Project Introduction

Hall thrusters are being considered for many space missions because their high specific impulse delivers a larger payload mass fraction than chemical rockets. With a low thrust, however, Hall thrusters need to operate for a long period of time to achieve the necessary velocity of the mission. For these missions, the lifetime requirements can reach into tens of thousands of hours. For Hall thrusters, the most important life-limiting process is the erosion of the channel walls. However, experimental verification of lifetime is time-consuming and expensive. Therefore, computational method is a useful tool to predict thruster lifetime. Many of the Hall thruster lifetime models were developed, and some of these models gave quite promising results. However, while qualitatively interesting, the results did not match well with experiment. The reason of this discrepancy is that these numerical models assume electrons as a fluid. The proposed innovation will provide a better understanding of the erosion physics and will be useful for future Hall thruster development, such as HiVHAc, with low cost and time. This tool also will allow to aid in the acceptance and implementation of Hall thrusters as a primary propulsion device through improving confidence of their long term reliability.

Primary U.S. Work Locations and Key Partners
SBIR/STTR

Predicting Hall Thruster Operational Lifetime Using a Kinetic Plasma Model and a Molecular Dynamics Simulation Method, Phase I

Completed Technology Project (2011 - 2011)

**Organizations Performing Work**

<table>
<thead>
<tr>
<th>Organizations Performing Work</th>
<th>Role</th>
<th>Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glenn Research Center (GRC)</td>
<td>Lead Organization</td>
<td>NASA Center</td>
<td>Cleveland, OH</td>
</tr>
<tr>
<td>Tech-X Corporation</td>
<td>Supporting Organization</td>
<td>Industry</td>
<td>Boulder, CO</td>
</tr>
</tbody>
</table>

**Primary U.S. Work Locations**

| Colorado | Ohio |

**Closeout Documentation**

Final Summary Chart
(https://techport.nasa.gov/file/15223)

**Project Management**

**Program Director:**
Jennifer L Gustetic

**Program Manager:**
Carlos Torrez

For more information and an accessible alternative, please visit: https://techport.nasa.gov/view/9613