

5th AIAA Propulsion Aerodynamic Workshop 2020

PAW05 – Rectangular Exhaust Nozzle

Guidelines/Instructions for Data Submission

This document provides guiding instructions for the nozzle test case data submission. Submitting these files will fulfill the requirements for participation as described in the “Guidelines/Instructions for Participation in PAW05” document. A set of 4 files are available as templates. Participants will submit this set of 4 files for each set point (SP) and blowing ratio (BR) completed. Each file, except 1, includes the same header with 4 data entries: participant ID, SP, BR, and case number (CN). Each workshop participant will be assigned an identification number for use by the workshop organizers to easily compare and report results. Each participant should assign a case number for each set of submission data in order to distinguish submissions at the same SP and BR (e.g. different grid resolutions or turbulence models). Participants should submit a description of each CN (e.g. CN1 = SP42, BR1, fine grid, S-A). The header information is mirrored in the filename structure. Each participant should update the filenames and headers for each submission with the appropriate data. Each file is a simple ASCII file which will be used by the test case leaders to easily search, concatenate, and compare data. Therefore, please do not alter the data headings, column headings, or format in any way and only input data where necessary. A description of each file follows.

File 1: ID##_SP##_BR#_CN##_global_results.txt

This file is used for submitting details of the solver, nozzle centerline data, and integrated quantities as described in paragraphs 5 c, d, e, g, and h of the participant guide. There are 6 entries under “Solver Details”. For some entries, a suggested (but not inclusive) list of options is provided. Besides the header, please only input data where there are brackets ([..]) and remove the brackets.

There are 3 entries under “Centerline Data”. Centerline jet velocity (u_j), static temperature (T_j), and density (ρ_j) should be computed at the centerline of the nozzle exit. Please only input data by replacing the “#” signs.

There are 5 entries under “Integrated Data”. Please only input data by replacing the “#” signs. It is recommended to use mass-averaged values to compute mass flow rates at the nozzle and plenum exit. The drag coefficient and heat flux calculations should only use the top surface of the plate. If not done automatically in the CFD solver, drag coefficient may be computed using:

$$C_d = \frac{2F_d}{\rho_j u_j^2 A_{plate}}$$

where F_d is the drag (viscous) force on the top plate surface, and A_{plate} is the top plate surface area. For code efficiency, the metric is total wall clock time divided by the total number of processors used in the simulation divided by the total number of grid points.

File 2: ID##_SP##_BR#_CN##_center_temp.txt

This file is used for submitting data on the plate surface static temperature along the axial centerline averaged over a 0.5 inch spanwise width at each axial data location, as described in paragraph 5a in the participant guide. Besides the header, please only input data below the column headings. The final x location is given and $z = 0$ should be assumed at each axial point.

File 3: ID##_SP##_BR##_CN##_BL_profiles.txt

This file is used for submitting data on the centerline velocity and thermal boundary layers, as described in paragraph 5b in the participant guide. As with the other files, the header is listed first. Below the header, the first column header displays the 4 x locations where boundary layer data is to be taken. Below each x locations, non-dimensional velocity data is requested for y locations from 0 to 18 mm. Please only input data below the second column heading.

The non-dimensional temperature is defined as:

$$T^* = \frac{T - T_\infty}{T_j - T_\infty}$$

where T is the local static temperature in Kelvin, T_∞ is the ambient temperature (300 K), and T_j is the nozzle centerline static temperature.

File 4: ID##_SP##_BR#_CN##_plate_temp.dat

This file is an example Tecplot data file that will be used to compute plate temperature contours. As such, it does not contain the same header as the other files. In the Tecplot header, participants should update the "SPXXBRXX" field with the appropriate set point and blowing ratio, and the "i" and "j" fields with the number of x and z points, respectively, in their surface data. The number of points reported will vary for each participant, but as a point of reference, the NASA report used a 505x117 mesh to plot the data. Please replace the provided example data below the header.

Submission Deadline

Please submit all data files to the PAW organizing committee using the PAW email address, aiaapaw@yahoo.com, by **15 November 2020**. Submissions after the deadline are not guaranteed to be included in the workshop summary. Questions about the data files can be directed to aiaapaw@yahoo.com, or posted to the nozzle test case Slack page: <https://aiaainpsipaw5.slack.com> under the #nozzle-test-case channel.