NEW ZEALAND SPACE AGENCY

Application for Payload Permit APP001

The information sought in this form is either information that is required under the Outer Space and High Altitude (Licences and Permits) Regulations 2017 or is the information that is required to enable the Minister to determine the application and which the Minister could seek under section 50 of the Act.

The Act allows the sharing of information both from the Ministry of Business, Innovation and Employment to other agencies, and from other agencies to the Ministry of Business, Innovation and Employment in order to assist the Minister in the performance or exercise of functions, duties, or powers under the Outer Space and High-altitude Activities Act 2017.

This sample application uses fictional names and details; any resemblance to real entities or people is coincidental.

SAMPLE Application Details

Provide details of the primary point of contact for questions in relation to this application:	
Name of contact Michael John SMITH	
Job title or relationship to proposed permit holder(s) Regulatory Compliance Manager employed by 'Space 2D2'	
Telephone number +64 21 1112223	Email address Michael.Smith@space2d2.com
Payload name (if known) SPACE2D2 Voltron MkIII	

Application Type

☒ Payload Permit to launch from New Zealand

☐ Overseas Payload Permit to launch outside of New Zealand (for New Zealand nationals only)

If any information required by this form is available elsewhere, you may direct us to where the information can be found rather the providing it on this form. All applications and supporting documentation should be provided in English.

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Section 1: Permit holder details

ⓘ Where the payload is owned and/or will be operated by more than one entity, you will need to provide the details of all of these entities in the payload permit application. For each additional entity please complete form APP 100P Additional Permit Holder Details (Payload permit).

1.1. Proposed Permit Holder: Identity Information ⓘ Full legal name of entity: If you are a natural person, include the details of any other names you have been known by and the date of the name change. If you trade under a different name from your legal name, provide these details in the form.	
Full legal name of entity Space 2D2 Ltd	
Form of entity Incorporated Company	
Place of incorporation (body corporate only) Seattle, Washington, USA	
Address for service (physical address) 1 Oriental Sunset Parade Wellington 6011 New Zealand	
Registered office address (body corporate), Principal place of business (other organisation or natural person) 23rd Avenue E Seattle Washington USA	
Phone number +64 21 1112223	Email address Michael.Smith@space2d2.com
Website www.space2D2.co.nz	
Natural persons only:	
Current nationality or nationalities Click here to enter text.	
Passport number(s) (attach a photocopy of the photo and details of your passport(s) as evidence of your identity) Click here to enter text.	Passport issuing nation(s) Click here to enter text.

1.2. Ownership and control interests

ⓘ If this information is publicly available on a database or register maintained by a country or state, such as the New Zealand Companies Office register, a link to that information (with a note on where in the information the detail can be found) is sufficient to satisfy this information requirement.

In respect of each entity who has a 10% or more ownership or control interest in the proposed permit holder (as defined in regulation 3(2) of the Regulations), provide the following details:

Legal Name	Percentage Holding (%)	Address for Service (Physical Address)/ Registered Office Address	Phone Number	Email Address	The unique number assigned to the body corporate on incorporation (if any)	Place of incorporation or current nationality (natural persons)
Space 2D2	53%	1 Oriental Sunset Parade Wellington 6011 New Zealand 23rd Avenue E Seattle Washington USA	+64 21 1112223	Michael.Smith@space2d2.com	XXX-1234567-89XX	Wellington, New Zealand
Voltron Holdings Ltd	25%	2 Oriental Sunset Parade Wellington 6011 New Zealand	+64 21 2223334	John.Michaels@vhl.co.nz	XXX-9876543-21XX	Wellington, New Zealand
FirstStart Space Funders UK	12%	1 Tavistock Regent Place London W6 OQU England	+44 871 4445555	Oliver.James@fssf.co.uk	XXX-2143658-79XX	London, United Kingdom
Click here to enter text.	Click here to enter text.	Click here to enter text.	Click here to enter text.	Click here to enter text.	Click here to enter text.	Click here to enter text.
Click here to enter text.	Click here to enter text.	Click here to enter text.	Click here to enter text.	Click here to enter text.	Click here to enter text.	Click here to enter text.
Click here to enter text.	Click here to enter text.	Click here to enter text.	Click here to enter text.	Click here to enter text.	Click here to enter text.	Click here to enter text.
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Section 2: Overseas licence, permit or authorisation

The Outer Space and High-altitude Activities Act 2017 allows the Minister to recognise an overseas licence, permit or other authorisation as satisfying some or all of the criteria for granting a payload permit. Currently the areas in which the Minister may recognise an overseas authorisation are:

- Orbital Debris Mitigation
- Safe Operation of the Payload.

2.1 Do you have or have you applied for an overseas authorisation which the Minister can recognise?
☒Yes ⇨ complete question 2.2, then continue filling in the rest of the form ☐No ⇨ continue on from Section 3 ⓘYou must attach a copy of the overseas authorisation (or when granted you must provide a copy of the overseas authorisation or advise the New Zealand Space Agency if it is declined).

2.2. For each overseas authorisation provide:
The jurisdiction in which the overseas authorisation was applied for or granted United States of America
The name and contact details of the overseas regulator that is considering or has granted the overseas authorisation Federal Communications Commission (FCC) National Oceanic and Atmospheric Administration (NOAA)
The entity/entities that hold or will hold the overseas authorisation Space 2D2
If the entity/entities named above are not the proposed permit holder, state the relationship to the proposed permit holder Click here to enter text.

2.3. For each overseas authorisation that was granted provide: ⓘ Please attach a copy of your overseas authorisation including any information about conditions imposed.	
Number or identifier (if any) assigned by the overseas jurisdiction ⓘ e.g. the reference number or call sign FCC licence – File number: SAT-MOD-12345678-00023, Call sign: S3456	
Duration and expiry date N/A	
Date of grant 1 January 2019	Date it came into force (if different) 1 January 2019
If it has been suspended or revoked, the date(s) of any suspension(s) or revocation N/A	

2.4. For each overseas authorisation that has been applied for but not yet determined provide:
Number or identifier (if any) assigned by the overseas jurisdiction ⓘ e.g. the reference number or call sign NOAA licence
The date of the application 1 July 2018
A description of the overseas authorisation applied for Licence to operate a private remote sensing space system - Low-Earth Orbit, Electro-Optical

Section 3: Payload details

3.1. Provide details of the mission and purpose of the payload or payloads that includes a description of the system (e.g. a constellation of satellites) that the payload is a part of (if relevant). ⓘ The details on mission and purpose should include a description of the ultimate objectives of putting the payload into space, and a description of how the payload contributes to that objective. If the payload or payloads will be part of a broader system of space objects, such as a constellation, provide the name of the system or services provided using the system, a description of the system and its purpose and an overview of the space objects making up the system (including the number, size, purpose, and a general description of the capabilities of the system). If operational components of the system are already in space (such as payloads previously launched), describe them. **If you propose multiple payloads, complete additional APP 700 Payload Details forms.**
Space 2D2 is working to provide real time whole earth imagery to our customers via our web platform www.lostinspace.com. The SPACE2D2 Voltron MkIII is a third generation payload featuring optical imagery enhancements as a result of our learnings from our previously launched payloads – 'Space 2D2 MkI' and the 'Space 2D2 MkII'. The payload is owned and operated by Space 2D2, and our ultimate ambition is to launch and operate a constellation of in excess of 200 payloads with the same specifications and capability. The intent of this payload is to test capability of the optical imagery (remote sensing) technology, including the upload and download functionality and antenna signal strength of this payload. The payload has a 6 kg mass and is a 1-Unit cubesat in size.

3.2. In respect of each payload proposed to be launched under the permit, provide the following details:			
Payload Name or reference number: SPACE2D2 Voltron MkIII			
Expected operational life of the payload 6 months			
Expected orbital life of the payload 3 years			
Anticipated dates for launch of the payload 1 July 2019			
Intended Orbital Parameters:			
Nodal period	Inclination	Apogee	Perigee
1hr 40mins	80 deg +/-0.15 deg	450km +/- 15 kms	450km +/- 15 kms

3.3. For each payload (and, if applicable, each spacecraft bus) provide: ⓘ Provide the name of the entity or person primarily responsible for the design, manufacture, build, and testing of the payload, and the place in which these services are performed. You do not need to disclose the manufacturer of all subsystems or components of the payload.
Name of the manufacturer or assembler The payload is manufactured and assembled by SolarWind Electronics Ltd, Wellington, New Zealand. Testing was conducted by us at our onsite laboratory in Wellington, New Zealand.
Principal place of manufacture or assembly SolarWind Electronics Ltd 180 Kent Basin Drive Wellington 6011 New Zealand

3.4. If the payload integrator is not the proposed permit holder provide: ⓘ The payload integrator is the entity (person or company or other) responsible for undertaking integration activity, for example coupling the payload to the launch vehicle or integrating payloads into a launch dispenser.	
Name of Integrator MarsXMoon	
Address for Service/Place of Incorporation/Principal Place of Business 42 Integration Terrace, Auckland, New Zealand	
Telephone Number +64 9 123 4567	Email Address Click here to enter text.
Place of integration MarsXMoon Space Lab, 42 Integration Terrace, Auckland, New Zealand	

3.5. Provide details of any protective security arrangements in place

ⓘ This may include protection of the payload command and control systems, any raw remote sensing data, and/or any systems commanding the payload or remote sensing systems and sensor tasking. Refer to https://protectivesecurity.govt.nz/ for more information.

The payload is protected from accidental or malicious access by third parties through the following means:
- HMAC authentication on the command link verifies the integrity and authenticity of any message received
- Commands sent from the ground to the satellite are hashed together with a secret key and a nonce so that the payload can verify the validity of the message

The satellite will communicate directly with our San Francisco based ground station, located on secure premises. Security measures in place include:
- Fencing, alarms, secure building access (electronic access control system), CCTV and uninterrupted power supply units
- Password protected computers with encrypted data files
- Transfer of data is achieved via secure and encrypted cloud based software Microsoft Azure

The payload will be transferred in a sealed container, carried by person from Wellington to the Auckland premises.

3.6. Provide a description of the ground station or ground stations that will be used to:

- **command or communicate with the payload and/or**
- **transfer data collected from the payload**

ⓘ If known, this should include the location of each ground station, the designated name or unique identifier (if they have one) and the functions they provide (e.g. communication of commands from the control centre, obtaining systems data or other monitoring activities, downloading data obtained by experiments or sensors on the payload). If you will be selecting ground stations dynamically and these will change over time, describe the proposed approach for communicating with the payload. This should include a description of the commercial contracts or entities with whom you will be obtaining ground station services.

The ground station is located at 101 Sunset Drive, San Francisco, California, USA. The ground station will be used to communicate with the satellite as well as to transmit and receive data. Messages will be stored on board the satellite for transmission as it passes over ground stations.

All payload communication is directly controlled by Space 2D2, using Space 2D2 owned and operated equipment.

Section 4: Payload capability

4.1. Describe the payload and its subsystems, capabilities and intended uses:

ⓘ This should include a description of:

- The spacecraft structure and its physical dimensions and weight (dry and wet weight, if appropriate)
- The power subsystem
- The command or on-board data handling (OBDH) subsystem
- The communications subsystems used for telemetry, tracking and control (TT&C), data transfer, or other mission purposes, including protocols supported and the types of transmitters or receivers and associated aerials required for communication with terrestrial stations or between spacecraft
- Any mission-specific subsystems, such as payload scientific experiments, and their objectives and purpose (if not already described in the Mission and Purpose overview)

Physical dimensions:
SPACE2D2 Voltron MkIII is a 6kg 1-Unit (100 mm x 100 mm x 100 mm) cubesat with two deployable solar panels, 340 mm x 400mm each.

Power subsystem:
The payload is powered by a 75 Wh battery, consisting of Lithium Ion batteries.

Command and communications subsystem:
The on-board data handling subsystem is managed through software developed by Space 2D2 and provides an interface between cloud-based software and the ground station software at 101 Sunset Drive, San Francisco, California, USA. TT&C link operated through a Space 2D2 antenna. A further on-board system takes sensor data and sends instructions to the actuators for attitude maintenance.

Mission specific subsystem:
The payload consists of an optical telescope (further details below), a GPS receiver for accurate speed and location information and S-Band and X-Band frequencies– primary uplink 3.078 GHz and primary downlink 9.45 GHz.

4.2. Describe the payload's manoeuvring capability (if any):

ⓘ For example the attitude and/or propulsion capabilities of the payload

No propulsion capability on SPACE2D2 Voltron MkIII.

The camera is able to perform nadir pointing and as such has on-board sensors that are able to detect its orientation and position velocity. The camera will never look to space and is solely to be used for Earth observation. It uses a magnetorquer system for active stabilisation.

The desired orbit and fly formation placement is achieved through the payload being dispensed from the payload plate at a predefined time during kick stage phase.

4.3. Is any part of the management, oversight or control of each payload or its operation (including the ground segment) is being contracted to another person?

☐Yes ⇨ complete question 4.4, then continue filling in the rest of the form

☒No ⇨ continue on from Section 4

4.4 Provide the name, address for service and a description of the function being performed by another person:

Click here to enter text.

Section 5: Payloads with remote-sensing capability

5.1. Does the payload have remote-sensing capabilities?

☒Yes ⇨ complete question 5.2, then continue filling in the rest of the form

☐No ⇨ continue on from Section 5

5.2. If Yes, provide a description of any payload sensors and a summary of their capability, including information about the payload's resolution, field of view, and field of regard, on-board storage and processing capabilities, geolocation accuracy and persistence

ⓘ Description of any payload sensors and a summary of their capabilities:

- The specification of remote-sensing capabilities should cover any ability to sense by any means the surface of the Earth or objects in outer space, or to sense or track the movement of objects (e.g. land-based vehicles, ships or aircraft) on, under or above the surface of the Earth
- Include a basic description of the type and spectral coverage of passive sensors (all bands) and details of any active sensors (e.g. radar).
- Make reference to the systems used to support the accuracy of the observations, e.g. GPS systems and other calibration methodologies.

"Persistence" will include details of:

- persistence over a particular area of the earth;
- area covered by an individual satellite view;
- operational time over an area;
- tasking if available (what additional visibility/frequency this can provide); and
- frequency of revisit - individually and if part of a constellation what the full constellation will offer

SPACE2D2 Voltron MkIII has an optical telescope with a primary optic of diameter 85 mm and a 40 MP CCD sensor. The ground sample distance resolution is 3 m at a 400 km altitude, pointing accuracy of +/- 0.5 degrees.

The on board mission data storage is 100 GB, with 20 GB of telemetry storage.

The persistence over a given area is 15 minutes on average as this is a single payload – once more Space 2D2 payloads are deployed, whole earth imagery will be provided daily. The images will be captured once every 3 seconds over the identified area of interest. The area covered by each image is approximately 40 km x 25 km.

5.3. Provide details of the proposed recipients of any enhanced and raw remote-sensing data, including details of:

- **any customers or classes of customers who will receive enhanced remote-sensing data; and**
- **whether the proposed permit holder will provide any raw data to any customers or classes of customers; and**
- **any plans to provide the raw data generated by the payload:**
  - **to governments whose territories have been sensed; or**
  - **for non-commercial, scientific, educational, or other public benefit purposes.**

ⓘ Provide information about when remote-sensing data, either in raw or processed form, will be made available to customers, such as whether the data is available on a near-real-time basis.

We will provide raw data to the US Government on request and subject to the conditions of our contract with them. Internal systems are in place to ensure that data is provided to legitimate customers only. Only enhanced imagery will be provided to our customers via the web platform.

We have three types of customers subscribed to our platform:
1. Scientific, including those invested in better understanding the relationship of climate change to sea-level rise.
2. Government, including those responsible for civil infrastructure works.
3. Educational, including tertiary educations such as University's.

We will adhere to NOAA guidelines for the sale and distribution of data.

Section 6: Orbital debris mitigation

6.1. Attach or include with this application an orbital debris mitigation plan (ODMP) that meets the requirements of regulation 13 of the Regulations:

We have conducted the Orbital Debris Mitigation Plan in accordance with the NASA standard 8719.14a using the NASA Debris Assessment Software (DAS) version 2.0.

A copy of this plan is been attached along with high-level technical drawings of the satellite and components.

The assessment was conducted by Space 2D2 and submitted to FCC and NOAA as part of the application process.

An independent assessment of this ODMP was also undertaken by the European Space Agency, a copy of their report has been attached to this application.

If the ODMP has been assessed by a person or body that is independent of the proposed permit holder, provide the following details:

Name of person or body:

MarsXMoon Analytics

Contact details of person or body:

42 Integration Terrace
Auckland
New Zealand
+64 9 123 4567

Section 7: Safe operation of the payload

7.1. Provide a description of the measures used to ensure the safe operation of the payload.

The satellite conforms to the Cubesat.org standards for materials, process control and quality. No debris is to be released during the 6 month operational lifetime of this payload, and there is a very low risk of collision during the 3 year lifetime of this payload.

The payload will remain completely unpowered until during the launch phase, meaning that it is incapable of transmission or mechanical deployment until after the launch is conducted.

Potential causes of failure have been considered, with the only viable cause of failure assessed to be with the lithium-ion battery. Failure could be as a result of over-charging, over-discharging, internal or external short. Appropriate standards have been followed to ensure risks are mitigated so far as reasonably practicable.

Space2D2 will comply with NASA Orbital Debris Mitigation guidelines and has calculated a risk of collision while in orbit as being less than 0.001 (refer ODMP attached).

There are on board GPS systems in place meaning we will know the exact location of the payload at all times.

7.2. Has the proposed permit holder or any other person who has, or is likely to have control over the exercise of rights under the permit ever had a licence, permit, or any other authorisation (in respect of the type of activity to which this application relates) refused, suspended, or revoked under the law of a country other than New Zealand?

☐Yes ⇨ complete question 7.3, then continue filling in the rest of the form

☒No ⇨ continue on from question 7.4

7.3. Please provide details of any licence, permit, or other authorisation (in respect of the type of activity to which this application relates) that was refused, suspended, or revoked under the law of a country other than New Zealand

Click here to enter text.

7.4. Has the proposed permit holder or any other person who has, or is likely to have control over the exercise of rights under the permit ever received notice from an overseas regulator to the effect that they are not a fit and proper person to hold a licence, a permit, or any other authorisation in respect of the type of activity to which the application relates?

☐Yes ⇨ complete question 7.5, then continue filling in the rest of the form

☒No ⇨ continue on from section 8

7.5. Please provide details of any notice received from an overseas regulator to the effect that they are not a fit and proper person to hold a licence, a permit, or any other authorisation in respect of the type of activity to which the application relates?
Click here to enter text.

Section 8: Spectrum authorisations

8.1. Provide details (including application or licence numbers) of: • any current or pending spectrum authorisations for the payload • any current or pending spectrum authorisations for any ground stations in New Zealand to or from which the payload is intended to transmit or receive information • the International Telecommunications Union Advance Publication Information number or numbers and associated status (if required and known).
ITU filing for a no-interference licence completed via FCC - reference number ITU SNS ID #123456789 FCC licence – reference Call Sign S3456

Section 9: Launch facility details

9.1. Confirm the launch facility or facilities from which you will launch the payload(s)

☒Launch Complex 1, Mahia, New Zealand ⇨ continue on from question 9.3

☐Other ⇨ complete question 9.2, then continue filling in the rest of the form

9.2. Provide as much information as you can, i.e., a list of facilities you are considering. If you are applying for a permit for multiple payloads, and plan to use multiple facilities explain this and provide details of all the proposed facilities:
Click here to enter text.

9.3. Launch Vehicle Provider

☒Rocket Lab Electron ⇨ continue on from question 9.5

☐Other ⇨ complete question 9.4, then continue filling in the rest of the form

☐Not yet known ⇨ complete question 9.4, then continue filling in the rest of the form

9.4. Provide as much information as you can, i.e., a list of providers you are considering. If you are applying for a permit for multiple payloads, and plan to use multiple facilities explain this and provide details of all the proposed providers:

Click here to enter text.

9.5. Is this application for an overseas payload permit?

☐Yes ⇨ complete question 9.6, then continue filling in the rest of the form

☒No ⇨ continue on from section 10

9.6 Provide the following details for the overseas launch facility provider:

Address for Service/Place of Incorporation/Principal Place of Business

Click here to enter text.

Address for Service

Click here to enter text.

The unique number assigned to the entity on incorporation (if any)

Click here to enter text.

Telephone Number Click here to enter text.	Email Address Click here to enter text.

Section 10: Other details

10.1. Provide any other information that you consider relevant:
We have provided a payload design summary for SPACE2D2 Voltron MkIII, for your information along with high-level technical drawings of the space craft and its components.

Section 11: Submitting your application

Before you submit this application, ensure that you have done the following:

☐ If there is more than one proposed permit holder: Attached or separately submitted completed APP 100P Additional Permit Holder Details (Payload Permit) form(s) for every proposed permit holder that is not identified in Section 1 of this form.

☐ If the proposed permit holder is a natural person, attached evidence of their identity.

☒ Attached a copy of your Orbital Debris Mitigation Plan

If, at any time before the application has been granted or declined you become aware of any new information that is relevant to the application, or if there is a change to the information already provided you **must** notify MBIE immediately.

Declaration

Declaration: I declare that all information provided in this application is accurate and complete in all material aspects and that I am authorised to sign this application.
Signature
Name Michael John SMITH
Position of Signatory Regulatory Compliance Manager employed by 'Space 2D2'
Date 31 January 2019

Collection and Use of Information

Information provided with your application is subject to the provisions of the Official Information Act (OIA) 1982. There are a number of reasons why it may be appropriate to withhold information under the OIA, including where the release of that information would be likely to prejudice the commercial position of the person who supplied or who is the subject of the information. We will inform you of any request under the OIA for information related to your application, and will consult you on any information that is considered for public release.

The personal information collected in this form is required to process your application. You have the right under the Privacy Act 1993 to access information held about you by the Ministry of Business, Innovation and Employment and request that this information be corrected if necessary.

You can email this form to nzspaceagency@mbie.govt.nz or you can mail it to the postal address listed below.

http://www.mbie.govt.nz/space

nzspaceagency@mbie.govt.nz

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The New Zealand Space Agency is a branch of the New Zealand Ministry of Business, Innovation and Employment.