National Aeronautics and Space Administration

Sounding Rocket Mission Fact Sheet

Mission: Sporadic-E Electro Dynamics (SEED)
Mission Number(s): 46.026 & 46.037 UE
Principal Investigator: Dr. Barjatya/Embry-Riddle Aeronautical Univ.
Launch Date: June 13, 2025 window open
Launch site: Roi Namur, Kwajalein Atoll, Marshall Islands

Science Discipline:
Geospace Science

Description

Sporadic–E (Es) (90-125km) is a generic term used to describe thin (one to several km) ionization layers that are typically formed in the E region ionosphere. The density within the Es layers is several factors to a few orders of magnitude higher than the background ionosphere and can sometimes get higher than the F-region densities. Despite decades of observations and modeling efforts of Es layers, there is a lack of complete understanding of Es layers and the role they play in E-F region coupling, especially at low latitudes. Degradation of RF communications and operational anomalies/failures during ionospheric disturbances are a crucial space weather influence on modern life. Es layers are the sole ubiquitous space weather source in the ionosphere that produce scintillations during nighttime and daytime, affecting operational RF transmissions such as HF, VHF and UHF communication links, as well as over-the-horizon radar and communications.

The SEED mission aims to do comprehensive measurements of the electrodynamics associated with Es layers observed at the low latitude location of Kwajalein Atoll in the Marshall Islands. In particular, SEED aims to investigate density-temperature anti-correlations.

SEED is a comprehensive experiment to address a series of specific but interlinked science questions related to the Es layer phenomena, especially high altitude (>100 km) Es layers, at a low-latitude location (Kwajalein) during solar-min. Progress on these three questions will also contribute to the broader science goal of understanding the role of Es layers in ionosphere coupling:

- Are low-latitude/equatorial Es layers associated with field-aligned currents (FAC) of a magnitude of 1 to 2 uA/m^2 in the presence of a nighttime F region dynamo?
- How do electric fields and winds modulate temperatures and conductivities in the E region via field-aligned currents?

Two comprehensively instrumented rockets will be launched into an Es layer, with each deploying four instrumented sub-payloads. At least one will deploy TMA puff releases. The experiment will be supported by ground-based observations from ALTAIR, digisonde, and GPS receivers. Observations will be used to constrain comprehensive modeling during the data analysis phase.