

GNSS Controlled Rescue System for Drones

Clemens Reitbauer, Manfred Wieser
Institute of Geodesy - Working Group Navigation
Graz University of Technology

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Motivation



Clemens Reitbauer
22.11.2018

Risks

- Uncontrolled UAV crash
 - Risks for humans
 - Risks for buildings
 - Material damage - expensive equipment



Quelle: <https://i.ytimg.com/vi/ApYaYDB498o/hqdefault.jpg>



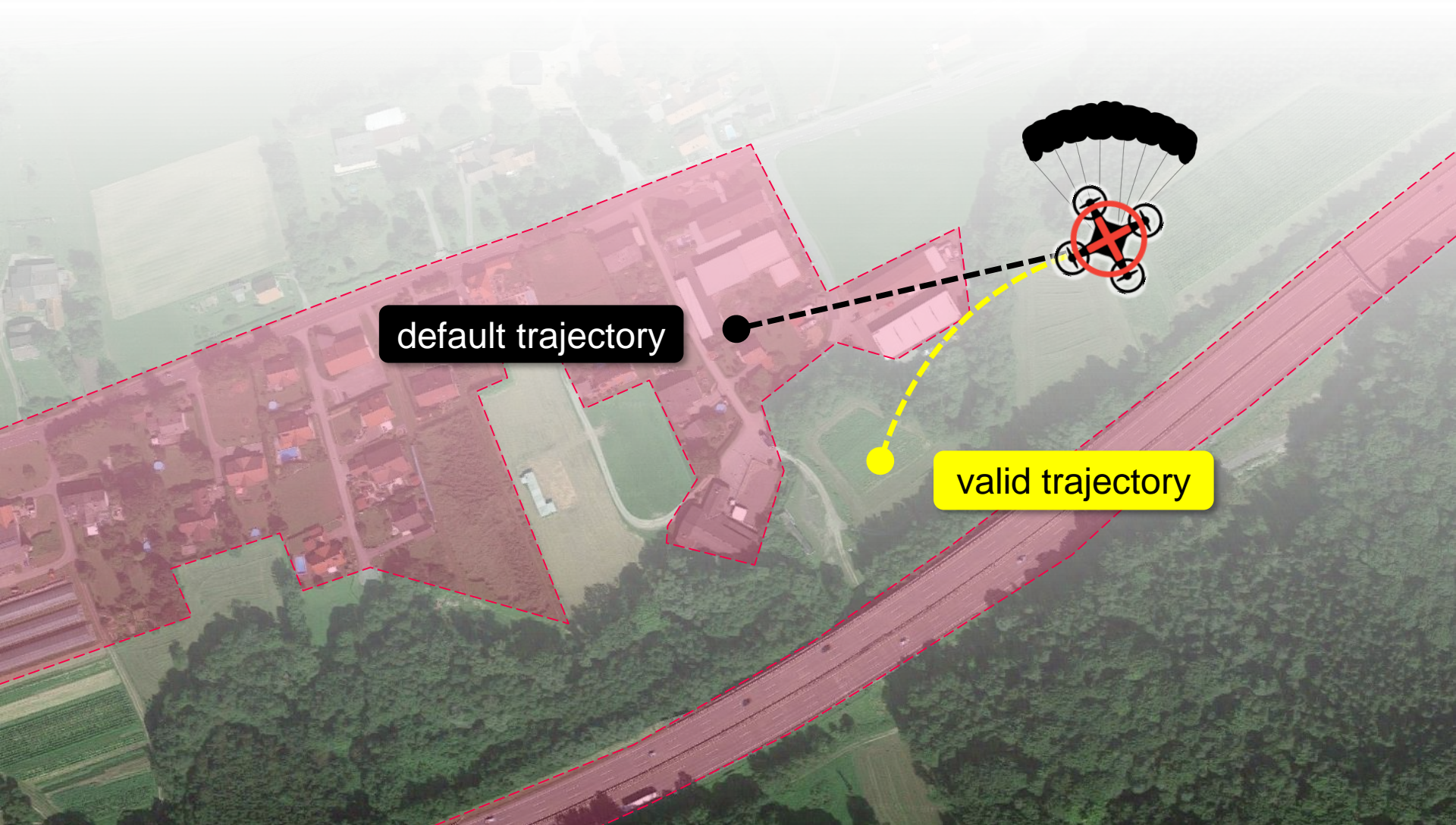
Quelle: www.berliner-kurier.de

Project Idea - GRESY

- Parachute based rescue system for drones
- Development of a fully autonomous steerable parachute
- Avoiding non-landing-zones
- Autonomous parachute deployment during critical flight conditions or while entering no-fly areas
- Data logging in black box



Scenario

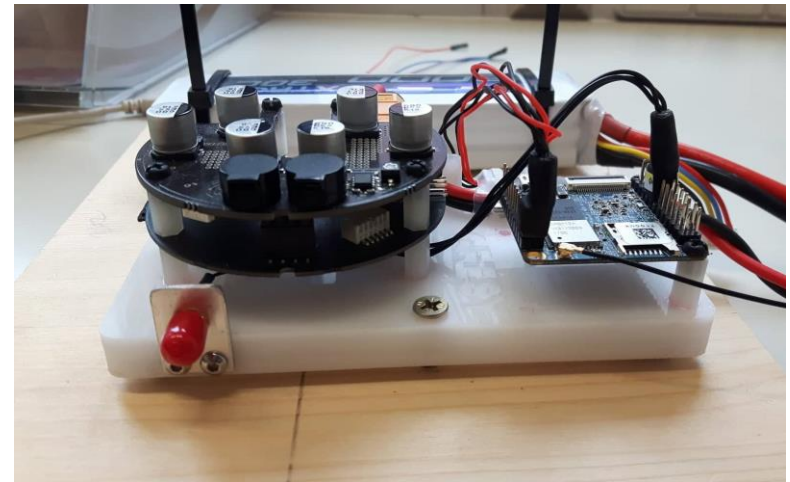
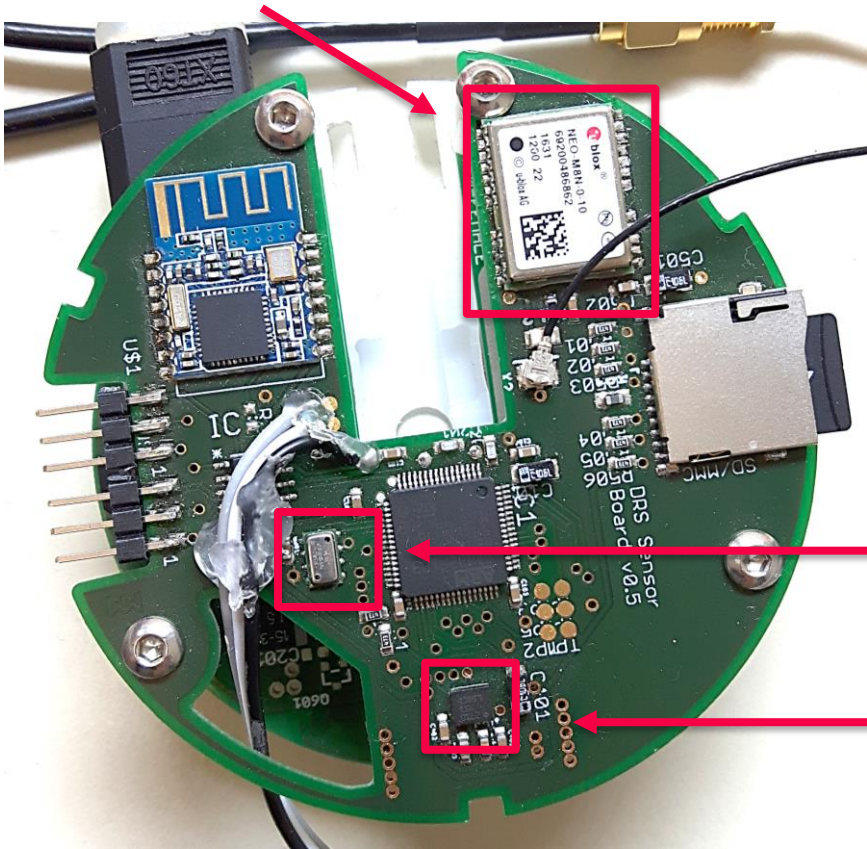


Prototype



Navigation module

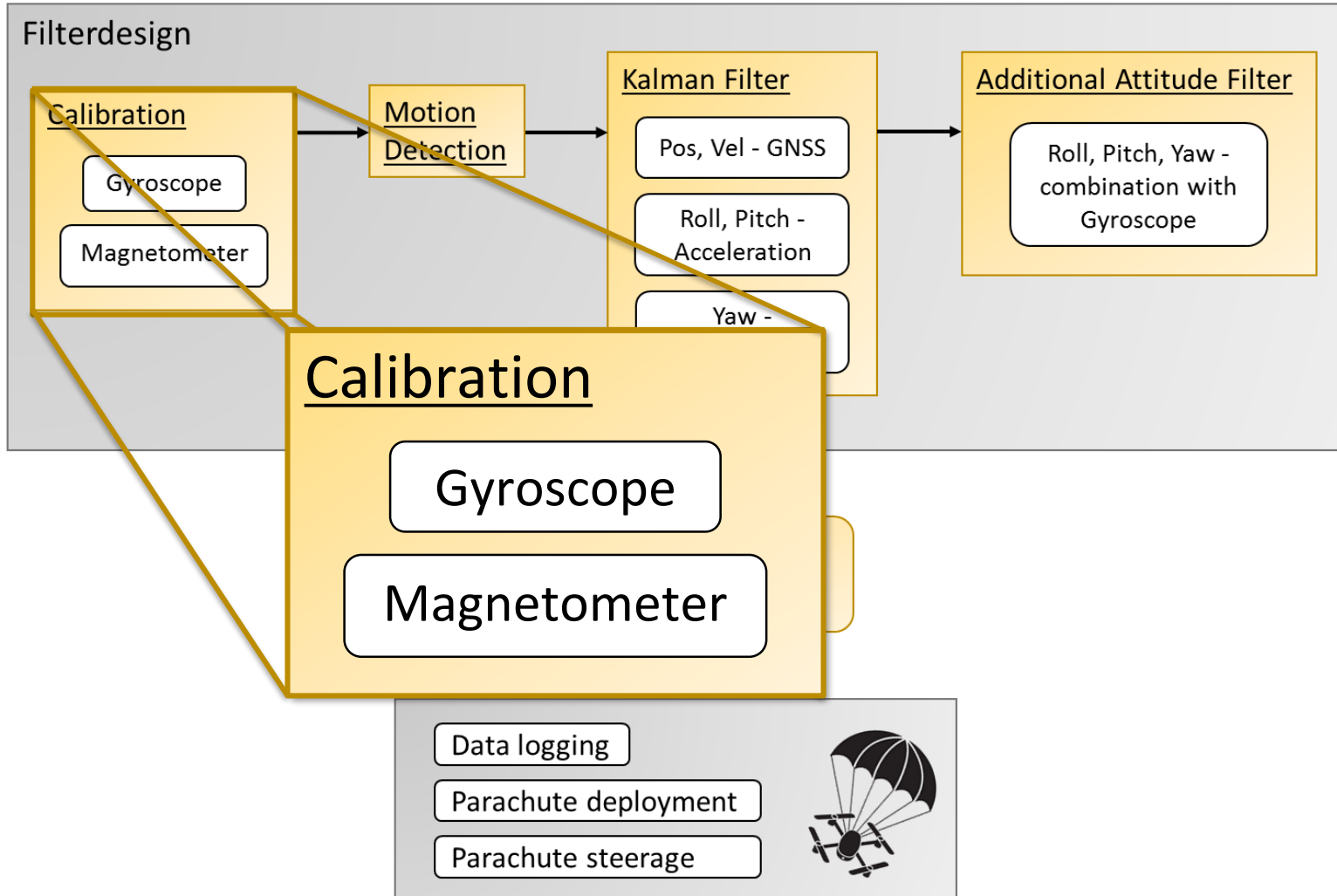
GNSS-Chip SPP



Barometer

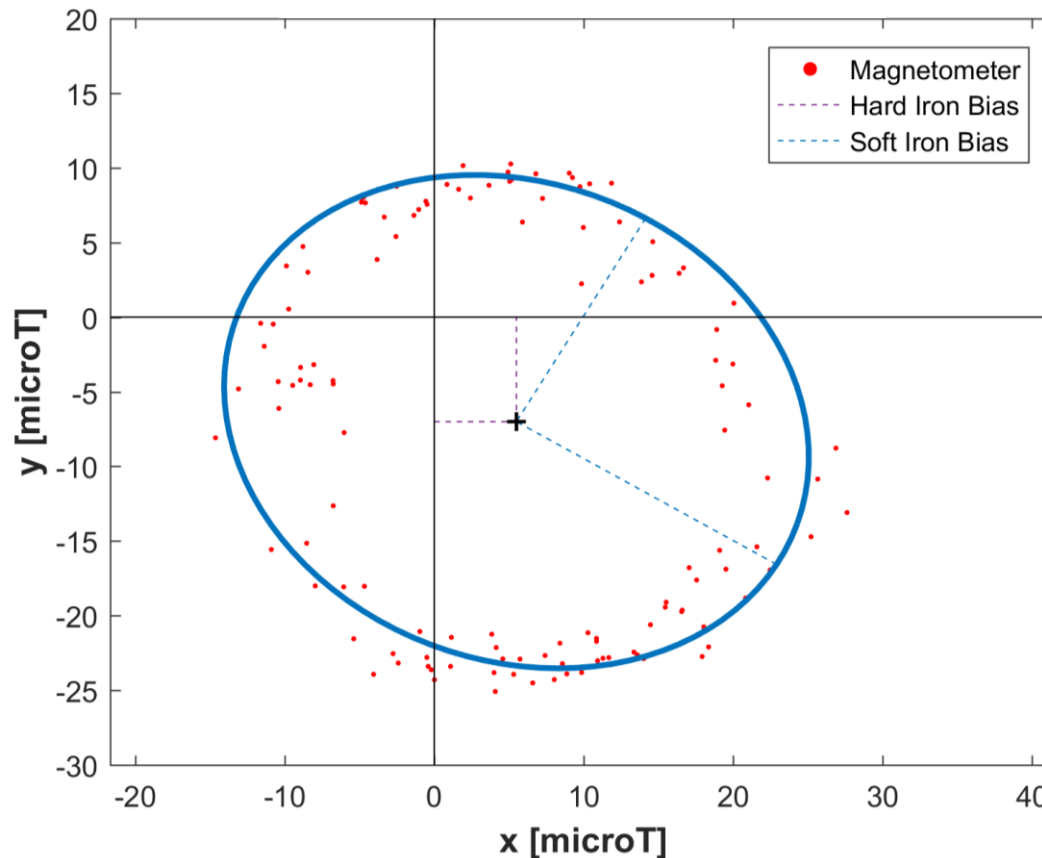
Accelerometer
Gyroscope
Magnetometer

Workflow – Navigation Filter

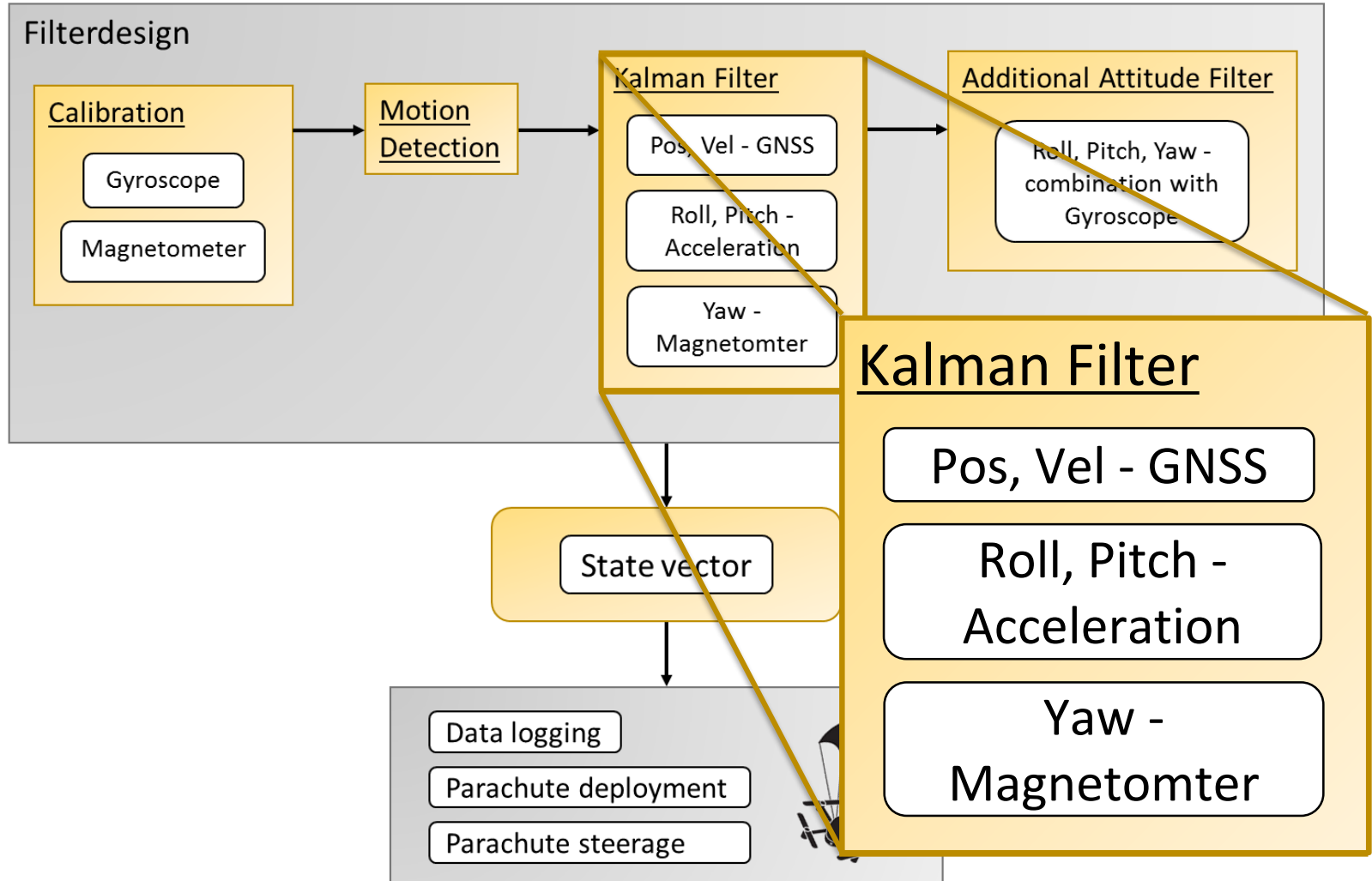


Magnetometer - Calibration

- Rotation about all three axes - sphere

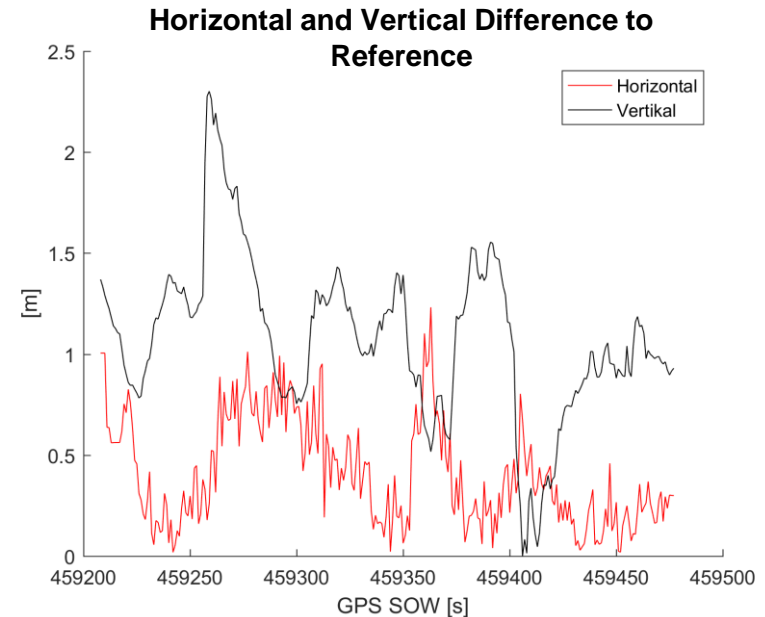


Workflow – Navigation Filter

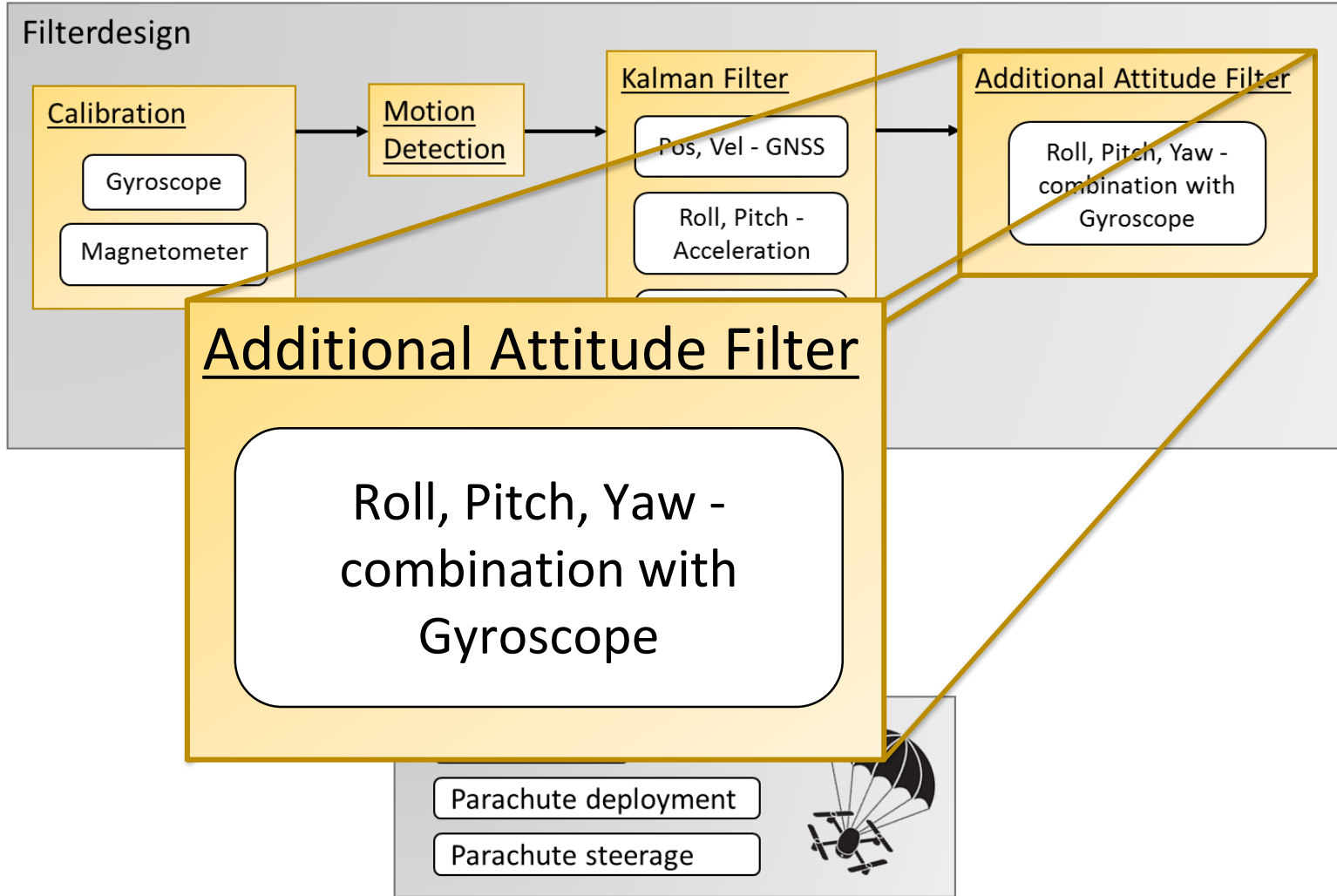


State Vector Estimation

- Kalman filter
 - Uniform motion
 - Position, velocity, attitude
- Position and velocity are uncorrelated from attitude

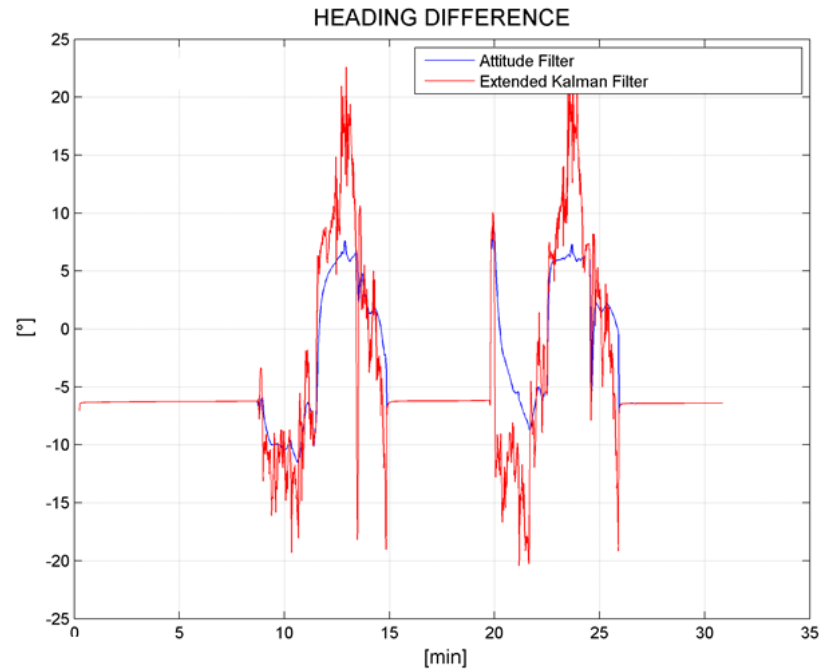


Workflow – Navigation Filter



State Vector Estimation

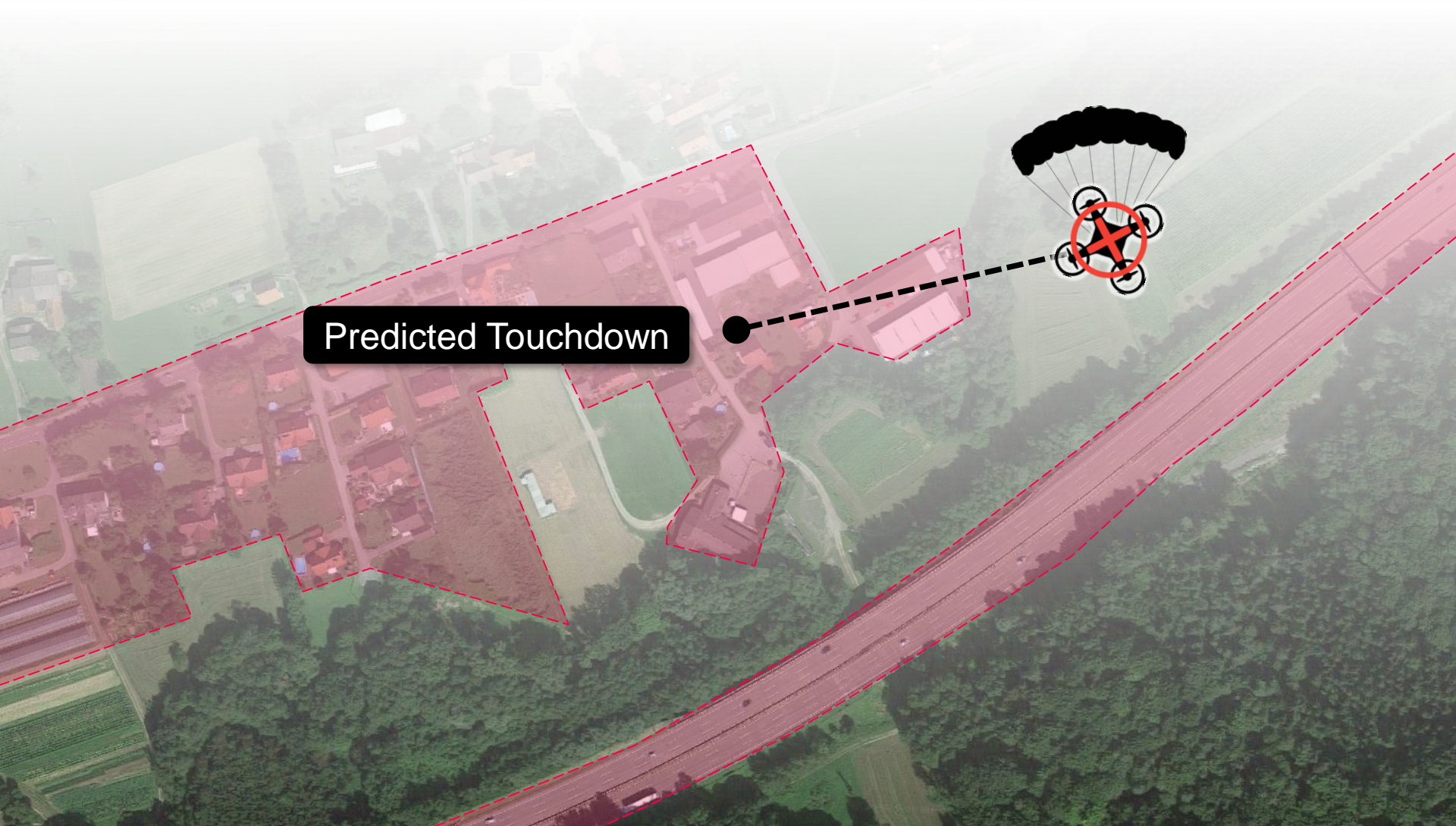
- Additional attitude filter
 - Combination with gyroscope data in kinematic phases



Parachute Deployment

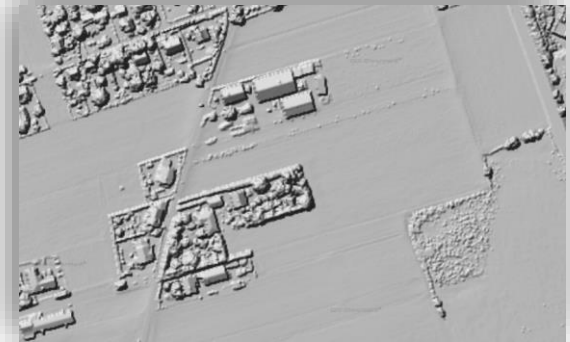


Parachute Steering

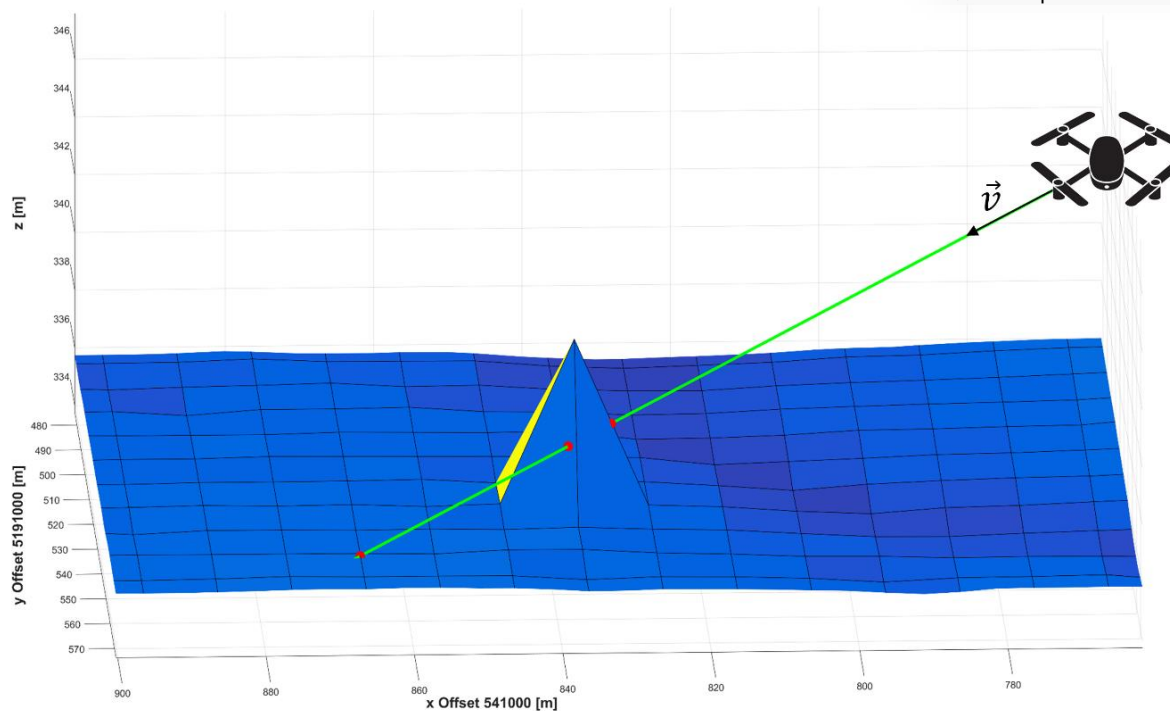


Touchdown Prediction

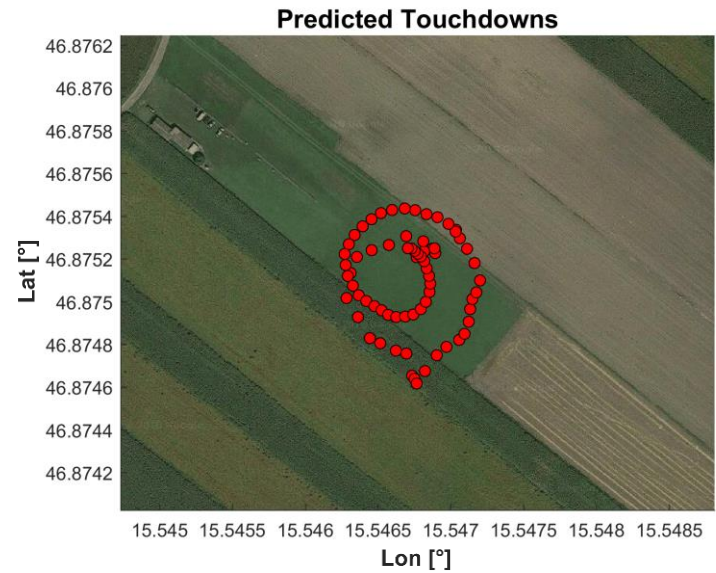
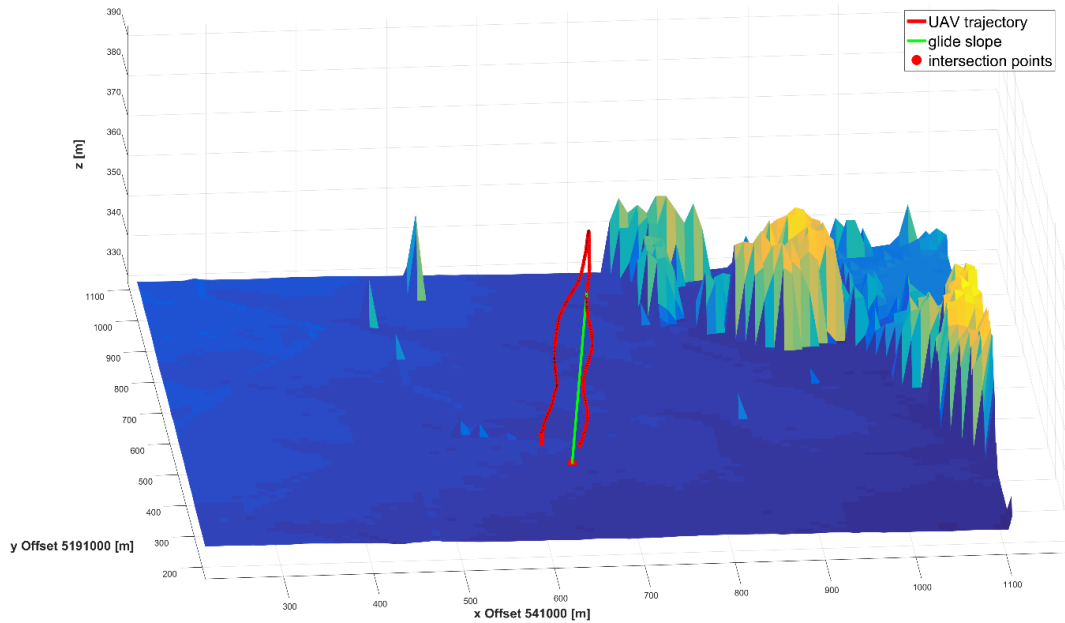
- Digital Surface Modell (DSM)
- Glide slope
- Position and velocity vector

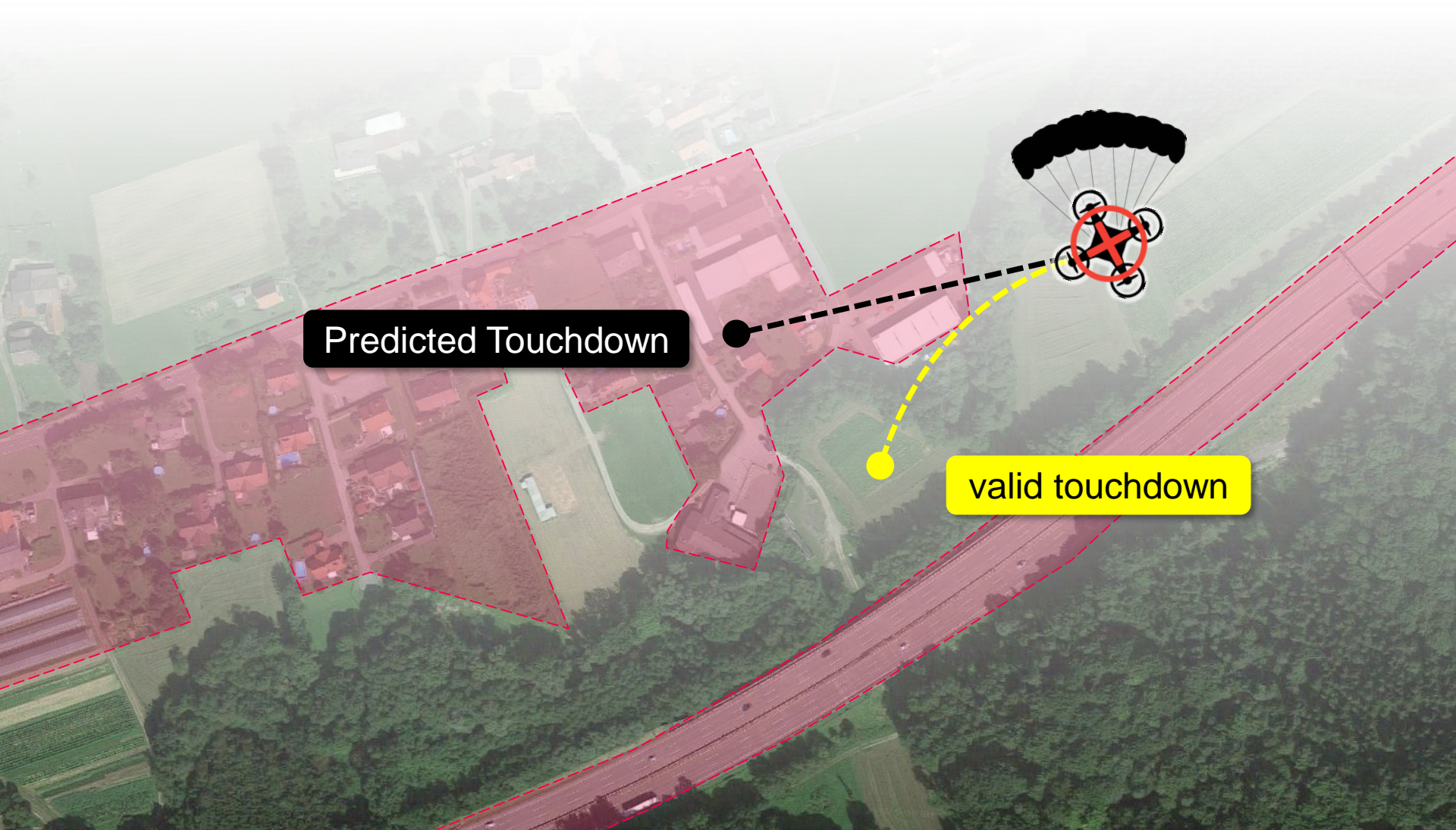


Quelle: <http://www.landesentwicklung.steiermark.at>

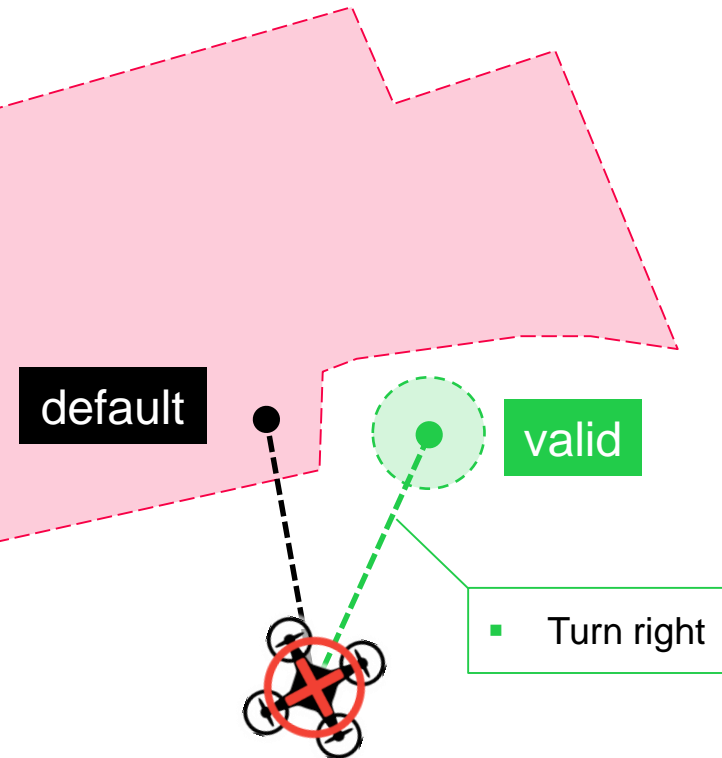


Touchdown Prediction





Valid Touchdown

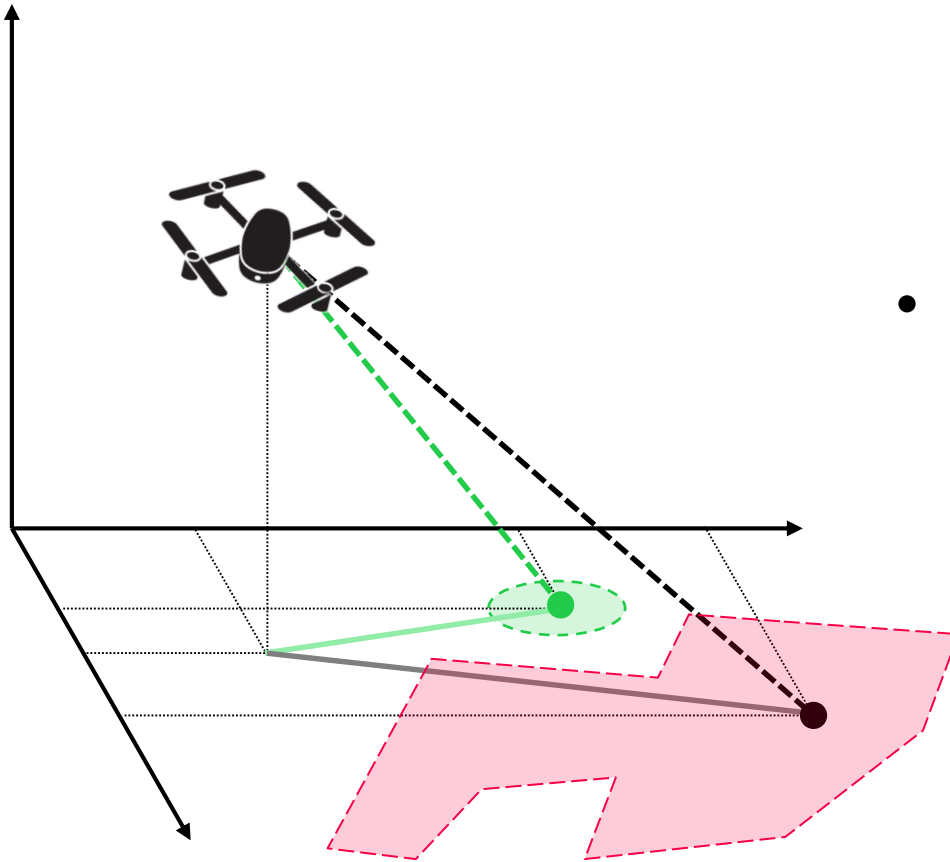


- Find a valid touchdown near the default touchdown that meets the minimal maneuvers (just pull right/left)
- For failsafe purposes, a buffer (30 m) around the target location must not intersect the non-landing-zones

Find Valid Touchdown



Valid Touchdown



- From the two given vectors (default and valid), steering parameters can be computed
- Steering parameters control either the direction or the rate of the descend

Status Quo



- Navigation module
- Automatic parachute deployment
- Touchdown prediction
- Find valid touchdown



- Steering-engines hadn't enough power
- Tests



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