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Author: Dr. Nathan Schilling
self, United States

Dr. Hideki Nakashima
Kyushu University, Japan
Dr. Taichi Morita
Kyushu University, Japan
Dr. Jason Cassibry
Propulsion Research Center, University of Alabama in Huntsville, United States
Mr. Tomoya Ogawa
Kyushu University, Japan
Mr. Douglas Soh
Malaysia
Mr. Koba Kento
Kyushu University, Japan

SUB-SCALE DEMONSTRATION OF A PULSED FUSION AXIAL MAGNETIC NOZZLE WITH A TARGET-TYPE THRUST STAND

Abstract

Currently, crewed missions to Mars and robotic missions to the outer planets are hampered by long trip times. Using state of the art technology, it will take 1-2 years for a crew to get to Mars, and 10-20 years for a robotic mission to rendezvous at an outer planet. These long trip times represent increased risk of mortality from galactic cosmic rays and microgravity for crewed missions, and increased programmatic risk for robotic missions. It has been known since the 1960s that using pulsed nuclear fusion propulsion reduces these trip times by up to 88%; 0.25-0.5 yrs for crewed Mars and 1-5 years for the robotic outer planet mission. However, pulsed fusion propulsion is currently hampered by numerous technological challenges, one of which is efficient conversion of exhaust to directed thrust. The leading technology to solve this problem is the magnetic nozzle, but authors disagree as to the most efficient configuration. Previous works have postulated that the solenoidal configuration, with solenoidally-wound coils, is ideal, but recent authors have proposed an alternative most-efficient configuration: the axial configuration, with axially-wound coils. Previously, this research team has tested a smaller, sub-scale version of the axial configuration, showing net thrust via a set of charge collector measurements. However, it is difficult to determine the efficacy of these results due to deficiencies in the charge collector thrust measurement method; for example, at certain points in the experiment the charge collectors show negative thrust, which is non-physical. Therefore, in this work we set out to measure thrust using a more traditional method: a target-type thrust stand which should not have the same deficiencies. We hope to verify the efficacy of the axial nozzle configuration via this new method, showing net thrust. If this can be done, pulsed fusion propulsion will be more feasible, making the solar system more accessible to all humanity.