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Transparent 2-D converging-diverging nozzle for gas dynamics instruction DELL OLMSTEAD, JON VIGIL, GREG NARANJO, C. RANDALL TRUMAN, University of New Mexico — A nozzle lab was created to combine qualitative and quantitative instruction of supersonic converging-diverging nozzle operation and design. The lab uses readily-available compressed nitrogen flowing through a 6.5mm square throat to produce exit Mach numbers up to 2.9. Several nozzles of different area ratio with transparent sidewalls can be quickly interchanged. Measured thrust, plenum pressure, plenum temperature, and exit pressure are displayed real-time and may be overlaid with data from other nozzle contours. Additionally, a Schlieren imaging system was used to observe shockwaves inside the nozzle and near its exit as plenum pressure was increased. Deviation between design and measured variables is around 3%. The correlation of Schlieren images of the exhaust with data from several different nozzles operated over the same total pressure range helps students understand not only how converging-diverging nozzles operate, but why they are used in some, but not all, propulsion applications.

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