EduServ 25th Distance e-Learning Courses
Spring 2027

EuroSDR
European Spatial Data Research

Universität Rostock

ifp

How to use drones for Surveying

Instructors:

Görres Grenzdörffer
University of Rostock, Chair for Geodesy and Geoinformation, Germany
e-mail: goerres.grenzdoerffer@uni-rostock.de

Michael Cramer
University of Stuttgart, Institute for Photogrammetry and Geoinformatics (ifp), Germany
e-mail: michael.cramer@ifp.uni-stuttgart.de

Dates: June 7-18, 2027

Pre-course seminar: March 1, 2027 (TU Delft)

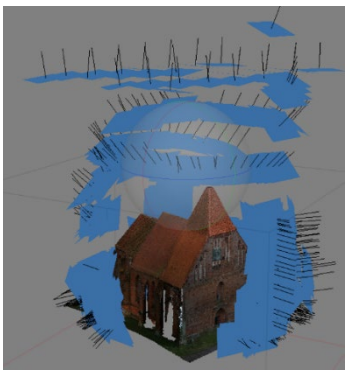
Target audience: Staff of national mapping agencies, other public authorities; professionals and researchers from the public and private sectors; PhD researchers; students

Prerequisites: Familiarity with the basic principles of photogrammetry and interest in drone operation and photogrammetric data processing. In order to perform the exercises, the participants must have access to a computer where several software tools can be run, which might involve administrator privileges.

Course objectives: The course introduces the use of unmanned aircraft systems (UAS) for surveying and land-management applications. Its main focus is the complete drone-photogrammetric workflow, from project planning and data acquisition to three-dimensional reconstruction, quality assessment and the production of geospatial deliverables. Students also learn the principles and applications of drone-based laser scanning, direct georeferencing and emerging technologies such as artificial intelligence, Automated point-cloud classification, Real-time mapping / onboard and edge processing, multisensor systems, Neural Radiance Fields and Gaussian Splatting. Legal, safety, privacy and ethical requirements are integrated into mission planning and drone operation.

Topics tackled: The course is divided into four practical exercises over two weeks, which will enable the participants to understand and plan a drone operation for surveying purposes and the subsequent photogrammetric data processing. The software necessary for the exercises is either open source or trial versions of commercial software. A Moodle e-learning environment provides access to pre-recorded videos, datasets and self-assessment quizzes.

The course is structured into four practical exercises.



- **Exercise 1 – Mission planning (week 1)** with two parts:
  - Calculate flight height, GSD, coverage, overlap, flight-line spacing, number of images and expected flight time for different scenarios, e.g. mapping, oblique and single objects.
  - Legal mission-planning exercise: determine the operational category, identify restrictions and prepare a risk and safety checklist based on different scenarios.

- **Exercise 2 – Photogrammetric processing (week 1)** with three parts:
  - Produce a sparse cloud, dense cloud, DSM, DTM, orthomosaic and textured model.
  - Accuracy assessment. Process the same dataset using different GCP configurations and compare checkpoint errors.
  - Photogrammetric processing of multispectral data.

- **Exercise 3 – UAS-LiDAR vs. Photogrammetric point clouds (week 2)** with two parts:
  - Examine structural differences between photogrammetric and LiDAR point clouds.
  - Classify ground and non-ground points and calculate heights, profiles or volumes.

- **Exercise 4 – Data Visualisation with Gaussian Splats / NeRF:**
  - Learn how to visualise drone data with Gaussian Splats / NeRF and compare the results to UAS photogrammetry.

Along with the short self-assessment quizzes, the practical assignments serve as the basis for grading. The participants shall deliver 3 out of four exercises to pass the course.