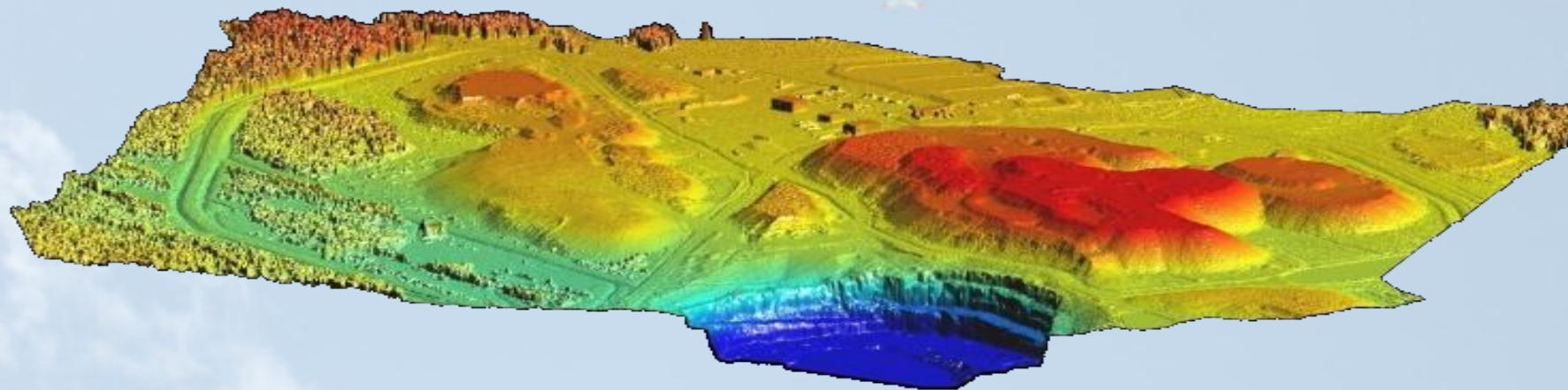




# Small UAS – new capabilities

Olle Hagner  
Smartplanes AB



[www.smartplanes.se](http://www.smartplanes.se)

# Vision – the Personal Aerial Mapping System

## PAMS



- Anyone – Simple to operate, safe
- Anywhere – Mobile, robust
- Anytime – Wind tolerant, automated flight
- Anything – Multirole, versatile

Optimised for:

- Aerial mapping and survey of small areas
- One-person operation
- Rapid deployment



# System overview

SmartOne aircraft and ground control station



Training

# PAMS

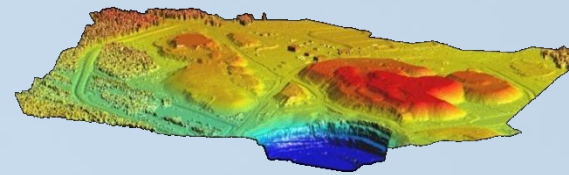
Personal Aerial Mapping System



Support and maintenance services



Aerial mapping software



Processing service

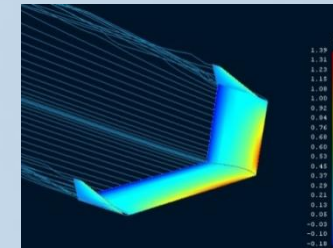
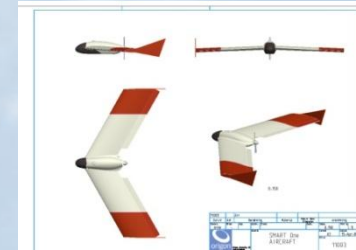
# Smartplanes *SmartOne mini-UAS*

## Specifications:

Take-off weight	1.1 – 1.5 kg *
Cruise speed	12,5 m/s
Operating altitude	100 – 1200 m AGL*
Wind rating	10 m/s **
Payload	200 – 600 gram*
Propulsion	Electric
Endurance	35min – 1.5 hr.*
Sensors	Compact cameras (RGB or CIR)
Payload compartment	120 x 90 x 85 mm
Control modes	Auto, Assisted, Manual
Control links	Dual frequency redundant, interference tolerant
Failsafe	Return-to-home, virtual fence, GPS/link/control-fail, other...
GCS software	Mission planning, Flight control
Aerial mapping software	Matching, triangulation, block adjustment and mosaicking
Operation	Hand launch, skid landing, automated flight
Back packable	Yes

\* Depending on configuration and national airspace regulations

\*\* Average wind speed at mission altitude



# Operation

- Deployment
- Flight planning
- Hand launch
- Flight monitoring
- Landing
- Data processing



# Data processing

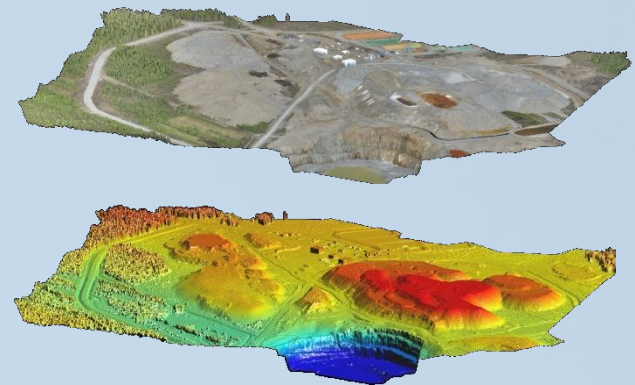
## On-site maps with PAMS aerial mapping software

- Georeferenced photo mosaics can be produced on-site within 15 minutes after landing
- Multiple flights can be merged into a single block

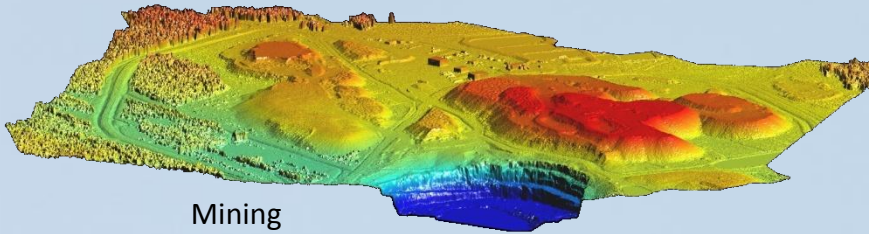


## PAMS processing service for advanced products:

- DSM  
0,35-0,5 m point spacing, height accuracy of 8-10 cm (RMS)
- Orthophoto mosaics  
Planar accuracy in the order of 0,5 pixels, e.g. 3-5 cm (RMS)
- Efficient production on clustered computers



# Applications



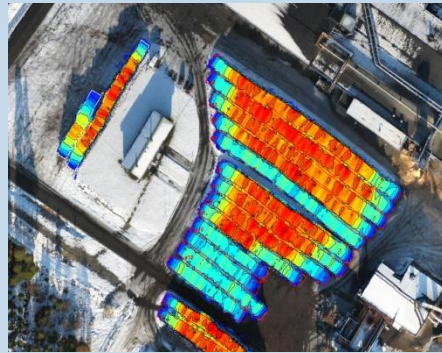
Mining



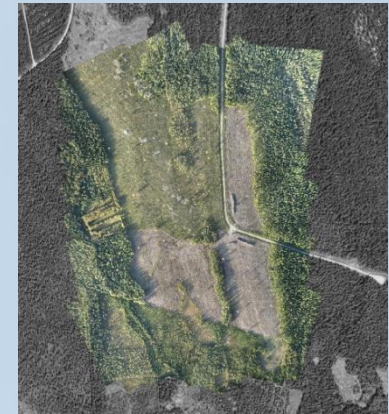
Biofuel



City planning



Volume measurement



Forestry



Agriculture

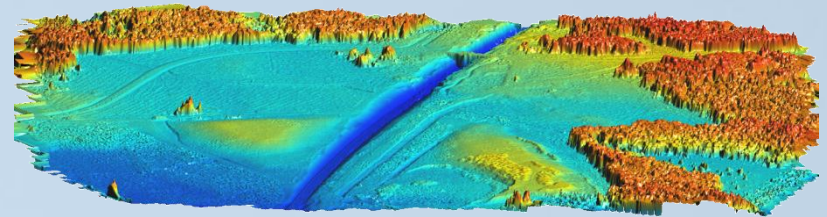
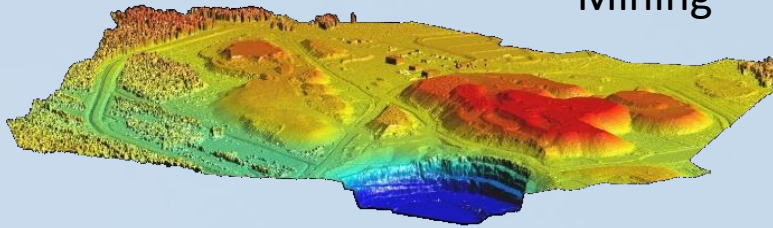


Infrastructure mapping

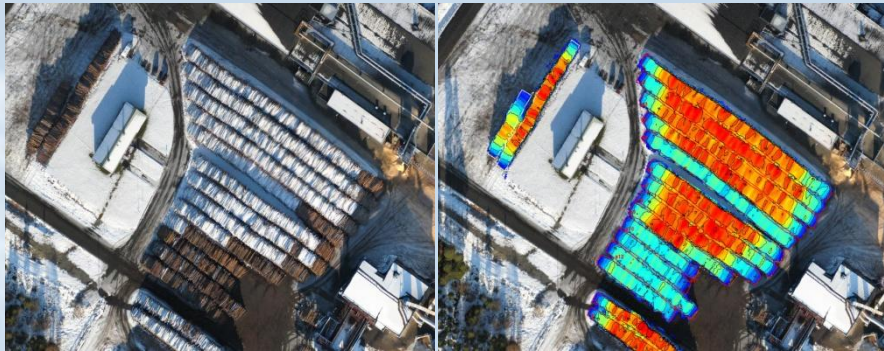
# Surveying



Mining



Infrastructure mapping



Volume measurements



# Agriculture



Crop monitoring



Precision farming



Research



Vegetation stress (CIR)

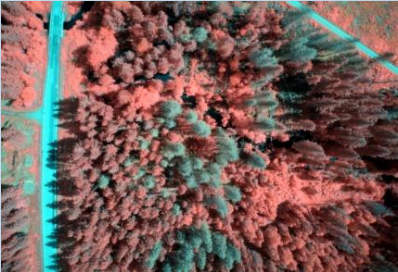
# Forestry



Forest inventory

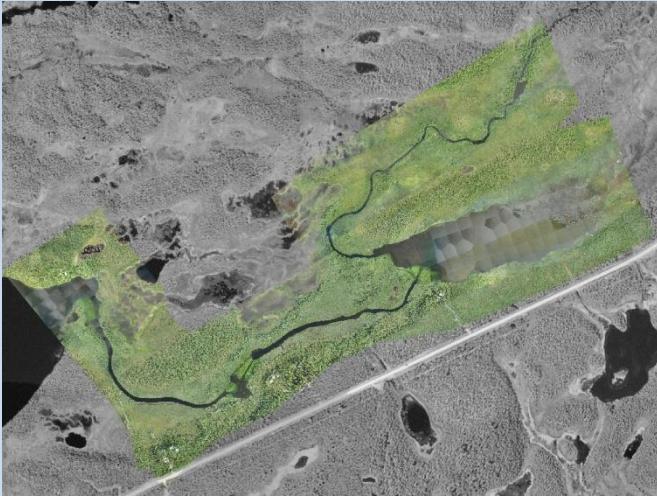


Forest health



Science

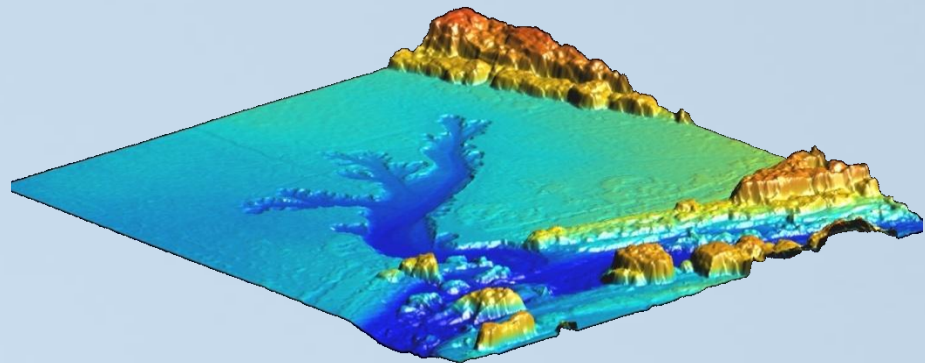
# Environmental monitoring



Luleå University of Technology: Monitoring of vegetation response to mining activities



Durham University: Mapping of river beds and glaciers in Svalbard

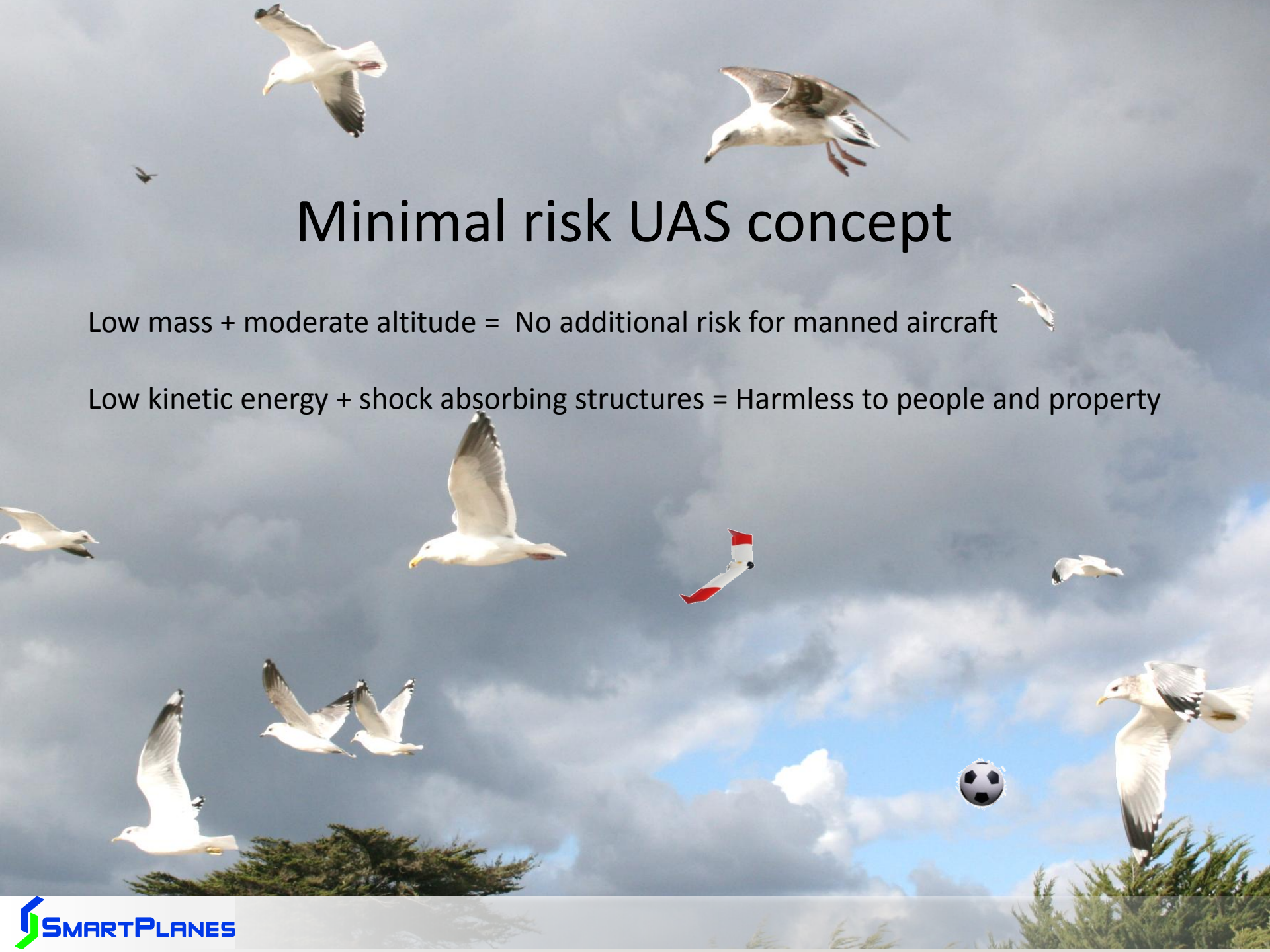


Durham University: Monitoring of river bank erosion dynamics

# Minimal risk UAS concept

Low mass + moderate altitude = No additional risk for manned aircraft

Low kinetic energy + shock absorbing structures = Harmless to people and property



# SmartOne UAS safety features

Mass 1.1 kg

Kinetic energy < 150 J

Dual redundant control links

Blunt, shock absorbing structures

Interference tolerance

Aft mounted propeller

Assisted and manual control modes

High visibility

Real time telemetry

- Moving map display
- On-board system monitoring

High reliability

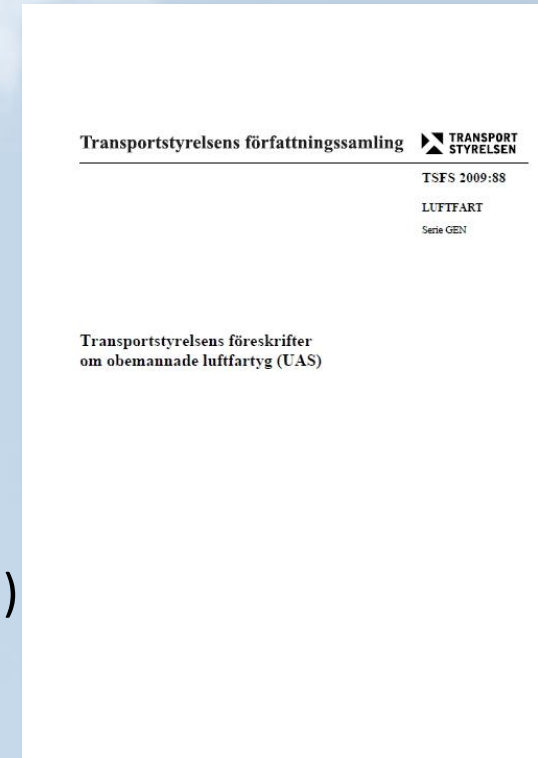
Fail-safe modes

- Auto return
- Virtual fence
- GPS/Link-loss
- Control failure



# Swedish UAS category 1A:

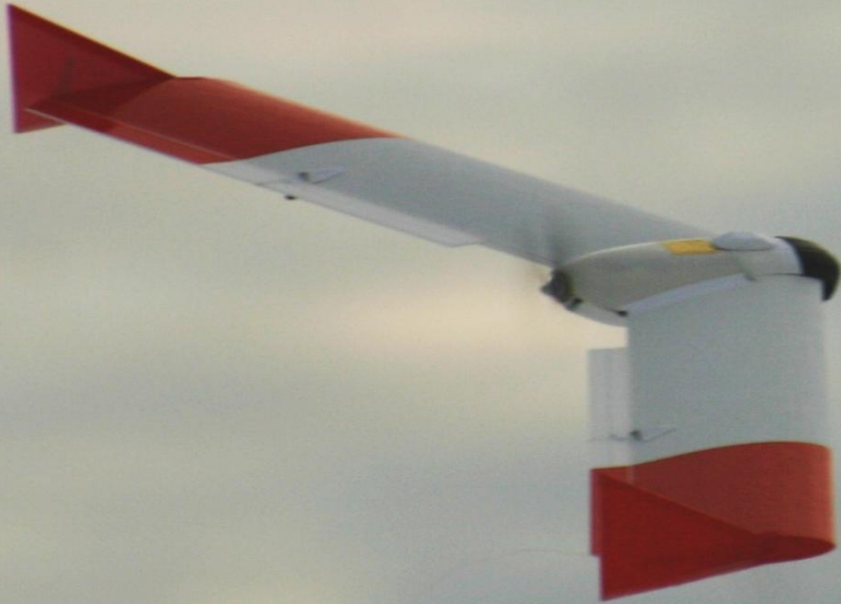
- Mass < 1.5 kg (Sea gull)
- Kinetic energy < 150 J (< football)
- Visual flight rules
- Minimal restrictions
  - Non-segregated airspace
  - Populated areas
  - Access to controlled airspace
  - NOT restricted to operate under 400 ft (120 m)



# Summary

## Mini-UAS:

- Are ideal for surveying of small areas
- Can generate high resolution surface models and orthophoto mosaics
- Can often operate in conditions where conventional aerial mapping is not feasible
- Can be deployed rapidly with a small logistic footprint
- Can operate safely in non-segregated airspace
- Is a versatile tool for a wide range of application areas



# Smartplanes false-colour infrared camera

- Digital compact camera modified to mimic the spectral response of false colour infrared film (CIR)
  - Internal filter similar to Kodak Wratten # 12
  - b/w near-infrared with external filter
- Interchangeable with standard RGB camera, fits into the same camera mount
- Exposure settings available in Exif-header for radiometric processing

