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SpaceX launches mega Starship rocket in successful test flight | AP News

The following was posted on LinkedIn on October 15, 2024, in response to the link above.

Truly an inspirational application of 3-D concepts supported by the global spatial data model (GSDM). Additional comments coming soon – see http://globalcogo.com/catch.pdf.

These are the additional comments.

The dramatic "catch" of a rocket booster embodies many concepts based on first principles including the geometrical environment as described by the global spatial data model (GSDM). See www.globalcogo.com and www.tru3d.xyz.

I was very impressed when watching the video of the SpaceX rocket booster returning to the launch pad. There is much I don't know about details of their success but, applying principles of reverse engineering within concepts of the GSDM, it is easy to conjecture the following.

Success of the catch relied on:

1. **The location of the target (launch pad) had to be known – feature of a high-definition map.**

2. **The instantaneous location of the booster had to be known in real time.**
    a. **Requires very fast computers.**
    b. **Determined by GNSS.**
    c. **Supplemented by inertial positioning.**

3. **Predicting the trajectory of the booster based on:**
    a. **Equations of motion subject to –**
        i.) **changing mass due to burning fuel.**
        ii.) **changing gravity due to changing elevation.**
    b. **Strategic corrections applied with thruster firings.**

4. **Knowing the positional accuracy of both target and booster.**
    a. **Target - within the "global" ECEF system – network accuracy.**
    b. **With respect to the spatial separation between them – local accuracy.**

5. **Rotation matrices used to reconcile the orientation of. . .**
    a. **Target (launch pad) – presumably stationery with respect to ECEF.**
    b. **Booster in multiple axes as determined from observations by . . .**
        i.) **GNSS in true 3-D.**
        ii.) **Inertial measuring unit in pseudo 3-D.**

Notes:

1. **Monitoring the "catch" is computationally intensive but uses "standard" equations.**
2. **This project bears some similarity to surveying with drones.**