIDE switch on the transcriber unit to the OFF position and watching the frame start light as the analog tape is being played. Care must be taken to insure a frame start generated by noise is not mistaken for a real frame start. To aid in this, the user should watch the pattern on the oscilloscope screen. The "edge of the Earth", as shown in figure 3, moves rather rapidly across the screen during retrace and appears to be standing still during actual scan. By counting retrace periods the proper picture file may be found.
19. Having found the desired data to be digitized, remove the signal input cord to the oscilloscope, while the analog data is being played. Turn the SYNC switch on the scope to LINE and zero the scope. Reconnect the cord and return the switch to the INT position. Adjust the transcriber

OFFSET control so the base line of the scan pattern coincides with the "scope zero line". Adjust the transcriber gain control so that the top of the NRZ is at 6.67 volts. (3 1/3 cm at vertical sensitivity of 2 volts/cm on oscilloscope). Recheck the scope zero.

20. Back the analog tape to the start of the data to be digitized. Start playing the tape and turn the digital recorder switch to AUTOMATIC. The digitizing process can then be started and stopped manually by setting the OPERATION mode switch on the transcriber in the MANUAL position and pressing the START and STOP buttons or automatically by setting the switch in the AUTOMATIC position.
21. Following all digitizing, turn the digital recorder switch to the READ MANUAL position to prevent noise from causing the system to "take off".
22. When all data is complete turn the digital recorder switch to the WRITE position and rewind.

CAUTION: Failure to turn this switch to the WRITE position will result in erasing all data during rewind.

23. Rewind the analog tape and return it to the tape library.
24. Turn power off all units and use the logbooks provided.

NOTE: These machines require periodic cleaning to ensure good data, therefore, running hours should be logged.

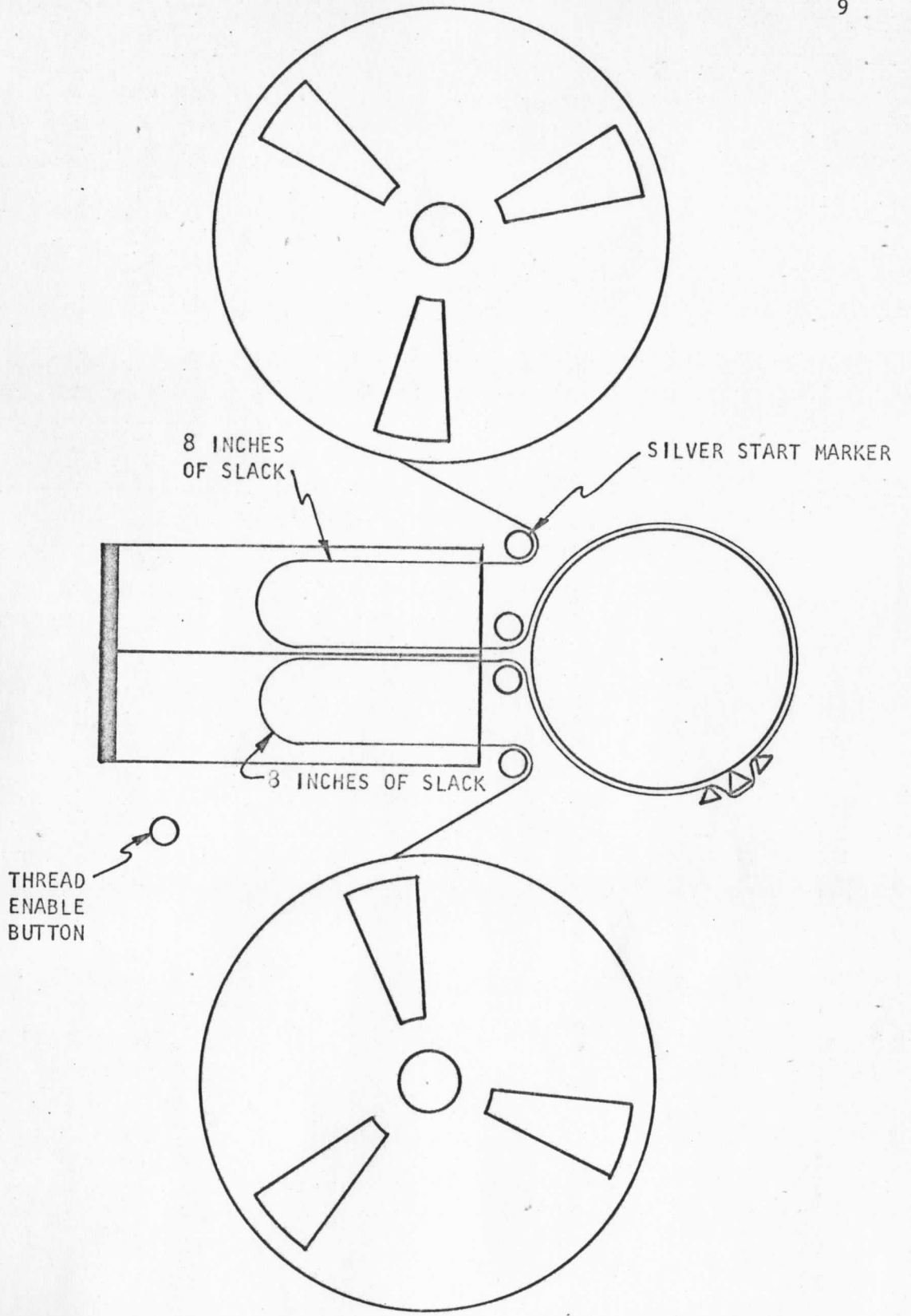


FIGURE 1
ANALOG RECORDER THREADING SCHEME

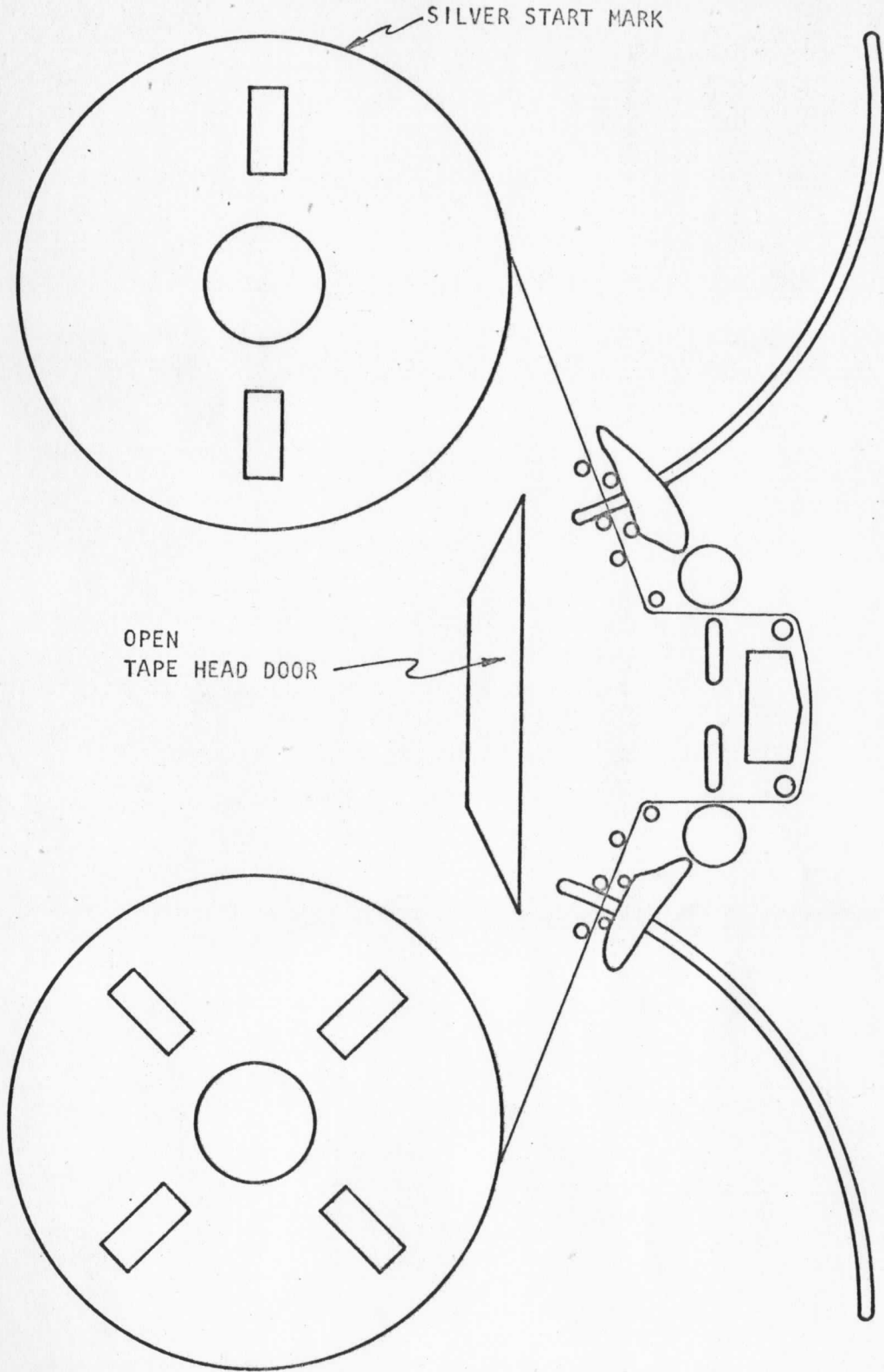


FIGURE 2
DIGITAL RECORDER THREADING SCHEME

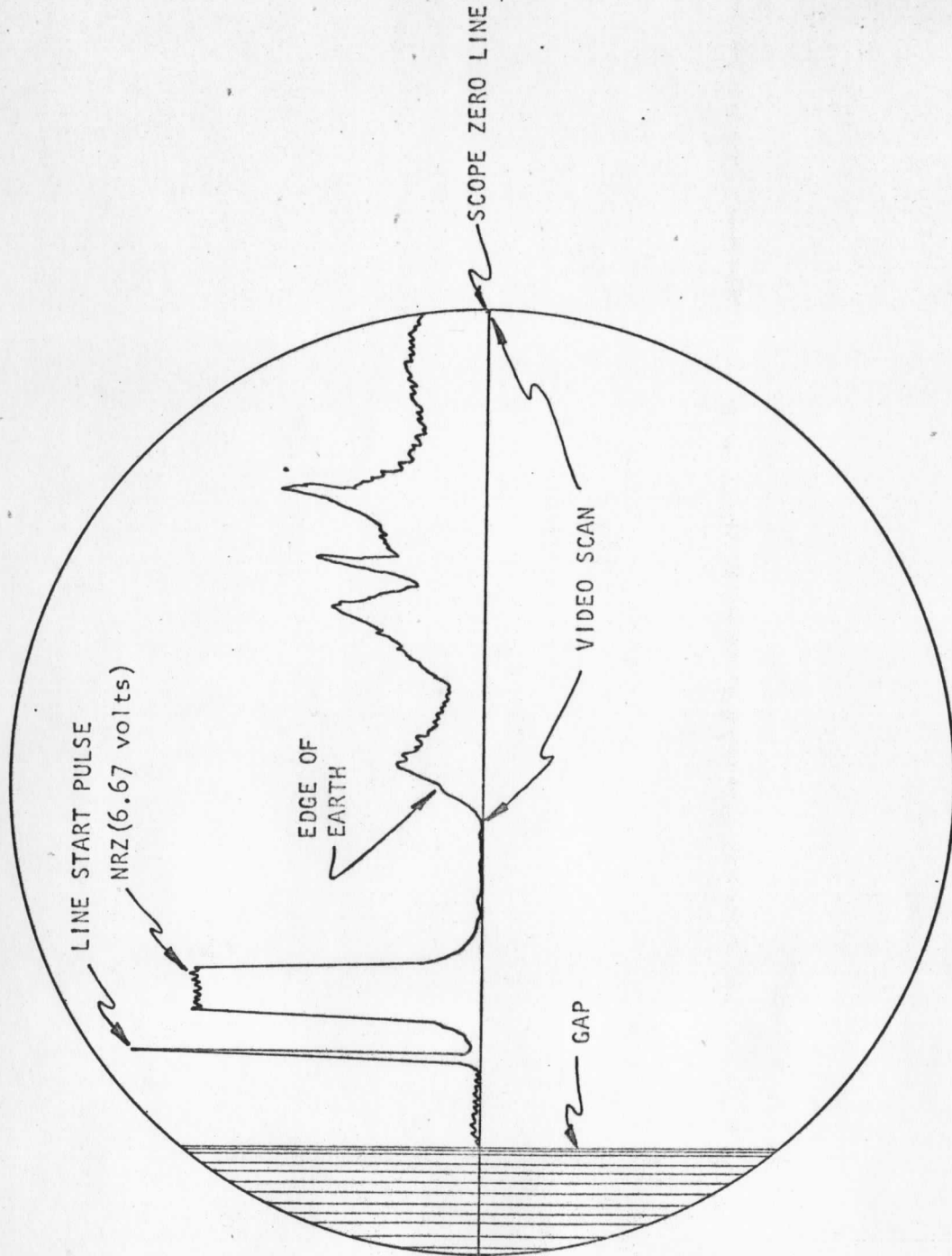


FIGURE 3
CORRECTLY ADJUSTED OSCILLOSCOPE PATTERN