



Lockheed Martin Research Keeps Solar Wind Information Current

Researchers from Lockheed Martin's Solar and Astrophysics Laboratory within the Lockheed Martin Advanced Technology Center (LMATC) recently used the latest technology to derive an explanation for what exactly drives the solar wind.

While solar physicists have thought for years that Alfvén waves were the source behind the wind, the waves had never been observed at sufficient strength to confirm this. Now, observations from the Focal Plane Package (FPP) of the Hinode satellite, a spacecraft equipped with three separate instruments used to provide almost continuous monitoring of the Sun, have allowed Lockheed Martin scientists to view the capability of these waves and begin to unravel the mystery.

Bart De Pontieu, a solar physicist at Solar and Astrophysics Laboratory in Palo Alto, Calif., led the research team that painstakingly focused on the Sun's chromosphere, a region that De Pontieu said is a poorly understood area of the Sun. De Pontieu and his team analyzed high resolution photographs of jets of gas being pushed in an upward direction. As these jets propel upwards they also sway side to side, revealing the presence of the Alfvén waves. When these waves bleed into the Sun's outermost atmosphere, they become strong enough to muscle the solar wind.

► *The solar wind's activity is a key element in carrying the Sun's disturbances to the Earth.*

"Our findings suggest that the low atmosphere of the Sun is permeated by Alfvén waves," De Pontieu explained. "When taken together with advanced numerical simulations, and previous work on the acceleration of the solar wind, these waves are strong enough to accelerate the solar wind."

The discovery – and Lockheed Martin's involvement with the project – has been

10 years in the making. In early 1998, Japan's Institute of Space and Aeronautical Sciences created a joint Japanese-U.S.-U.K. solar satellite project, known as Solar-B, that would observe the Sun and its disturbances. In December 1998, NASA awarded the Solar and Astrophysics Laboratory a contract to build the FPP for the Solar Optical Telescope (SOT) that would be onboard the satellite.

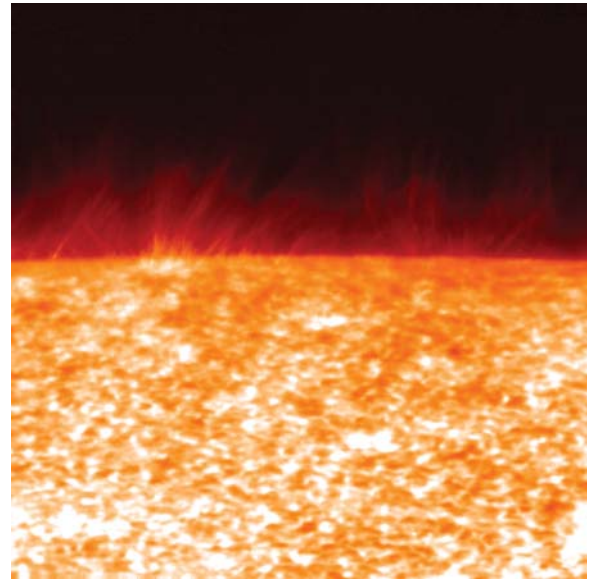
Since the launch of Solar-B, now known as Hinode, in September 2006, Lockheed Martin researchers in Palo Alto have been the lead U.S. investigators for the FPP. Fellow researchers in Japan, Norway, and Colorado have also contributed to the overall study of the Sun.

De Pontieu said that since the launch, scientists in the Lockheed Martin lab have performed scientific research including writing papers and giving presentations on the analysis of the solar images transmitted from the SOT.

"The SOT is an excellent instrument that, for the first time, is starting to resolve some of the crucial spatial scales and dynamics of the low solar atmosphere," De Pontieu said.

Since space weather derives from the behavior of the Sun, the solar wind is a key element in carrying the Sun's disturbances to the Earth. While few may know of the solar wind's composition of charged particles that are ejected from the Sun at speeds of 1,000 km/s, many are familiar with its affects: it is the solar wind that causes comet tails to point away from the Sun and is blamed for occasionally knocking out power grids here on Earth. Observing the Northern Lights isn't just a once in a lifetime chance – it's an example of the solar wind in action.

This discovery is part of the high caliber



This Hinode satellite image shows a region at the south pole of the Sun covering an area that is approximately as large as three Earth diameters. Spicules (thin fountains of gas) at the limb of the Sun form, propelling matter upward at speeds of more than 100,000 miles per hour. Alfvén waves move these jets transversely with enough power to drive the solar wind. (Image courtesy NASA/JAXA.)

of research that allows Lockheed Martin to maintain its expertise in solar physics. "Our solar physics expertise has been crucial in proposing and winning contracts to build scientific instruments onboard various NASA satellites," De Pontieu said. De Pontieu and his team will continue to study how the waves transmit their energy to the solar wind, the formation of the jets that carry these Alfvén waves and to analyze new data that emerges from the SOT.

The Solar and Astrophysics Laboratory at the ATC has a 44-year-long heritage of developing spaceborne solar instruments including the Michelson Doppler Imager on the ESA/NASA Solar and Heliospheric Observatory and the Solar X-ray Imager on the GOES-N environmental satellite. The laboratory also conducts basic research into understanding and predicting space weather and the behavior of the Sun, including its impact on Earth and climate. ♻️

WindTracer® Lidar System Installed at Narita International Airport

Lockheed Martin announced the Japan Meteorological Agency has purchased a second WindTracer® lidar system for operation at the Narita International Airport in Tokyo.

Developed and produced by Lockheed Martin Coherent Technologies, the WindTracer is providing advanced warning of wind hazards by continuously scanning the approach and departure corridors, enabling air traffic control personnel to offer precise, timely direction to pilots during their most critical phase of flight.

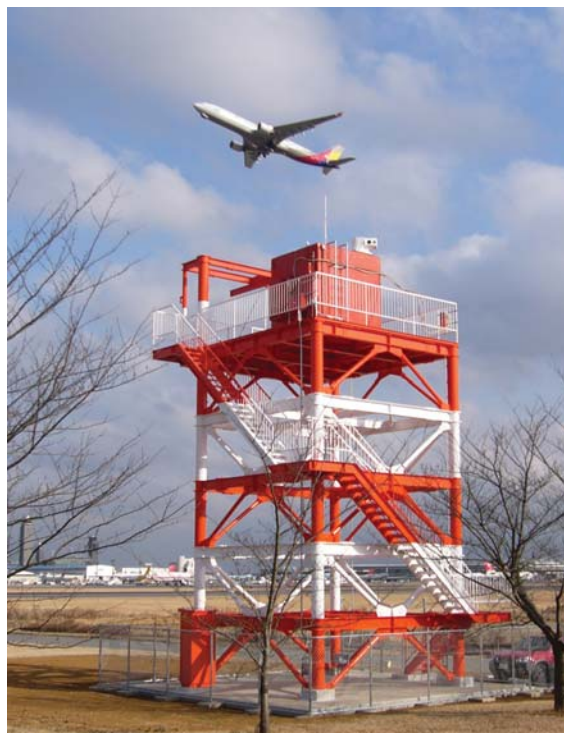
Lockheed Martin collaborated with the Kanematsu Corporation of Japan to introduce the WindTracer to the Japan Meteorological Agency (JMA). The first WindTracer was installed at Tokyo's Haneda Airport in 2006. The internationalization and localization of the system into the Japanese language was completed in time for this recent deployment at the Narita Airport. Lockheed Martin is now able to quickly and easily localize the user interface, thus expanding the market reach of WindTracer to airports worldwide.

"We are honored to continue our work with JMA," said Dr. Stephen Hannon, Products Group director for Lockheed Martin Coherent Technologies. "It's exciting to install a second WindTracer in Japan and see how it's benefiting passengers flying in and out of that country's premier international airport. WindTracer's Doppler lidar technology has made a significant contribution to aviation safety and airport operational

efficiency with its wind-hazard alerting capabilities."

The JMA is the Japanese government's weather service. Charged with gathering and reporting weather data and forecasts in Japan, it is an extra-ministerial bureau of the Ministry of Land, Infrastructure and Transport and Tourism. Narita International Airport is the second-busiest passenger airport in Japan. It handles the majority of international passenger traffic to and from Japan, and is a major connecting point for air traffic between Asia and the Americas.

WindTracer currently performs wakes-related functions at three U.S. airports and has been chosen as the primary tool for measuring wake vortices at airports in Frankfurt and Paris. Other systems for wind shear alerting are installed at Hong Kong International airport. ↻



Tokyo's Narita Airport is the latest international airport to operate the WindTracer® Doppler lidar system to better monitor wind hazards.

Lending a Helping Hand



In conjunction with this year's American Meteorological Society (AMS) Conference in New Orleans, employees from Lockheed Martin's Information Systems & Global Services and Space Systems companies volunteered on January 18 to help construct a Habitat for Humanity home. The Lockheed Martin workforce installed siding and roofing, stacked sheet rock, put in insulation as well as performed other tasks for the Bartholomew St. house. The New Orleans Area Habitat for Humanity (NOAHH) has been leading an unprecedented rebuilding effort in the wake of Hurricane Katrina. During 2008, NOAHH plans to build hundreds of new homes in the region.

The Monitor

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