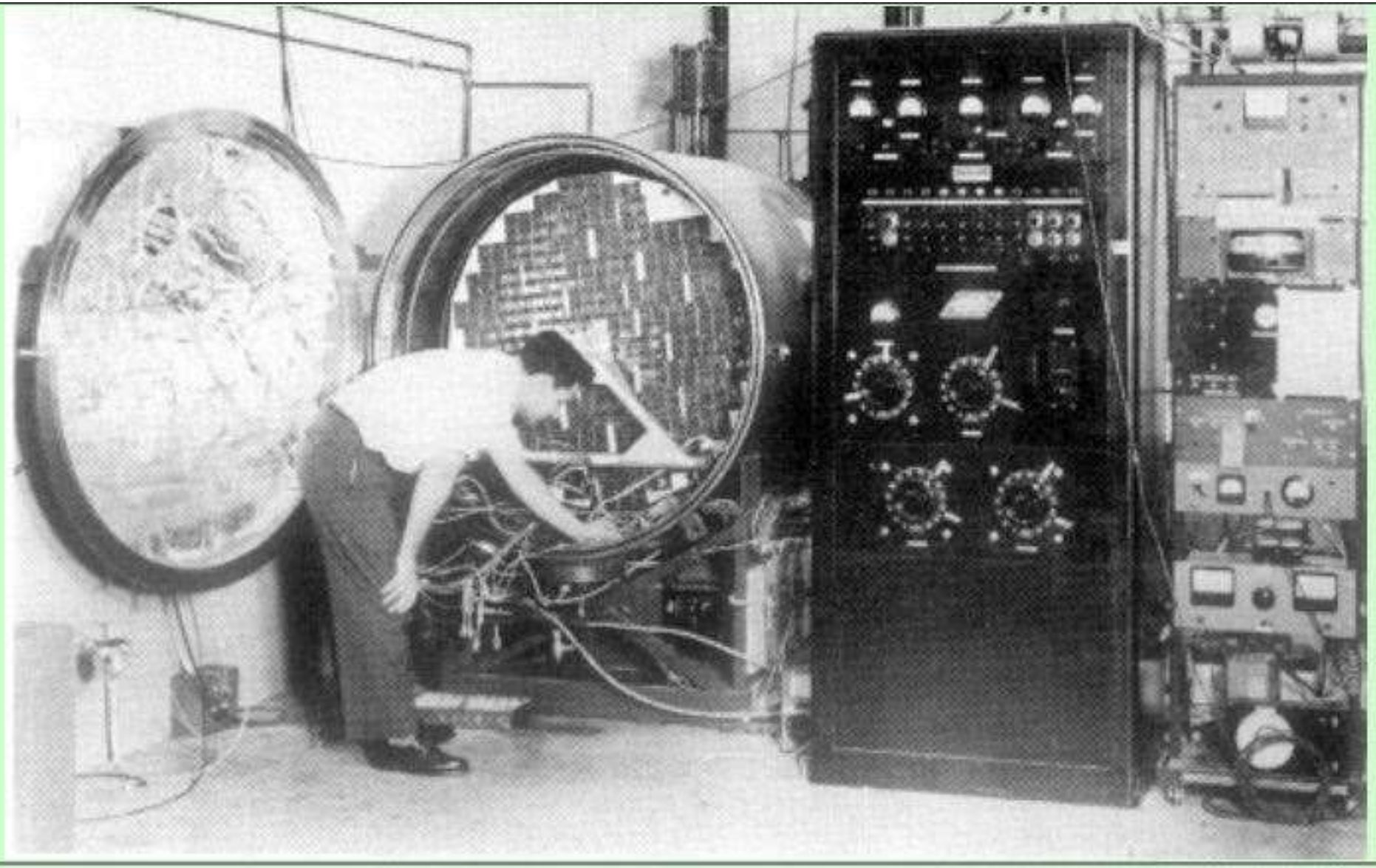
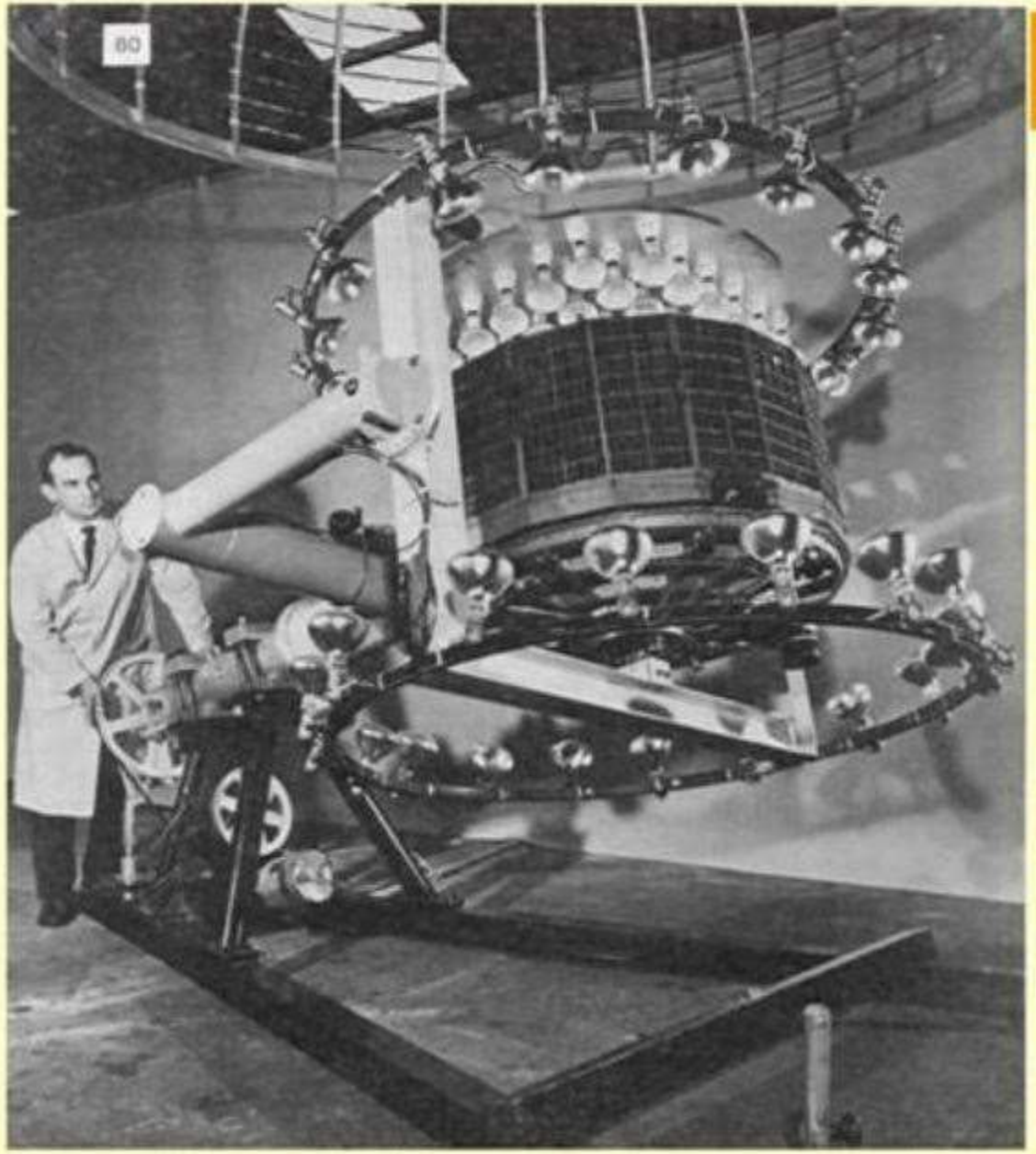
Part 2

Satellite Environmental Qualification

- Temperature cycling, sub freezing to 120+ Fahrenheit
- Pressure/Vacuum cycling
- Low frequency vibration (Shaker table)
- High frequency vibration
- Magnetic Signature
- Control and record/playback verification
- Outdoor antenna receive/transmit and antenna pattern verification



One of RCA's earliest thermal-vacuum chambers (see photo above) was built and instrumented by AED in about 1959 to test the TIROS satellites. Shown in the photo above is Paul Bizzaro, also member of the TIROS Integration and Test team. By the way, he was the AED Employee issued with badge number AED 0001.



TIROS 2

Spacecraft is being installed in magnetic dipole measurement cage to measure the spacecraft dipole.

The upper spherical cage is visible as the unit is rolled into the lower half of the cage.

During tests, lamps surrounding illuminate the solar cells as the spacecraft is operated while rotating.

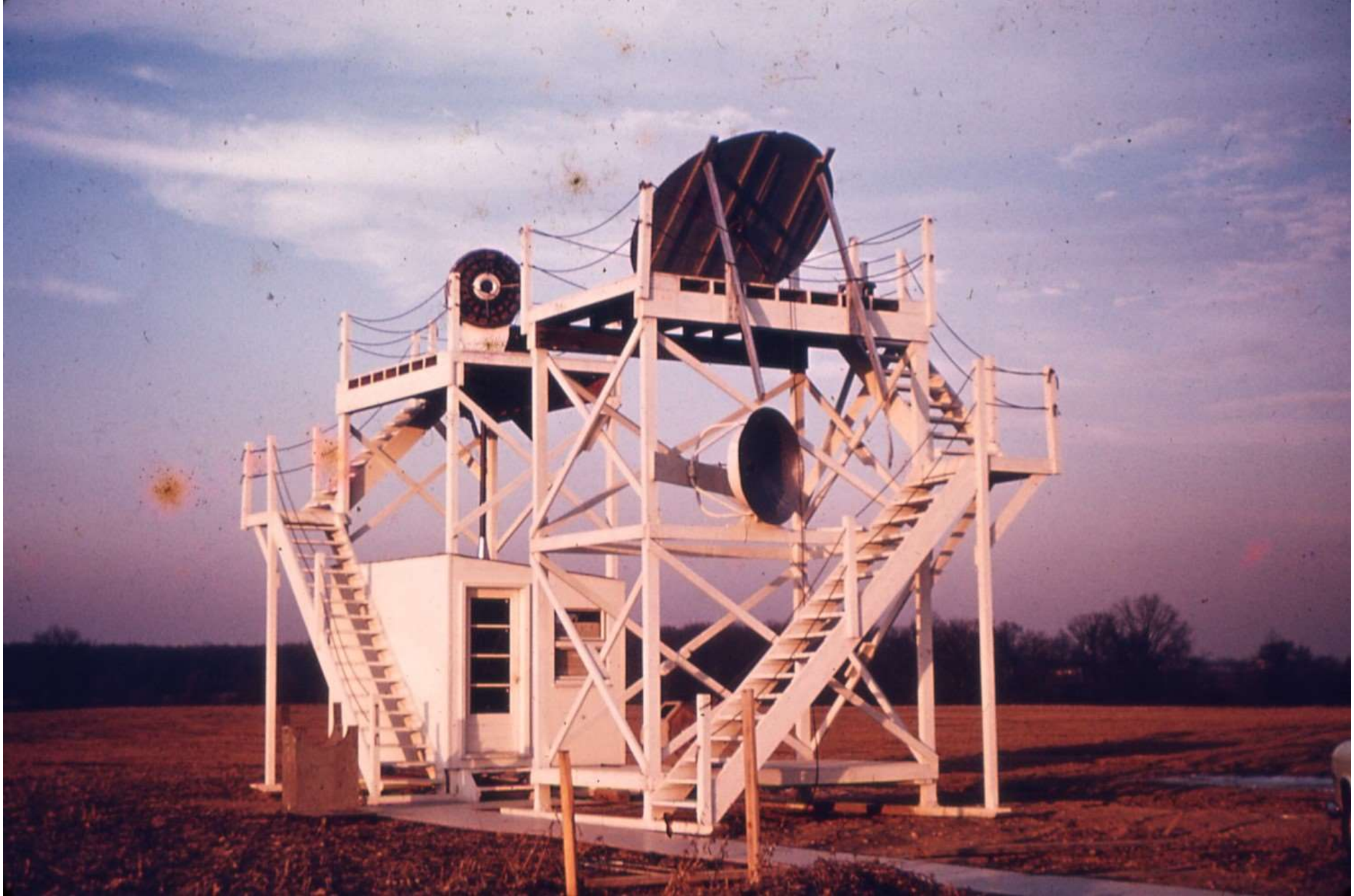
Designer Bob Wilkes is moving the spacecraft & supporting fixture.

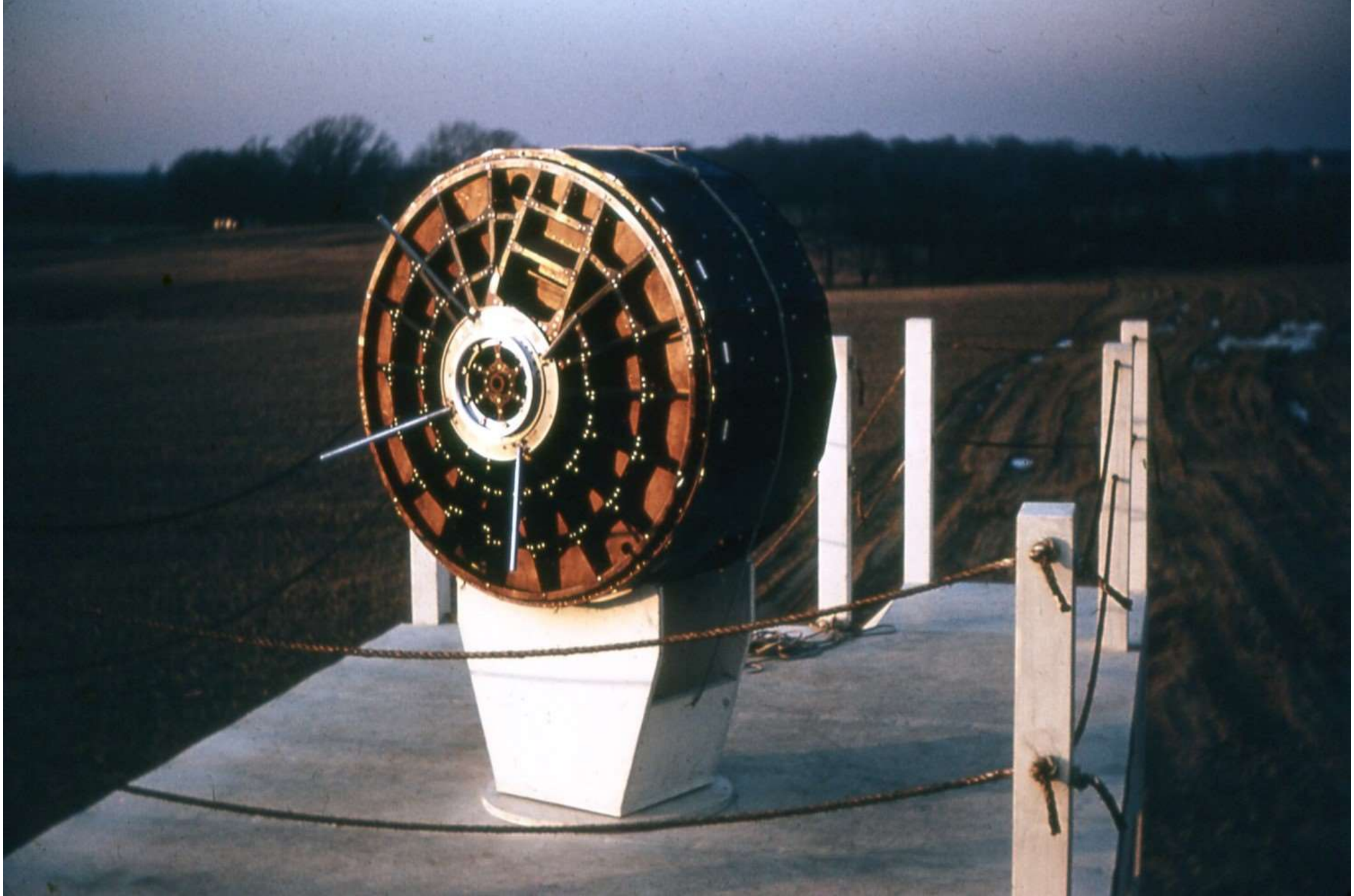
Magnetic Dipole Fixture

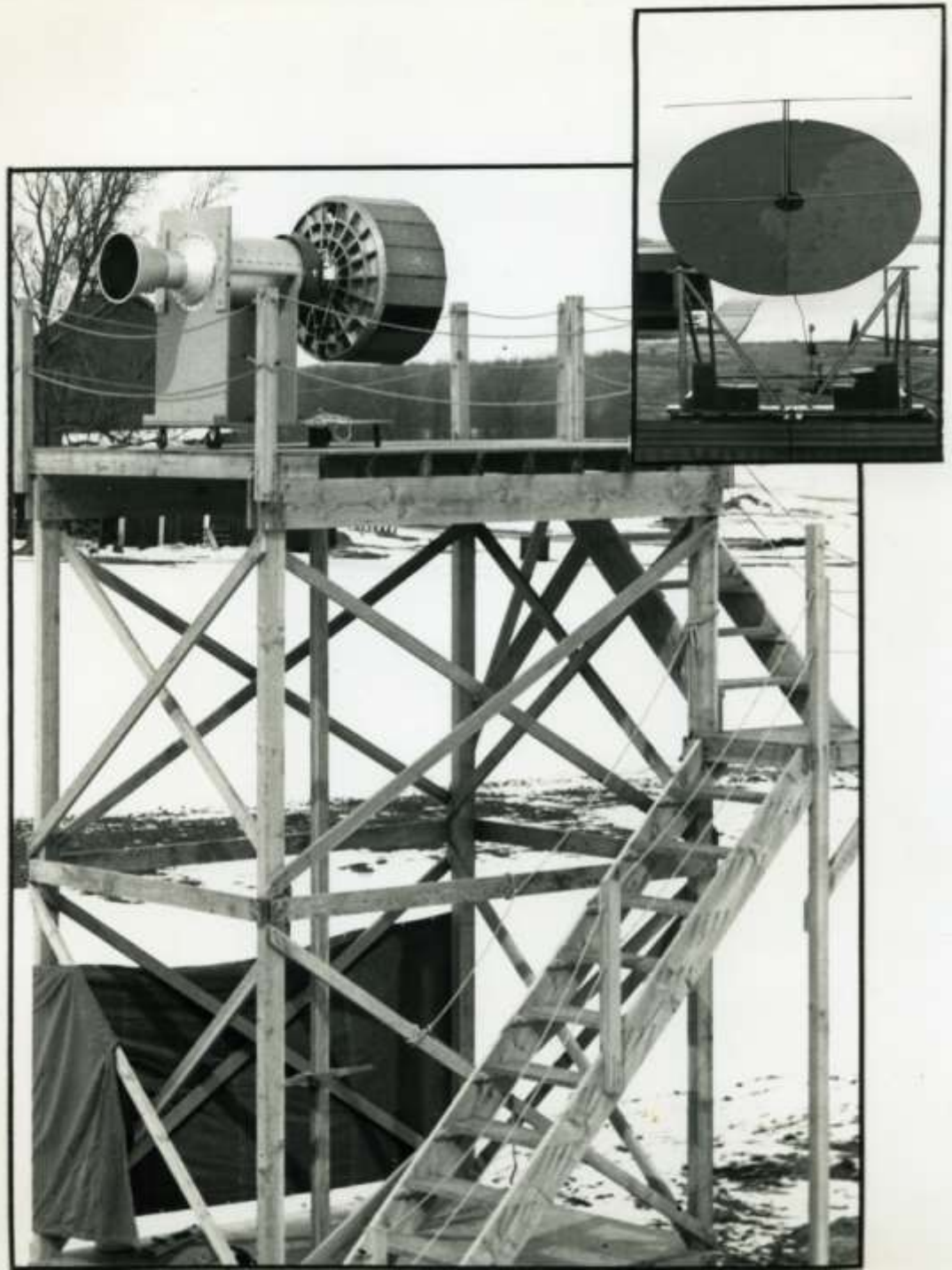
Photo from David Sarnoff Library Book

Astro's Bob Wilkes designed and built the fixture that was used to mount the spacecraft and spin it inside of a sphere made up of copper wires wound around spherical frames.

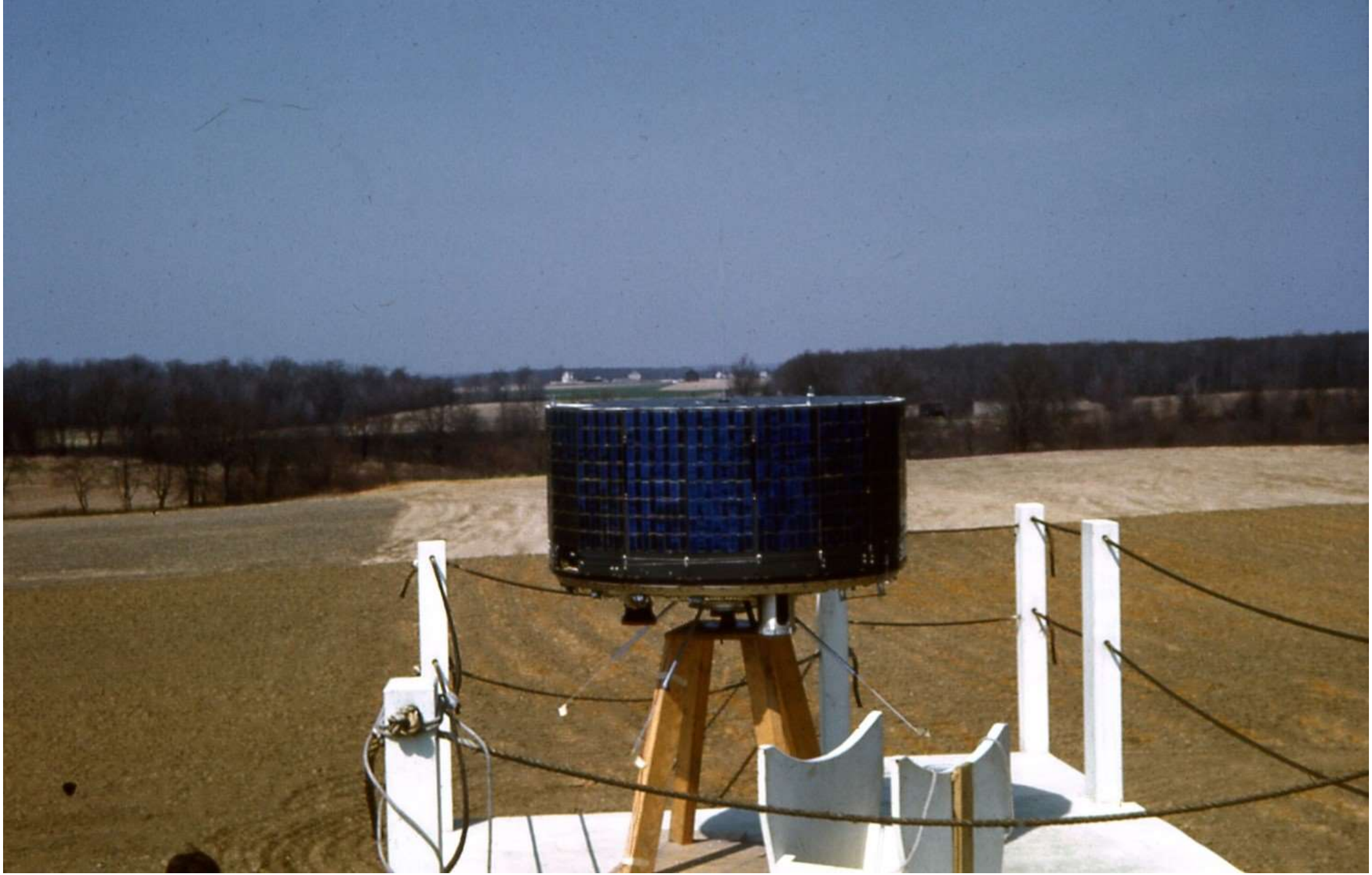
A Relay Communication spacecraft was under test when this photo was taken. Courtesy from David Sarnoff Library book "Inventing the Future" page 80.





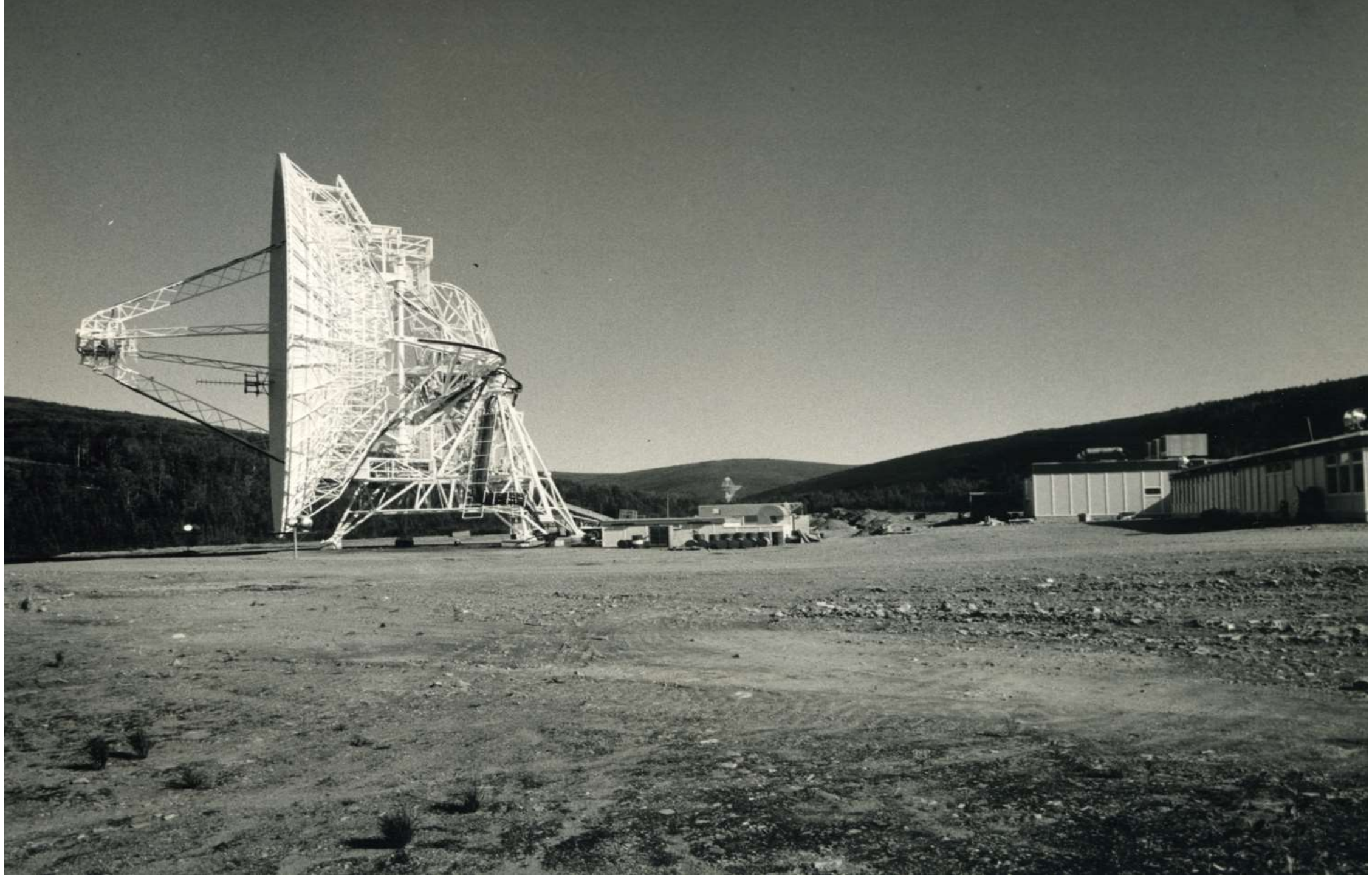



XPK 64



TIROS Ground Stations

- General Bronze Antenna at Locust Corner Plant site
- Dish at Goldstone, California
- Helical at Fort Monmouth, New Jersey
- Dish at Wall County, New Jersey (Primary TIROS Monitoring Station)



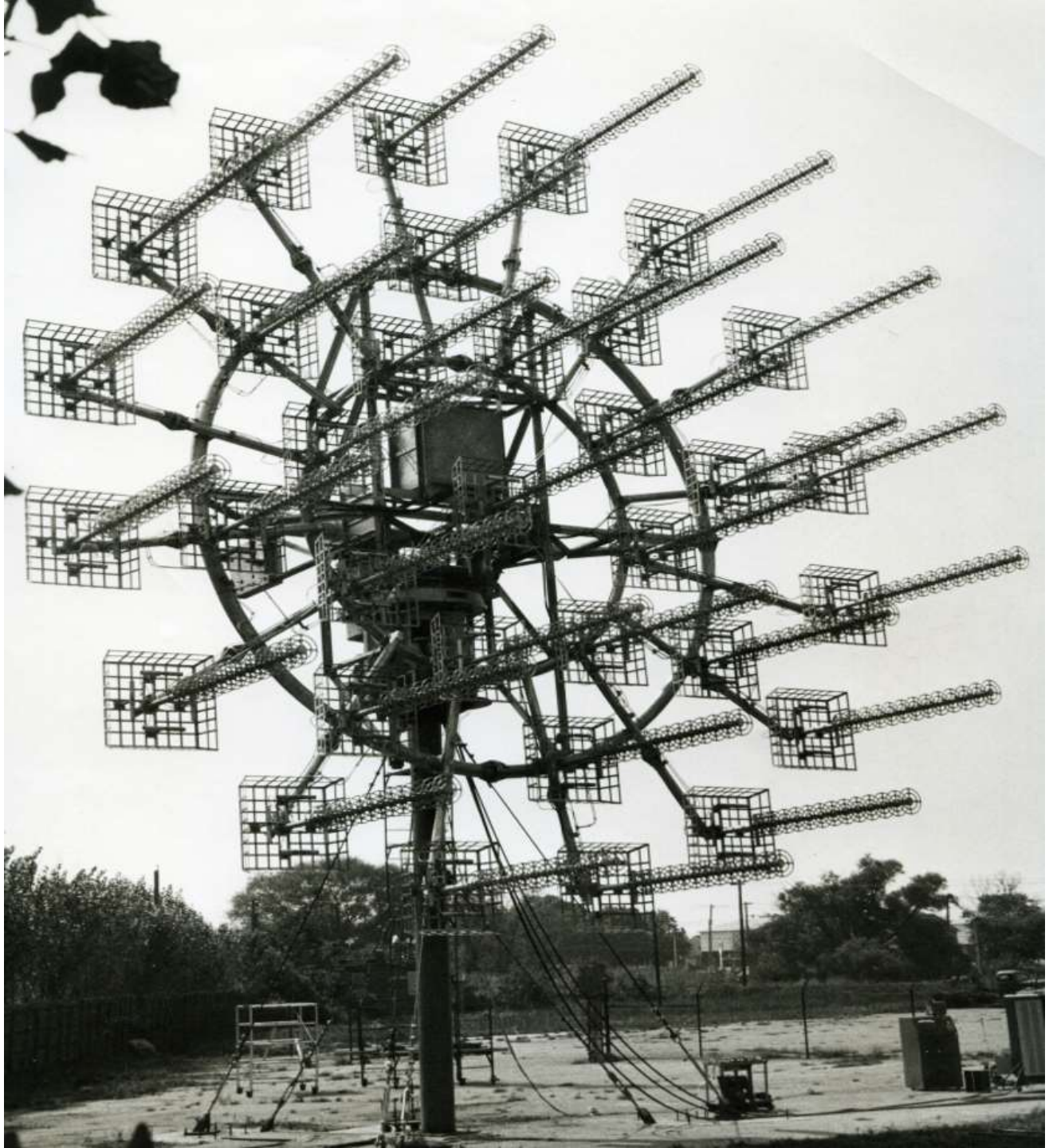


FIGURE 45.—The TIROS I command and data-acquisition station at Fort Monmouth, N.J., and (insert) the satellite programming racks, which are cut off at the right of the main picture.

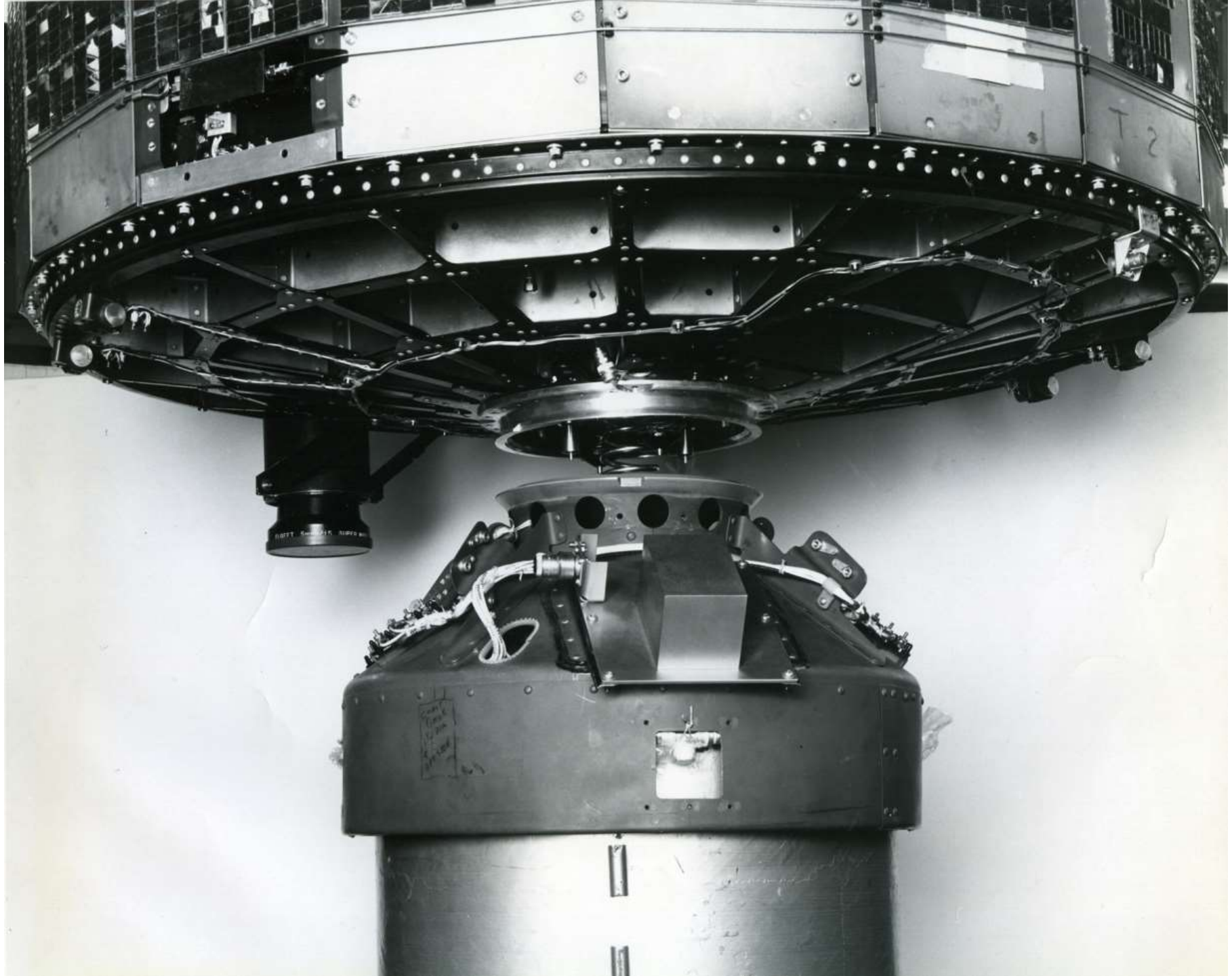
Source: NASA Technical Report R-131, 1962. Photo provided by Juan Jose Cabrero.

TIROS Placed Into Orbit!

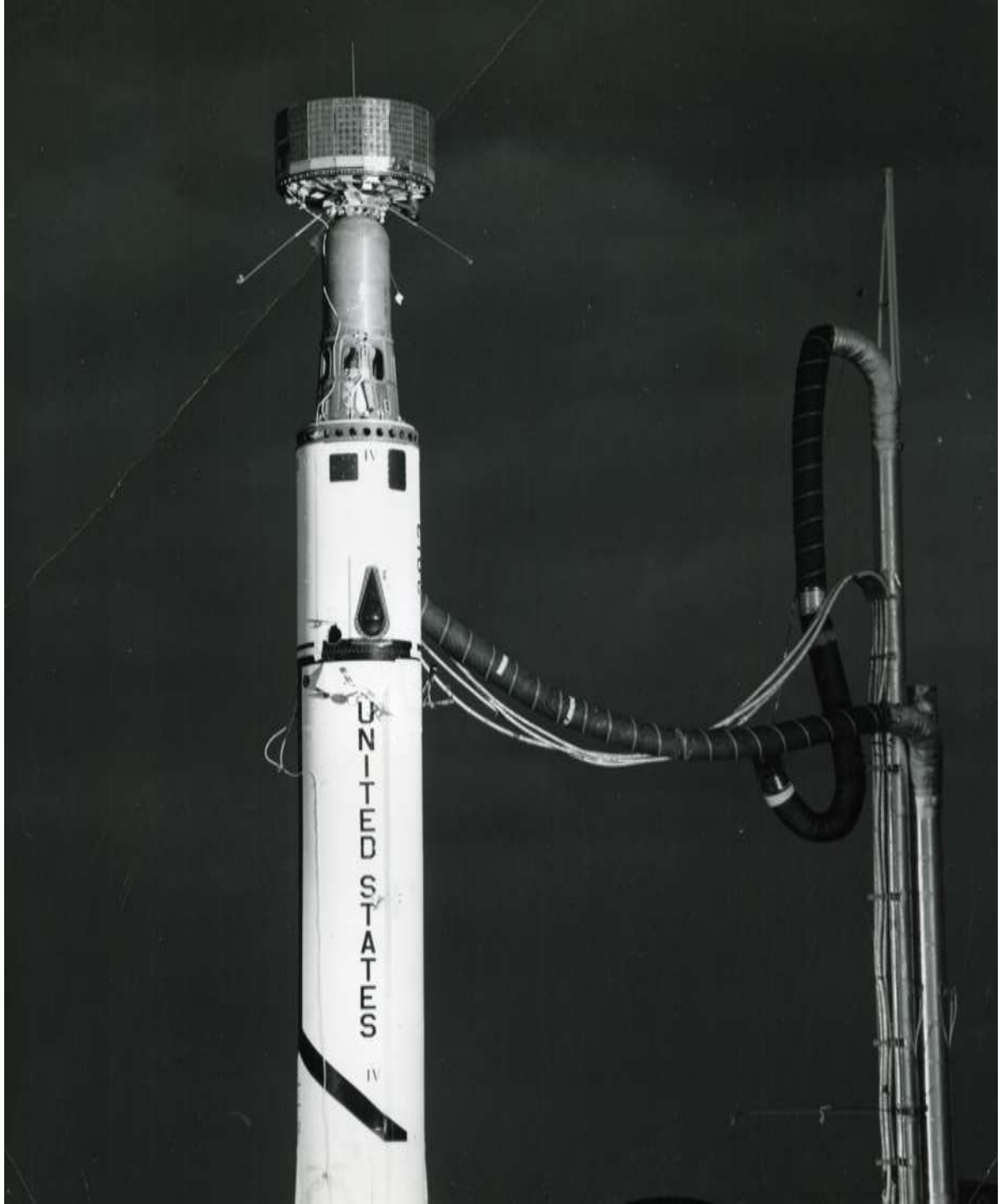
Launch Preparations

Launch on April 1, 1960

Release into orbit

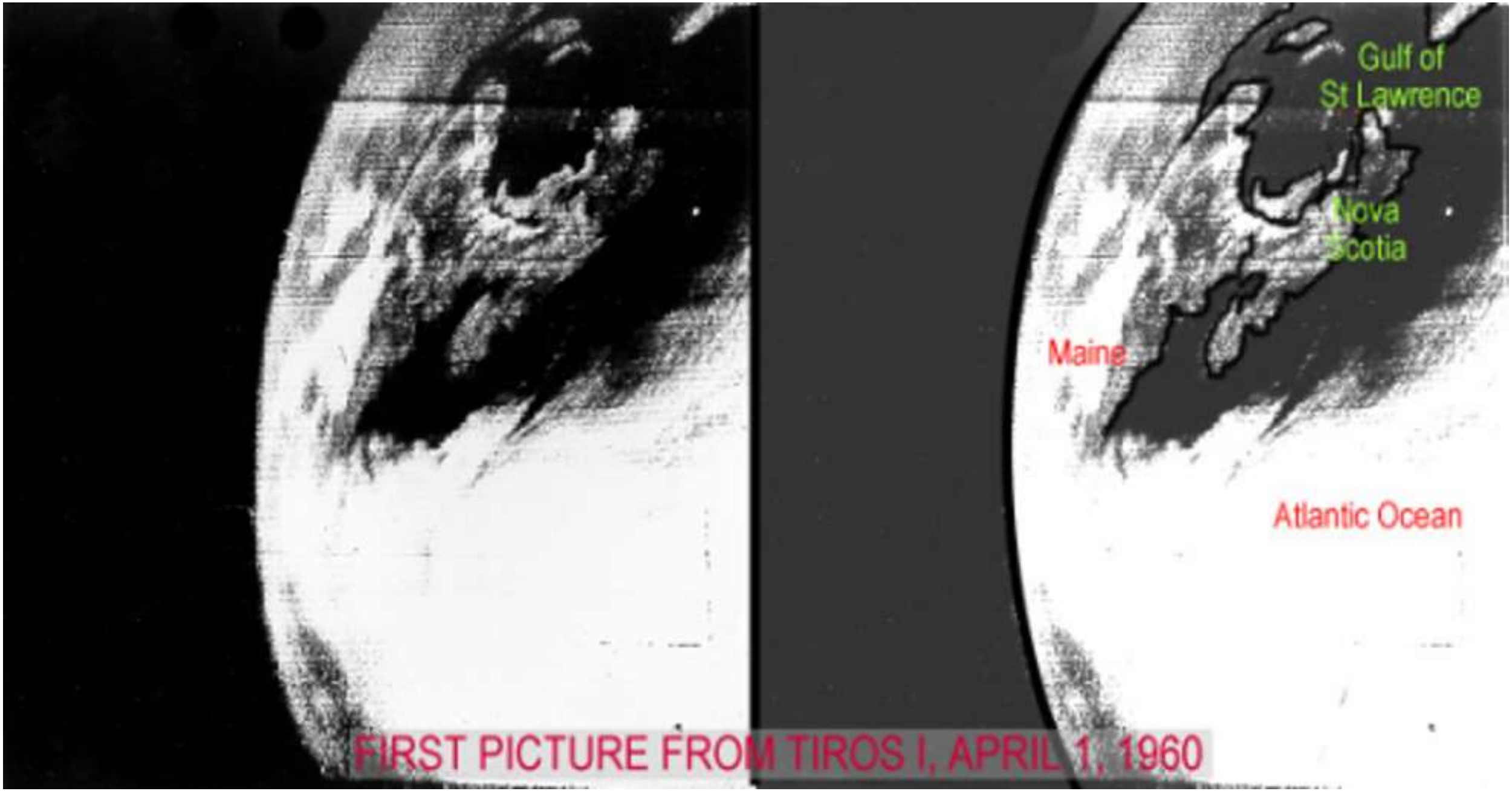



Satellite Control and Data Processing
OSCAR I Communications Satellite
Full-scale model
Launched in December 1961, OSCAR I was the world's first amateur satellite. The California-based radio operators who developed the original built this model.
Gift of Project OSCAR, Inc.


UNITED STATES


3025

FIRST TELEVISION PICTURE FROM SPACE
TIROS I SATELLITE APRIL 1, 1960



FIRST PICTURE FROM TIROS I, APRIL 1, 1960

TIROS satellite orbiting towards ground station in Tinton Falls, New Jersey

RCA-BUILT "TIROS" SATELLITE REPORTS WORLD'S WEATHER FROM OUTER SPACE

As you read these lines, the most remarkable "weather reporter" the world has ever known hurtles around our globe every three a day, hundreds of miles up in outer space.

The TIROS satellite is an orbiting television station. Its mission is to televise cloud formations within a belt around thousand miles wide around the earth and transmit a series of pictures back to special ground stations. Weather instruments and data sensors go to the making . . . to help make tomorrow's weather forecast more accurate than ever.

The success of experimental Project TIROS opens the door to a new era in weather forecasting—with benefits to people of all lands. The experiment may lead to advanced weather satellites which can provide meteorologists with hour-to-hour reports of cloud cover covering over the entire world. Weather forecasts, based on these observations, may then give simple time to prepare for floods, hurricanes, tornadoes, typhoons and blizzards—time which can be used to minimize damage and save lives.

Many extremely "sophisticated" television equipment and systems were required to make Project TIROS a success—two lightweight satellite television cameras, an infrared horizon-sensing system, complete receiving and transmitting equipment, and a solar power supply that enhances its energy from the sun itself. In addition to the design and development of the actual satellite, scientists and engineers at RCA's "Space Center" were responsible for the investigation and construction of a vast array of equipment for the earth-based data processing and command stations.

Project TIROS was sponsored by the National Aeronautics and Space Administration. The satellite payload and associated ground station equipment were developed and built by the Astro-Electronics Division of RCA, under the technical direction of the U.S. Army Signal Research and Development Laboratory.

The same electronic skills which made possible the success of man's most advanced weather satellite are embodied in all RCA products—RCA Victor black & white and color television sets, radio and high-fidelity systems enjoyed in millions of American homes.

This unique antenna, at RCA's "Sonicraft" in Princeton, N. J., is designed specifically for the Tiros project. Antennas must listen to ground stations from the satellite and ground stations relay to satellite and ground. Primary ground station, built by RCA, are at Fort Monmouth, N. J. and Kauai Tiros Station. Back-up stations are at Princeton, N. J. and Cape Canaveral, Fla.

RCA

THE MOST TRUSTED NAME IN ELECTRONICS

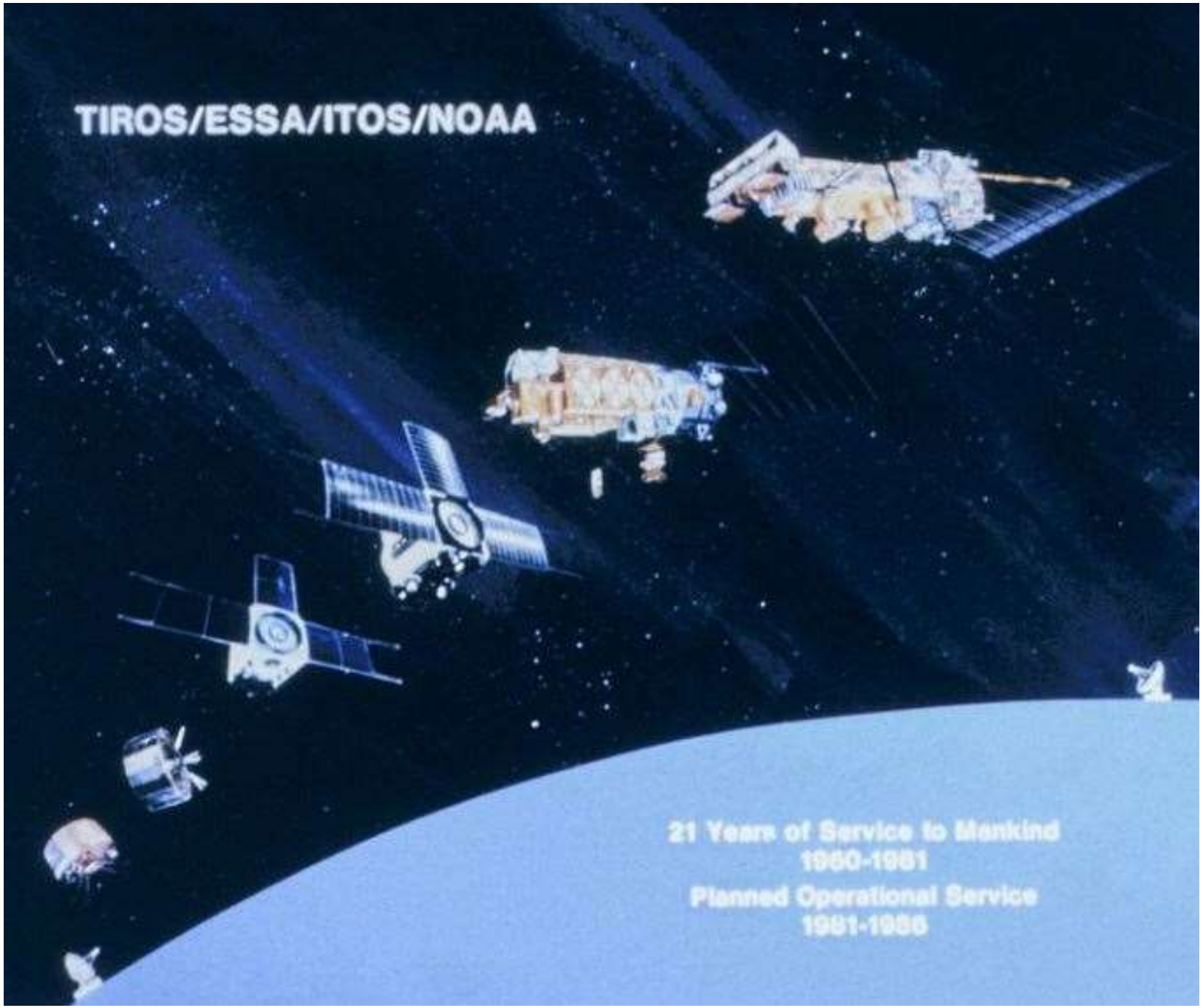
RADIO CORPORATION OF AMERICA

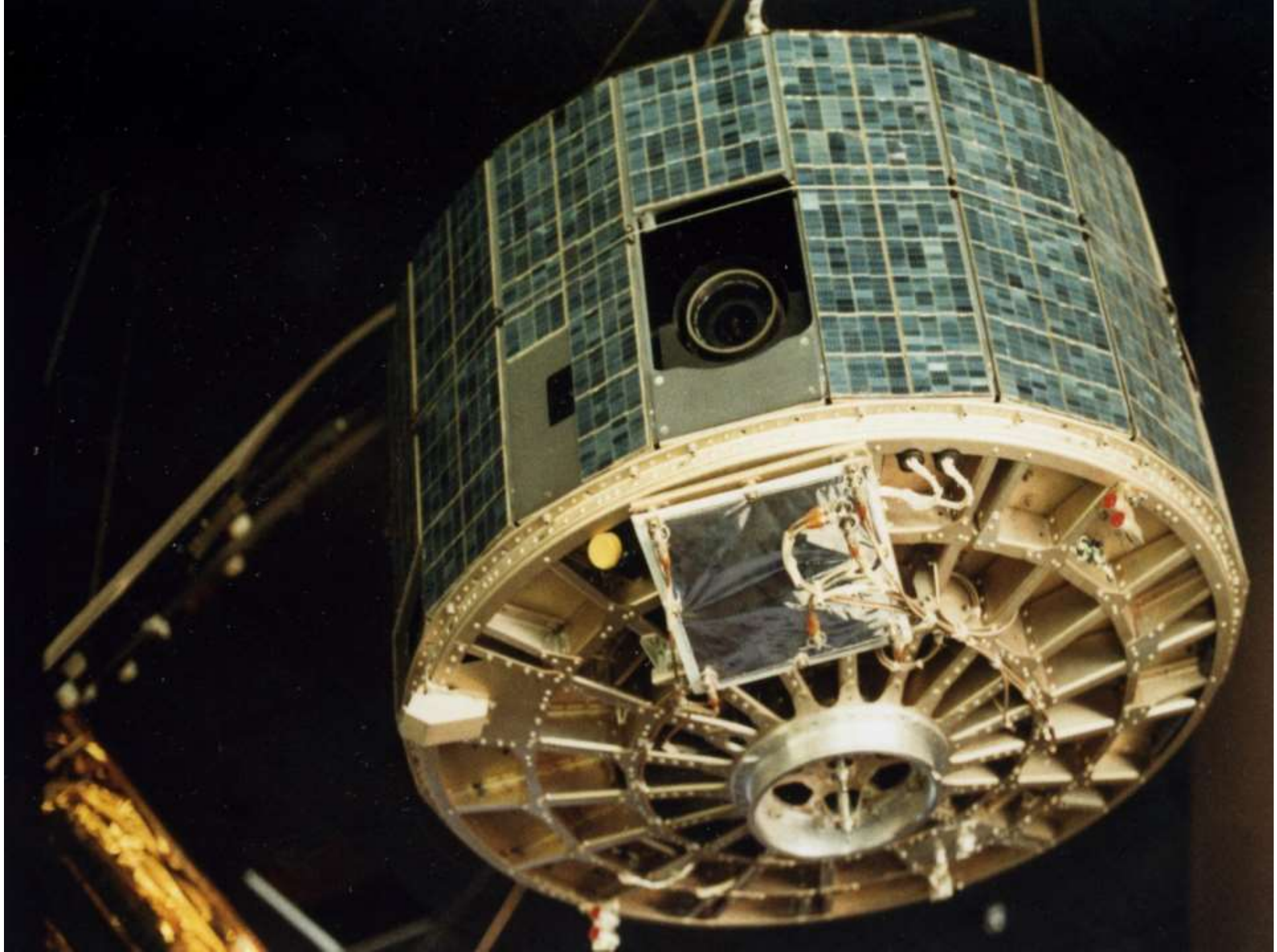
But what about Francis Gary Powers?

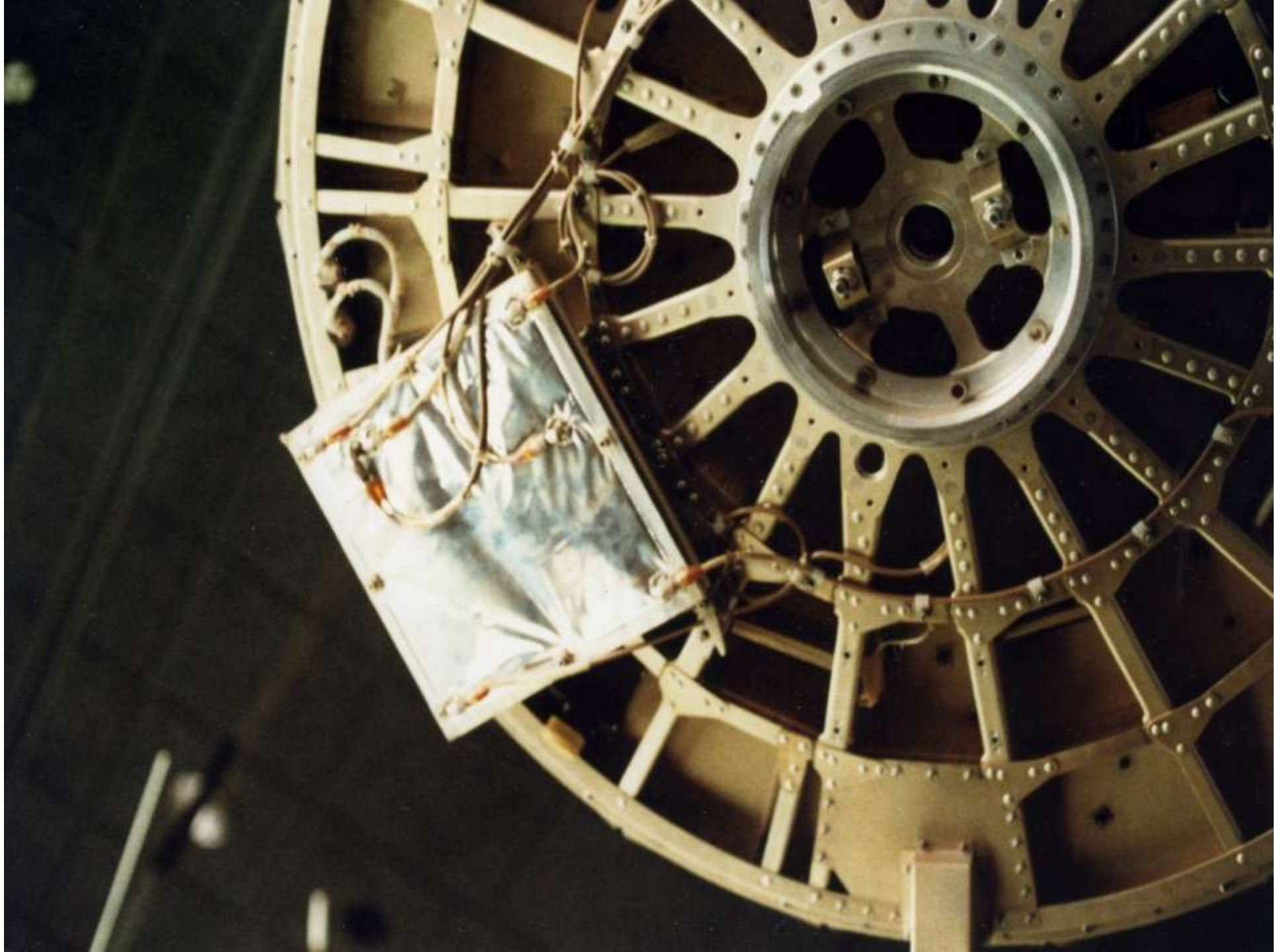
- May 1, 1960 – Just ONE MONTH after successful launch of TIROS!
- First attempt to fly all the way across the Soviet Union
- Shot down by an S-75 Dvina Surface-to-Air Missile
- Editorial Comment: Should we have continued with Project JANUS?
- After one year, nine months, ten days in captivity, he was released
- Release accomplished via a prisoner exchange of Rudolf Abel
- Died August 1, 1977 when his KNBC News Jet Ranger ran out of fuel

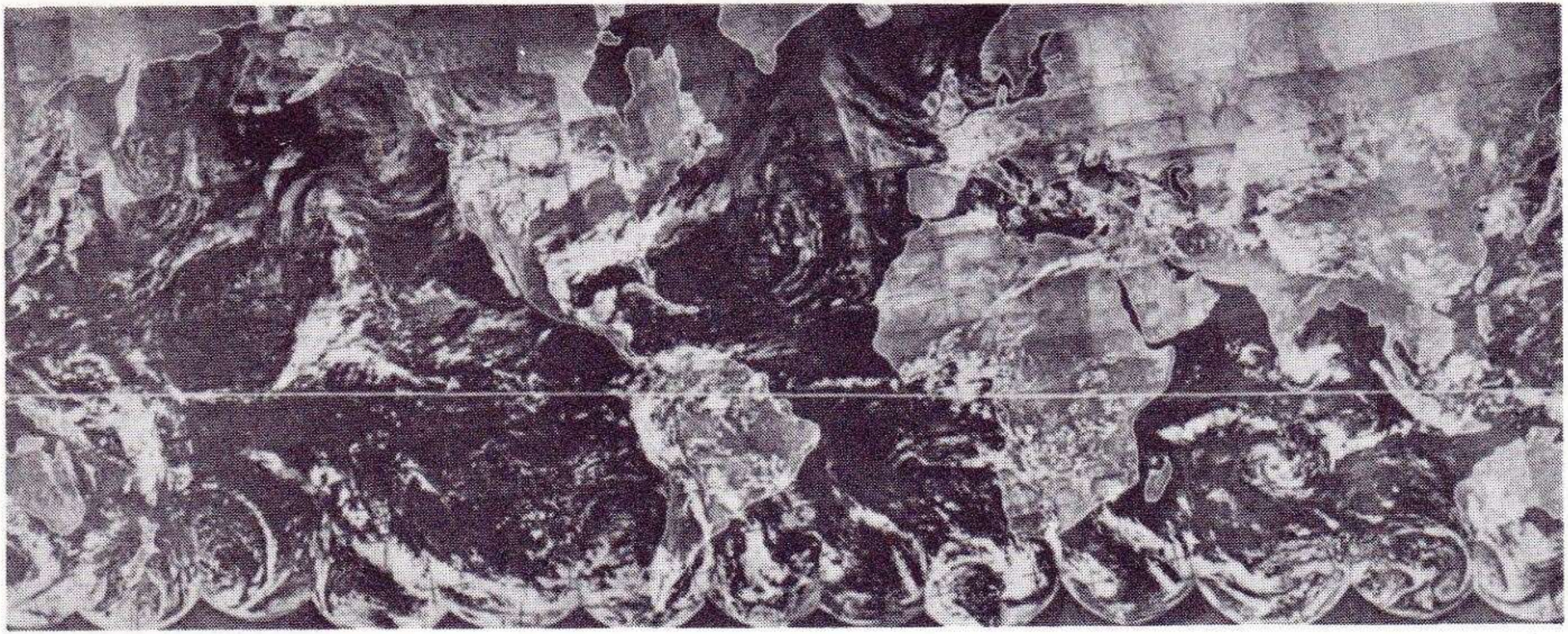
Follow-On TIROS Satellites

- Wheel Mode TIROS 9
- TIROS M
- TIROS N

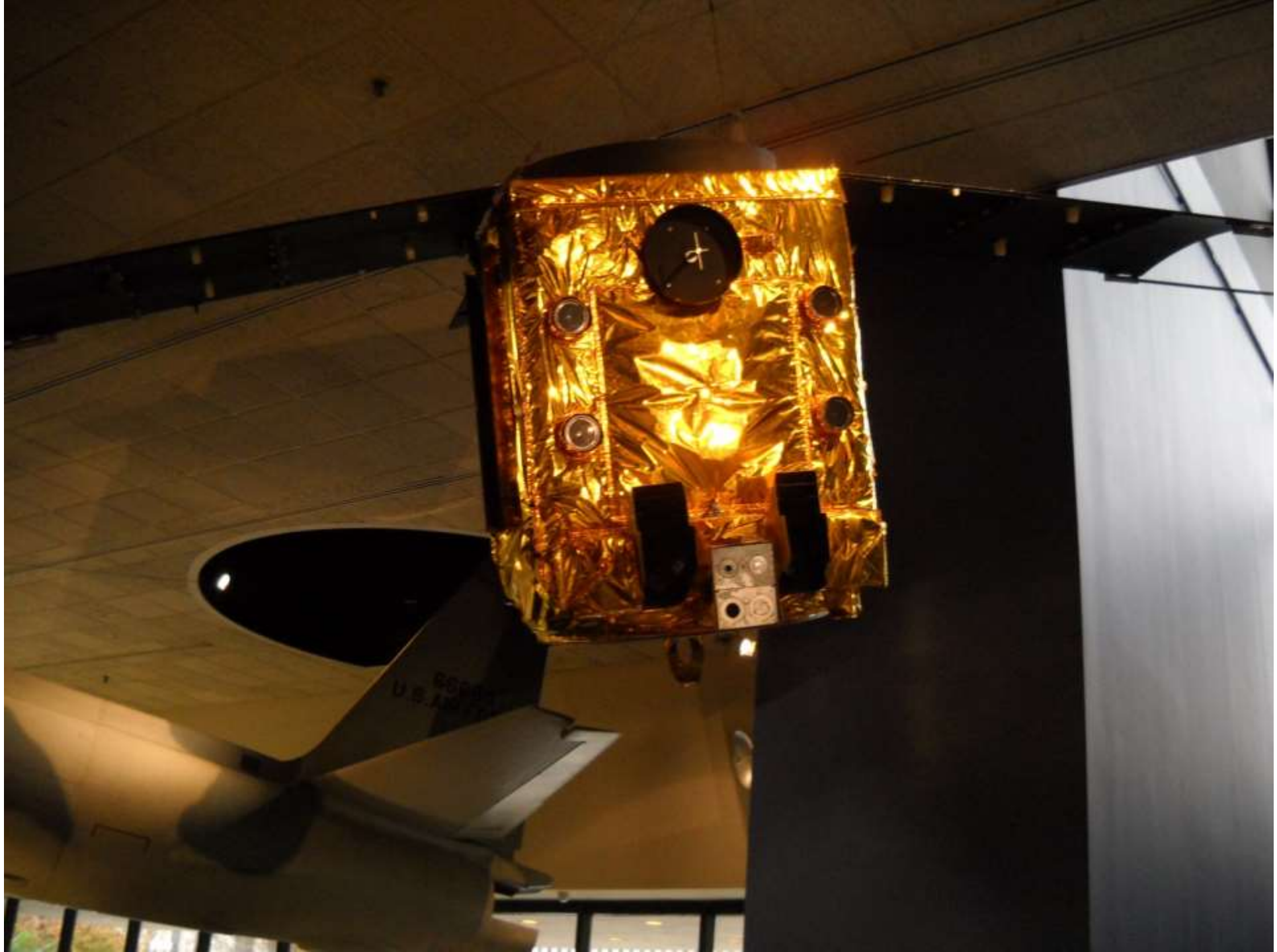

TIROS/ESSA/ITOS/NOAA
21 Years of Service to Mankind
1960-1981
Planned Operational Service
1981-1986

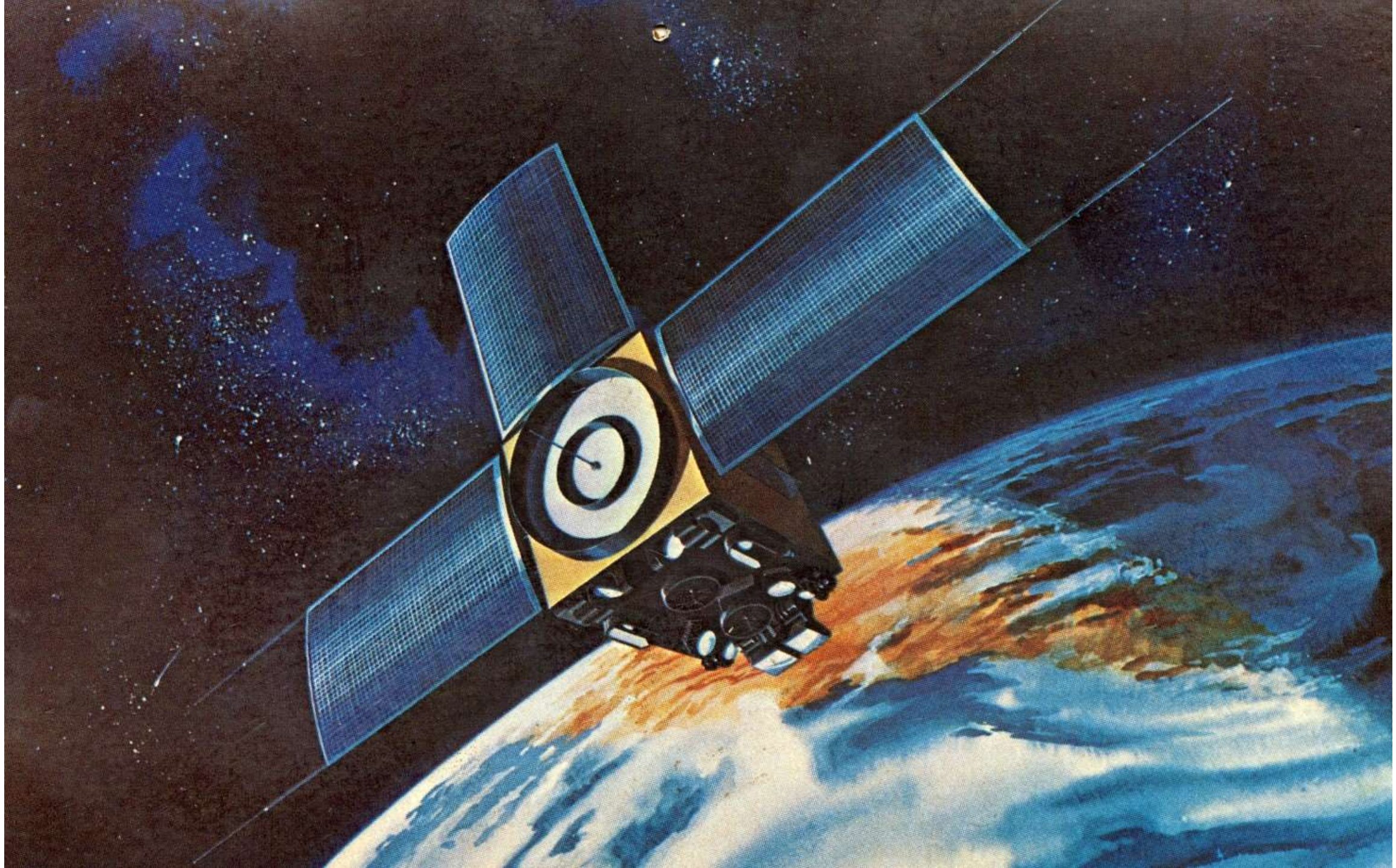






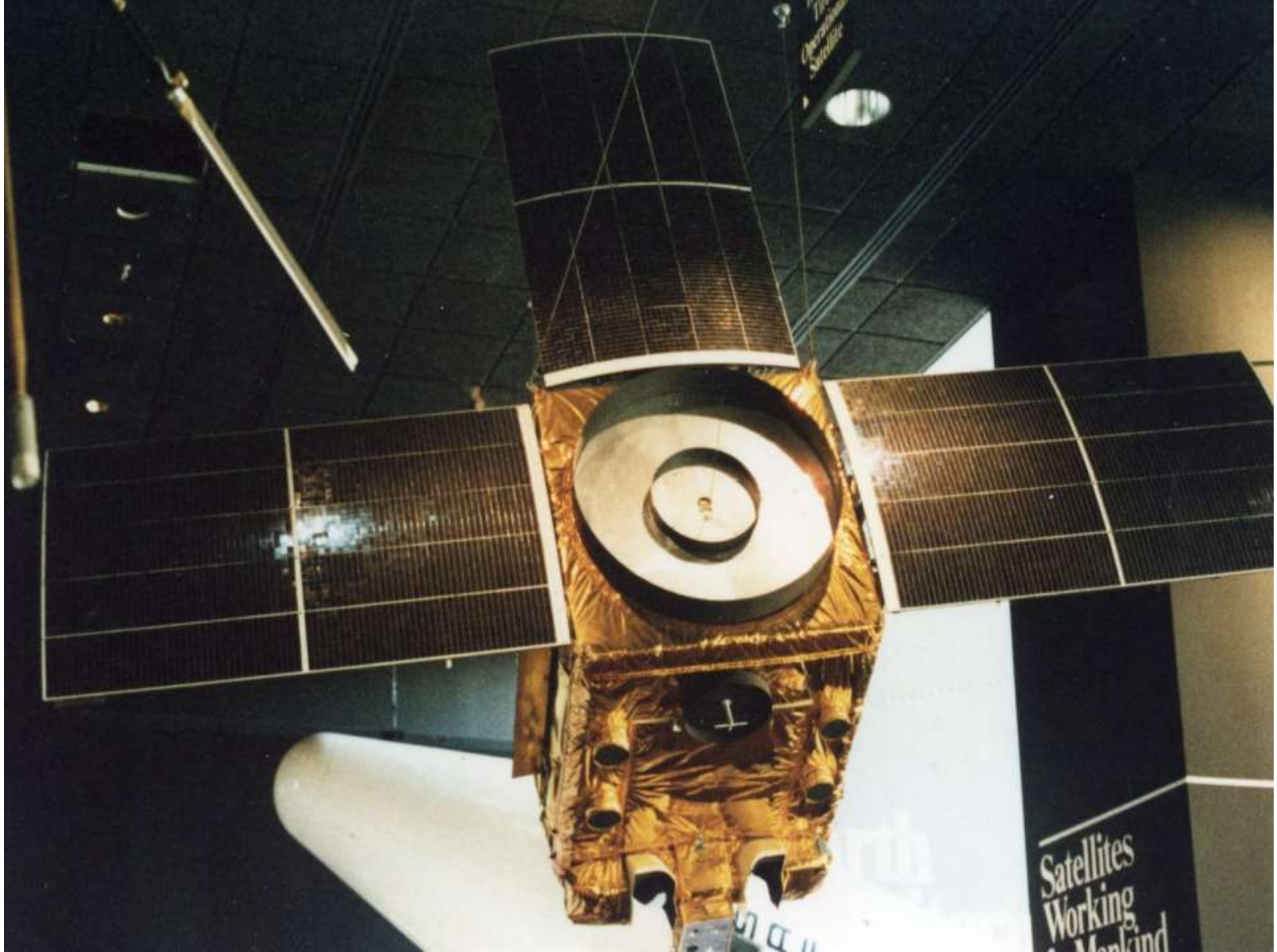
TIROS IX, first complete view of the world's weather



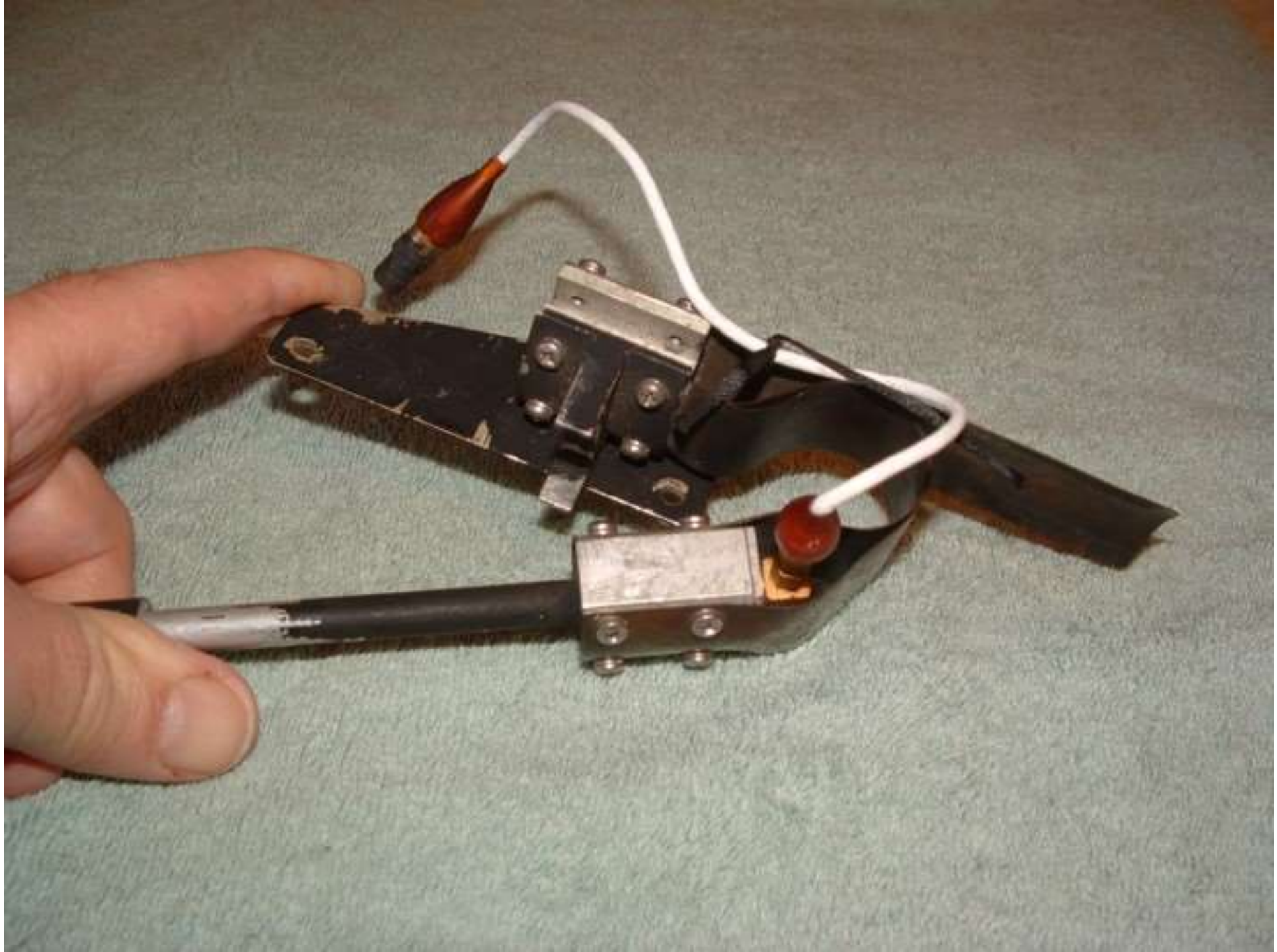


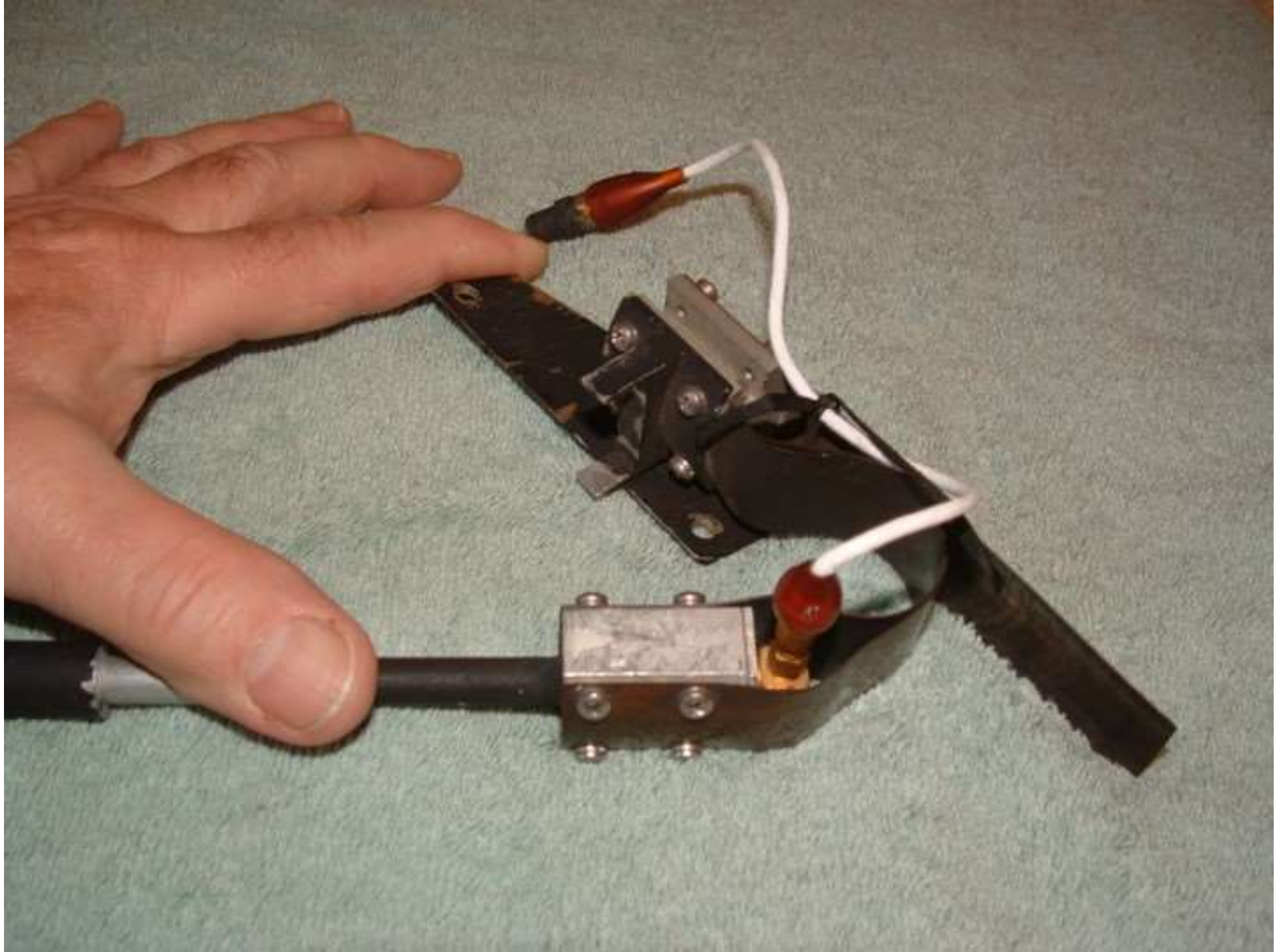
IMPROVED TIROS OPERATIONAL SATELLITE (ITOS/-NOAA) Most advanced satellite in the family of operational weather and environmental spacecraft. Since 1966, no major storm in the world has gone undetected by these tireless weather watchers which have traveled more than 6.5 billion miles and produced well over 2 million pictures. Twenty-three TIROS/ESSA/ITOS Weather Satellites have been successfully orbited since 1960. The National Oceanic and Atmospheric Administration manages and operates the satellites built by RCA for NASA's Goddard Space Flight Center.

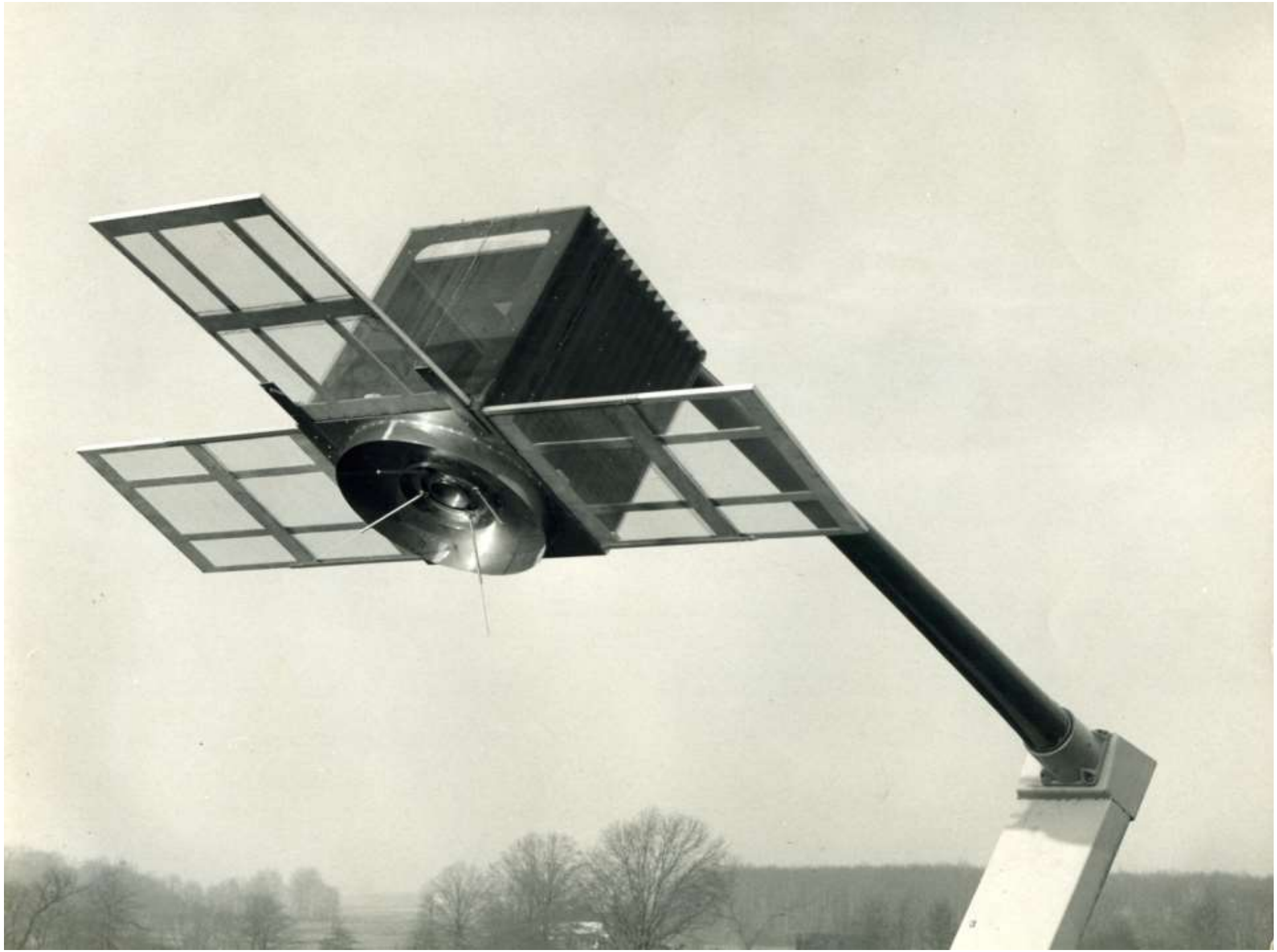

Improved
Tiros
Operational
Satellite


Satellites
Working


Improved
Tiros
Operational
Satellite



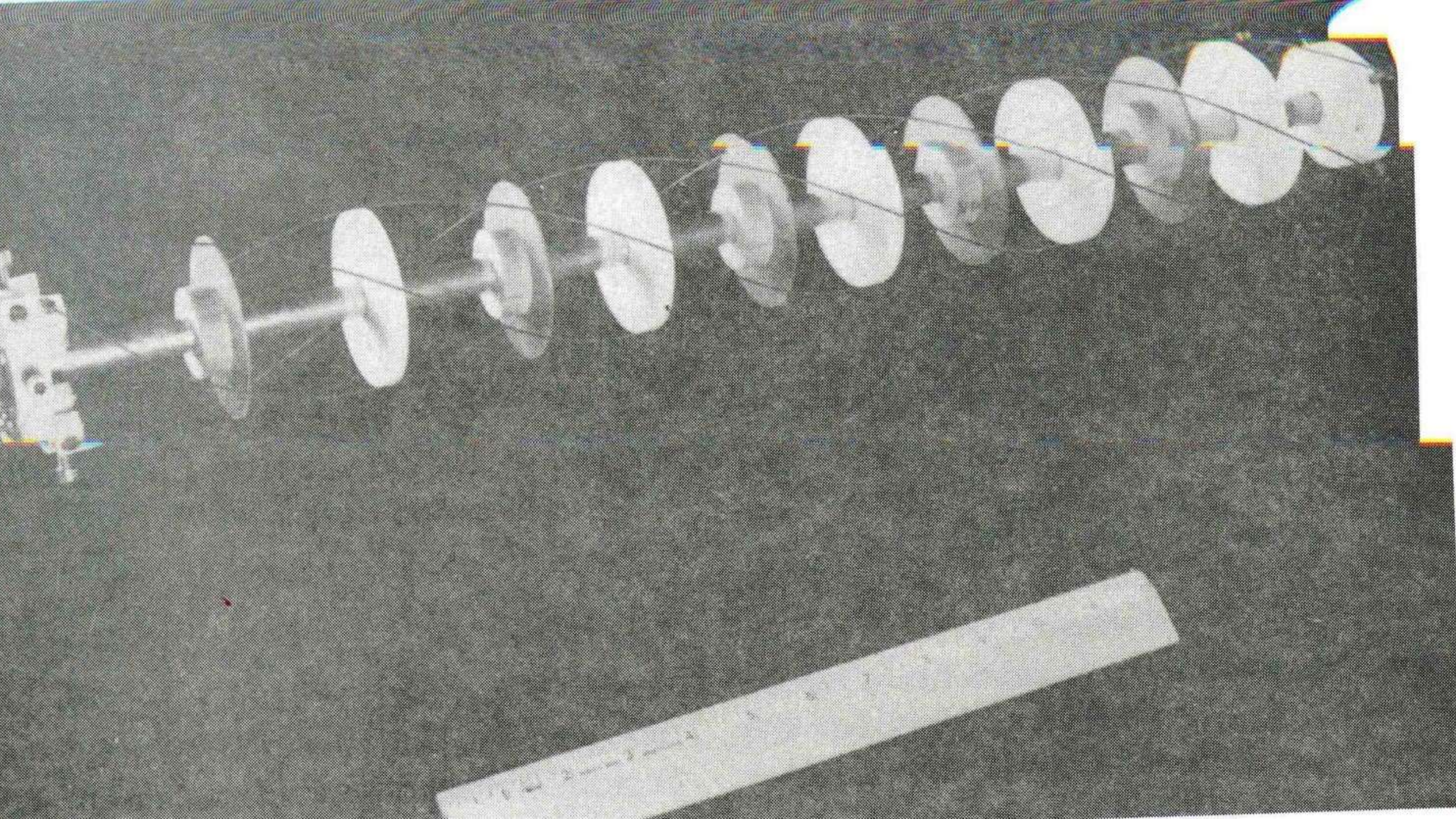





1975149-501
S/N 05

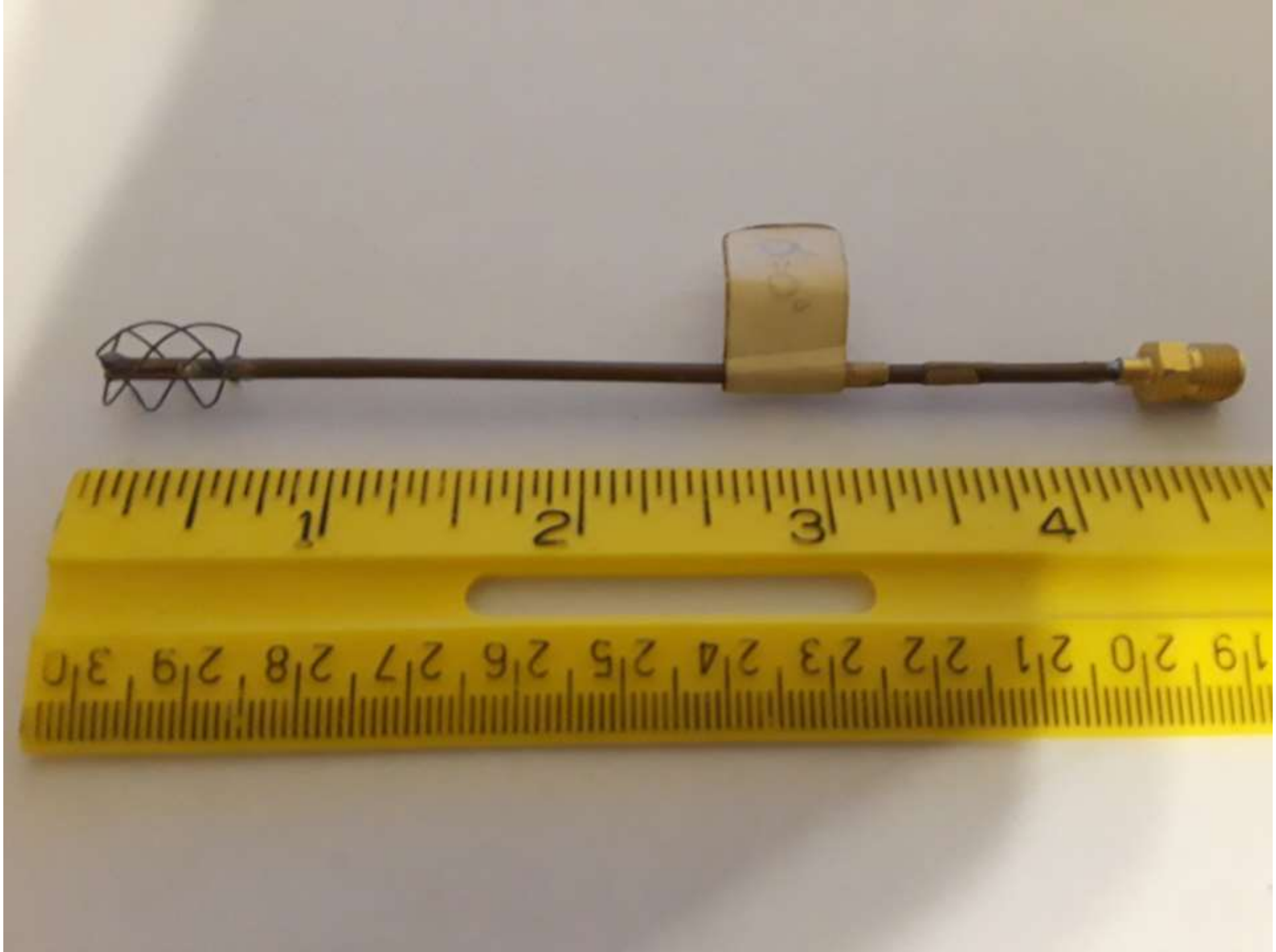
Quadrifilar Antennas

- Two Flight Model Quadrifilar Antennas
- 1.6 GHz and 2.2 GHz
- Find use in Commercial, Military, and Amateur Satellites
- Provides a large range of radiation characteristics from an antenna with very small size and weight
- TIROS N used Quadrifilars for SAR ELT




QUADRIFILAR, EXPERIMENTAL MODEL
or Infinite Balun, and 90° self-
phasing between loop elements
Short loop (capacitive), I leads 45°
Long loop (inductive), I lags 45°


RCA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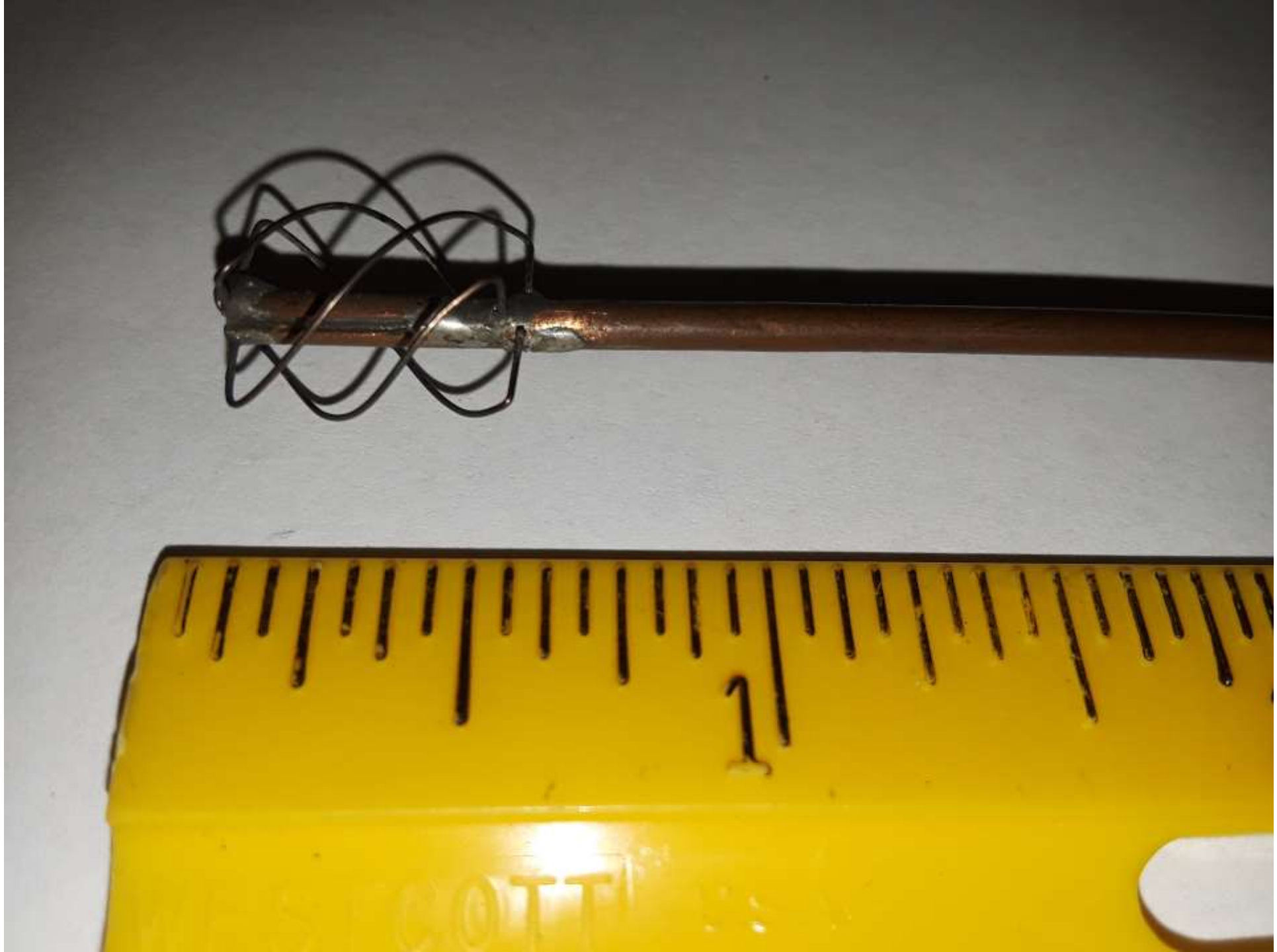
2
3
4


1

1
2
3
4


HEWLETT PACKARD

ECHO I

Launched August 8th, 1960

Applications Satellites

Echo 1 Communications Satellite

Length, upper stage:	2.4 m (8 ft)
Width, Echo container:	0.9 m (3 ft)
Manufacturer:	G. T. Schjeldahl Co.

Launched in 1960, Echo 1 was designed to explore the new field of communications via space. Its design was remarkably simple: a reflective sphere 30 meters (100 feet) in diameter that bounced signals directed at it from one location on Earth to another. By the time Echo 2 was launched in 1964, other types of communications satellites had proven superior, and researchers used the Echos primarily for scientific experiments.

Echo satellites posed a unique technical challenge. They were essentially balloons sent into orbit folded flat and then inflated in space. Inflation had to proceed carefully to ensure the integrity of the satellite's surface. This one is a flight spare folded in its launch canister.

Transferred from NASA Langley Research Center

NACA's ECHO I

- NACA (National Advisory Committee for Aeronautics) NASA predecessor
- First launch attempt on Thor Delta failed May 13, 1960
- Successful Launch on August 8, 1960
- Launched from Wallops Island, VA
- 100 foot diameter aluminized mylar balloon
- Carried two Beacons, 108.00 and 108.03 MHz
- Beacon power .010 watts (10 milliwatts QRP)
- Goal: To test passive repeater functionality
- Attempt at Global TV but signal too weak
- Extremely high power required for acceptable signal-to-noise ratio on downlink


N.A.S.A.

Balloon Statistics

- Aluminized Mylar is .0005 inches thick
- (½ mil thickness)
- Mylar made by E. I. du Pont de Nemours & Co.
- Mylar was being used for recording tape and for frozen-food bags
- Sphere weighs 132 pounds
- Four pounds of aluminum was vapor deposited on mylar to fabricate balloon

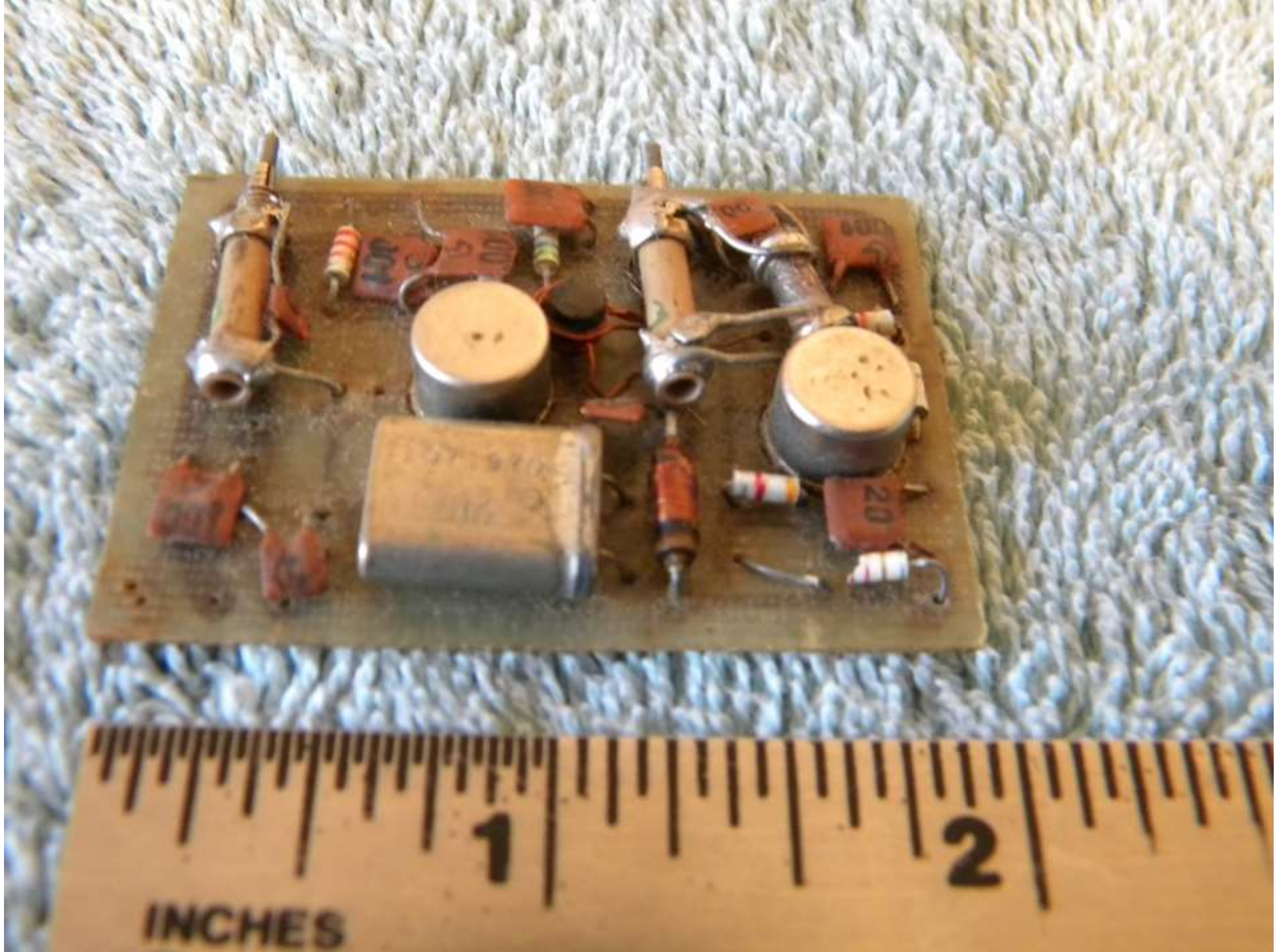

NIPPON
SPEED 2 1/2 MPH


BNR-15
BATES NATIONAL RULE
TRANSMITTER

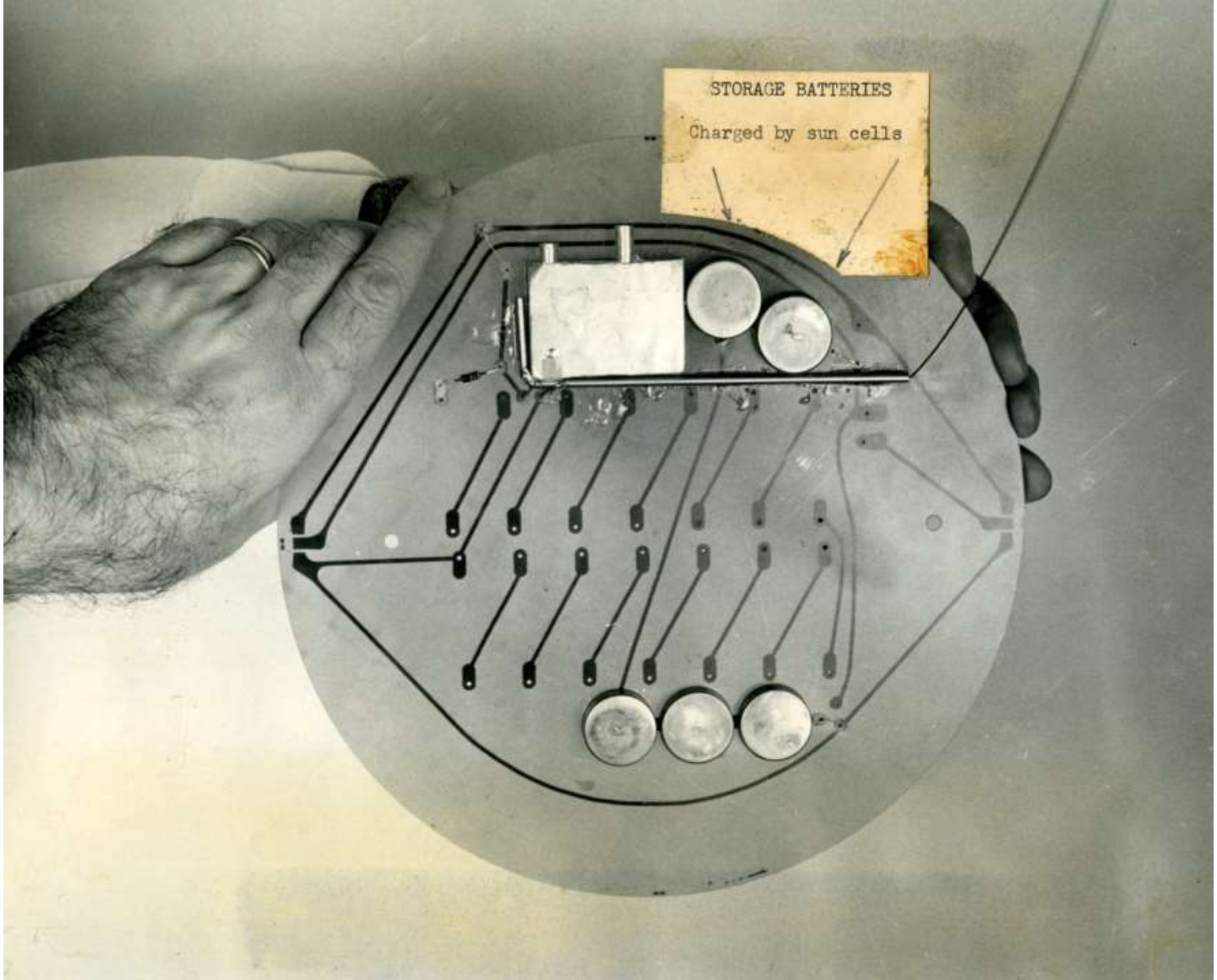
Beacon Details

- 3/8 inch thick, 11 ounces
- 70 solar cells
- 5 storage batteries
- Micro-switch enables transmitter upon antenna release
- ¼ wave monopole working against balloon as ground plane
- 10 milliwatts output


TRANSMITTER

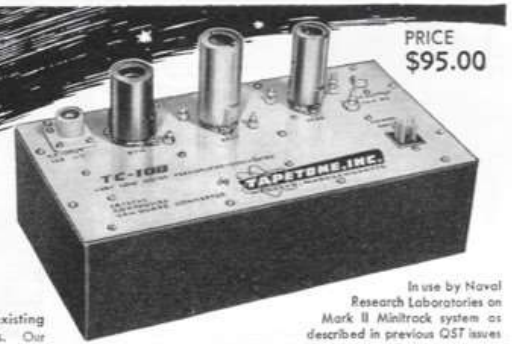

1
2
INCHES


ECHO I
RADIO BEACON
TRANSMITTER
POWER:
0.01 WATT
1
2


STORAGE BATTERIES
Charged by sun cells

Attaching the beacon to the balloon satellite.


LINE LEVEL
LINE METER
LINE GAIN
ANT TRIM
AGC
LIMITER
CARRIER LEVEL
AUDIO RESPONSE
BREAK IN
BANDWIDTH KC
BFO PITCH
FUNCTION
BFO
KILOCYCLE CHANGE
MEGACYCLE CHANGE
DIAL LOCK
ZERO ADJ.
CAUTION
READ INSTRUCTIONS PACKED WITH EQUIPMENT BEFORE USING
LOCAL GAIN
RF GAIN
PHONES



PRICE
$95.00

NEW! CONVERTER FOR TRACKING U. S. SATELLITE!

Now all radio amateurs can use their existing receivers to track the satellite signals. Our newest TC-108 converts the 108.000 mc satellite transmission to 14.4 mc standard output.

In use by Naval Research Laboratories on Mark II Minitrack system as described in previous QST issues

VANGUARD, TC-108

- Power Gain: 2000 (33 db).
- Noise Figure: 2.1 db.
- Rejection of Signals at Intermediate Frequency: 90 db.
- Image Frequency Rejection: 65 db.
- Intermediate Frequency output: 14.4 mc.
- Rejection of all other Spurious Responses: greater than 65 db down.
- Matched Input Impedance: 50 ohms.
- Output Impedance: 50 ohms nominal.
- Output Bandwidth: 300 kc at ½ power points.
- Tube Complement: 417A/5842, 6BQ7A/6BZ7, 6CB6, and 12AT7.
- Power Requirements: (a) 6.3 volts at 1.3 amperes. (b) + 150 volts DC at 60 ma. regulated.
- Dimensions: 9½" x 5" x 2½" shielded base. Maximum seated tube and tube shield height 2¼".

Write for free TAPETONE instruction booklet on how to assemble equipment for tracking U. S. Satellite.

New Regulated Power Supply
Model PSR-150 available . . price 49.95

TAPETONE, INC.
10 ARDLOCK PLACE, WEBSTER, MASS.

QST ADVERTISERS

"Advertising is accepted only from firms who, in the publisher's opinion, are of established integrity and whose products secure the approval of the technical staff of the American Radio Relay League."

Quoted from QST's advertising rate card

Amateurs and Electronic Engineers: Practically everything you need can be supplied by the advertisers in QST. And you will know the product has the approval of the League's technical staff.

NEW! CONVERTER FOR TRACKING U. S. SATELLITE!

Now all radio amateurs can use their existing receivers to track the satellite signals. Our newest TC-108 converts the 108.000 mc satellite transmission to 14.4 mc standard output.

- Power Gain: 2000 (33 db).
- Noise Figure: 2.1
- Image Frequency Rejection: 65 db.
- Rejection of all other Spurious Responses: greater
- Output Impedance: 50 ohms nominal.
- Tube Complement: 417A/
- Power Requirements: (a) 6.3 volts at 1.
- Dimensions: 9½" x 5" x 2½" shielded b

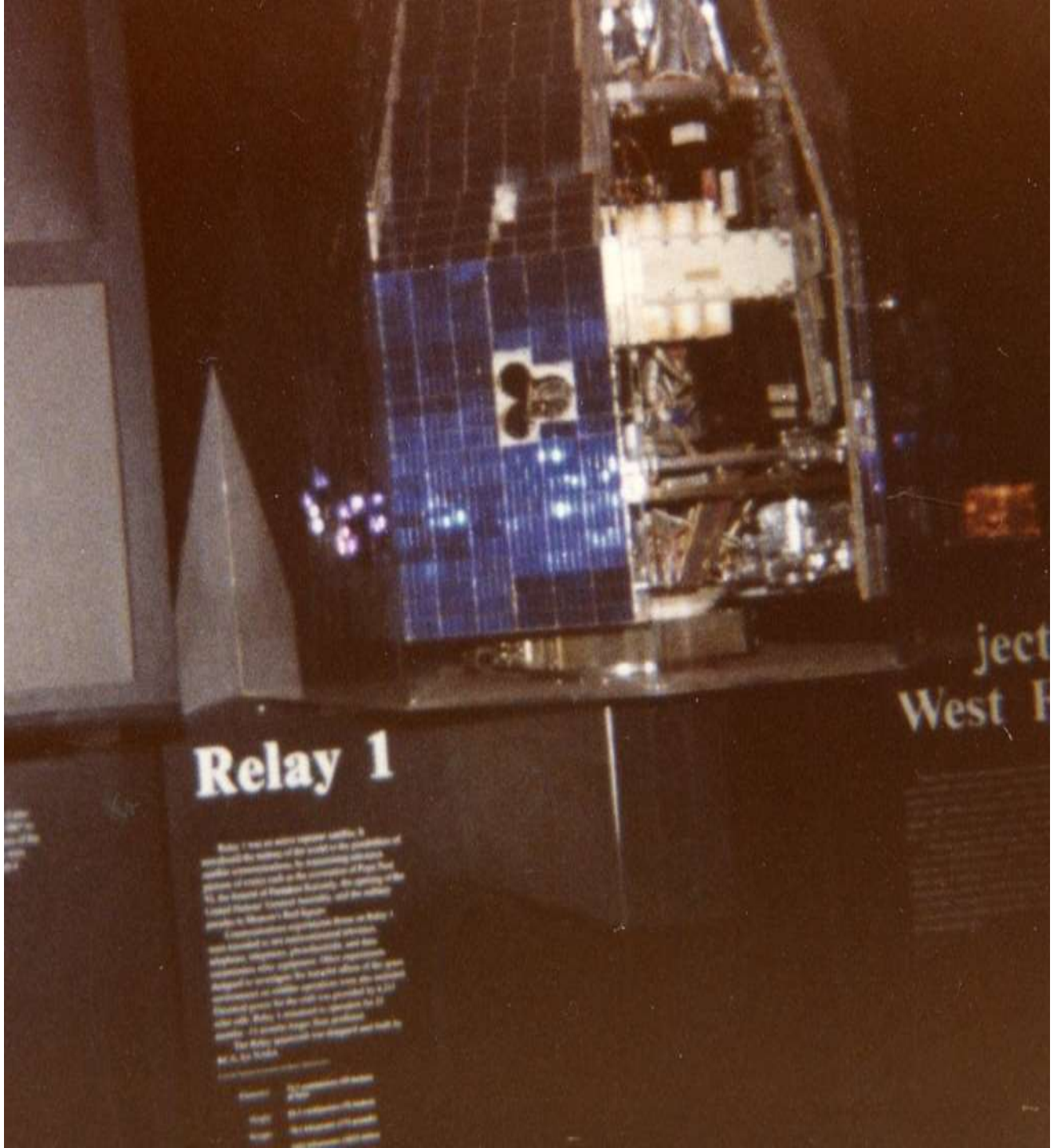
Write for free TAPETONE instruction bookle

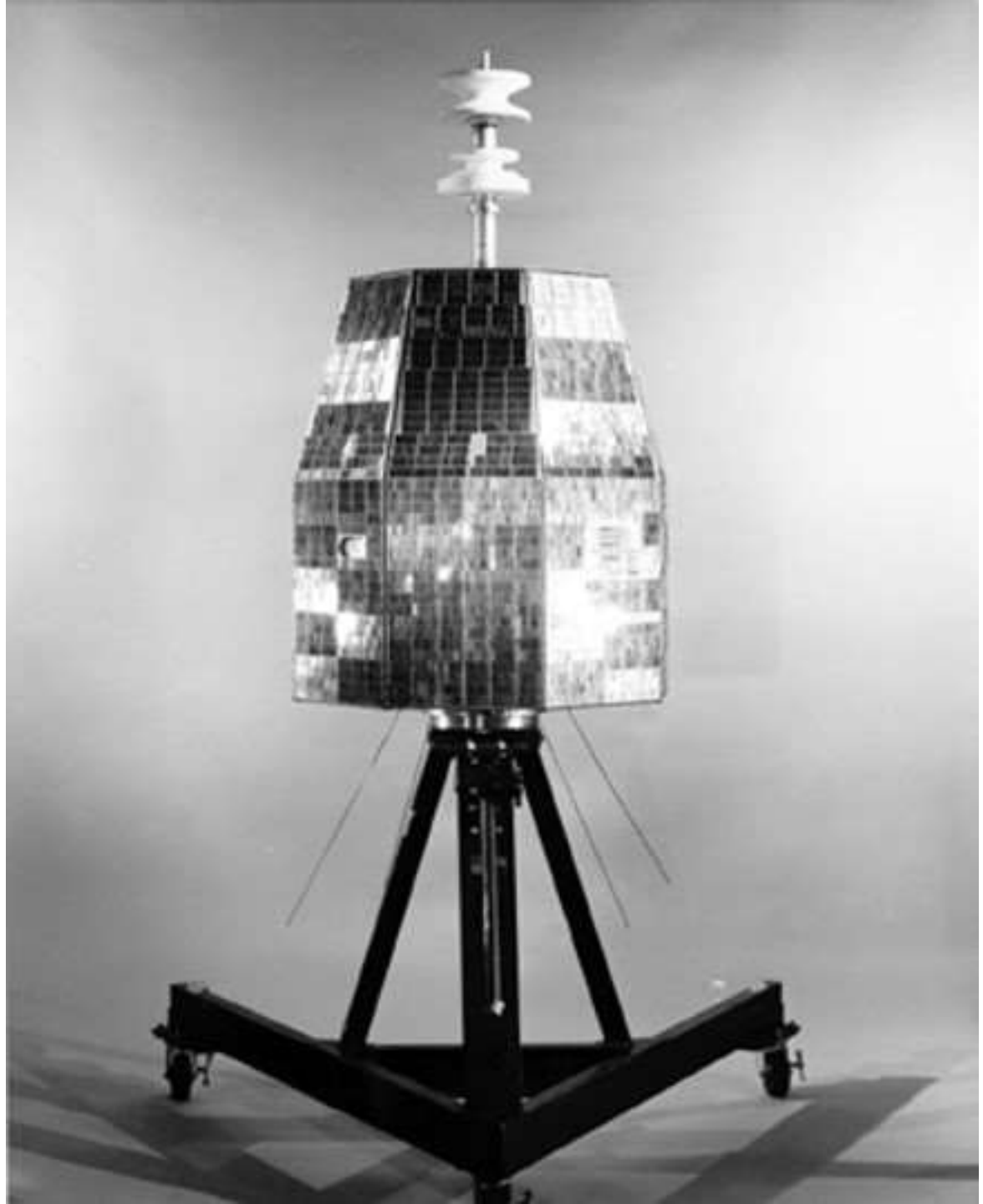
New Regulated Power Supply
Model PSR-150 available . . price 49.9

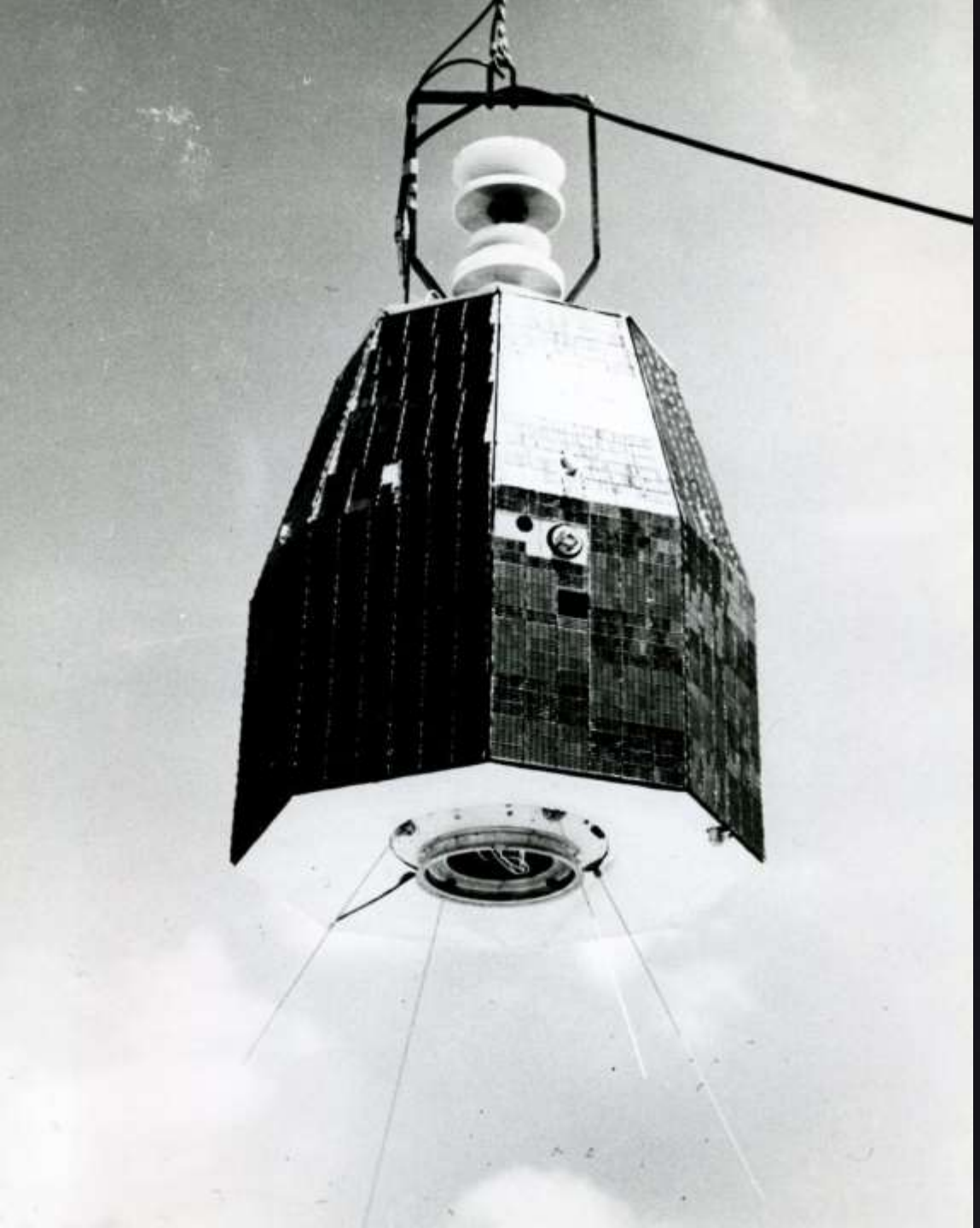

INPUT
417A
6BQ7
6CB6
OUTPUT
POWER
INPUT
TAPETONE, INC.
WEBSTER, MASSACHUSETTS

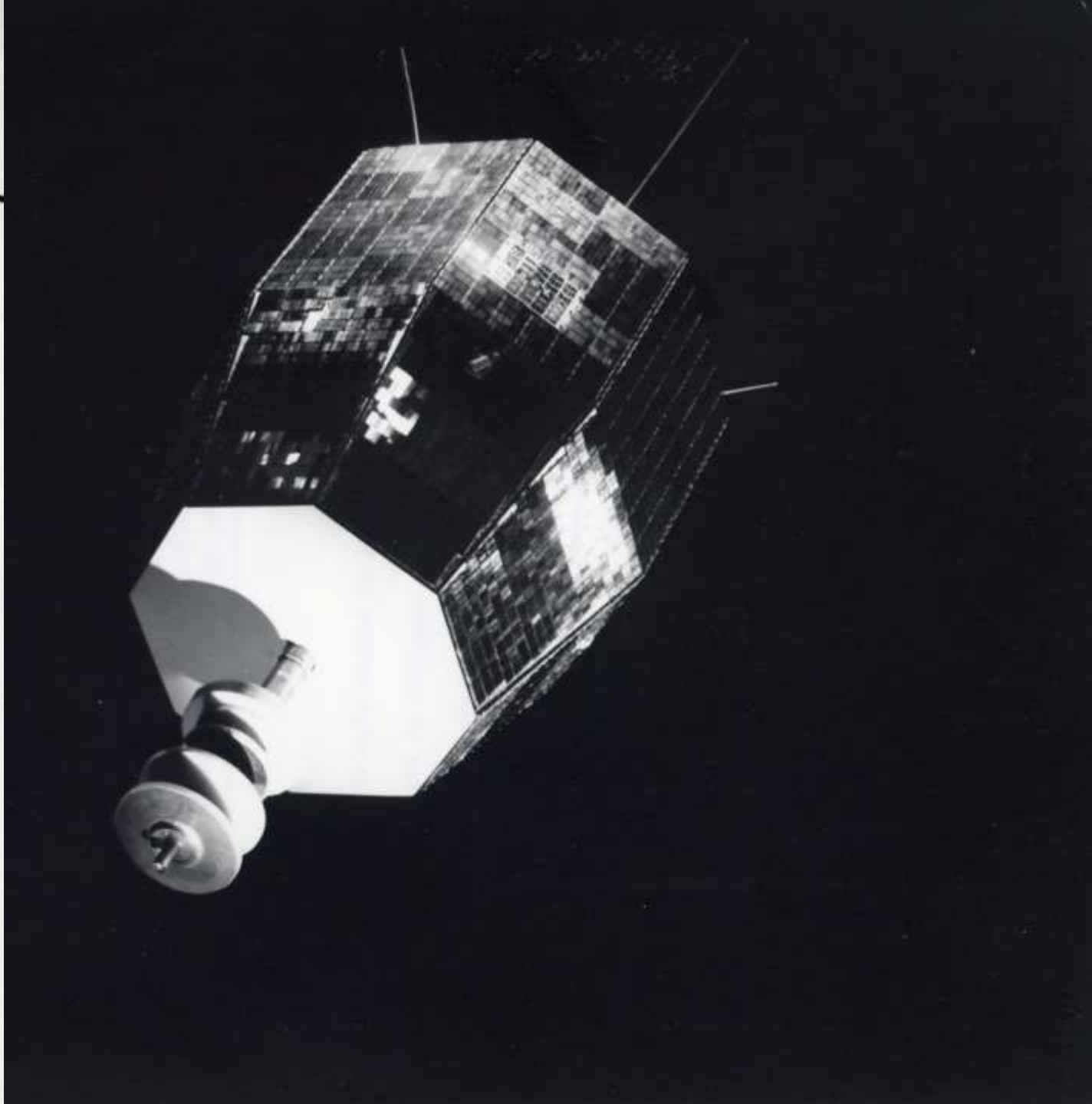
NASA’s RELAY I

- NASA’s Relay I Launched December 13, 1962
- (Telstar Launched June 10, 1962 – AT&T)
- Active Repeater for TV, Phone, RTTY, etc.
- Uplink 1.726 GHz RHCP
- Downlink 4.71 GHz LHCP
- Command 148 MHz
- Telemetry 136 MHz
- Command and Telemetry use 4 monopoles at base of satellite


Relay 1

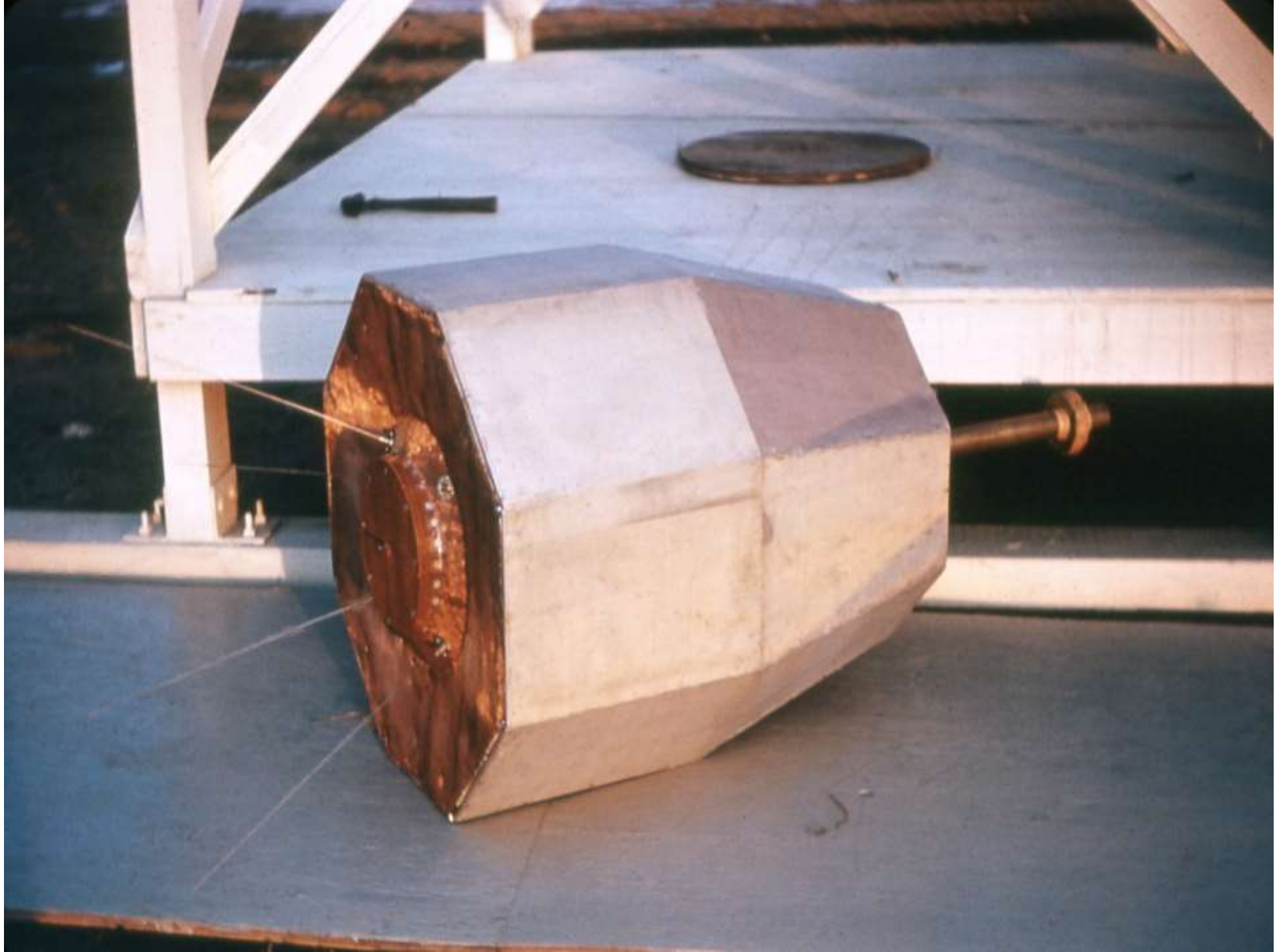


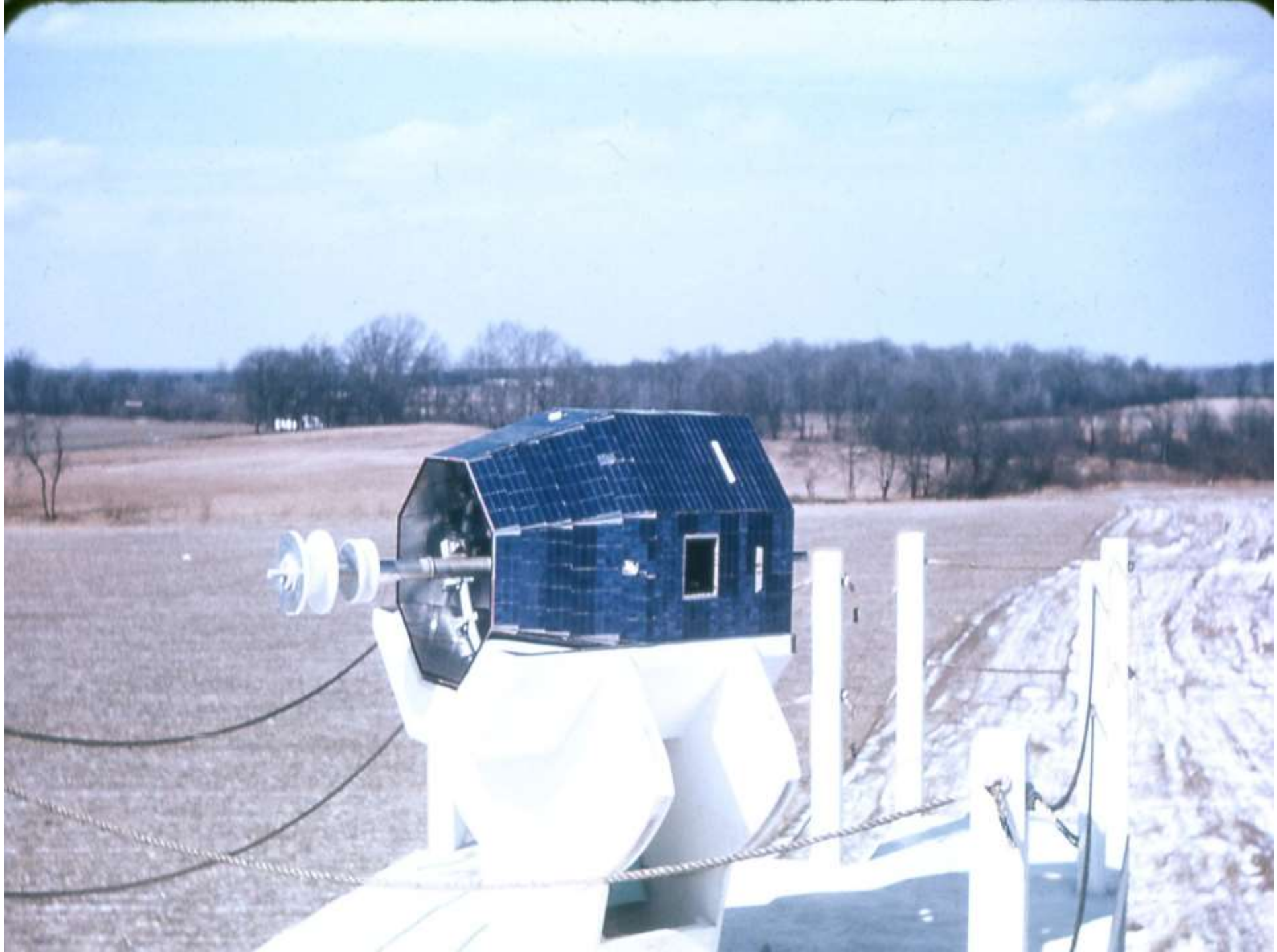




Relay and Telstar

- Telstar was credited with Relay's accomplishment of sharing the Tokyo 1964 Olympic Games with US, Europe, and other countries
- Relay Perigee 820, Apogee 4623 miles
- There was no booster in the 60s capable of achieving geosynchronous orbit (22,236 miles, 35,786 kilometers above the earth's surface)





Helical Filter

Permits Receiving and Transmitting on the same antenna array

Command Uplink on 148 MHz

Telemetry Downlink on 136 MHz


1
2
3
4
INCHES


28
29
30
31
32
33
34
35
36


1
2
3
4
INCHES
BNR-15

April 8, 1969 JAMES E. WEBB 3,437,959

ADMINISTRATOR OF THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

HELICAL COAXIAL RESONATOR RF FILTER

Filed Jan. 20, 1966

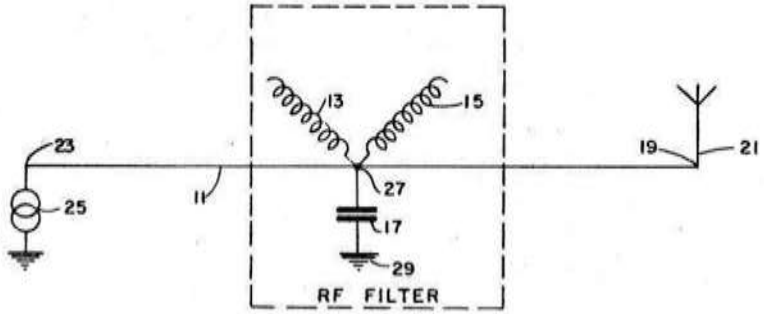


FIG. 1.

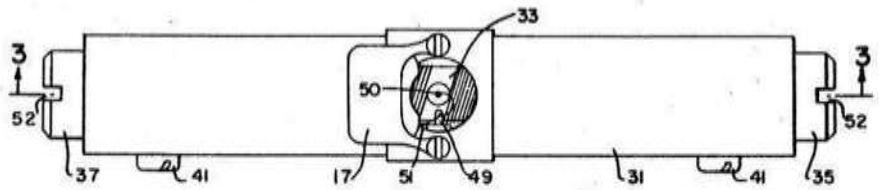


FIG. 2.

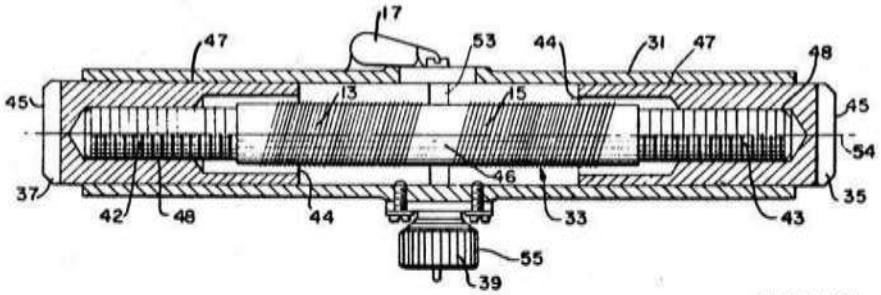


FIG. 3.

INVENTOR

Myron Walter Maxwell

BY

Stevens & Cary

Leonard Rainy

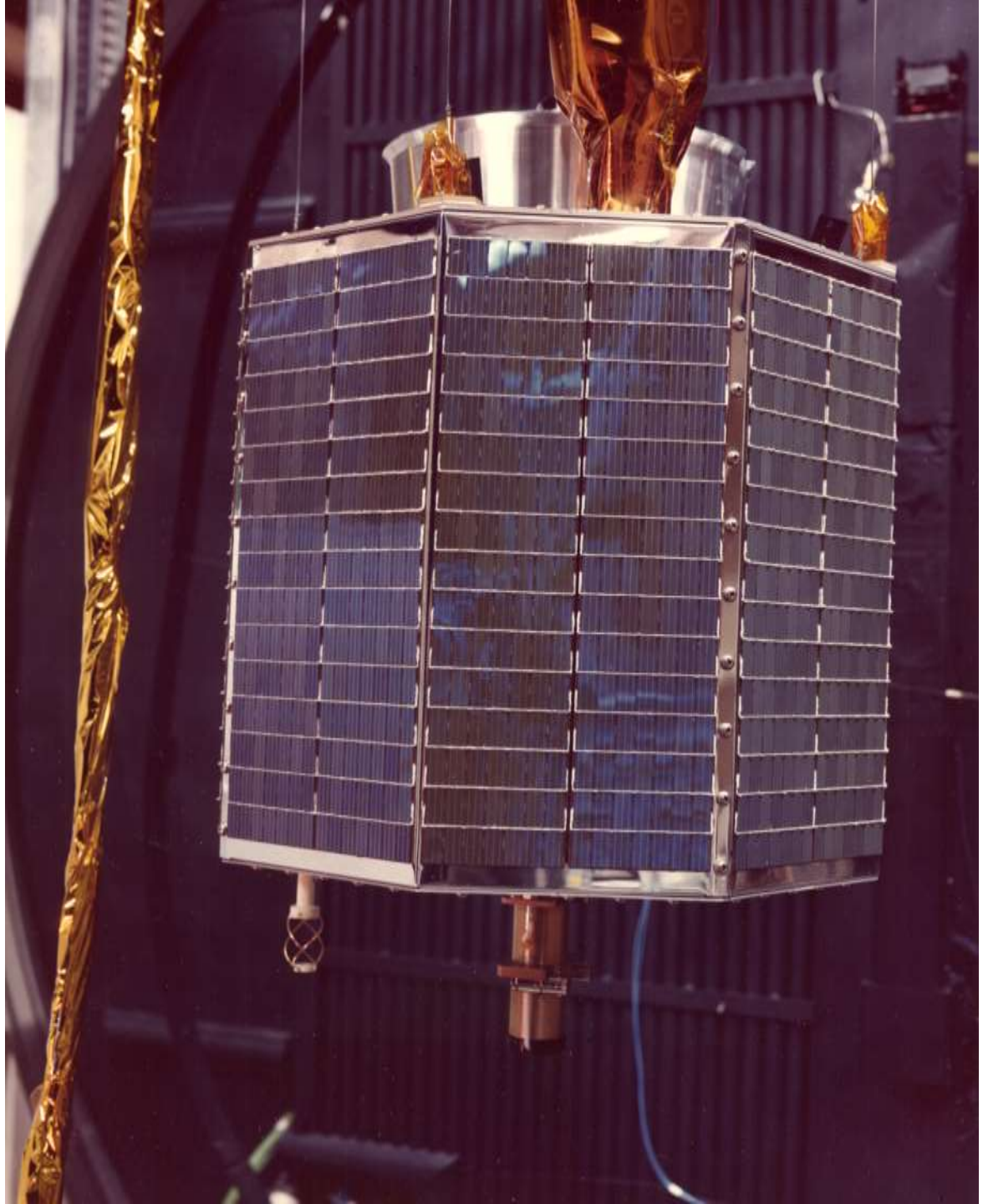
ATTORNEYS

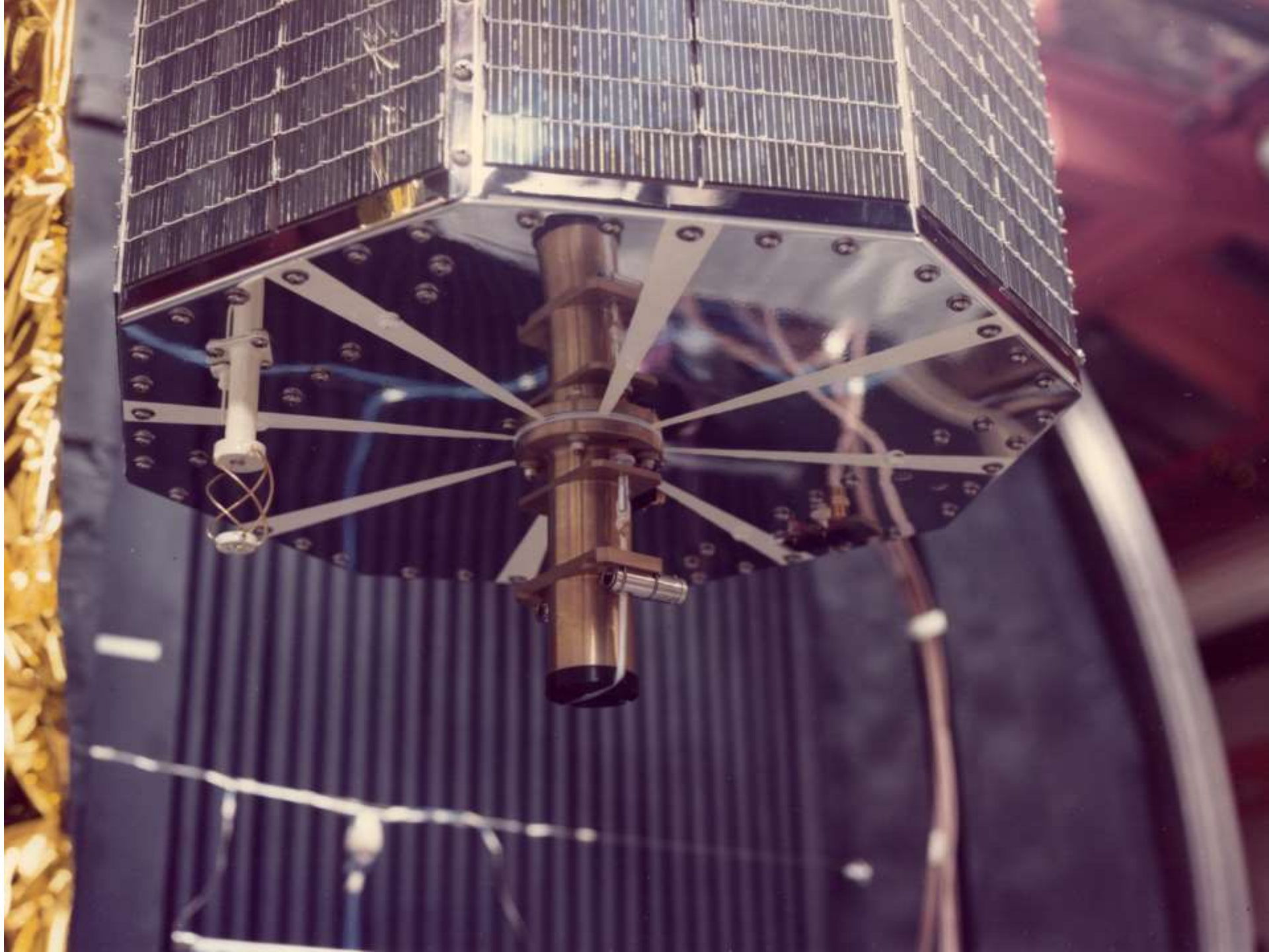
OSCAR SEVEN

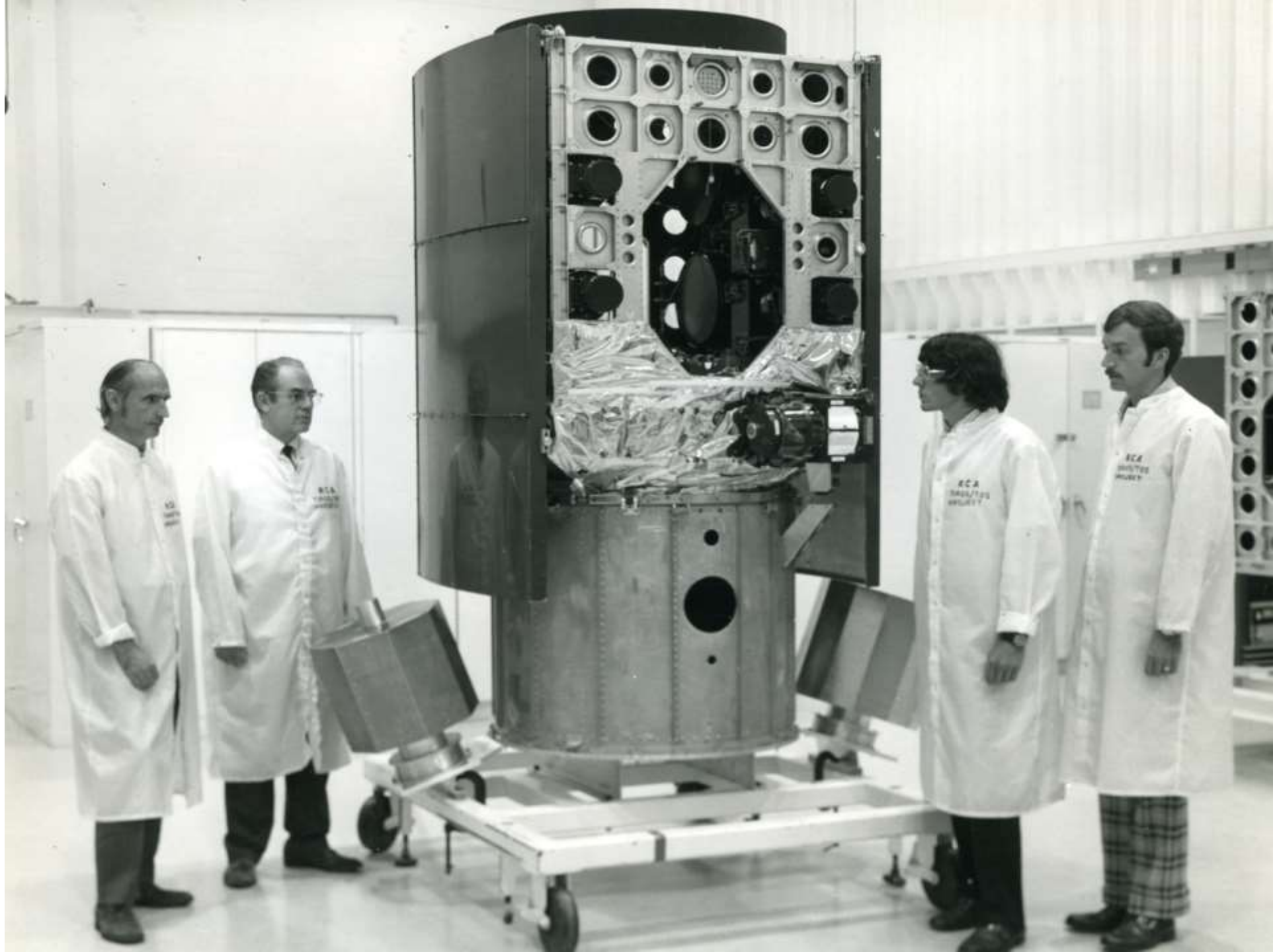
Quadrifilar Antenna donated to AMSAT


RCA
TIROS/TOS
PROJECT


RCA
TIROS/TOS
PROJECT
RCA
TIROS/TOS
PROJECT

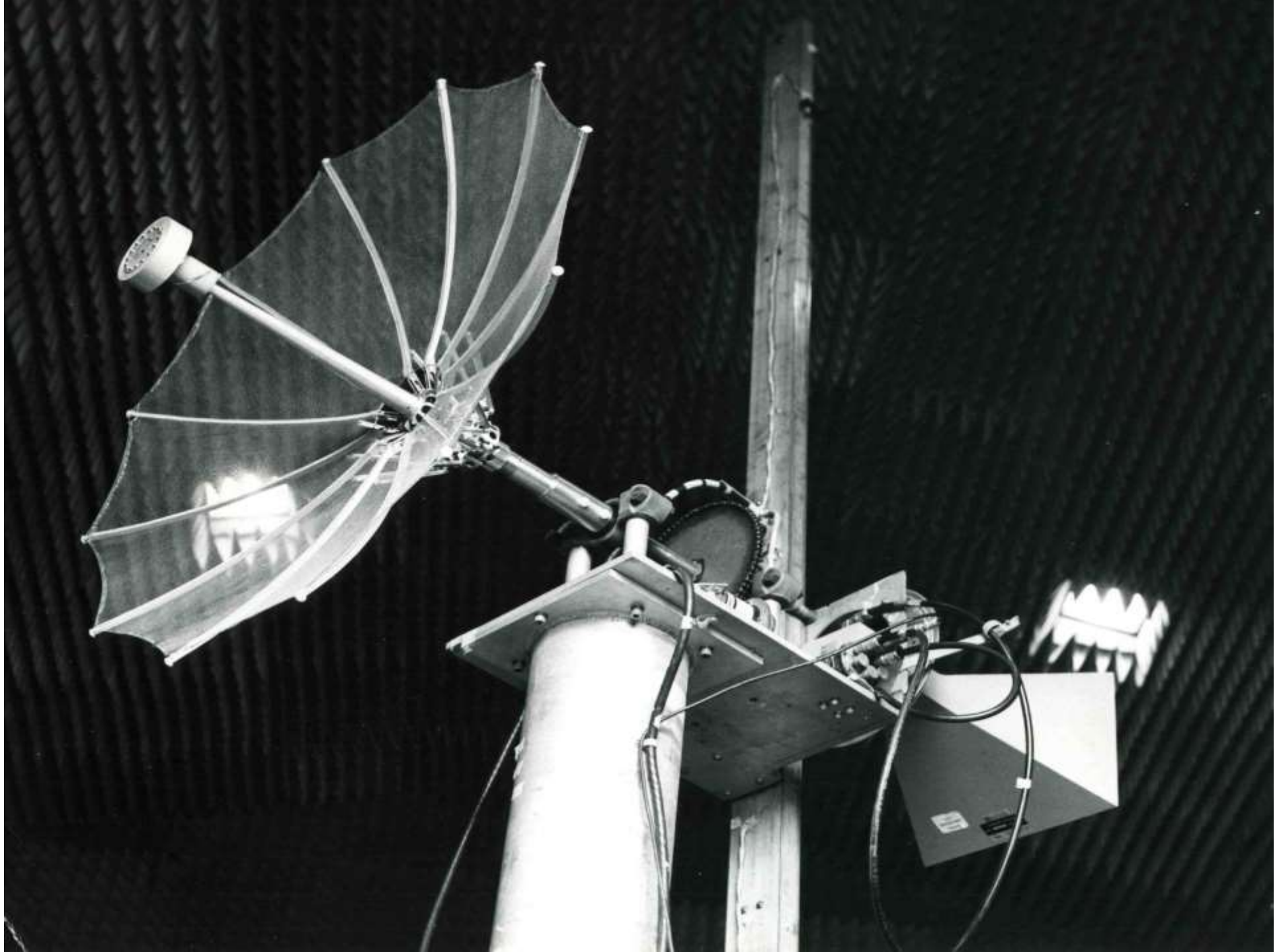


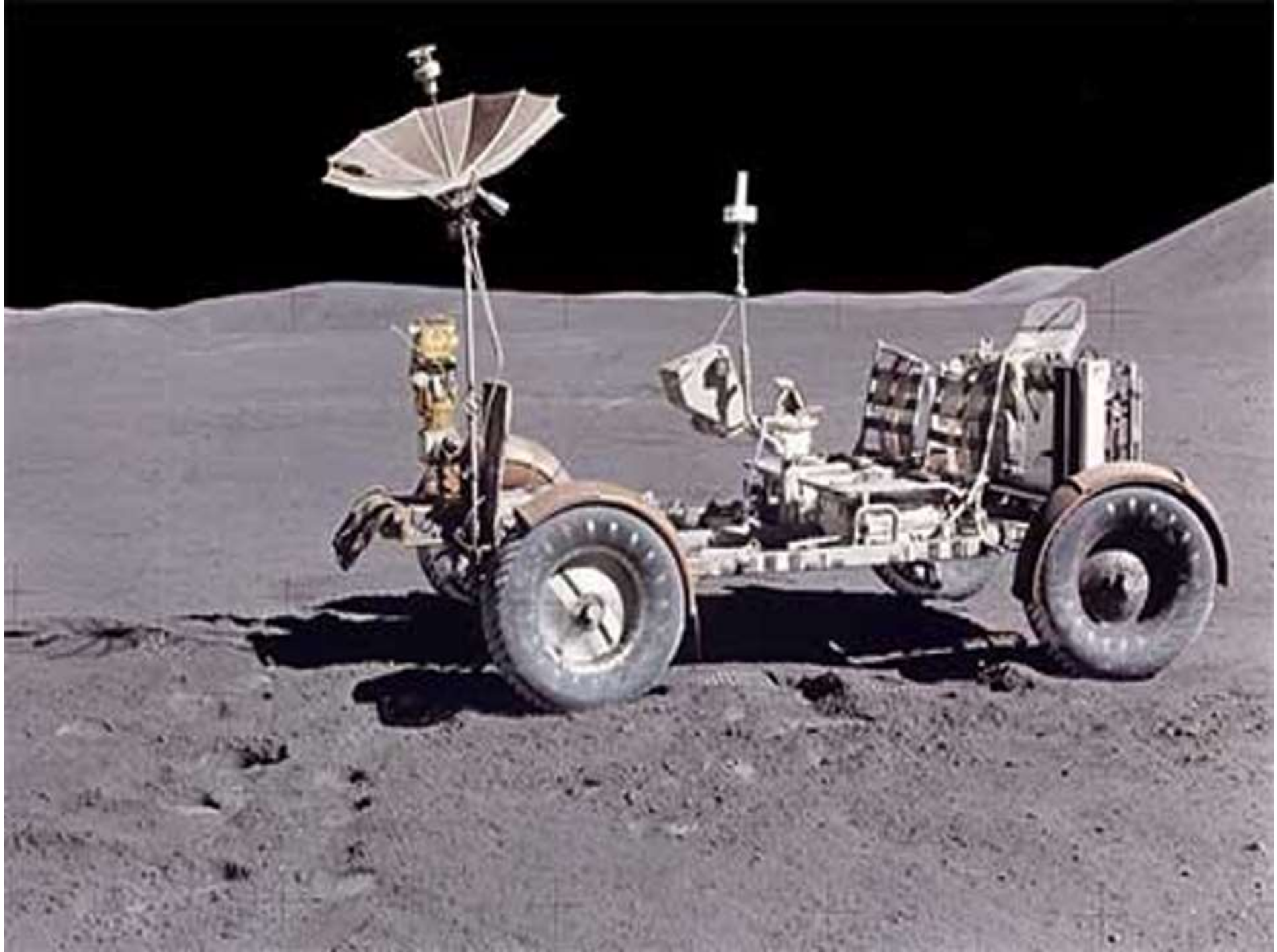


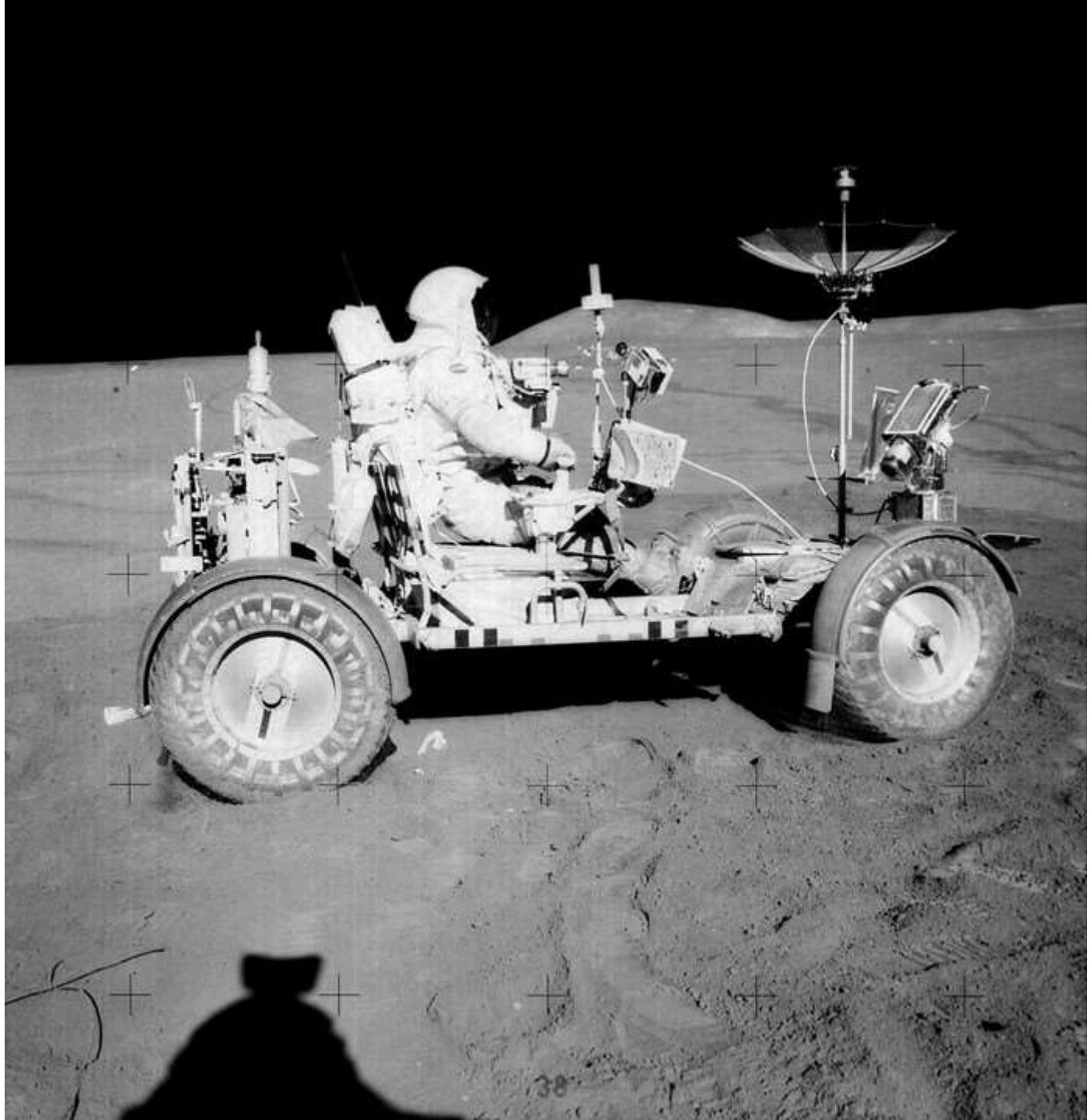


APOLLO !

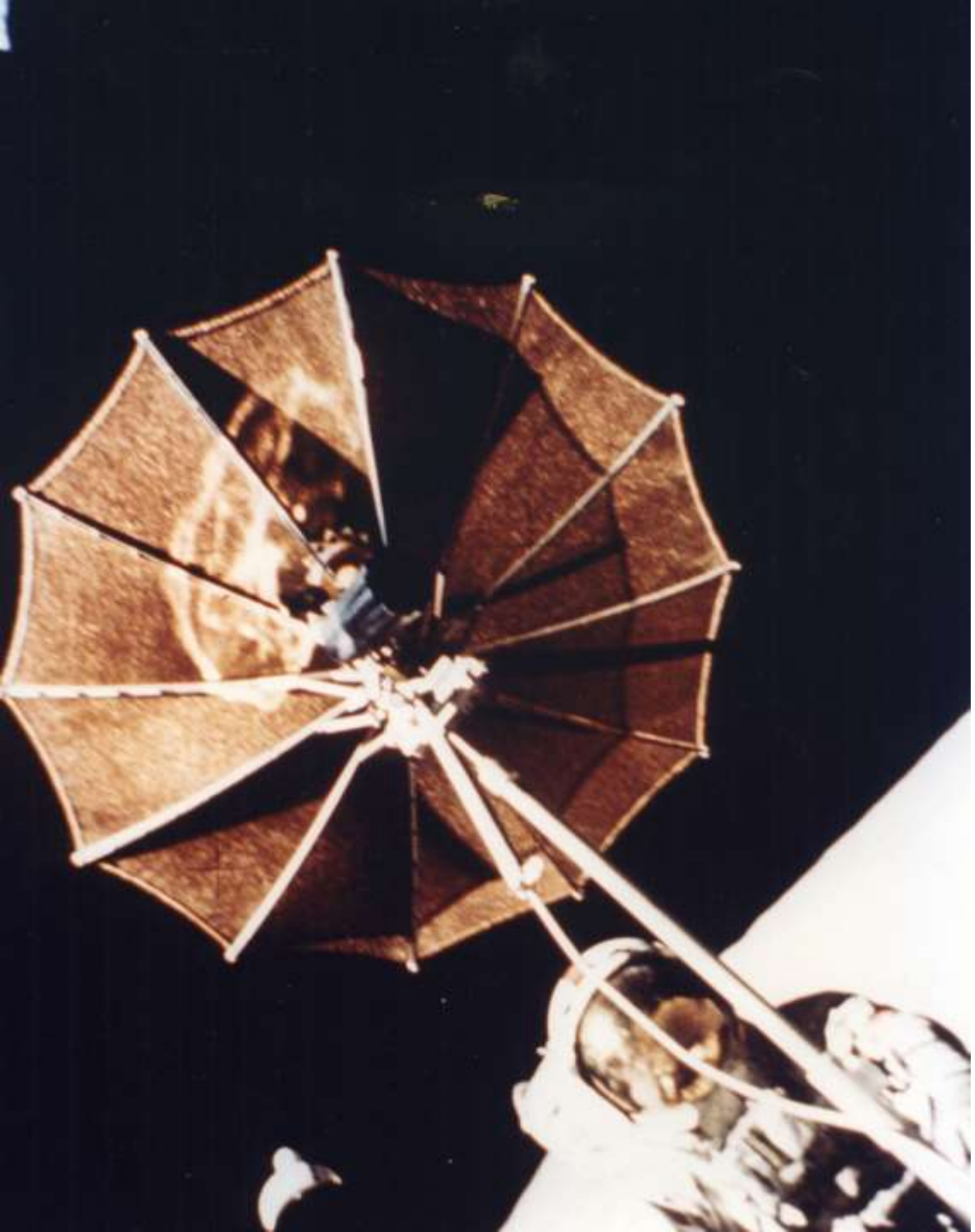
- RCA Astro Electronics Division developed the 36 inch 3.6 GHz antenna for the Lunar Rover.
- This antenna was used to transmit color television from the rover to earth.
- A telescope was added to the dish, with magnification factor that caused the earth to fill the viewing area when properly aimed.






38


UNITED
STATES



Further Reading……

- www.AMfone.net
- Scroll down to: “Reflections and other thoughts from W2DU”
- 50th Anniversary of TIROS I
- www.ubtrue2.net
- Scroll down to “The Stories”, then to “Chapter Index”

amfone.net/Amforum/index.php

Using AMfone

	Using the BBS Post your requests, bugs, etc. here	770 Posts 141 Topics	**Last post** by AG5UM in Re: Not secure on November 02, 2019, 04:44:34 PM
	Rules and Regs A 'must-read' for all members	2 Posts 2 Topics	**Last post** by Todd, KA1KAQ in Discussing QRM.... on February 28, 2014, 10:33:05 AM

THE AM BULLETIN BOARD

	Announcements Post your events, hamfests etc This board is an author-post only. The reply function has been turned off.	338 Posts 313 Topics	**Last post** by K4RT in "Frostfest" hamfest Sat.... on January 28, 2020, 08:07:19 PM
	Technical Forum If you have questions, the answers are here!	108337 Posts 8412 Topics	**Last post** by W2NBC in Re: Custom Audio Filter ... on **Today** at 08:36:46 PM
	Class E Forum All things Class E and related (solid state modulators, etc).	1223 Posts 88 Topics	**Last post** by N4LTA in Re: Class D 80 meter rig... on **Today** at 09:24:39 AM
	QSO This area is for discussions of the non-technical aspects of our hobby. No political or religious posts permitted.	134257 Posts 10095 Topics	**Last post** by KK4YY in Re: Antenna conundrum on **Today** at 07:54:46 PM
	Military Amateur Radio Section This section is for posts concerning the use of military surplus radio for AM and the amateur radio bands.	340 Posts 55 Topics	**Last post** by KA3EKH in AN/GRC-106 Stator Assemb... on February 07, 2020, 10:21:24 AM
	The ARRL Forum League information regarding our hobby and mode	3125 Posts 382 Topics	**Last post** by K1JJ in Re: Reshaping ARRL Objec... on February 09, 2020, 12:37:30 PM
	Reflections and Other Thoughts from W2DU	155 Posts 16 Topics	**Last post** by w8khk in Re: TIROS 1, World's Fir... on December 06, 2019, 01:16:11 PM

amfone.net/Amforum/index.php?board=66.0

1 Member and 0 Guests are viewing this board.

Subject	Started by	Replies	Views	Last post
Reflections from Walt	Steve - K4HX	8	19953	May 13, 2011, 10:14:41 AM by aa5wg
TIROS 1, World's First Weather Satellite	W2DU	15	51894	December 06, 2019, 01:16:11 PM by w8khk
A few short stories dad asked me to post for him	w8khk	10	88079	October 07, 2019, 08:30:08 PM by K4EMF
Examining the Johnson Matchbox ATU	Steve - K4HX	24	235822	November 30, 2017, 09:28:22 PM by Steve - K4HX
Now a Story from Jean	W2DU	10	22309	September 13, 2011, 03:15:12 PM by WA1GFZ
The Ubiquitous Conjugate Match Controversy	W2DU	1	13303	July 24, 2011, 12:02:31 PM by WA4WAX
A Messy Ground Radial System Can Cause Radiation of Spurious Signals	Steve - K4HX	2	8524	July 05, 2011, 04:23:23 PM by W2DU
NACA's ECHO 1 TV Satellite	W2DU	16	16992	May 07, 2011, 11:20:59 PM by DMOD
The FCC saved lives during WW2	W2DU	13	17617	February 07, 2011, 09:31:45 PM by K9PNP
History of K2BSA	W2DU	10	11172	January 31, 2011, 10:48:02 PM by Steve - K4HX
Lunar Rovers	Steve - K4HX	4	7042	January 17, 2011, 09:19:05 PM by W2DU
The Labor Pains and Birth of the W2DU Ferrite-Bead Current Balun	Steve - K4HX	0	5948	January 17, 2011, 12:47:24 PM by Steve - K4HX
NASA's RELAY Launched Dec 13, 1962	W2DU	2	5175	January 10, 2011, 01:39:06 AM by KA2DZT
Unique QSL Card	W2DU	1	5131	January 09, 2011, 01:02:09 AM by W7POW
The Score Project, launched in 1958	W2DU	11	14014	January 08, 2011, 02:29:09 PM by W2DU

TIROS 1's 50th Anniversary - April 1, 2010

An Astro Local Celebration

Chapters of The TIROS - DMSP Tale

Biblio-Legend

That’s All, Folks!

- Thank you for your interest and attention!