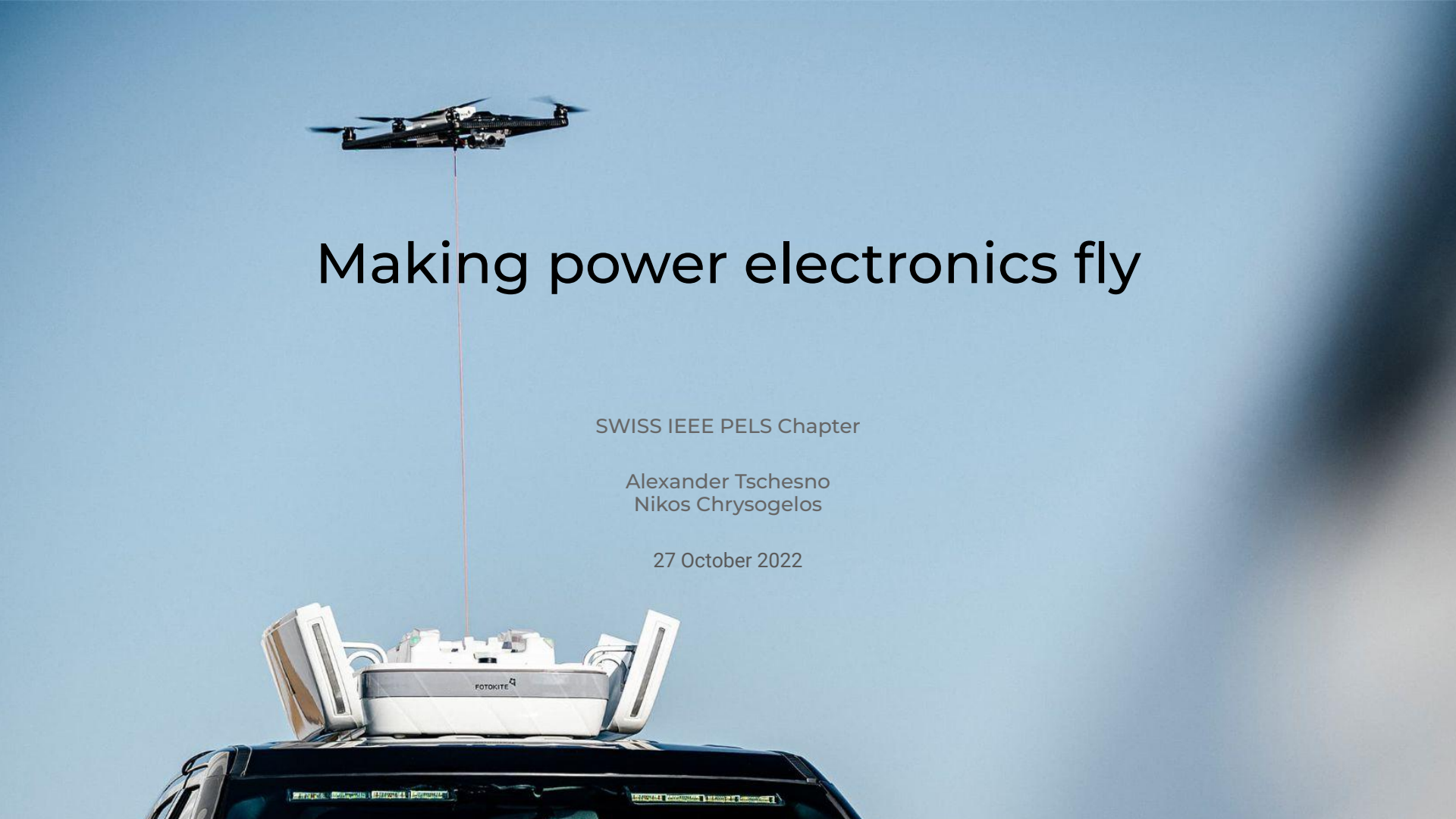
FOTOKITE



Making power electronics fly

SWISS IEEE PELS Chapter

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Nikos Chrysogelos

27 October 2022

Major fire in an industrial area of Spreitenbach AG, May 29th 2022
Source: 20min.ch, 01.06.2022

Source: Fotokite, commercial photo shoot Eiken AG, 27.06.2020

Source: Fotokite, commercial photo shoot Eiken AG, 27.06.2020

Situational awareness for first responders

Immediately

Single button push to launch

Uninterruptible flight

Active tethered drone

As long as required

Shore power

As little resources as possible

Fully autonomous system

Situational awareness for first responders

Uninterruptible flight

Active tethered drone

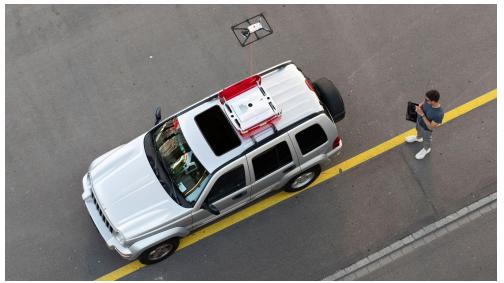
As long as required

Shore power

Shore power

Sigma (AC)

Rooftop Box (DC)



Active tether

Angle and tension control

- Force sensor-based active spool and thrust control

Data

- >2x 1080p video streams and control data

Power

- 360V - 380V DC @ 1 A

Power electronics requirements

Kite

Weight		
Efficiency		
Volume		
Water proof		
Cost		

Ground station

Kite power

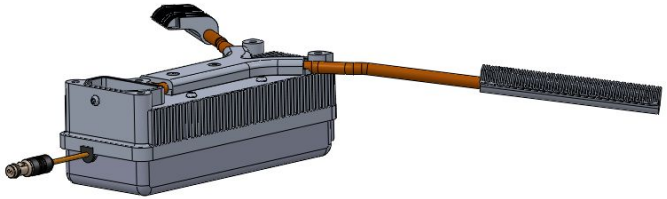
- Input voltage 380V
- Output voltage 24V
- Power ~ 500W
- PLC filters

- η ~ 93.5%

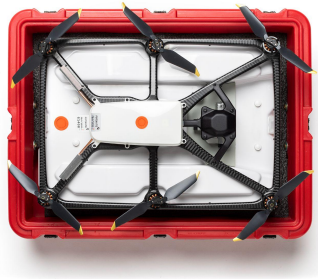
Kite power

- Input voltage 380V
- Output voltage 24V
- Power ~ 500W
- PLC filters

- η ~ 93.5%
- 143gr (12% of kite)
- 10 kW/l



Ground station power

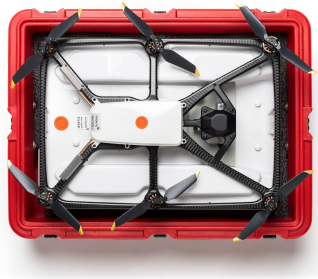


AC 90V - 230V

DC 10V - 32V

- P ~ 900W
- 2 Outputs (HV & LV)

Ground station power



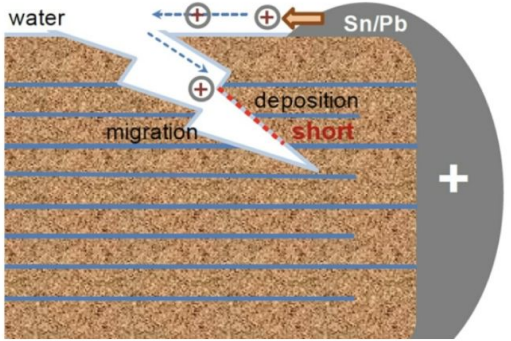
AC 90V - 230V

- η ~ 96%
- 900gr (10% of GS)
- 1 kW/l

DC 10V - 32V

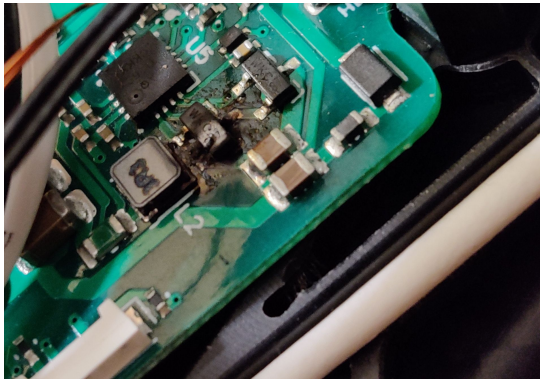
- η ~ 89%
- 1 kg (10% of GS)
- 0.9 kW/l

MLCC failures



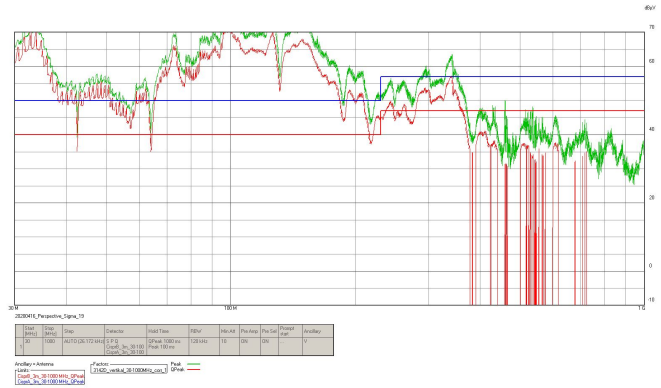
Mitigations

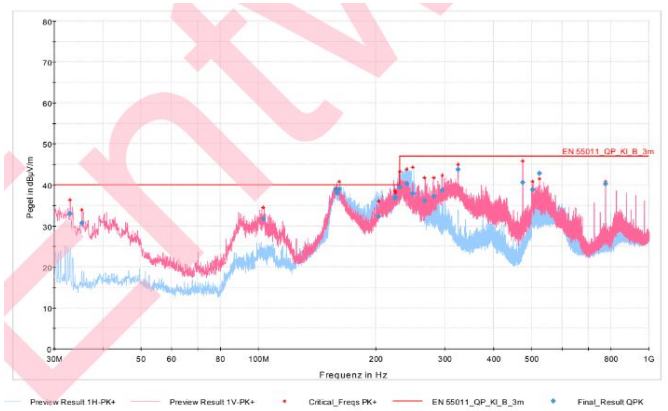
- Boardflex and automotive type
- Distance to rigid parts (mounting points and connectors)
- Additional circuit adjustments



EMC debugging

- System debugging
  - Isolate relevant noise sources
- In-house debugging
  - EMC toolkit (current and near field probes)
- Variation of Y caps resonant frequencies
  - Manufacturer / value dependent





Learnings

- Radiated emissions for every subsystem before integration
- Y caps have various resonant frequencies
- Test setups: Improvise. Adapt. Overcome
  - EMC
  - Thermals
- Climatic chamber is a must
- Vibrations destroy MLCCs
- Power Electronics for manufacturing


Thank you!