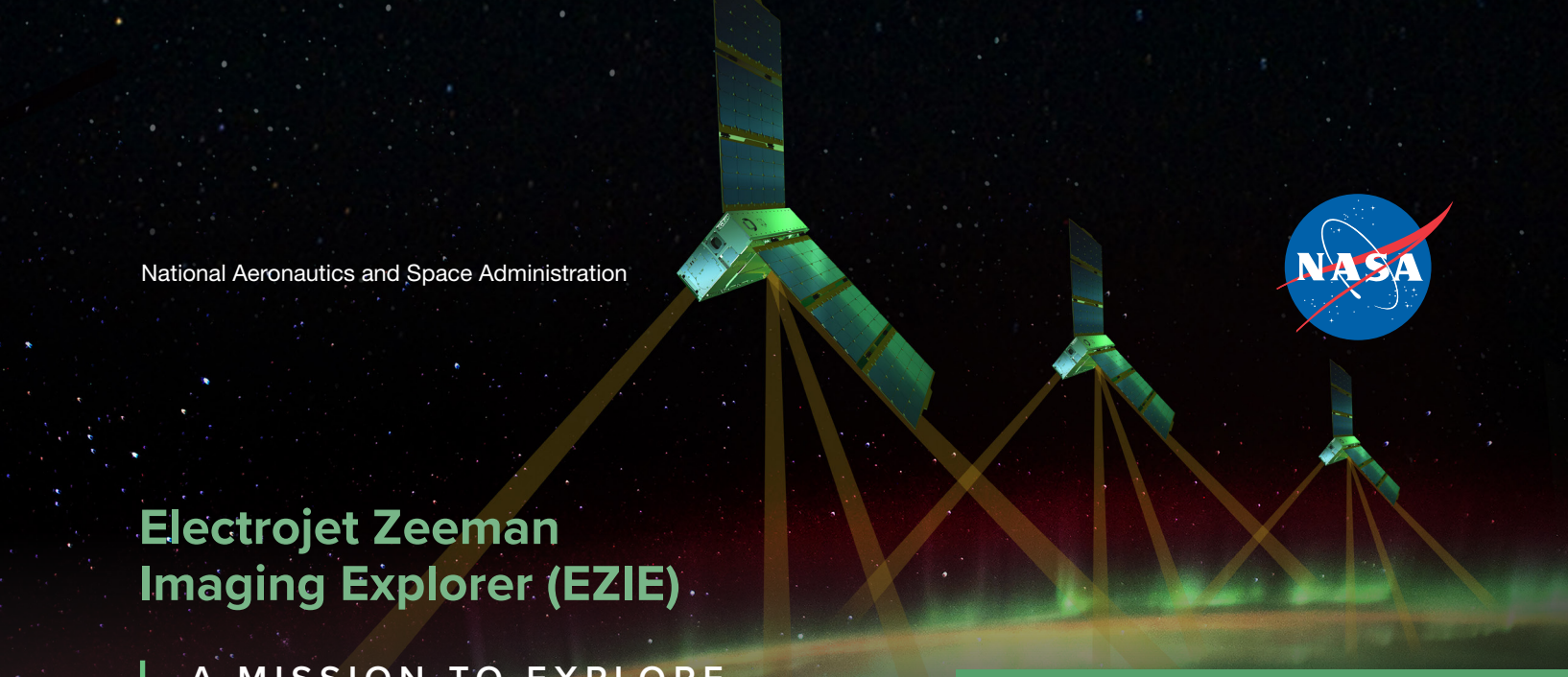
National Aeronautics and Space Administration



Electrojet Zeeman Imaging Explorer (EZIE)

A MISSION TO EXPLORE EARTH'S ELECTROJETS

Developed and led for NASA by the Johns Hopkins Applied Physics Laboratory (APL) in Laurel, Maryland, EZIE is a mission to explore Earth's electrojets – intense electric currents flowing high above Earth's polar regions and the dayside equatorial region. EZIE will provide unprecedented measurements of these electrical currents to answer decades– old – and much debated – mysteries. Understanding these currents is key to scientists' ability to develop capabilities for predicting hazardous space weather.

Earth's electrojets flow around 65 miles (105 kilometers) high in the atmosphere. They are part of a vast electric circuit connecting Earth to outer space, and are an integral part of the planet's spectacular auroras.

Over its 18–month mission, EZIE's three spacecraft will cross Earth's auroral regions more than 4,000 times, providing direct observations of Earth's electrojets.

Using a new, innovative sensor and CubeSat technology to capture electromagnetic information, the mission will shed new light on the vast electrical current system connecting Earth and space, as well as open the door to a greater understanding of how all magnetized planets interact with the space around them.

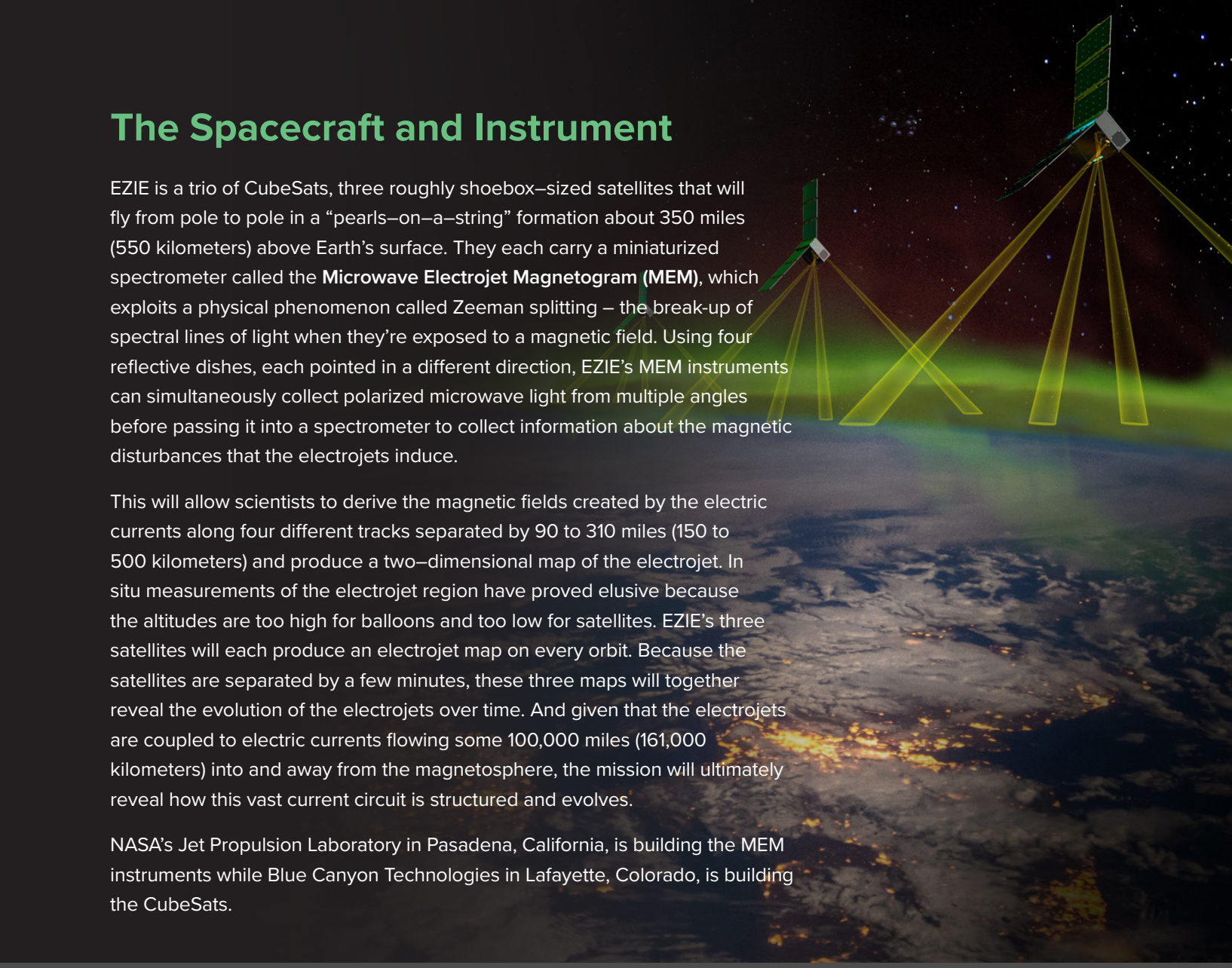
Studying the structure and dynamics of these electrojets will help scientists better understand space weather. Using EZIE mission observations, they will determine how space weather conditions behave, model them and ultimately make predictions to protect Earth's increasingly technological society.

EZIE is currently in the final design phase of the mission and is slated to launch no earlier than September 2024.

What is Space Weather?

The Sun's atmosphere constantly streams gas and particles in all directions – known as the solar wind. Conditions in the solar wind occasionally provide energy to the Earth magnetosphere, which is later released into the upper atmosphere. This leads to beautiful auroras in both hemispheres but also harmful effects, such as disruptions to communications systems and power grids. To predict space weather, we must understand these complex interactions between Earth and the surrounding space. EZIE will help provide this knowledge.

APL JOHNS HOPKINS APPLIED PHYSICS LABORATORY



The Spacecraft and Instrument

EZIE is a trio of CubeSats, three roughly shoebox–sized satellites that will fly from pole to pole in a "pearls–on–a–string" formation about 350 miles (550 kilometers) above Earth's surface. They each carry a miniaturized spectrometer called the **Microwave Electrojet Magnetogram (MEM)**, which exploits a physical phenomenon called Zeeman splitting – the break-up of spectral lines of light when they're exposed to a magnetic field. Using four reflective dishes, each pointed in a different direction, EZIE's MEM instruments can simultaneously collect polarized microwave light from multiple angles before passing it into a spectrometer to collect information about the magnetic disturbances that the electrojets induce.

This will allow scientists to derive the magnetic fields created by the electric currents along four different tracks separated by 90 to 310 miles (150 to 500 kilometers) and produce a two–dimensional map of the electrojet. In situ measurements of the electrojet region have proved elusive because the altitudes are too high for balloons and too low for satellites. EZIE's three satellites will each produce an electrojet map on every orbit. Because the satellites are separated by a few minutes, these three maps will together reveal the evolution of the electrojets over time. And given that the electrojets are coupled to electric currents flowing some 100,000 miles (161,000 kilometers) into and away from the magnetosphere, the mission will ultimately reveal how this vast current circuit is structured and evolves.

NASA's Jet Propulsion Laboratory in Pasadena, California, is building the MEM instruments while Blue Canyon Technologies in Lafayette, Colorado, is building the CubeSats.

The Team

Led by APL, the EZIE team comprises scientists, engineers, managers and other experts experienced in missions that have explored the Earth and the solar system from the Sun to Pluto and beyond.

Mission partners include the Jet Propulsion Laboratory, NASA's Goddard Space Flight Center, Blue Canyon Technologies, Maverick Space Systems, the National Center for Atmospheric Research, the University of Colorado, the University of Michigan, the Finnish Meteorological Institute, the Max Planck Institute for Solar System Research, the Norwegian University of Science and Technology, the University of Bergen, and the University of Oulu.

For more information about EZIE, visit:

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NASA Facts

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