

Interstellar Technologies Inc.

USER'S GUIDE of

Sounding Rocket MOMO

インターステラテクノロジズ 株式会社



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IST Sounding Rocket “Momo” User’s Guide

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Revision History

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ver.0.1 English ver. published on July/31st/2016

ver.0.11 English ver. published on Aug/8th/2016

ver.0.2 English ver. published on Oct/3rd/2016

Note

Contents is intended to reflect the developing situation at the time of its publication, there is a possibility to change without notice.

1. Introduction

1-1. Project Overview

Developed by Interstellar Technologies Inc. to provide a low cost launch service, the MOMO sounding rocket is capable of launching a 20kg payload to outer space (an altitude in excess of 100km). Providing a microgravity environment for approximately 4 minutes, the payload can then be recovered at sea. The rocket has a wide range of applications, including observations of the upper atmosphere and microgravity experiments, space observations with infrared and X-rays, technical experiments which require high acceleration environment during launch, business application such as PR activities for products, and entertainment.

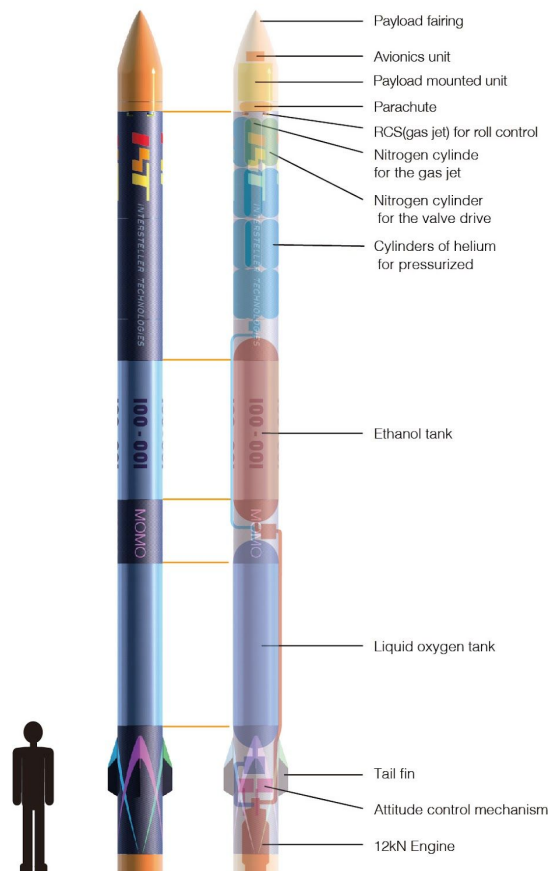
Everything from rocket construction, payload preparation, launch and operations for recovery are carried out at IST facilities located in Taiki, Hokkaido. One of IST's advantages is the fact that rocket components such as engines, fuselages, various types of mechatronics, avionics, radio equipment, and simulation programs are all produced by our selves. By utilizing the comprehensive engineering technologies developed within the company, we are able to respond flexibly to users' needs.

To perform our best, the first few launches will be carried out as technical experiment to demonstrate establishment of ballistic flight technology.



1-2. About the “Momo” Sounding Rocket

- Fuselage features



“Momo” is a liquid-fuel rocket which propellants are fed by Helium gas pressure. With liquid fueled rocket engines that use ethanol (EA) for fuel and liquid oxygen (LOX) as an oxidizer, Momo provides much gentler acceleration and vibration environment for the payload compared to solid fuel rockets.

The rocket's pitch and yaw are controlled through thrust vector control via the movement of engine gimbals. Roll is controlled with cold gas jets.

With real-time command uplinks and telemetry downlinks, thrust can be shut off by command at any time in case of emergency, thus making it possible to carry out safe launches.

Fuselage specifications (values are from development phase and are tentative)

- Length: 9.9 m
- Total weight: 1.0 ton (including propellant)
- Dry weight: 0.7 ton (without propellant)
- Outer diameter: 502 mm

1-3. Launch Facility

- Launch pad position

[Interstellar Technologies test site: Hamataiki 80, Taiki-cho, Hiroo-gun, Hokkaido](#)

Near north latitude 42.5058857°

Near east longitude 143.4571724°



(c) [OpenStreetMap](#) contributors

The launch site is located on the Pacific coast at Taiki-cho, Hiroo-gun, Hokkaido, and is surrounded by the coast, rivers, wetlands, and windbreaks. Next to the launch pad are the facilities for engine testing and machinery, a command control center, communications facilities, etc., where tasks such as adjustments to powered payloads and very simple machining can be done.

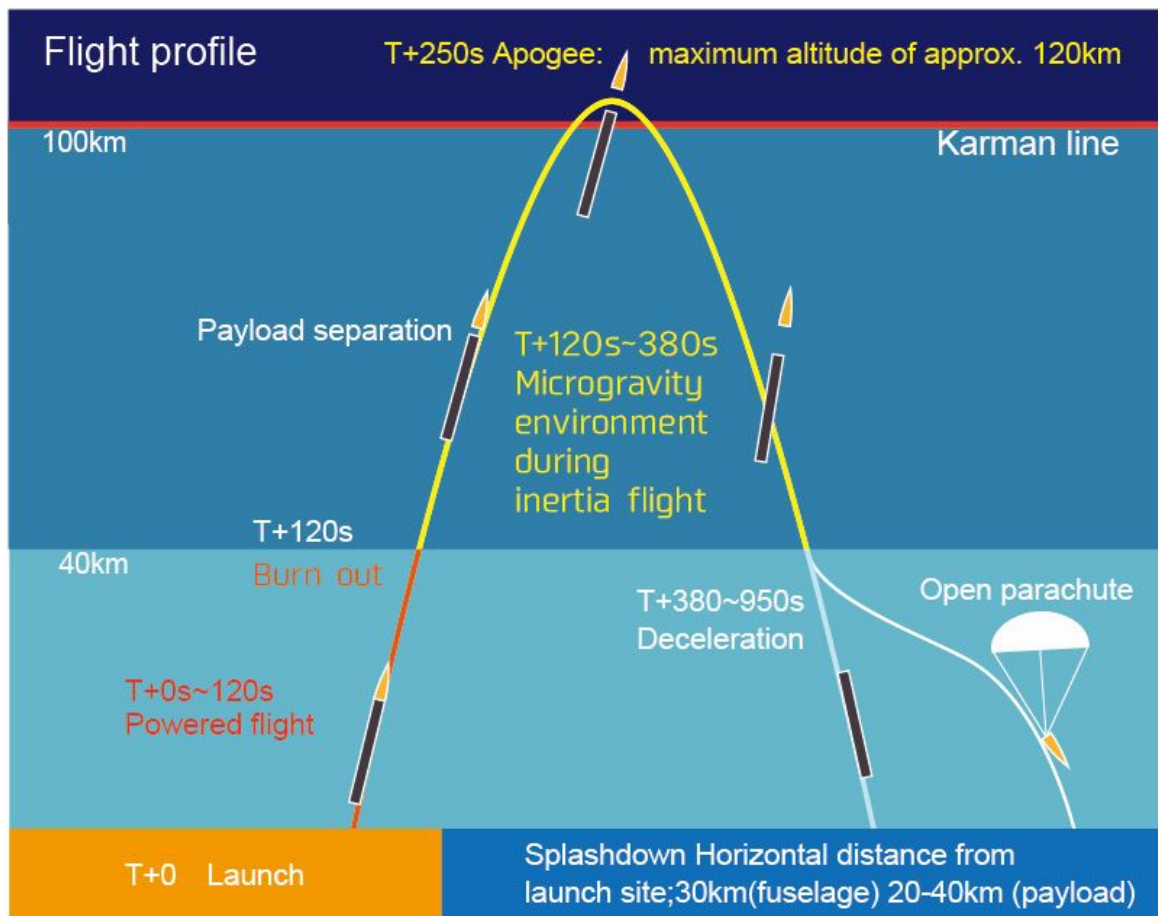
Additionally, the launch site is located at 15-minute drive from IST's main plant where additional support is available in the form of machine processing with lathes, milling machines, drills, and welding machines, and electrical and electronic tools that utilize equipment such as spectral analyzers, etc..

[Official website for the town of Taiki](#)

2. Mission Planning Guide

2-1. Flight stages

- Rocket and payload flight is divided into the following 3 stages.
- T+0s (launch) ~120s: accelerated flight
- T+120s~380s: inertial flight
- T+380~950s: decelerated flight & splashdown



2-2. Visibility from the ground

- Launch observation points
 - Currently being prepared
- Visible time
 - Ground elevation
 - 1km: 27 seconds till arrival
 - 2km: 37 seconds till arrival
 - 5km: 54 seconds till arrival
 - 10km: 70 seconds till arrival (around MaxQ)

2-3. Acceleration environment

- Maximum acceleration during ascent: 5G

2-4. Upper atmosphere environment

- Tropospheric flight (0-10km in altitude): approximately 70 seconds
- Stratospheric flight (10-50km in altitude): approximately 55 seconds on both ascent and descent (approximately 100 seconds in total)
- Mesospheric flight (50-80km in altitude): approximately 30 seconds on both ascent and descent (approximately 60 seconds in total)
- Thermospheric flight (80km + in altitude): approximately 180 seconds including peak altitude

2-5. Microgravity environment

- Changes in mission time corresponding to desired microgravity levels
 - 10^{-1} G or below: 240 seconds
 - 10^{-2} G or below: 200 seconds
 - 10^{-4} G or below: 150 seconds

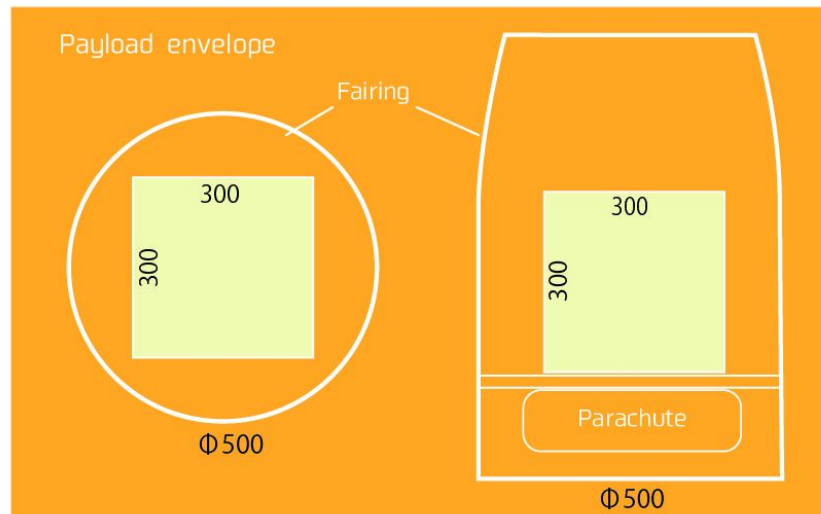
2-6. Payload recovery

- Splashdown speed: 15m/s (using parachute)

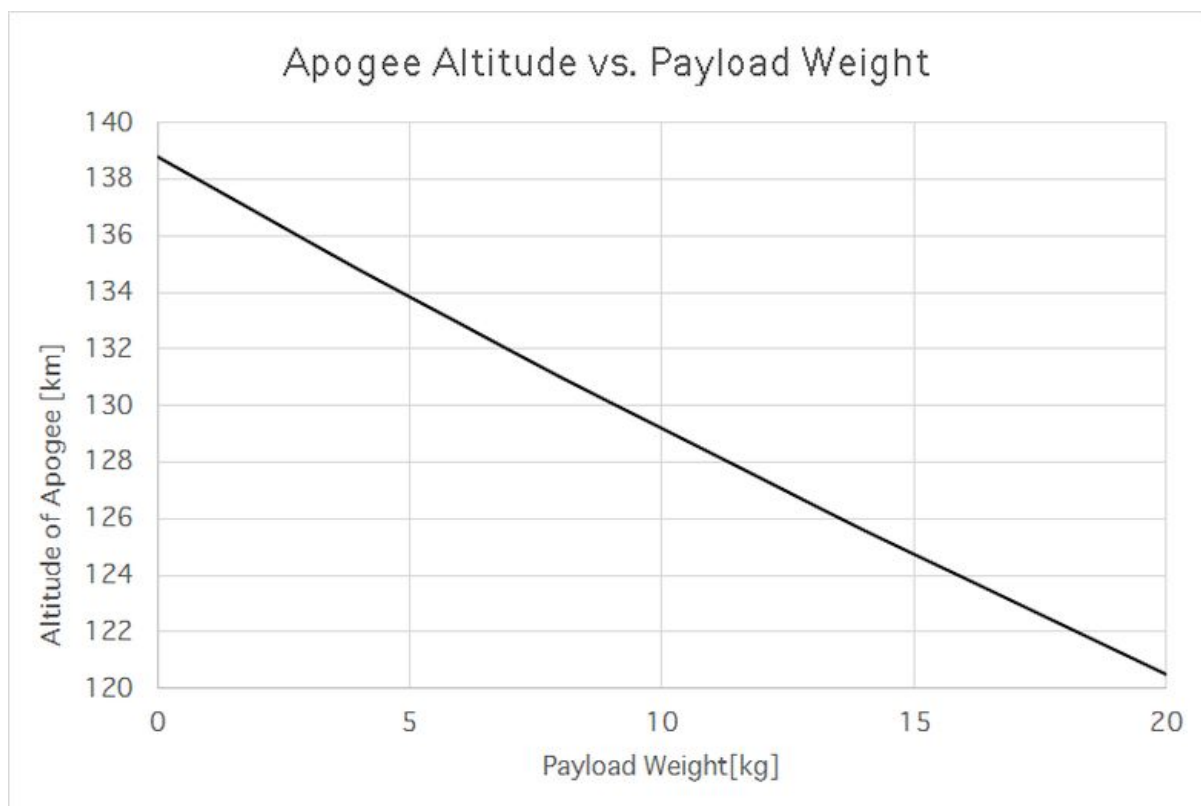
3. Payload Design Guide

3-1. Size and weight

- Payload envelope



- Size: within a maximum box size of 300×300×300mm
- Weight: 20kg



3-2. Payload interface with fuselage

- Mechanical interface
 - Fairing and integral
 - After the lock between the fairing and fuselage is released, the fairing is pushed away and separated with an air cylinder
- Electronic interface
 - A 12V DC power supply can be provided by the fuselage
 - A “hot launch” in which the power is on from the time of launch is possible

3-3. Surrounding environment

- The air pressure within the fairing equals external atmospheric pressure (non-pressurized fairing)
- The fairing itself is a non-watertight structure (although it is possible to make the fairing watertight for only the payload section)

3-4. Flow sequence until launch

- Payloads accepted up to 3 months prior to launch
- Testing of payload/fuselage interface
- Payload is brought to launch site 3-7 days prior to launch
- Payload is mounted onto fuselage
- Launch
- Payload is recovered and handed over

3-5. Other conditions regarding payload

- Payloads containing anything that can potentially cause harm to humans such as explosives, pathogens, or poisons cannot be mounted.

4. Advertising

4-1. Fuselage advertisements

- The exterior cylindrical surfaces of the ethanol and helium tanks (roughly 3-4m in length and 500mm in diameter) can be used as advertisement space.
- There may be cases in which the customer mounting the payload and the customer utilizing the advertising space are not the same.

4-2. Onboard video footage

- Customers may utilize mounted cameras to capture footage that will be handed over after launch and payload recovery.
- There may be cases in which customers utilizing advertisement space and those using the mounted cameras are not the same.

5.Support

5-1.Support facilities for launch

- Guest house
- IST Taiki factory
- Workroom in the launch field

6. Company & Contact

We are doing the rocket development business since 2006. It has offices and factory in Tokyo and Taiki-cho , continue to "Momo " , we are developing a rocket to launch a small satellite in orbit around the Earth .

Company name	Interstellar Technologies Inc.
Head office	Adress: 690-4 Memu, Taiki, Hiroo-gun, Hokkaido 089-2113, Japan
Tokyo office	B102 Bunkyo-MM building, Suido, Bunkyo-ku, Tokyo112-0005, Japan
Date of establishment	May 2003
Capital stock	90 million yen
Company executive	CEO Takahiro Inagawa
Business	Development of reaching technology to interstellar space

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

Twitter: <https://twitter.com/natsuroke>

Facebook: <https://www.facebook.com/istellartech/>