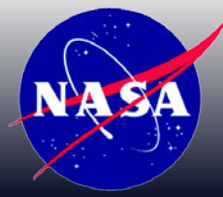




CREAM



Cosmic Ray Energetics And Mass

for the International Space Station

Principal Investigator: Professor Eun-Suk Seo, University of Maryland

Science Mission Statement

Extend the energy reach of direct measurements of cosmic rays to the **highest energy** possible to investigate cosmic ray origins, acceleration and propagation.

Physical Characteristics

- Payload total mass: 1258 kg
- Payload Dimensions: 1.85 m x 0.95 m x 1 m
- Launch scheduled on SpaceX-12 in Aug 2017
- Nominal data collection of 3 years on the JEM-EF

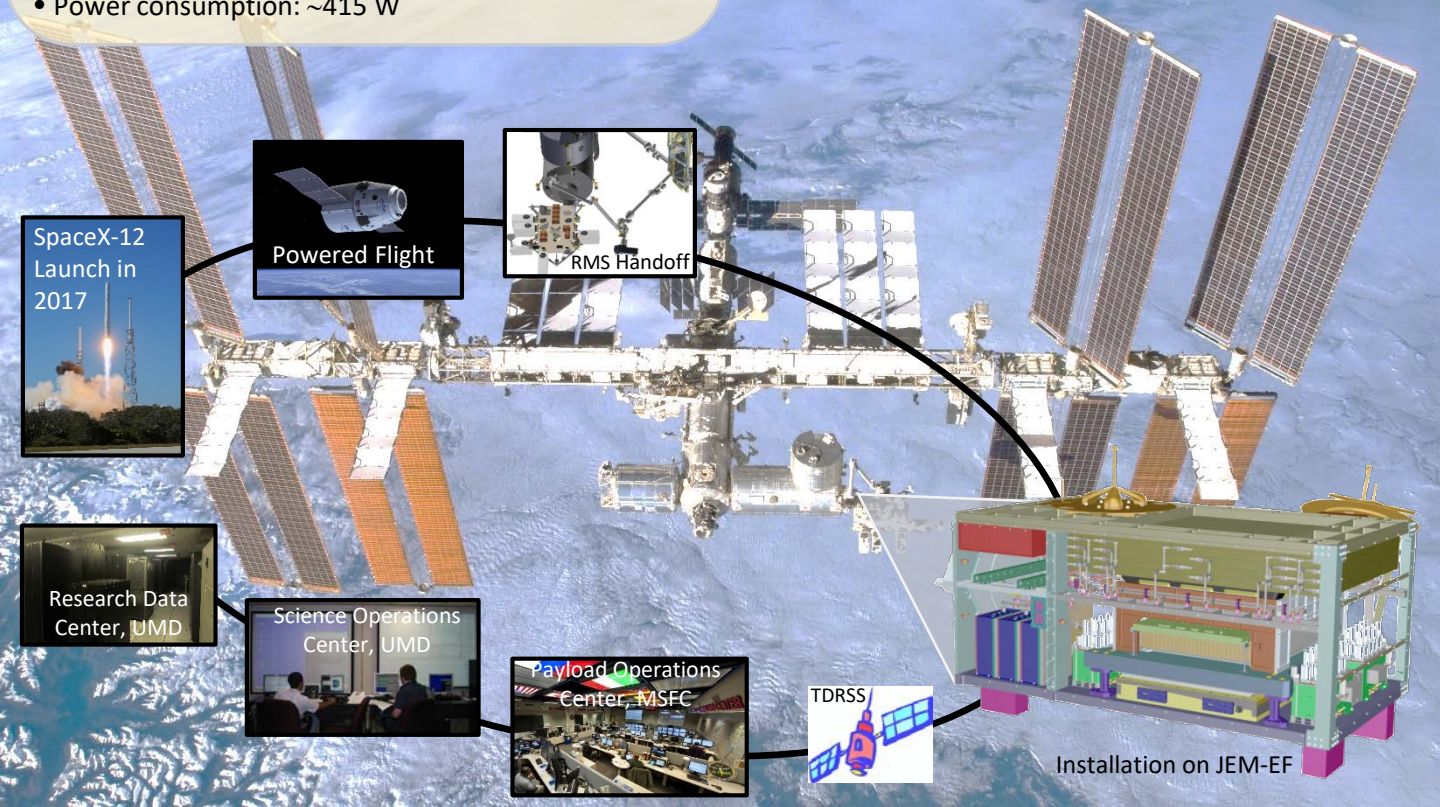
Operations

- Data produced at ~500 kbps, or ~5 GB/day
- 32 GB of onboard data storage (4-fold redundant)
- 24/7 monitoring from the Science Operation Center (SOC) at UMD
- Continuous downlink of housekeeping and science data in near real-time
- continuous commanding window to monitor and control the health of the instrument
- Power consumption: ~415 W

Collaborating Institutions

- University of Maryland, USA
- Penn State University, USA
- Northern Kentucky University, USA
- NASA Goddard Space Flight Center, USA
- National Autonomous University of Mexico, Mexico
- KyungPook National University, Korea
- Sung Kyun Kwan University, Korea
- LPSC Grenoble and CESR Toulouse, France

NASA GSFC WFF (inc. CSC/Vantage, SGT, and NMSU PSL) - project management and engineering support.
NASA JSC ISS Program Office - launch support and the ISS accommodation.
NASA MSFC -flight operations



SpaceX-12 Launch in 2017

Powered Flight

RMS Handoff

Research Data Center, UMD

Science Operations Center, UMD

Payload Operations Center, MSFC

TDRSS

Installation on JEM-EF

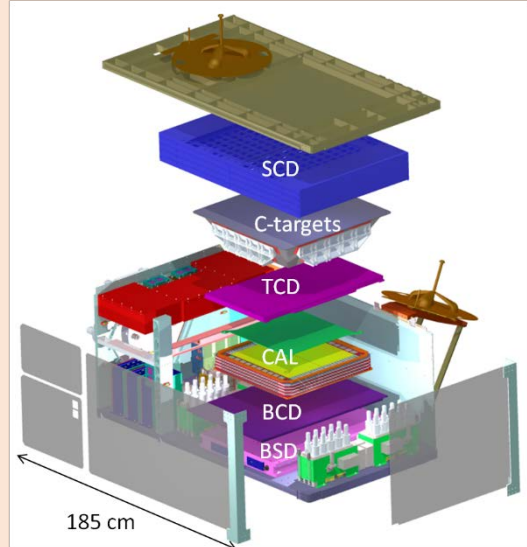


Balloon Heritage

- 191 days of flight over Antarctica
- Flight altitude around 40 km, with residual atmospheric overburden ~ 3.9 g/cm²
- Successful recovery and refurbishing of hardware
- Discovery of discrepant hardening of elemental spectra at high energies

Detector Systems

- **Silicon Charge Detector (SCD)** – 4 layers of 2x2 cm silicon pixels used to determine incident particle charge
- **Carbon Targets (C-targets)** – Layers of carbon plates to induce hadronic interactions for measurement in the calorimeter
- **Top/Bottom Counting Detector (TCD/BCD)** – Plastic scintillator for electron/proton distinction
- **Calorimeter (CAL)** – 20 layers of alternating tungsten plates and scintillating fibers used to measure incident particle energy and trajectory within the instrument
- **Boronated Scintillator Detector (BSD)** – Boron-doped scintillator to capture thermal neutrons from hadronic interactions in the calorimeter providing additional e/p distinction
- **Science Flight Computer (SFC)** – The onboard computer used to control detectors, assemble events and store science data



Acknowledgements

This work is sponsored by the NASA Science Mission Directorate Astrophysics Division via research grants to universities and RTOPs to GSFC/WFF. It is supported in Korea by the Creative Research Initiatives and by National Research Foundation grants. It is supported in France by IN2P3/CNRS and CNES and in Mexico by DGAPA-UNAM and CONACYT.