

International Radar Symposium IRS 2023

Károly Árpád

Kis

University of Debrecen

Ungarn



International Radar Symposium

IRS 2023

24 – 26 May 2023

Fraunhofer Forum Berlin, Germany

IRS

Parallel Session 123

Radar Applications

Chairs: Jochen Bredemeyer / István Balajti

14:00

Long Range Noise Radar Concept

Łukasz Maślikowski and Krzysztof Kulpa
Warsaw University of Technology, Poland

14:20

From TOPAs to ESIT: Estimating Transponder Load using Digital Twins of Surveillance Infrastructure

*Helmut Schreiber¹, Wolfgang Bösch¹, Helmut Paulitsch¹, Andreas Schlemmer¹,
Matthias Schäfer², Marc Kraft², Andrea Bartl³, Andreas Oberluggauer³ and
Jerome Bodart⁴*

¹ Institute of Microwave and Photonics Engineering, Graz, Austria

² SeRo Systems GmbH, Frankfurt/Main, Germany

³ Austro Control GmbH, Vienna, Austria

⁴ EUROCONTROL, Brussels, Belgium

14:40

Radar spectrum measurement from drone platform in situ

Károly Árpád Kis, Kornél Sarvajcz and István Balajti
University of Debrecen, Hungary

15:00

Investigation Of Effective Medium Theory Concerning Applications For Skin Cancer Detection

Nicolas Treier¹, Herman Jalli Ng², Serdal Ayhan² and Marlene Harter¹

¹ University of Applied Sciences Offenburg, Germany

² University of Applied Sciences Karlsruhe, Germany

15:20

UWB Radar-Based Pet Monitoring on Daily Basis in an Unconstrained Living Environment

Seongkwon Yoon, Shahzad Ahmed and Sung Ho Cho
Hanyang University, Seoul, South Korea

Igazolás DETEP teljesítménykredithez

Témavezető neve: Sarvajcz Kornél

Hallgató neve: Kis Károly Árpád

Hallgató szakja, évfolyama: Mechatronikai mérnök BSc, 3. évf.

Melyik DETEP programban vesz részt (a Neptunban szereplő "képzés neve", pl. DETEP-ÁJK):
DETEP-MK

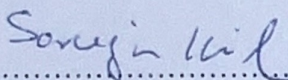
Rendezvény/konferencia/ folyóirat/hangverseny/tervpályázat, stb. neve: International Radar Symposium 2023 Berlin (IRS 2023)

Időpontja: 2023. május 24-26.

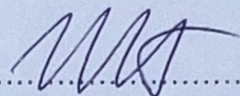
Elsőszerzős: igen nem (megfelelő aláhúzendő)

Előadás/publikáció/tervpályázat/poster/pályamunka, stb. címe: Radar spectrum measurement from drone-platform in-situ

2023. június 6.


.....

témavezető aláírása


.....

hallgató aláírása

„Make things happen, and
let's *make* it together.”

IRS2023
PAPER ID: 8916



Radar spectrum measurement from drone-platform in situ

Károly Árpád Kis, Student
Kornél Sarvajcz, Phd Student
István Balajti, Associate Professor

Presented by:
Károly Árpád Kis



UNIVERSITY OF DEBRECEN
FACULTY OF ENGINEERING
M E C H A T R O N I C S

24/05/2023

Contents

- Motivation
- Measurements procedure:
 - Flight planning, testing
- Measurements from drone-platform:
 - Spectrum analyzer
 - Radar in-situ measurements
- Further developments
- Take away



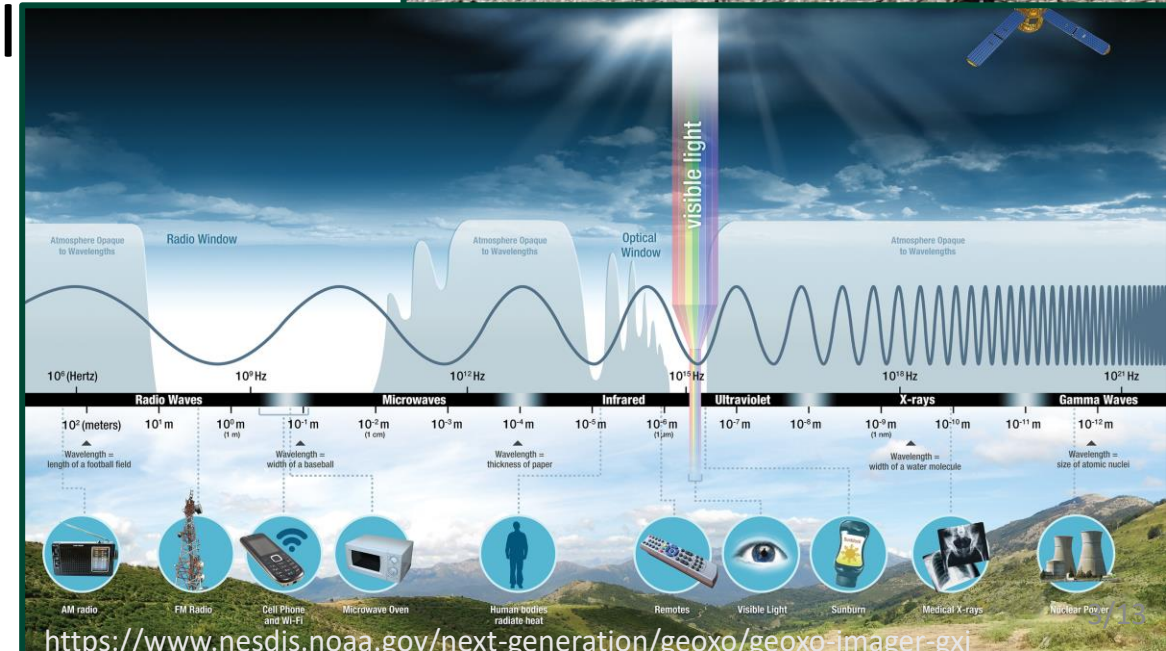
UAV „L” band antenna on top



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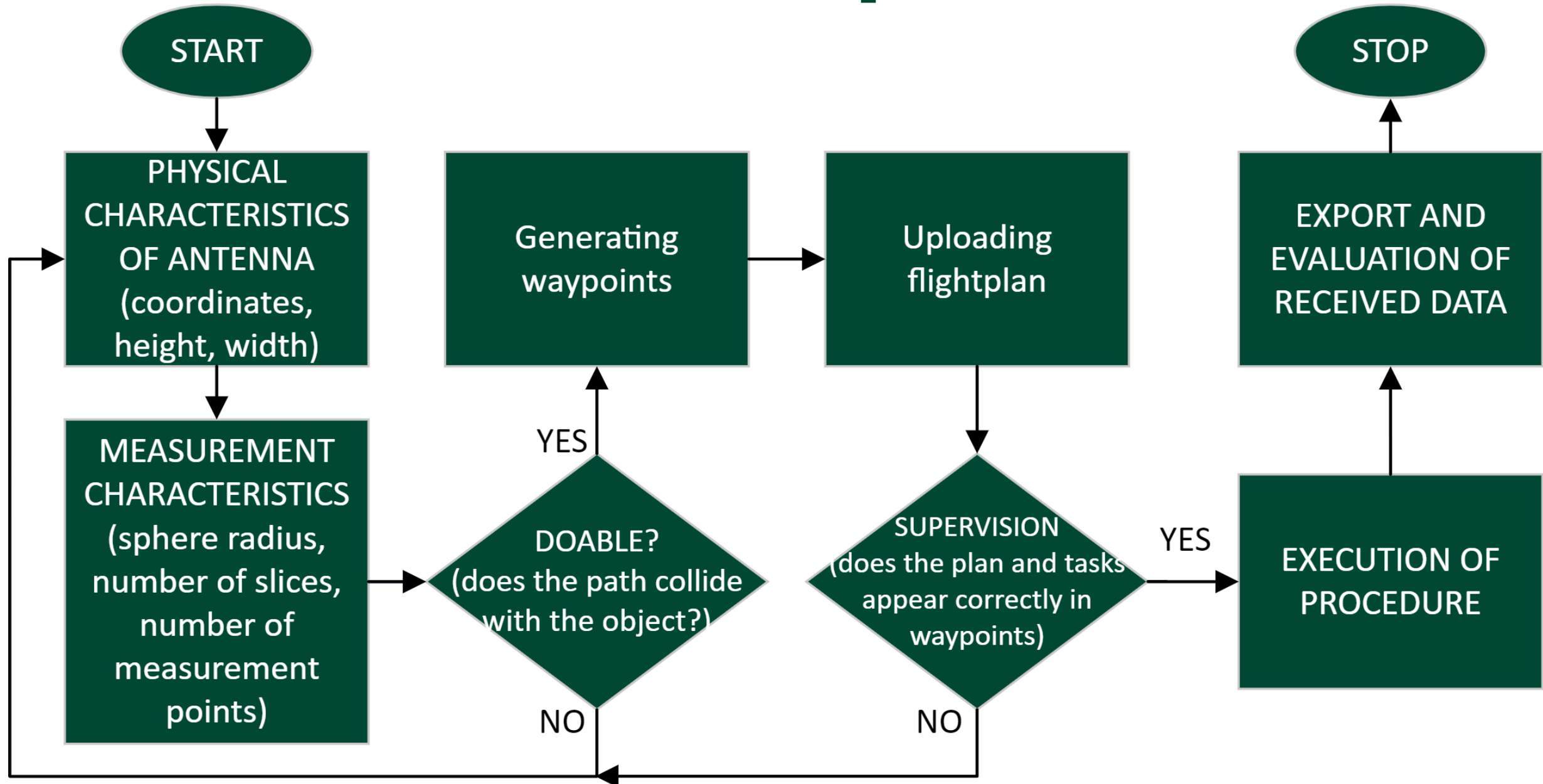
Motivation

- Using antennas is a part of our everyday life
 - Electromagnetic spectrum
 - Electrosmog
- Need for drone-platform based In Situ measurements
 - Radar, communication, WI-FI
- Drone-platform:
 - DJI Inspire 1 VTOL UAV
 - Use of 3D printed parts



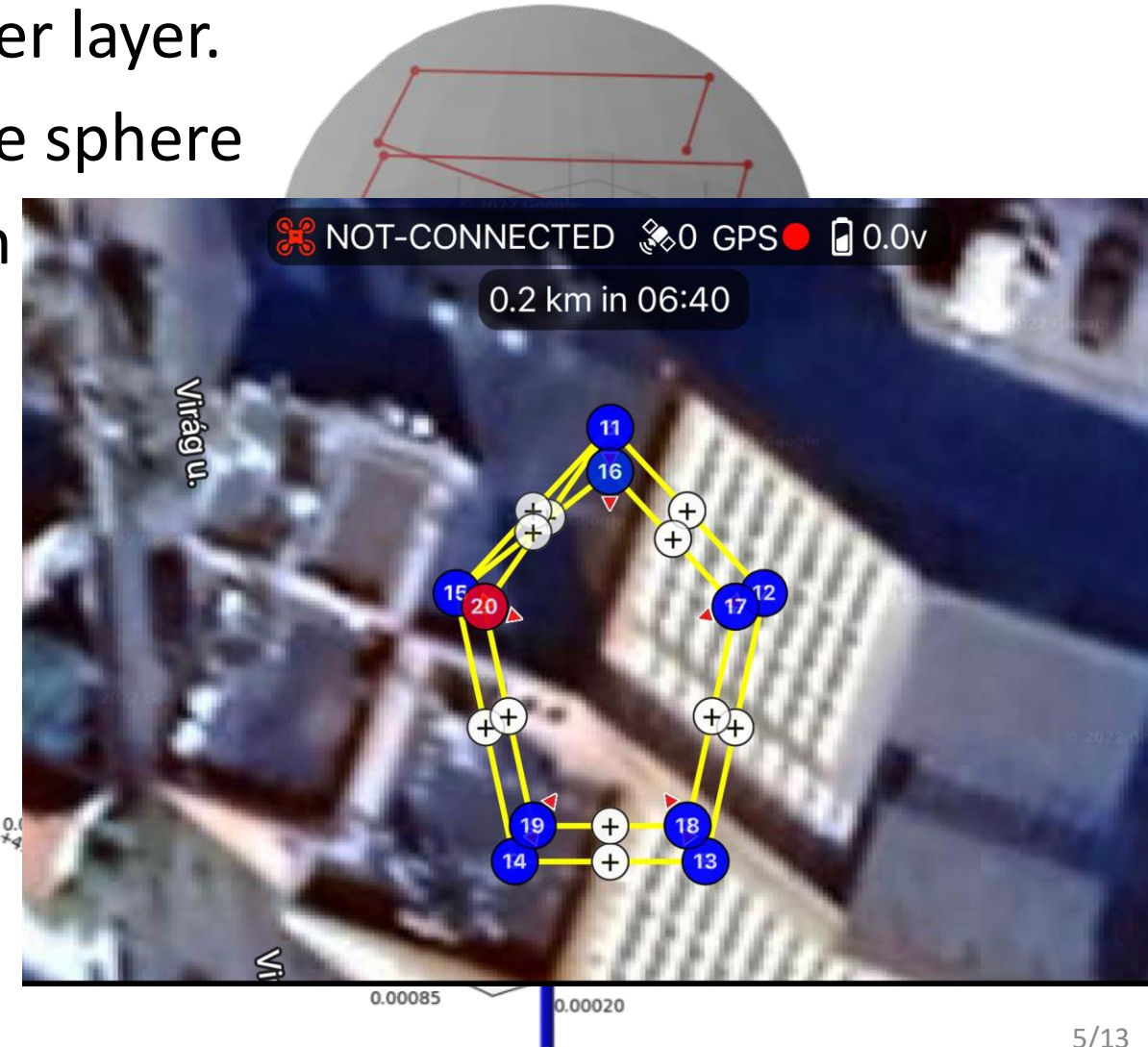
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Measurement procedure



Flight planning

- Adjustable measurement to any microstrip antenna type
- Basic surface of a sphere such as radome with the specified number of measurement points per layer.
- Adjustable vertical coverage of the sphere
- Warning in the event of a collision
- Optimized for In Situ usage
- Python program:
 - Visualization
 - Flight Plan application

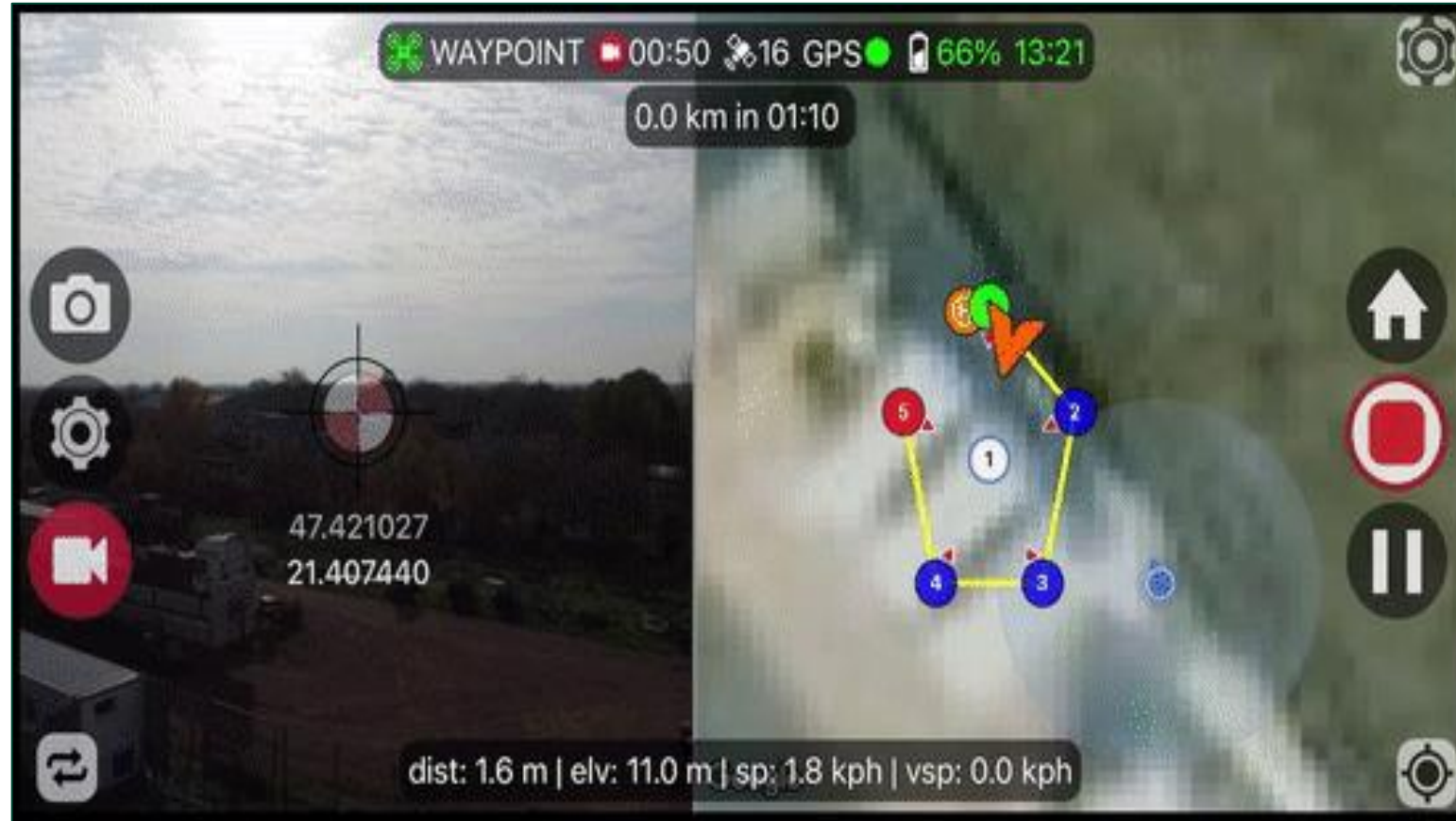


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Testing In Situ

Procedure verification:

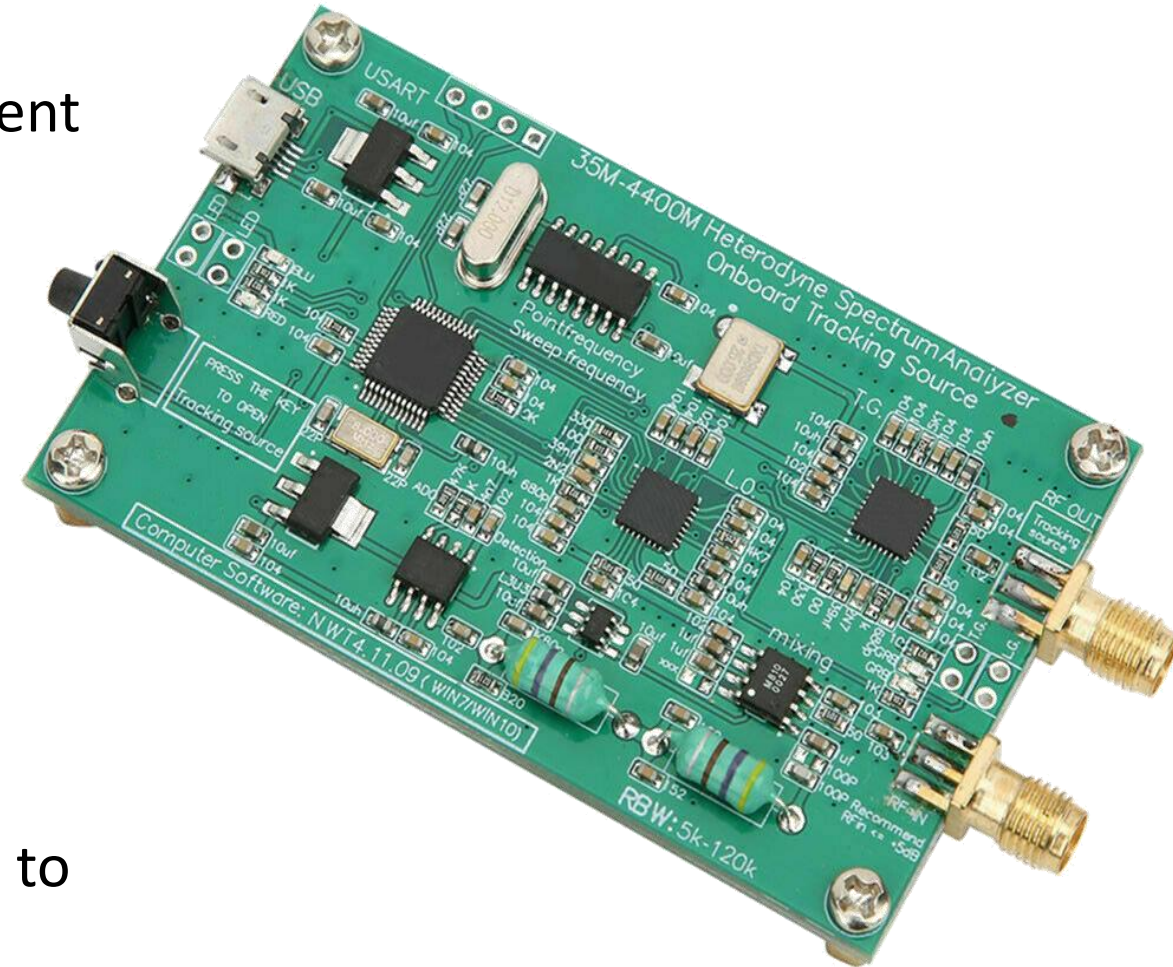
- Route plan generating
- Route flight test
- Flight function test
- Repeat accuracy test
- Capacity test



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Spectrum analyzer

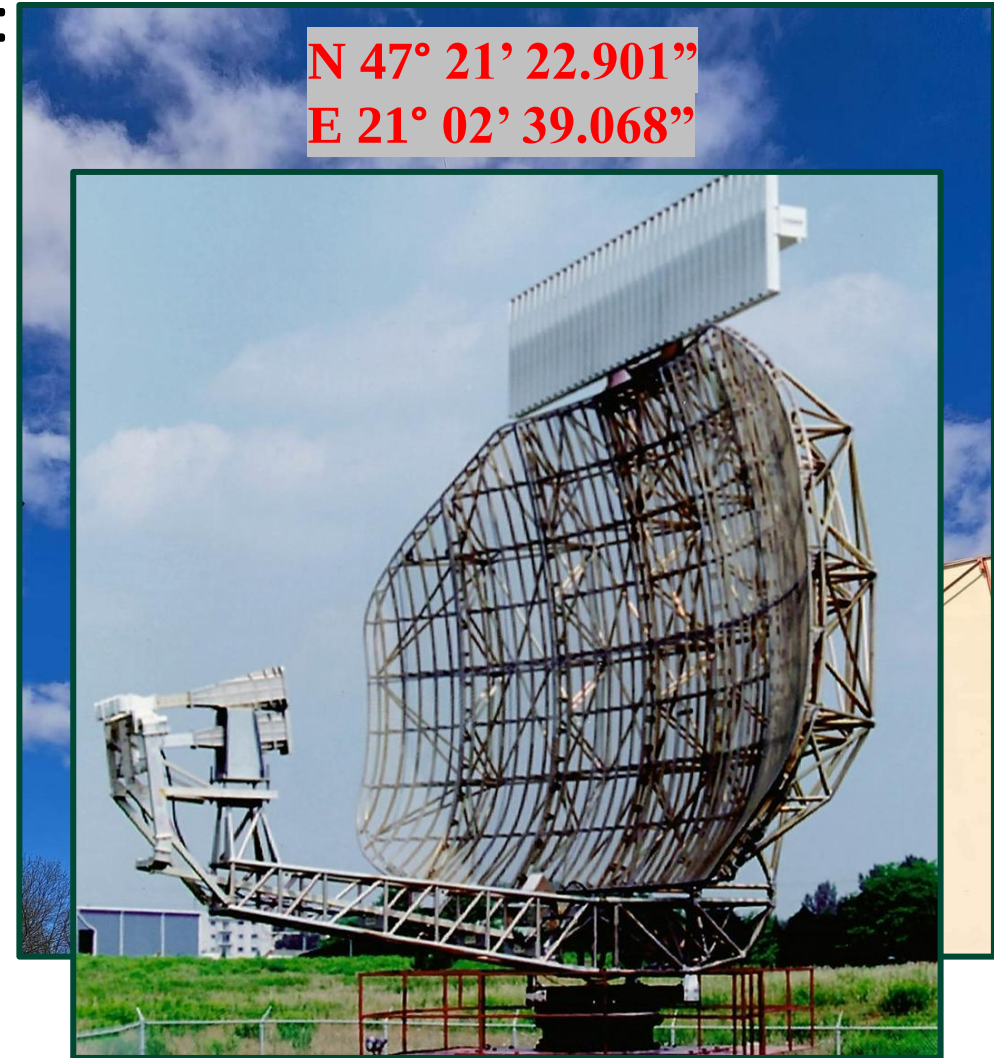
- Criterion
 - Small size, < 200 grams
 - „UHF”, „L” and „S” band measurement range
 - Economical solution
- Tool chosen for research:
 - 35-4400M USB Spectrum Analyzer
 - Use of microstrip antenna
- Operation:
 - Raspberry Pi + with 2.4/5.8 GHz technology
 - 50 Ohm impedance coaxial cable hanging from the drone, connected to antenna



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In Situ measurements at Püspökladány Radar

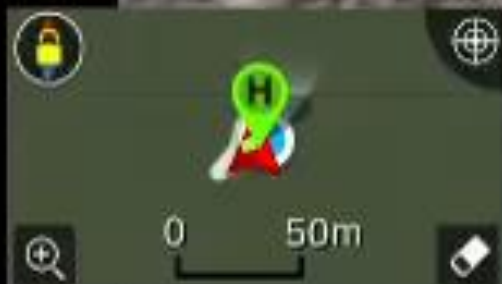
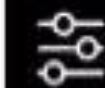
- Primary radar spectrum measurement:
 - Raytheon ASR23 SS passive antenna
 - Frequency: 1280 MHz
 - Pulse width: 1.8 & 98 μ s
- Measurement with microstrip antennas
- The system was functional, but the weather conditions were not suitable



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ISO	SHUTTER	EV	WB	CAPACITY
100	640	0.0	Auto	N/A 00:00

AE

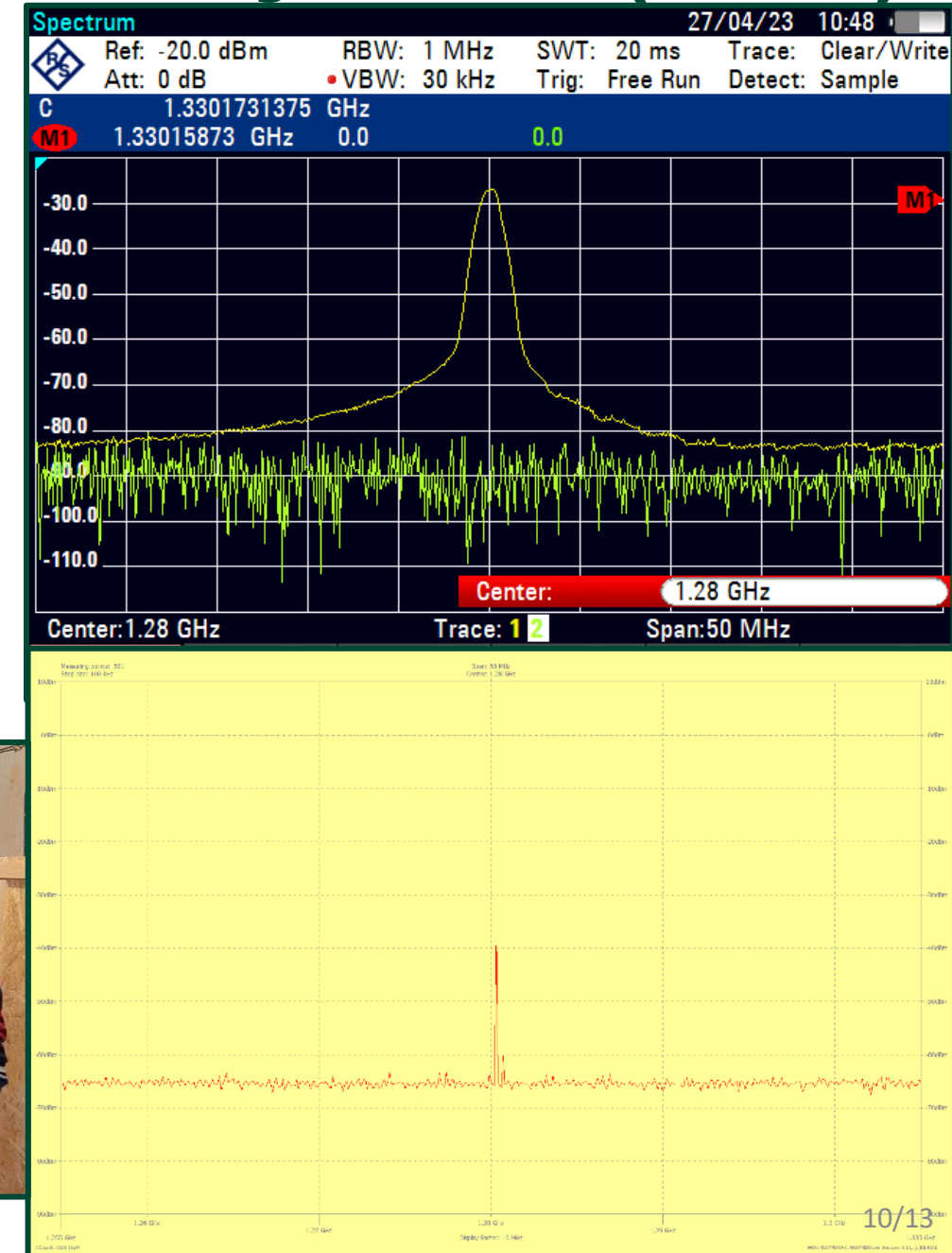


D 3.5 m H 0.0 m

H.S 0.0 km/h V.S 0.0 m/s VPS 0.1 m

In Situ measurements at Püspökladány Radar (cont.)

- Calibration of microstrip antennas
- Antennas and analyzer laboratory testing
 - Antenna testing and calibration with 4chVNA
 - R&S FSH4 spectrum measurements for reference
- Consequence: the chosen analyzer is suitable for this use, but needs more:
 - Sensitivity
 - Control set up

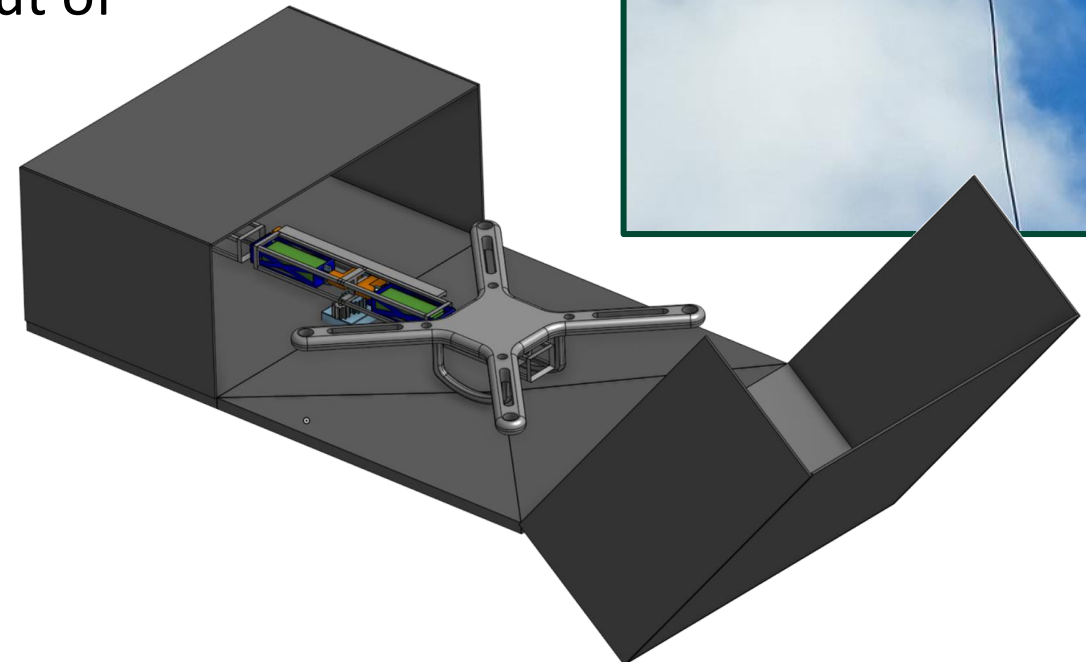
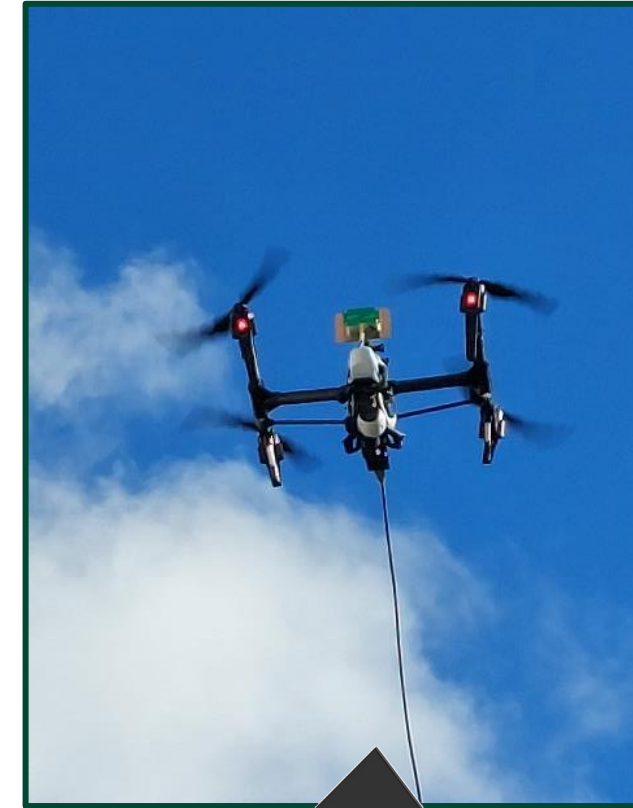


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Future developments

- For spectrum analyzer
 - Repeat Püspökladány In Situ measurements
 - Improve methods:
 - Data evaluation
 - Data visualization
 - „S” band spectrum measurements
- For drone-platform:
 - RTK-based GPS system (cm accuracy)
 - Low noise amplifiers on the output of antennas
 - 6 GHz Wi-Fi connection
 - Creating a fully functional system (docking station)

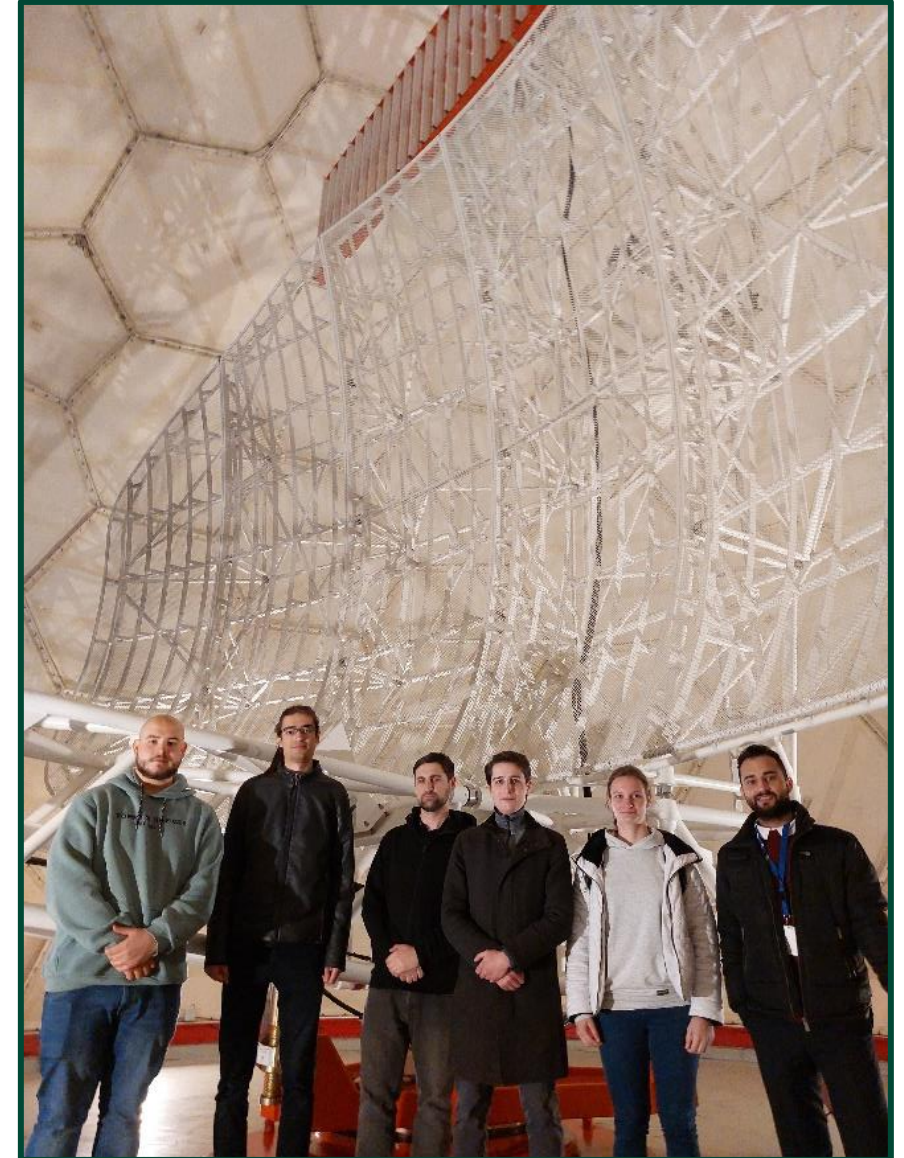
UAV „S” band antenna on top



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Take away

- Developed and partially tested a drone platform:
 - For „L” band In Situ measurements
- The system is validated by route planning, uploading, and flying modes
- The system proved to be:
 - Effective
 - Economical solution
- Need for further In Situ measurements and developments



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Thank you for your attention!



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If you have any queries, please feel free to ask.