

**NASA – JPL Spacecraft
Explorer I; 50 Years later Cassini
Henry L. Richter, PhD, PE_(ret)**

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Presenter: Dr. Henry L. Richter

- BS & PhD from Caltech 1956 Chemistry, Physics, EE
- At Jet Propulsion Laboratory 1955-1960
- Responsible for Explorer I design & development
- Section Chief responsible for all scientific instruments for Ranger, Mariner and Surveyor spacecraft.
- Several other careers, Electro-Optical Sys., UCLA
- Communications Engineer for LA County Sheriff
- Independent communications consultant 1978 – present
- Ham for 65 years - W6VZA



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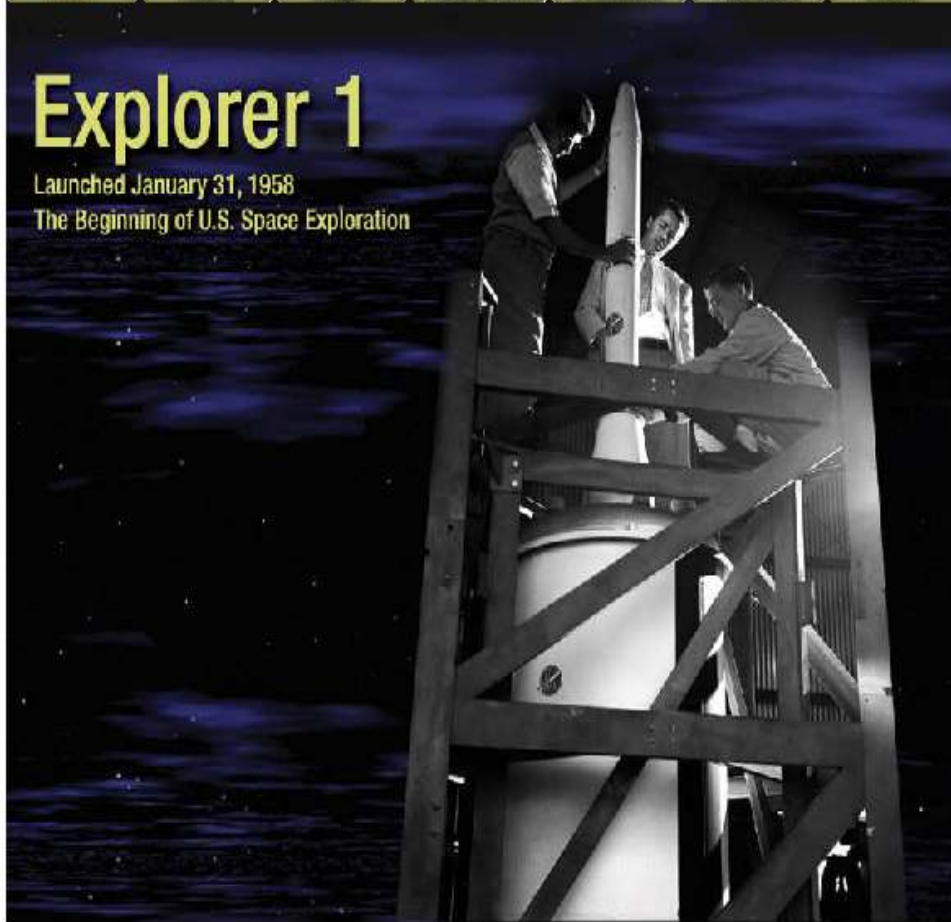
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Explorer 1

Launched January 31, 1958

The Beginning of U.S. Space Exploration



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Explorer 1 radios

- 108.000 MHz Low power – 10 mw 0 dB ant
five channels telemetering – 3 months
- 108.030 MHz high power – 60 mw turnstyle
five channels telemetering- 2 weeks
- Receiver sensitivity - 0.007 microvolts using a
10 Hz bandwidth tracking receiver.
- Total Doppler shift – 6 kHz horizon to horizon



Ham Tracking Station

Microlock system – Explorer 1

THE CASSINI MISSION TO SATURN



THE CASSINI SPACECRAFT



- **Launch Mass**
Spacecraft — 2,442 kg (5,394 lb)
Propellant — 3,132 kg (6,905 lb)
Total Mass — 5,574 kg (12,288 lb)
- **Propulsion:** Two engines, 445 Newton (100 lb) thrust each
- **Electrical Power Source:** Three radioisotope thermoelectric generators (RTGs)
- **Optical Remote-Sensing Instruments:** Will determine temperatures, chemical composition, structure, and chemistry of Saturn, its rings, moons, and their atmospheres; will measure the mass and internal structure of Saturn and its moons; will photograph Saturn, its rings, and moons in visible, near-infrared, and ultraviolet wavelengths.
- **Radar:** Will map Titan and measure heights of surface features.
- **Field and Particles Instruments:** Will map the magnetic field of Saturn; detect charged particles and plasmas; study interactions between solid bodies and the solar wind; investigate ice and dust, plasma waves, and radio waves.

HUYGENS TITAN PROBE

Touchdown on Titan — Nov. 27, 2004



- During 3 hours of science observation and measurements, the Huygens Probe instruments will:
- Collect aerosols for chemical analysis.
 - Make spectral measurements and take pictures of Titan's surface and atmosphere.
 - Measure wind speeds using the Doppler effect.
 - Identify constituents in atmosphere.
 - Measure physical and electrical properties of the atmosphere.
 - Measure physical properties of the solid or liquid surface of Titan.

CASSINI PARTNERS

The Cassini mission is a joint effort of the National Aeronautics and Space Administration (NASA), European Space Agency (ESA), and Italian Space Agency (ASI). The mission is managed for NASA by the Jet Propulsion Laboratory, California Institute of Technology. Partners include the U.S. Air Force (USAF), Department of Energy (DOE), and academic and industrial participants from 19 countries.

SATURN

- Diameter: 120,660 km (74,975 mi)
- Density: 0.69 g/cm³
- Length of Day: 10 hr 40 min
- Length of Saturn Year: 29.47 Earth Years
- Rings: 7
- Moons: 18
- **Composition of Atmosphere:**
Hydrogen (H₂)
Helium (He)
Methane (CH₄)
Ammonia (NH₃)
— and numerous other hydrocarbons

TITAN

SATURN'S LARGEST MOON

- Distance to Saturn: 1,221,850 km (758,200 mi)
- Diameter: 5,150 km (3,199 mi)
- Density: 1.82 g/cm³ (equivalent to 1.82 times the density of water)
- Surface Temperature: -181 °C (-294 °F)
- Surface Pressure: 1.5 bars (approximately 1.5 times surface pressure at sea level on Earth)
- **Composition of Atmosphere:**
Nitrogen (N₂)
Methane (CH₄)
— and other hydrocarbons and nitriles

World Wide Web (WWW): <http://www.jpl.nasa.gov/cassini>



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Rings of Saturn

Cassini approach photo



Water/Ice jets from Enceladus

Cassini skims 14 miles from surface