# UNLOCKING THE POWER OF SATELLITE-BASED DATA

**USE CASES & CUSTOMER INSIGHTS**

**OCTOBER 2022**

OHB DIGITAL

OHB DIGITAL's

**Top 20**

**Downstream Use Cases**

OHB DIGITAL HAS A CLEAR FOCUS IN ITS PRODUCT DEVELOPMENT: CLIMATE & DIGITAL INDUSTRY SOLUTIONS



## DIGITAL TWINS

### Making Better Decisions – More Efficient

### CLIMATE Digital Twins

based on satellite data and AI to evaluate the impact of urban planning

### INDUSTRY Digital Twins

for efficient organizational processes and resilient supply chains

**01**

# CLIMATE DIGITAL TWINS

# CITY CLIMATE DATA SERVICES

## MAKING HIGH-RESOLUTION CLIMATE SIMULATIONS & PREDICTIONS BASED ON COPERNICUS DATA

Development of a Generic City Climate Platform and City Climate Services in the scope of the current and upcoming climate-related challenges in urban areas with the aspects:

Project outcomes:

- **Identification**: Statistical analysis for identification of critical areas with respect to heat, air flow pattern and pollution

- **Simulation:** Users can simulate changes to urban areas and obtain analysis of the impacts to urban climate with respect to heat, pollution and airflow pattern

- **Warnings:** Monitor upcoming and ongoing heat waves and identification of strongly impacted areas

- **Information:** Actual and historical climate data for analysis and visualization

**Your OHB Expert**
Dr. Ingo Schoolmann

Heat

Air Flow

Pollution
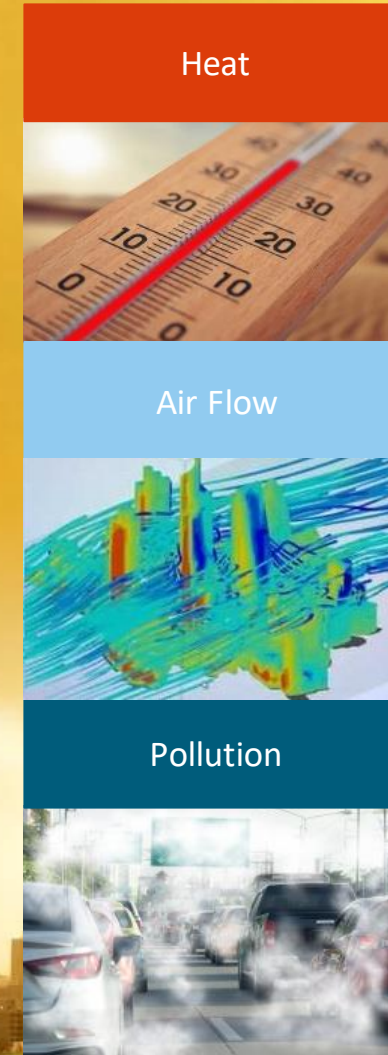
# URBAN GREEN ANALYSIS

## UNDERSTANDING THE IMPACT OF GREEN SPACES IN URBAN AREAS

Urban Green View is a project to study the impact of EO-based data in the development of data services for the integration of green spaces in a sustainable urban context, and so to improve the handling of present and future climate change related hazards.

- EO-based data services analyzed in the project:

  - Monitoring/detection of the changes in vegetation (monitoring of the urban greenery and their dynamics)

  - Estimation of corridors of cold air that could be used for city administration and/or for building constructors planning purposes

  - Monitoring of heat zones

- Integrated data sources:

  - Copernicus Sentinels and other non-commercial satellite missions

  - Upcoming satellite mission MTG or EnMAP

**Your OHB Expert**
Dr. Danijela Ristic-Durrant

# FOREST MONITORING

## CALAMITY MONITORING OF CONIFEROUS FORESTS WITH SENTINEL-2 SATELLITE DATA

The state enterprise HessenForst in Germany is responsible for the annual mapping of the forest damage areas as a critical basis for the management of the forest crisis. It is needed particularly for the planning of reforestation, but also for tax depreciation as a result of the decrease in value of forests, forestry planning and a wide range of nature conservation concerns.

- Project outcomes:

  - Automated processing workflow of Sentinel satellite data including download, atmospheric correction, cloud mask and mosaicking for image series in a very short period of time.

  - Change detection and classification of tree types and damages, also by machine learning technology.

- Integrated data sources:

  - I.a. Copernicus Sentinel-2 and Planet Dove.

**Your OHB Expert**
Irmgard Runkel
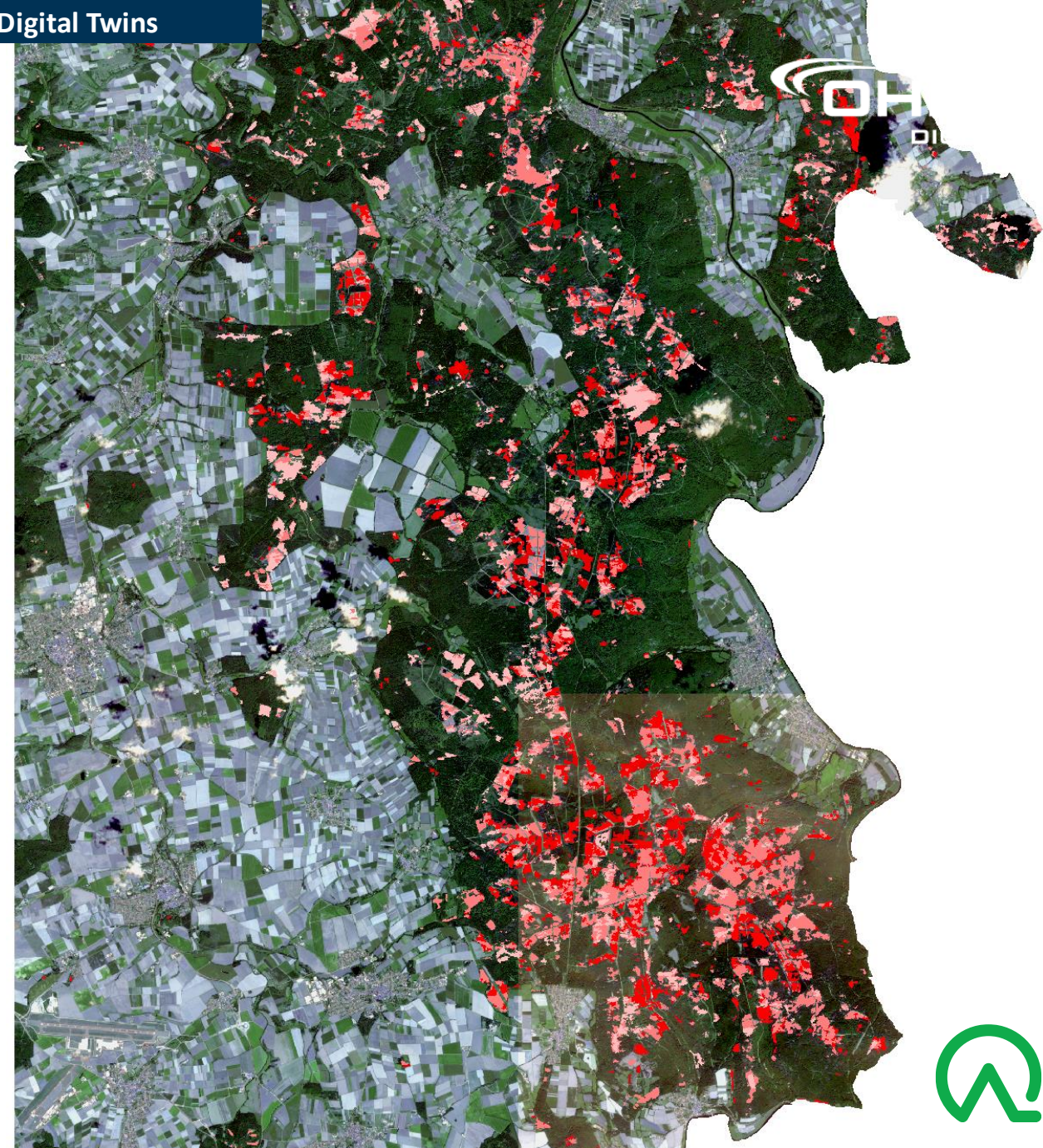
# CLOUD & SHADOW DETECTION

## OPTIMIZING PRE-PROCESSING OF IMAGE DATA VIA DEEP LEARNING TECHNOLOGIES

The detection of clouds and cloud shadows is an essential pre-processing task for many Earth Observation applications. No useful information about the Earth's surface can be extracted from optical images that are heavily covered by clouds and their shadows. On average 67% of the earth is covered by clouds

- Project Outcome

  - Development and use of inhouse, Python-based tool with various deep learning models

  - Detection of >90% of the clouds/shadows

  - Direct application also possible for on-board processing to save bandwidth

- Integrated data sources

  - Demonstration with Sentinel 2 & Landsat data

  - Application to other VIS/multi-spectral satellite data

**Your OHB Expert**
Dr. Alexander Kläser
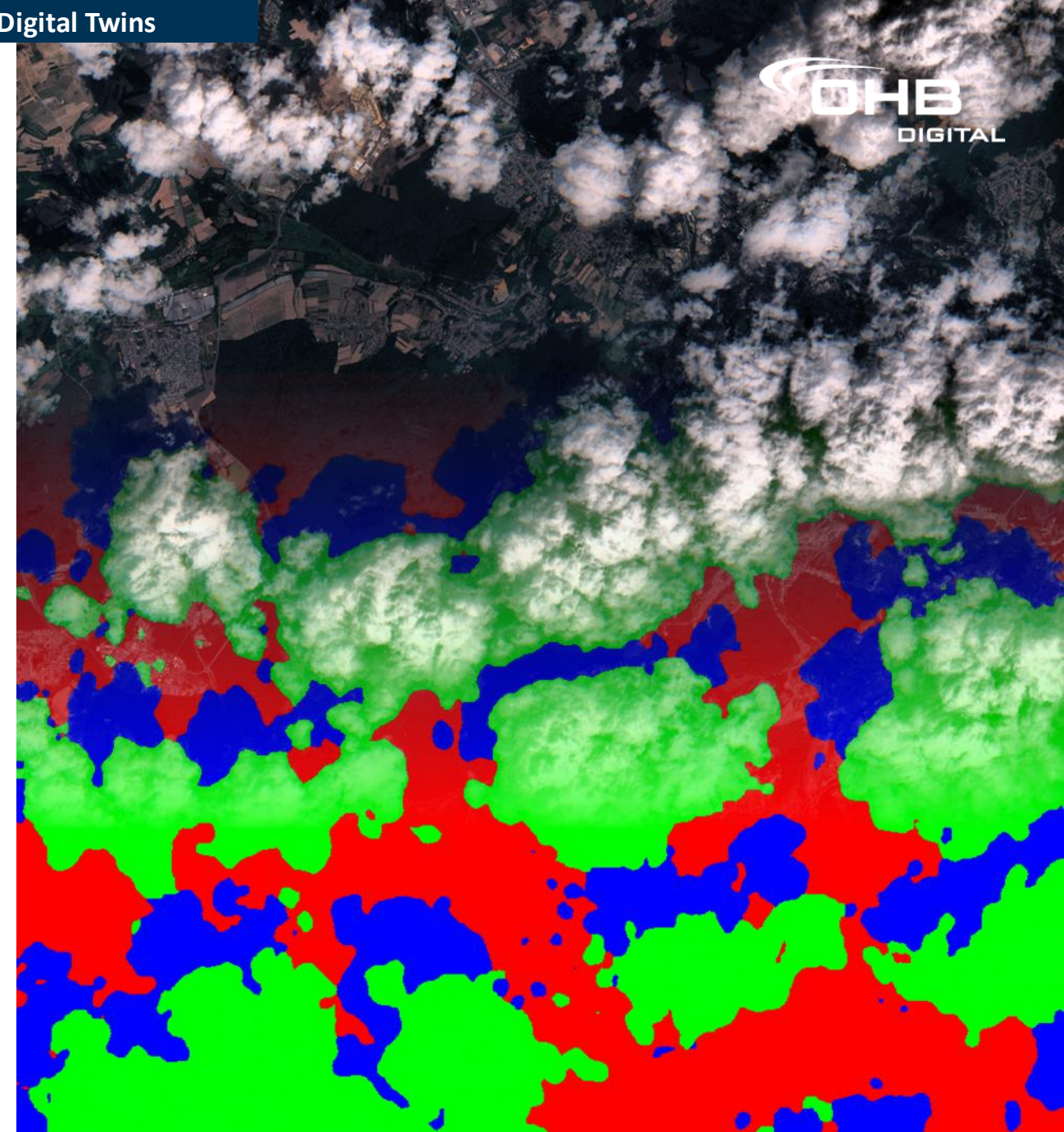
# HEALTH-PROMOTING INFORMATION

## HEALTHIER CITIES THROUGH BLUE-GREEN REGENERATIVE TECHNOLOGIES & QUALITY-ASSURED INDICATORS

Development of quality-assured indicators for health-promoting decisions for the urban ecosystem. Solutions targeted especially to municipal administrations.

- Project outcome:

  - The geospatial engine should automatically process satellite images to extract environmental indices

  - Focus on urban vegetation and green indices (e.g., UNGI and NDVI) as well as climate and atmospheric related information

  - AI on satellite data to assess various indices in the urban environment.

- Integrated data sources

  - Very High Resolution (VHR) satellite data

**Your OHB Expert**
Moritz Seidel

# REFORESTATION ANALYSIS
## USING SATELLITE DATA FOR MONITORING TREE GROWTH

Green Steps is at the forefront of one of the fastest moving technologies to help monitoring the state and success of reforestation projects. It uses a multi-spectrum remote sensor technology. The project focused on finding a solution to measure the growth of trees with satellite data.

- Project outcome:

  – Precise vegetation monitoring

  – Photogrammetric processing on stereo satellite data to calculate height differences on trees in reforestation areas in Madagascar.

  – Ingesting the results into customer's app to answer the question "How does the tree grow that was planted with my donation?"

- Integrated data sources

  – Satellite data, such as Copernicus Sentinel, Planet and WorldView

**Your OHB Expert**
Irmgard Runkel

**02**

# INDUSTRY DIGITAL TWINS

# LOGTWIN

## EFFICIENT WAREHOUSE MANAGEMENT BASED ON GNSS-BASED TRACKING SOLUTIONS

Many logistics companies face inefficient resource allocation due to lack of transparency in the supply chain. A key problem is the cost-efficient tracking of the flow of goods, materials and vehicles.

- Our LogTwin product:

  - All intralogistics processes in outdoor sites can be mapped in 3D

  - Provide full process transparency: Plan/automate/optimize workflows

- Our Technology

  - By combining AI, smart sensors and satellite data we create digital twins of company processes and supply chains based on cloud-based software architecture

  - Indirect 3D location tracking using the digital fingerprint

- Customer Benefit

  - Improving resource efficiency ~25%

  - Reducing loading errors to zero

  - Reducing CO2 footprint

**Your OHB Expert**
Christian Stelljes
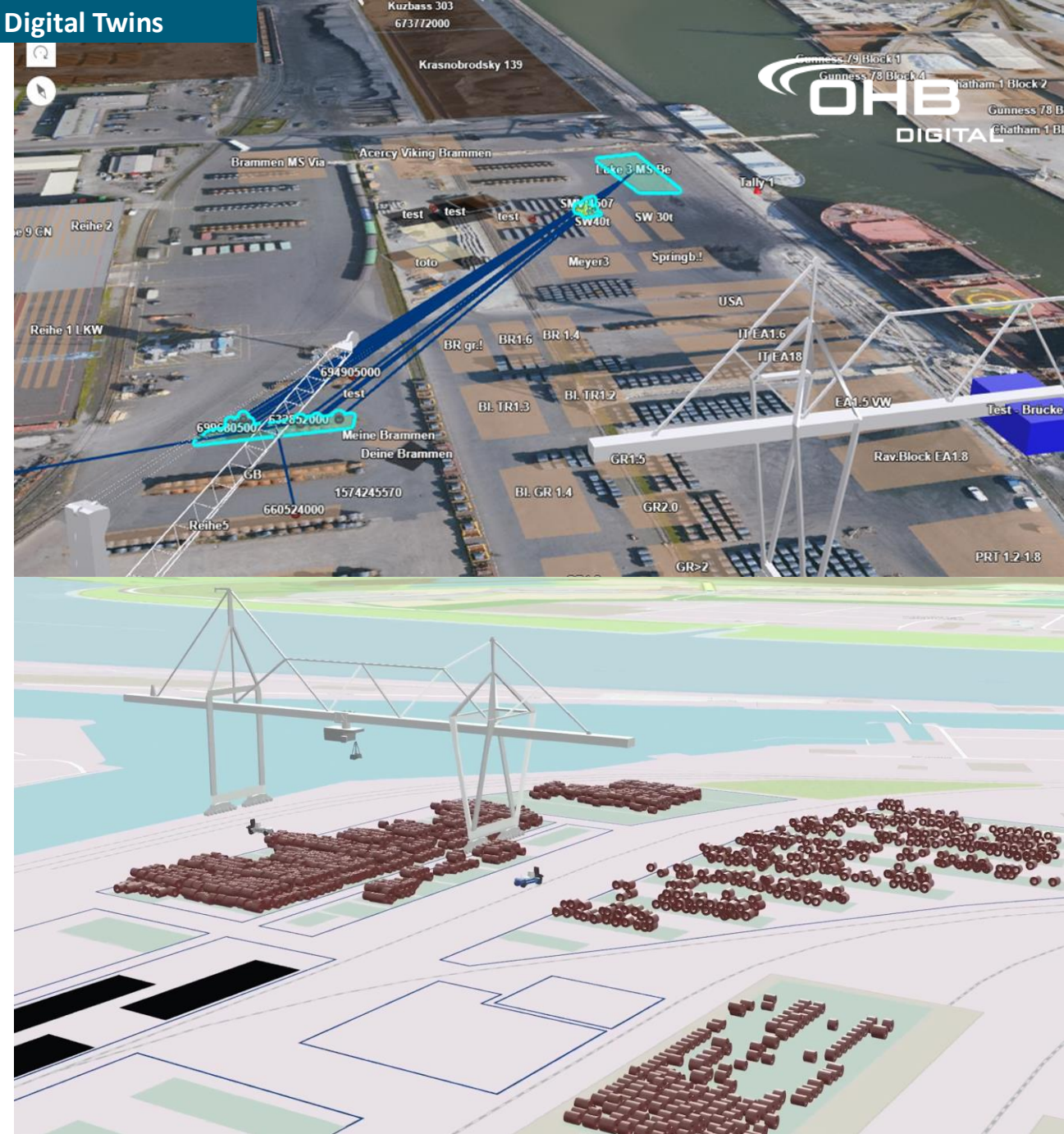
# AGRICULTURAL MONITORING
## MONITORING OF AGRI-ENVIRONMENTAL CONDITIONS

The "ScaleAGdata" project aim at scaling agricultural sensor data for an improved monitoring of agri-environmental conditions:

- **Water productivity:** Early prediction and detection of drought stress

- **Crop management**: Smart farming services

- **Yield monitoring**: Crop productivity over large scales

- **Soil health**: Soil quality assessment

- **Grassland:** Derivation of meaningful biophysical and biomass parameters

- **Sustain dairy:** Analysis of all parameters along the dairy chain

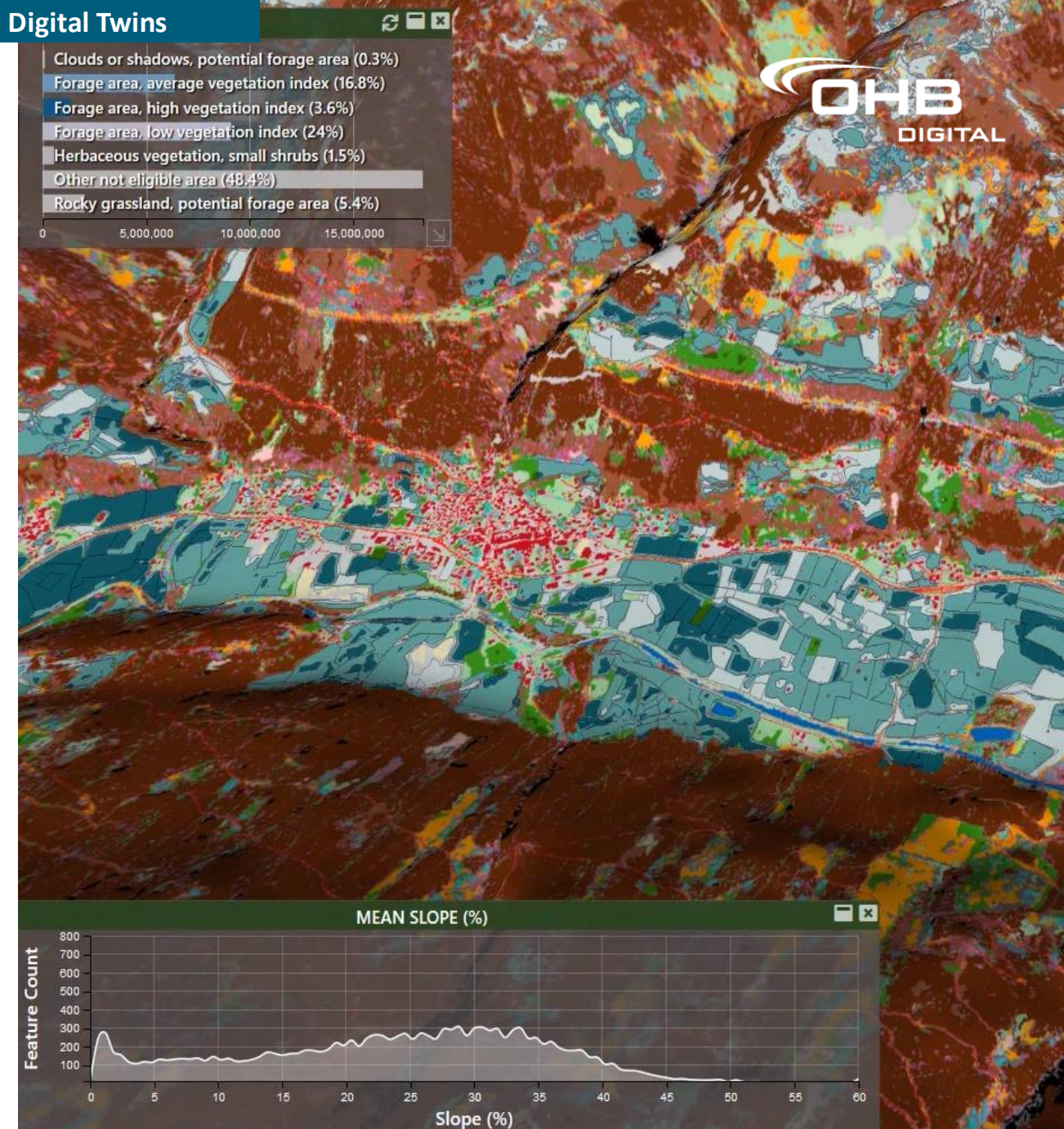**Your OHB Expert**
Dr. Ingo Schoolmann
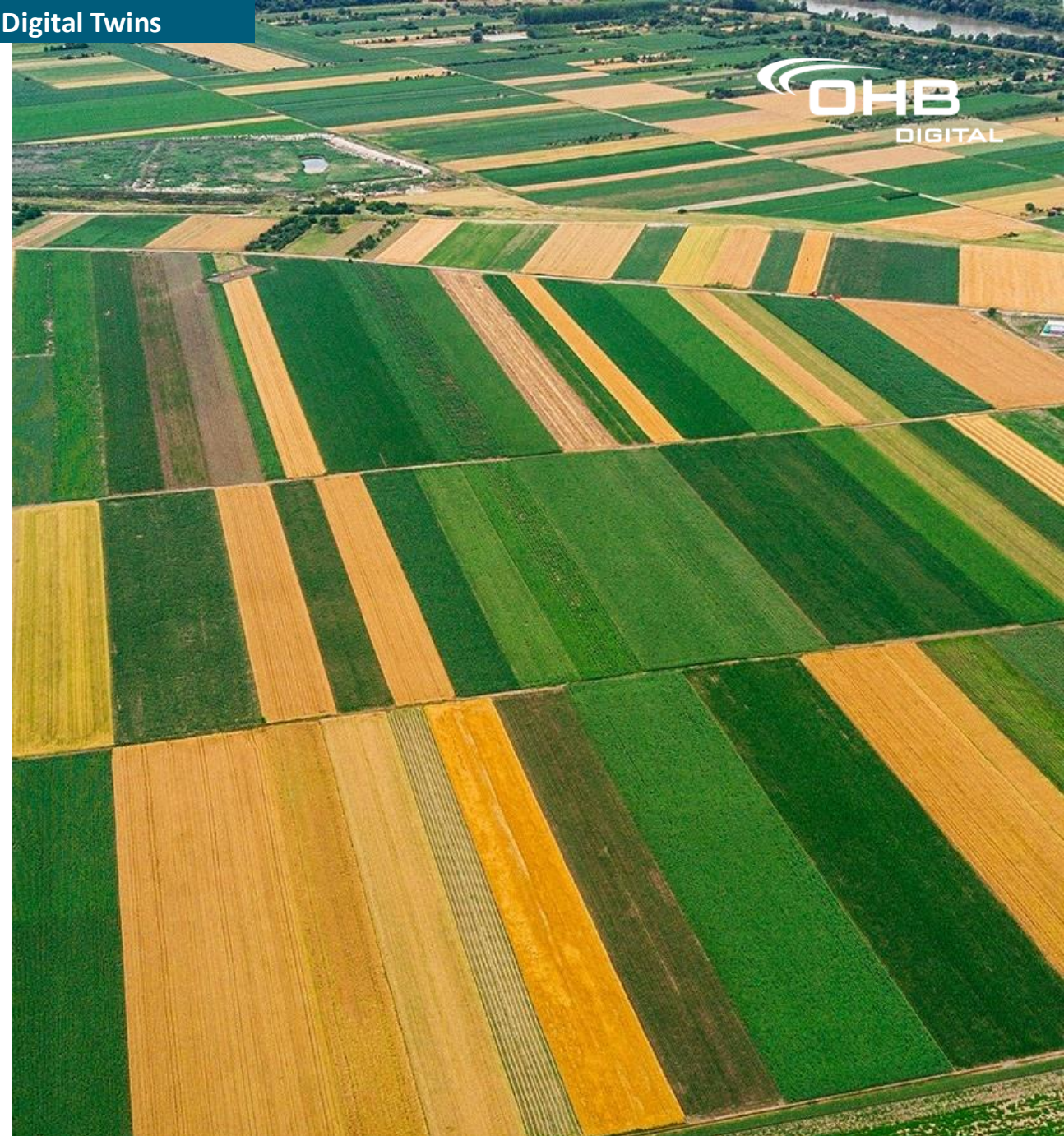
# AGRICULTURAL FIELD CLASSIFICATION
## AUTOMATED GEOPROCESSING FOR NATION-WIDE FORAGE AREAS

By developing suitable production chains, we have generated a highly automated process flow from raw satellite data to meaningful information for the paying agencies.

- Project outcome:

  - Automated pre-processing of Sentinel-2 data to generate an optimized and nationwide satellite mosaic of Austria

  - Classification of forage areas by a smart match of rules and machine learning algorithms

- Integrated data sources

  - Satellite data, such as Copernicus Sentinel-2

**Your OHB Expert**
Moritz Seidel



Clouds or shadows, potential forage area (0.3%)
Forage area, average vegetation index (16.8%)
Forage area, high vegetation index (3.6%)
Forage area, low vegetation index (24%)
Herbaceous vegetation, small shrubs (1.5%)
Other not eligible area (48.4%)
Rocky grassland, potential forage area (5.4%)

MEAN SLOPE (%)

# SMART FARMING

## ESTIMATING YIELD POTENTIAL WITH COPERNICUS SENTINEL-2

The objective of the solution for KWS SAAT SE & Co. KGaA, one of the world's largest seed producer, is creating a new smart farming procedure to automate and to improve yield analysis, satellite image processing and data accessibility — ultimately maximizing crop yields.

Project outcome:

- Automated data preparation of Sentinel satellite data including atmospheric correction, cloud mask and mosaicking

- Automated calculation of yield potential maps from Sentinel-2 time series. The customer provides indices and algorithms.

- Integration of results in KWS business processes and the service portal for farmers myKWS.

Integrated data sources

- Copernicus Sentinel-2 data.

**Your OHB Expert**
Irmgard Runkel

# LAND SURVEY AUTHORITIES
## STATE-WIDE SENTINEL SERVICES

The land survey offices and geoinformation centers in Germany are regularly tasked with providing remote sensing-based spatial information. A solution to automate the download, processing and sharing of terabytes of Copernicus and Sentinel satellite data was needed.

- Project outcome:

  - Uninterrupted download of Sentinel data according to specific and individually set parameters. Atmospheric correction, including cloud and cloud shadow masks and a cloudless mosaic of the entire state

  - Ingesting the mosaic as WMS into the existing regional web portal or as a 24/7 INSPIRE conform OGC-WCS2.0 service

- Integrated data sources

  - Satellite data, such as Copernicus Sentinels.

**Your OHB Expert**
Thomas Weser

# MONITORING CONSTRUCTION SITES
## LEVERAGING STEREO SATELLITE DATA FOR CHANGE DETECTION

Monitoring of large construction sites like the airport of Istanbul by the means of stereo satellite data and a photogrammetric workflow.

- Project outcome:

  - Detection of object states and object changes based on point clouds.

  - Derivation of information as volume changes (increase or decrease), type and form of change as well as measurements.

- Integrated data sources:

  - Stereo satellite data as WorldView-1 (pan) and WorldView-2 (RGBNIR)

**Your OHB Expert**
Eva Walter
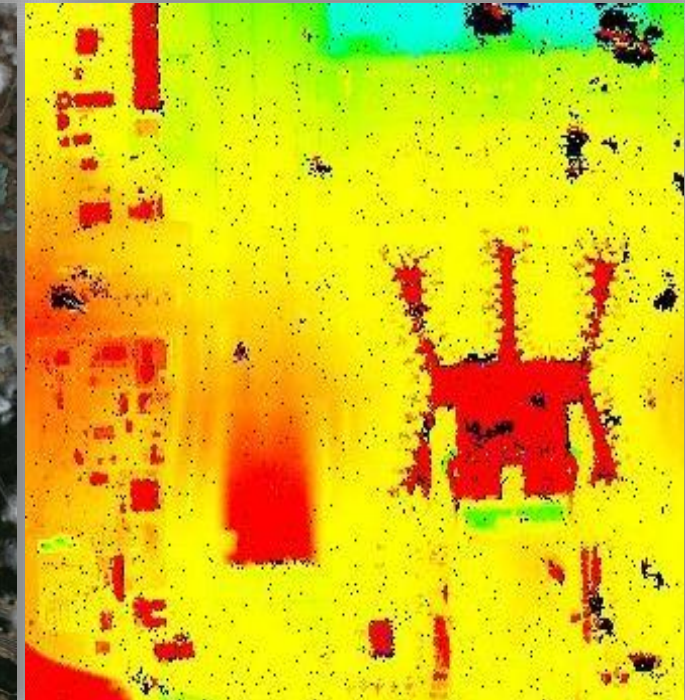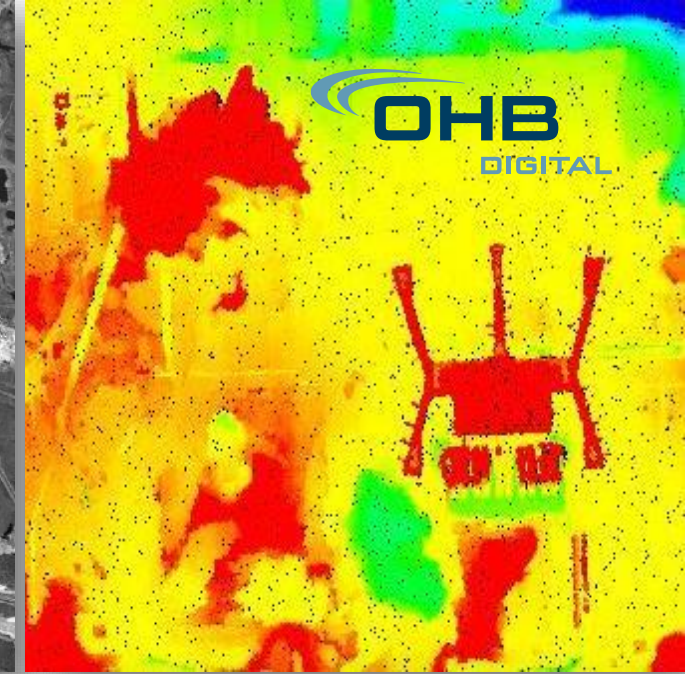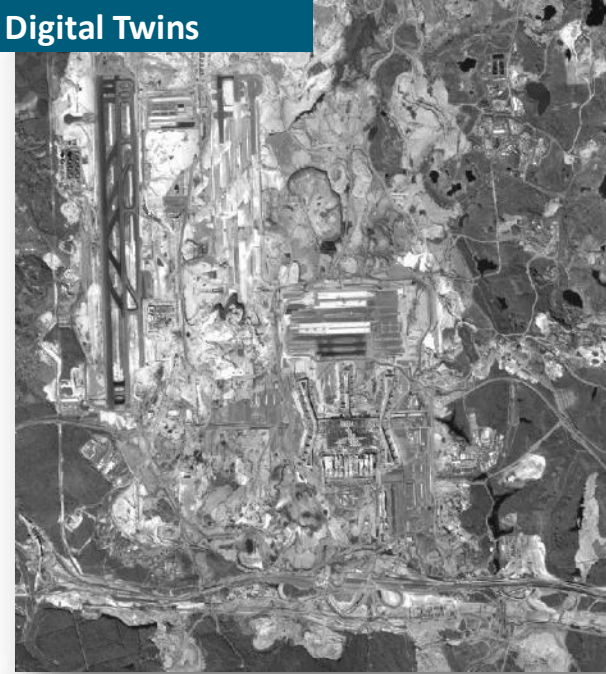
# AIRTRACKS
## FLIGHT INFORMATION SERVICE

Cost efficient flight information service for small and medium-sized airport towers for an enhanced airport safety during approach and departure.

- Integration of aircraft surveillance information (ADS-B, RADAR, MLAT, FLARM, …) in the vicinity of the airfield

- Visualization of air traffic on a web frontend

- Integration of relevant and customized ancillary information layers in a user-friendly way

  - Flight plan

  - Aeronautical charts

  - Meteo Information

  - eNOTAM (e.g. Birdtam)

- Demo system implemented at the Adolf Würh Airport Schwäbisch Hall

**Your OHB Expert**
Dr. Gerd Eiden
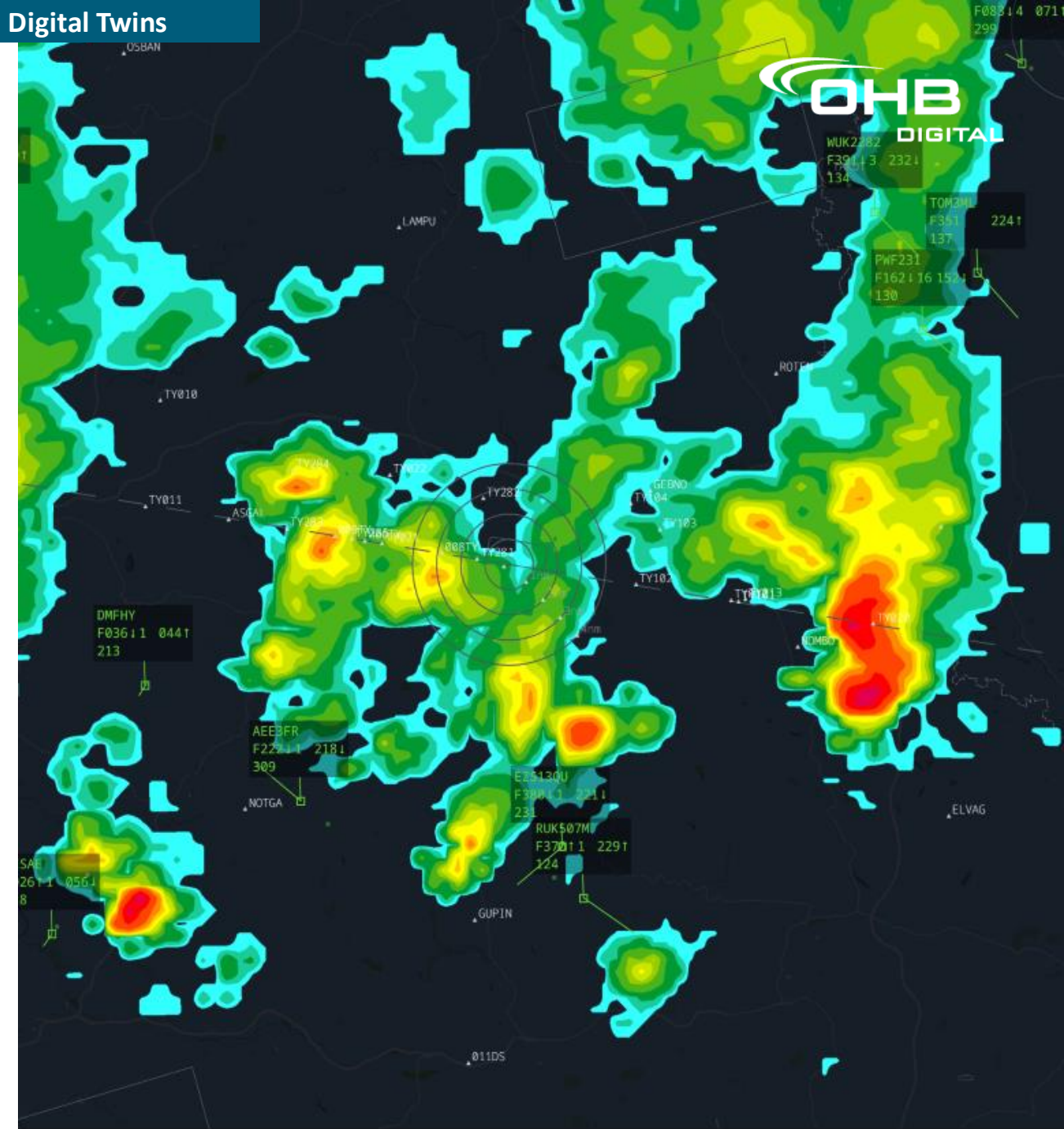
# MAP VALIDATION
## CHANGE INDICATOR FOR LARGE DATA SETS

Changes are meaningful. For defence application, detecting changes in large datasets are a major task for image analysts.

Based on radar data, we indicate areas of change automatically and return this "position of change" to image analysts and field experts.

- Project outcome:

  - Interferometric change layer based on radar images, here Sentinel-1

  - Geolocation of indicated change to be used in any geo-related software or device.

  - Very fast availability of geolocations of potential change areas, directly in the field.

- Integrated data sources

  - Radar satellite data, such as Copernicus Sentinel-1

**Your OHB Expert**
Irmgard Runkel
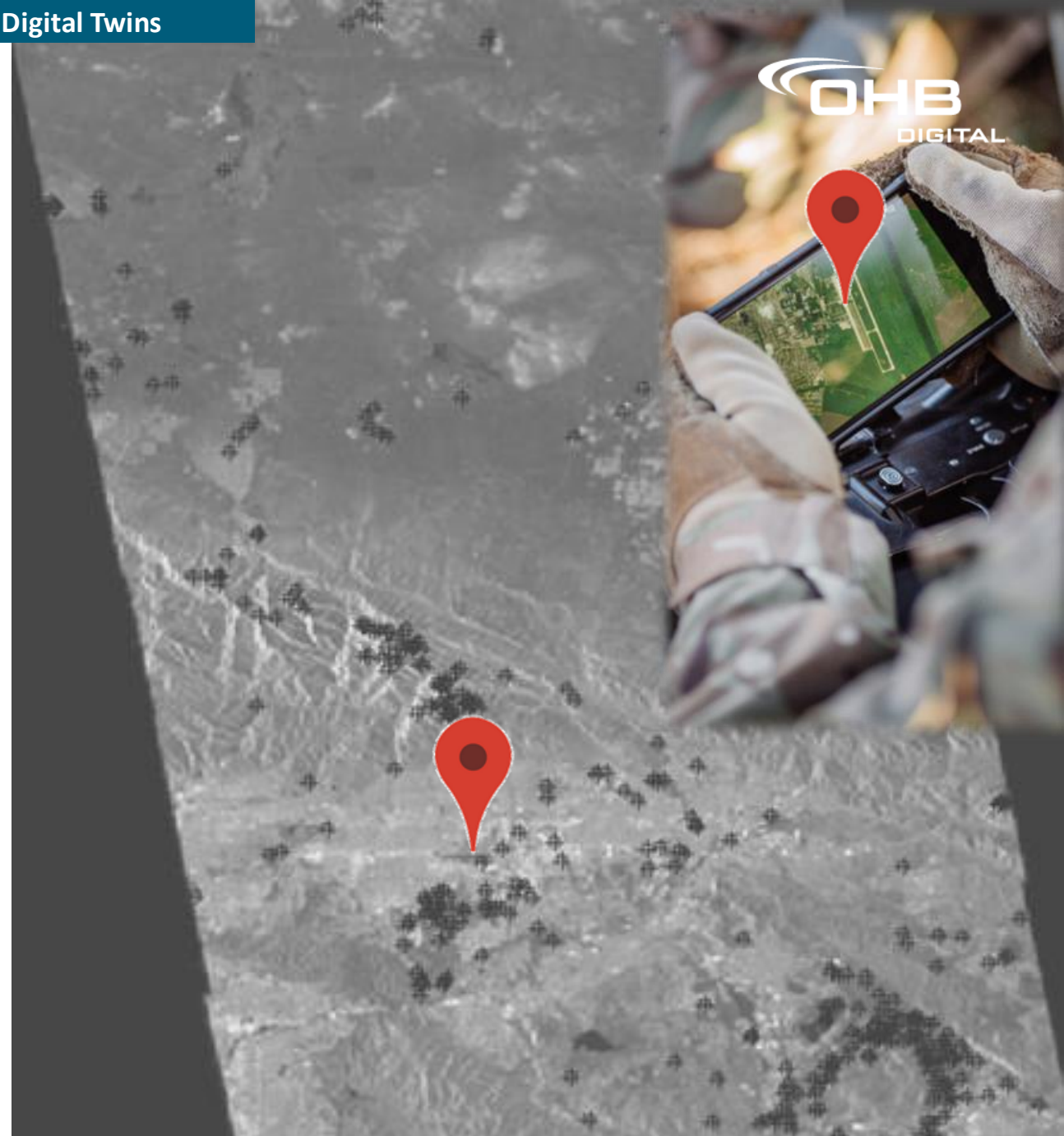
# INFRASTRUCTURE CHANGE DETECTION
## VIA DEEP LEARNING TECHNOLOGIES

Identifying relevant changes in multi-temporal EO data is a challenging task for many applications in the area of infrastructure monitoring. The meaning of "relevant" is application-specific and needs to be learned from examples

- Example applications:

  - Identification of man-made changes (construction work, buildings, reclamation of land, slash-and-burn, mining, agriculture, …)

  - Disasters analysis (forest fires, landslides, seismic activity, …)

  - Climate change monitoring (sea levels, ice cover, deforestation, desertification, …)

- Integrated data sources

  - WorldView & airborne datasets

**Your OHB Expert**
Dr. Alexander Kläser
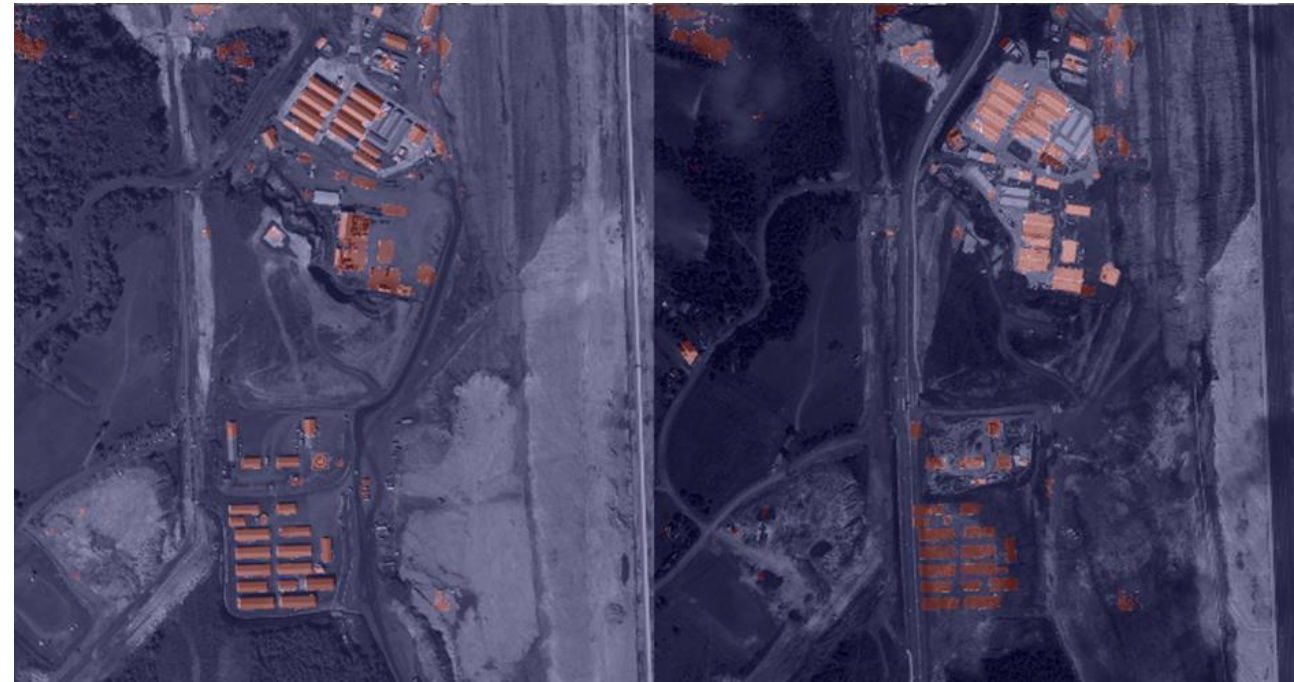
# ORBITSAILOR
## MONITORING OF WORLDWIDE VESSEL TRAFFIC

LuxSpace launched the first ever AIS (Automatic Identification System) receiver to space in 2009. Our AIS Data Service has been launched in 2011 and provides AIS data to customers around the world.

- **Our "OrbitSailor"** provides tracking and monitoring solutions for the maritime industry. We monitor more than 250 thousands vessels and is powered by more than 30 million positions reports each day

- **Our standardized products** provide information on position and performance of vessels around the globe

- **Our OrbitSailor Archive** provides historical AIS data which can fuel AI-based systems that can be used to optimize routes and fuel consumption as well as improve flow of goods

- **OrbitSailor Explorer** is an end-user easy-to-use interface, which is not overloaded with features and information.

**Your OHB Expert**
Niko Steindamm

**Global coverage**
- All main traffic routes
- All regions
- High-update rate for port areas

**>250 000 ships per day**
- Data acquisition from almost all visible ships around the world
- Class A and B

**Customized data delivery**
- Preparing data according to the needs of customers
- Various delivery mechanisms, e.g.: TCP/IP, Push, SSL, JSON, FTP, API

**Terrestrial, satellite, shipborne**
- Terrestrial AIS receivers: rivers and coastlines
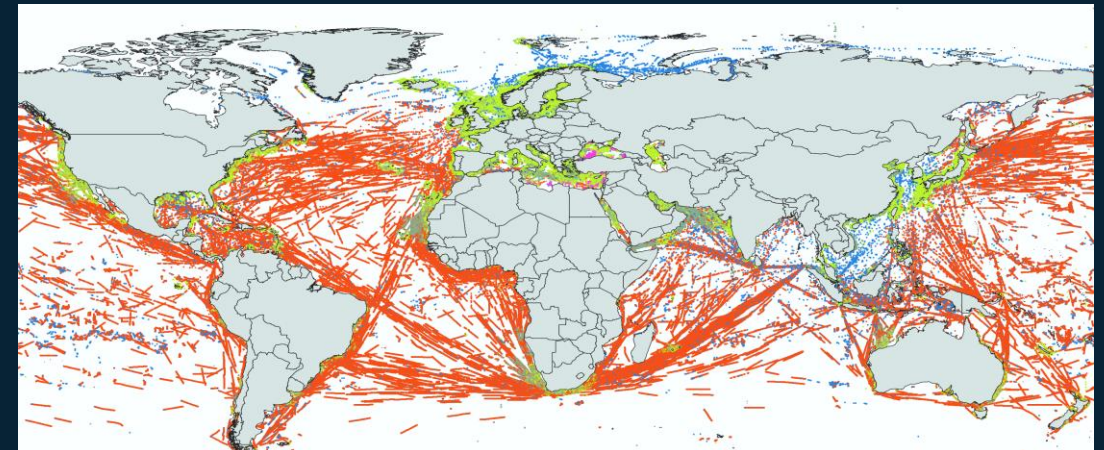- Satellites with AIS receivers
- Shipborne AIS

**Data analytics**
- Ship-2-ship
- AIS ON/OFF
- Sudden change of speed & course
- Loitering: individual and cluster
- ETA
- Transit of ship within forbidden areas

**Near real-time**
- Live stream of the latest data
- Providing data as quickly as it arrives to LuxSpace
- Real-time ships tracking

# SEA FISH

## FROM CATCH TO PLATE – A SEA FOOD INFORMATION PLATFORM

The objective of SeeFish is to provide transparency of seafood origin to consumers, a topic which is of concern of many customers.

- Our solution:
  - Using space-based AIS data and its ability to monitor fishing vessels, the origin of seafood products can be tracked back.
  - Customers just scan the QR code on the sea food product and are informed about the origin of the fish, catch date, region and fishing vessel name.
  - Moreover, customer are informed about all facets of sustainability and responsible fishery.

- Benefit:
  - Transparency creates trust in the food supply chain which is essential for the fishing industry and the (critical) consumer

**Your OHB Expert**
Dr. Gerd Eiden
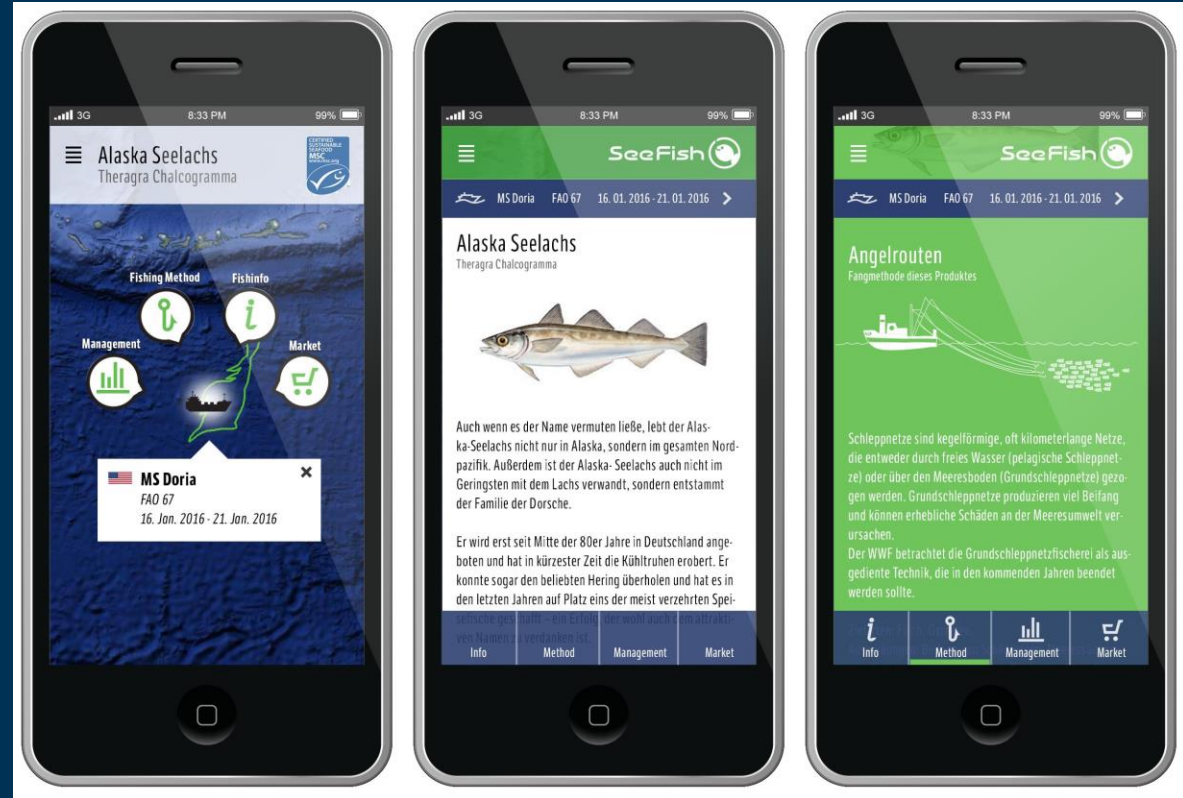
# SHIP DETECTION (1)
## IDENTIFICATION OF SHIPS USING COPERNICUS SAR IMAGES

Vessel tracking based on AIS data is a essential tool in supply chain management and maritime security. However, AIS data is not always reliable since ships have the opportunity to hinder the signal transmission. Therefore, additional approaches are needed.

- Detection of a ship in a synthetic-aperture radar (SAR) image

  - Enable the detection of non-cooperative/dark vessels

  - SAR uses a moving radar antenna over a target region  (resolution ranging from 0.5-10 m per pixel)

  - SAR is an active sensors and independent from weather and sun light conditions

- The pixel-wise mask gives exact localization & allows further analysis (e.g. estimation of heading, ship size/class)

- Integrated Data sources

  - Copernicus Sentinel-1 & TerraSAR-X

**Your OHB Expert**
Dr. Alexander Kläser
in

# SHIP DETECTION (2)
## STREET OF HORMUZ, BALTIC SEA & SUEZ CHANNEL

Using 400 samples for training artificial intelligence algorithms to detect ships on Copernicus Sentinel data in various regions around the globe

- Project outcome:

  - Deep learning algorithms detect ships on open and free Sentinel data with a very high accuracy of ~95%

- Integrated data sources

  - Satellite data, such as Copernicus Sentinel-2

**Your OHB Expert**
Eva Walter

# GNSS INTERFERENCE MONITORING

## GIDAS

Identification, classification and localization of GNSS interferences, such as jamming and spoofing

- Example Applications:

  - Large-scale installations as well as mobile systems or embedded algorithms are available

  - Securing critical infrastructure, such as airports, harbours, power grids, tolling stations, etc.

  - Localisation of interference sources to support law enforcement agencies or frequency regulators

  - Calculation of timing and positioning degradation

- Integrated data sources

  - Using separate or receiver embedded GNSS antennas

**Your OHB Expert**
Christian Reinecke
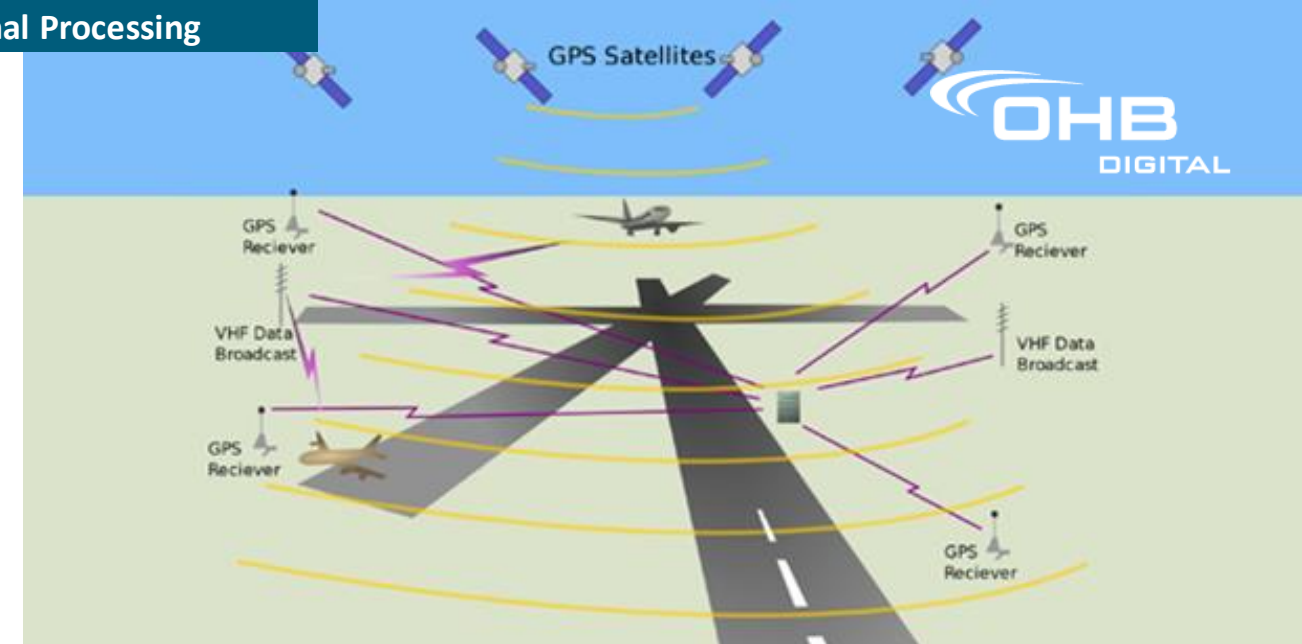
# WE SIMPLIFY YOUR LIFE THROUGH SMART SPACE SOLUTIONS.

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