Drones in Arctic Environments

WP8 PRESENTATION SALEKHARD

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WP8 partner Umbilical Design

Cecilia Hertz

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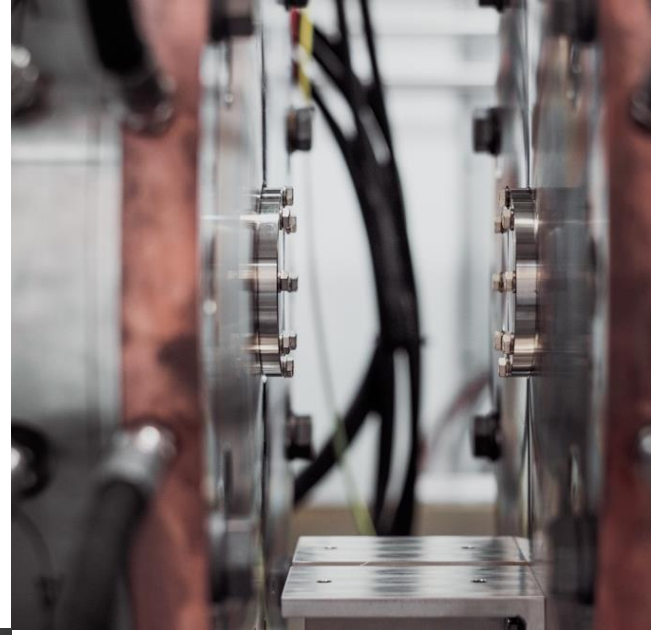
Infrastructure

Buildings
Rail & Road
Project Management
Water & Environment
Architecture & Design

Industry

Advanced Manufacturing
Automotive R&D
Food & Pharma
Process Industry
Product Development
Industrial Engineering
Specialized Technical Service



Energy

Thermal Heat & Power
Hydro Power
Renewable Energy
Nuclear Energy
Transmission & Distribution
Oil & Gas
Energy Markets

Digital Solutions

Experience Design
IT Solutions
Embedded Systems
Systems Management

Achievements since Svalbard October 2017

- Introduction and summary of WP8
- Highlight some details from two master thesis projects
- Explanation and summary of the final reporting (deliverables) with a few examples from the contents
- Future projects for the use of drones in the Arctic
- Questions and answers

Overview WP8

- New applications through cooperation between arctic researchers and technology industry (drones, sensors)
- Increase knowledge on drone technology and current legislation for use of drones among station managers
- Drone technologies to be used in arctic terrestrial settings
- Identify drone sensors specifically for arctic research or currently underrepresented in the Arctic
- Produce a best practice scheme for use of drones at arctic research stations
- Project end: September 2018

WP8 summary

OPPORTUNITIES IDENTIFIED

- Samples of snow, water, soil, air, etc.
- Use drones to retrieve data from sensors mounted or located in terrestrial areas
- Photogrammetry: 3D models, orthophotos, point clouds, maps
- Measuring snow depths and snow layers
- Pick up and deliveries
- Search and rescue

MASTER THESIS

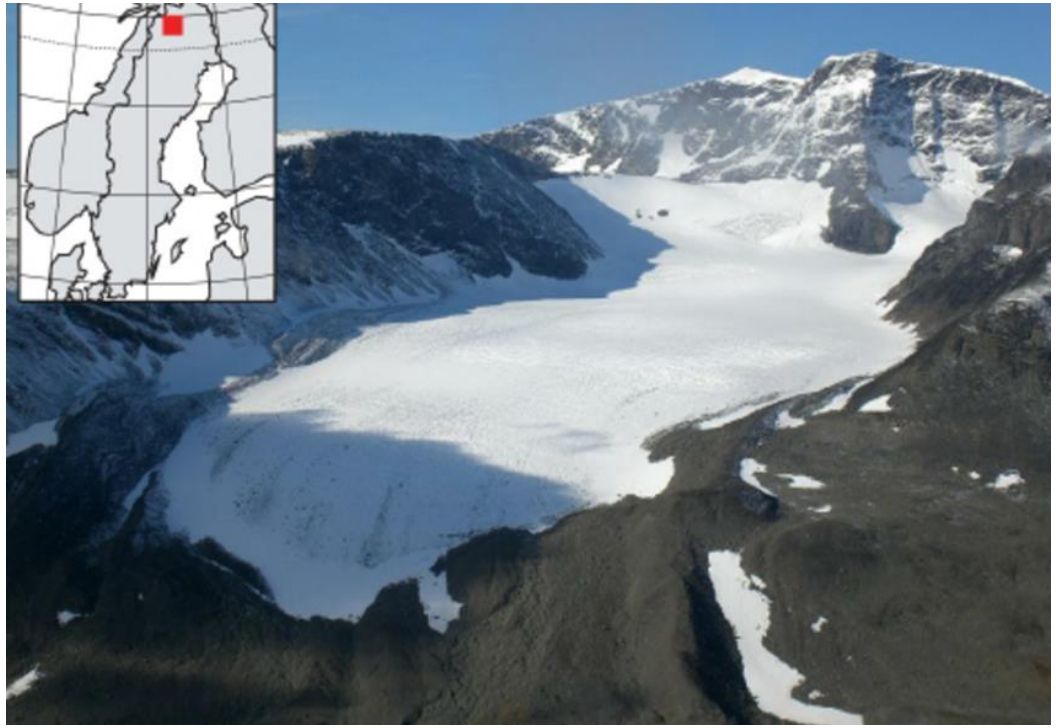
Snow Change Tracking Aid with a drone

Background

- Support to researchers study the mass balance of Storglaciären, Tarfala
- Trekking by foot, reading snow level on ablation stakes
- 75 stakes over Storglaciären
- Accuracy of 10 cm

Objective

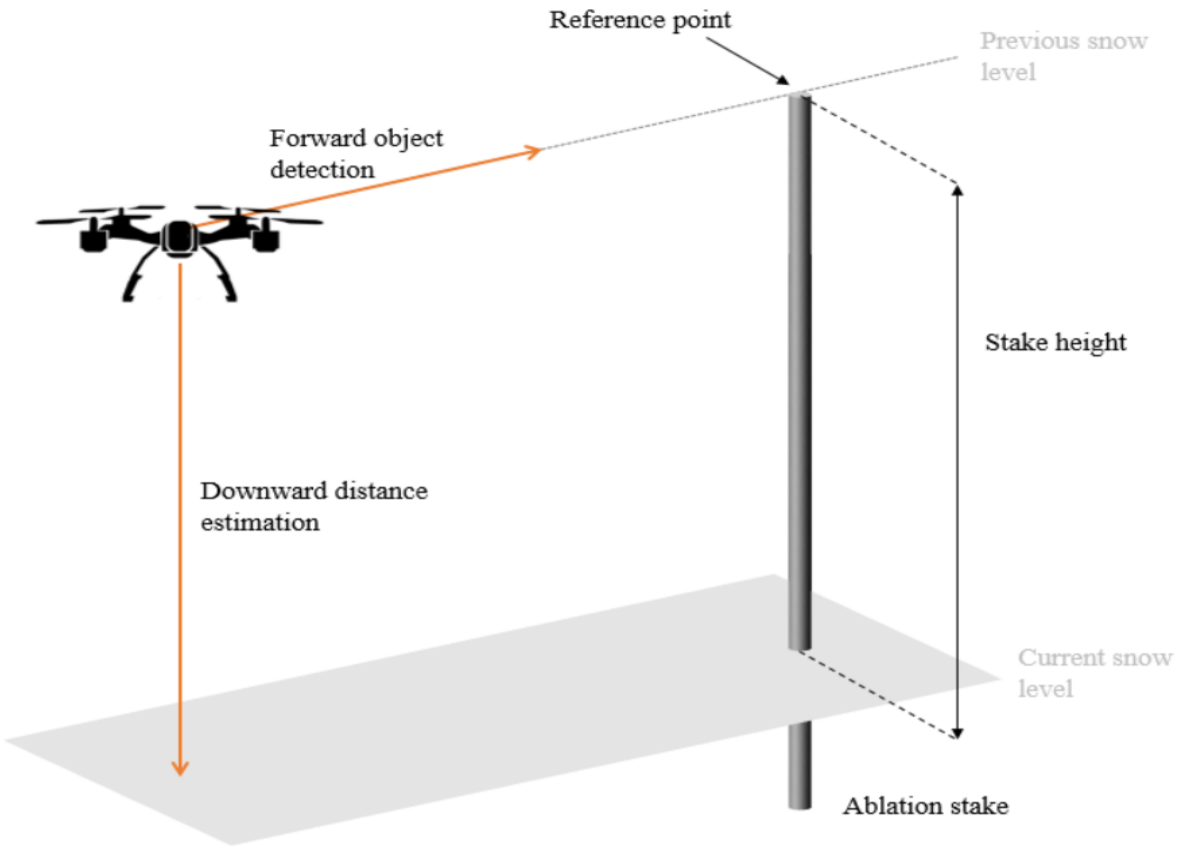
- Develop snow change tracking aid focusing on estimating the heights of ablation stakes



Master thesis students Daniela Attalla and Alexandra Tang

General concept

- Replace manual reading with automated, assisted by a drone
- Interpret height of stake
- Stake height is interpreted with assistance from sensors
    - Forward subsystem using LiDAR
    - Downward subsystem using ultrasonic
    - Downward distance is subtracted from stake height
- Achieve an final accuracy of 0.1m or smaller



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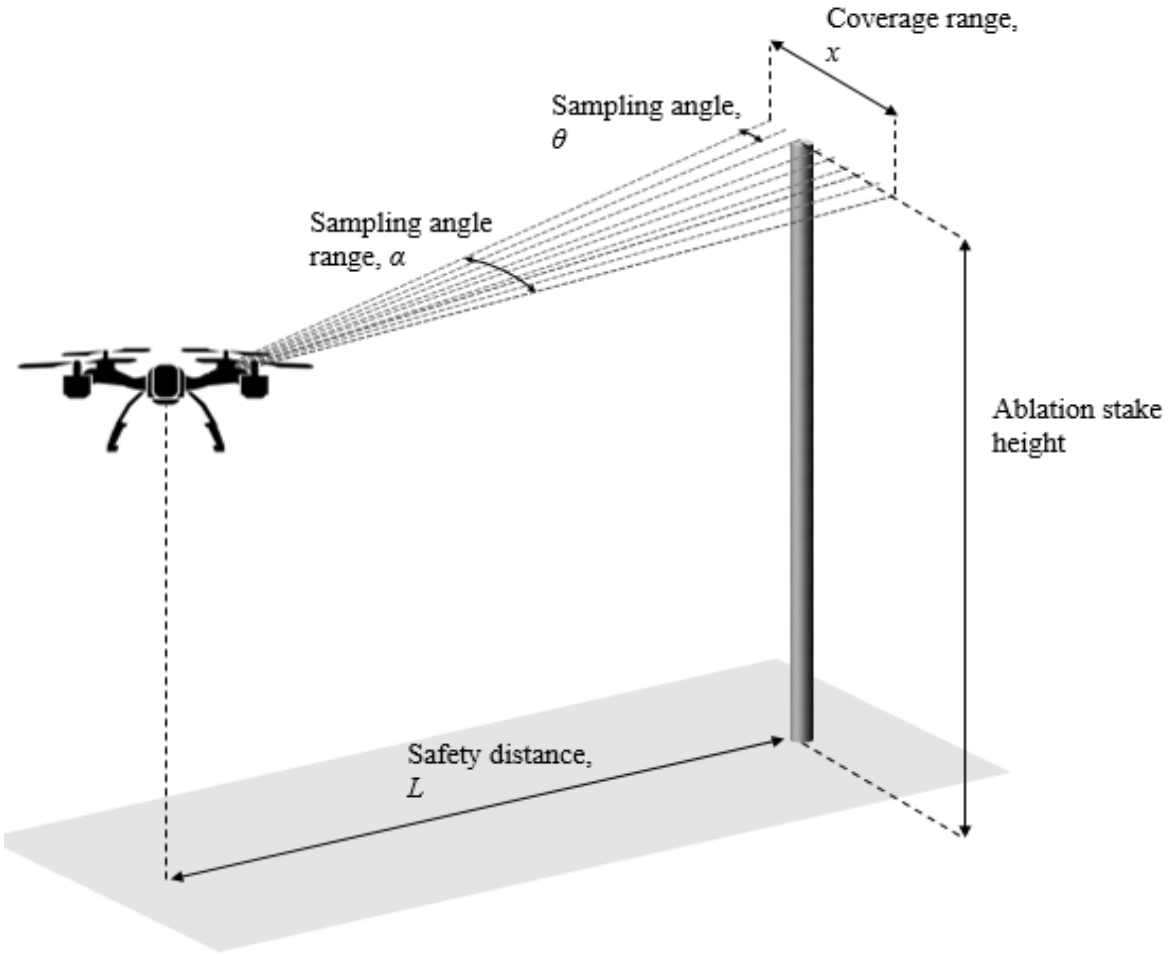
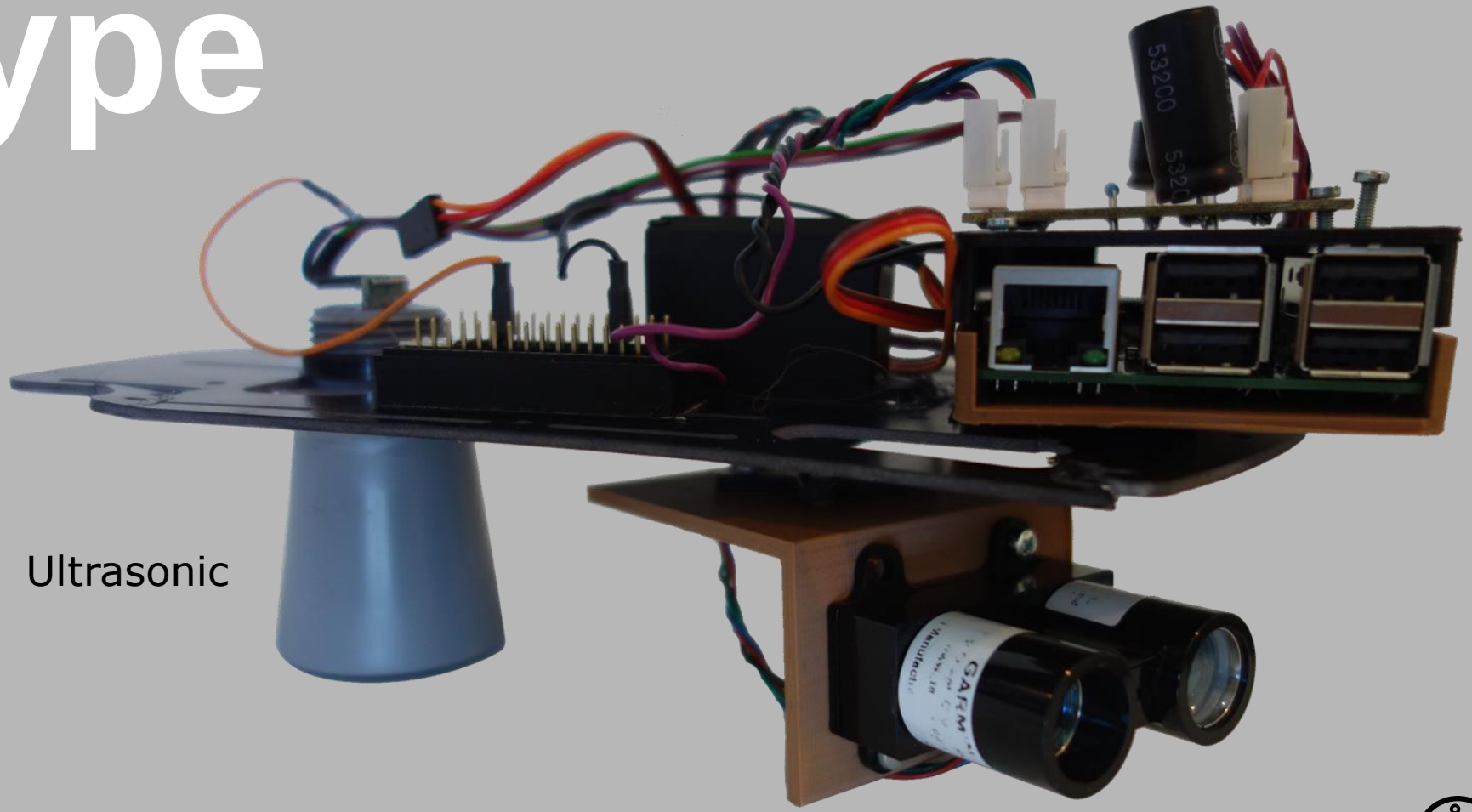


Final Prototype



Conclusions

- Tests showed that the concept is able to estimate stake heights with good accuracy given that both sensors are not tilted and LiDAR is allowed to sweep twice at every position

Future work

- Sensors should be mounted on gimbal – ensure leveling
- Testing in the real environment
- Integrate in a fully automated system
- Collision avoidance and positioning

MASTER THESIS

Development of automatic water sampler for aerial drones

Background

- Collecting samples of water with traditional methods
- Trekking, boats
- Security precautions, cold water, etc

Objective

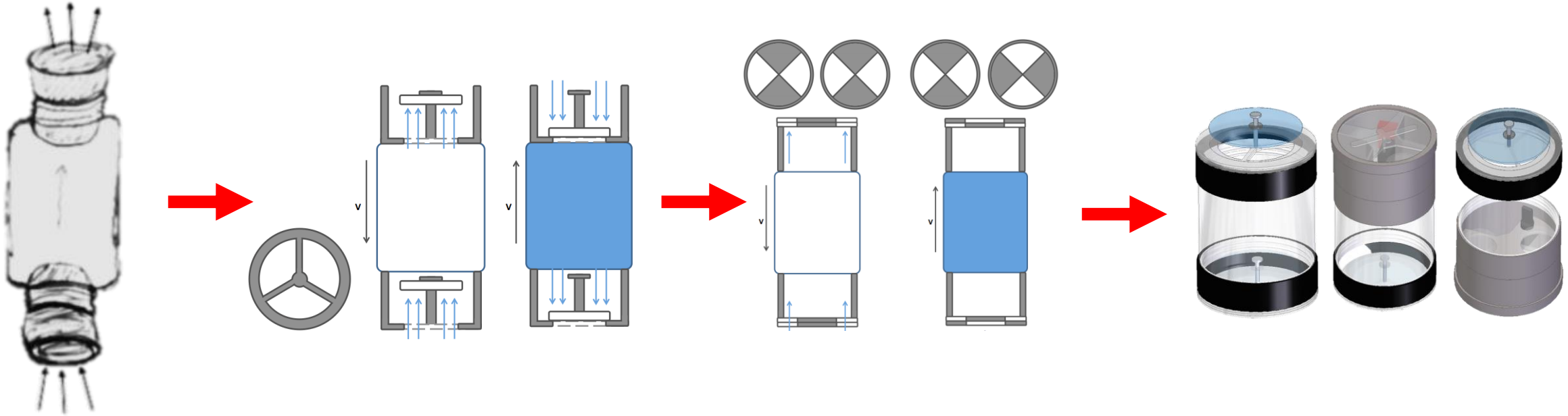
- Design a water sampler to be used on a given drone to automate the water sampling process?

Pre-study

- Amount of water sampling volumes
- How often?
- Maximum depth?
- Type of sampler used today?

Master thesis student Sofia Olsson

Concept generation
Prototypes different ideas and units



Diode unit

Wheel unit

Cake unit

Final CAD prototypes
Some parts 3D printed

Field tests prototypes

- Sampler reliability
- Airborne test with passive sampler with drones of different sizes
- 1 passive water sampler
- 1 active water sampler with build-in logics, pressure sensors, automatic closing, etc

Conclusions

- Possible to use a drone to collect samples

Future work

- Improve mechanical design
- Field test in real environments
- Different sizes – different needs

SUB HEADER OR CHAPTER NUMBER

Reporting

DELIVERABLES - REPORTS

D8.1 Drone workshop report

- Svalbard meeting (in October 2017)
- Drone workshop
- Seminars, group sessions, demonstration and practical drone flight

Insurance

National CAA

Restricted Areas

Local Rules

Shared Rules

Commen sense

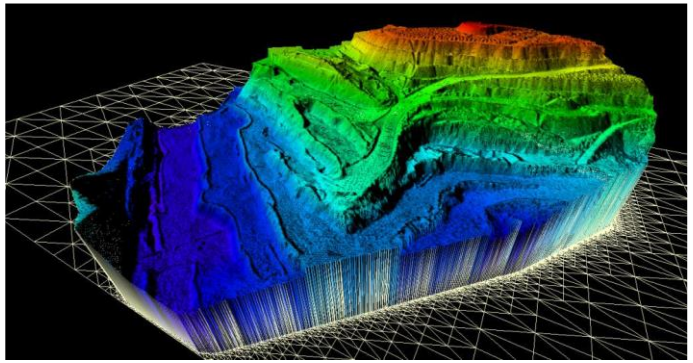
12.30 – 12.55	Drone demo Warehouse	Your ideas Festningen	Sensors Møysalen	Test Flight Outside garage
13.00 – 13.25	Test Flight Outside garage	Drone demo Warehouse	Your ideas Festningen	Sensors Møysalen
13.30 – 13.55	Sensors Møysalen	Test Flight Outside garage	Drone demo Warehouse	Your ideas Festningen
14.00 – 14.25	Your ideas Festningen	Sensors Møysalen	Test Flight Outside garage	Drone demo Warehouse

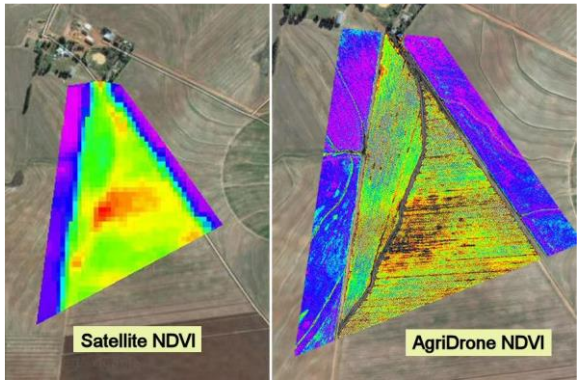
- Maggan
- Elmer
- Morten
- Doni

D8.3 Report requirement specifications for drones in arctic environments, including drone types, drone projects and sensor technology

Extensive reading, both for the beginner and the advanced user.

- Drone technology: rotors, fixed wing
- Drone accessories: controllers, navigation, batteries
- Sensor technology: photography, lidar, radar, ultrasonic
- Drone and sensor applications: green house gas, vegetation, 3D-models

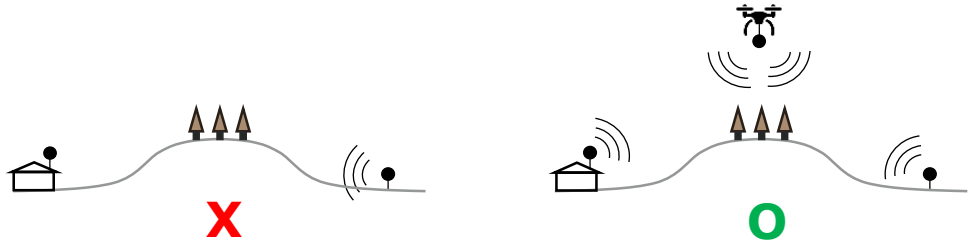




DELIVERABLES - REPORTS

D8.4- Report on recommendations for new sensor development

Your needs + Known technologies = New solutions



1. New sensor development

Sensor	Application
lightweight, sensitive and accurate sensors	measuring greenhouse gases
radar systems	earth observations of land, ice, snow, vegetation, sea,
stereo camera and artificial intelligence	identify types of vegetation, animals

2. Perform missions, e.g. master thesis projects

Mission	Application
drone as a relay station	collect data from fixed sensors in remote areas, or from underwater sensors
track animals or fish tagged with radio transmitters	collect transmitted data

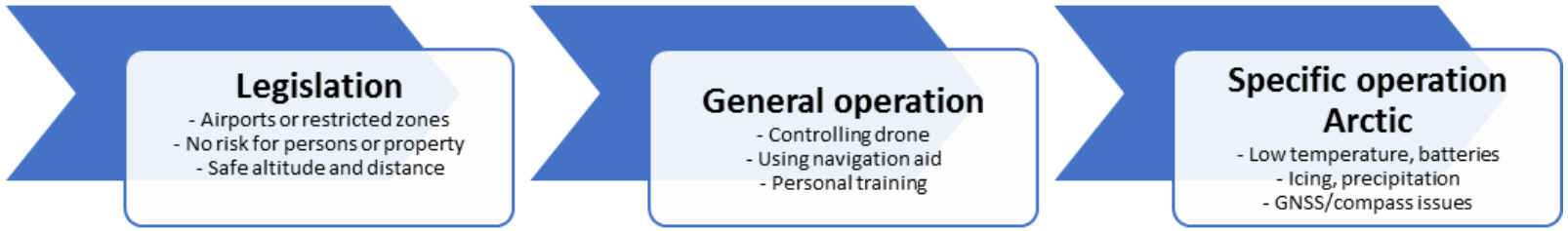
DELIVERABLES - REPORTS

D8.5 - Guidelines for drone usage in arctic environment

Best practice on how to get started!

Level of ambition?

Operational guidelines for the Arctic



DELIVERABLES - REPORTS

D8.6 - TA Drone Workshop Report

- Webinar in January 2018. WP8 and WP5.
- 50 participants from 11 countries
- Content and program based on Svalbard workshop
- Inform about the latest rules of using drones
- **Use-cases** from different Arctic research
- Discussion about resources, opportunities and challenges

Update of the “Drones pocket guide”

Future projects for the use of drones in the Arctic

Commercial drone operator programme

- One of the first in Europe
- Swedish National Agency for Higher Vocational Education, University of Lund and ÅF
- One year education, 35 students
- Work placement

Unique opportunity for **you**

- Use their knowledge during their work placement. Advanced expertise
- Can be based in a field station, perform specific tasks
- Period 1: 22 April – 31 May 2019
- Period 2: 1 Aug – 15 Sep 2019

Drone guided search technology to support alpine avalanche rescue

Background

- Drone-assisted autonomous search technology for alpine rescue and rescue service community

Objective

- Decrease lead time – increase survival ratio
- Use an avalanche rescue equipment, carried by a drone, to systematically and automated survey a large area
- User-friendliness and time-critical assistance
- Development of integrated modern radio technology, specific drone and user interface
- Public demonstration May 2018

VINNOVA Sweden's Innovation Agency

A SNOW QUALITY ASSESSMENT TOOL BASED ON NEW TECHNIQUES AND SAMI KNOWLEDGE

Snow4All

Objective

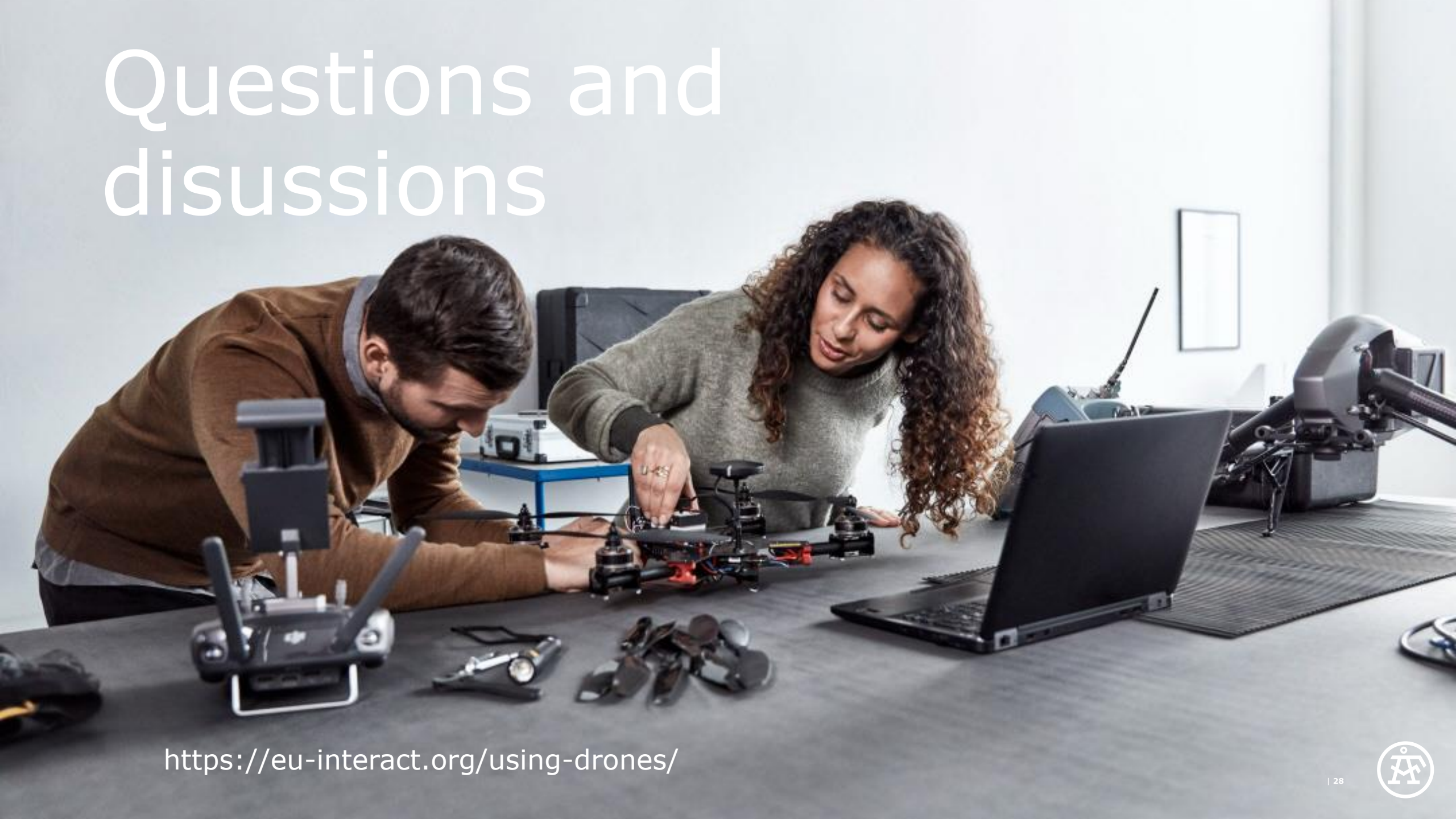
- Develop a prototype snow-forecasting tool test a physical snow-model, which simulates ice layers in the snowpack
- Melting snow → freezing water → ice layers → reindeer feeding
- Assess the impact of changed snow conditions on ecosystems using ‘traditional’ Sami knowledge
- Develop UAV methods to measure different snow properties
- Collect data in the field for calibration and validation of model and UAV derived data
- Project is led by University of Stockholm, a few other project partners (university, agencies and organizations)

VINNOVA Sweden’s Innovation Agency

Navigational issues in the Arctic

- Background: unexpectedly many crashing drones in Arctic region
- Objective: reliable and robust navigation
- Application to European Space Agency
- Product for drones (SW/HW)
- Timeline: during 2019

Questions and disussions



https://eu-interact.org/using-drones/