ASCENT Project 009

Geospatially Driven Noise Estimation Module

Georgia Institute of Technology

PI: Dimitri Mavris, Holger Pfaender

PM: Joseph DiPardo

Cost Share Partner: Georgia Institute of Technology

Objective:

Develop a novel geospatially driven noise estimation module to support computation of noise resulting from the operation of Unmanned Aircraft Systems (UAS) and other upcoming vehicle concepts.

Project Benefits:

- A GIS driven noise estimation module to evaluate the noise from large numbers of UAS vehicles.
- This tool will help provide decision-makers UAS noise exposure distributions as well as provide insight on where the noise would be located and identify mitigation solutions.

Research Approach:

- Literature Review and GIS Software Evaluation
- Investigate Emerging Computational Technologies
- Collaboration with ASSURE CoE Team at Mississippi State
  - UAS Source Noise Data Development
  - UAS Noise Computation Module
  - UAS Demand Studies
- Noise Computation Engine Integration

Major Accomplishments (to date):

- Delivered Review of GIS Software
- Initial benchmark study of computing and visualization techniques
- Close collaboration with ASSURE CoE team at Mississippi State

Future Work / Schedule:

Aligning schedule with Mississippi State Team on

- Source Noise, Demand Scenarios, Trajectories

Completing Benchmarking Tests

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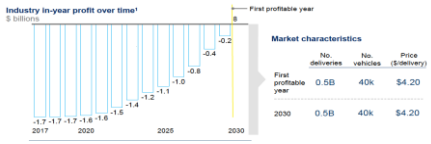
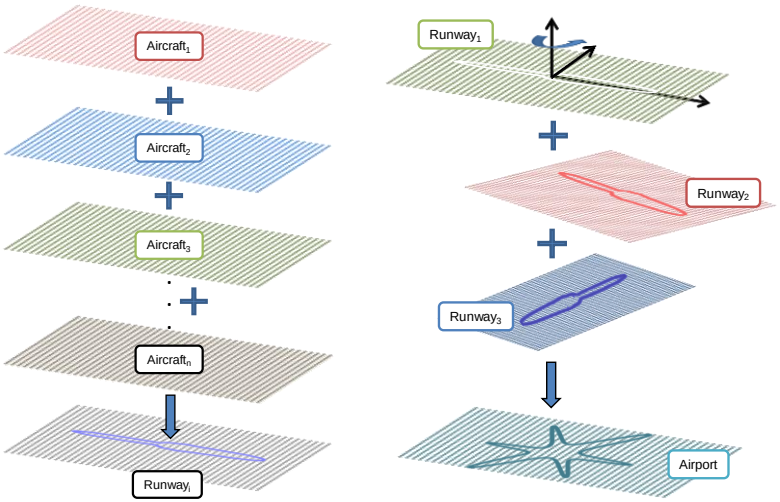
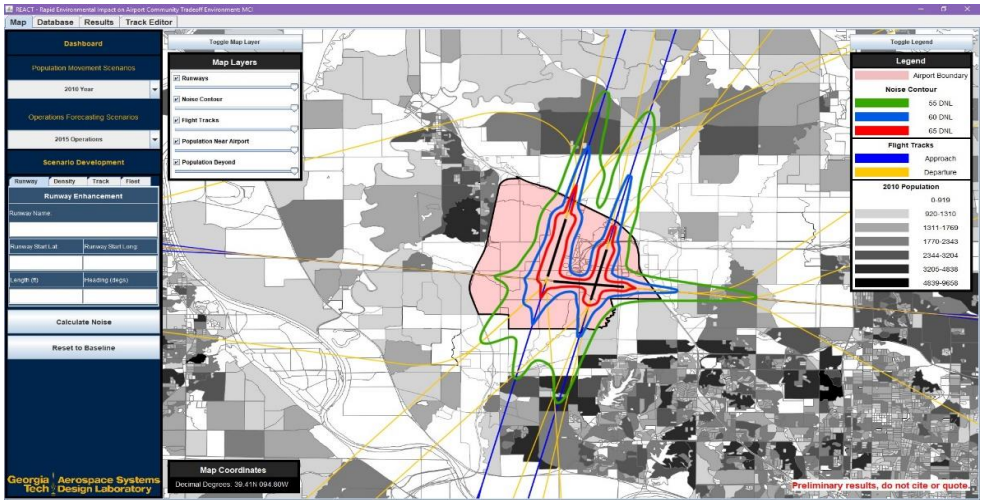
Motivation & Background Information

- The UAM market is rapidly growing with projections at $80 Billion by 2050.
- AEDT is currently focused on the computation of aircraft noise in the vicinity of airports
- The introduction of large numbers UAS vehicles will require innovative approaches to handle the increased requirements:
  - Potentially operate anywhere
  - Potential increase in operations by orders of magnitude may happen
- Take advantage of prior developed capabilities such as ANGIM and REACT





ANGIM Runway and Airport Grid Addition



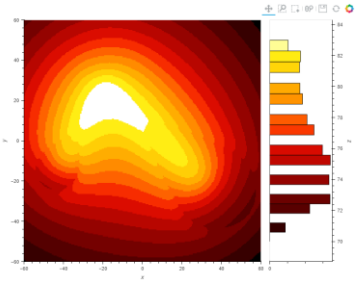
REACT Main Window Map Tab

UAS Computation Module/Noise Engine Development

- Working with Mississippi State on common data exchange format for vehicle flights and trajectories
- Requirements for noise engine
  - Compute point source moving on segments
  - Compute peak, time, and exposure based metrics
  - Adaptable to various parallelization schemes
    - Single node – multi-core
    - Many nodes (Networked/Cloud)
    - MPI – Infiniband
    - GPU/ CUDA
- Progress
  - Machine agnostic implementation in Matlab/C/Python
  - Common test benchmark setup to prove scalability
- Intent is to provide a level playing field to test approaches
- Initial results look promising, but have to factor in data overhead and partitioning details

Investigation of Emerging Computational Technologies

QGIS Maps and Contours.



DynamicMaps using Holoviews and bokeh.

Visualization Technologies

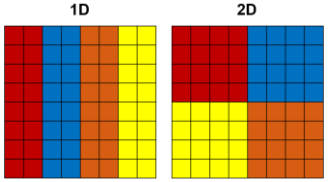
GPU Testing.
Photo Credits: Beebom

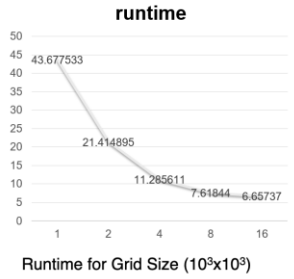
Cloud Computing Platforms.
Photo Credits: pcmag

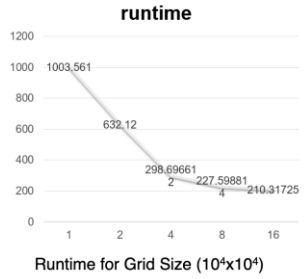
Other Emerging Technologies

Interactive Geospatially Driven Noise Estimation

Parallelization of Noise Engine





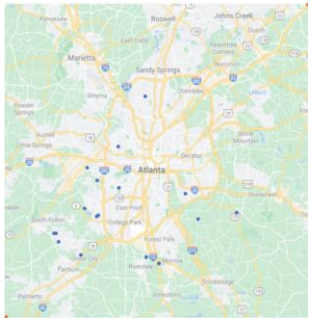


Matrix Parallelization Strategies in MPI.

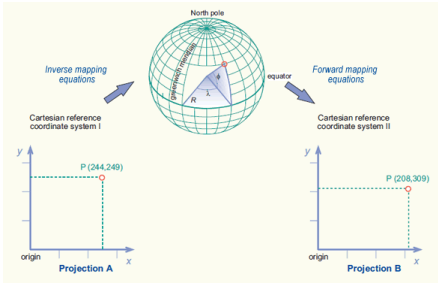
Benchmark Experimentation on PACE*.

*PACE: The Partnership for an Advanced Computing Environment at GT.

Data Pre/Post Processing



Accelerated & Realistic Path Generation on Atlanta Area using Numba.



Cartesian to GIS Coordinate Transformation.
Photo Credits: kartoweb

Current Accomplishments & Expected Benefits to the FAA

- Experimentation and detailed assessment of various Open Source GIS technologies, languages, and software.
- Assembly of lessons learned and recommendations on the way forward.
- Continue Collaboration with ASSURE Center of Excellence at Mississippi State University and Volpe.
- Development of a scalable interactive GIS driven noise estimation module to evaluate the noise exposure resulting from the operations of a large numbers of UAS vehicles into commercial and private use.