

## ERTS WIDEBAND TAPE RECORDER

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The ERTS Wideband Video Tape Recorder can store, in one pass, an amount of data equivalent to that contained in 300 copies of *Webster's Collegiate Dictionary*. It is the highest-rate and largest-capacity digital tape recorder ever launched.

In 1967 it became apparent that NASA would need a video bandwidth tape recorder, and in 1968 we commenced a program that resulted in the development of the ERTS tape recorder. This is a four megahertz base band.

High data rate implies high tape speed, in that the number of flux reversals per centimeter is limited. It is nearly impossible to run tape longitudinally at the velocities necessary, so a rotary head is used in the transverse mode. In Figure 1 the head wheel can be seen. It has four magnetic heads mounted on the periphery, and is about five centimeters (2 in) in diameter. The head wheel rotates at 18,750 rpm and gives us a head-to-tape surface speed of nearly 5080 centimeters (2000 in) per second. In the meantime, the tape runs longitudinally at a reasonable speed of 30.5 centimeters (12 in) per second.

The transport unit is shown in Figure 2. There is also an electronics unit of about the same

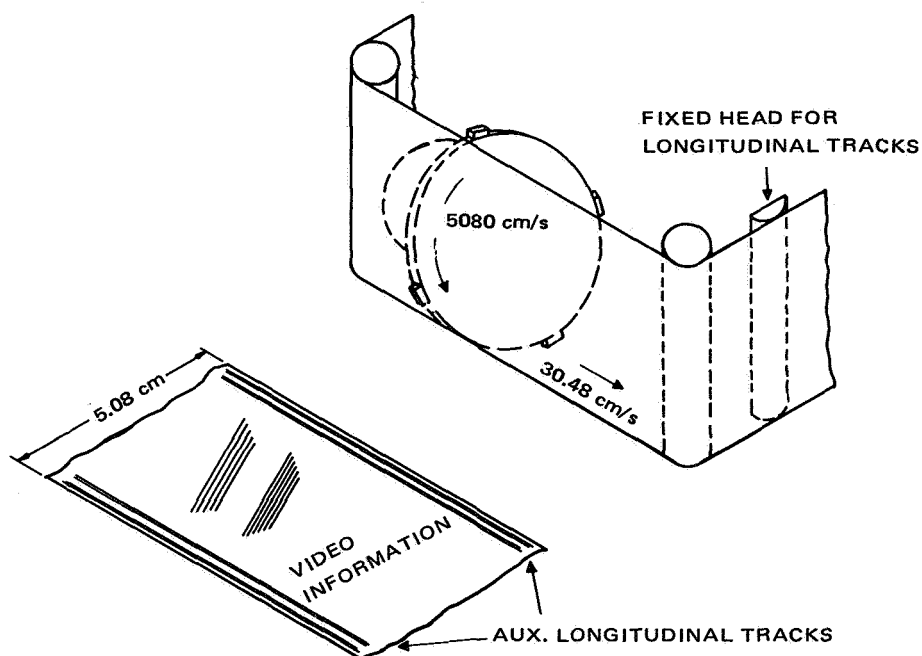


Figure 1. Head/tape interface.

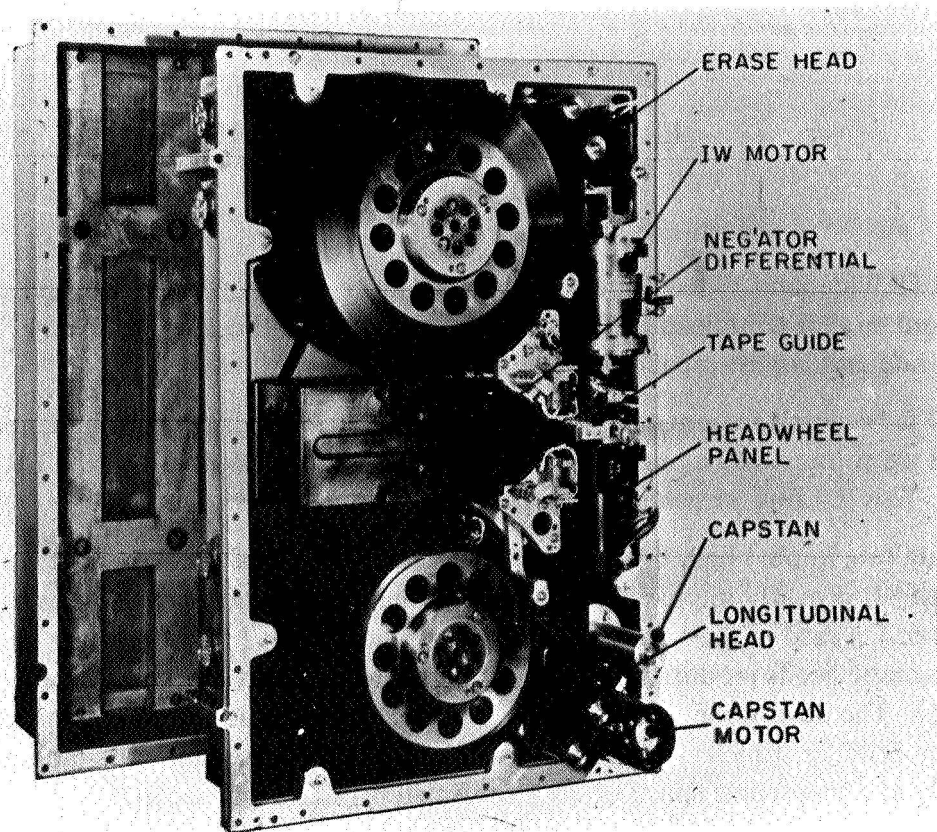


Figure 2. ERTS VTR transport.

size, 50.8 centimeters (20 in) tall. The head wheel panel is a removable panel that holds the head wheel, the head wheel motor, and the drive shoe. The rest of the components are pretty much as in any other tape recorder. This device has 610 meters (2000 ft) of five-centimeter-wide (2 in) tape. It records for 30 minutes and its four-megahertz bandwidth, with a signal-to-noise ratio of better than 39 dB, would be sufficient for color television. This device could be used for a normal half-hour color television show.

Partway through the development, when it was decided to put the MSS on the spacecraft, we were asked to handle its 15 megabits per second. This is where we spent most of the development time and money. We handle the 15 megabits per second rate with a typical bit-error rate of  $10^{-5}$ . Time-base error of the instrument is on the order of one-half TV element per line, or one part in  $10^4$ . But since you don't get something for nothing, the device weighs 34.5 kilograms (76 lb).

The most obvious technological advancements are in the digital area (Figure 3); the digital rate of this device is approximately 15 times that of any recorder flown previously. Its digital capacity is on the order of 300 times that of any recorder launched before. There was a previous Air Force recorder at six megahertz with a life of something less than 100

BEFORE ERTS	ERTS NEED	CAPABILITY
<ul style="list-style-type: none"> <li>● DIGITAL DATA: <ul style="list-style-type: none"> <li>RATE: NASA = 16 kbs</li> <li>AF = 1 Mbs</li> </ul> </li> <li>CAPACITY: <math>\sim 10^8</math> bits</li> </ul>	<ul style="list-style-type: none"> <li>15 Mbs (BER = <math>10^{-4}</math>)</li> <li><math>10^{10}</math> bits (10 min)</li> </ul>	<ul style="list-style-type: none"> <li>15 Mbs (BER <math>\approx 10^{-5}</math>)</li> <li><math>3 \times 10^{10}</math> bits (30 min)</li> </ul>
<ul style="list-style-type: none"> <li>● ANALOG DATA: <ul style="list-style-type: none"> <li>NASA: 60 kHz</li> <li>AF: 6 MHz</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>4 MHz (39 dB)</li> </ul>	<ul style="list-style-type: none"> <li>4 MHz (<math>\sim 43</math> dB)</li> </ul>
<ul style="list-style-type: none"> <li>● LIFE: <ul style="list-style-type: none"> <li>AF: 6 MHz <math>\approx 100</math> hrs</li> <li>Grd Rec's <math>\approx 100</math> hrs</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>500 hrs</li> </ul>	<ul style="list-style-type: none"> <li>5 Grd Life Tests</li> <li>&gt;1000 hrs</li> </ul>

Figure 3. Technology advancement.

hours. ERTS requires on the order of 500 hours and we plan on getting there, so that's an advancement of five to ten times in life on the analog.

Concerning performance in orbit, we have two units on board ERTS-1, and either unit will store the output of either the MSS or the RBV. One unit has been secured due to a short in the power supply transformer. The other device is operating excellently, returning images from the 85 or 90 percent of the earth that is not available in real-time. Figure 4 relates to that – it's a rather psychedelic slide of the Amazon River.

We also provided the ground station recorders that will store data from either of these sensors. For the future, aside from ERTS-B, this device will fly on Skylab in April 1973, and we are looking forward to EOS in a two-speed mode – a slow-speed record, and high-speed playback. This would be about a 1.2 megabit record and 30 megabit per second playback. We have a mechanical test running that is up around 2500 hours, so we think we can achieve life from that mode. We feel the device is usable at up to 30 megabits per second.

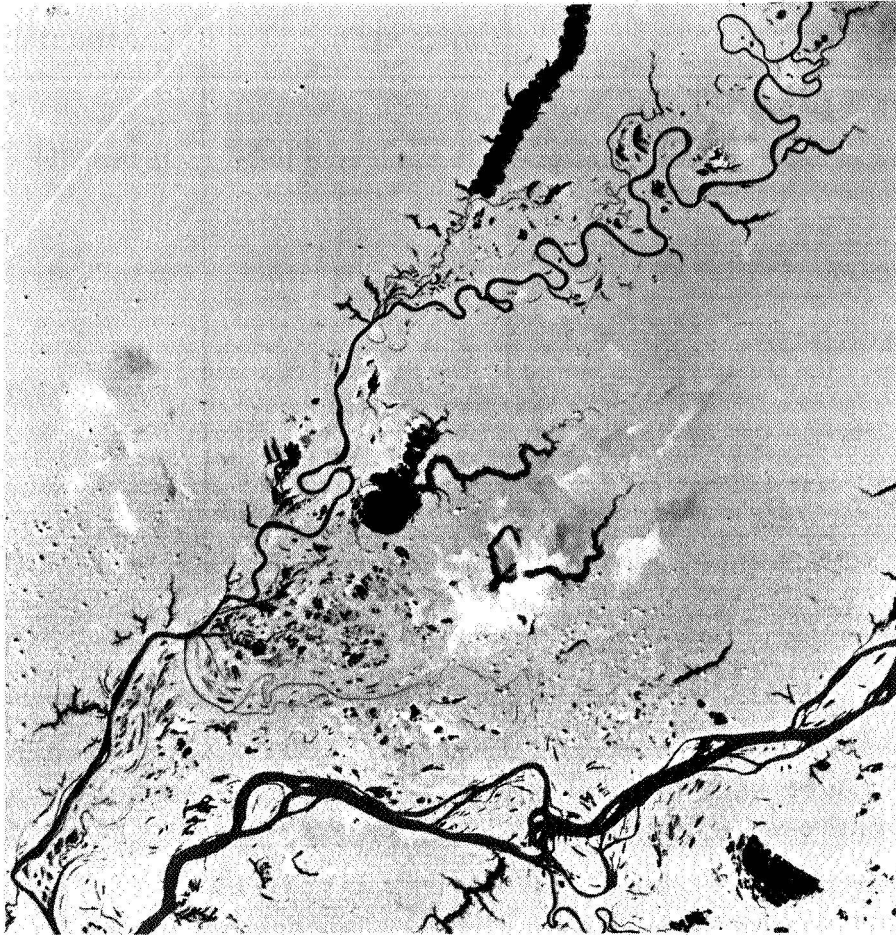


Figure 4. Composite image of the Amazon River. Source: NASA ERTS E-1008-13481-(5,7)01. Original in color; can be ordered from EROS Data Center, Sioux Falls, S. D. 57198.