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[Main page](#)
[Contents](#)
[Featured content](#)
[Current events](#)
[Random article](#)
[Donate to Wikipedia](#)

Interaction

[Help](#)
[About Wikipedia](#)
[Community portal](#)
[Recent changes](#)
[Contact Wikipedia](#)

Toolbox

Print/export

Languages

[Català](#)
[Deutsch](#)
[Français](#)
[Italiano](#)
[Latviešu](#)
[Magyar](#)
[Português](#)
[Suomi](#)
[中文](#)

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Van Allen Probes

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The **Van Allen Probes** (formerly known as the **Radiation Belt Storm Probes**^[1] (RBSP)) are two [robotic spacecraft](#) being used to study the [Van Allen radiation belts](#) that surround Earth. [NASA](#) is conducting the Van Allen Probes mission as part of the [Living With a Star](#) program.^[2] Understanding the radiation belt environment and its variability has important practical applications in the areas of spacecraft operations, spacecraft system design, mission planning and astronaut safety.^[3] The probes were launched on August 30, 2012.

Contents [hide]

- Overview
 - Milestones
 - Launch vehicle
- Science
- Spacecraft
 - Instruments
- See also
- References
- External links

Overview

[edit]

NASA's [Goddard Space Flight Center](#) manages the overall [Living With a Star](#) program of which RBSP is a project, along with [Solar Dynamics Observatory](#) (SDO). The [Applied Physics Laboratory](#) is responsible for the overall

implementation and instrument management for RBSP. The primary mission is scheduled to last 2 years, with expendables expected to last for 4 years. The spacecraft will also work in close collaboration with the [Balloon Array for RBSP Relativistic Electron Losses](#) (BARREL), which can measure particles that break out of the belts and make it all the way to Earth's atmosphere.^{[4][5]}

The Radiation Belt Storm Probes mission is part of NASA's [Living With a Star](#) program, which is managed by [Goddard Space Flight Center](#) in Greenbelt. The Johns Hopkins University [Applied Physics Laboratory](#) (APL) manages the mission and is building and will operate the Van Allen Probes for NASA.

Milestones

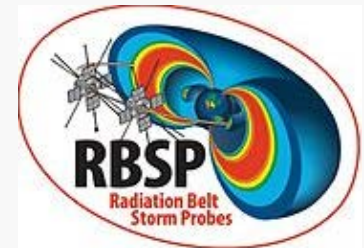
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- Mission concept review completed, January 30–31, 2007^[6]
- Preliminary design review, October, 2008
- Confirmation review, January, 2009
- Probes transported from [Applied Physics Laboratory](#) in Laurel, Maryland to [Cape Canaveral Air Force Station](#) in Florida, April 30, 2012
- Probes launched from Space Launch Complex-41 at [Cape Canaveral Air Force Station](#) in Florida on Aug. 30, 2012. Liftoff occurred at 4:05 a.m. EDT.^[7]

Launch vehicle

[edit]

Van Allen Probes



Operator	NASA
Major contractors	Applied Physics Laboratory
Mission type	Two Earth orbiters operating within Earth's radiation belts
Launch date	2012-08-30, 08:05 UTC
Launch vehicle	Atlas V
Mission duration	2 years
COSPAR ID	2012-046 ↗
Homepage	RBSP at APL ↗
Mass	~1500 kg for both
	Orbital elements
Inclination	~10 degrees
Apoapsis	~5.8 Earth Radii
Periapsis	~700 kilometers
Orbital period	~9 hours

On March 16, 2009 United Launch Alliance (ULA) announced that NASA had awarded ULA a contract to launch RSBP using an [Atlas V 401](#) rocket.^[8] NASA delayed the launch as it counted down to the four-minute mark early morning on August 23. After bad weather prevented a launch on August 24, and a further precautionary delay to protect the rocket and satellites from [Hurricane Isaac](#), liftoff occurred on August 30, 2012 at 4:05 AM EDT.^[9]

Science

[[edit](#)]

The [Van Allen radiation belts](#) swell and shrink over time as part of a much larger space weather system driven by energy and material that erupt off the Sun's surface and fill the entire [Solar System](#). Space weather is the source of [aurora](#) that shimmer in the night sky, but it also can disrupt satellites, cause power grid failures and disrupt [GPS](#) communications. The Van Allen Probes will help scientists to understand this region and to better design [spacecraft](#) that can survive the rigors of [outer space](#).^[2] The mission is to gain

scientific understanding of how populations of relativistic electrons and ions in space form or change in response to changes in [solar activity](#) and the [solar wind](#).^[2]

The mission's general scientific objectives are to:^[2]

- Discover which processes - singly or in combination - accelerate and transport the particles in the radiation belt, and under what conditions.
- Understand and quantify the loss of electrons from the radiation belts.
- Determine the balance between the processes that cause electron acceleration and those that cause losses.
- Understand how the radiation belts change in the context of [geomagnetic storms](#).

Spacecraft

[[edit](#)]

The Van Allen Probes consists of two spin-stabilized spacecraft to be launched with a single Atlas V rocket. The two probes must operate in the harsh conditions they are studying; while other satellites have the luxury of turning off or protecting themselves in the middle of intense space weather, The Van Allen Probes must continue to collect data. The probes have, therefore, been built to withstand the constant bombardment of particles and radiation they will experience in this intense area of space.^[2]

Instruments

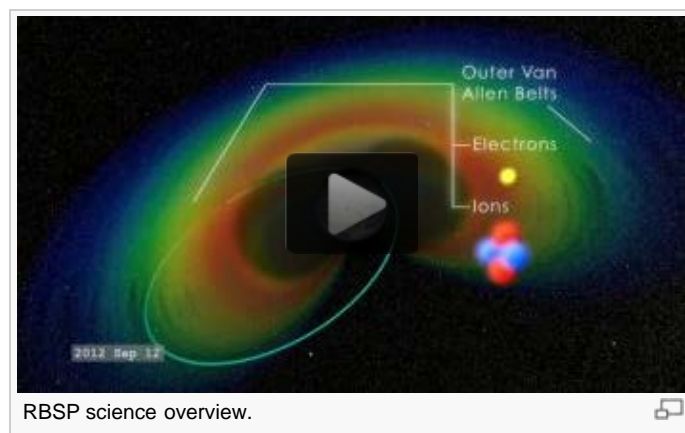
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Because it is vital that the two craft make identical measurements to observe changes in the radiation belts through both space and time, each probe will carry the following:

1. Energetic Particle, Composition, and Thermal Plasma (ECT) Instrument Suite [\[1\]](#) [↗](#); The Principal Investigator is Harlan Spence [\[2\]](#) [↗](#) from [University of New Hampshire](#). Key partners in this investigation are [LANL](#), [Southwest Research Institute](#), [Aerospace Corporation](#) and [LASP](#)
2. Electric and Magnetic Field Instrument Suite and Integrated Science (EMFISIS); The Principal Investigator is Craig Kletzing from the [University of Iowa](#).
3. Electric Field and Waves Instrument (EFW); The Principal Investigator is John Wygant from the [University of Minnesota](#). Key partners in this investigation include the University of California at Berkeley and the University of Colorado at Boulder.
4. Radiation Belt Storm Probes Ion Composition Experiment (RBSPICE); The Principal Investigator is Lou Lanzerotti [\[3\]](#) [↗](#) from the New Jersey Institute of Technology. Key partners include the [Applied Physics Laboratory](#) and Fundamental Technologies, LLC [\[4\]](#) [↗](#).
5. Relativistic Particle Spectrometer (RPS) from the [National Reconnaissance Office](#)

See also

[[edit](#)]



RBSP science overview.

- [Balloon Array for RBSP Relativistic Electron Losses \(BARREL\)](#)
- [Cassini–Huygens](#)
- [Cluster \(spacecraft\)](#)
- [Heliophysics](#)
- [Solar Dynamics Observatory](#)
- [Solar and Heliospheric Observatory](#)
- [STEREO \(Solar TERrestrial RELations Observatory\)](#), launched 2006, still operational.
- [WIND \(spacecraft\)](#), launched 1994, still operational.

References

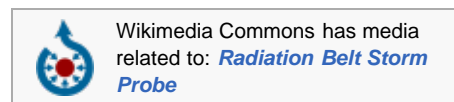
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- ↑ ^{*a b c d e*} "[RBSP - Mission Overview](#)" . NASA. March 28, 2012. Retrieved 2012-07-08.
- ↑ [Radiation Belt Storm Probes \(RBSP\)](#)
- ↑ "[Launching Balloons in Antarctica](#)" . NASA. 22 February 2011. Retrieved 2012-07-13.
- ↑ [Balloon Array for RBSP Relativistic Electron Losses](#)
- ↑ "[Construction Begins!](#)" . The Johns Hopkins University Applied Physics Laboratory. January 2010.
- ↑ "[Probes launched](#)" .
- ↑ "[United Launch Alliance Atlas V Awarded Four NASA Rocket Launch Missions](#)" . ULA. Mar. 16, 2009.
- ↑ "[Tropical Storm Isaac Delays NASA Launch](#)" . The Brevard Times. Retrieved 26 August 2012.

External links

[[edit](#)]

- [NASA Radiation Belt Storm Probes Mission page](#)
- [Johns Hopkins APL Radiation Belt Storm Probes Mission](#) page
- [Radiation Belt Storm Probes](#) on Twitter
- [Hi-res spherical panoramas in the clean room before encapsulation for launch](#)



V • T • E •	National Aeronautics and Space Administration (NASA) [hide]	
Policy and history	<p>NACA (1915) • National Aeronautics and Space Act (1958) • Paine (1986) • Rogers (1986) • Ride (1987) • Space Exploration Initiative (1989) • Augustine (1990) • U.S. National Space Policy (1996) • CFUSAI (2002) • CAIB (2003) • Vision for Space Exploration (2004) • Aldridge (2004) • Augustine (2009)</p> <p>General: Space Race • Administrator and Deputy Administrator • Chief Scientist • Astronaut Corps • Budget • Spin-off technologies • NASA TV •</p>	
Robotic programs	Past	Hitchhiker • Mariner • Mariner Mark II • MESUR • Mars Surveyor '98 • New Millennium • Lunar Orbiter • Pioneer • Planetary Observer • Ranger • Surveyor • Viking • Project Prometheus •
	Current	Living With a Star • Lunar Precursor Robotic Program • Earth Observing System • Great Observatories program • Explorer • Small explorer • Voyager • Discovery • New Frontiers • Mars Exploration Rover • Mars Scout •
Human spaceflight programs	Past	X-15 (suborbital) • Mercury • Gemini • Apollo • Apollo–Soyuz Test Project (with USSR) • Skylab • Shuttle–Mir (with Russia) • Space Shuttle program • Constellation program •
	Current	International Space Station program •
	Future/planned	Commercial Orbital Transportation Services (COTS) • Commercial Crew Development (CCDev) •
Individual featured missions	Past	COBE • Apollo 11 • Mercury 3 • Mercury 6 • Magellan • Pioneer 10/11 • Voyager 1/2 • Galileo • WMAP • WISE • Space Shuttle •
	Currently operating	MRO • Mars Odyssey • MESSENGER • Dawn • New Horizons • Kepler • International Space Station • Hubble Space Telescope • Spitzer • RHESSI • SWIFT • GALEX • THEMIS • Mars Exploration Rover • Cassini •



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	Future	NPP · James Webb Space Telescope · MAVEN · WFIRST · InSight · OSIRIS-REx · MMS · Unnamed 2020 rover ·
Space Comm and Nav (SCaN)	Space Network · Near Earth Network · Deep Space Network (Goldstone · Madrid · Canberra) ·	
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