Mountain Search and Rescue with Remotely Piloted Aircraft Systems

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A. Motivation and Opportunities

Increasing number of people practicing winter sports in backcountry areas

Avalanches are one of the greatest hazards

RPAS can contribute to save lives by means of:

- Autonomous search of ARTVA signal
- Visual (visible/IR) Search&Rescue
- Aid Kit deployment

Haegeli P, Falk M, Brugger H, Etter HJ, Boyd J. 2011. Comparison of avalanche survival patterns in Canada and Switzerland. CMAJ, 183(7):789-795.
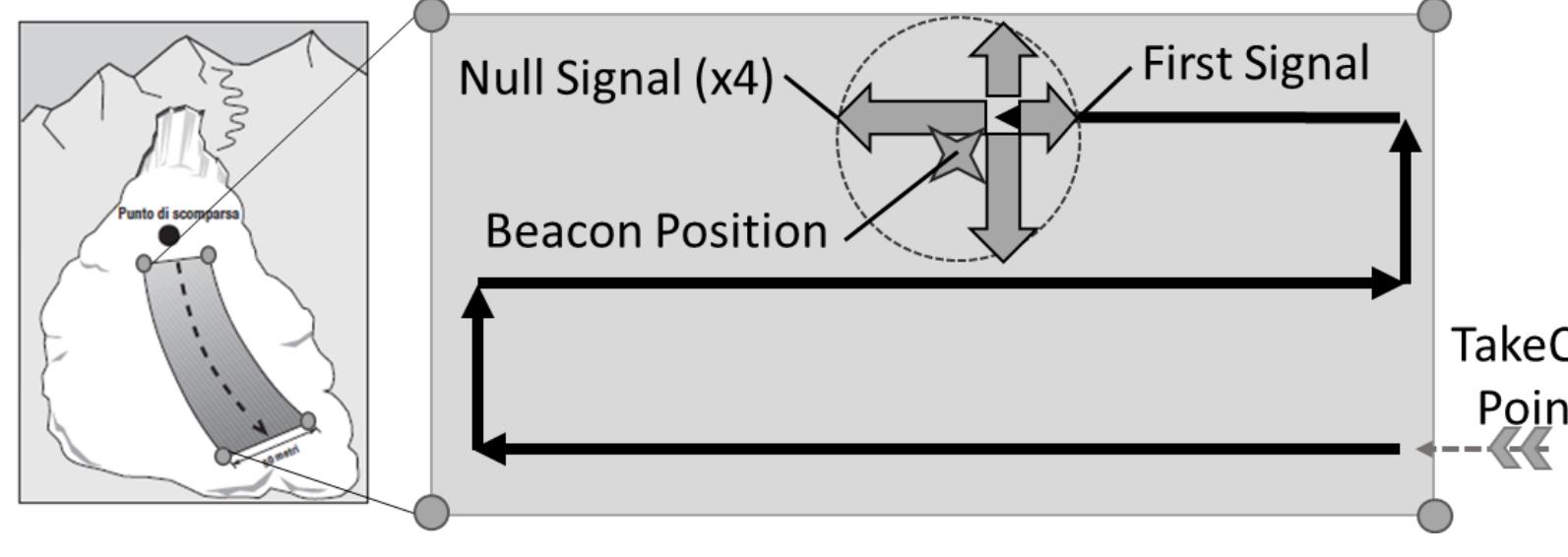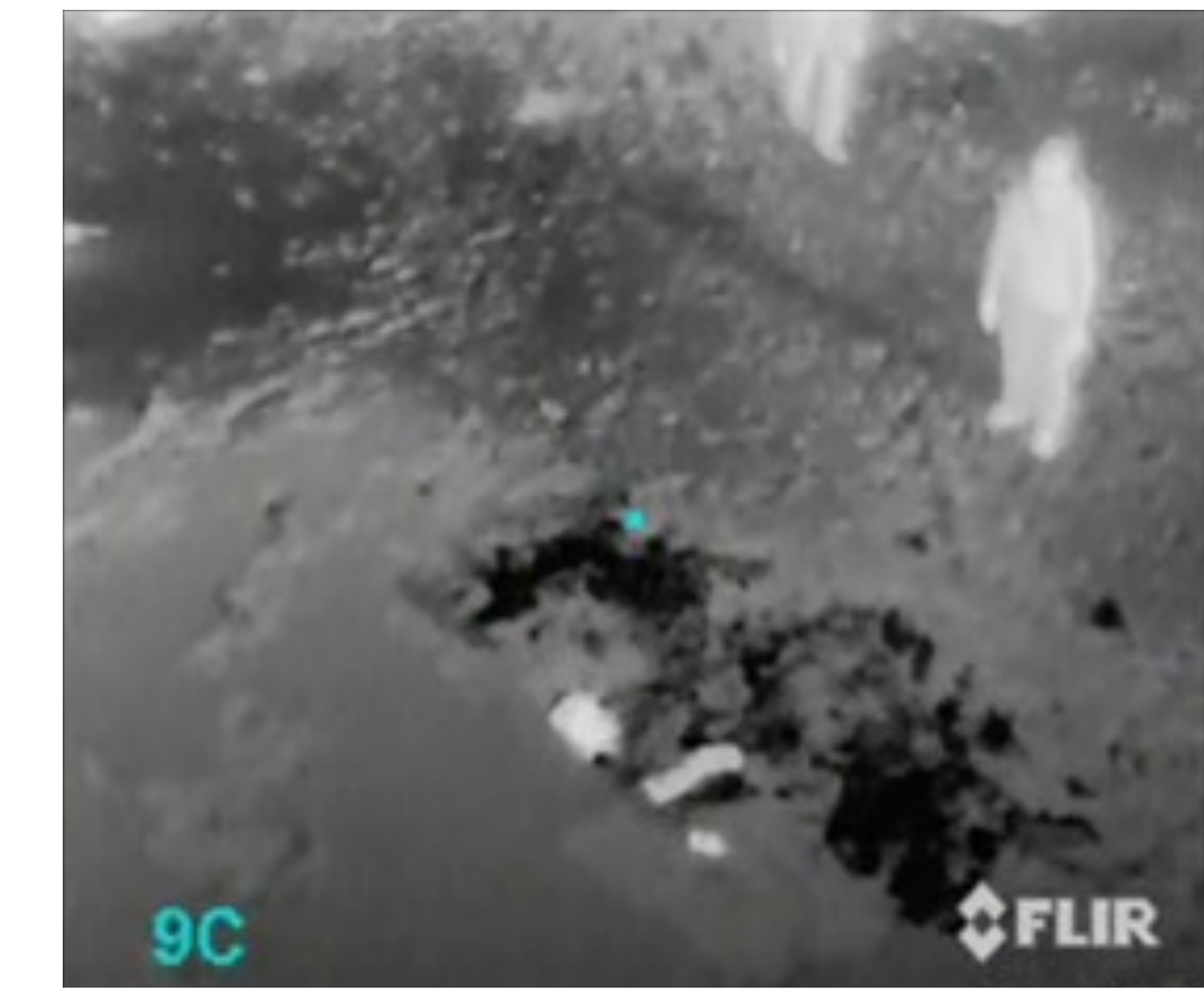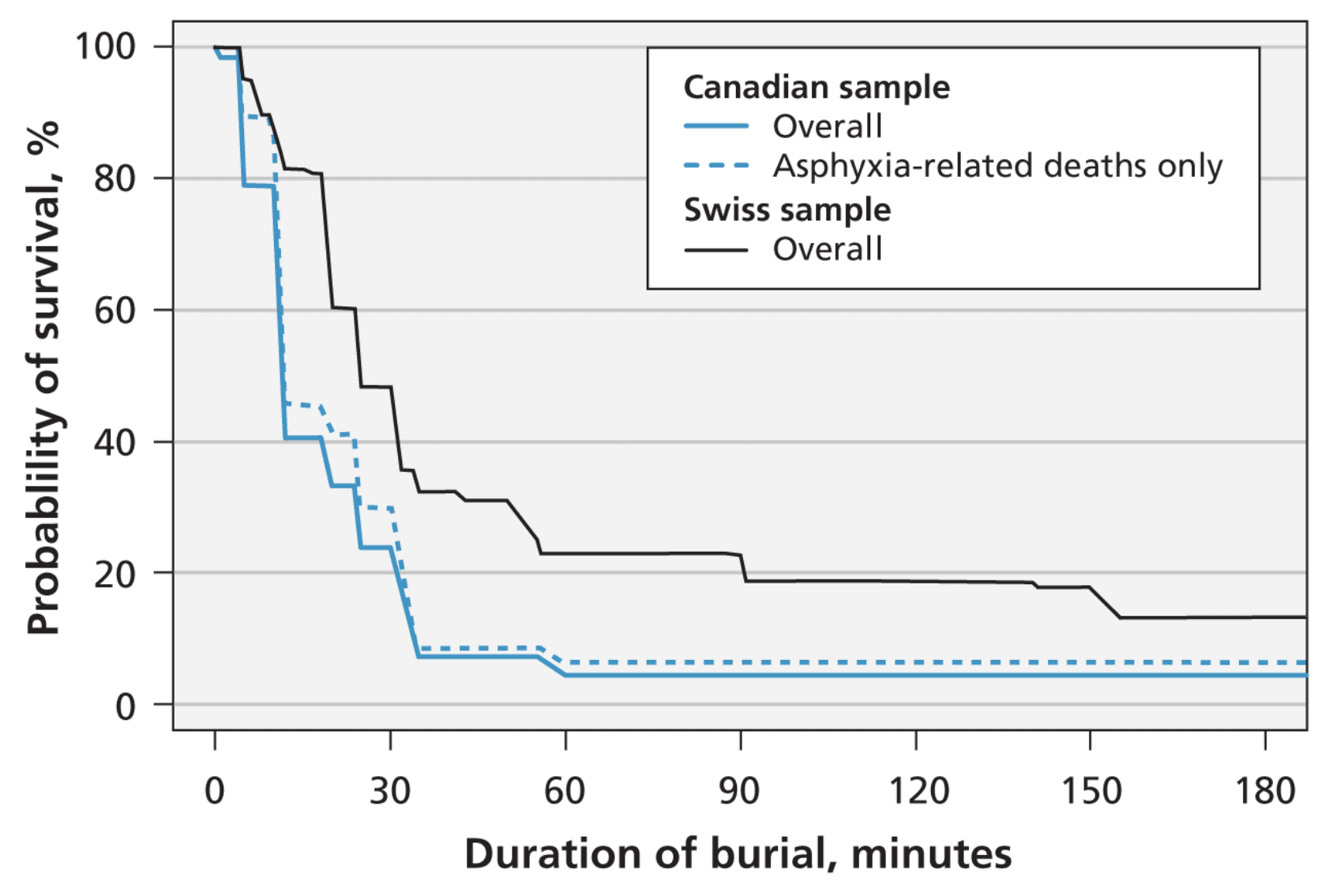

B. Rescue Mission

Follows the typical ARTVA search path

Minimal RPAS deployment time (to T.O.)

No need of flight programming and sensors calibration

Full Automatic flight (no remote piloting)

Typical search path with

- GRID
- CROSS

Automatic Landing on Identified Target (opt. GPS coordinate)

C. Proposed Solution and Devices

Small commercial quadcopter RPAS with:

- Customizable SW
- Calibrated Sensors
- Full Autonomous capabilities

Retractable ARTVA Antenna

- Compact design for easy transport/deploy
- Proper distance from Avionics/Power
- Minimize wind and manoeuvres effects

Automatic Terrain Following

- Cope with mountain orography
- Constant ground-antenna distance
- Landing time optimization

Full Autonomous Mission

- Auto Heading / Avalanche size selection
- Automatic in-flight reprogramming by detected ARTVA signals

DSP based ARTVA signal processing

Optional GCS monitoring/communication
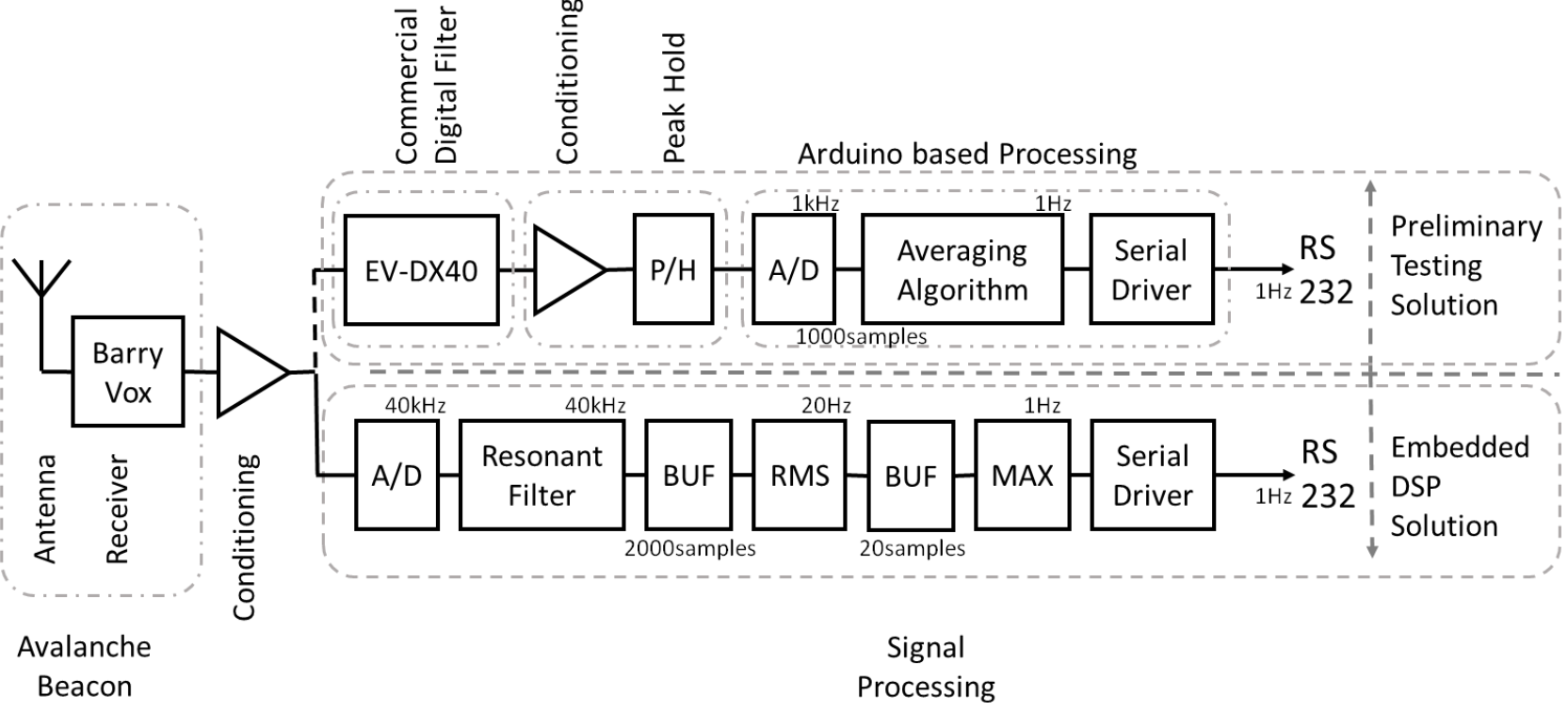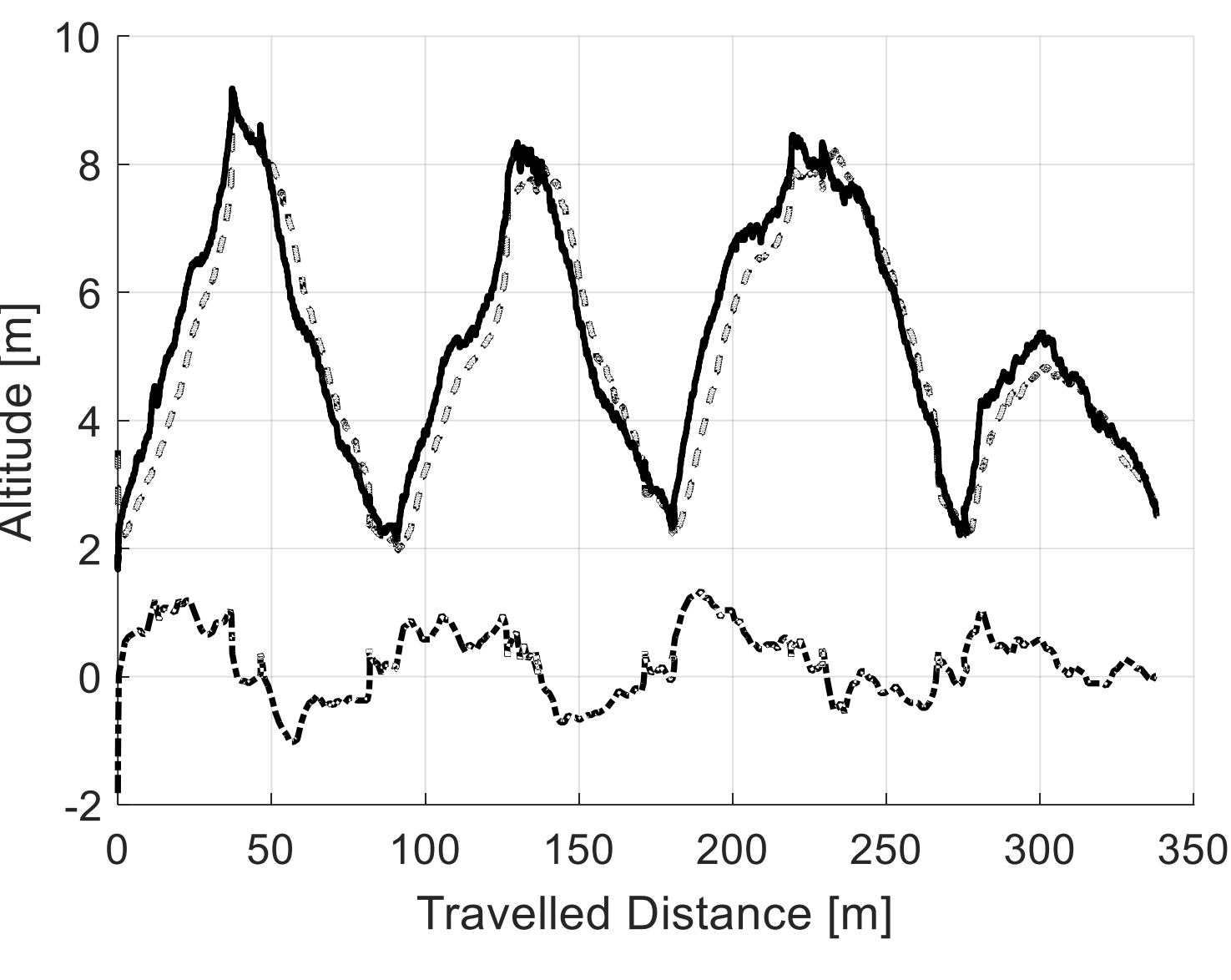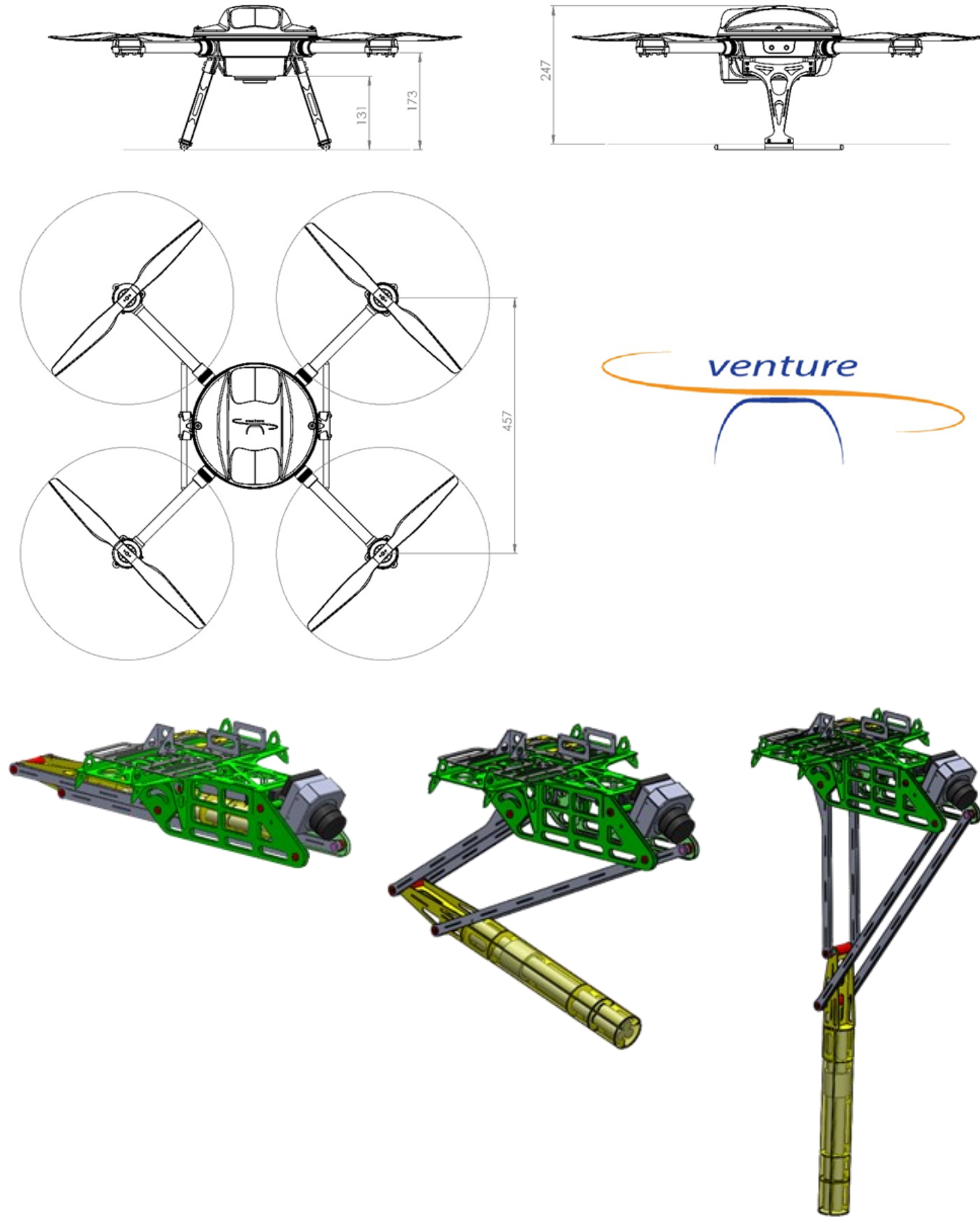
D. Results

TOW: 3.5kg (incl. ARTVA, IR, 6s4.6Ah LiPo battery)

Reliable flight in mountain: altitude/temperature/wing/terrain

Flight time optimization (turns/landing)

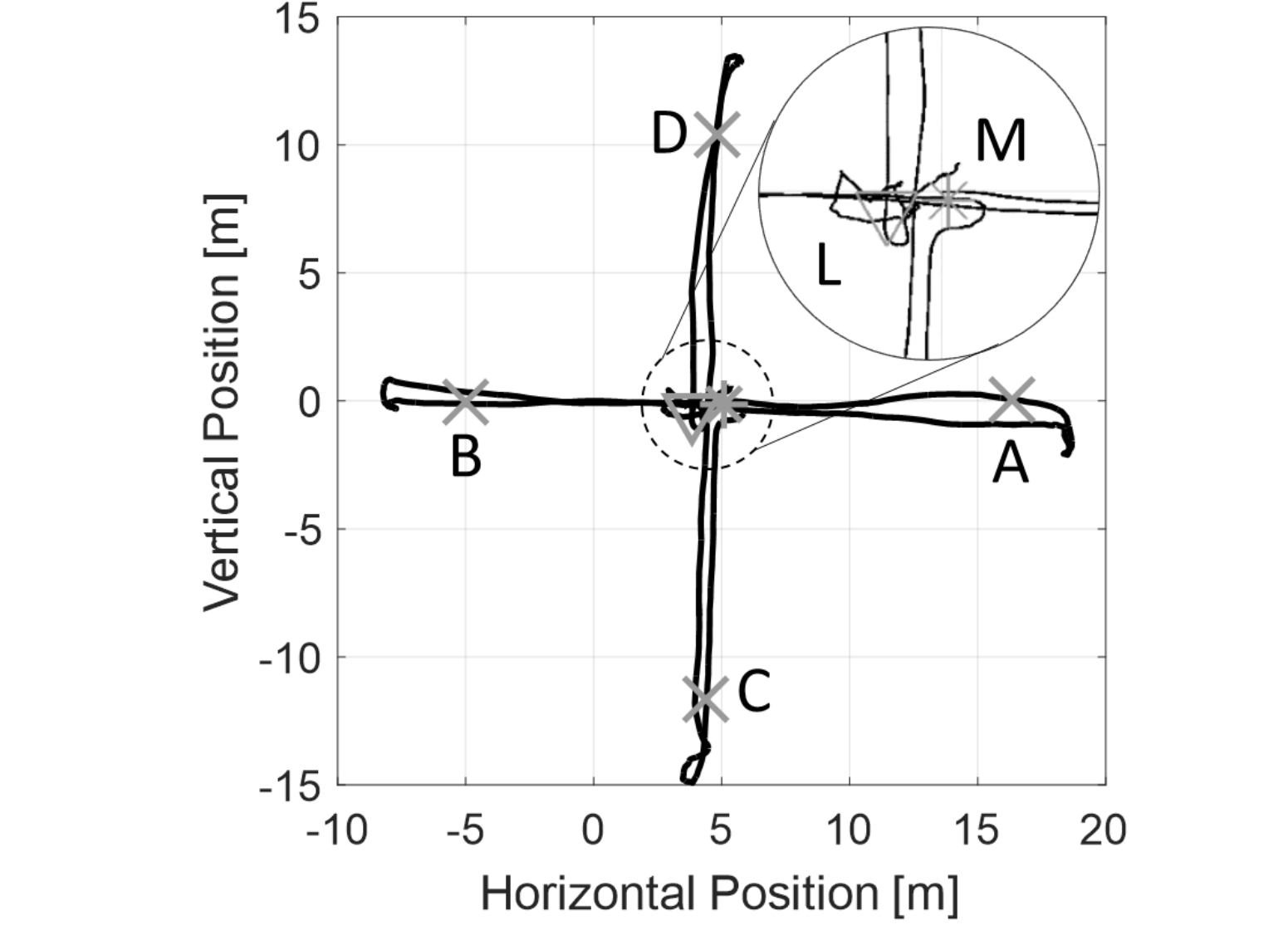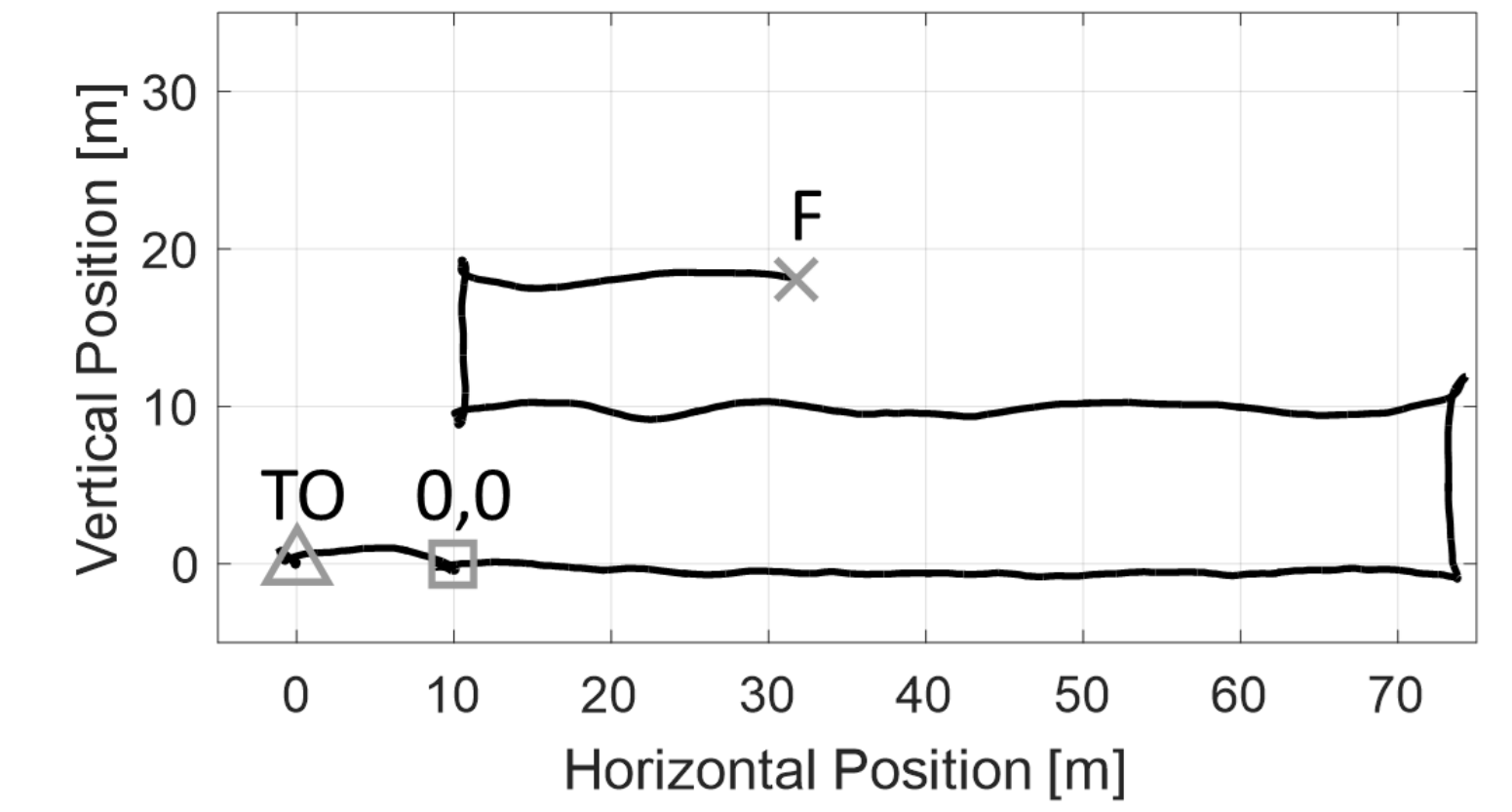Navigation accuracy 1-2m (GPS+IMU, 5m/s wind gust)

Reliable ARTVA detection (limited by beacon TX timing)

Detection ranking for additional refinement

Flight Speed : min 4m/s (GRID), typ. 2m/s (CROSS)

Typical buried identification accuracy less than 1m

S.L. Altitude	300m	2200m
Power Consumption	460W	550W
Endurance	13min	11min

E. Conclusions

Tests performed in backcountry terrain show the effectiveness of RPAS for:

- ARTVA search of buried people
- Visible/IR search of partially buried people