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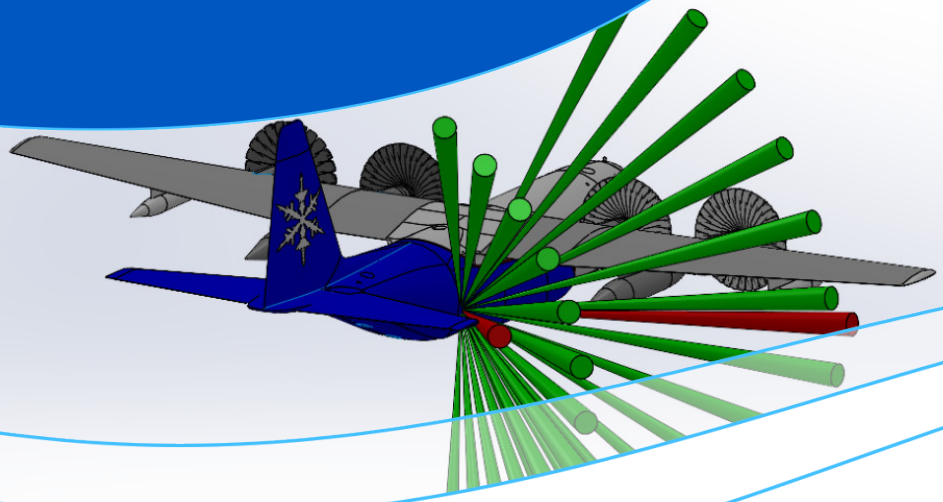
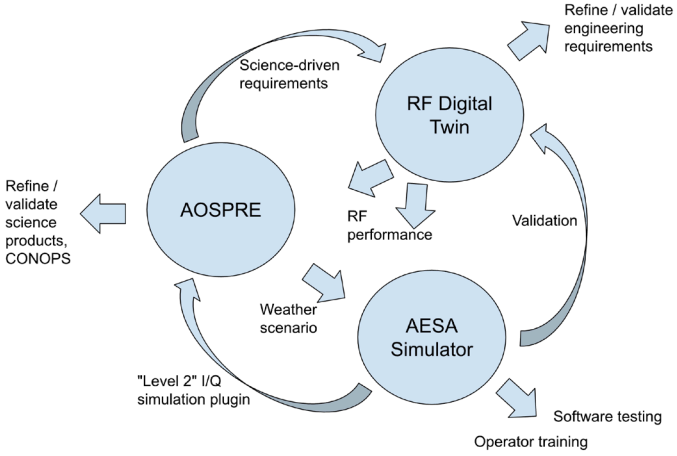


Phased Array Radar Integrated Digital Twin

The **Phased Array Radar Integrated Digital Twin (PAR-IDT)** is a suite of simulation tools that targets the reduction of developmental and operational risks in PAR systems. It creates a new collaboration space for science and engineering teams to successfully address the challenges of groundbreaking PAR technology.

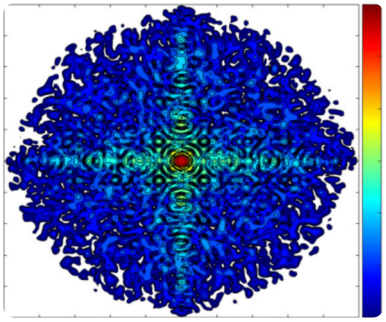


RF Digital Twin

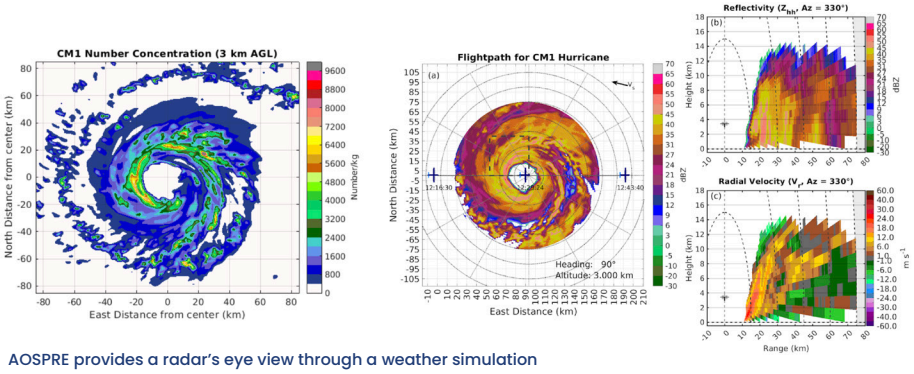
The Digital Twin model computes and reports the key engineering parameters of a PAR including the beam shape, sidelobes, and gain, incorporating factors such as element pattern, calibration, failed elements, quantization, etc.

AOSPRE

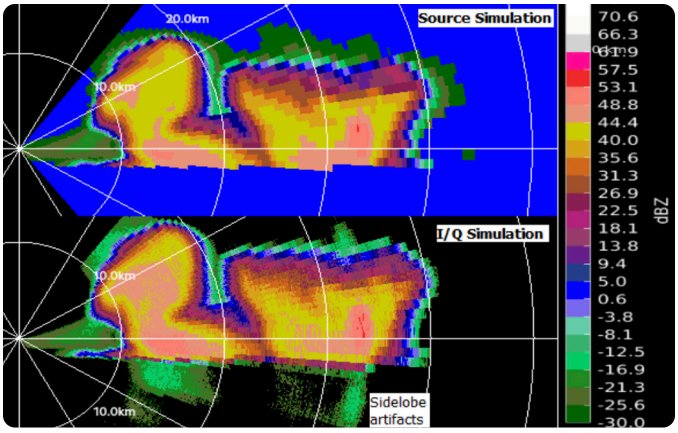
The APAR Observing Simulation, Processing, and Research Environment creates data sets that simulate results from PAR airborne observations. AOSPRE relies on high-resolution simulations of real or idealized weather events as provided by, e.g., the Weather Research and Forecasting Model (WRF) or the Cloud Model version 1 (CM1). AOSPRE takes a user-specified flight plan, together with radar scanning instructions, to show the radar's "view" of the simulation, synthesizing observed moments (CR-SIM) and deducing dual-Doppler windfields (SAMURAI).



RFDT models the key PAR engineering parameters



AOSPRE provides a radar's eye view through a weather simulation



Benefits

AESA Key Performance Parameter Analysis With a long list of design requirements, it can be very difficult to understand the implications of the interaction between multiple discrete parameters. A digital twin models the parameters to identify potential conflicts and/or performance shortfalls.

System Design Performance Prediction Understand the implications of the design requirements on weather retrievals; predict and benchmark performance under defined weather conditions.

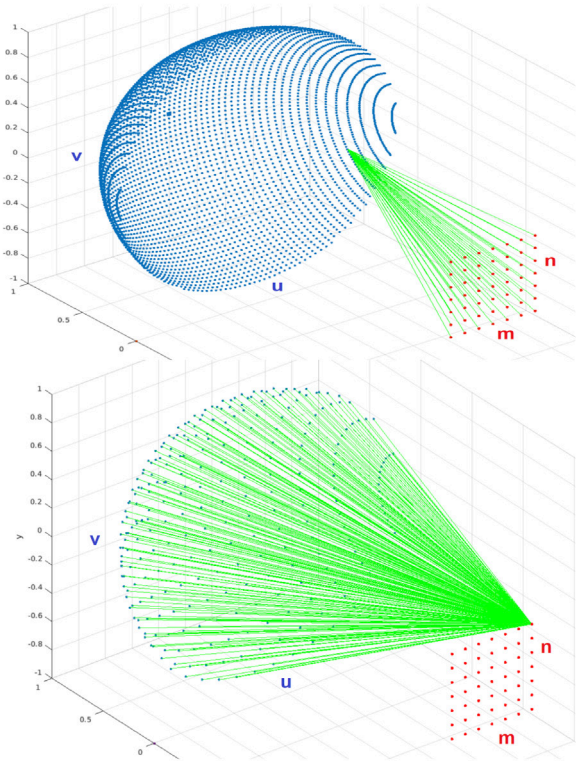
Operational Input Parameter Definition and Optimization Plan missions - refine operational strategy, optimize radar parameters prior to a test campaign based on the observed performance of the digital twin in the simulated environment. Perform operator training and dress rehearsal - change scans/modes in real time.

System Performance Validation and Troubleshooting Validate software changes and predict potential issues by feeding hardware data into the model. Cross-validate real observations with simulations.

Advanced Calibration Methods Using PAR digital twin perturbation models during radar operations can improve active weather retrievals, by using real time data to actively monitor and potentially update the calibration constants.

AESA Simulator

This tool performs a low-level I/Q data simulation on AOSPRE data - modeling the RF effects imported from the RF Digital Twin, producing multichannel I/Q data, then optionally resynthesizing back to moment observables. It is an All-to-All (sub-array x atmosphere gridpoint) simulation that can test pulse compression, sidelobe cancellation, imaging, etc., both hardware-in-the-loop and standalone, in GPU-accelerated real time - or integrated as a plugin in the AOSPRE flow to increase the realism of the scientific observables.



AESA Simulator sums every atmospheric gridpoint at every sub-array I/Q output

Ways to Stay Connected

ucar.edu @ncar_science

info@ncar.ucar.edu

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