

Feasibility Study on Missile Launch Detection and Trajectory Tracking

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Thesis Objectives

- This thesis studies the feasibility of utilizing UAVs to patrol a potential Intercontinental Ballistic Missile launch area using a single or multiple Counter Unmanned Aerial Vehicles (CUAVs), detecting the launch event and tracking it using the CUAVs' onboard optical sensors.

Main Research Ideas

- Using a simulation program to detect a launch event offline and track the missile trajectory. Research is based on the amateur rocket launch data gathered during the launch trials at Mojave Desert in May of 2016.

Research Results

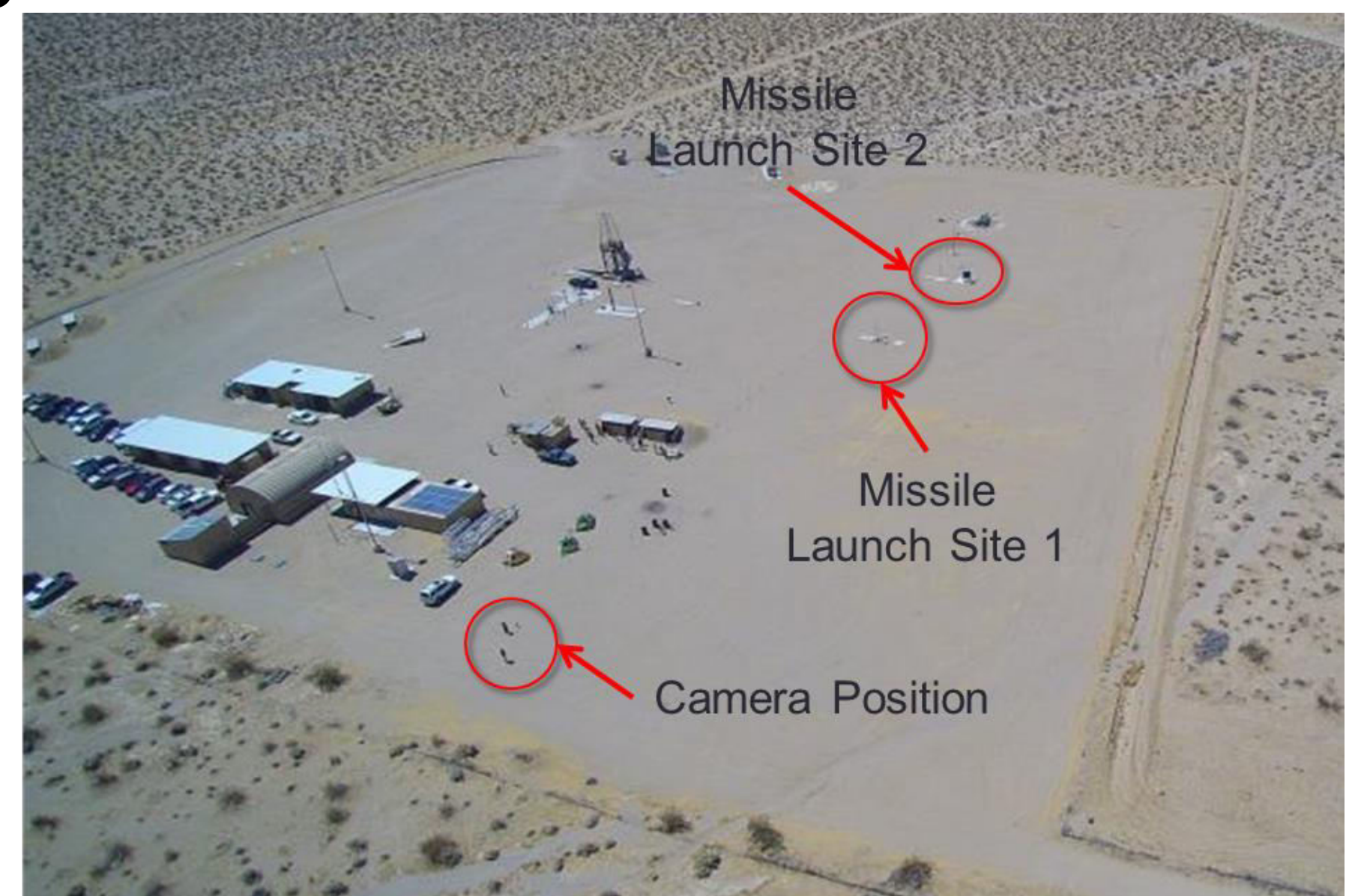
- Simulation program is unable to consistently detect a missile launch and track its trajectory for all the test videos. However, the developed algorithms allowed a surveillance UAV to detect a missile launch for most of its videos and track its trajectory with an accuracy that is sufficient for targeting purposes.

Benefits/Potential Applications of the Research

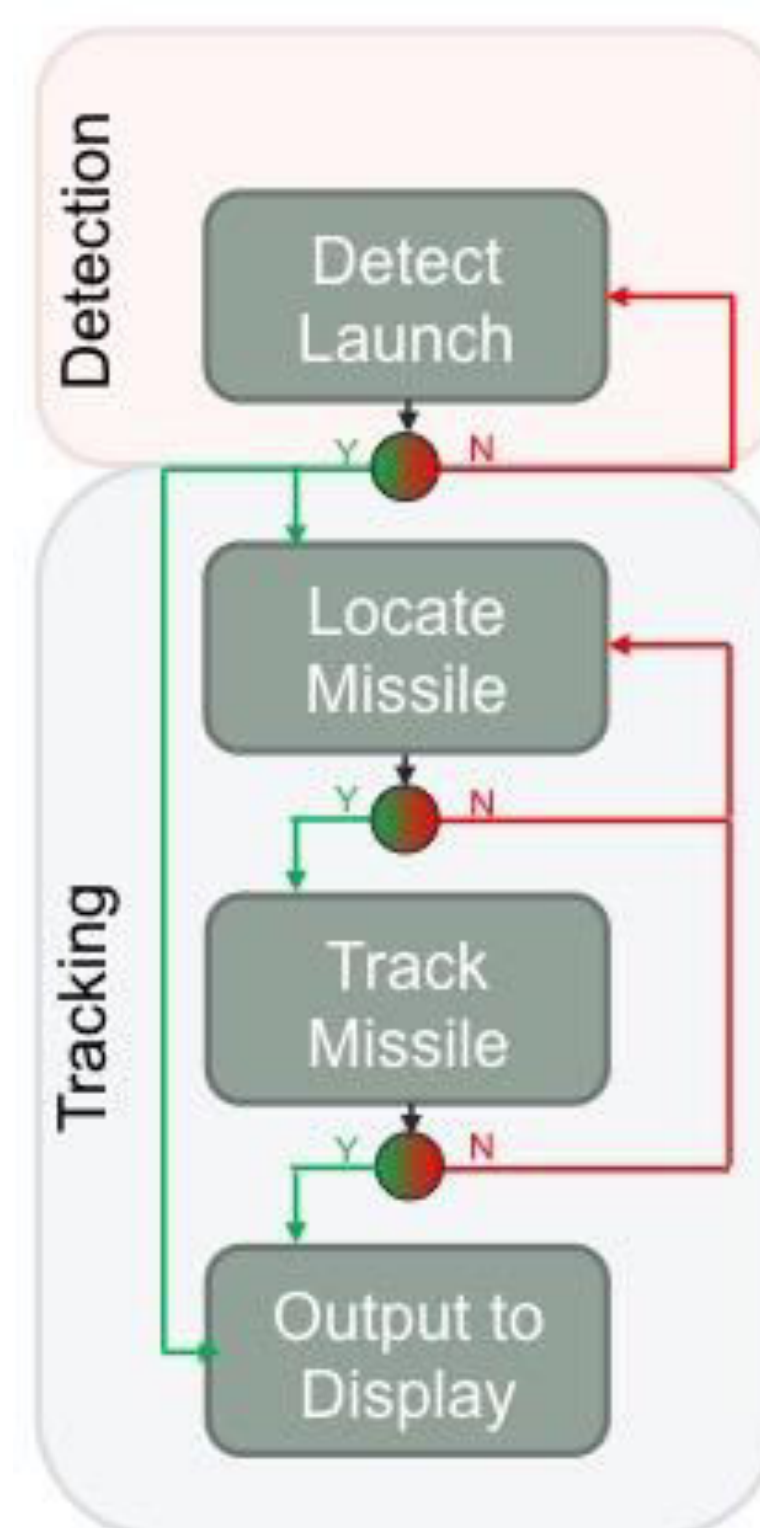
- Simulation program can be enhanced to improve the missile trajectory tracking methods and determine the 3D location of the missile. If the video can be stabilized, the simulation program can allow real-time surveillance by the UAV at the missile launch site.

Further Research Areas

- Determination of missile location in 3D space.
- Video Stabilization
- Object Motion Tracking



Experimental Setup of the Missile Launch



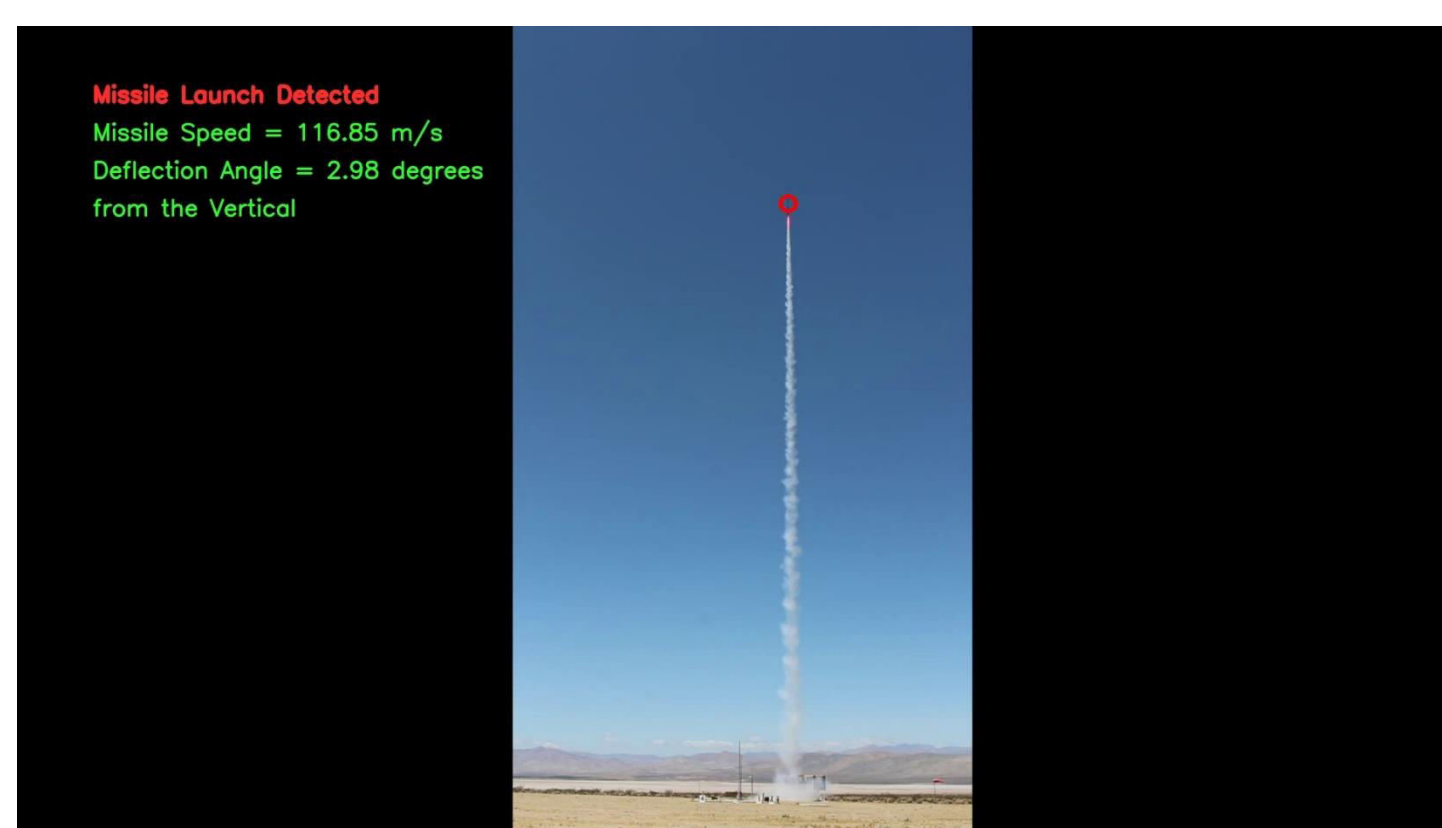
Simulation Program Algorithm



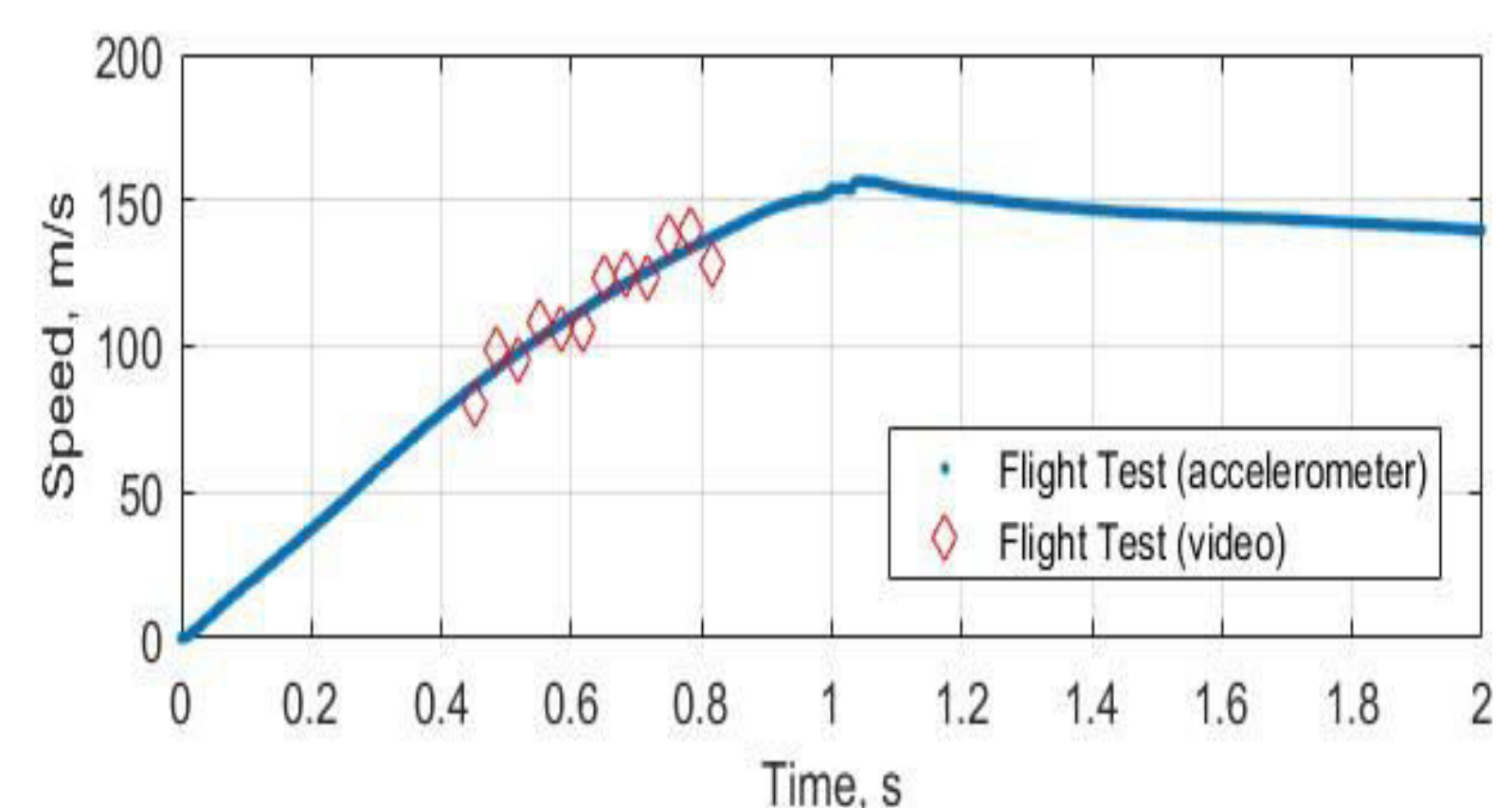
Missile Trajectory Tracking



Missile Launch Detection



Rocket Speed Calculation



Rocket Speed Time History