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# TOWARDS A STANDARD APPROACH TO UAS BASED DATA COLLECTION FOR OPTICAL MONITORING OF HETEROGENEOUS FLOW

Dariia Strelnikova<sup>1</sup>, Gernot Paulus<sup>1</sup>, Karl-Heinrich Anders<sup>1</sup>, Sabine Kaefer<sup>2</sup>, Petr Mayr<sup>3</sup>, Rudi Schneeberger<sup>4</sup>, Helmut Mader<sup>5</sup>

<sup>1</sup> [CUAS](#), <sup>2</sup> [Verbund AG](#), <sup>3</sup> [Flussbau iC](#), <sup>4</sup> [ViewCopter](#), <sup>5</sup> [BOKU](#)



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# Use cases



- heterogeneous flow (various degree of turbulence, different depth and velocity, partially opposite directions)
- tracer input positions not obvious
- width up to 60 m

## Importance of standardization

- Reduction of time and cost
- Possibility to avoid data insufficiency and/or inconsistency
- Guarantee of comparability
  - crucial for long-term flow monitoring and change detection at the same test site
  - simplifies the comparison of different test sites

# Documentation

## Example: data collection checklist

Tracer input	General equipment
<input type="checkbox"/> Tracers selected and prepared	<input type="checkbox"/> Air horn
<input type="checkbox"/> Tracer input positions determined	<input type="checkbox"/> Chest waders
<input type="checkbox"/> Staff trained or experienced staff available	<input type="checkbox"/> Plastic shovels for particle seeding
Reference flow measurements	<input type="checkbox"/> Headsets
<input type="checkbox"/> Measurement method selected	UAS
<input type="checkbox"/> Measurement equipment prepared	<input type="checkbox"/> UAS prepared
<input type="checkbox"/> Measurement positions planned	<input type="checkbox"/> UAS licence available
<input type="checkbox"/> Staff trained or experienced staff available	<input type="checkbox"/> Sensors selected, mounted and tested
GCPs	<input type="checkbox"/> UAS pilot(s) available
<input type="checkbox"/> GCP locations planned	<input type="checkbox"/> Extra batteries prepared
<input type="checkbox"/> GCP markers prepared	Formal
<input type="checkbox"/> Measurement equipment prepared	<input type="checkbox"/> Access to the test site granted
<input type="checkbox"/> Staff trained or experienced staff available	<input type="checkbox"/> Fishing authorities informed

# Example: metadata collection form (or data collection log)

Optical Flow Analysis					
Experiment Log					
date		ordered by			
experiment id		form filled in by			
location name		email			
coordinates		phone			
Experiment conditions					
water conditions <sup>1</sup>		wind		discharge	
other weather conditions				river width	
tracers <sup>2</sup>				river depth	
participants <sup>3</sup>					
Video Information					
start time		end time			
drone coordinates at video start <sup>4</sup>		sensor description			
file type		sensor settings <sup>5</sup>			
Ground Control Points					
measurement tool		accuracy			
size, material, color				count	
A		E			
B		F			
C		G			
D		H			
Comments					

Study Area Sketch <sup>6</sup>

Reference Measurements					
Cross-section available?	Yes (attached) / No (velocity measurements are below)				
Measurement methods and measurement accuracy					
location / depth		velocity		direction	
method	accuracy	method	accuracy	method	accuracy
Reference velocities					
point id	coordinates	velocity	direction	comment	

<sup>1</sup> Turbid/clear, turbulent/calm, high/low etc.

<sup>2</sup> Material, color, size, quantity, # of seeding positions

<sup>3</sup> # of participants with roles: S – seeding, R – reference measurements, L – lead, V – video recording

<sup>4</sup> Add a log file with the drone trajectory if/when available

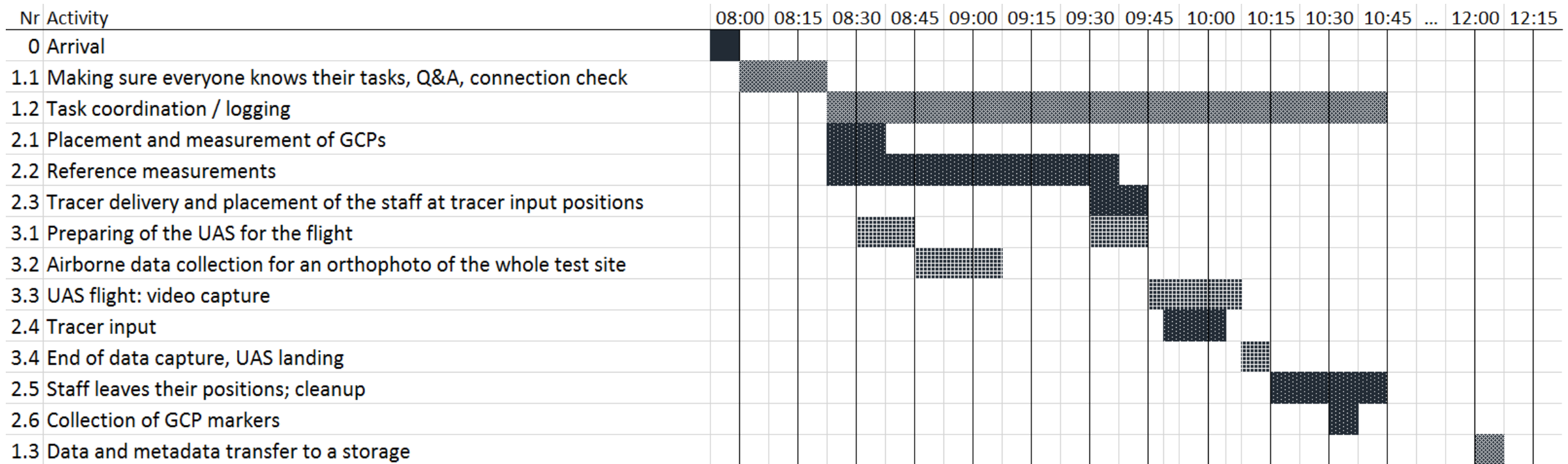
<sup>5</sup> Frame rate, image size

# Planning

## Preliminary flight

- Short flight, without tracers or with minimal tracer volumes
- The goal: empirical estimation of
  - optimal positions for tracer input
  - number and location of flow reference measurements
  - the UAS flight plan and sensor parameters
  - the required tracer volumes and the speed of tracer input based on the differences in turbulence and flow speed in various parts of the watercourse

# Time plan



## Arrival

Making sure everyone knows their tasks, Q&A, connection check



## Placement and measurement of GCPs

Reference measurements



Tracer delivery and placement of the staff at tracer input positions



Preparing of the UAS for the flight



Data collection for an orthophoto



UAS flight: video capture

Tracer input



# Dedicated coordination

## Coordinator's tasks

- Getting access to the test site
- Making sure all participants are there, and everyone knows their tasks
- Control of reference measurements and GCP placement/measurement
- Control of the FOV before/during the video capture
- Permanent contact to all data collection participants
  - Observation “from above”, management of individual participants
    - adjustment of the seeding speed
    - correction of tracer input locations
- Creation of the data collection log
- Control of data and metadata transfer into the designated storage

## Points of focus:

- Standard documentation
- Planning
- Coordination



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