



CBAR

Link Analysis and Channel
Propagation Modeling Software



Powerful, Next-Gen Wireless Channel Propagation Modeling Software

Bidirectional Analytic Ray Tracing and Radiative Transfer Modeling

CBAR (Channel modeling based on bi-directional ray tracing and radiative transfer method) is a wireless channel propagation modeling software developed by BlueHalo. It predicts bit error rate and link availability of air-to-ground and ground-to-air communication links by incorporating the impact of the following factors: terrain; aircraft position, orientation and velocity; antenna pattern of aircraft and ground stations; receiver operating characteristics; and modulation schemes. It is a low-cost, powerful software designed to aid planners in optimizing communication coverage.

Powerful Techniques

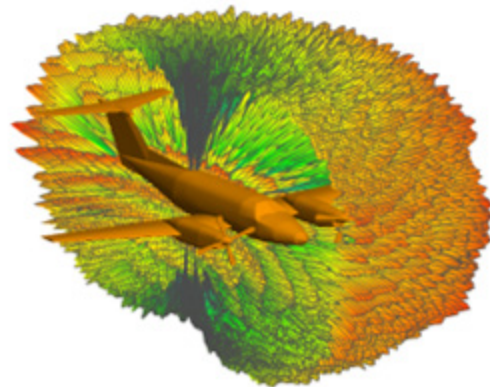
Bidirectional ray tracing launches rays from transmitter and receiver. It employs computational geometry to accurately trace polygon ray tubes and calculate shadowing and reflection.

EM Scattering Models

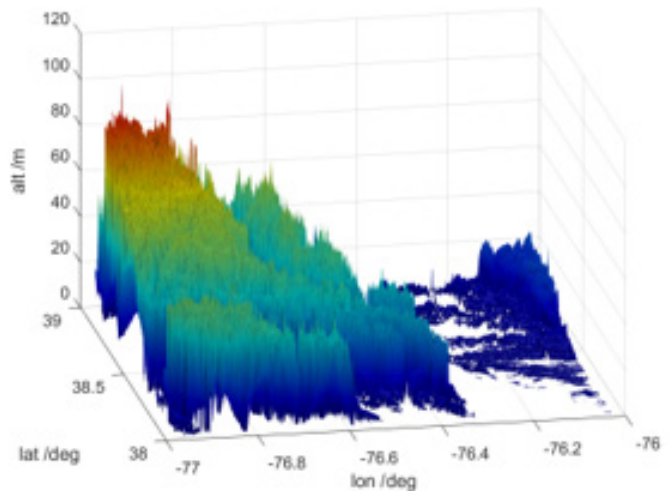
It incorporates the Electro-magnetic (EM) scattering model of Physical Optics (PO). Multithreading is used to parallelize the scattering computation across multiple CPU cores.

Full Validation

It is validated versus commercial simulation tools, RF channel emulation system, and field testing to prove the full benefits of the techniques and compatibility with all RF systems.



Antenna Pattern



Terrain

CBAR



Low Cost and Efficient

Testing the computing requirements of CBAR Real-Time Ray-Tracing (RT2) compared with commercial Uniform Geometrical Theory Of Diffraction (UTD) tool shows that CBAR using ray tracing techniques are much more efficient to implement, which is a key consideration.

CBAR RT2 Algorithm

It computes time-varying channel-impulse response accounting for the following factors:

- Position, orientation and velocity of transmitter and receiver.
- Scattering due to terrain (buildings, ground and other objects).
- Antenna patterns of the transmitter and receiver.
- Attenuation due to weather effects such as rain.
- Propagation over ocean.

Accurate

Testing CBAR RT2 against UTD techniques have proved that CBAR captures much more multipaths, and are therefore much more accurate.

Terrain

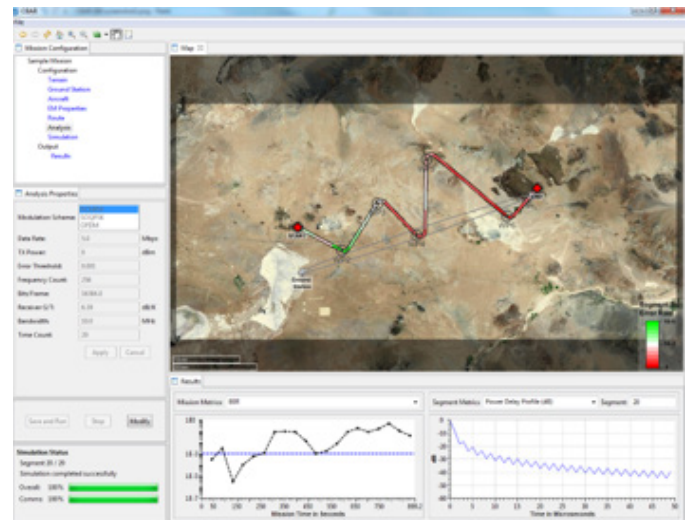
Based on the elevation data received from United States Geological Survey (USGS) and high resolution data BlueHalo has developed a terrain database.

Aircraft Route Design

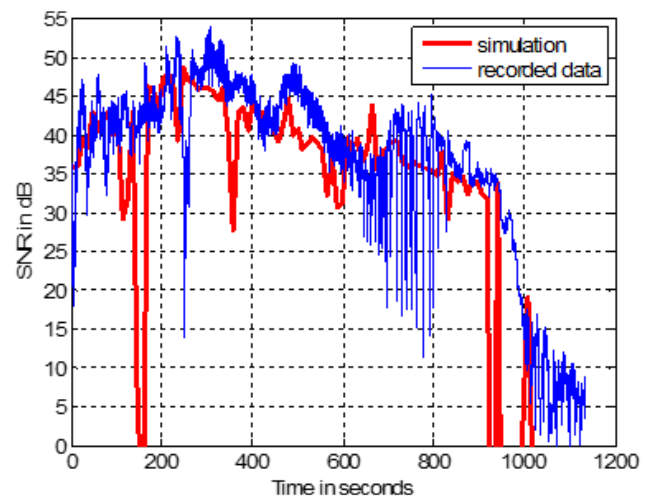
CBAR can generate the route of a desired aircraft (specified through its performance characteristics) based on waypoints provided as inputs by the user.

Ray-Tracing and Physical Optics

CBAR contains BlueHalo's RT2 engine that uses ray-tracing and physical optics to generate the frequency response of the channel from the transmitter to the receiver. Furthermore, by accounting for the Doppler shift associated with each ray due to motion, RT2 generates a time-varying



CBAR UI



Validation with actual flight test data

Specifications	CBAR
Channel Modeling Algorithm	Highly efficient 3D ray-tracing algorithm
EM scattering models	Physics Based, incl. PO.
Scattering Computation	Multi-thread across multiple CPU cores
CPU time vs. UTD	12%
Memory vs. UTD	22%

For More Information

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