ASSESSING THE FEASIBILITY OF USING SUPER HIGH-RESOLUTION FOREST ENVIRONMENT MAPS IN HARVESTING SIMULATORS FOR PRECISION HARVESTING APPLICATIONS

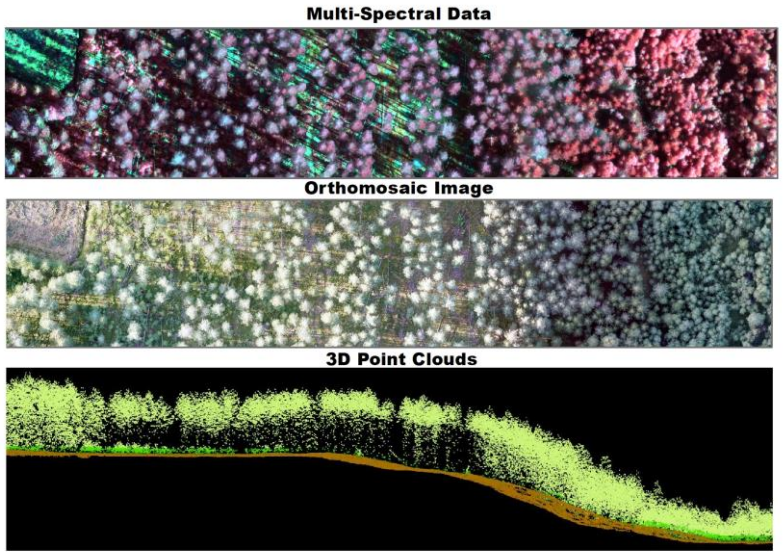
Jori Uusitalo, Omid Abdi, Veli-Pekka Kivinen, Ville Laamanen & Janne Ruokonen

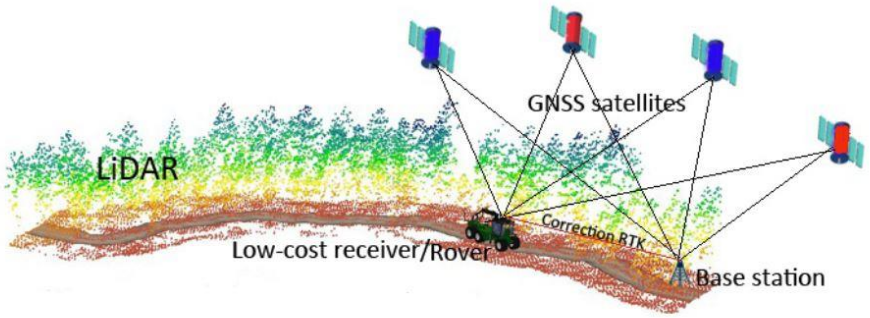
LUOMUHAKKUU-PROJECT

- The work is part of the Luomuhakkuu-project that is funded by the NextGenerationEU -funds

Euroopan unionin rahoittama

NextGenerationEU





HARVESTER SIMULATORS TODAY

- Harvester simulators have a well-established role in teaching trainees different working methods
- The modern simulators encompass high realism in visualization of both harvester components, soil and photorealistic trees.
- The simulators are equipped with exactly same seat, joysticks and control systems than in real machines.
- High level of augmentation is complemented with multiple screens or VR-glasses.

Photo: Ponsse

HARVESTER SIMULATORS TODAY

- Today, terrain topography and location of trees can be customized with separate editors where the location of trees are modified individually by hand
- It means that trainees will learn, how to use machine but teaching of silviculture has to be carried out by other means

Photo: Ponsse

SCOPE OF THE PRESENTATION

- In this presentation, we will
  - Demonstrate how we managed bring a real forest structure – with real world topography and exact locations of the trees – to the Ponsse simulator
  - Discuss the benefits of bringing real forest structure to the simulator world

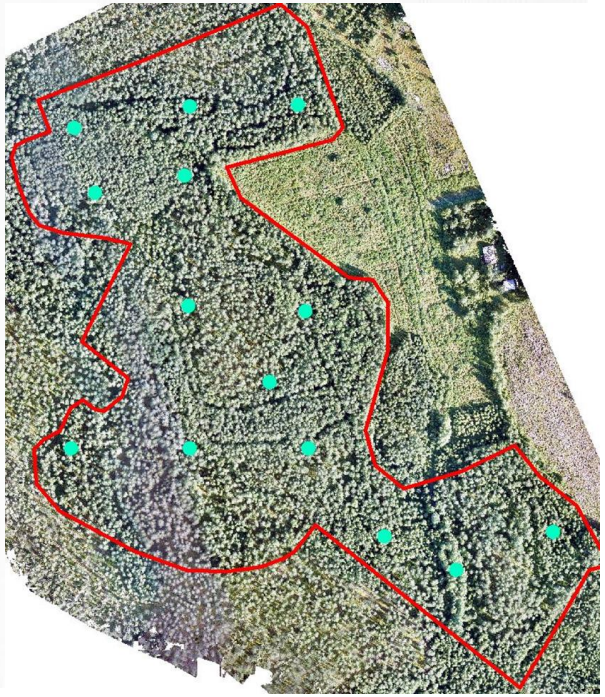
Photo: Jori Uusitalo

SINGLE TREE DETECTION

In ongoing LUOMUHAKKUU-project 11 stands (including between-stand variation in tree species proportion, maturity and structure) were inventoried with a drone

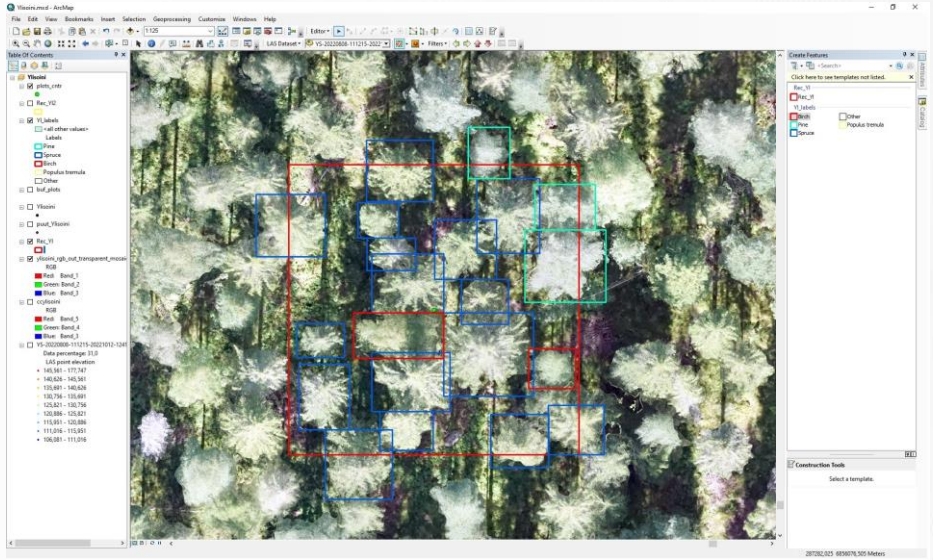
- LiDAR data with a density of 50-100 points/m²
- RGB/multispectral images with the resolution of 30-40 Mpx

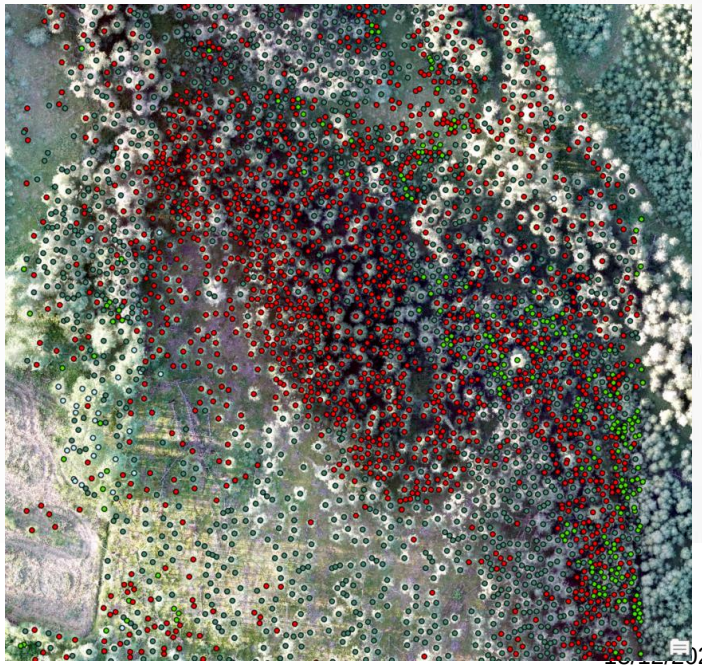
- The drone inventories were complemented with field inventories
  - Roughly 1 circle plot per hectare
  - Exact location of trees defined with GNSS/RTK – system given accuracy of roughly 50cm
  - Tree species and dbh (+ some height samples)



DEEP-LEARNING BASED SINGLE TREE PREDICTION

- Detection of individual trees
  - Bounding Boxes delineated and trees “labelled”
  - DL algorithm that predicts trees with their exact locations, tree species and heights





PROCEDURE

Terrain topography and tree lists to Creanex Oy

↓

Interpretation and fine-tuning by Creanex Oy

↓

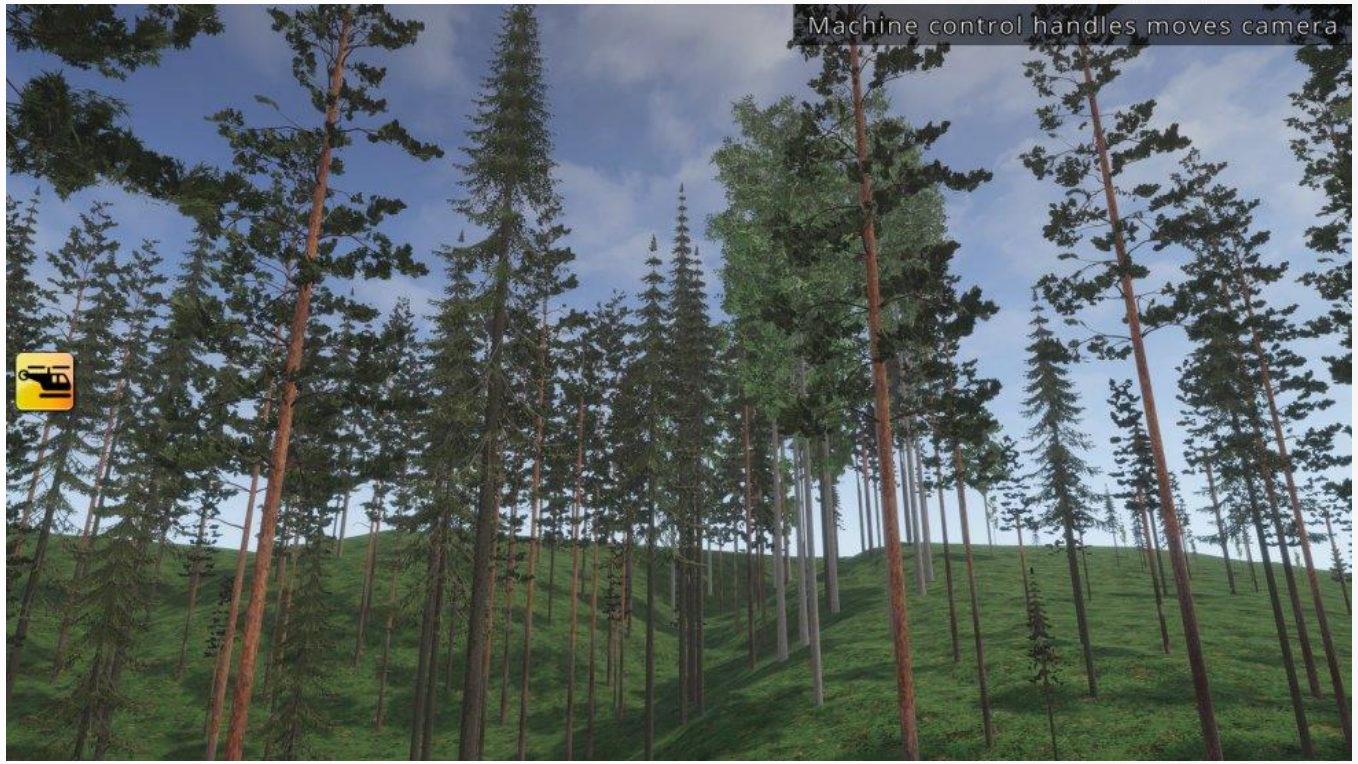
A new software and data assembled to the TREDU forest school Ponsse simulator

EXAMPLES ON HOW TO TEACH SILVICULTURE

- Plan and harvest of logging trail network in this steep terrain in a way that minimize soil erosion risks

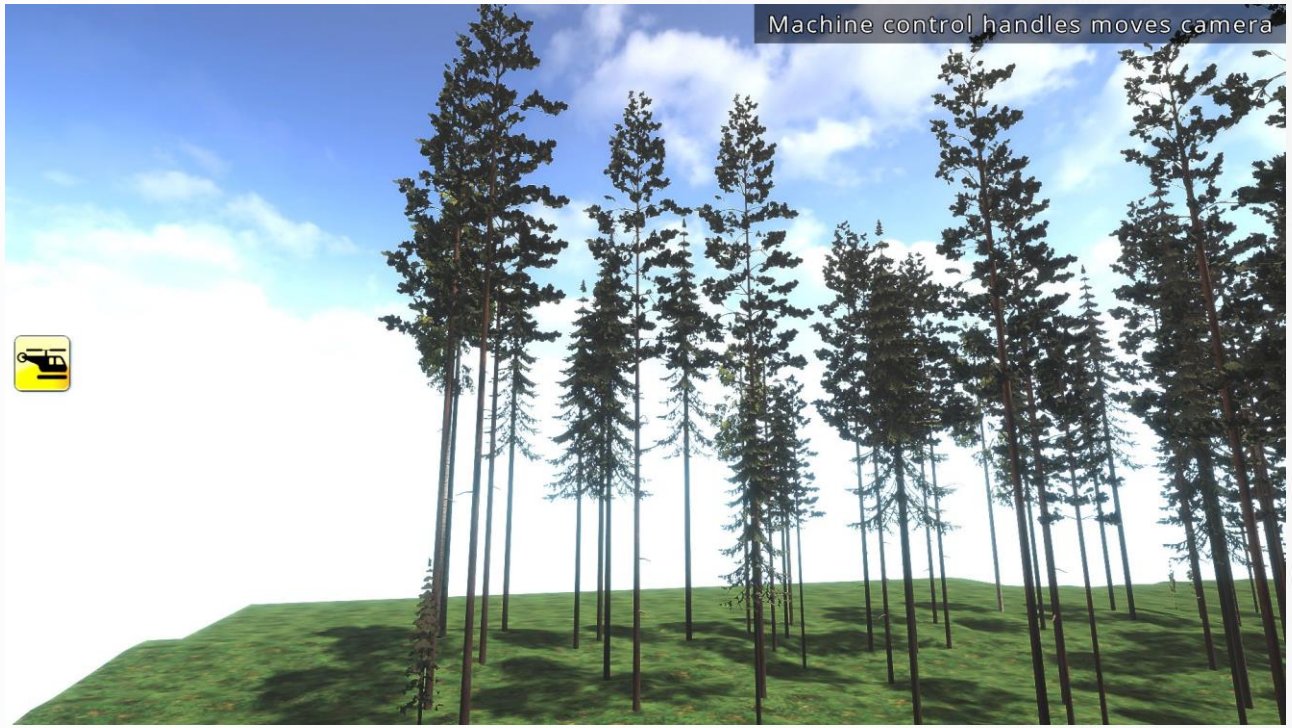
EXAMPLES ON HOW TO TEACH SILVICULTURE

- A challenging form of terrain – how to harvest it in a clever way?



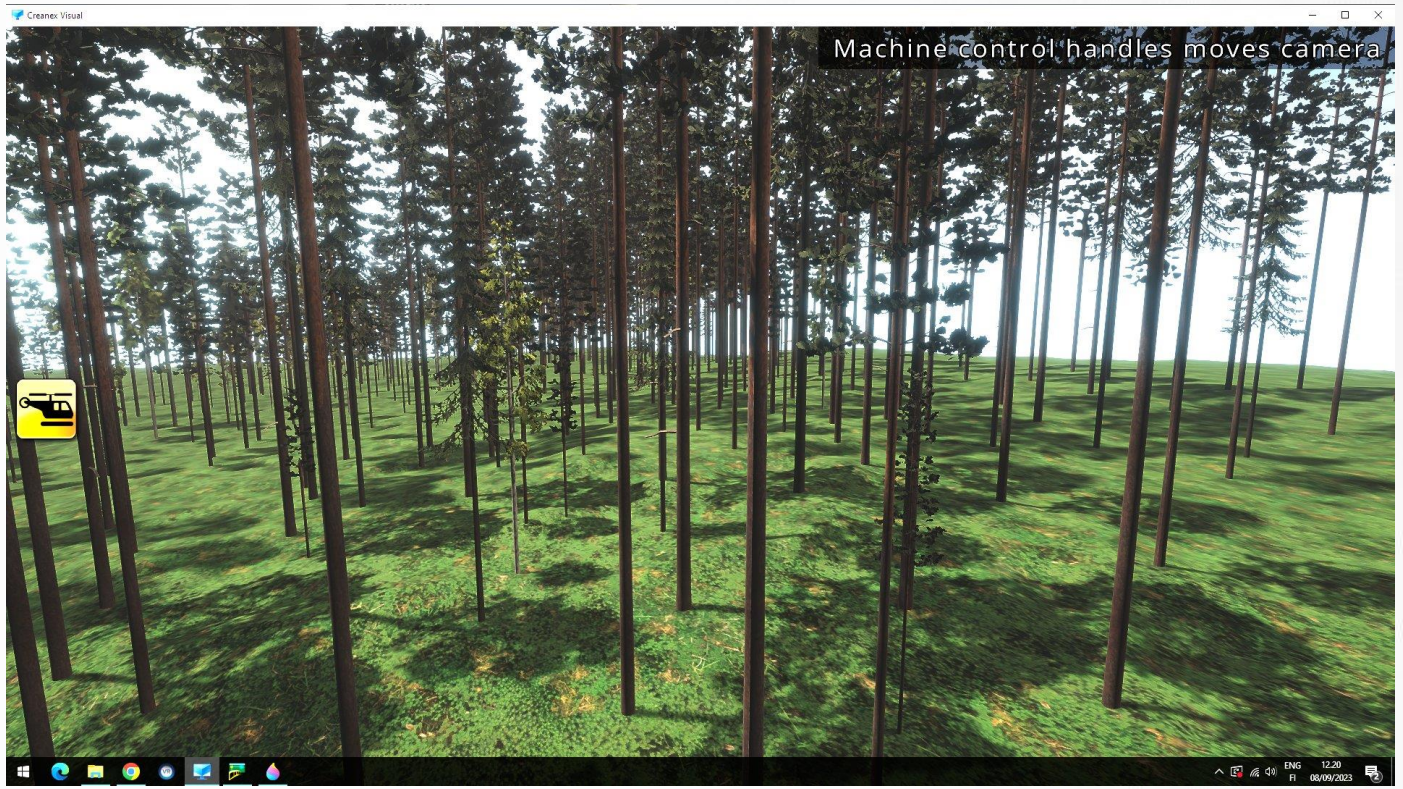
EXAMPLES ON HOW TO TEACH SILVICULTURE

- Treatment of the corner
  - Which trees forms the retention tree group
  - How to deal with risks of wind damages?



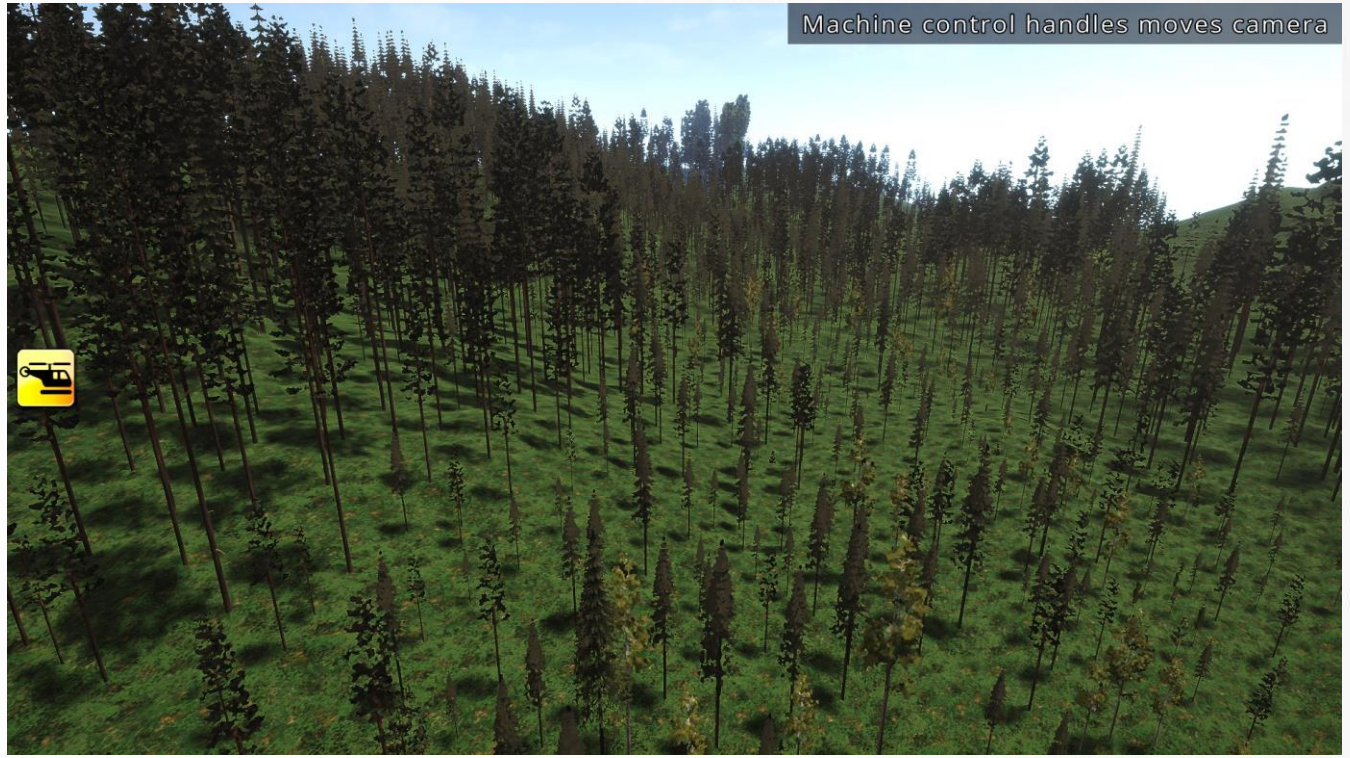
EXAMPLES ON HOW TO TEACH SILVICULTURE

- Clear uneven-aged structure – how to select the removed trees



EXAMPLES ON HOW TO TEACH SILVICULTURE

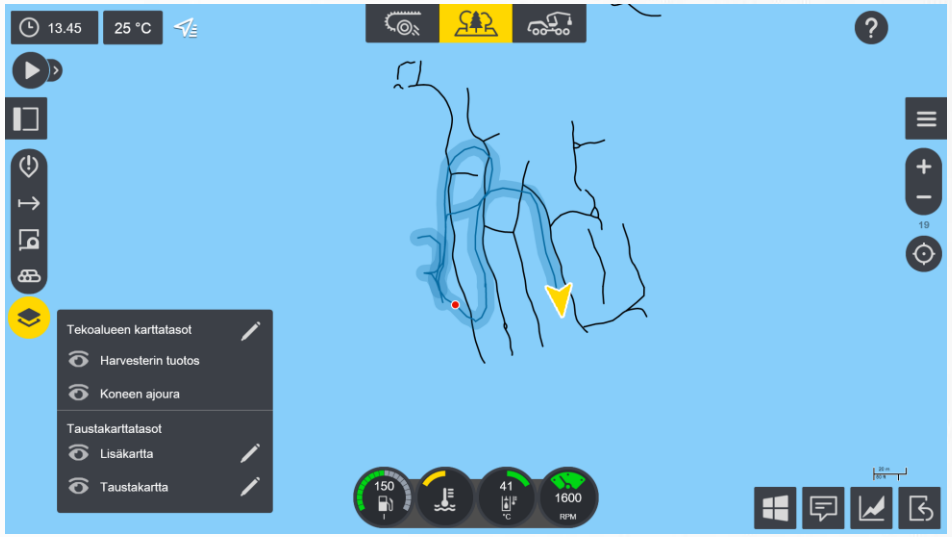
- A silvicultural patch that clearly differs to adjacent forest structure
- How to manage the area in order to follow Closer-to-Nature Forest Management “philosophy”



TESTING OF NEW MAP-LAYERS

- Full environment with joysticks and assisting visualizations
- Which type of visualizations are most effective

- As an example the benefits of the OLT-layer.




THANK YOU!