Sustainable Space Initiative

RESEARCH SUMMARY

ADVANCES IN SPACE RESEARCH · 2023

Life cycle assessment as a tool for sustainable space activity in Aotearoa New Zealand

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We ran a life cycle assessment (LCA) of a New Zealand-built CubeSat, the most common satellite launched from Aotearoa, to find its environmental hotspots and the data gaps in the way.

$1.75b
NZD sector revenue a year (2019)

92%
of satellites approved for NZ launch weigh under 10 kg

1 kg
APSS-1, a 1U CubeSat launched on Electron in 2020

15,600
personnel hours to design and build it

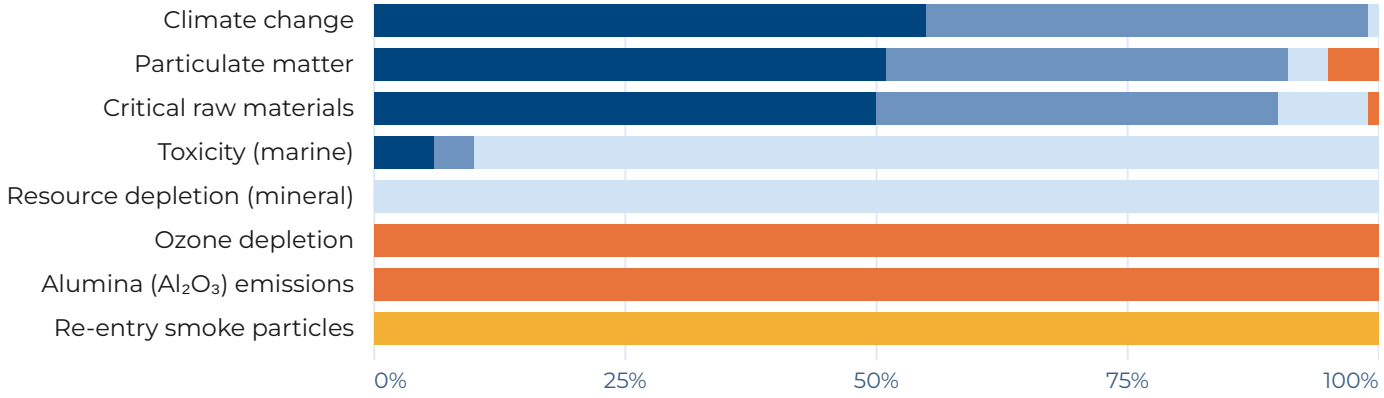
THE MISSION LIFE CYCLE WE MODELLED

A+B **Design** office work → C+D **Build and test** office work → C+D **Spacecraft** components → E1 **Launch** launcher activities → F **End of life** re-entry

Operations (E2) and the ground segment were left out: the satellite never made contact after deployment.

WHERE THE IMPACTS COME FROM

Share of each impact category by life cycle phase, one 1U CubeSat mission (selected categories)



Office work dominates

Staff energy use in design, build and test drives most categories for a 1 kg satellite.

Solar cells matter

Germanium in the solar modules drives mineral depletion and toxicity.

Launch and re-entry stand apart

Only launch emits alumina and depletes ozone; only re-entry makes smoke particles.

RECOMMENDATIONS

1. Better modelling and measurement of launch emissions into the stratosphere, especially black carbon and ozone loss
2. Better estimates of energy used in design and build, with a flexible data framework shared with suppliers
3. Close the data gaps: proprietary supplier data, low awareness of LCA standards (ISO 14040), no shared data infrastructure
4. Research what NZ space businesses and policymakers know about sustainability, and what support they need

Dhopade, P. et al. (2023). Life cycle assessment as a tool for sustainable space activity in Aotearoa New Zealand. *Advances in Space Research* 72, 2936–2947. doi.org/10.1016/j.asr.2023.01.055

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