Nasa mission to unravel sun's threat to Earth

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A new probe could help scientists predict the solar storms that cause chaos for us

Scientists have designed a space probe to peer deep beneath the solar surface and observe how sunlight is generated

Chris Hastings and Jonathan Leake

NASA is to embark on one of its most ambitious missions in an attempt to unlock the secrets of the sun.

Following its launch in nine days' time, the US space agency's Solar Dynamics Observatory (SDO) will spend five years in orbit trying to discover the causes of extreme solar activity, such as sun spots and solar winds and flares.

Scientists have long been aware that disturbances on the sun can trigger dangerous x-rays, charged particles and magnetic fields that can disrupt power supplies, communication signals and aircraft navigation systems on Earth.

By understanding how such solar phenomena are created, they hope to be able to produce reliable forecasts of "space weather" and provide advance warnings of any threat.

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Orbiting the Earth at a distance of 22,300 miles, the observatory will measure fluctuations in the sun's ultraviolet output, map magnetic fields and photograph its surface and atmosphere.

Experts have likened the mission to a "giant microscope" that will capture for the first time every nuance of the sun's exterior. The images relayed to Earth will be 10 times clearer than high-definition television.

Barbara Thompson, project scientist, said: "It is Nasa's first weather mission and it aims to characterise everything on the sun that can impact on the Earth and near Earth.

"We know things happen on the sun which affect spacecraft, communications and radio signals. If we can understand the underlying causes of what is happening then we can turn this information into forecasts.

"The key thing about the mission is that it is not just pure science for its own sake. There is likely to be a direct and immediate benefit for people."

Solar magnetic storms and space weather disturbances have had a number of dramatic consequences over the years.

On March 13, 1989, millions of people in Canada and the United States were left without electricity for more than nine hours after a magnetic storm sent shockwaves through the Hydro-Québec power grid.

Five years later, a geomagnetic storm temporarily knocked out two Canadian satellites and Intelsat-K, an international communications satellite.

The most powerful solar storm in history, known as a "superstorm", occurred on September 1, 1859. It caused the failure of telegraph systems in Europe and North America.

The storm produced auroras — phenomena normally only seen near the poles — which were visible in Cuba, Mexico and Italy. The lights were so bright in California's Rocky Mountains that gold prospectors mistook them for dawn and began preparing breakfast.

Transpolar aircraft are particularly sensitive to space weather because they rely on navigation systems for the entire duration of a flight.

Nasa estimates that the SDO will transmit as much as 50 times more scientific data than any other mission in the space agency's history.

Each image will consist of more than 16m pixels and the amount of data sent back to Earth daily will be equivalent to downloading 500,000 songs a day from the internet.

In order to process the data, the organisation has set up a pair of dedicated radio antennae near Las Cruces, New Mexico.

The SDO's orbit will match the speed of the rotation of the Earth, meaning that it will be in constant view of the two 59ft dishes throughout the mission.

The UK-based Science and Technology Facilities Council is supplying some of the equipment for the observatory.

Professor Richard Harrison, of the Rutherford Appleton Laboratory in Oxfordshire, said understanding the impact of the sun's magnetic fields was key to the mission.

"The idea is to image different layers of the sun's atmosphere all the way down to the surface and measure magnetic fields," he said.

"The bottom line is that you are trying to understand how this atmosphere works. We can already see phenomena like the flares. The question is how does the magnetic field form to allow this sort of thing to happen."