NASA selects PUNCH mission to image beyond the Sun's outer corona

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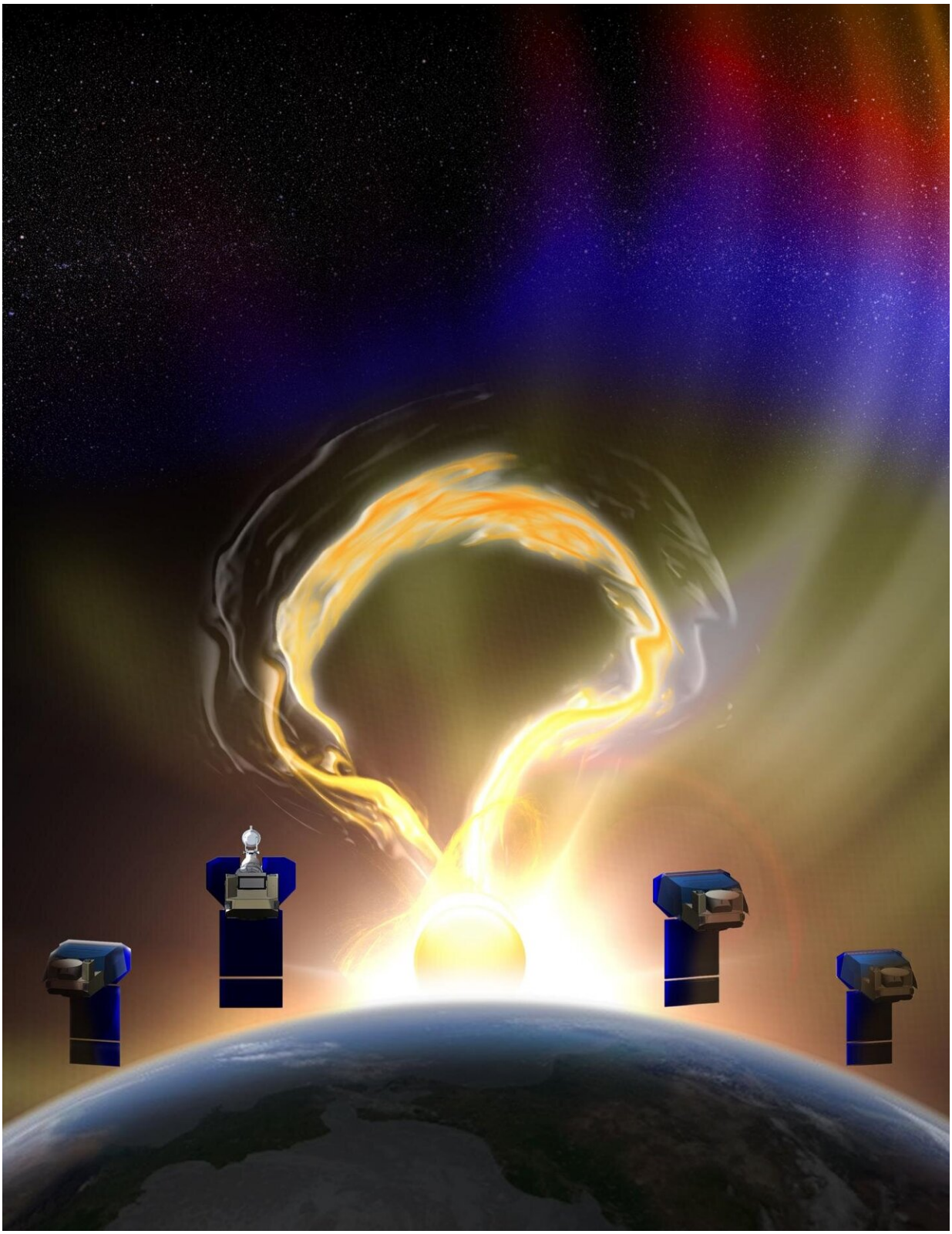


NASA has selected Southwest Research Institute to lead a microsatellite mission

to image the Sun's outer corona. PUNCH proposes a constellation of four suitcase-sized satellites that will orbit the Earth, studying how the Sun's corona connects with the interplanetary medium, to better understand how coronal structures infuse the solar wind with mass and energy. Credit: Southwest Research Institute

NASA has selected Southwest Research Institute to lead the "Polarimeter to Unify the Corona and Heliosphere" (PUNCH) mission, a landmark Small Explorers Program mission that will image beyond the Sun's outer corona.

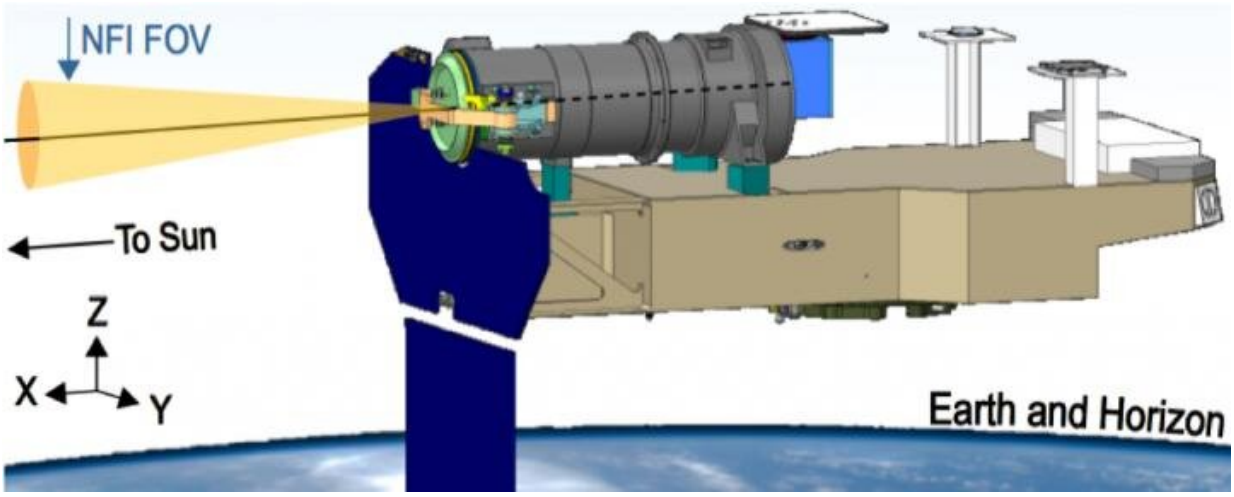
PUNCH will consist of a constellation of four suitcase-sized microsatellites or "microsats" that will launch as early as 2022. The microsats will orbit the Earth in formation to study how the Sun's atmosphere, or corona, connects with the interplanetary medium. PUNCH will provide the first global images of how the solar corona infuses the solar wind with mass and energy.

"The vacuum of space between the planets is not completely empty—it is actually filled with a tenuous, hypersonic 'solar wind' that streams out from the corona and affects spacecraft and planets—including our own," said PUNCH Principal Investigator Dr. Craig DeForest, a scientist and program director in SwRI's Space Science and Engineering Division. "PUNCH will observe the 'no-man's land' between the outer solar corona and the solar wind, giving us our first clear images of the entire system connecting the Sun and Earth."

PUNCH will track and image the solar wind as it emerges from the solar corona, transitions to interplanetary space and streams through the solar system, bathing the planets and other solar system bodies. These measurements will reveal how and why the material coming from the

star becomes gusty and turbulent en route to Earth.

In addition, the PUNCH satellites will track in 3-D the Sun's coronal mass ejections, also known as "CMEs" or "space storms," as they erupt from the corona out into interplanetary space. CMEs cause some "space weather" events that affect Earth, which can threaten astronauts, damage satellites, black out power grids, and disrupt communication and GPS signals.



US Naval Research Laboratory's Narrow Field Imager shown on one of the four PUNCH micro-satellites. PUNCH will provide imaging of the solar wind from low Earth orbit. Work was funded by NASA. Credit: PUNCH Team/Southwest Research Institute

"Most of what we know about the space weather delivered by the solar wind comes from direct sampling by spacecraft embedded in it," said PUNCH Project Scientist Dr. Sarah Gibson, acting director of the High Altitude Observatory in Boulder, Colorado. "This is like understanding global weather patterns based on detailed measurements from a few

individual weather stations on the ground. PUNCH is more like a weather satellite that can image and track a complete storm system as it evolves across an entire region."

The four spacecraft will fly in a distributed formation spread around the globe, operating in sync to produce polarized images of the entire inner solar system every few minutes. Each of the four PUNCH spacecraft carries a specialized camera to capture faint glimmers of sunlight reflected by free electrons in interplanetary space.

One spacecraft carries a Narrow Field Imager that captures the outer corona itself, and the others carry SwRI-developed Wide Field Imagers (WFIs). Dark baffles enable the WFIs to photograph space weather effects that are over a thousand times fainter than the Milky Way, despite flying in direct sunlight.

"Photographing the sky in polarized light is the secret sauce of the mission," DeForest said. "When sunlight bounces off electrons, it becomes polarized. That polarization effect lets us measure how solar wind features move and evolve in three dimensions, instead of just a 2-D image plane. PUNCH is the first mission with the sensitivity and polarization capability to routinely track solar wind features in 3-D."

"The Explorers Program seeks innovative ideas for small, cost-constrained missions that can help unravel the mysteries of the universe," said Dr. Paul Hertz, director of NASA's Astrophysics Division. "PUNCH absolutely meets the standard to solve mysteries about the Sun's corona, the Earth's atmosphere and magnetosphere, and the solar wind."

Provided by Southwest Research Institute