Acoustic Sensor (ASEN)

User Guide
2017
by Tummah Technology, Inc.

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# 1. Introduction

Acoustic Sensor (ASEN) is a tool designed to calculate geometric information to support the evaluation of acoustic sensors. It takes sensor parameters and a trajectory file and outputs information related to the geometry between the two objects as a function of time.

ASEN is provided "as is", completely free, and may be distributed freely as long as mention is given to Tummah Technology Inc.

2. Running ASEN

Upon launching ASEN, the user met with a form pre-loaded with default inputs.
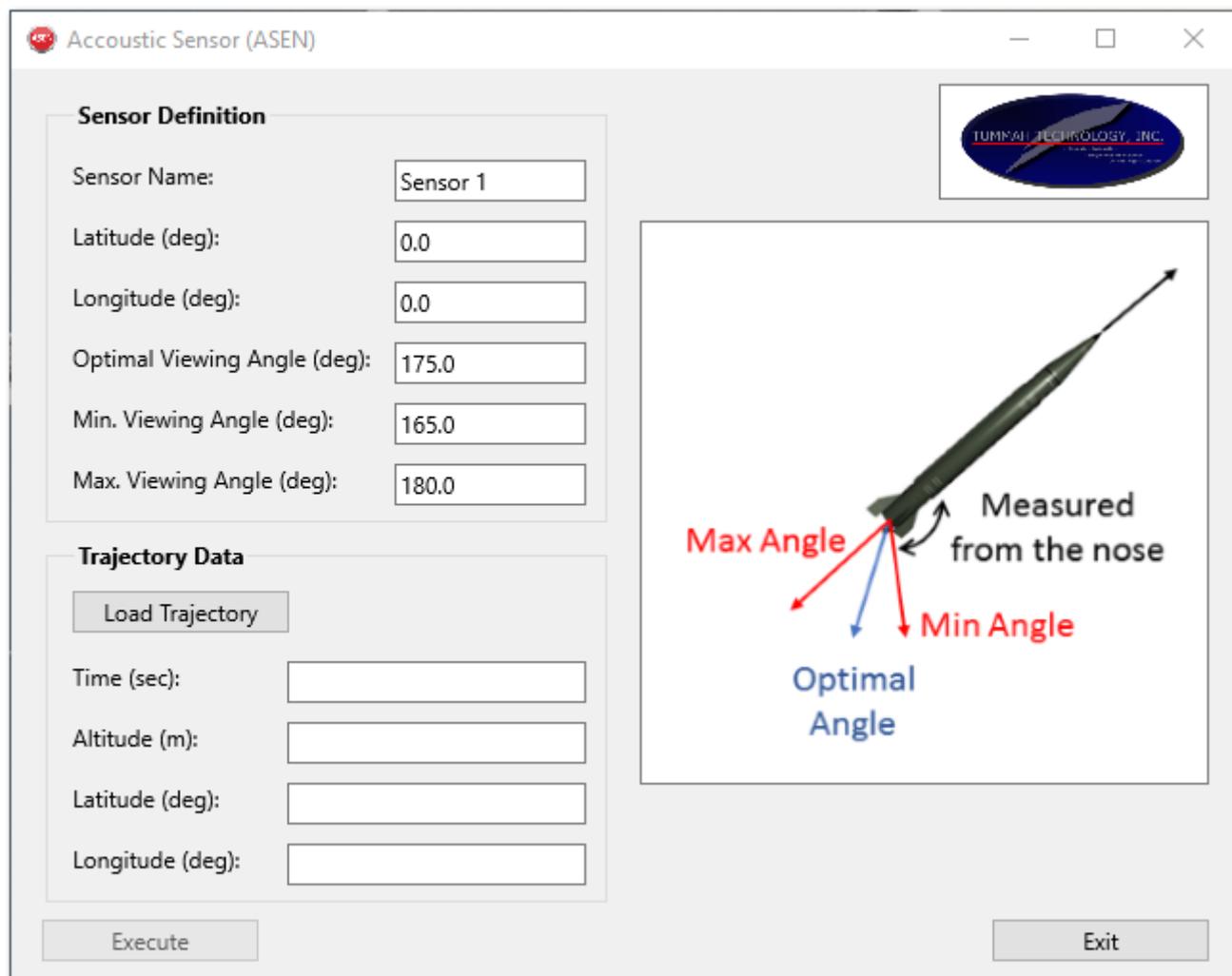
(U) Figure 1: ASEN Main Window

While the Sensor Definition information is pre-populated with default values, the user can (and likely should) change these values to reflect the correct sensor characteristics. These values include the Sensor Name, Latitude and Longitude (in decimal degrees (-180.0 to 180.0), with western longitudes and a southern latitudes being negative), and the sensor's viewing angles. These angles are defined as:

• Optimal Viewing Angle (deg) - the "best" viewing angle relative to the nose (0°) of the missile. For example, the aft-end of the missile is located at 180°.
• Minimum Viewing Angle (deg) - the minimum angle, relative to the nose, that the sensor can be located at and still detect the missile. This value must be <= the Optimal Viewing Angle.
• Maximum Viewing Angle (deg) - the maximum angle, relative to the nose, that the sensor can be located at and still detect the missile. This value must be >= the Optimal Viewing Angle.

These angle definitions are portrayed in an image to the right of the Sensor Definition area.

Once the user has changed these values, the next step is loading a reference trajectory using the "Load Trajectory" button. ASEN will load a trajectory file, auto-detect the required fields (time, range, altitude, latitude, and longitude), and use them in the geometric calculations. The user simply navigates to the file's location and selects the appropriate file. Please see the section on Trajectory Files for more information. Once the file load is complete, a message will appear and display the last time point loaded.
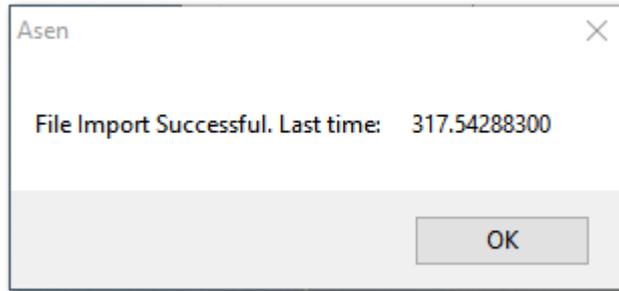
(U) Figure 2: Sample Message Window (displaying a successful loading)

For trajectory files with multiple datasets, ASEN will load the initial dataset (the "critical path") and use it for all geometric calculations.

After successfully loading a reference trajectory, the Execute button will be enabled. The user presses the Execute button to begin calculations. ASEN will attempt to create three output files, which will be located in the root directory (where ASEN.exe is located). If any of the files already exist, ASEN will prompt the user about overwriting those files.
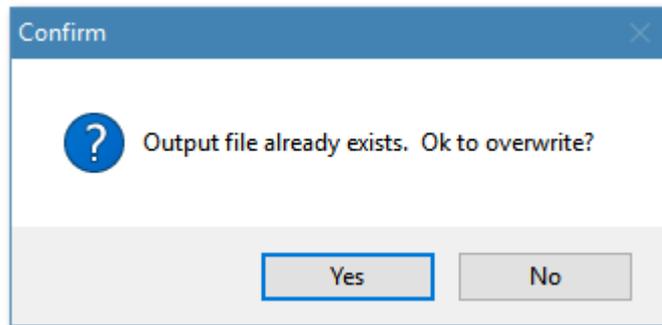
(U) Figure 3: Sample Confirmation Window (displaying file overwrite message)

If the user selects "No", ASEN will create the output file(s) with an appended time stamp instead. This allows the user to create multiple runs without overwriting previously output files.

Once the run is complete, ASEN will notify the user by another Message Window.
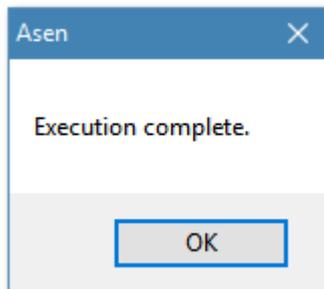
(U) Figure 4: Execution Complete Message Window

Once ASEN is finished, three comma-separated values (.csv) files will be generated. The first file contains the entire trajectory, along with the sensor's distance and angle relative to the missile. The second file, appended with "_viewing", contains the same information for only the trajectory portions that fall within the minimum and maximum viewing angle of the sensor. The third file, appended with "_optimal", contains the same information for only the trajectory portions that have the optimal viewing angle (+/- 0.2 degrees). These three files allow the user to analyze the position of a given sensor relative to the loaded trajectory and when the proper (and optimal) viewing angles are achieved.

The .csv files can be imported directly into Microsoft Excel and plotted.
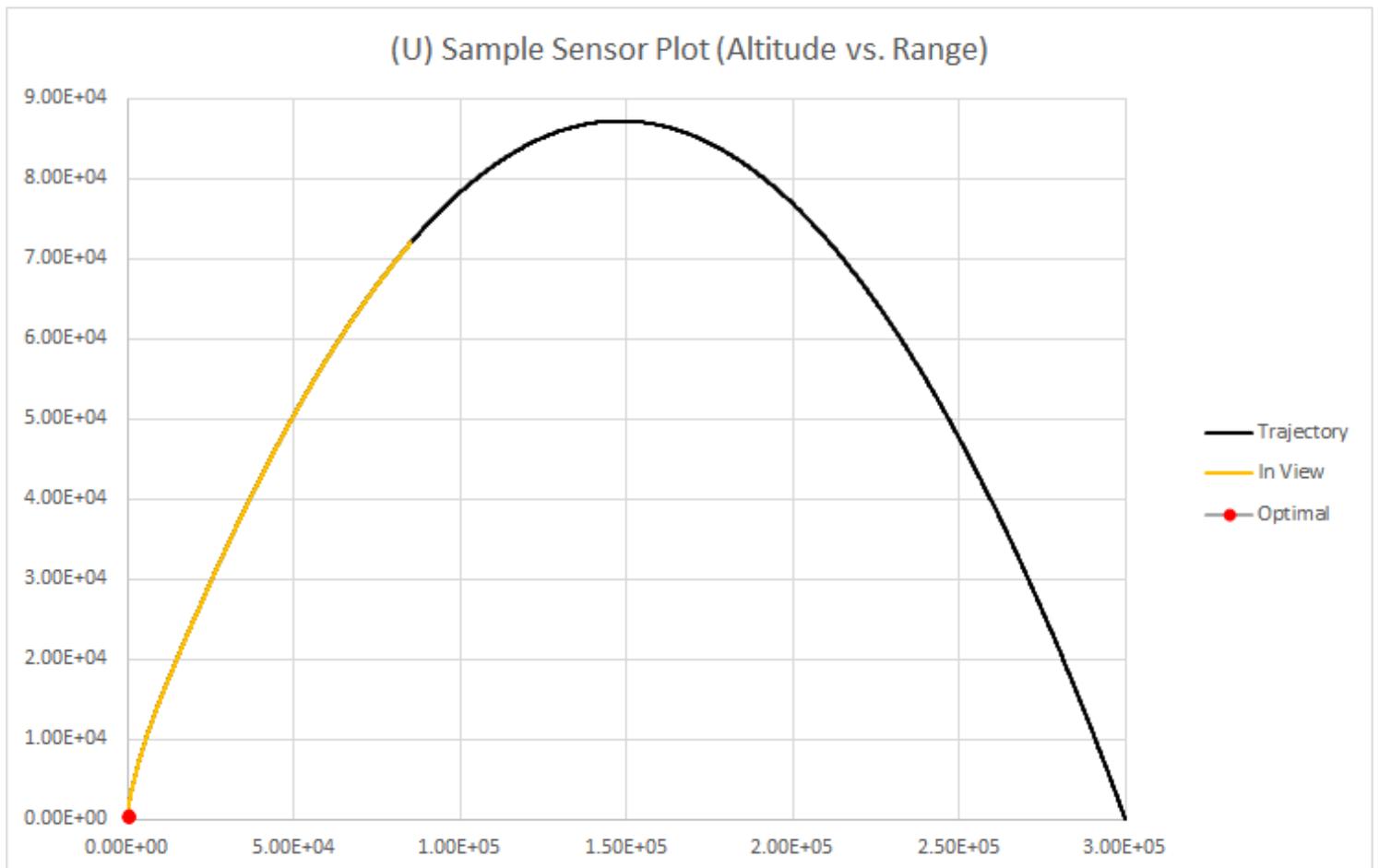
(U) Figure 5: Sample Sensor Plot from Excel

Once the user is finished generating outputs, clicking the "Exit" button closes the application.

3. Trajectory Files

ASEN loads in trajectory files for evaluation, thus the trajectory files must contain a minimum set of data to be valid. The trajectory file header consists of five lines, as follows:

Line 1: Number of datasets contained within the trajectory file
Line 2: The name of the dataset, given in the format "dataset: <name>" (without the "")
Line 3: The number of columns of data for the given dataset
Line 4: The column headers for the data
Line 5: The units for the columns of data

An example of this header structure is (bolded for visibility only):

1
dataset: Missile_1
5
**Time	Altitude	Range	Latitude	Longitude**
**s	m	m	deg	deg**
<data values start here>

Line 2 and line 5 are ignored in the current version of ASEN, though they need to exist in the trajectory file. The delimeter used between values in the header (lines 4 and 5) and the data is a tab. The column headers can consist of various names, including:

Time, simTime
Alt, Altitude, Dynamics:coordinates.alt
Range, Dynamics:rangeFromLaunch
Lat, Latitude, Dynamics:coordinates.lat
Lon, Longitude, Dynamics:coordinates.lon

Additionally, these header names are not case sensitive. The trajectory file can consist of any number of columns of data, though the minimum dataset above (i.e., Time, Alt, Range, Lat, and Lon) must be present in any order. If additional datasets are included (and currently ignored in ASEN), the same header structure is repeated, minus the initial line (i.e., Line 1). Thus, a second trajectory would have something like the following header example (and note, the initial file header's Line 1 would read 2 for two datasets):

dataset: Missile_2
5
**Time	Altitude	Range	Latitude	Longitude**
**s	m	m	deg	deg**
<data values start here>

Please note that currently, any additional dataset past the first is ignored by ASEN. Typically, the first dataset contains the "critical path" object of interest. Also, each dataset in a trajectory file can contain a different number of columns of data.