Hybrid Rocket Engine

Chakmakjian, Caleb (School: Live Oak Classical School)
Tyson, Wyatt (School: Live Oak Classical School)

Large space travel corporations like SpaceX and NASA employ liquid engines because they can be activated and deactivated at will. This is accomplished simply by opening or closing the tubes connecting the oxidizer and fuel chambers to the combustion chamber via the use of solenoid valves. In contrast, model rocket companies use solid propellants because they are simple and easy to store. A hybrid rocket engine combines the benefits of both by making use of a liquid or gaseous oxidizer and a solid fuel. This project was an attempt to create a hybrid rocket engine using nitrous oxide as an oxidizer and solid PVC as a fuel. The individual components of the engine were designed in Fusion 360 CAD software and then professionally machined. The engine was controlled by an Arduino Micro, which regulated the times at which the igniter and valve were activated and deactivated. The Arduino was connected to a laptop via USB and ran a program to turn the igniter and valve on and off in timed intervals. A successful firing was achieved following several dry tests. A few misfires with the nitrous oxide occurred. An electric match was utilized as an igniter instead of a homemade igniter. The time intervals were adjusted to accommodate the burn time of the igniters employed. Further experimentation will involve designing a nozzle for the engine and testing ABS 3D printed fuel inserts to investigate designs that maximize exposed surface area of propellant.

Awards Won: