

# WaveTrain™

wave optics for the rest of us

## The Challenge of Wave Optics Simulation

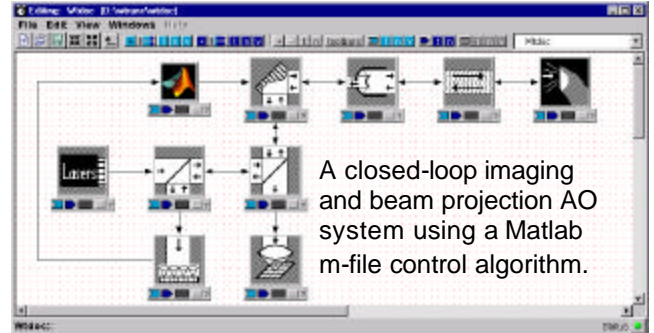
For years wave optics simulation -- computer modeling of optical effects based on scalar diffraction theory -- has been a crucial technology for the design and development for advanced optical systems. But until now it has been the sole province of a handful of specialists, the authors of the wave optics codes and a few others, because the codes were extraordinarily complicated and difficult to use. Also, it has been impractical to run large wave optics simulations on desktop machines because of the severe computational requirements.

## The Solution is WaveTrain

WaveTrain puts the power of wave optics simulation onto your desktop -- or laptop, for that matter. Not only have computers become much faster, but now, with WaveTrain, wave optics has been made much easier. WaveTrain provides an intuitive connect-the-blocks visual programming environment in which the user can assemble beam lines, control loops, and complete system models, including closed-loop adaptive optics (AO) systems. There are graphical interfaces for setting up adaptive optics geometries and turbulence profiles, and a spreadsheet-style interface for setting up and executing parameter studies. The generated output -- imagery, field quantities, control signals, and the like -- can be loaded into Matlab™ for analysis and post processing.

## WaveTrain simulates...

- Propagation through turbulence
- Coherent and incoherent sources
- Compensated imaging systems
- AO beam projection systems
- Novel AO concepts
- Non-optical effects
- Atmospheric turbulence profiles



## WaveTrain provides...

- Connect-the-blocks model building.
- High fidelity optics, atmospheric, beam generation, and adaptive optics component models.
- Extensibility. Users can add components using C++, C, Fortran, or Matlab™ m-files.
- Automated parameter studies.
- Optimized propagator.
- Analysis and development in Matlab™.



## WaveTrain is based on a solid design

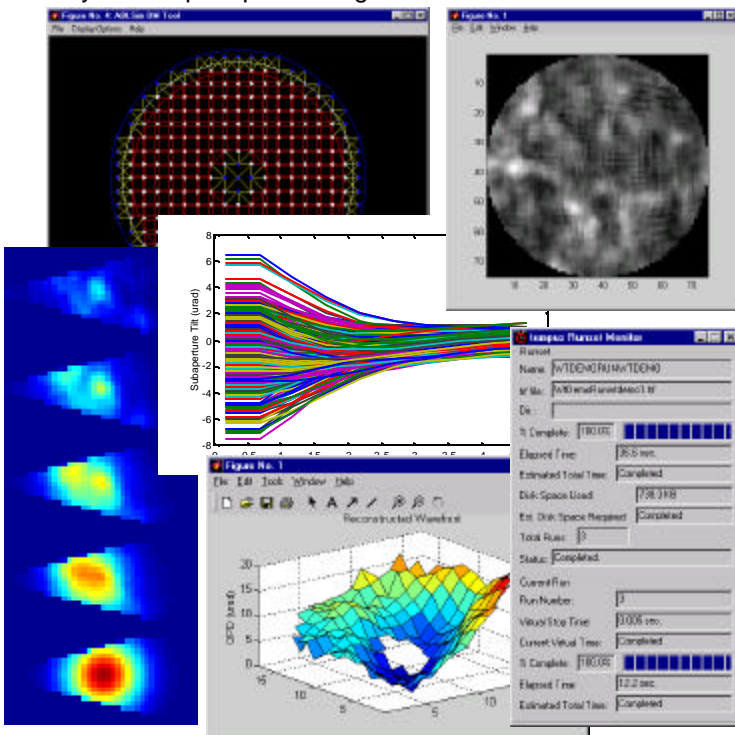
WaveTrain is the first large application based on tempus™, MZA's general purpose object-oriented simulation tool. tempus is similar in appearance to tools such as SimuLink™ and Easy5™, but it is much more powerful and flexible. Most of the connections in WaveTrain represent optical interfaces, and each of these describe all the light crossing it, from any number of sources, with the same or different wavelengths, coherent or incoherent, collimated or uncollimated, pulsed or continuous wave. There is built-in logic to coordinate propagations with sensor exposure intervals, and to avoid performing redundant propagations when two sensors are looking at the same light. WaveTrain handles the tricky details so you don't have to.

## WaveTrain builds upon a proven legacy

WaveTrain has been anchored to theory, experiment, and other wave optics codes. It uses algorithms and source code drawn from a number of legacy codes. The development of WaveTrain was funded largely by the Air Force Research Laboratory, which uses the code in support of its directed energy experiments and weapons programs.

## Contact MZA to catch the WaveTrain

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## WaveTrain runs on...

- Windows-NT/2000/95/98
- Linux
- AIX (including SP computers)
- SGI