

TRANSISTOR MUSEUM™

"THE FIRST TRANSISTORS IN SPACE"

PRESERVING HISTORIC 1950S/60S/70s TRANSISTORS
USED IN EARLY SATELLITES AND MISSILES



EXPLORER 1 SATELLITE SILICON TRANSISTOR TI TYPE "2N335"

TRANSISTOR MUSEUM PRESERVATION KIT-TM1001

HISTORIC PHOTO ARCHIVE

First U.S. Satellite: Successfully launched on January 31, 1958, this satellite was a welcome success for the U.S. space program, which had experienced a major setback with the earlier Vanguard launch explosion. Explorer 1 data led to the discovery of the Van Allen radiation belt.

Photo Credit: "Explorer 1 in Orbit", Image credit: Bob Trembley, simulated in Kerbal Space Program. Hosted at Vatican Observatory.

TRANSISTORS AND EXPLORER 1

Explorer 1 was launched with a Jupiter-C rocket on January 31, 1958 from the Cape Canaveral missile center. The cosmic ray instrumentation package on this satellite was designed by Dr. George Ludwig, who was then a graduate student at the University of Iowa in the Cosmic Ray Lab under the guidance of Dr. James Van Allen. This instrumentation package accounted for the majority of the approximately 50 transistors used in Explorer 1, including both germanium and silicon devices. Due to weight and battery life considerations, no vacuum tubes were used. Dr. Ludwig's personal experiences with designing the Explorer 1 circuitry using some of the first commercially available transistors are documented in this [2007 Transistor Museum Interview](#). For example, regarding the selection of the 2N335: *"For the silicon transistors, I was in touch with the people at TI on a fairly regular basis, and as they would have some new ones coming out, I would get some samples to try them out. I think I settled on that one as one that was available in reasonable quantities, and that had desirable characteristics. For later satellites I switched to newer ones as they appeared."*

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EXPLORER 1 SATELLITE - 2N335 TRANSISTOR



HISTORIC SEMICONDUCTOR DATA

Device ID: Texas Instruments 2N335

Type: Silicon NPN grown junction transistor

Case Color/Style: Black painted/silver metal TO-5

Vintage/Date Code: Late 1950s-1960s

Use: Explorer 1 scalar circuits

Notes: The TI 2N33X series of transistors were rugged and reliable industry workhorses used in a wide range of industrial and military circuits.



George Ludwig (C)1958



Pickering, Van Allen and Von Braun. Copyright (C) 1958 JPL

TRANSISTORS FOR THE FIRST U.S. SATELLITE

There was much to celebrate in the U.S. space program after the successful January 1958 launch of the Explorer 1 satellite. In late 1957 the Soviets had launched the Sputnik 1 and Sputnik 2 satellites (the latter carrying a dog onboard) and were clearly ahead of the U.S. in the ongoing space race. Shown above right in the Explorer post-launch excitement are (from left) William Pickering - Director of JPL, James Van Allen - designer of the radiation measurement program for Explorer, and Wernher von Braun - aerospace engineer involved in the development of the Jupiter-C rocket. Shown at far left is George Ludwig holding the backup payload for Explorer 1. He was responsible for designing the early transistor circuits used in the Explorer instrumentation package. An excellent account of the early days of the U.S. space program can be found in Ludwig's 2011 book: ["Opening Space Research Dreams, Technology, and Scientific Discovery"](#).