Innovation Expo 2023 - Quarterfinals Elevator Pitch
March 31, 2023
PSI Research

Some of the most exciting events in the aerospace industry in recent years have been NASA's missions to Mars. Speaking personally, these missions to the red planet are what inspired me and so many others to dream big and become an engineer. In 2020, the Perseverance rover created a huge dust storm during its landing procedure, and back in 2012, the Curiosity rover was noticeably damaged by rocks and dust kicked up by its own powered landing. These rovers are small and unmanned, but what about when we try landing something as big as SpaceX's starship? Can we afford to risk billions of dollars, because we don't yet understand how to control these dust storms? Can we afford to risk the lives of the people we send on future missions?

At PSI Research, we are looking to better understand how a rocket's supersonic exhaust affects the surface it's landing on. Known as Plume Surface Interactions, these forces can kick up dust and debris which both limits visibility and can severely damage valuable assets.

Our team has developed an experimental system to physically model and measure these interactions using state of the art techniques and equipment. Using our current model, we have collected a wide range of both quantitative and qualitative data describing these flows. The impact of our work will advance the understanding of plume surface interactions and help ensure asset protection during future powered launches and landings.

What sets PSI apart is our connections to industry leading experts and entities. Our primary consultant, Dr. Jason Rabinovitch, was previously a Mechanical Engineer for the NASA Entry, Descent, and Landing Group at JPL and has provided specific insight to the gaps in human understanding of space related challenges. Through our associate, Dr. Nicholaus Parziale, we have access to key resources such as the Stevens Hypersonic Shock Tunnel and its high precision equipment. Also, here at Stevens Institute of Technology, we have been granted access to prototyping and manufacturing facilities such as the PROOF Lab and the MakerCenter, allowing for the cheap and fast production of test articles. With these resources available, PSI Research exists in an environment ripe for space research and innovation.

As a business, we intend to expand beyond plume surface interactions and use our experience operating high speed and high fidelity equipment to tackle other projects through renewable research grants and private contracts. Our plume surface project will serve as a seed to allow us to build up our facilities and capabilities in the future. In order to continue this project, retain our partnership with Stevens, and branch out into acquiring our own facilities, we are

asking for $200,000 in return for a 10% stake of each future contract taken. With initial government research funding through SBIR, we anticipate contracts detailing anywhere from $100,000 to $250,000 for six months of research. Although all contracts are different, we expect $250,000 to $500,000 for renewed contracts through the SBIR program and eventually government and private entities.

With the continual advancement of powered flight and control systems, hypersonic research is becoming an increasingly important field. With promises of future endeavors from NASA and SpaceX as well as military desires for effective defensive measures, there has never been a greater need for our skills in modeling and capturing high speed flows. PSI Research is ready to provide invaluable knowledge that will continue to push the aerospace industry forward.