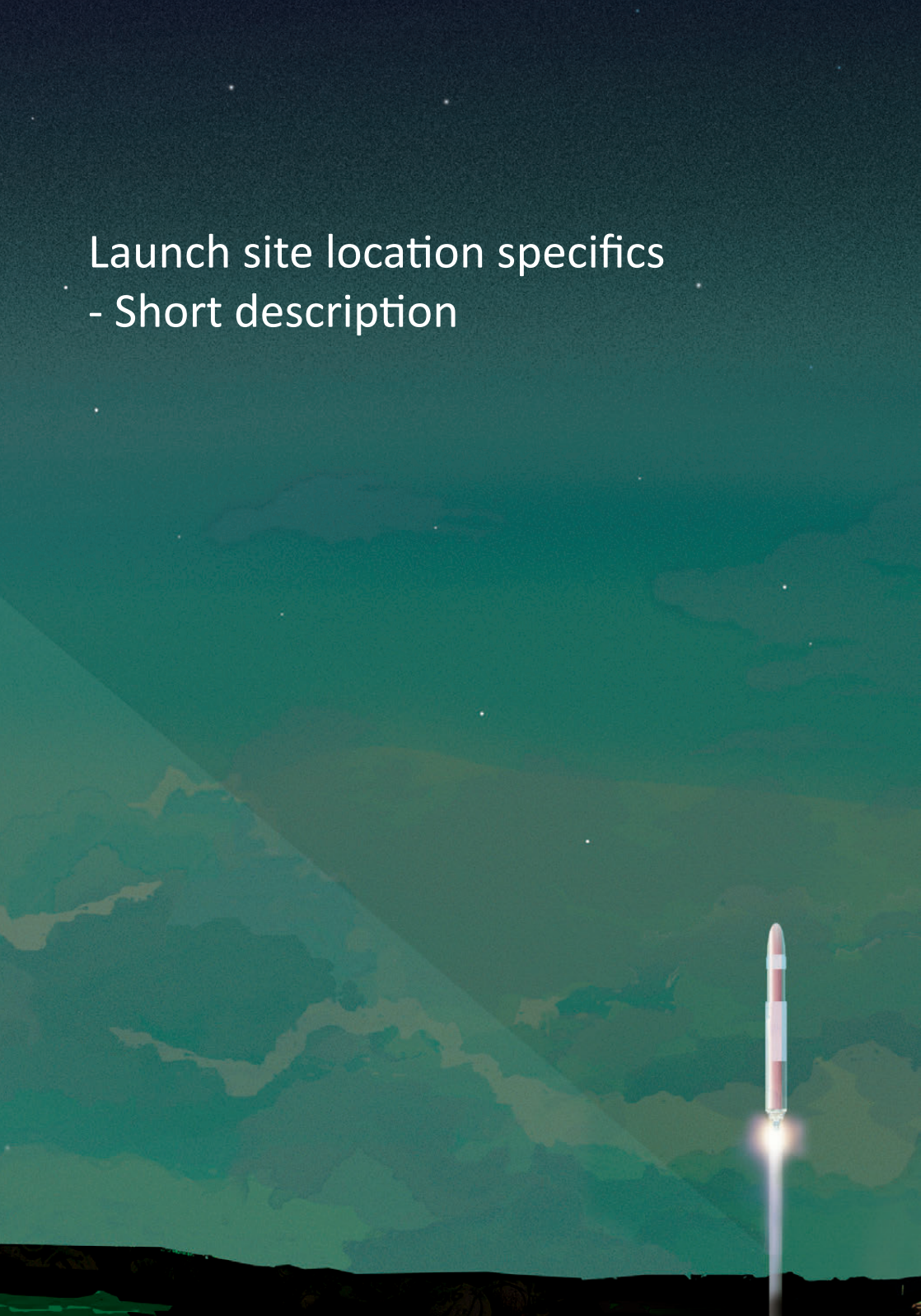
Launch site location specifics - Short description



The islands of Azores and, in particular, the location of Malbusca in the island of Santa Maria, has been identified as a promising launching site through the feasibility studies performed in collaboration with UT-Austin's Center for Space Research (2017), as well as the preliminary studies conducted under the ESA´s Future Launchers Preparatory Program (FLPP; under progress), among other studies performed recently by major international players. These technical studies have shown that an Azorean spaceport offers a wide range of Azimuth and good weather conditions enabling regular and frequent launches. It would benefit from and leverage the current Azorean space infrastructures.

Deeper detailed analyses are now necessary to guarantee adequate safety, low environmental impact, geological stability conditions and sustainable electrical and water usage.

ORBITS AND MASS

The foreseen launch base geographical position has to be compliant with the market demand of small satellites and satellite constellation projects regarding efficient reaching to polar and sun-synchronous orbits (i.e., about 400-1000km altitude / 90-98º or larger inclinations). An indication of expected payload mass should be indicated, preferably in a range up to 500Kg.

LAUNCH ANGLE/AZIMUTH

The launch base position must ensure that in any scenario of operations, a launcher cannot overfly populated areas until the consequences of a failure would become negligible.

SAFETY – DOWN RANGE

The launch base shall cope with safety requirements, including "EC –Expected Casualties", and thus must be implemented close to major bodies of water. Depending on the design of the launcher, safety of the launches must be foreseen in order to have buffer areas, which

may be used as drop zones for the launcher. As a consequence, a launch base is usually built close to major bodies of water to ensure that no components are shed over populated areas. In the absence of detailed local regulations, US Federal Aviation Administration (FAA) regulations should be considered as binding standards.

SAFETY - ROCKET RANGE

The launch base shall be well clear of anything that could be damaged by a failed launch. Typically a launch range spaceport site is large enough that, should a vehicle explode, it will not endanger human lives or adjacent launch pads (if more than one). The range shall be large enough also to accommodate all the buildings with safety distance between them to avoid “domino effect” in case of problems, and during launches human presence is prohibited. The safety range radius to be considered around the launch base must be limited to safeguard the impact on human populations. The launch base must consider other safety variables, including noise, pollution, and radio-electric environment. As an example, rocket exhaust should be carefully assessed to minimise any damage of material on the ground due to acoustic energy (i.e., shock waves, vibration). In the absence of detailed local regulations, US Federal Aviation Administration (FAA) regulations should be considered as binding standards.

ENVIRONMENTAL IMPACTS

A launch base or spaceport must highly regard the importance of environmental protection, including the impact on both wildlife and human populations. Specific local, regional, and national regulations are of paramount importance to be considered on environment and safety (including population, workers, flight safety, transport of dangerous goods).

A diversified set of parameters should be considered for a baseline environmental study, including: habitat destruction (land use), noise (population, fauna), dust from earthwork (flora, agriculture), traffic from launch base logistics (noise, air pollution, infrastructures), (if any) launch emissions (noise, vibration), ground water consumption, waste water discharge and waste water treatment, (if any) chemical uses and pollution risks, infrastructure impacts (electrical grid, water supply, road works and new roads), prospection of sensitive fauna, flora and habitats during a full biological cycle (standard period, 1 year), considerations of

launch base site location versus environmental protected areas in land and sea, considerations on ground operations and limitations of major potential accidents regarding safety of employees, spaceflight participants and third parties, procedures considerations for recurrent public presentations of safety reports.

WEATHER CONDITIONS AND NATURAL RISKS

Meteorological considerations (such as storms, strong and high winds, temperature) and other natural hazards phenomena (e.g., high risk seismic areas) are of prime importance in the choice of the launch base location since it may restrict launch operations and therefore affect the business plan for commercial launch services. The launch rate of a launch base or spaceport will be directly associated to the meteorological conditions that can strongly affect planned launches. Launches are expected to be operated in clear weather conditions and good visibility for safety purposes. In the absence of detailed local regulations, US Federal Aviation Administration (FAA) regulations should be considered as binding standards.

ECONOMIC IMPACT OF A SPACEPORT AND ENGAGEMENT OF THE LOCAL COMMUNITY

The development and construction of a spaceport represents a significant investment and therefore the break-even can take several years or even decades to reach. Therefore, a spaceport must have a long-term strategy to manage a prospective, but still uncertain launch services market and for this is mandatory to engage the local community and economy to succeed.

A diversified and rich set of variables must be assessed concisely, including:

- Direct effects - Activity and employment by the bidder and its key suppliers. Key suppliers are those who directly supply parts to the launch service;

- Indirect effects - Activity and employment by industries that supply intermediate goods and services to the bidder and its key suppliers. Space tourism and launch infrastructure to be accounted within;

- Induced effects - Activity and employment that is the result of spending by those employed directly or indirectly owing to the bidder activities;

• Catalyst effects - Other benefits not counted above where the bidder activities have acted as a catalyst to benefits being realised. Specifically: i) Aspirational effects; ii) R&D spill-overs; iii) technology-business spill-overs, including easier access to satellites for Portuguese industry.

BUSINESS SUITABLE ENVIRONMENT

The spaceport should be planned together with a set of infrastructures allowing the establishment of a cost-effective solutions for both spaceport construction and operations. The proposed infrastructure will comprise: intermodal connections (airport/harbour/accessible roads that ensure population safety), telecommunications and power services (modern and reliable local/regional grid, reliable water facilities and network, state-of-the art internet connections), and minimum local services (hotels, schools, hospitals, fire safety, air and maritime traffic management).

POTENTIAL INNOVATIVE ALTERNATIVES AND SOLUTIONS

The potential use of air-based launching solutions may be considered, given that the island of Santa Maria has great airport facilities and this would also reduce the impact of a launch pad on the ground. It also extends the possible launch trajectories.