Multiple Water Propulsion Systems: All Propulsive Capabilities for CubeSats from LEO to Deep Space

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What is Pale Blue Inc.?
- Start-up company from University of Tokyo
- Established in April 2020
- Focusing on:
  - Propulsion system for nano-/micro-satellite
  - Propulsion system using water as a propellant

Water propellant
- Safety / No toxic
- Liquid in 1 atm
- Easy to handle
- Low cost
- Reducing cost on safety requirement
- ISRU: In-Situ Resource Utilization
- Scalable total impulse

Water resistojet thruster
- 1U module / 5-20 W
- 5 Nozzles
- Thrust: 200 mN/kW
- Specific impulse: 70 s
- 400 g water propellant
- Launched in 2019 / TRL 7-8

Water ion thruster
- 1U+ module / 30 W
- Ion source & Neutralizer
- Thrust: 140 µN
- Specific impulse: 500 s
- 300 g water propellant
- TRL: 6-7

Proposal: Multiple Water Propulsion System
- Combine water resistojet and water ion thruster
  - Resistojet: High thrust and reaction control
  - Ion thruster: High specific impulse and large delta-V

Designed based on the same concept
- Safety requirement for ISS
- Vibration / radiation test
- Reproducibility

Applied to the system
- Improvement on ion thruster collaborating with U Tokyo

Conclusion / Future works
- Multiple Water Propulsion System is proposed
- Resistojet thruster passed all tests and was launched
- Ion thruster was developed and is being improved
- Integrated model is designed and under construction

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