UAS-ability
DANISH DRONE INFRASTRUCTURE

Newsletter
June 2020

This issue - June 2020

About the UAS-Ability Project

UAS-Ability is a cooperation between major Danish universities to establish a Danish research infrastructure for development of drone technologies, integration and use of drones in research and data collection.

The research infrastructure facilities can be rented by academic and commercial users upon application.

UAS-ability is supported by the Danish Agency for Science, Technology and Innovation and partners.

Dear Drone Community,

In 2017, we began the UAS-ability project to provide drone infrastructure to the research and business communities. Over the last three years, the partners in the project have developed world class facilities, platforms, and payloads to develop drones and collect data. While the infrastructure has primarily supported research efforts, I hope in this newsletter you also see the impact the infrastructure is having on Denmark's drone business, education, new research initiatives, and the future of the drone industry.

We highlight our activities to inspire the reader to utilize the available resources and pursue their own development and use of Denmark's Drone Infrastructure.

-Best regards, Brad Beach

News from the Development initiative

SDU UAS Test Center is an ecosystem for developing and testing drones and drone-related system platforms. Our hangar facility is located at Hans Christian Andersen Airport north of Odense.

SDU UAS Test Center offers companies, researchers, partners, and engineering students access to our state-of-the-art laboratories and test areas to create coherent and safe drone systems.

SUNDHEDSDRONER

Contact us

Development initiative

Brad Beach, SDU UAS Center
E-mail: brbe@mmmi.sdu.dk
Phone: (+45) 20370124
Address: Campusvej 55, 5230 Odense M, Denmark

Laboratory facilities
Hans Christian Andersen Airport
Address: Beldringevej 252,
5270 Odense N, Denmark

Facilities:

SDU

Composite Laboratory

The Composite Lab in the SDU UAS Test Center offers 300 square meters of lab space for composite production for drones, space systems, and for a variety of other purposes.

Systems Integration Laboratory

The systems integration lab is a multidisciplinary research and workshop environment that focuses on integrating and testing the many different parts and subsystems that comprise a modern drone system. Its mission is to provide a flexible and well-equipped work environment for researchers and companies to come together to test and integrate mechanical, electronic and software subsystems into coherent and safe drone systems.

Projects and Research:

SORA Workshops at SDU UAS Test Center

The business potential of the drone industry relies on the ability to fly Beyond Visual Line of Sight (BVLOS). The Specific Operations Risk Assessment (SORA) is a comprehensive analysis of the operation, drone system, and the intended environment requiring an air and ground risk assessment. The SDU UAS Center is generating insight to the SORA process by writing several successful applications and conducting BVLOS flights in the airspace over Northern Funen. The aim of the workshop is to share our expertise and guide the participants in making their own SORA applications for BVLOS flights in Denmark.

HealthDrone

The HealthDrone project is now freeing the drones over Nordfyn

An important milestone has been reached in the HealthDrone Project. The partnership has been authorized to make the first routine BVLOS flights and tests have now begun at HCA Airport. The consortium flies 2-3 times per week to develop the system, procedures, and training in preparation for BVLOS flights from Ærø to Svendborg and Odense University Hospital later in the year.

ArtDrones

Drone expedition to the Arctic

Researchers from SDU UAS Center are working in the ArtDrone project on how to make the Northwest Passage between Europe and Asia safe for Arctic shipping companies by using drones to detect and navigate around icebergs.
Drone experts Jussi Hermansen and Erling Hansen from SDU went on an expedition to Ilulissat, Greenland in November 2019 to test a series of drones flying over the ice fjord. The main goal of the expedition was to make initial investigations on how the cold weather affected the battery endurance and to test the infrared cameras mounted on the drones.

Contact us

Integration initiative, AU
Anders La Cour-Harbo, Aalborg University
E-mail: alc@es.aau.dk
Phone: (+45) 99408737
Address: Fredrik Bajers Vej 7, building C2-202, 9220 Aalborg Ø

News from the Integration initiative

Aalborg University operates three drones and a large mobile ground control station (GCS). They can carry a 5-35 kg payload for up to 4 hours, and are able to operate from inside the GCS in most weather conditions.

AALBORG UNIVERSITET

Equipment and facilities

The Drone Research Lab in Aalborg provides equipment for research purposes. The Lab has BVLOS capabilities and helicopter drones with a supporting GCS van. The Lab is capable of performing advanced tests at all locations where the GCS van can go.

Rotorcraft test platforms

Drone Research Lab has three available aircraft with rather different capabilities. The choice of platform depends on a range of parameters, including payload mass, flight distance, expected weather conditions, and airspace restrictions.

Mobile ground control station

The mobile ground control station is integrated into a Mercedes Sprinter Van. It transports the three aircraft as well as all necessary flight equipment and maintenance tools. It accommodates 4 people during flight operations. It can run up to 6 hours on internal batteries, and has an integrated air-condition system for heating and cooling.

Projects and research:

OPAL research project

The purpose of the OPAL research project is to deliver a payload to wind turbines. A number of sensors and payload equipment has been installed on the T50 aircraft and demonstrated in flight.

SafeEYE research project

The aim of the SafeEye project is to develop, demonstrate, and commercialize an automated emergency response system for larger (>7 kg) drones. It is a small device, mounted on a drone, that keeps track of safe places to crash, and on the health state of the drone. If necessary, it can terminate the flight with the least probability of fatalities. This means significantly reduced risk for automated flight, typically BVLOS operations. SafeEye is thus an enabler for many applications, including farming, inspection, transportation and search and rescue.

News from the Applications initiative

AARHUS UNIVERSITY
KØBENHAVNS UNIVERSITET
DTU Danmarks Tekniske Universitet

Drone technology has many important applications. The Application Initiative at AU, KU and DTU focuses on various applications of drone-mounted sensors to answer fundamental research questions, to optimize workflows, and investigate new innovative ways of data collection.

Members of the Application Initiative can assist you to apply drone technology and associated sensors if your specific aim is to:

- Answer fundamental research questions within your field (e.g., biology, agrobiology, energy, environment, or climate)
- Increase quality or efficiency when mapping and monitoring (e.g., animals, vegetation, crops, pollutions, hydrology).

The Application initiative provides airborne data collection equipment (various drones and sensors) and insight on data collection and processing workflows that assures that you most efficiently get from your questions/aims to high quality data and results.

Aarhus University

The overall focus within the Application Initiative at Aarhus University is to answer questions in environmental science, agrobiology and biology in general with data collected with drones.

AARHUS UNIVERSITY

Equipment

The Application initiative drone fleet at Aarhus University includes various rotary and fixed-wing drones for environmental science.

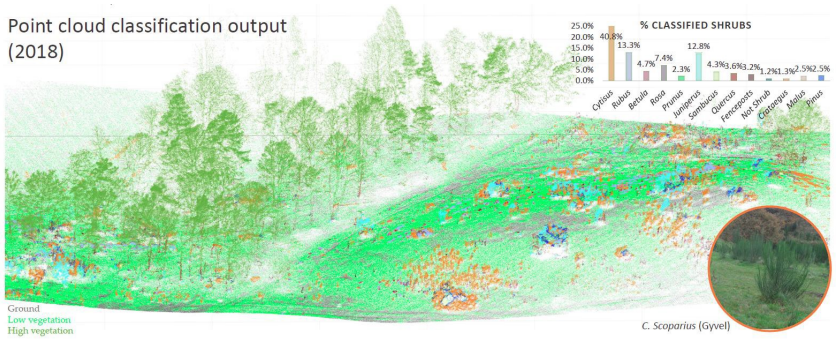
AARHUS UNIVERSITY

The main focus for the Application Initiative at Aarhus University is the application of different sensors, the data that we get from the sensors, and the information we can extract from the data. That is why we are working with different types of sensors varying from consumer-based cameras, handheld field spectrometers, different multispectral and thermal sensors to advanced sensors like the Hyperspectral and the LiDAR sensors.

Projects and Research

Drone LiDAR: Detecting species in 3D

A project where we detected species in 3D and estimated biomass by using a drone with a mounted LiDAR sensor (Surveyor, YellowScan). The LiDAR is providing a point cloud with a very high density of geospatial information, which then can be used to identify species and monitor change over time.



For example, based on the individual species in the 3D point cloud it is possible to estimate how much the volume has increased when flying over the area at different times. See Madsen et al. Detecting shrub encroachment in seminatural grasslands using UAS LiDAR. Ecol Evol. 2020; 00: 1– 27.

Quantifying biomass and plant diversity in a grassland experiment

This project is in cooperation with researchers in Switzerland where they have different treatments on Pathogens (foliar), Nitrogen and plant diversity. We are working with very high point densities of more than 10.000 points per square meter. Our UAS-LiDAR system proved to be very reliable in providing such ultra-high geospatial information, although in this particular project we have been flying as low as 10m above the experimental site to acquire the information needed.

Contact us

Application initiative, AU
Signe Normand, Aarhus University
E-mail: signe.normand@bios.au.dk
Phone: (+45) 23718009
Address: Ny Munkegade 114-116, building 1540, 8000 Aarhus C

Contact us

Application initiative, KU

Department of Geosciences and Natural Resource Management

Thomas Friborg
E-mail: tfj@ign.ku.dk
Phone: +45 3532 2574
Address: Øster Voldgade 10,
1350 København K

University of Copenhagen

The main focus for the Application Initiative at the University of Copenhagen is to develop methods for detection of surface roughness, biomass and to detect radiometric properties of natural and managed ecosystems. The aim is that this information can be routinely used for drought detection in crops, mapping field drainage problems, benefitting precision agriculture, and for detecting surface exchange of gasses and energy.

Equipment

The newly developed UAV-based LiDAR scanners and optical imagery provides a research tool to yield a fine-grained analysis of atmospheric-surface processes by generating the 3D structure of a land and by monitoring the reflected/ thermal radiation in both high spatial and temporal resolution. Data processing routines for these data are being developed and schemes for the interpretation are made utilizing machine learning algorithms in collaboration with computer scientists.

Projects and Research

Climaccess

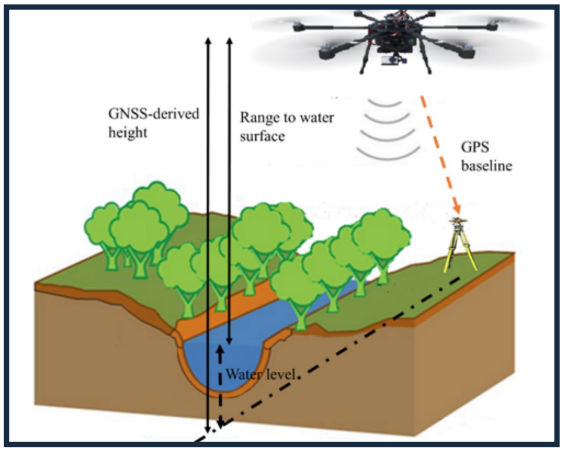
Flooding prediction in greater Accra area

Accra metropolis suffers urban flooding due to a combined effect of rainfall intensities, low soil infiltration capacities, landforms, current land use and impervious surface, characteristic of most urban places. Accra has additionally experienced very rapid spatial growth within the last 20 years, and this expansion is occurring in a largely unplanned and uncontrolled manner. The purpose of the project is to establish a comprehensive understanding of the physical and human factors that determine resilience to climate change impacts on mobility and accessibility in the Accra region. The methods include surveys, computerized analysis of local and city-wide elevation models, satellite images as well as GISbased analysis of the urban transport networks. Additionally a small UAV "drone" will be used to collect local elevation data.

MapCLand

Development of deep learning routines for biomass estimates, from UAV borne data

The objectives of the PhD project will require the elaboration of aerial campaigns to collect point cloud datasets and ground truth data in agricultural and forest experimental sites in Denmark, which will necessitate the application and development of deep learning architectures that are capable of detecting individual plants and trees and associated geometrical properties. If successful, we can provide very accurate information of the spatial distribution of biomass and its non-linear relationship with vegetation dynamics and environmental variables to foster the sustainable resource management and functions of croplands and forest ecosystems.



Contact us

Application initiative, DTU– Space

DTU Space Drone Center
Michael Linden-Vørnle
Dir. 45 25 97 61
Mob. 20 93 48 88
mykal@space.dtu.dk
Centrifugevej
Building 356
2800 Kgs. Lyngby

Technical University of Demark—DTU Space

DTU Technical University of Denmark

The Application Initiative at the Technical University of Denmark is engaged in numerous projects with different scientific and technical themes. The effort is coordinated by DTU Space DroneCenter – part of the National Space Center (DTU Space).

One theme is the optimization of navigation in GNSS degraded areas using advanced GNSS and Inertial Navigation System (INS) sensor fusion, Visual Odometry, GNSS-based heading solutions, exploitation of Galileo High Accuracy Signal (PPP: Precise Point Positioning) and research in network-RTK and PPP (GNSS).

Applications include hydrological Monitoring using radar to measure the range to a water surface and a GNSS/INS system to determine the payload's position with centimeter accuracy. Another theme is the use of magnetic sensors to conduct magnetic field surveying. Magnetic surveys can be used to locate Unexploded Ordonnance (UxO) or specific minerals.

Other themes under continuous development include, but are not limited to: generation of Digital Elevation Models (LiDAR, photogrammetry), automatic classification of biological systems (e.g. Mussels and Oysters), Bathymetry using tethered sonar, Mineral Exploitation using Gamma-Ray spectrometer and magnetometers, and Intelligent farming measuring Soil moisture, NDVI etc.

Equipment and facilities

DTU Space Drone Center continues the optimization of standard payloads including a Generic Payload Controller. The available payloads now include the following sensor types: RGB camera (photogrammetry payload), Multi- and Hyperspectral camera, Thermal camera, LiDAR (Velodyne Puck Lite), Radar, Sonar, Gamma-Ray spectrometer. Under development is a magnetometer payload.

Furthermore, there is focus on developing and establishing test facilities for both controlled environment and realistic environment test purposes. In collaboration with DTU Elektro and DTU Aqua, DTU Space is developing the Autonomous Systems Test Arena (ASTA) which is a 1000 square meter air-dome allowing individual and combined testing of autonomous systems in all domains (air, land and sea) in a controlled environment. ASTA is expected to be fully operational during 2020.

For the testing in a realistic environment, DTU Space continues the development of the infrastructure called TAPAS (Testbed in Aarhus for Precision Navigation and Autonomous Systems). TAPAS was established in 2018 has an RTK-network in the city of Aarhus. During 2019 there has been a continuous effort to expand TAPAS with an Unmanned Traffic Management system and high-speed communication. This development is expected to be fully operational during 2021. The combination of ASTA and TAPAS will allow an efficient staged approach to testing and eventually certification of unmanned, autonomous systems and autonomous infrastructure.

UAS-ability
DANISH DRONE INFRASTRUCTURE

Preliminary agenda

09.15—09.30 Arrivals

09.30 – 11.00 Demonstration of the Composite lab, System Integration Lab by SDU

11.00 – 11.15 Coffee break

11.15 – 12:45 Demonstration of the Mobile Ground Control Station by AAU

12.45 – 13.30 Lunch, networking

13.30 – 15.00 How to use different payloads to gain data. Project examples and experiences By AU, KU, DTU

Location: SDU UAS Center at the HCA Airport

Address: Beldringevej 252, 5270 Odense

Meeting Room: SDU hangar Multi-room (1st floor)

Registrations: akl@tek.sdu.dk

Save the Date!
UAS-Ability Workshop

GET HANDS ON ACCESS TO THE UAS-ABILITY INFRASTRUCTURE TO HELP FURTHER YOUR DRONE RELATED PROJECT OR BUSINESS

Representatives from SDU, AAU, AU, KU, DTU will be on hand to demonstrate the available drone infrastructure and answer your questions on how to work with UAS-Ability!

Limited space—please register early.

Tuesday 17th of November 2020, at 09.30 - 15.00

SDU UAS Center at the HCA Airport, Odense

Registrations: akl@tek.sdu.dk

For more information about UAS Ability and registrations for the future newsletter and events check the project home page, here

SDU AARHUS UNIVERSITY AALBORG UNIVERSITY UNIVERSITY OF COPENHAGEN DTU Technical University of Denmark Ministry of Higher Education and Science — Danish Agency for Science and Higher Education