

Targeted Outcome: 2025-beyond, Opening the Frontier

Predicting Solar Magnetic Fields and Energy Release

Required Understanding

Dominant processes controlling solar dynamo

Characterize predictability of dynamo: analytic, statistical, or chaotic

Dominant processes controlling magnetic structuring, energy buildup, storage, and release

Characterize predictability of magnetic energy release

Solar surface and interior flows as drivers for solar magnetic field evolution on active region, solar cycle and century time scales

Production of paleoclimate tracers of solar activity

Enabling Capabilities & Measurements

Whole-Sun remote-sensing observations (magnetic, velocity, XUV, EUV)

Global heliosphere *in-situ* observations (plasma, field, particles)

Active region coronal measurements of magnetic field, velocity, thermal fine structure

Integrated solar interior-atmosphere magnetic models using observational inputs

Integrated MHD/plasma models of coronal magnetic heating and stability

Enabling:

SHIELDS, SPI, Farside - remote sensing

SWB, SPI, Mars GOES - *in-situ*

RAM, MTRAP - coronal structure

Implementation

Theory and Modeling:
Predictability analysis of MHD systems

Enhancing:

Stellar Imager – dynamo context
Mars Polar Sampler - extend paleoclimate record