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# The *Hinode* (Solar-B) Mission: An Overview

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**Abstract** The *Hinode* satellite (formerly *Solar-B*) of the Japan Aerospace Exploration Agency's Institute of Space and Astronautical Science (ISAS/JAXA) was successfully launched in September 2006. As the successor to the *Yohkoh* mission, it aims to understand how magnetic energy gets transferred from the photosphere to the upper atmosphere and results in explosive energy releases. *Hinode* is an observatory style mission, with all the instruments being designed and built to work together to address the science aims. There

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are three instruments onboard: the Solar Optical Telescope (SOT), the EUV Imaging Spectrometer (EIS), and the X-Ray Telescope (XRT). This paper provides an overview of the mission, detailing the satellite, the scientific payload, and operations. It will conclude with discussions on how the international science community can participate in the analysis of the mission data.

## 1. Introduction

The *Hinode* spacecraft (formerly Solar-B) of the Institute of Space and Astronautical Science, Japan Aerospace Exploration Agency (ISAS/JAXA), was launched on 22 September 2006, at 21:36 GMT, aboard the seventh in JAXA's series of M-V rockets. The principal scientific goals of the *Hinode* mission are the following:

(1) To understand the processes of magnetic field generation and transport including the magnetic modulation of the Sun's luminosity.
(2) To investigate the processes responsible for energy transfer from the photosphere to the corona and for the heating and structuring of the chromosphere and the corona.
(3) To determine the mechanisms responsible for eruptive phenomena, such as flares and coronal mass ejections, and understand these phenomena in the context of the space weather of the Sun – Earth System.

This mission is the follow-on to *Yohkoh,* an ISAS mission with significant NASA and United Kingdom participation that was launched in 1991 (Ogawara *et al.*, 1991) and continued taking observations for nearly a solar cycle. *Yohkoh* demonstrated that the high-temperature corona is highly structured and dynamic and that rapid heating and mass acceleration are common phenomena (Acton *et al.*, 1992). *Yohkoh* was launched shortly after the maximum of solar cycle 22, which was an ideal period for studying large solar flares. The subsequent observations provided considerable evidence to support magnetic reconnection as the driver for energy release in flares. Hard X-ray "above the loop top" sources were found in compact flares (*e.g.*, Masuda *et al.*, 1994) and also in long-duration flares (*e.g.*, Harra *et al.*, 1998). In soft X rays the flaring loops often took on the appearance of cusps, which is to be expected from the standard model where the reconnection occurs high in the corona (*e.g.*, Tsuneta, 1996; Canfield, Hudson, and McKenzie, 1999; Sterling *et al.*, 2000). The edges of the loops were also found to be hotter, as expected if the outer edges are the last to be heated from reconnection. As expected from the reconnection, plasma ejections from flaring sites have been found on many occasions (*e.g.*, Shibata *et al.*, 1995). On smaller scales, many jets were found in soft X rays; these are interpreted as reconnection occurring through the interaction of emerging flux and already existing magnetic field (Shimojo *et al.*, 1996). Many small-scale flares were observed in active region loops (*e.g.*, Shimizu, 1995; Shimizu *et al.*, 2002) and in bright points (Priest *et al.*, 1994). On a more global scale, dramatic coronal waves were observed (*e.g.*, Hudson *et al.*, 2003) and trans-equatorial loops were found to erupt (*e.g.*, Khan and Hudson, 2000) followed by coronal mass ejections or flares (Harra, Matthews, and van Driel-Gesztelyi, 2003).

*Hinode* is designed to address the fundamental question of how magnetic fields interact with the ionized atmosphere to produce solar variability. Measuring the properties of the Sun's magnetic field is the fundamental observational goal of *Hinode* and differentiates it from previous solar missions. The three instruments were selected to observe the response of