



RUNNING OUT OF TOES

PRESS KIT | LAUNCHING FROM 15 MAY 2021

LAUNCH INFORMATION



LAUNCH WINDOW

14-day launch window opens from 15 May UTC



LAUNCH SITE

Launch Complex 1, Pad A
Mahia Peninsula,
New Zealand



DAILY LAUNCH OPPORTUNITY

The launch timing for this mission will shift slightly each day of the launch window.

Date	NZST	UTC	ET	PT
15 May	22:00 – 0:05	UTC (15 May) 10:00 – 12:05	ET (15 May) 06:00 – 08:05	PT (15 May) 03:00 – 5:05
16 May	21:35 – 23:40	UTC (16 May) 09:35 – 11:40	ET (16 May) 05:35 – 07:40	PT (16 May) 02:35 – 04:40
17 May	21:15 – 23:20	UTC (17 May) 09:15 – 11:20	ET (17 May) 05:15 – 07:20	PT (17 May) 02:15 – 04:20
18 May	20:50 – 22:55	UTC (18 May) 08:50 – 10:55	ET (18 May) 04:50 – 06:55	PT (18 May) 01:50 – 03:55
19 May	20:25 – 22:30	UTC (19 May) 08:25 – 10:30	ET (19 May) 04:25 – 06:30	PT (19 May) 01:25 – 03:30
20 May	20:00 – 22:05	UTC (20 May) 08:00 – 10:05	ET (20 May) 04:00 – 06:05	PT (20 May) 01:00 – 03:05
21 May	19:35 – 21:40	UTC (21 May) 07:35 – 09:40	ET (21 May) 03:35 – 05:40	PT (21 May) 00:35 – 02:40
22 May	19:15 – 21:20	UTC (22 May) 07:15 – 09:20	ET (22 May) 03:15 – 05:20	PT (22 May) 00:15 – 02:20
23 May	18:50 – 20:55	UTC (23 May) 06:50 – 08:55	ET (23 May) 02:50 – 04:55	PT (22 May) 23:50 – 01:55
24 May	18:25 – 20:30	UTC (24 May) 06:35 – 08:30	ET (24 May) 02:25 – 04:30	PT (23 May) 23:25 – 01:30
25 May	18:00 – 20:05	UTC (25 May) 06:00 – 08:05	ET (25 May) 02:00 – 04:05	PT (24 May) 23:00 – 01: 05
26 May	17:35 – 19:40	UTC (26 May) 05:35 – 07:40	ET (26 May) 01:35 – 03:40	PT (25 May) 22:35 – 00:40
27 May	17:15 – 19:20	UTC (27 May) 05:15 – 07:20	ET (27 May) 01:15 – 03:20	PT (26 May) 22:15 – 00:20
28 May	16:50 – 18:55	UTC (28 May) 04:50 – 06:55	ET (28 May) 00:50 – 02:55	PT (27 May) 21:50 – 23:55



ORBIT

430km



SATELLITES

2



INCLINATION

50

Degrees



CUSTOMER

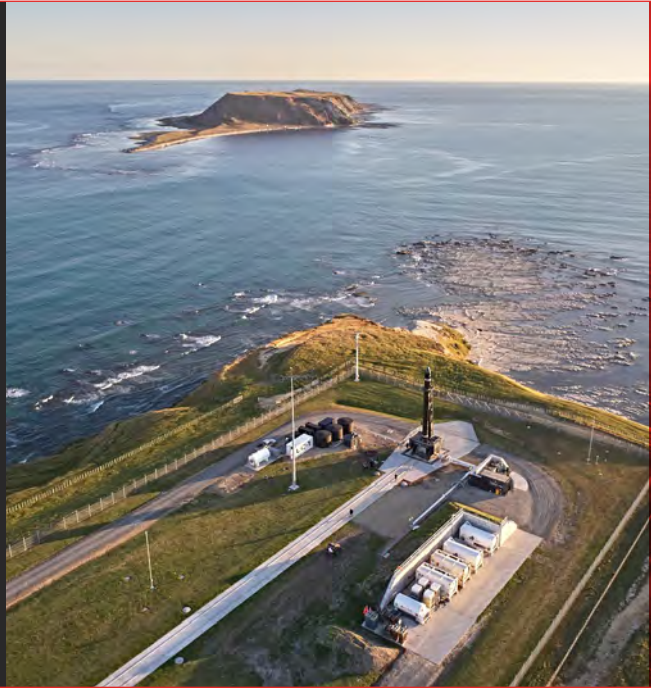
BlackSky

Dedicated mission

MISSION OVERVIEW

ABOUT 'RUNNING OUT OF TOES'

LAUNCHING FROM ROCKET LAB LAUNCH COMPLEX 1 ON NEW ZEALAND'S MAHIA PENINSULA, RUNNING OUT OF TOES WILL BE ROCKET LAB'S 20TH ELECTRON LAUNCH AND THE SECOND OF THREE PLANNED OCEAN SPLASHDOWN RECOVERY MISSIONS.



LAUNCH COMPLEX 1
MAHIA, NEW ZEALAND



The launch is Rocket Lab's third mission of 2021 and will bring the total number of satellites launched by Electron to 106.

Running Out Of Toes is the first of four dedicated launches this year for BlackSky, a leading provider of real-time geospatial intelligence and global monitoring services. Running Out Of Toes will see Electron deploy two 60kg class Earth-observation satellites to low Earth orbit, where they'll join three BlackSky satellites previously deployed by Rocket Lab as part of BlackSky's constellation. The mission furthers BlackSky's goal to achieve a 16-satellite constellation by early-2022. Spaceflight Inc. arranged the launch and is providing mission management and integration services for BlackSky.

Rocket Lab will, for the first time this year, attempt to bring the launch vehicle back from space as part of its efforts to recover and reuse Electron for future missions.

Electron's first stage will undertake a series of complex maneuvers designed to enable it to survive the extreme heat and forces of atmospheric re-entry during its descent to the ocean. For this recovery attempt Electron will be equipped with a heat shield to help protect the stage's nine Rutherford engines and a parachute to slow Electron down before its splashdown in the Pacific Ocean. There, Rocket Lab's recovery team will be stationed with a new retrieval method to recover Electron from the water: the Ocean Recovery Capture Apparatus, or ORCA, a recovery-optimized strongback for Electron.

Running Out Of Toes is the second of three planned ocean splashdown recovery missions before moving into the final phase of the recovery program – mid-air recovery. Using this approach, Electron stages will be captured mid-air by a helicopter.



FLIGHT 19 'THEY GO UP SO FAST'
MARCH 2021

PAYLOADS ONBOARD ELECTRON

BLACKSKY

PAYLOAD: **BLACKSKY GLOBAL SERIES!**

Launch integration and services by Spaceflight Inc.



Running Out Of Toes will launch the second and third of nine BlackSky satellites scheduled to launch with Electron this year.

BlackSky's Earth-observation microsats capture high-resolution images of the planet. Combined with their monitoring service Spectra AI, BlackSky uses artificial intelligence to analyze and make sense of satellite images to track trends, from a region's economic recovery from COVID-19 through to international cargo transport.

Once on orbit, BlackSky's two Gen-2 satellites will continue to grow the BlackSky space network and enable BlackSky to provide more frequent revisits globally with heightened revisit capability in the 45-to-50-degree markets. This mission will expand BlackSky's space sensor network and analytic product throughput, growing their ability to offer timely, rapid and more vivid insights to their customer customers and partners globally.

How BlackSky delivers data to those who need it

When changes are happening on the ground, getting fresh intelligence into the hands of decision makers is critical.

Combining artificial intelligence, cloud computing, analysis, autonomous satellite tasking, and more, BlackSky and their satellites are able to rapidly deliver essential alerts to those who need to know.



1. Insight for early responders

BlackSky's proprietary AI/ML algorithms allow Spectra AI to read the world's news, task BlackSky's smallsat constellation to image emerging events, and automatically analyze those images, delivering actionable insights to BlackSky's customers around the clock. In August 2020, Spectra AI recognized seismic anomalies and early reporting of the port explosion in Beirut. Spectra AI then automatically tasked BlackSky's Global constellation to image the port for damage assessment, delivering critical insight to early responders.



2. Tracking economic activity

BlackSky's Spectra AI combines the power of high-resolution satellite imagery with artificial intelligence and machine learning techniques to automatically create detailed maps indicating activity along roads, buildings, waterways, construction sites, and more.



3. COVID-19 in a changing world

Centered on the spectacular Masjid al-Haram, this image shows the continued impact of COVID-19 on our lives and the new patterns of life that have emerged. At the heart of the Masjid al-Haram is the Kaa'ba. Typically the outdoor space surrounding the Kaa'ba is packed with pilgrims. However, this image instead shows the well-spaced pattern of prayer rugs and an otherwise empty floor, exemplars of the social distancing measures necessary to keep pilgrims to the Kaa'ba safe.

RECOVERY MISSION

A MAJOR STEP IN MAKING ELECTRON A REUSABLE ROCKET



F16 'RETURN TO SENDER'
NOVEMBER 2020



Running Out Of Toes will be Rocket Lab's second attempt to return Electron's first stage back to Earth from space. After optimizing the process from our first recovery mission – 'Return To Sender' – just six months ago, Rocket Lab continues to progress closer to small launch vehicle reusability.

But here is how this mission's retrieval process is different.

- At around two and a half minutes after launch, Electron's first and second stages will separate while the second stage will continue on to orbit for payload deployment.
- With the booster's Rutherford engines shut down, Electron's first stage will coast to apogee.
- During the coast, the reaction control system will re-orient the first stage 180-degrees putting the stage on the ideal angle for re-entry. As well as being equipped with an evolved heat shield designed to protect its nine Rutherford engines and direct the force of plasma away from the rocket, this change in positioning will help the booster survive heats up to 2,400° while traveling up to around eight times the speed of sound during its descent.
- Before Electron reaches the point of its descent when the forces against it are at their peak – otherwise known as Maximum Aerodynamic Pressure, or Max Q – the first stage will reposition engines-first.

- After decelerating to <Mach 2, a drogue parachute will be deployed to increase drag and to stabilize the stage as it descends.
- During the last couple of kilometers, a large main parachute will then be deployed to further slow the stage and enable a soft water landing.
- Rocket Lab's recovery vessel will recover the stage after splashdown using its new retrieval method, the Ocean Recovery Capture Apparatus (ORCA), a recovery-optimized strongback for Electron.
- The stage is then transported back to Rocket Lab's production complex for inspection.



F16 'RETURN TO SENDER'
NOVEMBER 2020

VIEWING A LAUNCH ONLINE



LIVE STREAM

The best way to view a launch is via Rocket Lab's live video webcast. This offers the best views of launch and includes helpful commentary about the launch process. A livestream will be made available approximately 15-20 minutes prior to a launch attempt. Rocket Lab will post links to the webcast when live via Facebook and Twitter.

LIVE STREAM LINKS

The livestream is viewable at:

rocketlabusa.com/live-stream

Also available on:

youtube.com/RocketLabNZ

LAUNCH FOOTAGE & IMAGES

Images and footage of the 'Running Out Of Toes' launch will be available shortly after a successful mission at:

www.rocketlabusa.com/about-us/updates/link-to-rocket-lab-imagery-and-video

UPDATES

For information on launch day visit:

rocketlabusa.com/next-mission

Follow Rocket Lab:

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 facebook.com/RocketLabUSA

VIEWING A LAUNCH IN PERSON

Location

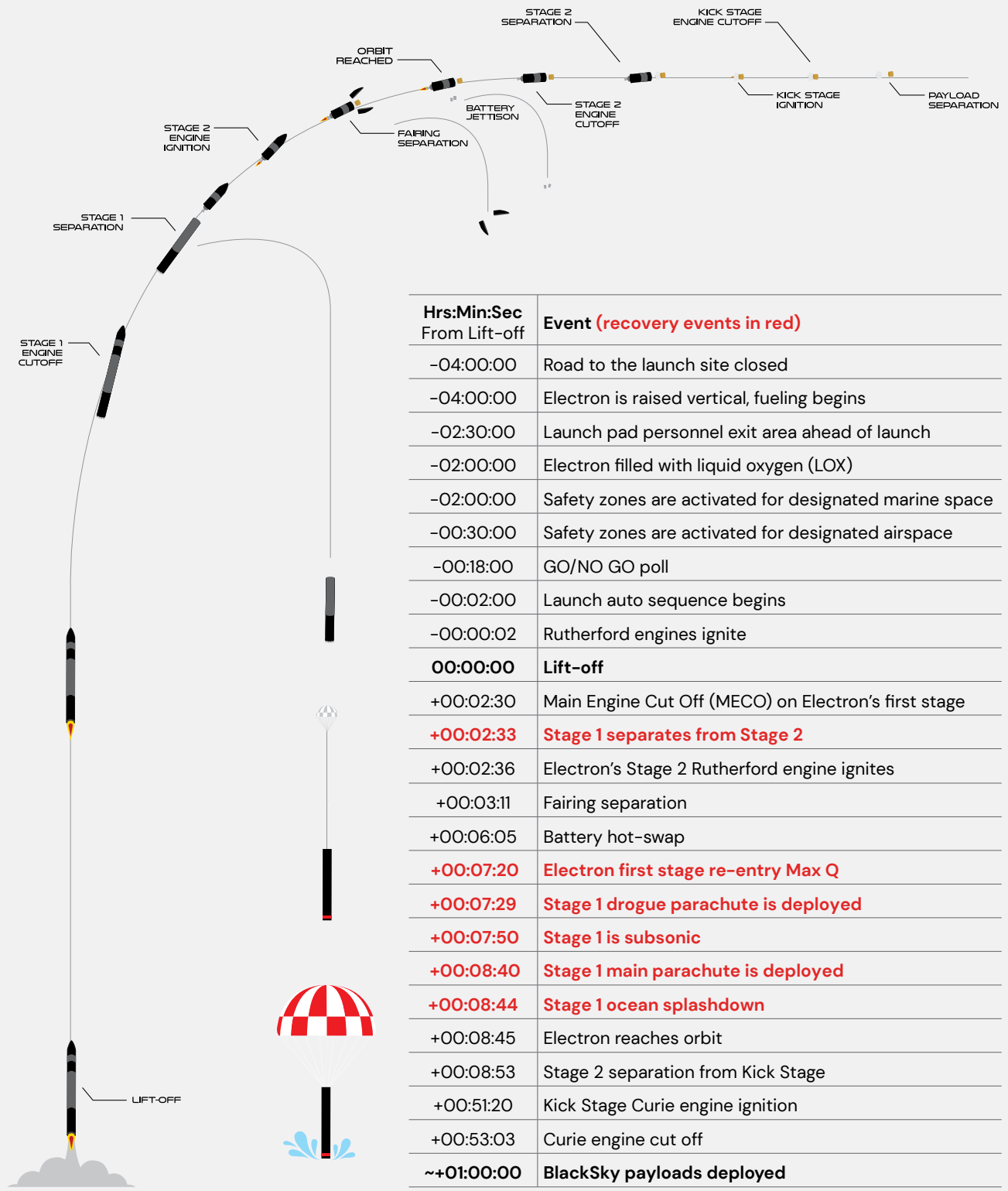
Wairoa District Council has allocated a rocket launch viewing area for the public near Nuhaka, accessible via Blucks Pit Road. Scrubs and postponements are likely during launch windows, so visitors to the Blucks Pit viewing site should anticipate multiple postponements, sometimes across several days.

More information visit

www.visitwairoa.co.nz/welcome-to-wairoa/space-coast-new-zealand



TIMELINE OF LAUNCH EVENTS



Hrs:Min:Sec From Lift-off	Event (recovery events in red)
-04:00:00	Road to the launch site closed
-04:00:00	Electron is raised vertical, fueling begins
-02:30:00	Launch pad personnel exit area ahead of launch
-02:00:00	Electron filled with liquid oxygen (LOX)
-02:00:00	Safety zones are activated for designated marine space
-00:30:00	Safety zones are activated for designated airspace
-00:18:00	GO/NO GO poll
-00:02:00	Launch auto sequence begins
-00:00:02	Rutherford engines ignite
00:00:00	Lift-off
+00:02:30	Main Engine Cut Off (MECO) on Electron's first stage
+00:02:33	Stage 1 separates from Stage 2
+00:02:36	Electron's Stage 2 Rutherford engine ignites
+00:03:11	Fairing separation
+00:06:05	Battery hot-swap
+00:07:20	Electron first stage re-entry Max Q
+00:07:29	Stage 1 drogue parachute is deployed
+00:07:50	Stage 1 is subsonic
+00:08:40	Stage 1 main parachute is deployed
+00:08:44	Stage 1 ocean splashdown
+00:08:45	Electron reaches orbit
+00:08:53	Stage 2 separation from Kick Stage
+00:51:20	Kick Stage Curie engine ignition
+00:53:03	Curie engine cut off
~+01:00:00	BlackSky payloads deployed

ELECTRON LAUNCH VEHICLE

OVERALL

LENGTH

18m

DIAMETER (MAX)

1.2m

STAGES

2 + Kick Stage

VEHICLE MASS (LIFT-OFF)

13,000kg

MATERIAL/STRUCTURE

Carbon Fiber Composite/Monocoque

PROPELLANT

LOX/Kerosene

PAYLOAD

NOMINAL PAYLOAD

200kg / 440lbm To 500km SSO

FAIRING DIAMETER

1.2m

FAIRING HEIGHT

2.5m

FAIRING SEP SYSTEM

Pneumatic Unlocking, Springs

STAGE 2

PROPULSION

1x Rutherford Vacuum Engine

THRUST

5800 LBF Vacuum

ISP

343 Sec

INTERSTAGE

SEPARATION SYSTEM

Pneumatic Pusher

STAGE 1

PROPULSION

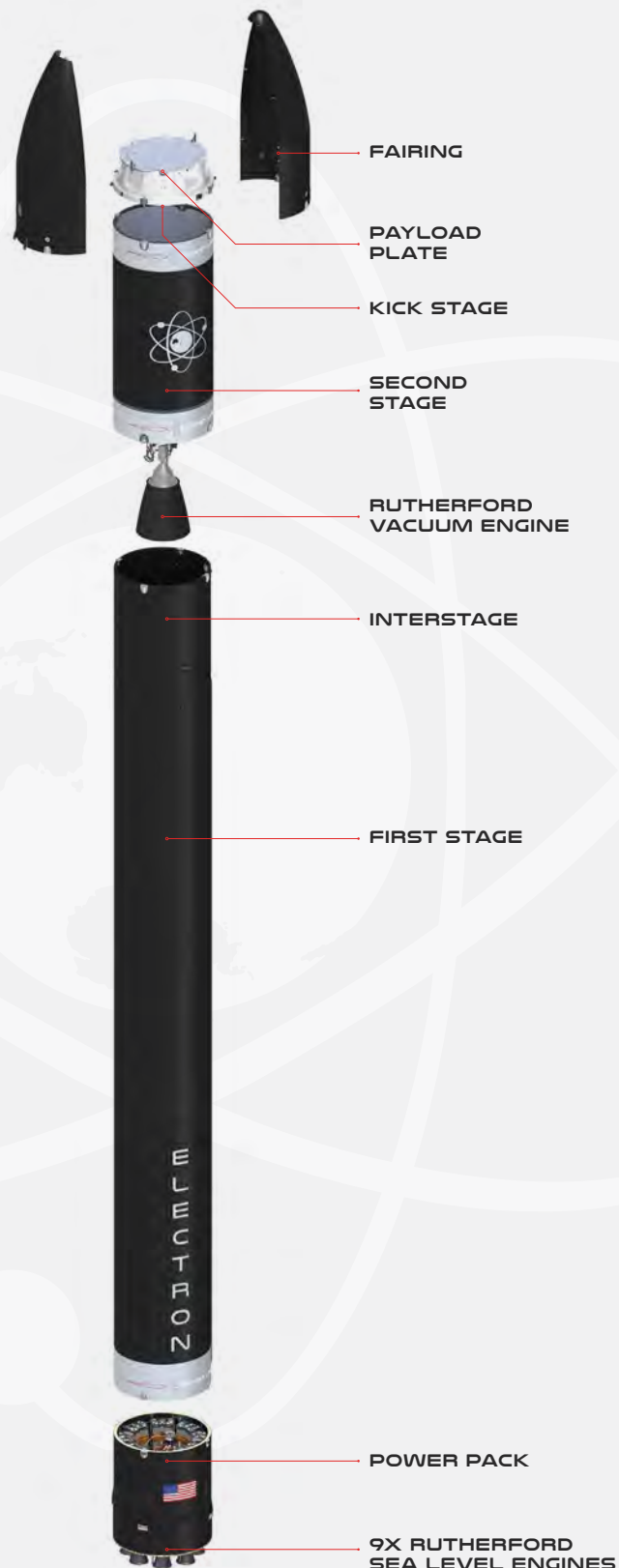
9x Rutherford Sea Level Engines

THRUST

5600 LBF Sea Level (Per Engine)

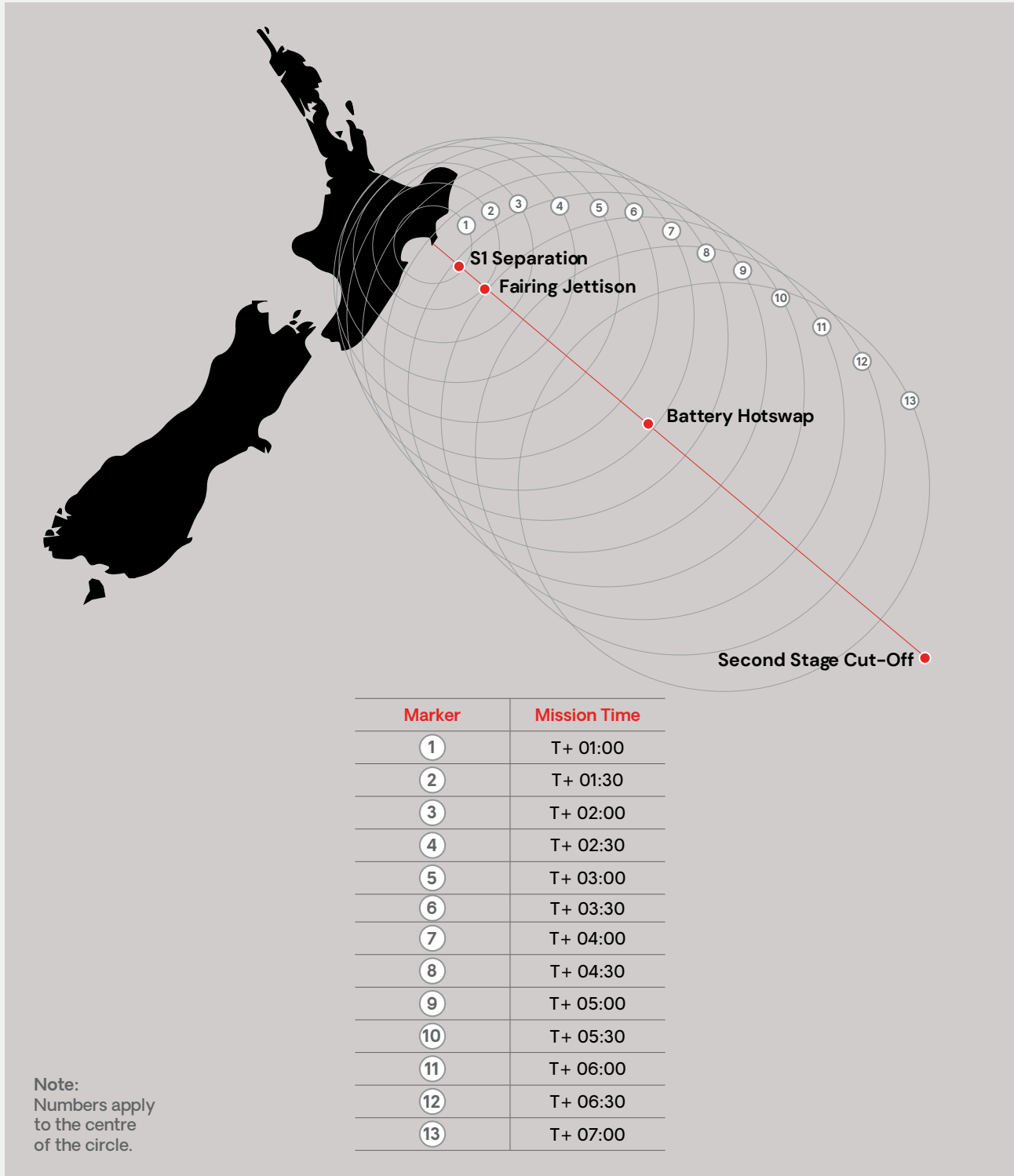
ISP

311 Sec





LAUNCH VISIBILITY MAP

WHEN AND WHERE TO SPOT THE LAUNCH





CONTACT US


 rocketlabusa.com

 media@rocketlabusa.com

CONNECT WITH US

 [@rocketlab](https://twitter.com/rocketlab)

 [RocketLabUSA](https://www.instagram.com/RocketLabUSA)

 facebook.com/rocketlabusa

