OverFlight
A New Graphical Acoustics Community Impact Tool

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Analytical Mechanics Associates

Contents
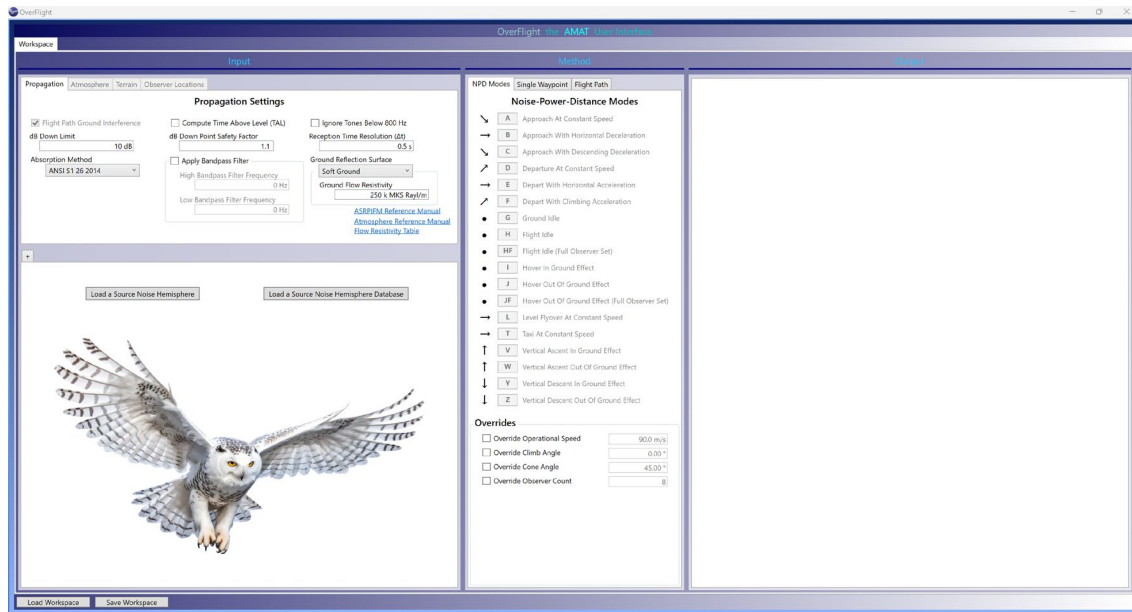
Introduction & Overview

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- Aircraft operations in urban areas often produce noise complaints
- Aircraft operations planning can help reduce noise in areas of interest
- Need for an easy-to-use tool to aid in designing aircraft operations from an acoustic perspective without requiring advanced acoustic expertise
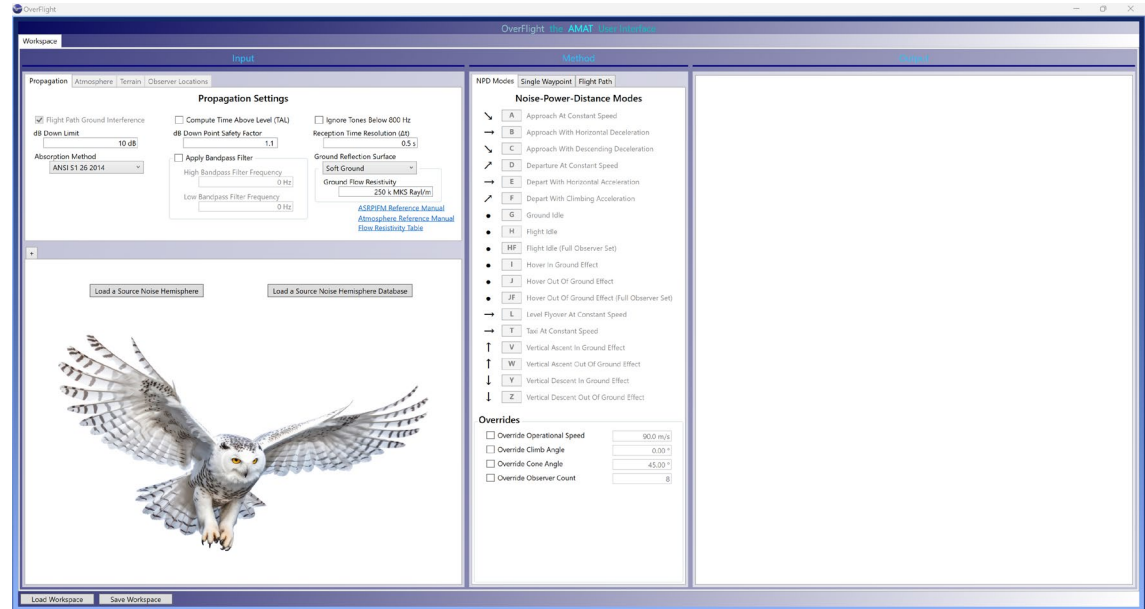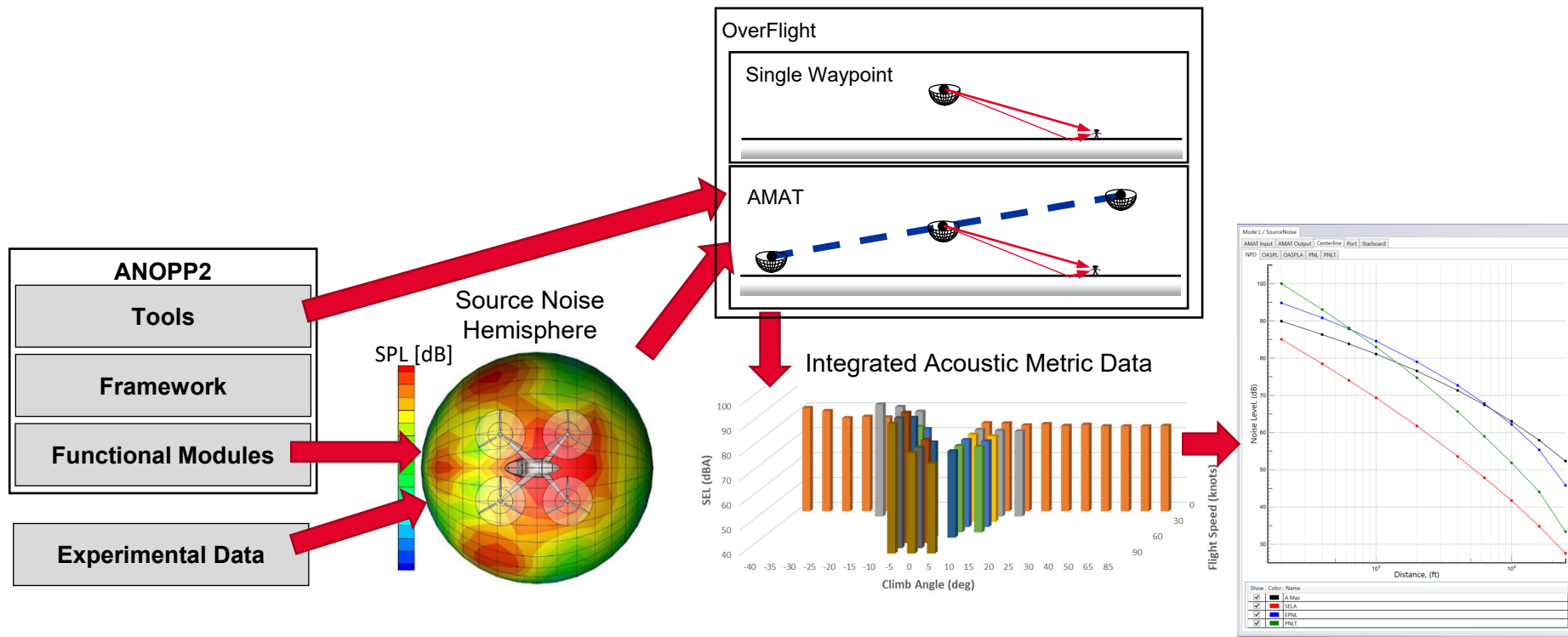
Introduction & Overview

- New user interface for land use planning and community noise impact
- Based on the Aircraft Noise Prediction Program 2 (ANOPP2) and the ANOPP2 Mission Analysis Tool (AMAT)
- Designed to be easy to use and extensible
- Supports Digital Terrain Elevation Data (DTED) for real time terrain visualization
- Easily maintain session persistence and transfer simulation settings to different computers and colleagues

Introduction & Overview

ANOPP2
- Tools
- Framework
- Functional Modules

Experimental Data

Source Noise Hemisphere

SPL [dB]

OverFlight

Single Waypoint

AMAT

Integrated Acoustic Metric Data

Introduction & Overview

UI Overview

UI Overview

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UI Overview: Hemispheres

- Supports ANOPP2 Restart files and traditional netCDF (RNM/AAM) hemispheres
- View different one-third octave bands, or OASPL/OASPLA

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- View different one-third octave bands, or OASPL/OASPLA as well as different noise components
- Right click provides more options
  - Copy images to clipboard
  - Export hemispheres to Tecplot
  - Change display coordinates
  - View source noise spectrum at specified point
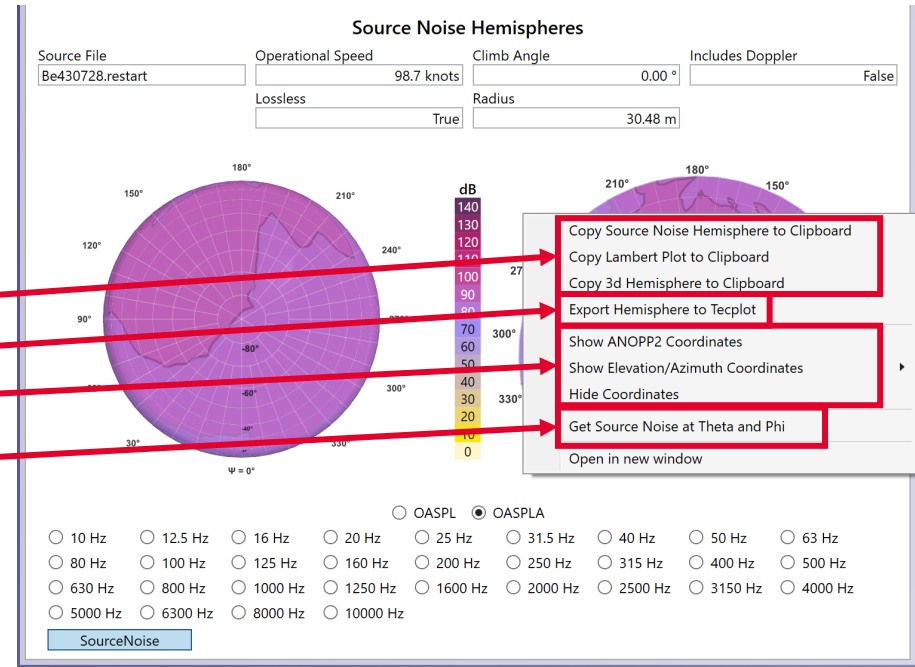
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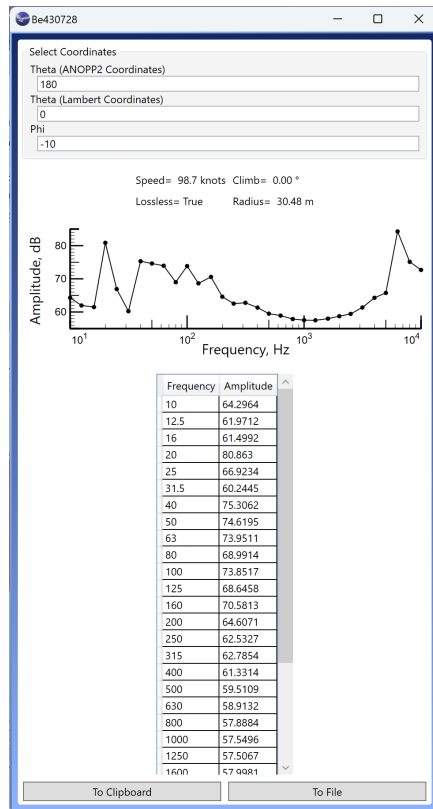
UI Overview: Workspaces
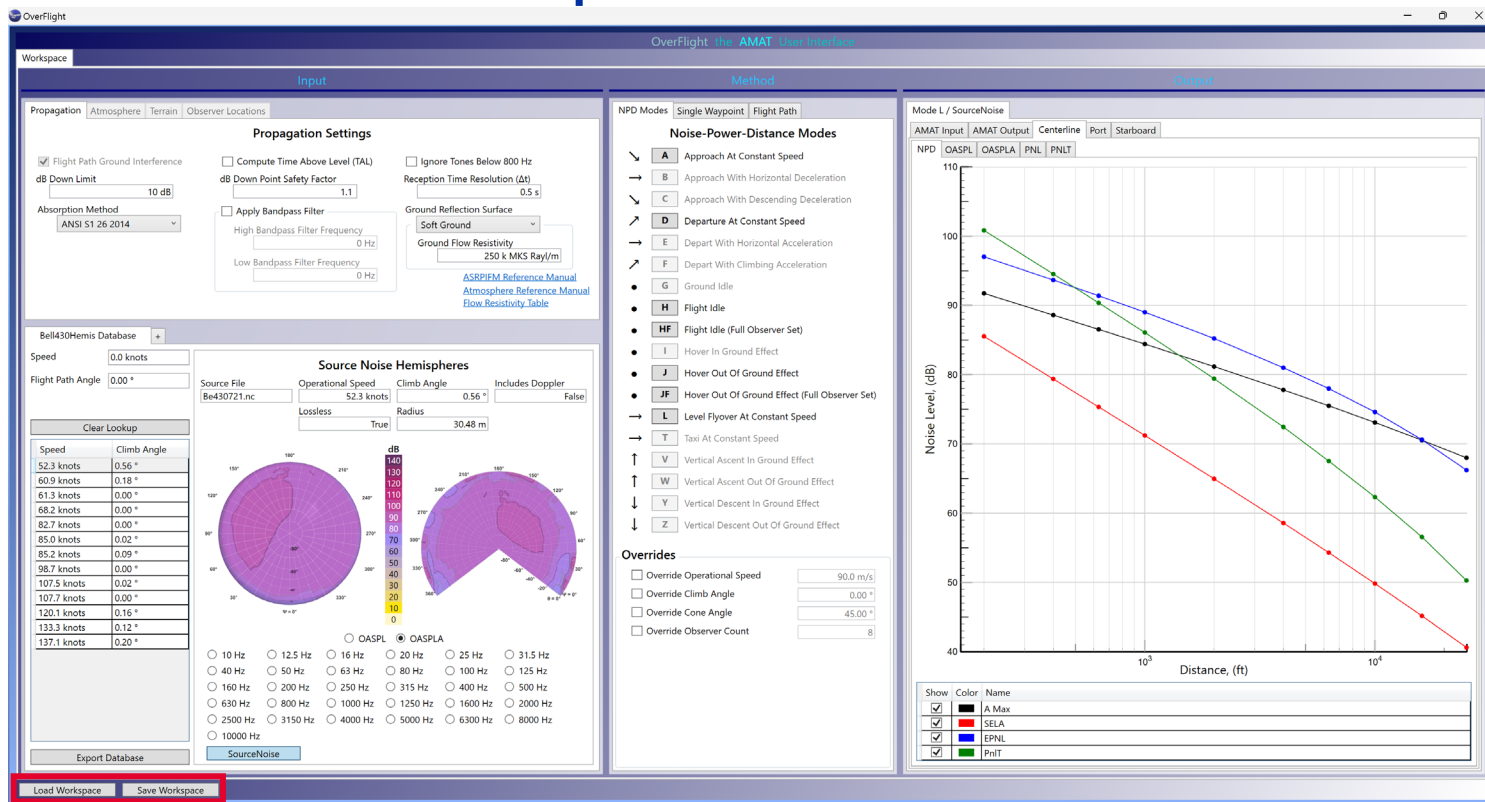
UI Overview: Workspaces

- Save Workspace
  - Saves all user input: Loaded hemispheres and databases, propagation settings, atmosphere settings, etc.
  - Saves method settings
- Load Workspace loads back all information saved in workspace file. Results are recomputed
- Different workspaces for different tasks. Different tabs for different workspaces
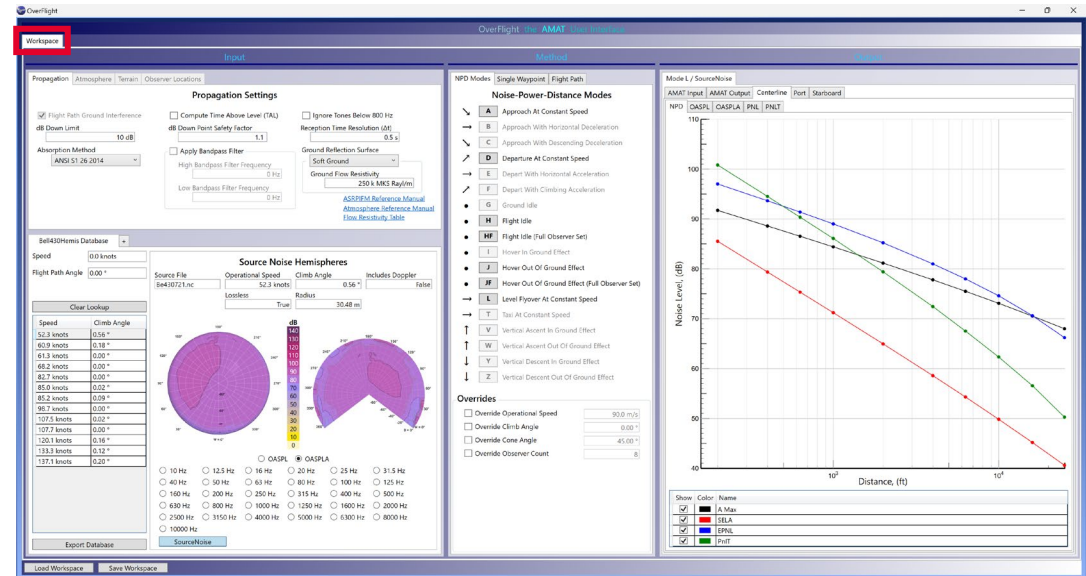
Acoustic Propagation

Acoustic Propagation

- Powered by ANOPP2 Straight Ray Propagation Internal Functional Module (ASRPIFM)
  - Straight ray propagation: no curvature due to wind, atmospheric variations, etc.
  - Accounts for spherical spreading

| Propagation | Atmosphere | Terrain | Observer Locations |

Propagation Settings

Absorption Method
ANSI S1 26 2014

Ground Reflection Surface
Soft Ground

Ground Flow Resistivity
250 k MKS Rayl/m

ASRPIFM Reference Manual
Atmosphere Reference Manual
Flow Resistivity Table

Acoustic Propagation

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- Atmospheric absorption
  - Several models
    - SAE ARP 866A
    - 1978 ICAO
    - ANSI S1.26-1978
    - ANSI S1.26-2014
  - Atmospheric attenuation averaged across atmosphere layers using selected absorption method
  - Uniform per layer, no spatial variance

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  - Atmospheric attenuation averaged across atmosphere layers using selected absorption method
  - Uniform per layer, no spatial variance
- Ground reflection model based off Chien and Soroka[†]
- Ground impedance model base off K. Attenborough[‡]
  - Options are: no reflection, hard reflection, soft reflection
  - Uniform, no spatial variance

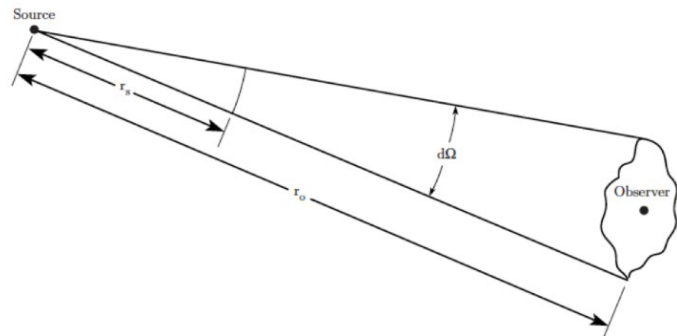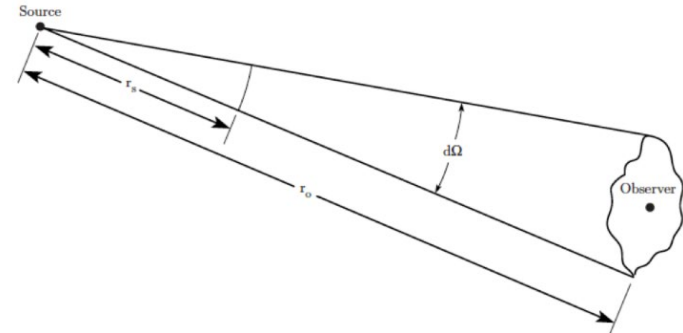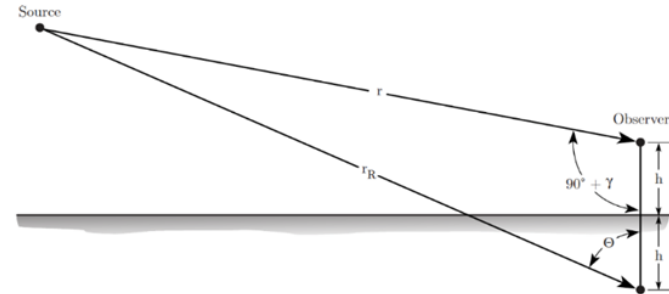**Propagation** Atmosphere Terrain Observer Locations

Propagation Settings

Absorption Method
ANSI S1 26 2014

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ASRPIFM Reference Manual
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Flow Resistivity Table

[†]C.F.Chien and W.W.Soroka, "Sound Propagation along an Impedance Plane," *Journal of Sound and Vibration*, Vol. 43, 1975, pp. 9–20.

[‡] K. Attenborough, "Acoustical impedance models for outdoor ground surfaces," *Journal of Sound and Vibration*, Vol. 99, 1985, pp. 521–544.

Modes of Operation: Noise-Power-Distance

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- User Inputs
  - Propagation settings

Modes of Operation: Noise-Power-Distance

- User Inputs
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  - Source noise hemisphere

Modes of Operation: Noise-Power-Distance

- User Inputs
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  - Source noise hemisphere or selection from database

Modes of Operation: Noise-Power-Distance

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- Standard Noise-Power-Distance Modes (NPD)
  - Currently Available Modes: A, D, H, HF, J, JF, and L

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  - Can override prediction parameters

NPD Modes	Single Waypoint	Flight Path

Noise-Power-Distance Modes

↘	A	Approach At Constant Speed
→	B	Approach With Horizontal Deceleration
↘	C	Approach With Descending Deceleration
↗	D	Departure At Constant Speed
→	E	Depart With Horizontal Acceleration
↗	F	Depart With Climbing Acceleration
●	G	Ground Idle
●	H	Flight Idle
●	HF	Flight Idle (Full Observer Set)
●	I	Hover In Ground Effect
●	J	Hover Out Of Ground Effect
●	JF	Hover Out Of Ground Effect (Full Observer Set)
→	L	Level Flyover At Constant Speed
→	T	Taxi At Constant Speed
↑	V	Vertical Ascent In Ground Effect
↑	W	Vertical Ascent Out Of Ground Effect
↓	Y	Vertical Descent In Ground Effect
↓	Z	Vertical Descent Out Of Ground Effect

Overrides

☐ Override Operational Speed		90 m/s
☐ Override Climb Angle		0 °
☐ Override Cone Angle		45 °
☐ Override Observer Count		8

Modes of Operation: Noise-Power-Distance

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  - Can override prediction parameters
- Results:
  - NPD Curves
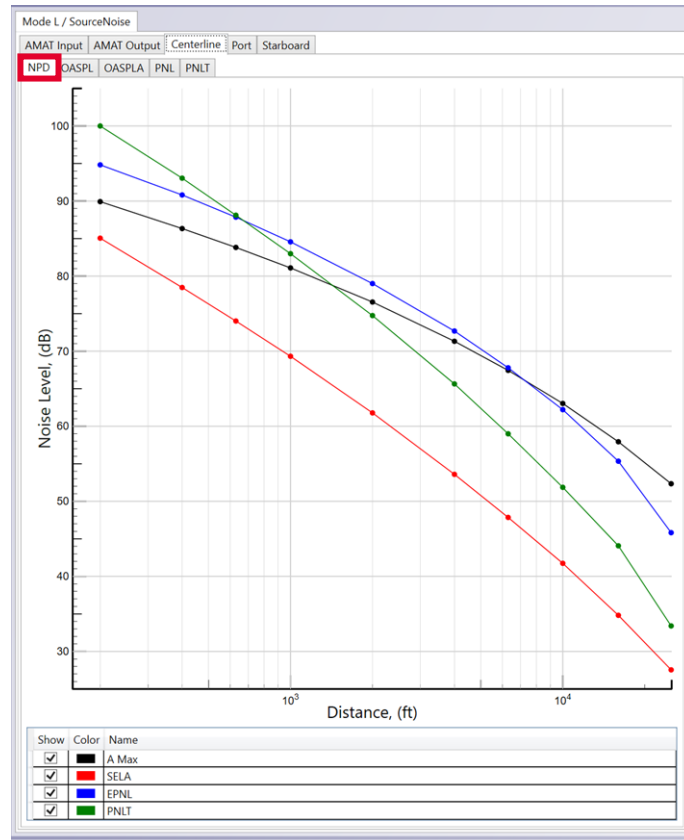
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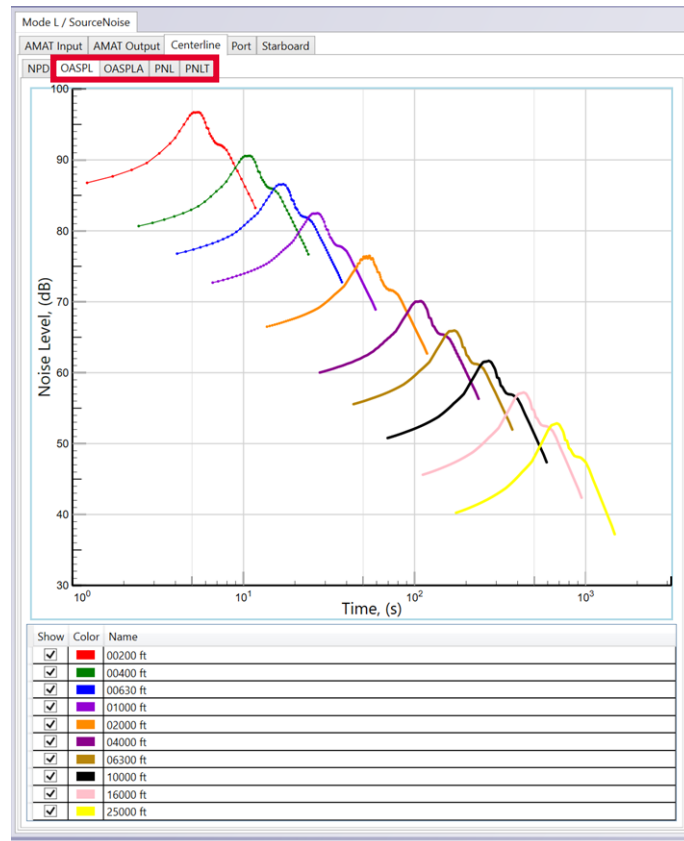 - OASPL, OASPLA, PNL, and PNLT at different altitudes

Modes of Operation: Noise-Power-Distance

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- Results:
  - NPD Curves
  - OASPL, OASPLA, PNL, and PNLT at different altitudes
  - Available at different observer angles where applicable: Centerline, Port, Starboard
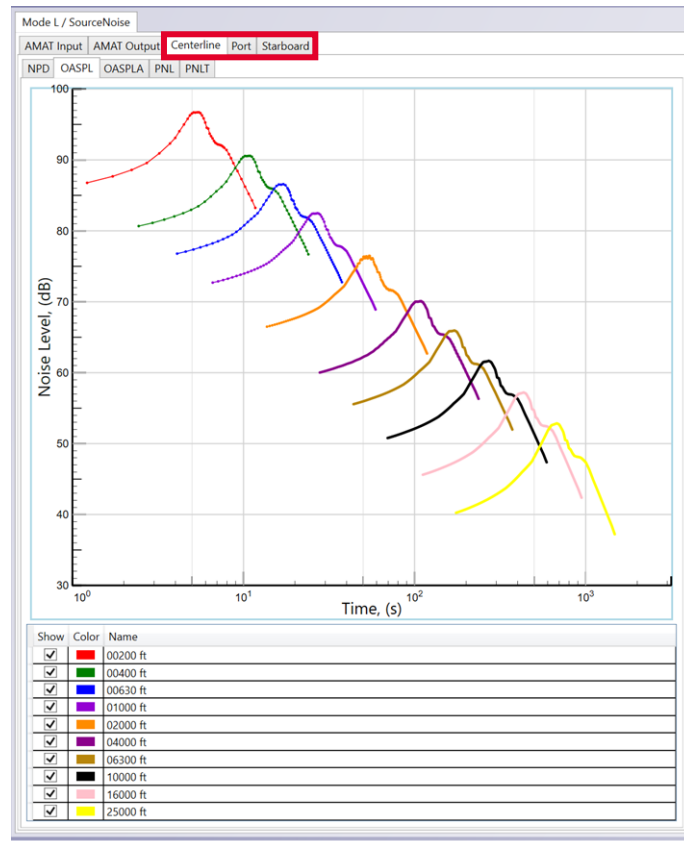
Modes of Operation: Single Waypoint

Modes of Operation: Single Waypoint

- User Input
  - Propagation
  - Atmosphere
  - Terrain from DTED
  - Source noise hemisphere or database

Modes of Operation: Single Waypoint

- User Input
  - Propagation
  - Atmosphere
  - Terrain from DTED
  - Source noise hemisphere or database
- Method configuration
  - Location for terrain line-of-sight calculation
  - Vehicle position and orientation
  - Vehicle speed or a range of speeds
  - Observer settings
  - User notes

NPD Modes | Single Waypoint | Flight Path

Single Waypoint

Vehicle Settings

Location
37°06'40.6190476"N 81°36'26.3809524"W

Altitude
200 ft

Compass Heading
0.00 °

Speed
52.3 knots

Speed Sweep at climb angle: 0.00 °   Interpolat...
Start: 0.0 m/s   End: 0.0 m/s   Steps: 1

Observer (Microphone) Settings

Ear Height
4 ft

Angular Range
From 0.00 ° To 360.00 ° , # of Points 72

⌄ Noise Range

Prediction Settings

Description

Delta (what's different about this run)

Calculate Noise Level On Ground

Modes of Operation: Single Waypoint

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- Results
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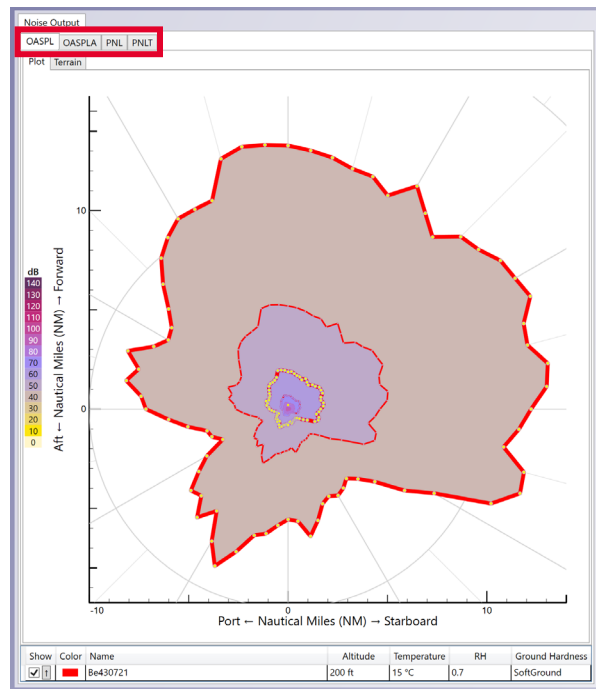
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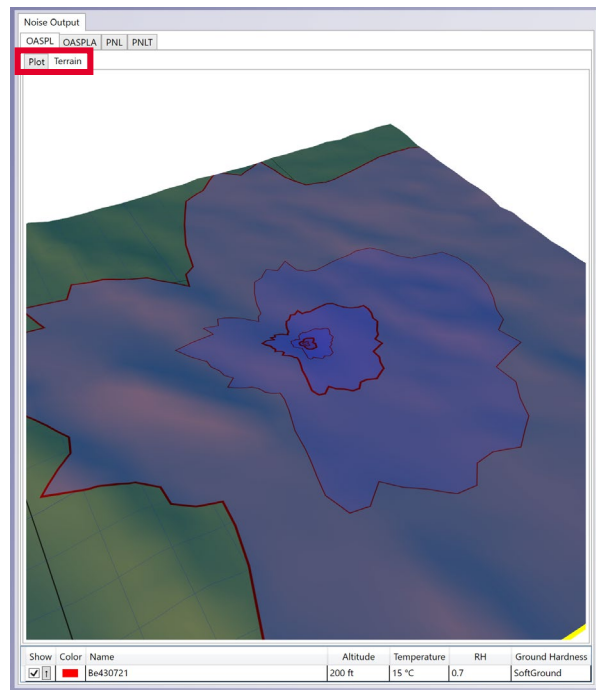   - Viewable on terrain

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- Results
  - Contours of OASPL, OASPLA, PNL, and PNLT
  - Viewable on terrain
  - Geometric "Line-of-Sight" can mask out acoustic results based on terrain
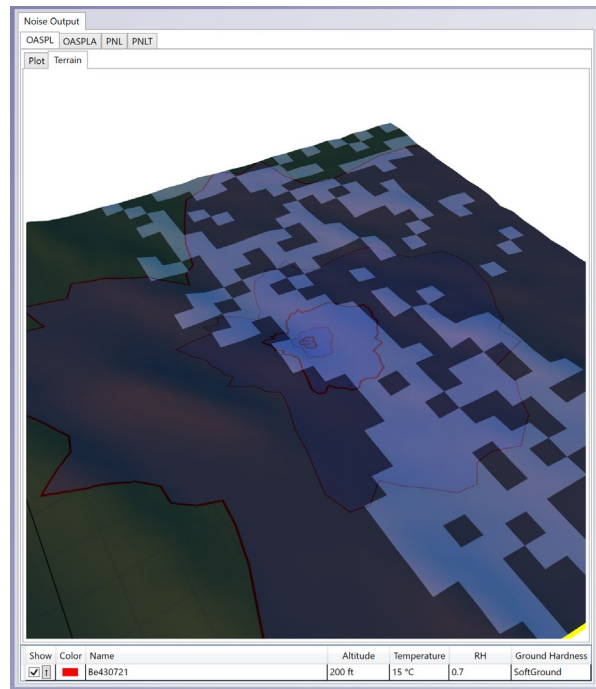
# Modes of Operation: Single Waypoint

Next Steps

Next Steps: Flight Path Planning

- Integrated flight path editor
  - Edit waypoints and view path properties change in real time
  - Plan around terrain features with DTED support
- In the future:
  - Multiple pathing algorithms and vehicle dynamics models can be implemented and will be selectable
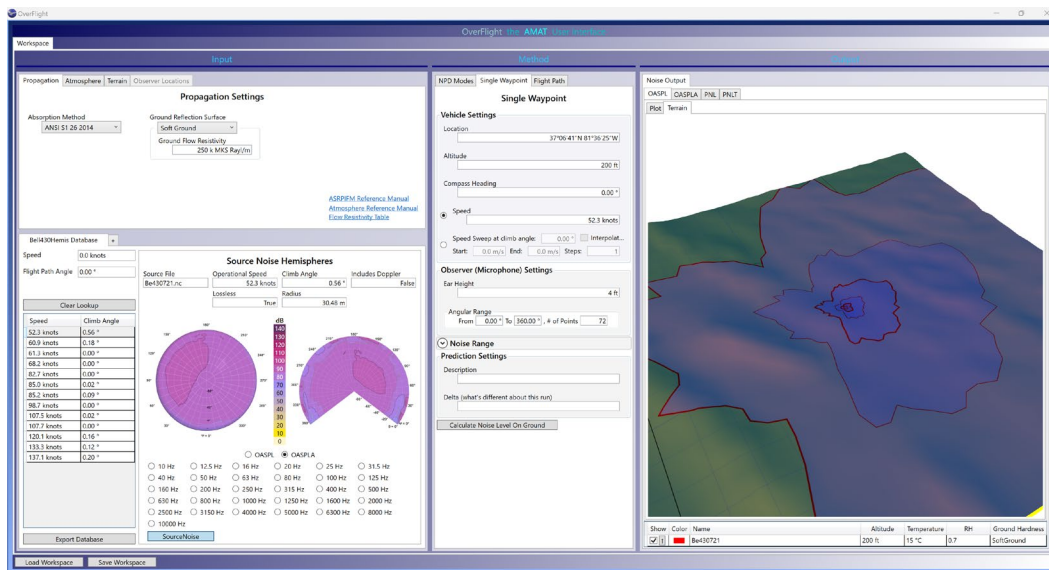 - View acoustic contours on terrain for simulated flight path
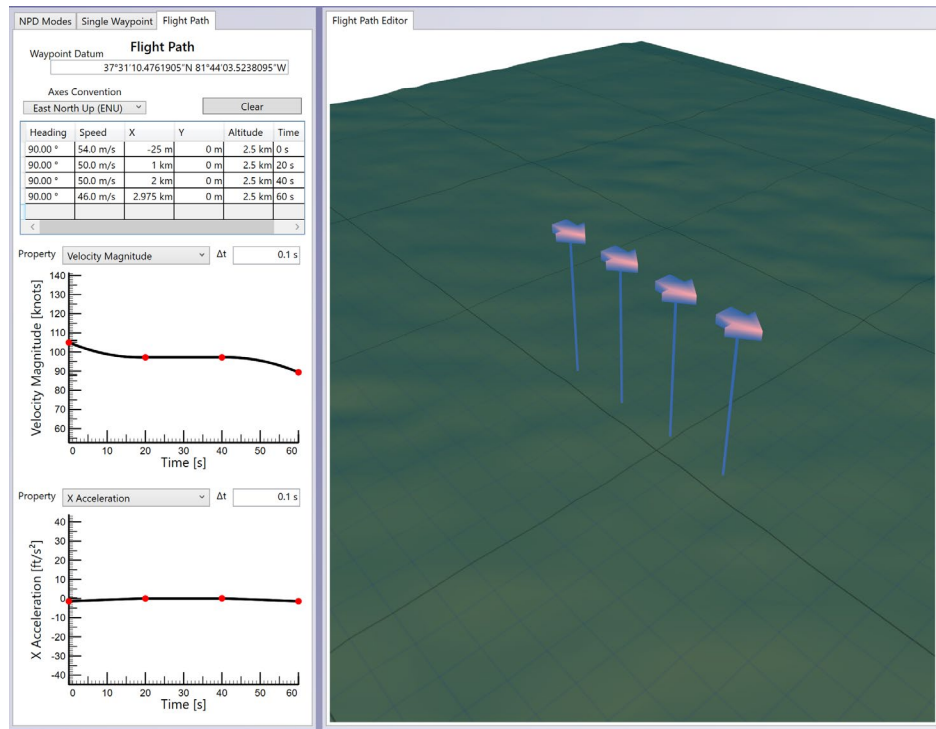
Next Steps: Flight Path Planning
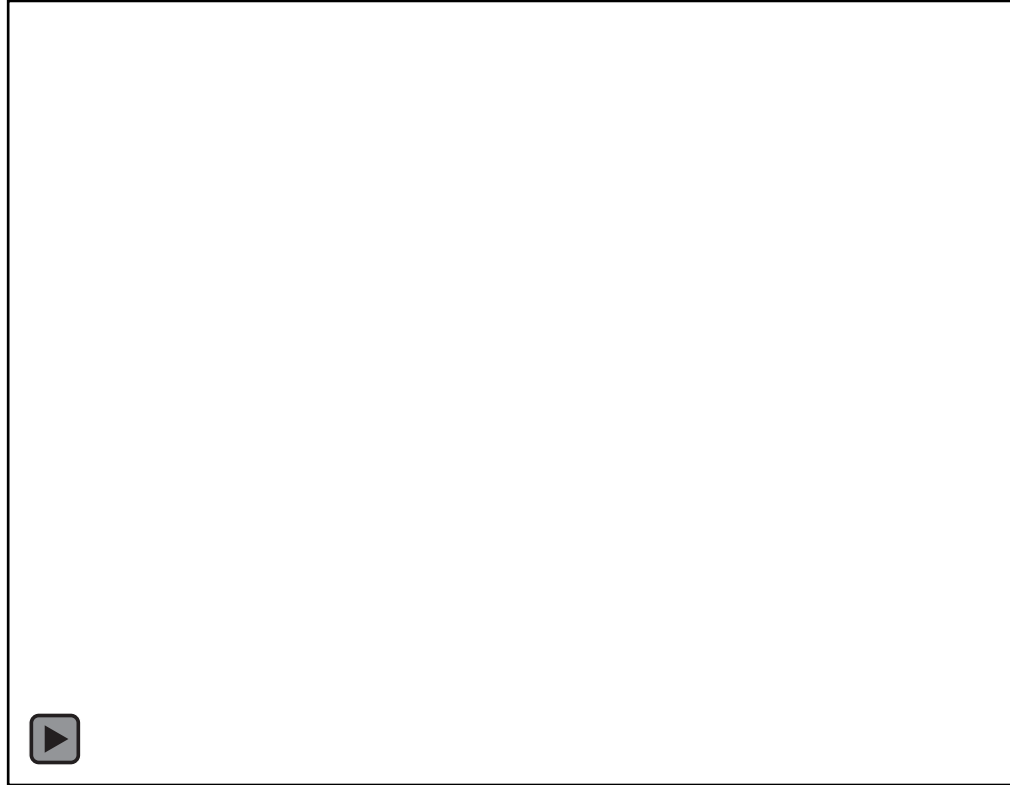
Summary

- OverFlight makes acoustic predictions easy to setup and execute
- Extensible design allows for rapid implementation of new models and features
- Workspaces make for easy data sharing and program persistence
- Integrated DTED viewer to visualize acoustic impact on real terrain data
- Estimated release date: Summer 2026 with ANOPP2v1.6

Questions?