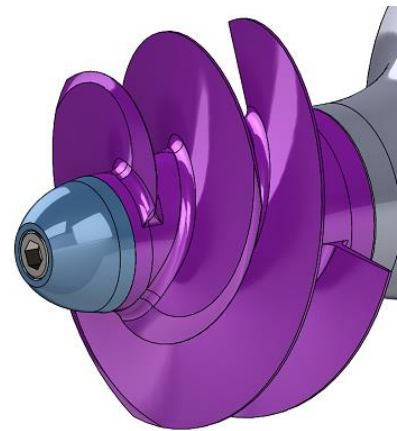
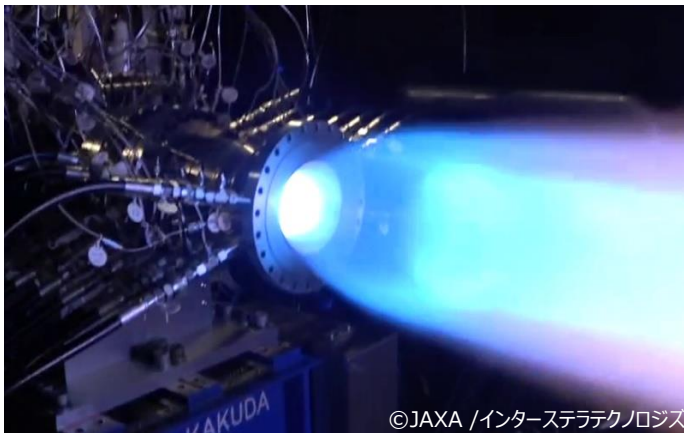


**Interstellar Technologies Inc. selects LNG as the propellant for microsatellite launch vehicle “ZERO”**



Interstellar Technologies Inc. (“IST”, Head Office: Taiki, Hiroo, Hokkaido Japan, CEO: Takahiro Inagawa) hereby announces that Liquefied Natural Gas (LNG), mainly consist of methane, will be the propellant used for the main engine on micro satellite launcher “ZERO”, currently under development.

**LNG is the choice for the 21<sup>st</sup> century.**

IST has been conducting research and testing on a wide variety of hydro-carbon based propellants including methane, kerosene, and many others including ethanol which is currently used in IST’s sounding rocket “MOMO”. Among various options for launcher “ZERO”, LNG has significant environmental and logistical advantages, in particular, low cost and stable supply chain available within Japan. Unlike solid propellants, LNG engines are environmentally friendly, non-toxic, easy to procure and handle, and pose no risk of sea contamination. In addition, LNG has many advantages such as higher engine performance and lower cost associated with its chemical density and handling temperature in comparison to other common propellants.

Considering these advantages, methane based rocket engines are getting popular throughout the world. This fuel was a high technological barrier to overcome by IST alone, however the cooperation with JAXA and Muroran Institute of Technology under the technical service agreement “Minroke” has boosted our confidence in the use of this new fuel.

## Injector testing in JAXA Kakuda Space Center

### ■ Test Overview

Combustion tests for Injector performance evaluation were conducted during Jan-Feb, 2020 in JAXA Kakuda. Two injector geometry candidates, each designed by JAXA and IST were swapped and tested respectively. Specification of the sub-scale combustion chamber are as follows:

- Thrust: 30kN
- Injector Type: Pintle
- Fuel: Methane
- Oxidizer: Liquid Oxygen

IST has been developing the main engine for launcher “ZERO” with “JAXA Space Innovation through Partnership and Co-creation (J-SPARC)” since FY2019, stationing one engineer on site in Kakuda Space Center to learn and conduct firing tests. 30kN class subscale combustion chamber was used, in order to evaluate its characteristics of the prototype pintle injector, and it was the first time an engine designed by IST which was tested on JAXA’s test stand. Pintle injector have very few parts, and are easy to manufacture with extremely low costs compared to conventional injectors. A similar type of injector developed by IST has been also used for sounding rocket “MOMO”. JAXA has been conducting firing tests using LNG for over 30 years and their expertise were fully utilized. The last round of firing tests was based on a JAXA design, and tests were conducted until July 2019, after which the data was used to design the current prototype. The main objective for this test was to obtain combustion chamber performance, wall heat flux and wall cooling channel characteristics. Heat flux distribution is extremely important in developing a regeneratively cooled combustion chamber. JAXA’s test facility is able to measure these data along the entire length of the combustion chamber for detailed evaluation.

### 《Video footage of firing tests》

LOX/Methane Pintle Injector Engine Testing in JAXA Kakuda Space Center

URL : <https://youtu.be/q3uffM8keol>

## Turbopump inducer design in partnership with Muroran Institute of Technology.

### ■ Test Overview

Turbopump inducers, designed in partnership between IST and Muroran Institute of Technology, were tested during Sept.-Oct, 2019, using the cavitation tunnel in Osaka University. Validation models for prototype manufacturability were also fabricated. The following specifications were used for the basic design of the turbopump

- Thrust: 60kN
- Engine cycle: Gas Generator
- Fuel Turbopump: Methane
- Oxidizer Turbopump: Liquid Oxygen

IST and Muroran Institute of Technology has been co-developing a low cost turbopump system for “ZERO” since 2019. IST engineers were permanently stationed at Aerospace Plane Research Center (APReC) in Muroran Institute of Technology and leveraged APReC’s research resources and expertise in turbomachinery and rocket systems. Both oxidizer and fuel pump inducers have been designed and successfully tested in 2019. The inducers are responsible for supplying adequate pump suction head to the pump impellers, and one of the most difficult items to develop. Water flow tests on P-Q and cavitation performance were conducted during Sept.-Oct.,2019 using cavitation tunnel in Osaka University, with successful results. This test campaign has validated the development and design process, and a portion of the achievement was announced in the annual Turbomachinery conference in Okayama, in September. Manufacturability validation was also conducted using various fabrication models. Further information is scheduled to be released as development further progresses.

Using the results of these tests, IST is currently designing the oxidizer and fuel turbopumps for “ZERO” and aims to start integration testing during 2021.

## LNG propellants (additional material)

《CEO Takahiro Inagawa note(Available in Japanese only)》

URL : <https://note.com/ina111/n/n2432acff2200>



### 近未来のロケットは都市ガスで飛ぶ

 ina111 / 稲川 英夫  
2020/05/07 13:10

性能が良く、環境に優しく、安く、将来は月でも火星でも使えるロケット。  
近未来のロケットの燃料は都市ガスである。

## **Keywords**

### **1: Microsatellite launcher “ZERO”**

Orbital rocket under development by IST. The vehicle is designed to transport small satellites to various orbits from IST's launch site in Taiki. Check IST's HP for further information.

### **2:Sounding Rocket “MOMO”**

Sounding Rocket under operation by IST. 4 launches have been attempted to date, with the third being the first successful launch in May, 2019. Check IST's HP for further information.

### **3: Pintle Injector**

A type of fuel injector used with minor usage in engines such as the Apollo lunar descent vehicle and SpaceX Merlin. Check IST's HP for further information.

## **Company Profile, Contact**

### **[Interstellar Technologies Inc.]**

IST develops the world's lowest cost launch platforms in order to realize the company's mission “ Make space accessible to everyone”. The sounding rocket “MOMO” and orbital micro satellite launcher “ZERO” are being developed by IST. In May, 2019, IST became the first privately funded company in Japan to reach space, and the fourth privately funded company worldwide using liquid propellant engines and a guided trajectory to reach space.

<http://www.istellartech.com/>

### **[JAXA]**

Japan Aerospace Exploration Agency “JAXA” is a national organization responsible for implementation of national space policy by aerospace and aeronautic research and development. Mid-to-Long Term Plan started from FY2018 has defined JAXA's role to increasing commercial partnerships and providing more test opportunities for the expansion of Japanese space market, and for the acceleration of technology innovation.

<http://www.jaxa.jp/>

### **[Muroran Institute of Technology]**

Muroran Institute of Technology, abbreviated as MuroranIT, MuIT, or Muroran Tech is a national university in Muroran, Hokkaido, Japan. The university located in an industrial city, promotes education and research to deepen professionalism and to foster human resources who contribute to manufacturing and value creation.

<https://www.muroran-it.ac.jp/>

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