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Proposed expansion of Arnhem Space Centre – submission on Supplementary Environment Report

The Environment Centre NT (ECNT) is the peak community sector environment organisation in the Northern Territory, raising awareness among community, government, business, and industry about environmental issues. We assist people to reduce their environmental impact and support community members to participate in decision-making processes and action.

We thank you for the opportunity to provide a comment on the Supplementary Environment Report (**SER**) for Equatorial Launch Australia's (**ELA**) proposed expansion of the Arnhem Space Centre (the **Project**).

ECNT has previously made a submission on the referral, under the *Environment Protection Act*, of the Project, in which we raised a series of concerns with the proposed activity. ELA has failed to address the concerns raised in that submission in any meaningful way, and as such ECNT reiterates the concerns raised and considers them outstanding. While ELA's SER contains a table summarising ECNT's concerns, instead of directly addressing them it refers to locations elsewhere in the document; however, these sections do not clearly and in some cases do not at all respond to the concerns raised.

As an initial, overall comment, ECNT submits that the SER is inadequate for the purposes of providing the public and the regulator an opportunity to understand the potential impacts of the project. The proponent has made little attempt to outline the range of potential risks and impacts or discuss ways to avoid, mitigate, and manage them. Risks are often minimised, if they are mentioned at all, and, in particular, nowhere does the proponent consider the possible impacts of launch accidents or malfunctions. This is despite the proponent's acknowledgement that launch failure likelihood can be as high as 2%; given the proponent estimated frequency of launches could be as many as 60 a year, there is therefore a statistical likelihood of a launch failure occurring every single year. The precautionary principle is not employed in the SER, nor is a range of worst-case scenario planning undertaken. Given the nature and scale of the proposed activities, ECNT submits that this approach to environmental assessment is unacceptable.

Summary of the activity

As described by the proponent in the SER, ELA proposes to expand the existing Arnhem Space Centre to become a spaceport targeting both commercial and defence clients, launching rockets into both low-medium earth orbit and sub-orbital distances. 91ha of vegetation will be cleared to make way for the construction of up to 14 new rocket launch pads. As per the referral



of the activity to the EPA, “there will be between 16 and 60 launches per year when Phase 2 of the ASC is fully operational.”

Impacts on terrestrial biodiversity

Impacts on terrestrial biodiversity are asserted by the proponent to be insignificant without reference to an appropriate evidentiary basis. No original surveys were done, and the most recent report referred to in the SER was written in 2019; even in that report, no surveys were undertaken. The SER asserts that “no recent regional or local records of occurrence” for listed threatened species exist for the area. The likely reason for this is that no targeted biodiversity surveys have been undertaken, with the assessment in this SER based on desktop analysis only with a quick site visit by consultants.

The terrestrial environment surrounding the project area is rich in fauna and flora. Black-footed tree-rat (*Mesembriomys gouldii gouldii*), common brushtail possum (*Trichosurus vulpecula arnhemensis*), Partridge Pigeon (*Geophaps smithii smithii*) and Northern Brush-tailed Phascogale (*Phascogale pirata*) are all found near to the project site. Furthermore, the site is suitable habitat for a range of other species, particularly the critically endangered Northern Blue-tongued Skink (*Tiliqua scincoides intermedia*).

A single clonal population of *Erythroxyllum* (*Erythroxyllum* sp. Cholmondely Creek) is found in the vicinity of Cholmondely Creek approximately 15km north from the project area. Targeted searches on the Gove Peninsula and west through Arnhem Land have been undertaken by botanists with the species yet to be found in other locations despite extensive survey effort in suitable habitats. This species is not mentioned in the body of the SER and scarcely mentioned in the appendices, with no attempt made to consider the risks of the project to this species.

The project area includes a patch of Monsoon vine forest. This is a significant vegetation type and requires a 50m land clearing buffer as per the NT Land Clearing Guidelines. Clearing within 20m of this vegetation type as stated in the SER will not adequately protect biodiversity values, including the most likely habitat for the critically endangered Northern Blue-tongue Skink.

Scientific literature on the topic recognises that there is a “paucity of research on the impacts of disturbance by rocket launches” on biodiversity.¹ The few studies that do exist indicate a reduction of species diversity and abundance around space launching sites.² There is scarce engagement with this literature in the SER. There is a strong scientific evidence base showing that noise pollution is a threat to the persistence of many species, in particular military noise

¹ Yang Xue, Robert John, Xiang Liu, Xiaoyan Wang, Shaofeng Su, Zhaoyuan Tan, Qi Yang, Qifang He, Kai Jiang, Hui Zhang (2021) ‘Rocket launching activities are associated with reduced insect species richness and abundance in two types of tropical plantations around the Wenchang Satellite Launch Center, southern China’ *Ecological Indicators* 127 <https://doi.org/10.1016/j.ecolind.2021.10775>

² S. Lednve, T. Koroleva, P. Krechetov, A. Sharapova, I. Semenov, A. Karpachevskily (2017) ‘Revegetation of areas disturbed by rocket impact in Central Kazakhstan’ *Ecoscience*, 25:25-38.

Yang Xue, Robert John, Xiang Liu, Xiaoyan Wang, Shaofeng Su, Zhaoyuan Tan, Qi Yang, Qifang He, Kai Jiang, Hui Zhang (2021) ‘Rocket launching activities are associated with reduced insect species richness and abundance in two types of tropical plantations around the Wenchang Satellite Launch Center, southern China’ *Ecological Indicators* 127 <https://doi.org/10.1016/j.ecolind.2021.10775>



pollution such as rockets.³ The impacts of noise pollution on wildlife and cultural heritage has not been addressed in the SER.

Impacts on marine biodiversity

The indicative suborbital and orbital LV recovery areas extend across a vast stretch of the Gulf of Carpentaria. No attempt has been made by the proponent to assess the potential impact of the proposed activity on marine biodiversity in this environment. Whilst it may be the case that the proponent expects to assess these impacts in an EPBC referral, the nearshore waters in the Gulf remain in Territory waters and should be assessed in this SER.

Of primary concern is the entanglement risk to marine fauna within the recovery zone across the biodiverse shallow waters of the Gulf of Carpentaria. It is disconcerting that ELA has raised the impact of parachutes becoming entangled in trees in the Land Vehicle Recovery Protocol but has failed to mention this risk to marine wildlife in the Sea Vehicle Recovery Protocol. It is unclear in the information provided what the actual retrieval time would be for rocket hardware and parachute to be retrieved from drifting in the remote waters of the Gulf of Carpentaria. Furthermore, the original recovery plan stated hardware will be retrieved 'where practicable' but this is not defined. ELA must clearly define when recovery of rocket hardware from the middle of the Gulf of Carpentaria will be deemed practicable vs. not practicable (and therefore, it must be assumed not recovered.)

43 migratory and 21 threatened species, including the White-tailed Tropicbird (*Phaethon lepturus*), Whale Shark (*Rhincodon typus*), and Green turtle (*Chelonia mydas*), have critical habitat in the region where rocket debris will fall. The coastal and marine environment within 15km of the project site are critical habitat for six migratory shorebirds such as the Lesser Sand Plover (*Charadrius mongolus*), four marine turtles such as the Olive Ridley turtle (*Lepidochelys olivacea*), and the Scalloped Hammerhead (*Sphyrna lewini*).

The chain of small islands that run north-east of Nhulunbuy support significant colonies of breeding seabirds. Counts of 3,000 Roseate Terns and 10,000 Bridled Terns on Higginson Islet (colony # S030) in May 1994, and 2,500 Roseate Terns on East Bremer Islet (S032) in 1993 (Chatto 2001) are internationally significant (>1% global population). Neighbouring islands to the west and south of Higginson Islet, also support significant breeding populations of Roseate, Black-naped, and Bridled Terns (S033, S085, S0117)⁴.

Migratory and other birds are particularly susceptible to impact from the proposed activity, with no attempt being made to assess the activity's impacts on (for example) flight paths or nesting grounds.

The launch zone and parts of the recovery area falls within the NT Site of Conservation Significance 'Gove Peninsula and North-East Arnhem Coast'. This region is of international significance containing important biodiversity and cultural values:

³ Sordello, R., Ratel, O., Flamerie De Lachapelle, F., Leger, C., Dambry, A., & Vanpeene, S. (2020). Evidence of the impact of noise pollution on biodiversity: a systematic map. *Environmental Evidence*, 9(1), 1–27. <https://doi.org/10.1186/s13750-020-00202-y>

⁴ Chatto, R. (2001). The distributions and status of colonial breeding seabirds in the Northern Territory. Technical Report 70, Parks and Wildlife Commission of the Northern Territory, Darwin. 206pp



- Three Hummocks Island, Higginson Islet, and other small islets north of Nhulunbuy, are proposed to be nominated by Birds Australia as internationally-recognised Important Bird Areas due to the occurrence of globally significant numbers of congregatory seabirds.
- There are 54 migratory animal species recorded from this site that are listed under international conventions or bilateral agreements.
- Five sites on the North-East Arnhem Coast are listed on the Register of the National Estate for their natural values, including Rocky Bay Jungle, Dalywoi Bay Monsoon Vine Forest, Holly Inlet Monsoon Vine Forest, Rindarry Jungles, and Yalangbara Monsoon Vine Forest (Australian Heritage Council).
- The Nhulunbuy area contains the richest, most extensive and diverse coral reefs of the NT which are possibly of national significance, but ~50% were destroyed by cyclone Ingrid in March 2005 (Gomelyuk 2007). The marine areas within this site are likely to encompass other significant biodiversity values and these are currently being explored and collated in a project by the Marine Biodiversity Group of NRETAS (K. Edyvane, NRETAS, pers. comm.)

Cumulative impacts from increased marine debris

In August 2003, 'Injury and fatality to vertebrate marine life caused by ingestion of, or entanglement in, harmful marine debris' was listed as a key threatening process under the *Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act)*⁵. Marine debris may cause injury or death through drowning, injury through entanglement and internal injuries, or starvation following ingestion. Turtles, marine mammals and sea birds can be severely injured or die from entanglement in marine debris, causing restricted mobility, starvation, infection, amputation, drowning and smothering.

Rocket debris and hardware with parachutes attached by long parachute leads, springs, and sometimes utilising an additional drouge parachute, will have the same deadly affect as 'ghostnets' - drifting in the ocean indiscriminately killing marine life from entanglement and drowning. Ghostnets are a particularly innocuous issue along the northern coast of Australia, with concentrations of derelict nets washing onshore in the Gulf of Carpentaria as high as or higher than any other area in Oceania and southeast Asia⁶. Marine debris in this region has entangled invertebrates, teleost fish, sharks, turtles, crocodiles, and dugongs.

Rocket debris will contribute to cumulative impacts of an already significant marine debris problem in the region – recognised as a key threatening process under the EPBC Act.

Research by the CSIRO⁷ shows that south of the Gove Peninsula within the Territory Gulf waters is a marine debris accumulation "hot spot". Despite management intervention marine debris accumulation is increasing due to local and regional currents that concentrate debris in this

⁵ [Threat abatement plan for the impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans \(2018\) - DCCEEW](#)

⁶ Wilcox, C., Hardesty, B.D., Sharples, R., Griffin, D.A., Lawson, T.J. and Gunn, R. (2013), Ghostnet impacts on globally threatened turtles, a spatial risk analysis for northern Australia. *Conservation Letters*, 6: 247-254.

⁷ Hardesty BD, Roman L and Wilcox C (2021). Ghost nets in the Gulf of Carpentaria, Australia, 20042020. CSIRO, Australia.

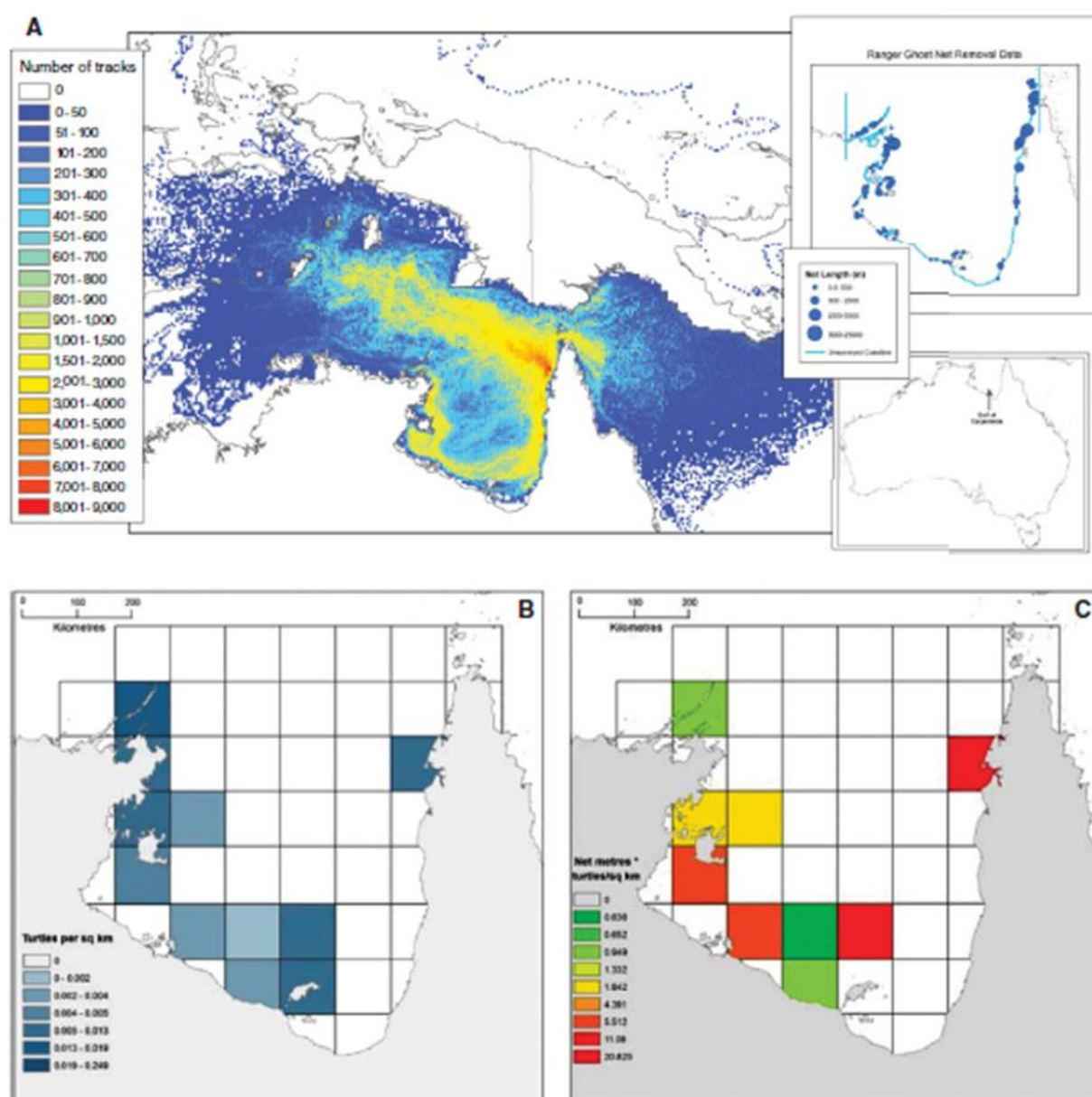


area. Additional marine debris from rocket hardware, particularly the parachute material with long cords attached, presents a new form of marine debris with a high risk of entanglement. The risk of marine entanglement must be considered cumulatively with the existing ghost net problem within the 'hot spot' area.

Figure 1: Map from Wilcox, C. et al 2013 showing the regional currents in the Gulf of Carpentaria resulting in marine debris “hot spots” that are deadly for marine species.

C. Wilcox et al

Ghostnet impacts on threatened turtles



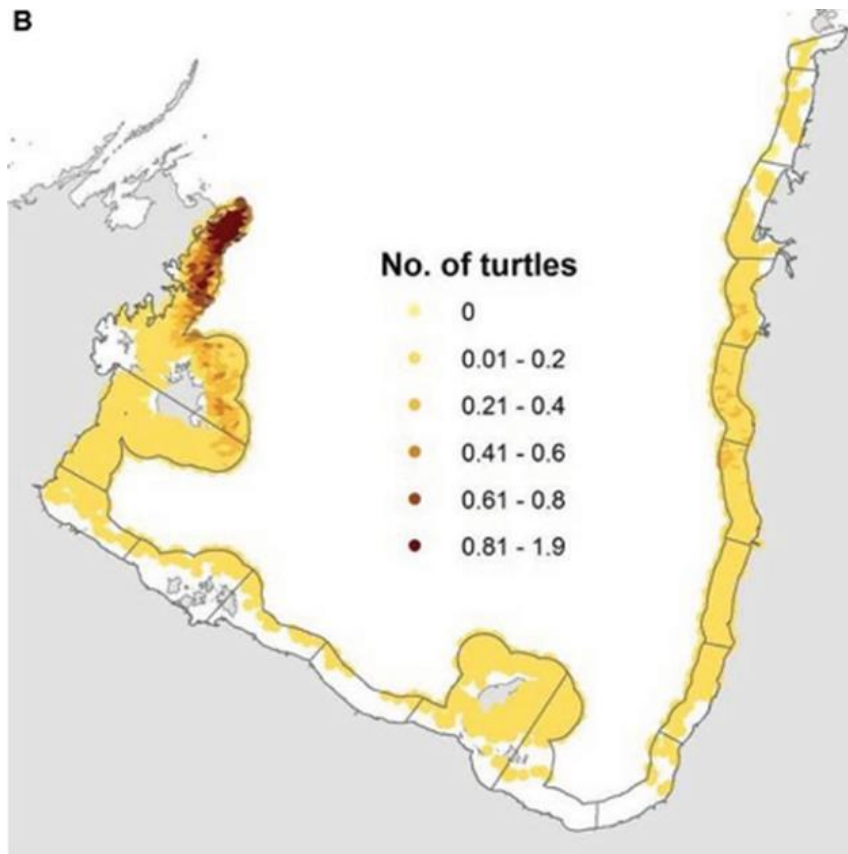
Increased entanglement risk to sea turtles

The research clearly shows where the marine debris “hot spots” occur within the rocket recovery zone in the Gulf of Carpentaria across NT and Qld waters. This information must be



considered in conjunction with the fact that the area south of the Gove Peninsula supports the highest concentration of sea turtles in the Gulf⁸ and therefore the highest risk of turtle entanglements.

Figure 2: Concentrations of marine turtles and entanglement risk (Wilcox et al 2013).



Marine turtles comprise >80% of all observed animals entangled, with entanglement the **primary cause of sea turtle mortality** in the Gulf region⁹. Increased marine debris from rockets, especially rocket debris with long cords and billowing parachute material, will increase this risk of entanglement and mortality for all threatened species of sea turtle that occur in the region.

Little to no attempt has been made to assess the impacts of the proposed activity on the Gulf of Carpentaria Marine Park. The proponent has not adequately described the conservation values of the area nor its ecological significance. The Gulf of Carpentaria Marine Park, adjacent to the Wellesley Islands, is culturally important for the Lardil, Yangkaal, Kaiadlit and Gangalidda people who have responsibilities for sea country here. The Carpentaria Land Council Aboriginal Corporation is the representative body for these Traditional Owner groups and must be appropriately informed and engaged on this matter.

⁸ Wilcox et al 2013.

⁹ Wilcox et al 2013



Atmospheric emissions

In documents submitted under an EPBC referral for an associated activity, ELA acknowledged in a table of representative launch vehicles deploying a range of propellant types, including hybrid, solid, and liquid, that would be used at the site.¹⁰ A range of fuel types are included, including Hydroxyl-terminated Polybutadiene (HTPB), RP-1 (C₁₂H₂₄), Jet-A1 (C₁₁H₂₂), Methane (CH₄), Propane (C₃H₈) and BioLPG. Oxidiser types include Aluminium/ Ammonium perchlorate (Al/NH₄ClO₄), Liquid oxygen (LOX (O₂)), and High-test peroxide (HTP (H₂O₂)). Primary emissions include Carbon soot, H₂O, CO₂, HCl, Al₂O₃, CO, NO_x, N₂, H₂, OH and sulphur compounds.

The inclusion of possible emissions scenarios in the SER fails to cover the potential range of impacts from these fuels, oxidisers, and emission types, failing to discuss them all. For example, only two representative LV types are modelled, and the emissions mass of only four substances is modelled despite the “primary emissions” list including ten substances. In terms of strategies to mitigate risk and impact, from the list of entire primary emissions outlined by the proponent only two of them (CO and HCl) are proposed to be monitored. The air quality dispersion modelling takes as its longest time interval a 24-hour period, failing to assess cumulative impacts or longer-term ambient concentrations of emissions.

It is unclear whether the proponent has excluded mention of exceedances that have been modelled—for instance, the proponent claims that “24-hour average ground-level concentrations of Al₂O₃ as PM₁₀ are predicted to comply with the air quality standard at the Garma Cultural Knowledge Centre” but do not mention results for 1-hour or 8-hour intervals. For the sake of completeness and transparency, the proponent should produce a table similar to Table 6 of the SER but with an additional column including the actual modelled concentration of the pollutants, and the list of pollutants included should be extended to include all of those acknowledged by the proponent as “primary emissions” from the activities.

The proponent has failed to comprehensively engage with the growing body of scientific evidence concerning the risks and impacts of atmospheric emissions from the kinds of activities proposed. A 2022 study has found that the increased growth of the rocket industry has the potential to “undermining O₃ recovery achieved with the Montreal Protocol” (Ryan et al 2022). The study found that emissions of black carbon contribute to warming, with black carbon directly injected into the upper atmosphere having a “greater climate forcing efficiency...almost 500 times more” than other atmospheric pollutants (Ryan et al. 2022). As with the literature on rocket launch impacts on biodiversity, there is an acknowledgement in the study that there are “large uncertainties [that] need to be addressed to further enhance our understanding of the true impact of contemporary rocket launch and re-entry heating emissions on atmospheric composition and climate” (Ryan et al 2022). Despite this, the proponent has not made an adequate attempt to account for the impacts of the activity on stratospheric ozone concentration, let alone propose strategies for mitigation. It is acknowledged that stakeholders raise these concerns, but they are not addressed. In terms of engagement with relevant

¹⁰ https://epbcpublicportal.awe.gov.au/_entity/sharepointdocumentlocation/f3634384-d70c-ef11-9f89-00224895474f/2ab10dab-d681-4911-b881-cc99413f07b6?file=Att%202-LV%20types%2C%20propellant%20types%2C%20and%20environmental%20considerations.pdf



regulatory mechanisms, the proponent mentions the NEPM but does not engage with the Montreal Protocol governing global efforts to reduce ozone-depleting substances.

Furthermore, there is no attempt to engage with the human health impact of various pollutants, no engagement with relevant epidemiological or toxicological impacts of these pollutants on nearby human populations.

The proponent has failed to adequately assess the cumulative impacts of the activity across a range of factors. NASA found that at a site in Texas after 135 launches over a 30-year period significant impacts included "the accumulation of aluminium particulates, damage to vegetation and temporarily reduced pH in adjacent waters".¹¹ The proposed activity would see rockets launched with significantly greater frequency over potentially a longer period of time, yet there has been no attempt to engage with the impacts of the activity over the entire duration of the activity.

In light of these outstanding uncertainties and information gaps, the proponent's proposal to exponentially increase the frequencies of launches at its site without an appropriate evidence base establishing the safety of this practice for the environment is alarming.

Noise emissions

A glaring omission from the SER is any discussion of the risks and impacts of noise emissions on a range of factors. No acoustic modelling has been undertaken. Attempts around the world, and in Australia, to develop similar facilities are often met with significant controversy and opposition due to their impact on the amenity of nearby human populations, in part due to noise pollution.

The proponent should be required to fully assess the possible risks and impacts of noise from the activity. Noise has the potential to impact several factors, including terrestrial biodiversity (i.e. impact on animals), marine biodiversity, as well as community and economy (i.e. the local amenity of nearby residents).

The Boca Chica launch facility for SpaceX's Starship rocket in Texas was required to undertake a noise assessment, analysing rocket noise background and metrics, launch noise levels, re-entry/landing noise levels, static fire test noise levels, and cumulative noise levels. To make an imperfect comparison, the Boca Chica facility's noise assessment alone is longer than the entire SER for the Arnhem Space Centre Expansion. In light of this and the potentially significant impact of noise from the activity, is it unacceptable that the SER fails to assess the impact of noise.

Community and economy

ELA have publicly claimed that "the facilities, technologies and capabilities of ELA and the ASC are also able to allow it to be used as a state-of-the-art test and development range for both commercial and defence missiles and rockets".¹² Despite these public admissions, and a series

¹¹ BBC <https://www.bbc.com/future/article/20240627-the-environmental-cost-of-rocket-launches>

¹² ABC News April 2023 [Arnhem Land space centre could be used for missile testing and development, Equitorial Launch Australia says - ABC News](#)



of commercial agreements with space companies including those with military ties,¹³ the proponent in the SER is not explicit about the extent and nature of the activity and the potential impacts of these, glibly asserting that “ALC is not a military base”. The fact that there is a degree of contradiction and secrecy surrounding the nature of ELA’s proposed activities both undermines the genuineness of the consultation efforts and prevents the SER from adequately assessing the potential risks and impacts to the Community and Economy factor.

There is little to no attempt to evaluate risks and impacts of the activity to community and economy. The ‘economic development’ section of the SER contains only a dot-point list of alleged economic benefits of the activity. There has been no attempt to engage with what a large-scale militarisation and industrialisation of the area will mean for the demographics of Nhulunbuy, homelands, or the greater region. There has been no analysis of projected workforce changes, the impact of demand for particular services in Nhulunbuy, the impacts on tourism or public amenity of the area, or a genuine engagement with risk of disruption of commercial and passenger air travel.

To take just one example of a local impact, the proponent merely notes that there is the potential for road closures of up to 30 minutes each time a rocket launches. There is no assessment of the impact of these potentially more-than-weekly, extended road closures on roads that service an airport, provide access to hospitals and services from homelands, and that contain a high frequency of trucks transporting goods to the town.

The larger question around the desirability and community acceptance (or not) of locating defence activity in this area is not engaged with at all by the proponent. There exists some significant, widespread, and longstanding community opposition to the location of US defence activities in Northern Australia, with concomitant fears of becoming a first strike target, and regarding the independence of Australian foreign policy. These fears are clearly not shared by the proponent, but it is unacceptable that they are completely ignored. The risks posed by militarisation are incredibly severe even if their likelihood is contested and, therefore, they deserve thorough attention of the proponent, and a process of genuine public engagement and debate.

The Proponent commits to not launching any rockets during the Garma festival. This is one of the few mitigation measures proposed in the SER. But therein lies an acknowledgement of the potential disruption of the rockets to the surrounding environment, an implicit recognition of the social undesirability of their presence. If rockets are not to be launched during the one time of year when politicians visit the region, then there must be a more honest and thorough acknowledgement of the impacts of the 60 rockets throughout the rest of the year on the people, animals, and environment that live in the vicinity.

Conclusions

In conclusion, ECNT submits that the SER is not an acceptably comprehensive appraisal of the project’s risks and impacts, and makes very little attempt to present mitigation strategies. In

¹³ MOU signed with ESS: <https://ela.space/ess-mou-signed/>.



addition to the information gaps highlighted in ECNT's submission on the referral of the project, ECNT recommends that the proponent be required to include the following:

- An analysis of the likelihood, severity, and possible consequences of accidents or malfunctions on a range of factors, as well as a full discussion and evaluation of mitigation strategies;
- Targeted biodiversity surveys in the clearing area providing a comprehensive species list for the site and implementation of the mitigation hierarchy to avoid, minimise or offset impacts;
- Clearly define when retrieval of rocket hardware on land/ sea is 'practicable vs not practicable' and provide updated information on the impacts of non-retrieval – particularly on marine megafauna;
- Provide detailed time estimates for how long rockets and parachutes will be 'ghost netting' in the waters of the gulf of Carpentaria, and any other marine areas possibly affected;
- A revised and complete analysis of atmospheric emissions from the activity, including all pollutant types;
- An analysis of the impact of emissions on atmospheric ozone concentrations;
- A health impact analysis of the establishment of a commercial rocket launch facility on nearby human populations, analysing the full range of potential emissions, oxidisers, and fuel types;
- An analysis of the cumulative impact of the activity on all factors addressed in the SER, with a thorough appreciation of the increase in frequency of proposed rocket launches compared with existing facilities and similar facilities worldwide;
- A noise study, including acoustic modelling, and proper consultation on noise emissions with a range of stakeholders;
- An evaluation of the economic and demographic impacts of the proposed activity to the region, including homelands and Nhulunbuy, including demographic and workforce changes;
- A register of risks and impacts to local amenity, including but not limited to road and passenger airport use, and an evaluation of mitigation strategies;
- Engagement with the question of the risks of defence infrastructure and community concern regarding militarisation;

Yours sincerely,

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