Using UAS in Future Civil Command and Control Scenarios

Rego Granlund (RISE)
Research Institute of Sweden

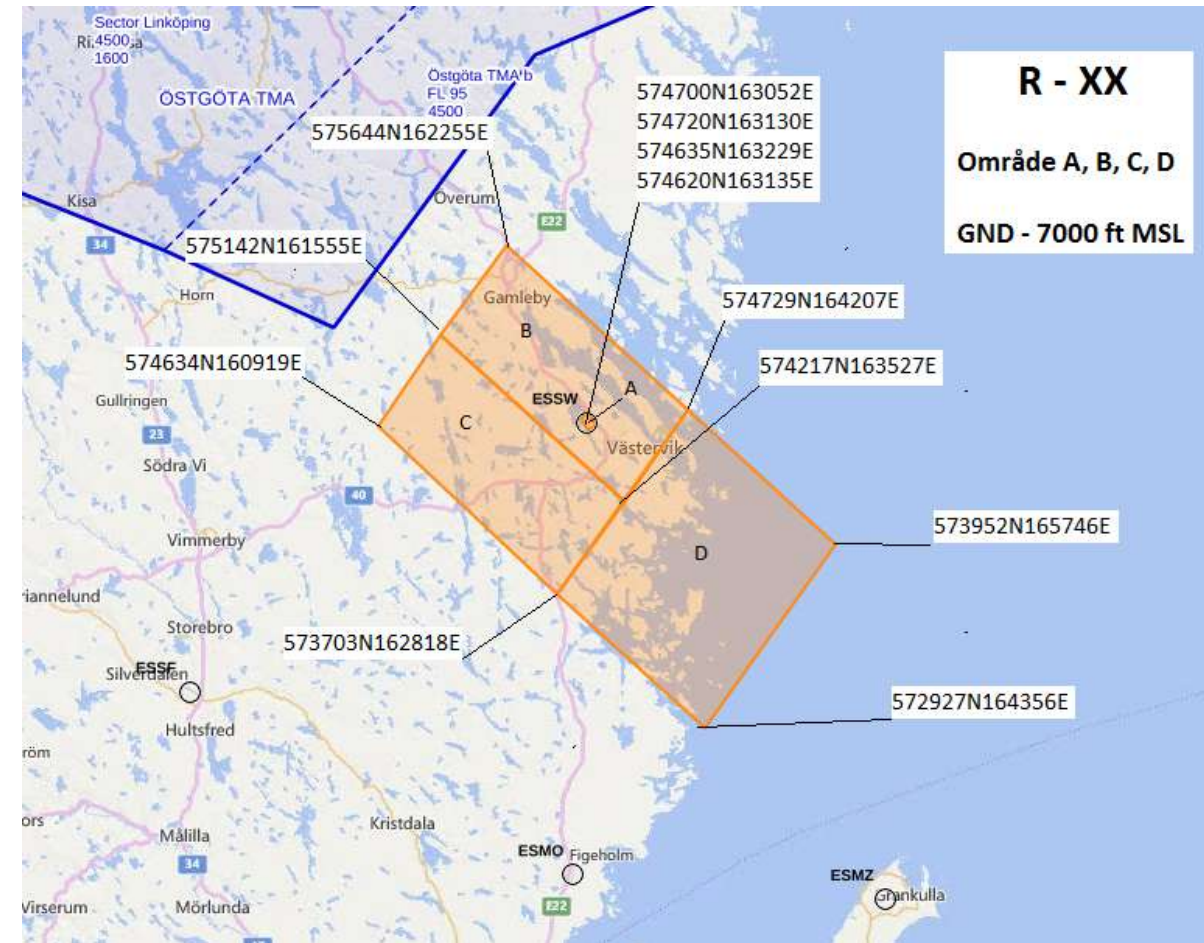**Jens Alfredsson**, Saab

Jonas Lundberg, Linköpings Universitet

- RISE – Autonomous systems group
- Workshop with Swedish rescue service and Swedish police.
- Drone systems current work
- Simulation current work

UAS Test area - Västervik

- No military or regular civil air traffic
- Test area 40 x 60 km up to 2500 m
- The area contains a large set of different geographic types and infrastructure.

Workshop – Future drone usage

- Swedish rescue service
- Swedish police
- LVF (Air traffic control in Sweden)

Sensors and mission goals

The verity of types of drones and sensors will be large.

Dependent on the mission goals

- Situation awareness

- Transportation

- …

- Object, people and situation detection

Change sensors depending on mission goal.

A fleet of drones

Usage examples

The workshop generate a large set of different usage examples.

- Systematic information collection

- …

- Pre mission, Inspections

- Post mission analysis

- …

- Security for own staff

Automation

- Flight Automation

- Mission Automation

- Data collection Automation

Flight Automation

- Collision avoidance

- Fight zones, Geofensing

- Lost of communication channels

- Emergency landing

- Control handover

Regelation dependent

Mission Automation

One of the key tasks for the drone usage is the possibility to make drone missions automatic.

The user should based on predefined type missions be able to activate the drones mission with a basic command.

- Controlled by the on site commander
- Controlled from the command and control center

Data collection Automation

The new drone systems makes it possible to collect allot of data.

In many situations it is desirable to collect a lot of data,

- Analysis

- Training

- Forensics

- Goal to build automatic systems that help the organizations to collect all needed information.

- Preprocessing of data during data collection to detect when all data needed are collected.

Cooperation between organizations

UAS used in civil context, where information that can be shared and used by many community services.

- Rescue service

- Ambulance

- Traffic control centers

- First response dispatchers

- Police (Police can not share information)

Command and control

Examples on current research areas

- How to control a fleet of drones or a swarm of drones

- Systems of systems

- Mission communication with autonomous system

- The controller sometimes needs to be able to understand the current state in an autonomous system.

- Decision support

RISE Drones and current work

Automation is key

- Pixhawk 2.1 autopilot:
  - 3 x 3-axis IMU's
  - 3 x 3-axis magnetometers
  - 2 x barometer
  - Heated for compliance in cold conditions
  - Support for 3 GPS modules

- Mauch power module:
  - 2 x 5V, 1A for flight critical components (redundant)
  - 1 x 12V, 1A for payload

- Sixfab 4G modem, raspberry pi dock on.

- Jetson TX2:
  - dual-core NVIDIA Denver2 + quad-core ARM Cortex-A57
  - 256-core Pascal GPU
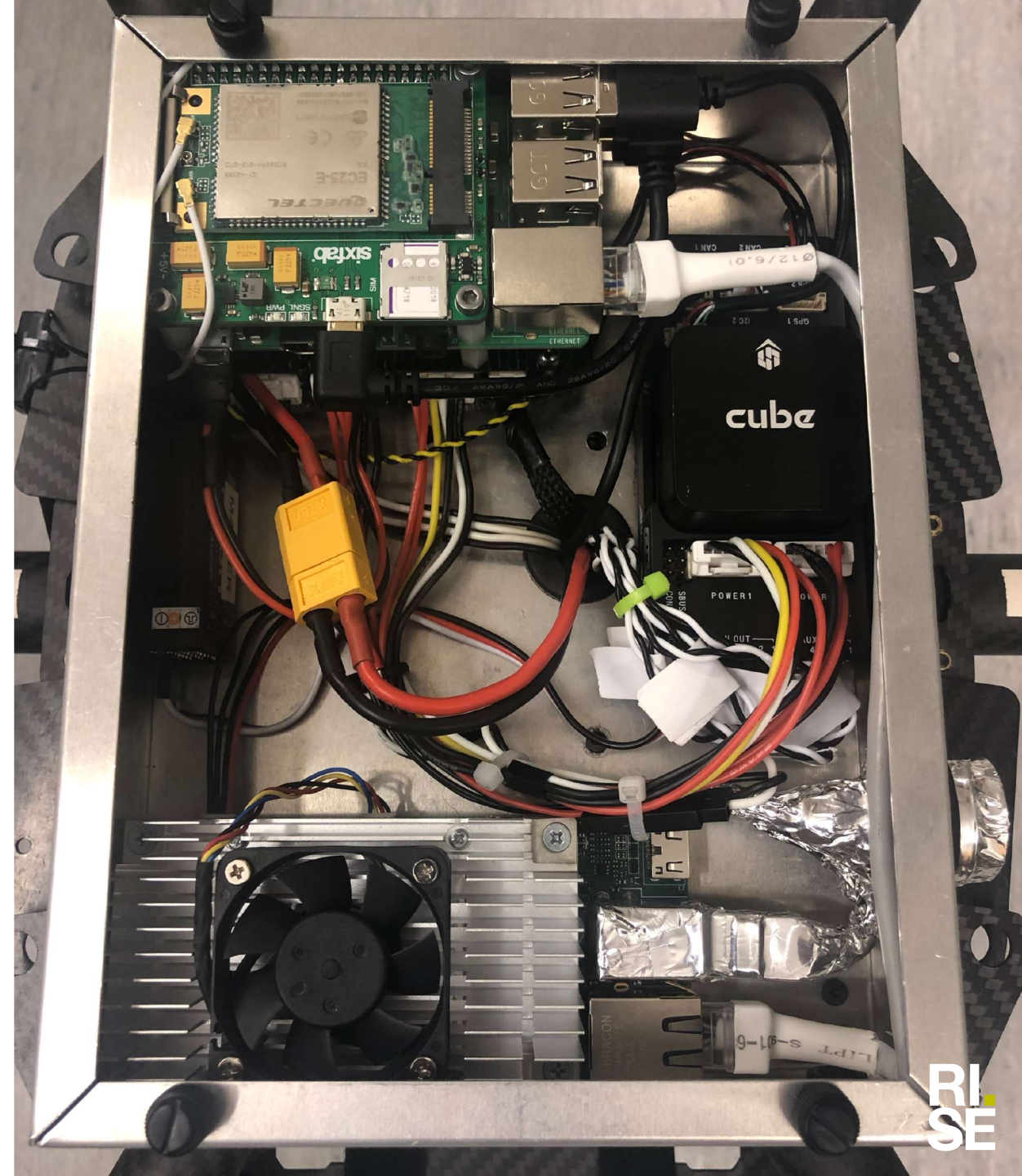
Future work

- AI applications

- Utilize on board Jetson GPU to evaluate collected data during flight

- Act on analyzed data, guarantee data quality
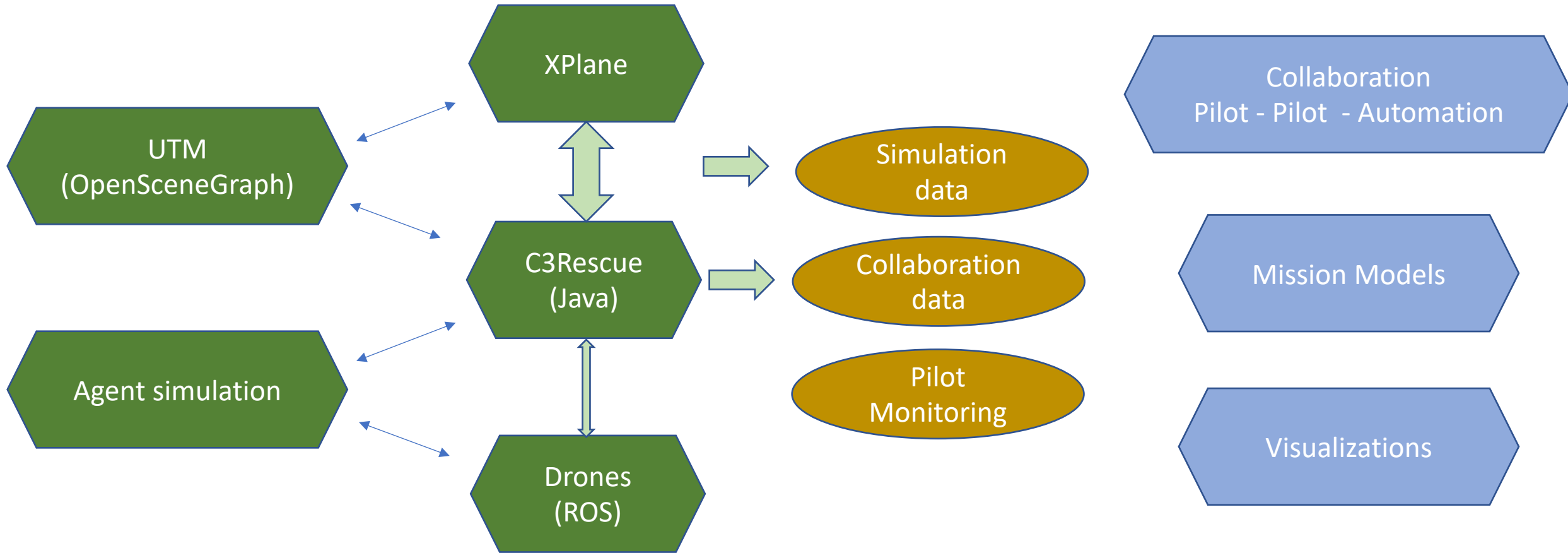
- Increase level of automation to include …

Simulation to test future drone systems

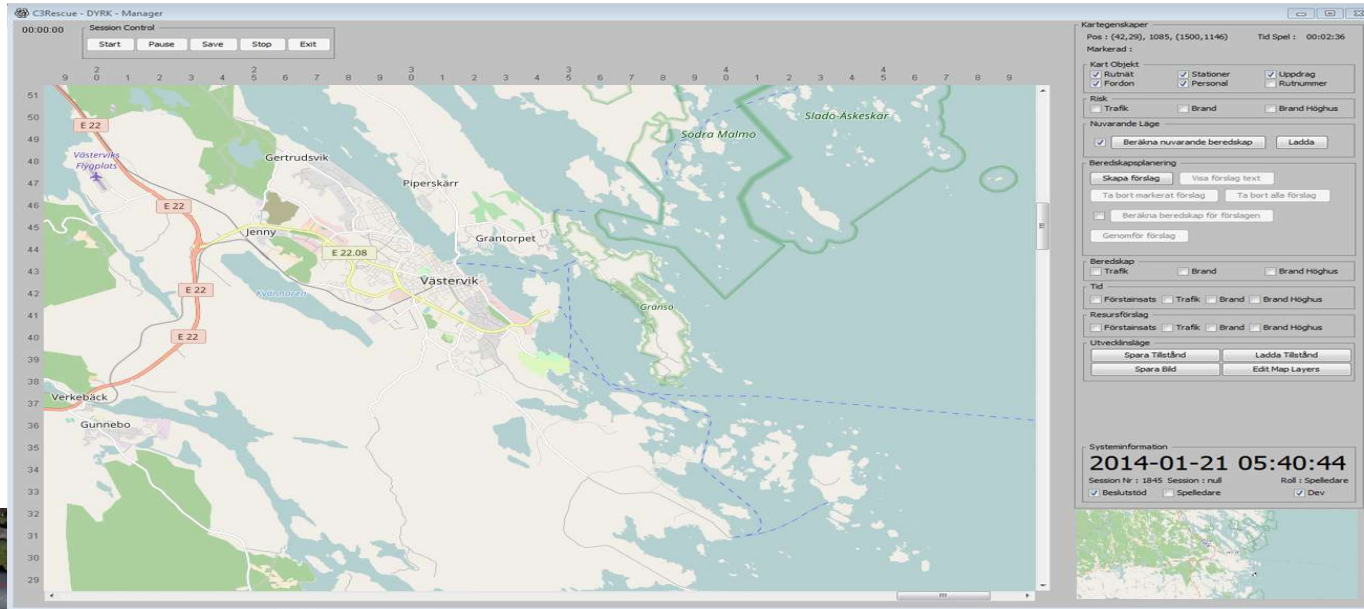Human Factors Lab for Future Air Systems

Linköping University, Saab, RISE

Simulations in Human Factors Lab
for Future Air Systems

Simulation Platforms

Command and Control

Drone simulation 3D

X-Plane

Command and Control
Experiment and Training with professional participants

Questions?

Rego Granlund (RISE)
Research Institute of Sweden

rego.granlund@ri.se

Jens Alfredsson, Saab

Jonas Lundberg, Linköpings Universitet