<u>Title</u>: Return-to-Flight Electromagnetic Measurements - The NASA Shuttle Ascent Debris Radar System

Speaker:

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Abstract: The NASA Debris Radar (NDR) system was developed to characterize ascent debris liberated during the Shuttle's ascent into space. Radar is well suited for characterizing ascent debris, and is essential during night launches when optical sensors are severely degraded. The NDR mission presents challenging radar requirements in terms of target detection, tracking, minimum detectable radar cross-section (RCS), calibration accuracy, power profile management, and operational readiness. After revisiting the Columbia accident investigation, I describe the NDR system, consisting of a stationary C-band radar located at Kennedy Space Center and two sea-based X-band radars. During the 3 year development effort, the NDR team examined static and dynamic radar signatures of the shuttle and liberated debris, and executed an "in-situ" Electromagnetic Interference Measurement on the Orbiter "Discovery" to certify its safety from radar EMI. Since Shuttle Mission Managers needed definitive safety assessments within 24-30 hrs of launch, analysis tools and software provided shuttle metric data in real-time, visualize metric and signature data during post-mission analysis, automatically detect and characterize debris tracks in signature data, determine ballistic numbers for detected debris objects, and assess material type, size, release location and threat to the orbiter based on radar scattering and ballistic properties of the debris.