

OPENLANDER
AI-Assisted Autonomous Landing Decision Maker

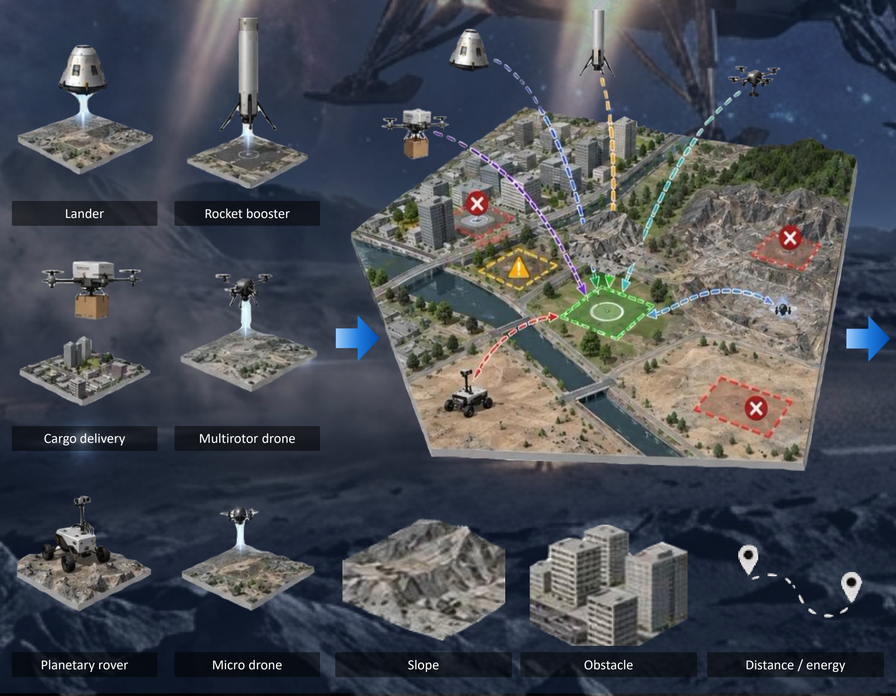
FORUM8
14th CPWC
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Background

Today, spacecraft landings are still highly mission-specific. A landing zone is usually studied in advance, trajectories are carefully planned, and contingency procedures are prepared for a limited set of known situations. That approach works when every mission is rare, expensive, and individually designed. But the future looks very different.



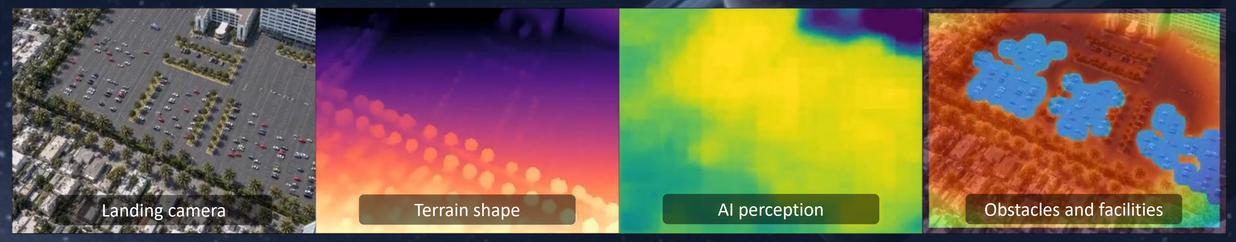
In the future, many more vehicles will need to land autonomously. Not only spacecraft, but also reusable rockets, cargo vehicles, drones, planetary robots, and even very small flying systems. The vehicle may change, but the question is the same: where can I land safely, and can I still reach that place?



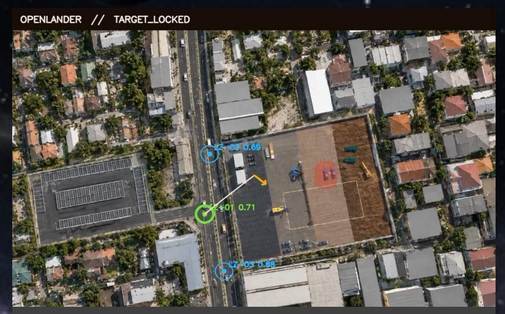


System

OpenLander is an adaptive, AI-powered landing assistant system. It does not look at only one image. It receives a sequence of RGB frames during descent. From a few consecutive frames, it can estimate depth, understand terrain shape, detect obstacles and facilities, and measure how the scene is moving over time. This allows the system to build a live picture of the landing area.

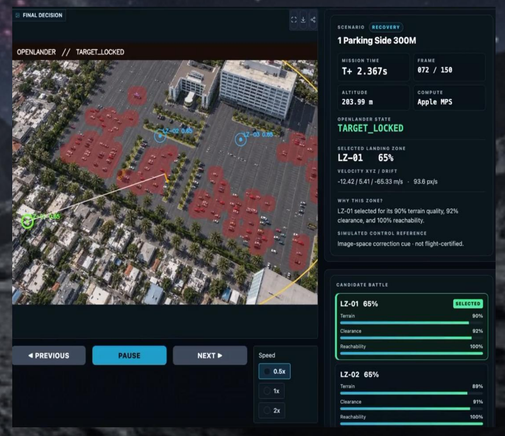


A wide variety of landing environments are constructed and controlled using UC-win/Road. This allows the team to create terrain and infrastructure layouts that would be difficult, dangerous or impossible to capture repeatedly in the real world. The simulation library covers more than 40 landing scenarios, spanning environments such as lunar terrain, Mars-like surfaces, deserts, forests, mountains, coastlines, lakes, cities, densely populated areas, sparsely populated regions and environments containing human facilities.



Landing scenarios by UC-win/Road, green and blue circles mark potential target to land.

Because the decision system is explainable, we can see what happens inside each scenario: which areas were rejected, which candidate was preferred, when drift changed the decision, and why the final landing zone was selected. This makes the system adaptive. It does not choose once and blindly continue. It watches how the situation changes and can switch to a better target when needed. The AI is mainly used for perception: depth, terrain, objects, and semantic understanding. The final decision is made by an explainable scoring system. So OpenLander can say not only where it wants to land, but also why.



Future

In the future, as space becomes more accessible, landing must become more autonomous, adaptive, and scalable. OpenLander is our step toward making that future possible.
Hardware integration with spacecraft and autonomous vehicles. Validate the system on drones and experimental landing platforms. Develop a plugin to simulate detailed landings scenarios in UC-win/Road.