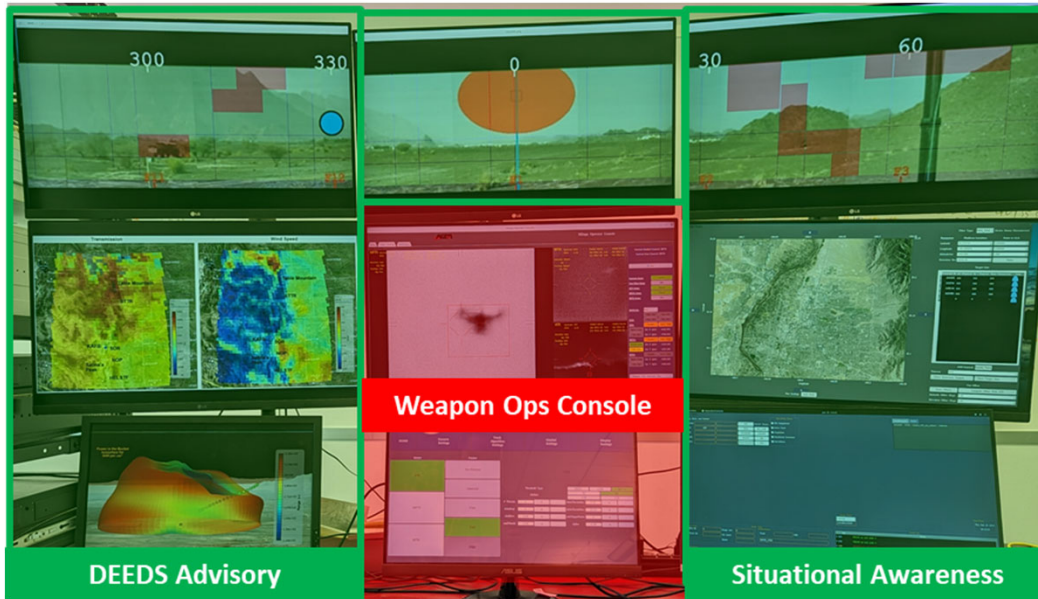




Directed Energy Environmental Decisions System (DEEDS)



DEEDS Add-On 4U Processing Unit

Processor	I9-10980XE – 3.0 GHz(up to 4.6GHz) Intel Octadeca (18) Core CPU – 24.75MB Cache, Multiple Graphics Displays
Memory	4 x 32GB DDR4 3200MHz OC RAM
Hard Drive	2.0TB SSD SATA 6.0Gb/s 560/530MB/s 2.5" – Samsung 870 EVO

Description

MZA's Directed Energy Environmental Decision System (DEEDS) Processor provides environmental situation awareness for Directed Energy (DE) applications. This add-on is available for modular integration with two or more DELTA-Wx deep-learning turbulence sensors. Each of the DELTA-Wx sensors measures turbulence strength along a line of sight with target images and weather data using the "Wx" weather station. Weather data and C_n^2 data from DELTA-Wx sensors are integrated into MZA's Modular Atmospheric Sensor Software (MASS) suite and used on a daily basis to provide a weather-driven turbulence model using DELTA-Wx's automated machine-learning algorithm. This model can be applied during subsequent weather measurements. DEEDS applies the weather-driven atmospheric models with SHaRE and WaveTrain models for laser weapon system performance prediction. A set of configurable displays provides an operator with immersive visualization of the range capability of a laser weapon system as it evolves with varying atmospheric conditions.

Applications

- Real-time decision aid for HEL weapons
- Forecasting of system capability at range
- Monitors and processes turbulence conditions
- Laser propagation path characterization
- Atmospheric imaging diagnostics
- Predict optical comm link performance
- Include turbulence in live simulations
- Integrates with battle management systems
- Network solutions for archived data

Unique Advantages

- Modular integration of 4U processor integrates with existing beam control sensors to measure turbulence
- SHaRE + WaveTrain model system performance metrics:
 - Power in bucket, peak irradiance
 - Beam jitter
 - Scattering and absorption
 - Dynamic atmospheric propagation
- Application of turbulence model with weather data enables automatic computation of turbulence parameters

Operation

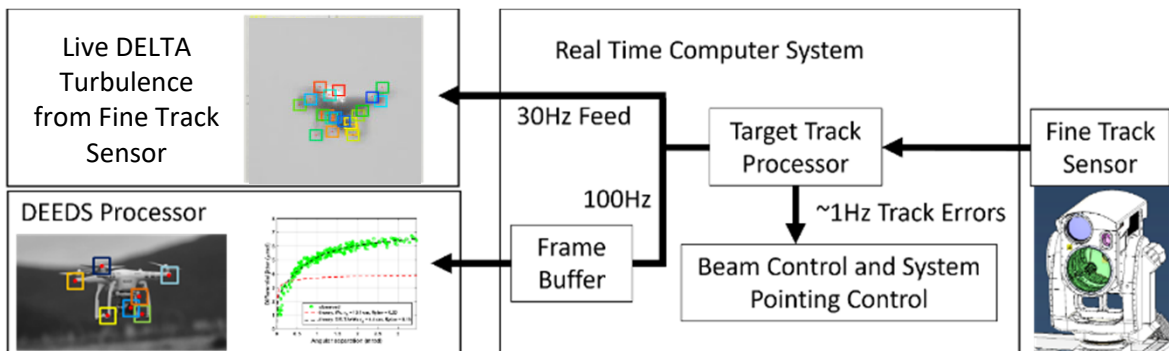
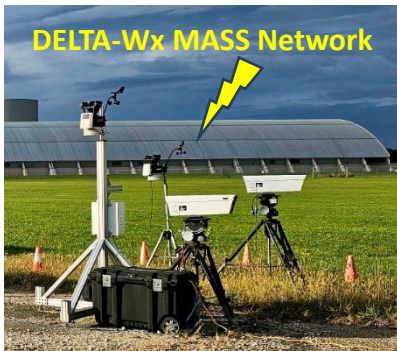
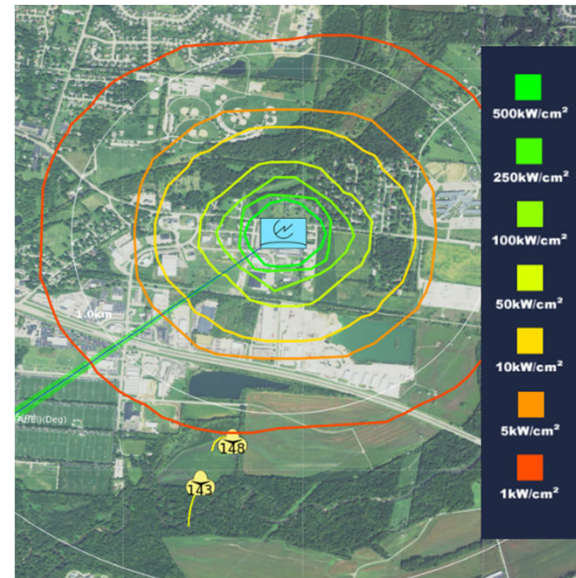
The DEEDS Processor integrates with MZA's DELTA-Wx sensing to provide sensing, modeling, and forecasting of turbulence, optical, and other DE performance metrics. DEEDS uses available weather data and forecasts along with advanced atmospheric models to analyze and simulate laser propagation from weapon to target. When provided HEL system beam control camera feeds, DEEDS uses DELTA turbulence sensing to measure atmospheric jitter, which enables calculation of a C_n^2 profile. This C_n^2 data, weather data from the co-located station, and Numerical Weather Prediction (NWP) are used by the DEEDS processor to generate data that can be visualized in 3D or integrated with a beam control system to provide on-screen feedback concerning laser propagation conditions and predicted performance. Real-time laser simulation visualizes a "virtual fire" for weapon operators.





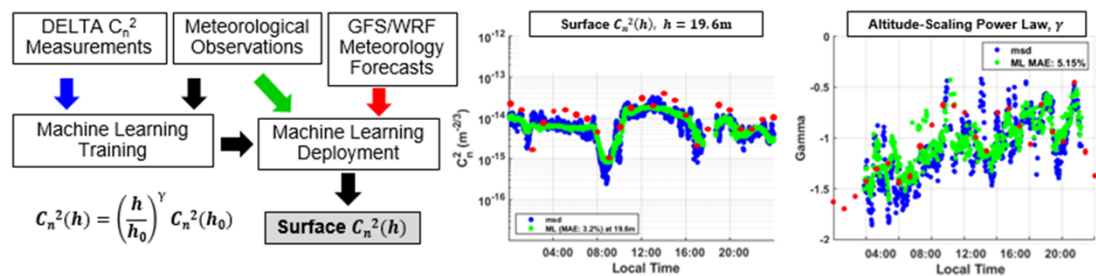
Real-Time Decision Aid for Laser Propagation

The DEEDS processor ties together powerful sensors and modeling tools developed by MZA - DELTA-Wx, MASS, SHaRE, and WaveTrain – and allows their potential to be expressed in the domain of real-time DE decision-making. A MASS Server on the DEEDS processor gets the raw optical and weather measurements and uses machine learning to provide enhanced forecasts to be included in the weather cubes. If integrated with an optical Beam Control Executive Processor, MASS can also derive turbulence data from that source. Using the DEEDS laser operators use the turbulence and other data derived using this system to visualize laser performance in real-time to inform their decision-making or plan for future laser propagations based on forecasted conditions. If integrated with a beam control system, the DEEDS processor provides on-screen feedback on the laser propagation conditions for whatever target a laser operator may be tracking in real-time.



DEEDS can access weather, turbulence, and modeling available from the MASS archive, which includes DELTA-Wx sensors operating in proximity to the laser weapon system, on nearby ranges, or deployed globally. Even without additional hardware, the built-in DELTA image processing enables live turbulence profiling using weapon system fine-track sensor data streams. If standard meteorological sensors are available, then weather-driven atmospheric modeling may be applied. The output turbulence profiles are used into system models for immediate operator feedback.

When network access is available to the DEEDS processor, numerical weather prediction (NWP) or other weather data may be downloaded to provide weapon performance forecasting in the future. At any given time, the laser weapon operator sees 2D range contours and 3D equivalent displays for knowing the evolving range capability of for HEL effects. As soon as a target is acquired in the optical sensors, the operator may initiate a “virtual fire” for on-screen display of instantaneous or time-integrated laser irradiance on target for go/no-go decisions.



A sensor for measuring and forecasting turbulence conditions along a designated propagation path.

