# ESA Business Applications

Space19+

## Inter-Ministerial Workshop

ESA-TIAA-HO-2019-1654



N. Hübner, ESA Business Applications Department

Warsaw, 29 May 2019

https://www.youtube.com/watch?v=twBAOv8MIH0

# → THE POWER OF SPACE

## Satellite Navigation

Global Positioning
Navigation
Velocity
Precision Timing
Activity Tracking
Route Optimisation
Personal Security

## Satellite Communication

Reliable and Secure Communication
Remote Connectivity (maritime, oil rigs, undeveloped areas)
Backup to Terrestrial Infrastructure

## Earth Observation

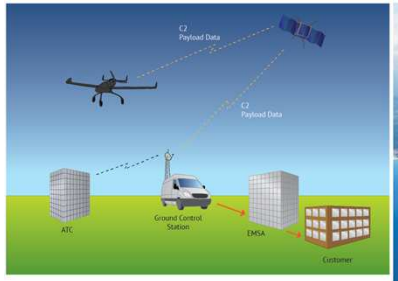
Land, Sea, Air Monitoring
Resource Mapping
Environment Sensing
Change Detection
Weather and Pollution Forecasting
Chemical and Physical Properties Detection

## Spaceflight Technologies

Augmented Reality
Tele-operation Systems
Health Sensors
Procedures
Big Data Processing
Artificial Intelligence

# → WHEN TO UTILISE SATCOM

- Voice, text, data, imagery, video, …
- Connecting remote places without terrestrial communications
- Secure transmission of information
- Beyond Line Of Sight (BLOS) communication (e.g. ships, drones)
- Applications requiring large bandwidth (lot of data / information)
- Multicast / broadcast applications.
- Back-up for terrestrial systems
- Machine-to-machine / IoT applications




Wide area maritime operations like Pollution Monitoring and Search & Rescue - Rapsody (ARTES IAP)

Fighting Ebola with a transportable connected biological laboratory – B-LiFE (ARTES IAP)


Remote monitoring - AMAZON (ARTES IAP)

Connected ambulances - SATCARE (ARTES C&G)

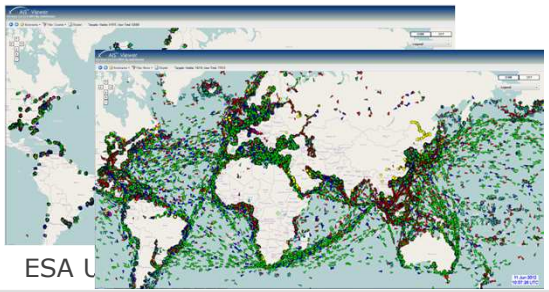

Microfinance office in Cameroon

SatFinAfrica (ARTES IAP)

Cash withdrawal in Ghana via Satcom

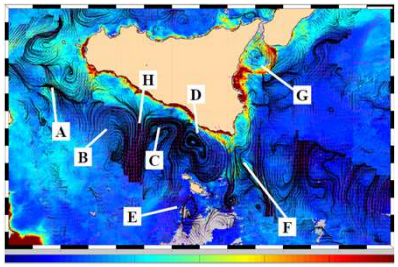
# → WHEN TO UTILISE SATNAV

- Positioning from GNSS:
  - Correction data such as RTK allows centi-metric precision
  - autonomous ships, autonomous cars
- Tracking of individual persons and goods
- Precise time stamping of events
- GNSS reflectrometry:
  - Sea state measurements
- SAT-AIS for maritime applications:
  - Estimated time of arrival (logistics)
  - Misbehaviour
  - Ocean currents



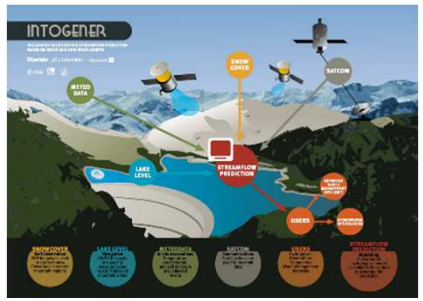
ESA U

Ships monitored by
a) terrestrial AIS
b) terrestrial and Sat-AIS
(source: Exact Earth)

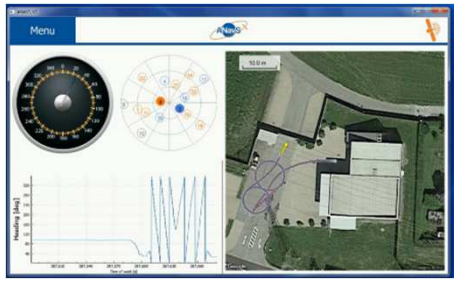



Using ships as in-situ sensors to observe ocean dynamics (currents)
- eOdyn Surface Currents (ARTES IAP)

Guidance, Navigation, Control for high precision farming and individual plant treatment – AGRILOC (ARTES IAP)




Lake water level measurements
- INTOGENER (ARTES IAP)




High Precision Navigation System for Long Truck Trailer Combinations assistance)
(ARTES IAP)

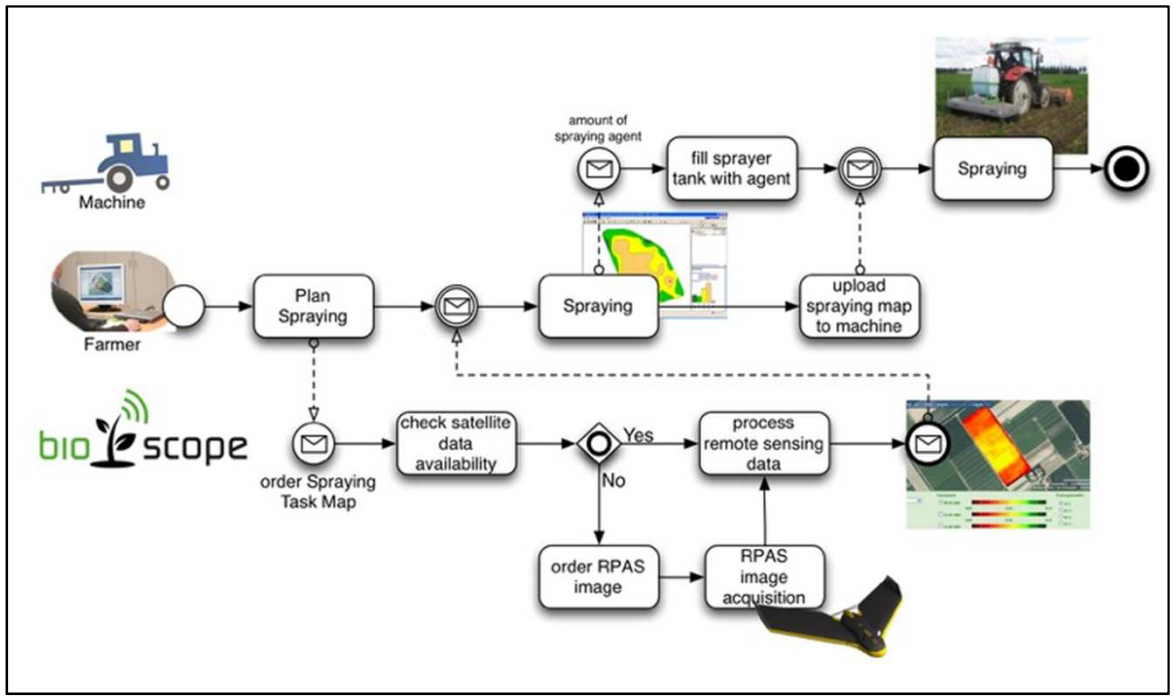

Tracking of medicines during transport
- Xcit'ID (ARTES IAP)

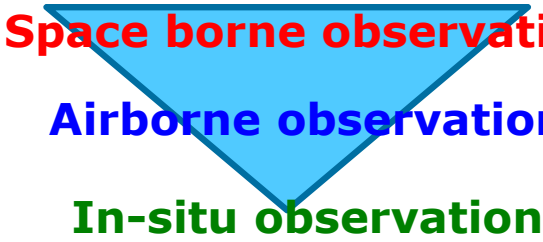
# → WHEN TO UTILISE SATEO

- Meteorology:
  - outdoor tourism, maritime applications, environmental applications, etc.
- Optical (panchromatic, multispectral, hyperspectral, etc.)
  - agriculture / precision farming, aquatic ecosystems, biodiversity, forestry, land cover and change, natural hazards, snow and ice cover, etc.
- Radar:
  - ship detection, oil spill, sea ice, critical infrastructure, soil moisture, flooding, surface topography, ground deformation, subsidence, etc.
- LIDAR (Light Detection And Ranging):
  - topographic features, cloud profiling, atmospheric components, etc.
- Infrared:
  - heat maps, energy signatures, etc.

# → WHEN TO UTILISE SATEO

But often complementary solutions are required to fill potential observation gaps, e.g. aerial imagery, field measurements / in-situ sensors



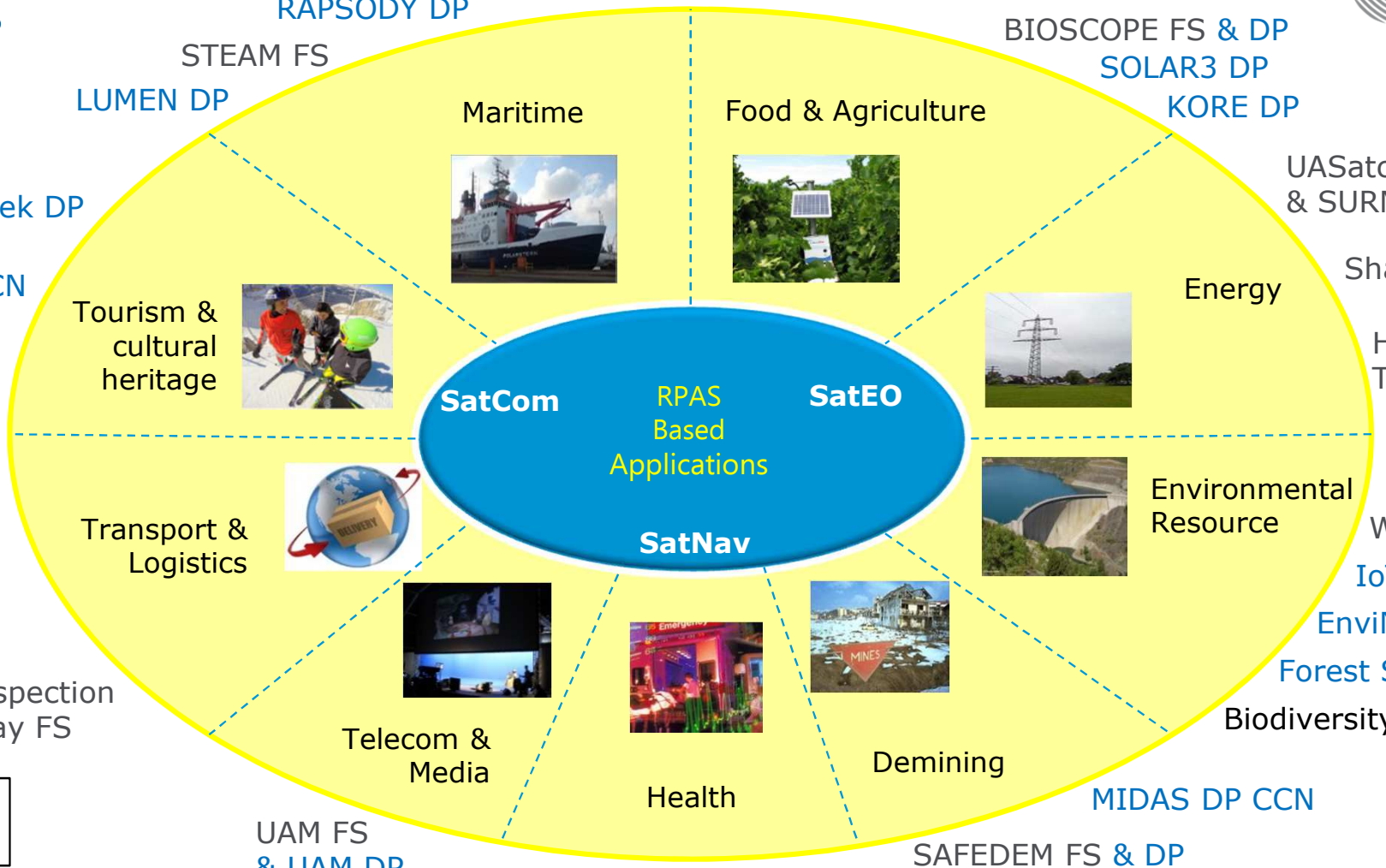




Example: "Bioscope"
https://business.esa.int/projects/bioscope

Customers: potato farmers

Need: guaranteed delivery of information products in predefined time windows

# RPAS related Activities




Activity completed
On-going activity
*Activity under preparation*

# Application needs

Maritime Surveillance

Tourism cultural heritage

Energy

Demining

Safedem- <2 kg


Transport

SURMON – 78 kg


RAPSODY – 150 Kg

DeSIRE- 1250 kg

Agriculture

KORE – 2.5 kg

Flying BLOS – Satcom equipped


LUMEN – 40 kg

DeSIRE 2- 6600 kg

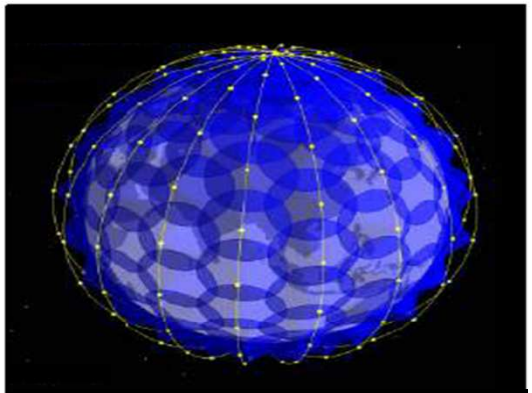
Micro-RPAS — Light RPAS — MALE

Maximum Take Off Weight

# → TRENDS - FACTORS OF CHANGE


Reutilisation


Miniaturisation


Constellations


Intersat. Links


Privatisation


Motorisation


Multifunction

Automation

# → FUEL YOUR BUSINESS

**€200M+** invested
in over
**500** businesses

Project web pages:
**https://business.esa.int/projects**

Space Weather
Earth Observation
Satellite Navigation
Satellite Communication
Human Spaceflight Technologies
Financial
Aviation
Education
Energy
Media
Agriculture
Environment
Transport
Healthcare
Maritime

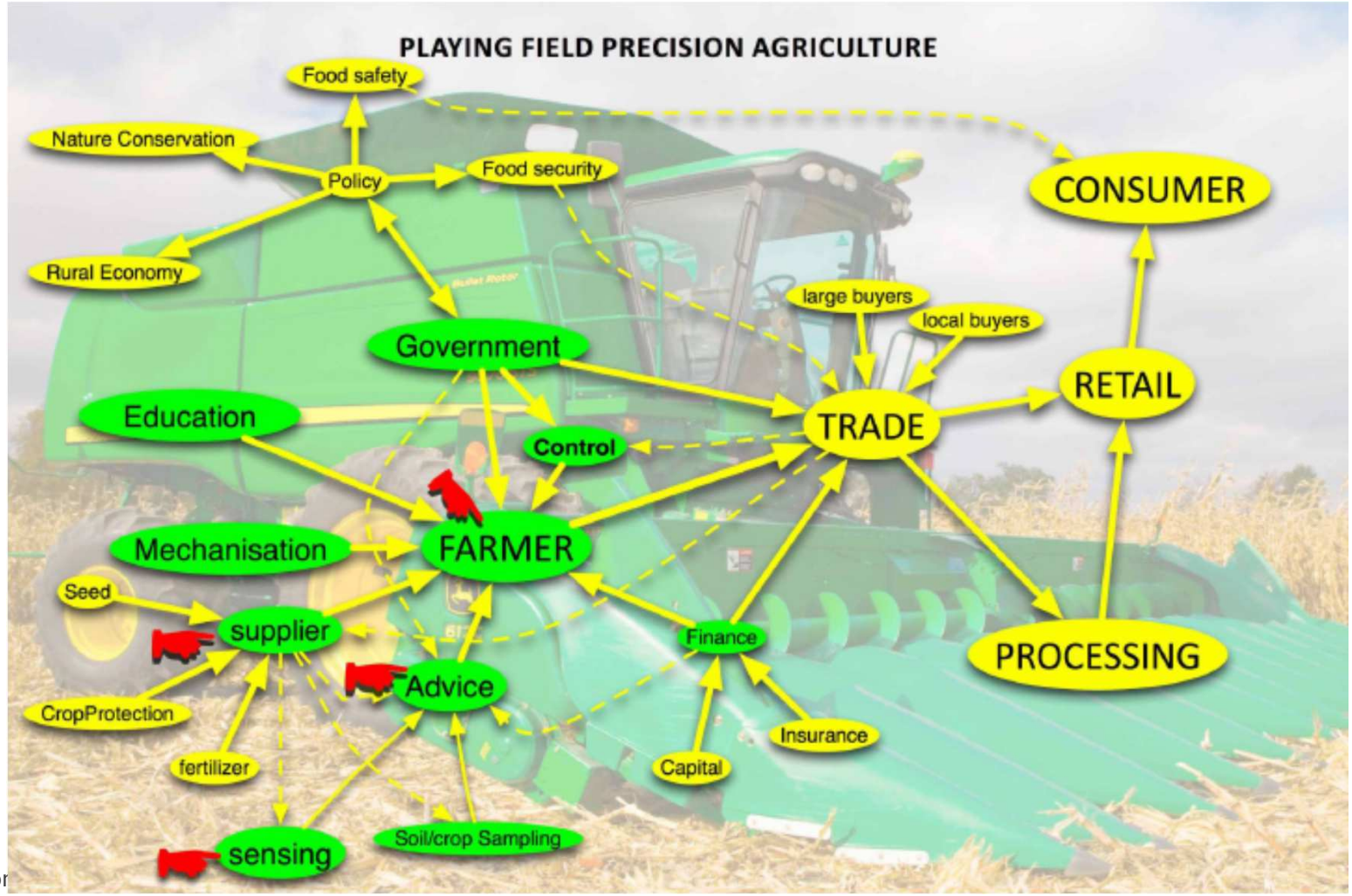
# → AGRICULTURE

https://www.precisionag.com/market-watch/europe-a-look-at-precision-agriculture-adoption-in-poland/ (15 Feb 2019)

“Total agricultural land area in Poland in 2017 was 14.6 million ha, while the total sown area was 10.8 million ha. Cereals consisted of 70.7% of the sown area. The total number of farms, 1.4 million, is decreasing but is still one of the highest in Europe. Farms of 50 and more hectares account for only 2.5% of the total number of farms, but cover about 31% of the agricultural land area. The average agricultural land area per farm varies greatly depending on the region of Poland, the smallest in the south-eastern part reaching only 4.1 ha in Małopolskie Voivodship and the highest, 30.8 ha, in the Zachodniopomorskie Voivodship (north-western Poland).

That range of farm size helps explain why Polish farms differ in terms of precision agriculture adoption. Due to glaciation, fields are often characterized by high spatial variability of topography and soil properties, which increases the potential for adoption of precision ag solutions. Environmental conditions (e.g., growing season, annual rainfall, soil quality) result in a yield potential that is about 30%-40% lower in Poland than in Western European countries.”

# → APPLICATIONS - AGRICULTURE



# Example "ASAP"

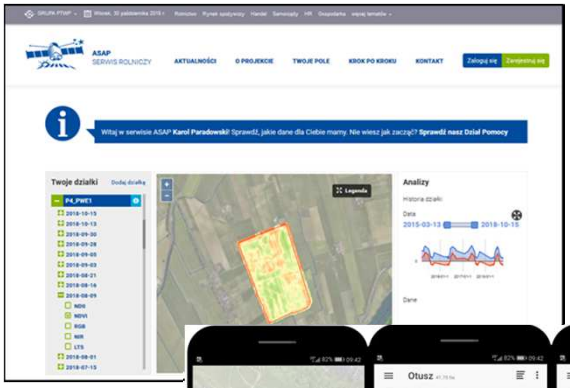
business.esa.int/projects/asap

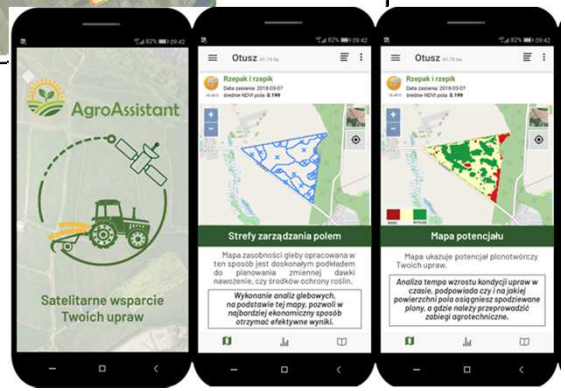
**"Advanced Sustainable Agriculture Production" :**
Provision of various services related to precision farming and agriculture


Delivers services to end users via *asap.farmer.pl* portal and to commercial customers via the *Agro-Assistant Mobile App*

- Drought monitoring (Polish Agency of Agriculture, PZU Insurance Company)
- Monitoring of overwintering of crops (Polish Agency of Agriculture, PZU Insurance Company)
- Crop condition, soil moisture (Free service via mobile portal)
- Archive maps of crop condition, maps of potential yield (Commercial service )

*Targeted customers:*
- *Individual farmers and food production companies.*
- *Ministry of Agriculture and Executive Agencies supervising the agricultural market in Poland.*
- *Companies providing Services for the Agricultural Market, such as Insurance and Consulting Companies.*





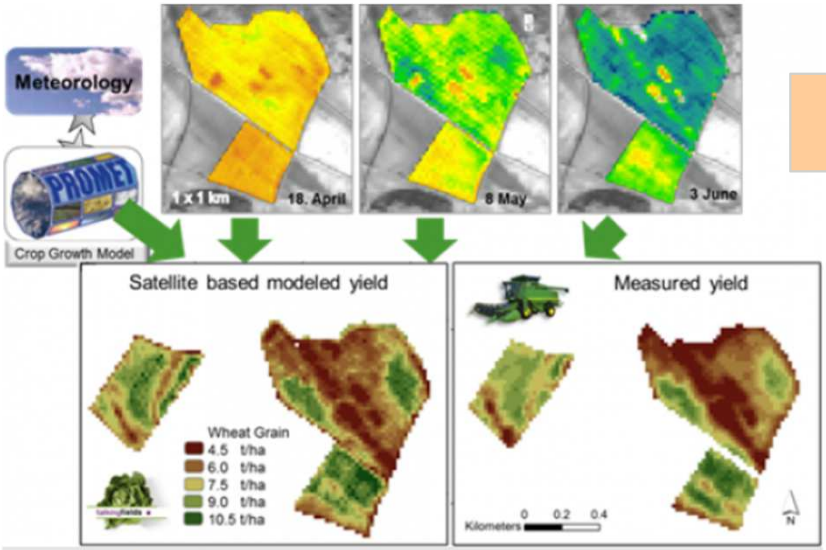

## Achievements

- ✓ *Commercial*: 1 commercial contract - delivery of ASAP products via the mobile app for 20 000 hectares for 2 years
- ✓ *Institutional*: Awareness among and cooperation with Executive Agencies of Agricultural Production
- ✓ *Export potential*: Cooperation with Ukrainian partner established

# Example "TalkingFields"

business.esa.int/projects/talkingfields

**"TalkingFields" - Service:**
Based on integration of space and ground based assets, cost-effective end-to-end Precision Farming services for winter wheat, maize and sugar beet that allow farmers with little effort to adopt a comprehensive site-specific farming system.


The TalkingFields concept of coupling a crop growth model with EO information allows daily biomass provision as well as yield forecasts.

*Customers involved: Farmers in Germany and Eastern Europe.*

Because of the growth in world population, the global nutrition demand is continuously increasing. However, it is not possible to further increase the surface of cultivable land significantly. The only available option is to increase field production in a sustainable way.
Farm managers require information on the precise location of heterogeneities in their fields in order to be able to apply site-specific management.


2015 Agritecnica Gold Medal for "Connected Nutrient Management"

# Example “Agriloc”

business.esa.int/projects/agriloc

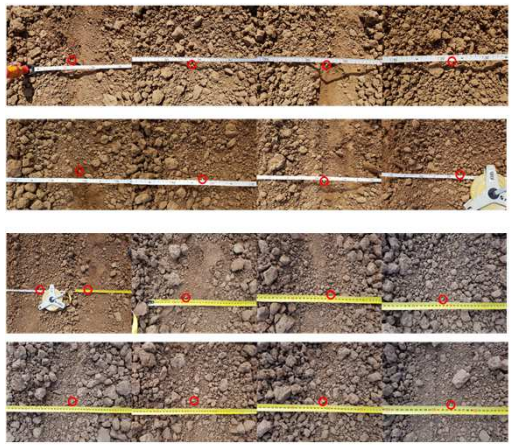
**“Agriloc” - Service:**
Superior routing of farm machinery for high precision farming, allowing for individual treatment of plants. Transmission of correction data via Satcom.

*Customers involved: Large arable farmers in Germany, agricultural machinery & guidance system manufacturer*



SatNav: highly accurate and highly reliable GNSS receivers utilizing Galileo, Beidou, GLONASS and GPS navigation satellites for guidance, navigation, and control of farm machinery. Individual plant treatment: geo-referenced seed, fertilizer and chemical placement.

SatCom: for transmission of position corrections and telemetry in rural areas with sparse cellular network infrastructure or fields shielded by surrounding terrain.



# Example "OWASIS-NL"

business.esa.int/projects/owasis-nl-dp



**"OWASIS-NL" - Service:**
Improved water availability information for water managers: 'soil water storage capacity service' and 'water auditing service' providing state-of-the-art information on water availability and water resource use to water managers.

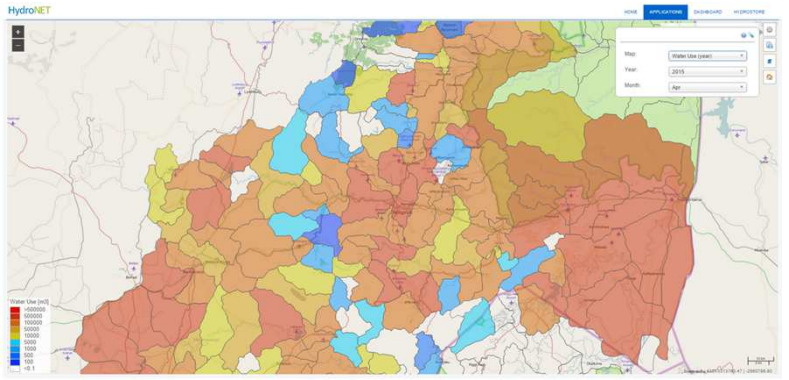

**Soil Water Storage Capacity Service**

providing reliable information on the water storage capacity of the soil determining both the risk of flooding during wet periods, and the need for irrigation in dry periods. .

*Customers involved: NL Regional Water Authorities, South African Incomati-Usuthu Catchment Agency (IUCMA)*

SatEO: is used to obtain the precipitation forecasts, soil moisture contents and evapotranspiration data.

SatNav technology is used to obtain location of users providing local data on mobile phones or tablets, and for geotagging of in-situ measurements.




**Water Auditing Service**

to regulate the amount of water being used for irrigation in South Africa ensuring equal distribution and efficient use of the available water resources in line with National Water Act (NWA).

# Example "TIKKA"

business.esa.int/projects/tikka-service

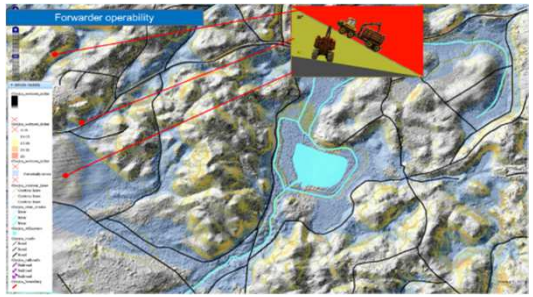
**"Satellite Based Tools for More Efficient Logging Operation Planning":**
support and improve the management of timber logging plans, significantly reducing the time and cost that its realization requires today in Polish State Forests


- Information to support cheap and fast timber logging plan management.
- Up-to-date geo-referenced information layers that facilitate the development of logging plans indoors.
- Improvement of the current quality level of logging plans.
- Ability for the Users to utilize this information in their own GIS system without the need of additional IT projects

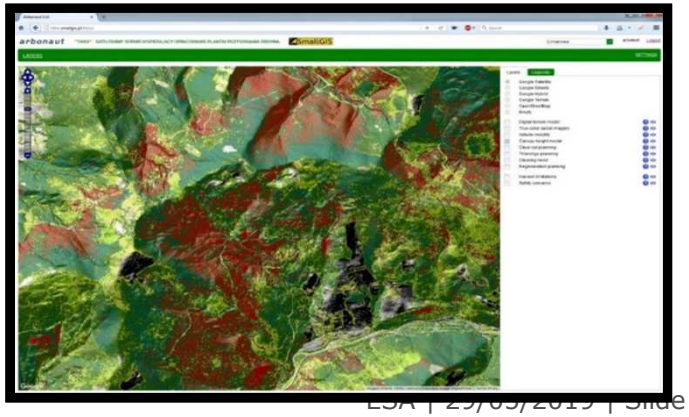
*Targeted customers:*
*Polish Regional State Forests*

- Combination of SAR, LIDAR and GNSS technologies
- Lidar provides the optimal mean to derive baseline forest inventory information. EO (SAR and VHR) data will be used to update such baseline info.

**Achievements**
✓ *Institutional*: Shaping the new regulation definition for logging plans




*Canopy height model map of Limanowa viewed in TIKKA ProMS web portal*



# Example “Satmodo”

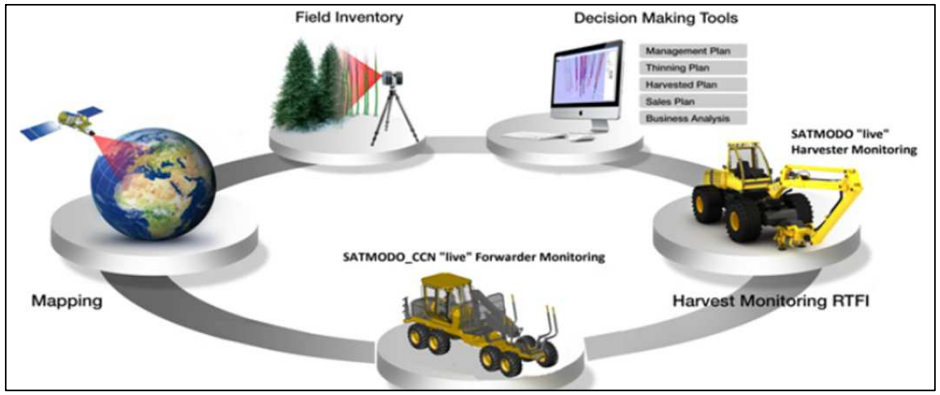
business.esa.int/projects/satmodo

**“Satmodo” Service:** ”live” monitoring of round-wood timber harvest processes by utilizing both satellite and terrestrial wireless transmission technology as a means of providing data transmission pathways for the live harvest data knowledge-sharing.



- provide the harvester with a “Forest Warehouse” operating model, assigning the most appropriate cutting solution to the most appropriate forest, thereby matching the optimum value harvest solution to the current demands of the industry.
- web-based management system, allowing forest owners and managers to maximise the value of their crop.
- provide a data back-haul and communications platform for harvesting vehicles, through Inmarsat IsatM2M, using L-band remote terminals with highly compact antenna.

*Targeted customers:*
- *Forest owners*
- *Forest manager*


# Example "Curio Canopy"

business.esa.int/projects/curio-canopy

**"Curio Canopy Urban Forest Community Platform" - Service:**
Combining analysis of satellite imagery with crowdsourced data, the platform connects communities and urban forestry professionals. It provides an open data service that drives improved understanding of urban trees and access to better information in order to i) increase tree planting and tree care; ii) improve environmental conservation management and planning; iii) support educational and communication resources for learning and knowledge-sharing

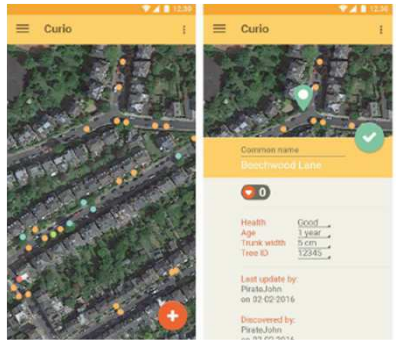

**Improved tree stock identification** utilising active learning algorithms combined with automated tree identification models.

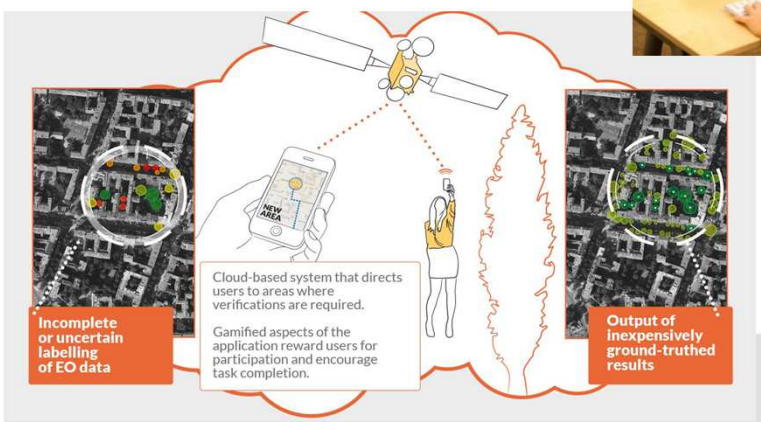
**Custom analytics tools** to monitor change in urban forest stock and their vitality and diversity.

**Crowdsourced inspection data** (photos, messages, measurements, observations) by indicating areas without clear information

**Community outreach** creating public awareness of trees and the benefits they provide to society and environment.

*Customers/Users involved: arborists, municipal authorities, academic researchers, NGO's, community groups, the public.*

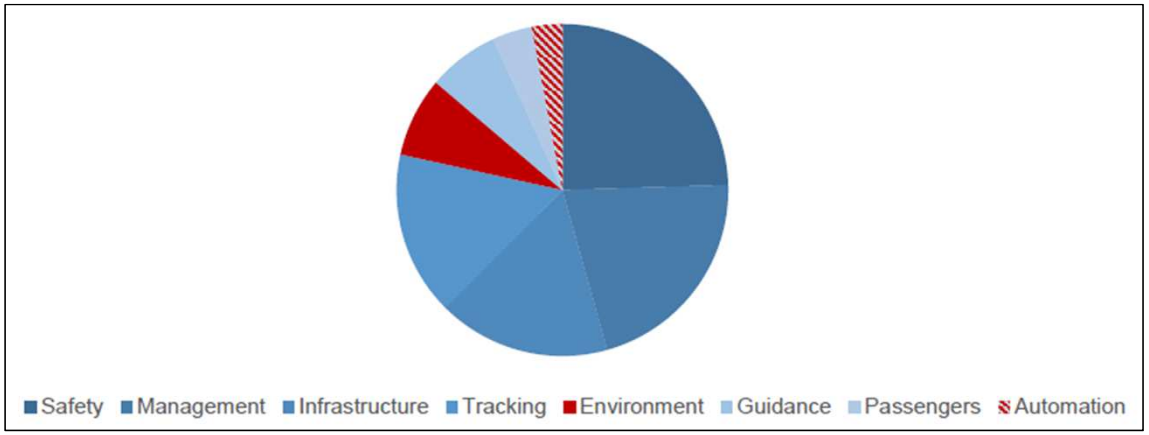



European Space Agency

# → TRANSPORT

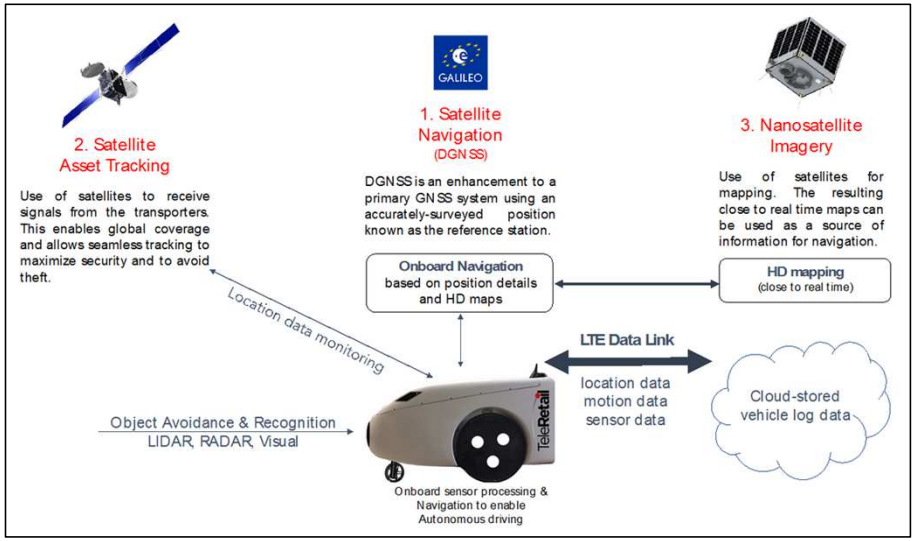
During the period 2010-2019, IAP has run a total of 90 Transport and Logistics activities distributed as follows: 42% road transport; 28% air transport; 19% multi-modal transport; and 11% railway transport




# Example "AITO"

business.esa.int/projects/teleretail-delivery-robot

**"Automated Urban on-demand Courier Service:**
Automated delivery service with courier robots for urban and sub-urban logistics to deliver products, spare parts, etc. locally, within their assigned territory on the same day. This fulfils the rapidly growing need for cost effective, energy preserving, space efficient urban and sub-urban logistics.




*Consortium: DE*

*Users involved: retail organisations, logistics companies*





**SatNav:** The use of differential GNSS enables close to cm navigation accuracy.

**SatCom:** The use of satellite-based asset tracking permits global tracking.

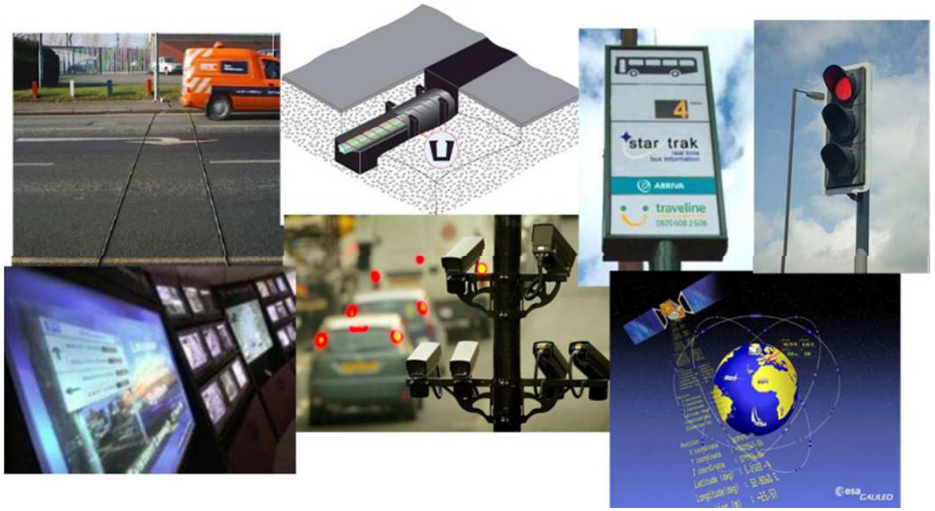
**SatEO:** The use of satellite imagery provides the most cost-efficient method to create high definition maps.

# Example “uTRAQ”

business.esa.int/projects/utraq-urban-traffic-management-and-air-quality

**“urban TRaffic Management and Air Quality:**
Provide Air Quality and Weather Monitoring Systems, Modelling and Traffic Forecasting tools, and Adaptive Traffic Management Systems into one single user-centric, intelligent solution which integrates with the existing traffic management system of urban and municipal authorities.



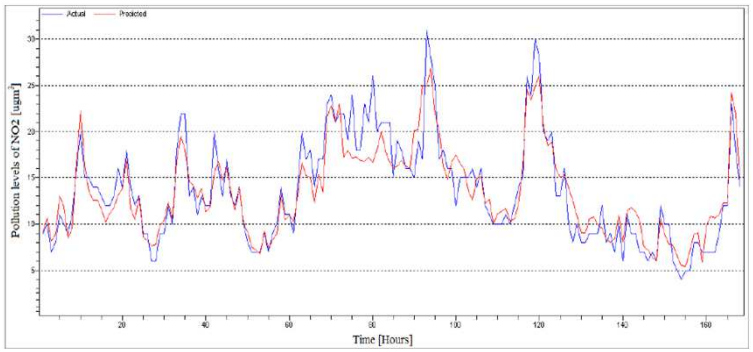



For medium-sized cities (> 200,000 people), the proportion of imported pollution can be a substantial contribution to regulatory levels, and therefore local abatement strategies need to adapt rapidly to external influences. Goal is to implement traffic control strategies mitigating the effects of traffic congestion on local air quality. The service will also provide evidence to support regulatory reporting and to enable a valuable assessment of the current/future policy.

*Consortium: UK*

*Users involved: medium cities in UK*

- SatNav: localisation and tracking of vehicles e.g. buses, trucks and cars, time information directly relates to congestion on the route.
- Earth Observation: Copernicus Atmosphere Service (CAS): data products such as wind-vectors, temperature, pressure, and ozone. Assimilated data used to model the dynamics and chemistry of atmospheric composition and deliver a surface-level concentration of pollutants, particularly nitrogen dioxide.



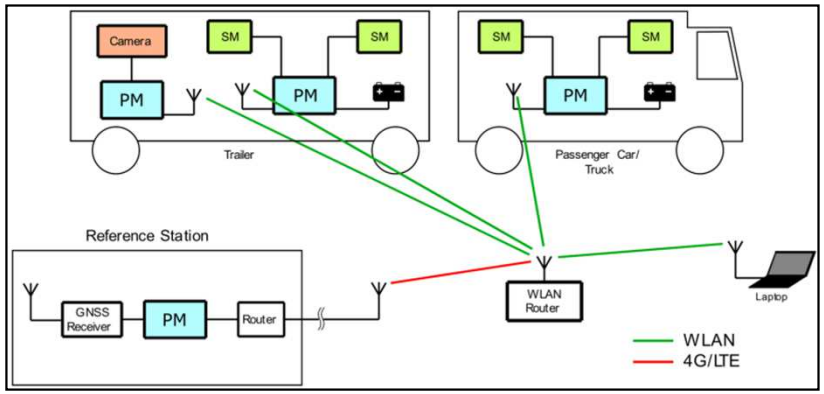

Pollution forecast (red line) compared with actual readings (blue line).

# Example “Long Truck Parking Assistance”

business.esa.int/projects/high-precision-navigation-system-for-trucks

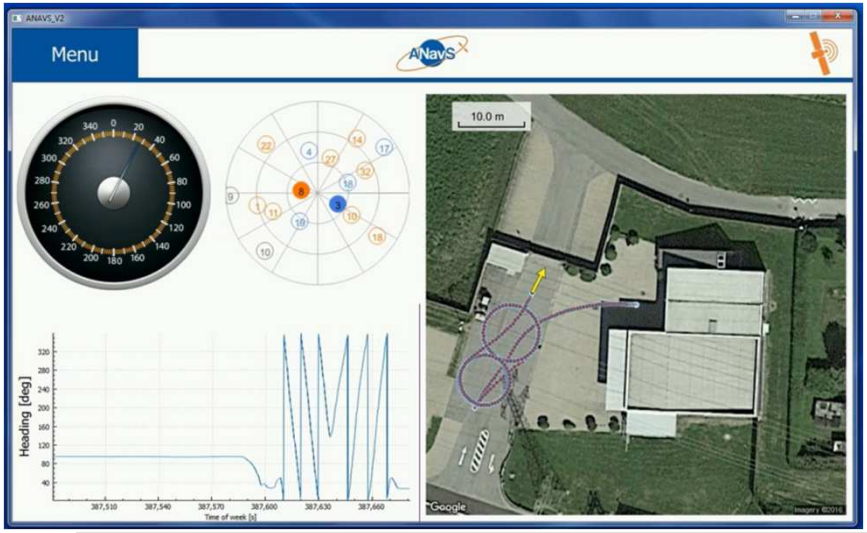

**“High Precision Navigation System for Trucks - Parking Assistance System for Long Truck-Trailer Combinations using Low-Cost GNSS Sensors”:**
The navigation assistance system uses Multi-GNSS RTK for positioning of the truck and trailer with centimetre level accuracy. The precise knowledge of the tilt between the truck and the trailer is the key for precise steering wheel guidance information and the prevention of jack-knifing during reversing. The rear-view camera provides an additional livestream to enable a safe and fast reverse parking even during heavy passenger traffic and/ or in narrow streets.






*Consortium: DE*

*Users involved: Truck manufacturer & logistics company in DE*

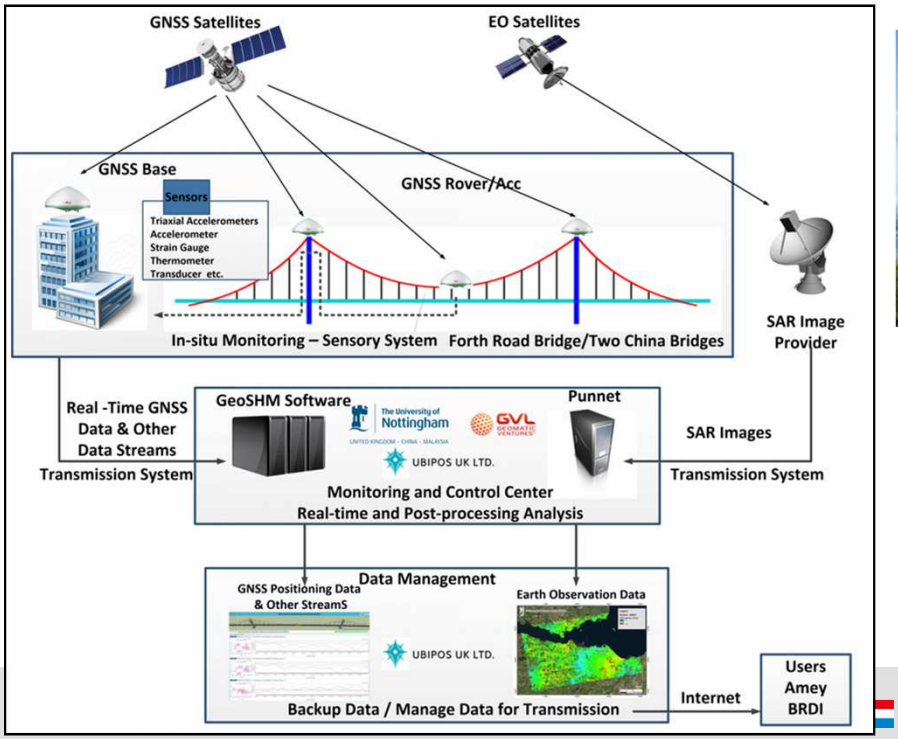



- SatNav: acquisition of globally available, free, weather independent and precise (with appropriate processing algorithms) real time positioning and attitude information.
- SatEO: provision of top view map to the driver. The relationship between the current positions of the truck and trailer and the final parking position can be analysed from top view, which is especially beneficial if the parking requires a curved trajectory and/ or there is a substantial tilt between the truck and trailer.

# Example "GEOSHM"

business.esa.int/projects/geoshm-demo-project

**"GEOSHM - GNSS and Earth Observation for Structural Health Monitoring":**
Structural Health Monitoring (SHM) service for the maintenance mainly of large bridges with a main span greater than 400m (potential also for shorter bridges) providing real-time measurements during normal and abnormal loading conditions, as well as a complete picture of the structure in its changing landscape, identifying threats caused by environmental conditions, land motion, engineering works, landslip, mining and industrial activity, in order to reduce cost of bridge maintenance.


Forth Road Bridge in Scotland

*Consortium: UK*

*Targeted Customers: Bridge operators in UK and China*

- Real-time 3D displacement and acceleration data at key locations of the structure based on GNSS
- Precise synchronisation of terrestrial sensors with GNSS time tags using fibre-optics
- Slow subsidence characteristics of the supporting structures provided by Interferometric SAR (InSAR)
- Estimates of long-term bridge motion, e.g. affected by thermal expansion, based on GNSS and InSAR
- Deformation estimates of a wide area of land surrounding the bridge based an integrated GNSS and InSAR data.

# Example "ASSIST WRM"

business.esa.int/projects/assist-wrm

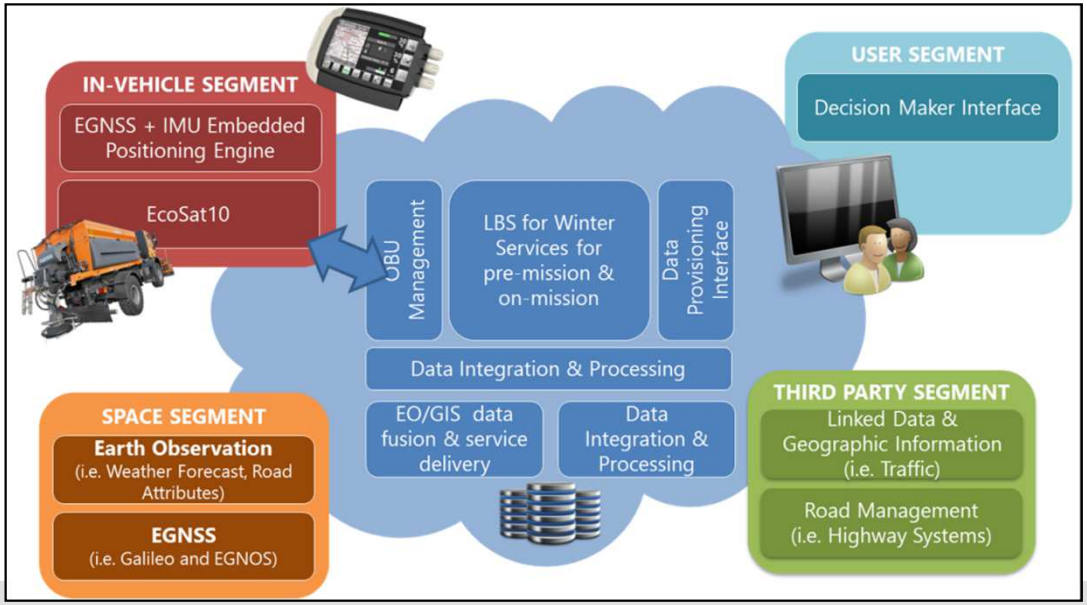
**"ASSIST WRM - Advanced Snow plough and salt Spreader based on Innovative Space Technologies - Winter Road Maintenance":**
Services in support of winter road maintenance operations, i.e. Road Icing Control Assistance, Snow Plough Control Assistance Service, Driving Assistance Service, and Management Assistance Service.



Winter is a critical season due to the impact on the transport sector. The necessity to maintain roads open and safe for public/private transport has become a continuously growing concern and cost for the public authorities – especially in times of shrinking municipal budgets. Better monitoring and forecasting information contributes to cost reduction.

*Consortium: IT, AT*

*Users involved:*
*Road authorities in SE, NO, IT, AT*



# Example "RPAS Intelligent Parcel Delivery"

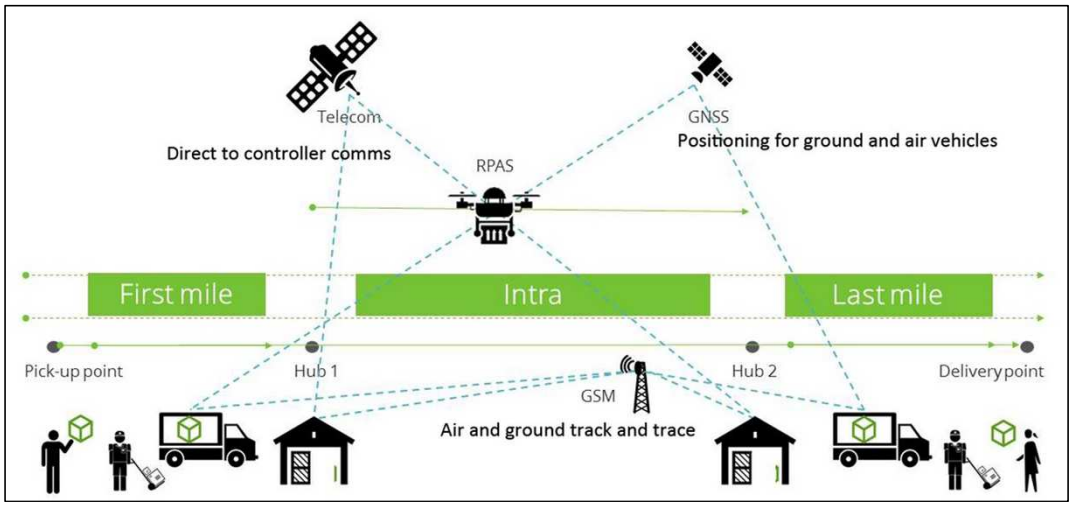
business.esa.int/projects/rpas-intelligent-parcel-delivery

RPAS UPD
Unmanned Parcel Delivery

esa

**"RPAS Intelligent Parcel Delivery":**
Utilise RPAS (drones) to provide a high-performing unmanned delivery solution for customers in remote locations.





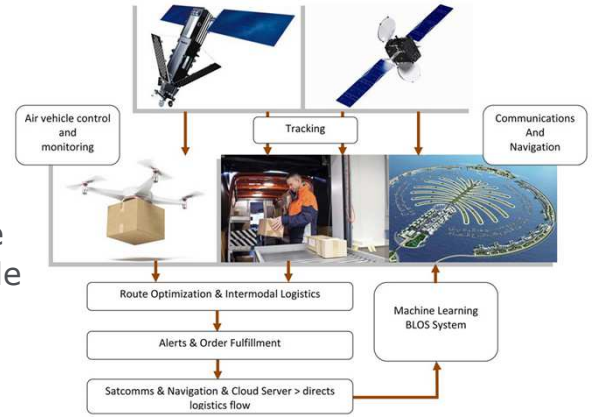

Involving an autonomous network of ground and air transportation, the UPD service will operate along static flight routes between fixed arrival and departure locations, a model that can be scaled upwards to meet demand. Operating under a reduced level of autonomy with some human interaction in the early stages.

*Consortium: NL, UK*

*Users involved: express parcel delivery organisation*

**SatNav:** for guidance, navigation and control of the RPAS.

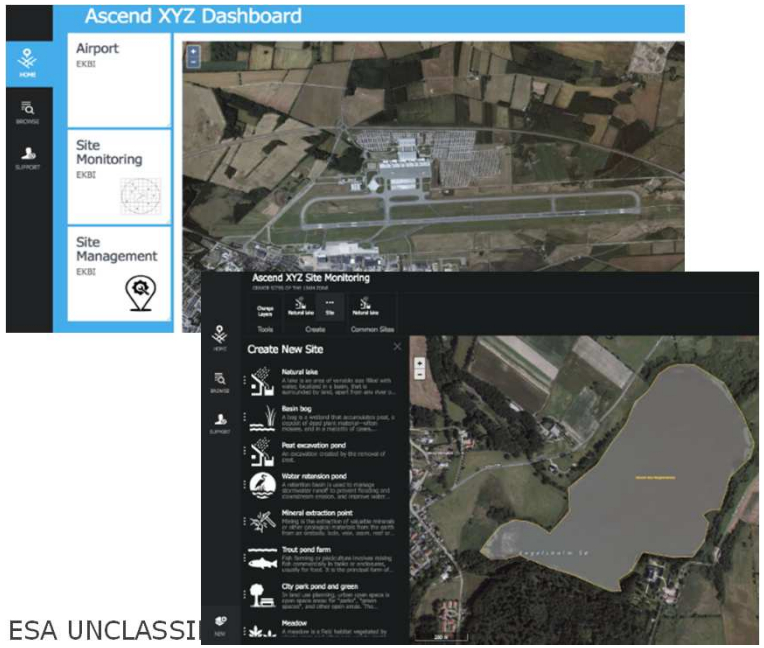
**SatCom:** for Beyond Line of Sight (BLOS) beyond the range of any existing terrestrial mobile network, to ensure the safety, security and reliability of the UPD service by allowing remotely piloted systems, and other vehicles in the delivery chain, to be connected and located at all times



# Example “AMMO”

business.esa.int/projects/ammo

**“Aerodrome Monitoring, Management and Operations”:**
End-to-end service to support Aerodrome Operators in increasing flight safety in the surroundings of aerodromes. AMMO will allow to monitor and survey potential threats (e.g. wildlife, vegetation, man-made constructions) and to facilitate the distribution of relevant up-to-date safety-related information to aeronautical entities (e.g. civil aviation authorities, airline companies) through the combined used of aerial photography and space assets (SatEO, SatNav).


*Consortium: DK*

*Users involved: airport operators, aviation authorities*

**SatEO:** Synthetic Aperture Radar (SAR) and multispectral images for aid in monitoring changes in ecosystems and landscapes. Very High Resolution (VHR) satellite images for monitoring airports surroundings and producing Digital Elevation Models (DEMs).

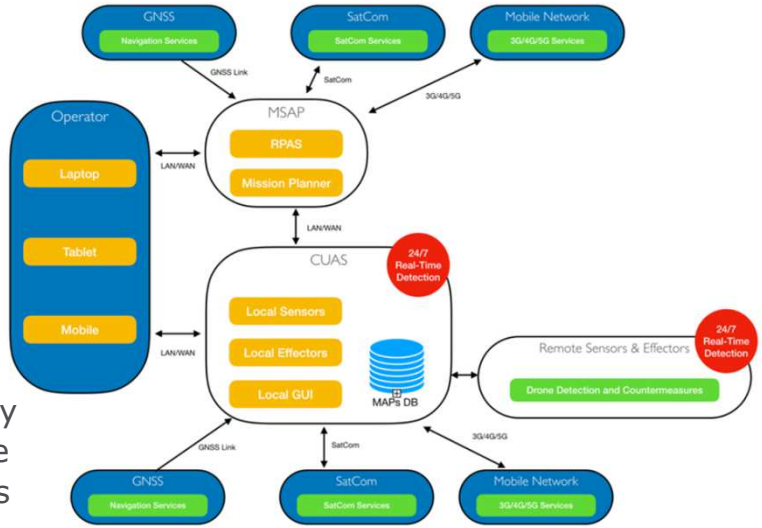
**SatNav:** supplies geo-positioning in the data gathering process of aerial images, and is also used to locate problem areas identified in the analysis process, for manual inspection or corrective actions (e.g. tree trimming).

# Example "DroSecMa"

business.esa.int/projects/drosecma

**"Drone Security Management":**
DroSecMa provides the ability to mitigate the threat presented by drones while leveraging their capabilities for enhanced surveillance and inspection. Drones may be used in ways that are much more efficient, especially in situations where human interactions may be problematic, un-safe, not cost effective, or impossible.


DroSecMa provides enhanced enterprise security and operational efficiencies by integrating drone detection and countermeasures (CUAS) services and drone surveillance and inspection services (MSAP).






*Consortium: DE*

*Users involved: airport operators, aviation authorities*

**SatCom:** provides communication and connectivity where other networks are not available or not sufficient in view of bandwidth, reliability or latency.

**SatNav (EGNOS/EDAS/D-GPS/RTK):** provides position data for localization of intruding drones or guidance of MSAP surveillance / inspection drones. It also improves the localization accuracy of sensors.

# Example "MARIA"

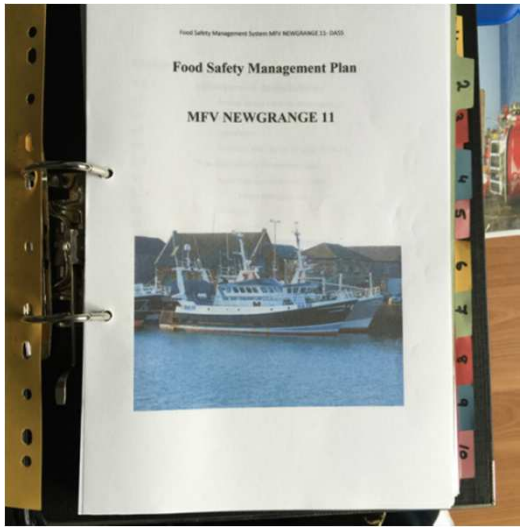
business.esa.int/projects/maria

**"Marine Integrated Applications":**

Capture and input real time data while vessels are fishing and to introduce more vessels to these standards (e.g. Marine Stewardship Council and BIM Responsibly Sourced Standard).


- to improve the management of certification data,
- to improve the quality of the data captured,
- to provide a two way information highway between vessels and their sales agents/processors,
- to address processors' requirements regarding supplier controls and information on vessels landing to them


*Targeted Customers: Fisherman, supermarkets, fish processors*



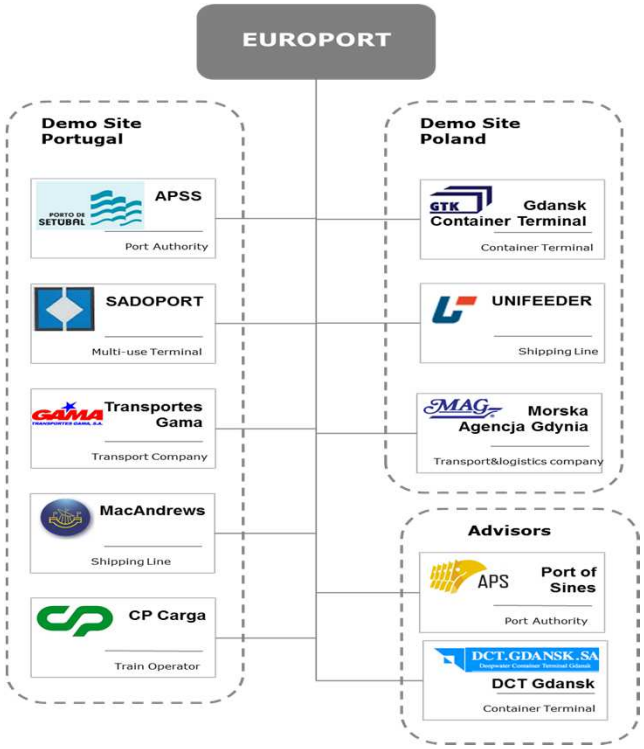
# Example "Europort"

business.esa.int/projects/europort

**"Europort":**
Services, based on the use of satellite assets, to end users involved in intermodal freight transport through European ports in order to optimize the intermodal transport chain.

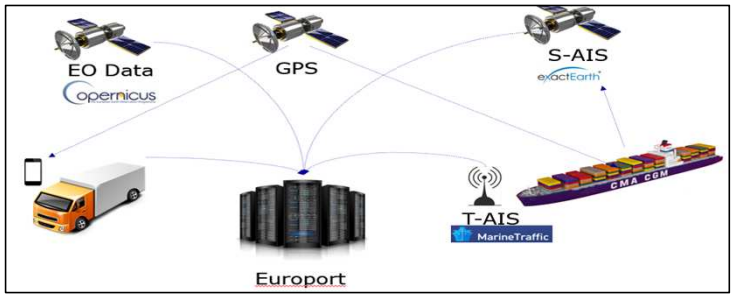



- When trucks arrive at the gate, time is saved as all documentation for issuing the gate-in gate-out is already provided to the gate in advance;
- Gate Operator by having a warning of an approaching truck can prepare everything before the truck arrives;
- The port user knowing the vessels ETA will be able to organize in advance the port operations;
- Port Authority can extract data on its area of influence learning where its main customers are;
- Shipping Company (as MacAndrews) by tracking their containers after leaving the port can provide a better service to the clients.




*Consortium: PT, PL*

*Targeted Customers: port authorities, shipping lines, transport organisations, container terminals*



# Example "NG-RMP"

business.esa.int/projects/ng-rmp

**"Next Generation Recognised Maritime Picture":**
According to the Irish Naval Service (INS) a key challenge in Ireland's control of its territorial waters is security and surveillance. NG-RMP enhances the quality and accuracy of the recognized maritime picture for the Irish Naval Service Services, based on the use of satellite assets.



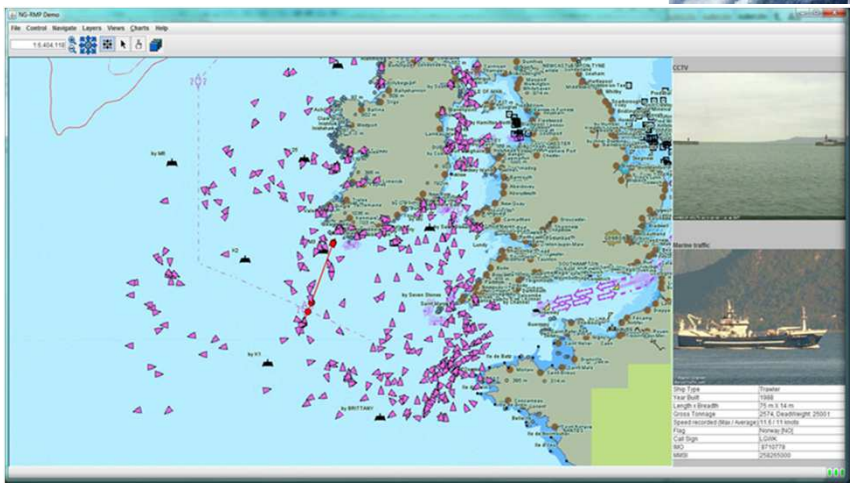

- **Improve maritime domain awareness:** support of security operations, maritime security threats
- **Environmental applications:** hazardous cargos monitoring, prevention of pollution caused by ships, pollution response
- **Maritime surveillance services:** monitoring of vessels in sensitive areas (international waters), anti-drug smuggling, border control

*Targeted Customers: Irish Navy*

SAT-AIS: ship related information data feeds into the Irish Navy's

SatEO: Integration of additional data sources (Weather, EO, LRIT, VMS)

Generating automated decision support on the captured data



# Example "AUDROS"

business.esa.int/projects/audros

AUDROS AUTONOMOUS DRONE SYSTEMS

esa

**"Autonomous Drone Services in the CBRNe operations":**

- a solution providing fully autonomous 24/7 Remotely Piloted Aircraft Systems (RPAS)-based services for security and defense applications with special focus on CBRNe
- The service constitutes the hangar for the RPAS itself from where the RPAS takes off deployed in the operations area and allowing fully automated battery recharging/ swapping




## Added Space Value

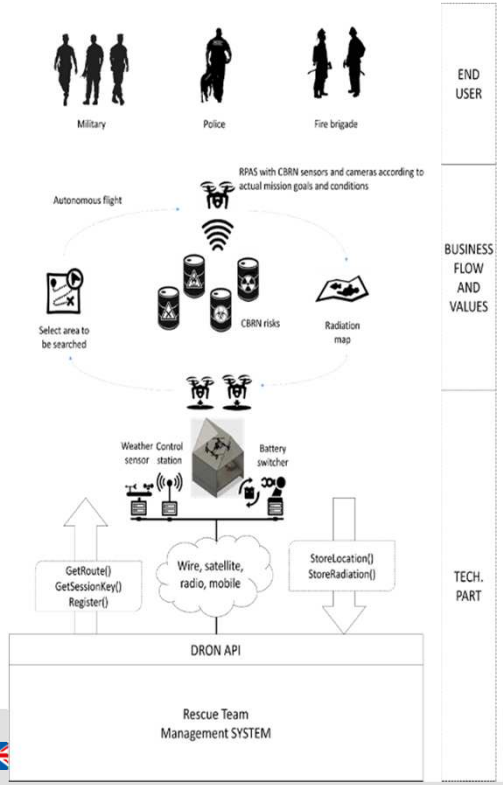
Earth Observation (EO): meteorological information and forecast are used to analyse possible situation development

Satellite Navigation (GNSS): crucial component to autonomous drone services and to military forces and rescue team management in the field.

Satellite Communication (SatCom): is used as part of the drone hangar to secure data transfer to remote dispatch/command.

*Consortium: CZ, PL*

*Value proposition:*
*10% cost saving (50k€)*
*60% time saving (3-4m)*



# → APPLICATIONS - RAILWAY

http://space4rail.esa.int

**Broadband to passengers**

- Opportunities: On board internet and entertainment in case of lack of terrestrial coverage in rural areas complemented by terrestrial networks
- Activities: Broadband to Trains, SAET, INDRA, EOMST


**Signalling**

- Opportunities: Signalling using GNSS and SatCom through virtual balises and carrier independent telecommunications solutions, innovative solutions at level crossing, train integrity
- Activities: 3InSat, SBSRailS, SatCom Rail, EMUSER, INLU, RailSafe, LeCross, Saferail, Sat4Train, Iris for Railway communications, Train Integrity

**Railway Infrastructure monitoring**

- Opportunities: railways stability and subsidence analysis, landslides and rock fall prevention
- Activities: MATIST, LIVE LAND

**Tracking**

- Opportunities: railway asset monitoring for safety and operational effectiveness
- Activities: SAMOLOSA , IRISS

# Example "3InSat"

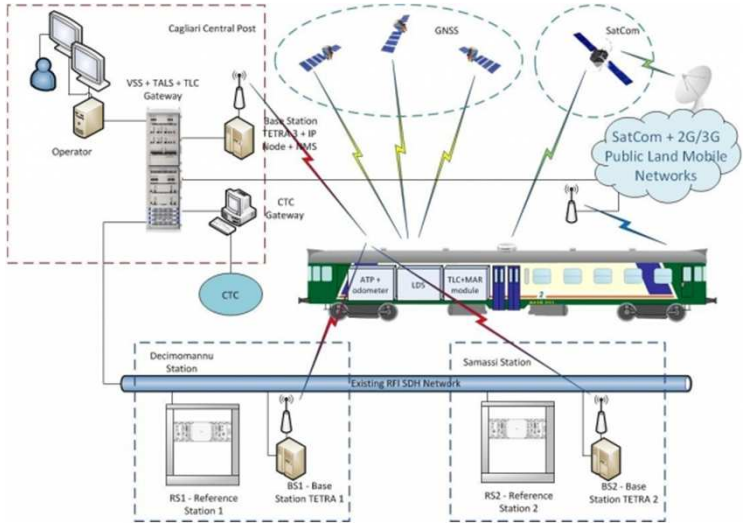
business.esa.int/projects/3insat

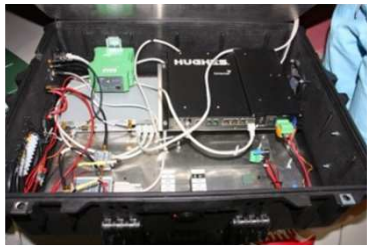
**"Train Integrated Safety Satellite system" Objective:**
Satellite-based platform using SatNav and SatCom to be integrated into a ERTMS system for local and regional lines and freight transport. The developed solution will be compliant with the stringent SIL4 railway requirement (Safety Integrity Level 4).



- SIL4 train localization through GNSS satellites and the use of dedicated local augmentation system avoiding the installations of positioning balises along the railway lines
- Flexible Telecommunication solution of the train control systems, which is bearer independent and can use 3G/4G public networks, TETRA and SatCom

*Targeted customers:*
- *Railway Infrastructure Managers*
- *Roy Hill Australian private mining company*



# Example "SaMoLoSa"

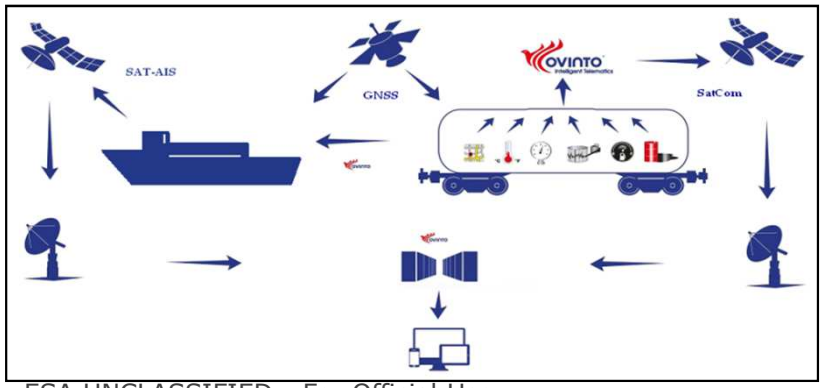
business.esa.int/projects/samolosa

**"Satellite Monitoring for Logistics Safety" Objective:**
Service to monitor critical parameters during transports of hazardous goods in unpowered transport assets such as rail tank cars and intermodal tank containers in order to reduce the transport risk, enhance the security and optimise the logistics operations.




End users and other stakeholders in this transport domain need to be informed about the overall status during the transport, and want to be alarmed worldwide in real time when specific critical parameters exceed predefined limits (e.g. temperature, pressure, shocks).

*Consortium: BE*



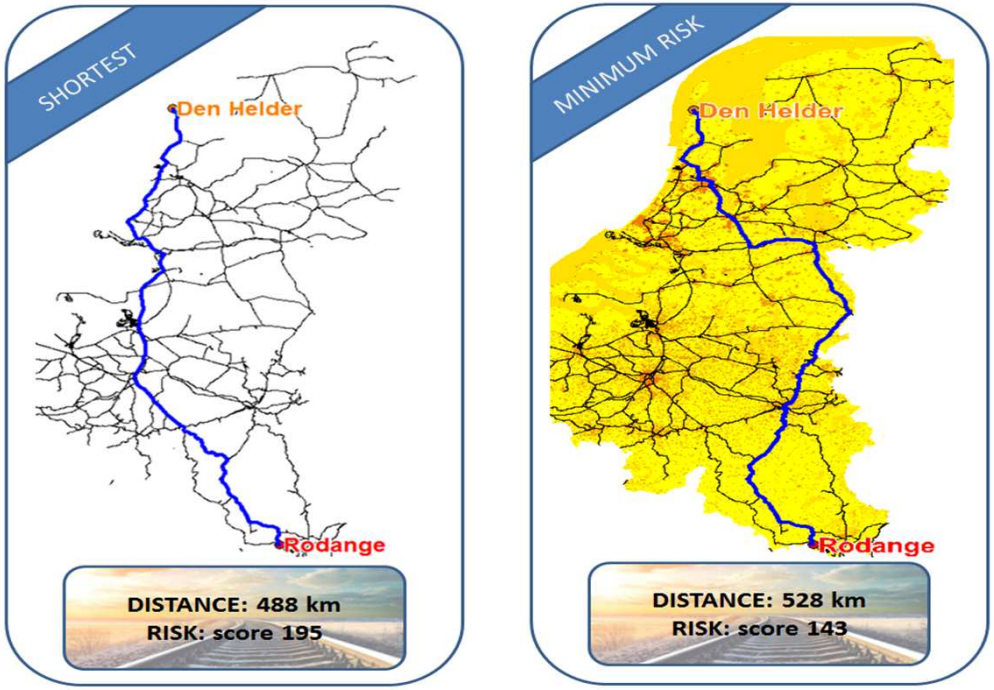

*Users involved: Railway carriers of hazardous goods in BE, DE*

Messages every 2 hours, single battery with a lifetime of min. 5 years, certification to operate in explosive environments (ATEX)

# Example “SaMoLoSa”

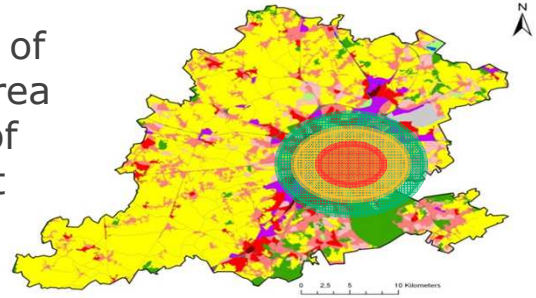
business.esa.int/projects/samolosa

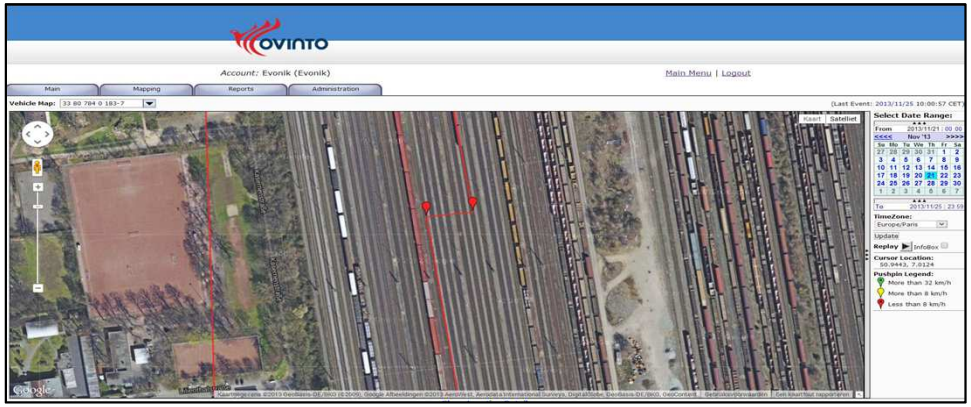
SaMoLoSa: **Sa**tellite **Mo**nitoring for **Lo**gistics **Sa**fety




Safest routing

Indication of damage area in case of accident






Clear rail track separation

# Energy

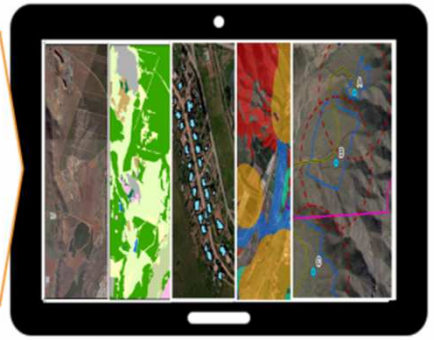
# Example "SPOTTITT"

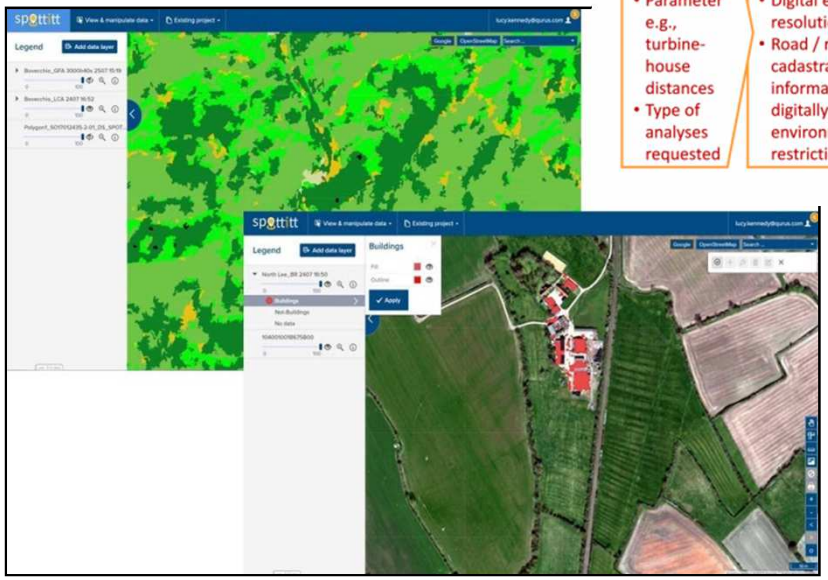
business.esa.int/projects/spottitt

**"SPOTTITT – Space Enabled Wind Installation Site Screening":**
Support onshore wind developers, turbine manufacturers and energy providers with the complex, expensive and time consuming process of screening and selecting the most suitable greenfield sites for development, without the need for initial travel to sites of interest.



1. **User inputs:**
   - Area of interest
   - Parameter e.g., turbine-house distances
   - Type of analyses requested
2. **Spottitt automatically sources from data library:**
   - Satellite imagery with resolution 0.4m to 15m
   - Digital elevation data, resolution 5m to 90m
   - Road / rail data, cadastral maps and information (where digitally available), environmental restrictions
3. **Automatic outputs:**
   - Selection of most suitable sites for wind farms
   - Surface roughness model to improve wind and noise modelling

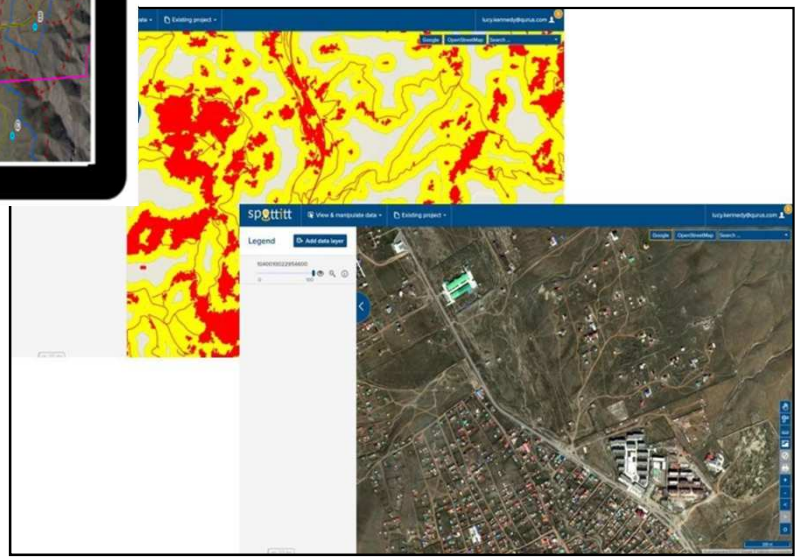




Automatically generate high resolution land cover analysis and sub meter building footprint data for any location in the world from the most recent satellite imagery.

*Market: South America, Asia, Africa*

*Value proposition:*
*10% cost saving (50k€)*
*60% time saving (3-4m)*

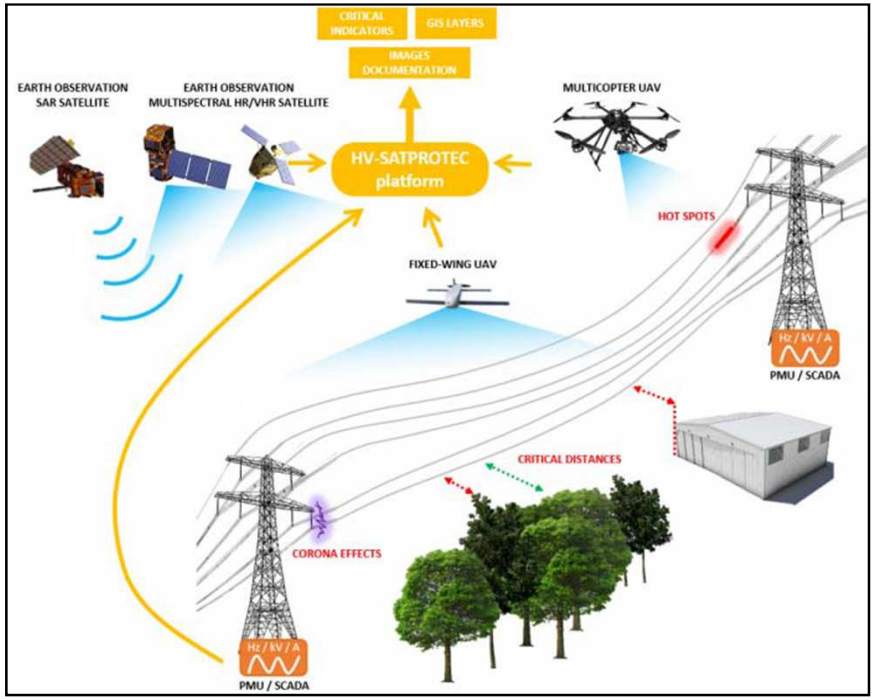


Choose Greenfield Analysis and Turbine Positioning Analysis ruleset and let Spottitt automatically define suitable areas for wind farm development and even ideal turbine positions

# Example "HV-SatProtec"

business.esa.int/projects/hv-satprotec

**"HV-SatProtec – Maintenance and Recovery of High Voltage Electricity Transport Systems":** Support cost-efficient planning of necessary maintenance tasks, anticipate risks threatening overhead power lines and improve the overall safety of monitoring operations within transmission corridors, in order to reduce the risk of power outages and to decrease related high maintenance/recovery cost




Service element 1: Infrastructure surroundings (e.g. pruning, tower deformation)
Service element 2: Infrastructure integrity (e.g. damages, thermal anomalies)

## Added value of space assets:

**SatEO:** tower localisation and deformation detection with SAR data, mapping of land cover / use change in the surrounding of corridors based on high resolution multispectral data, inspection of objects and vegetation with stereo-optical VHR data

**SatNav:** precise location and autonomous flying of Remotely Piloted Aircraft Systems (RPAS, drones)

**SatCom:** communication in areas with limited terrestrial coverage, back-up to RPAS communication system

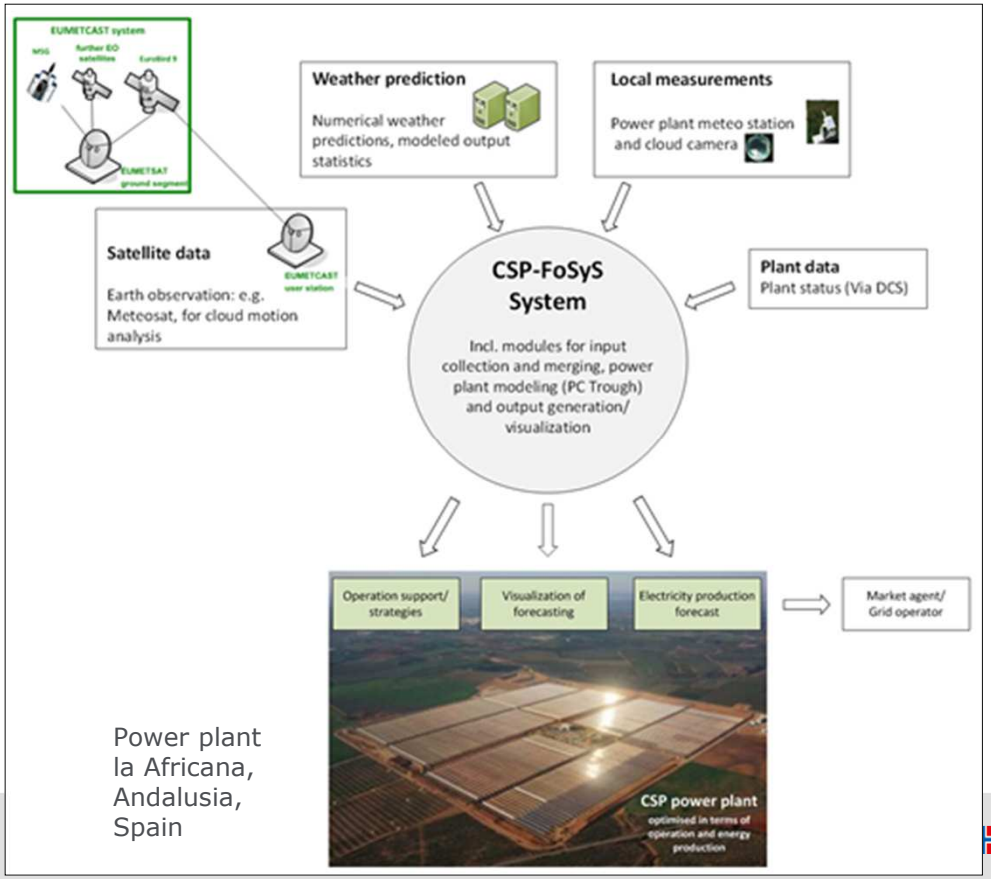

*Market: TSOs, DSOs*

*Value proposition: cost-efficient planning systematic information reduced monitoring and maintenance cost*

# Example "CSP FoSyS"

business.esa.int/projects/csp-fosys-dp

**"CSP-FoSys – Concentrating Solar Power Forecast System":**
Day-ahead and intra-day forecast of the energy production of concentrating solar thermal power plants for integration into the electricity grid.




Power plant la Africana, Andalusia, Spain



## Added value of space assets:

**SatEO:** EUMETCast weather data products, aerosol monitoring, cloud motion

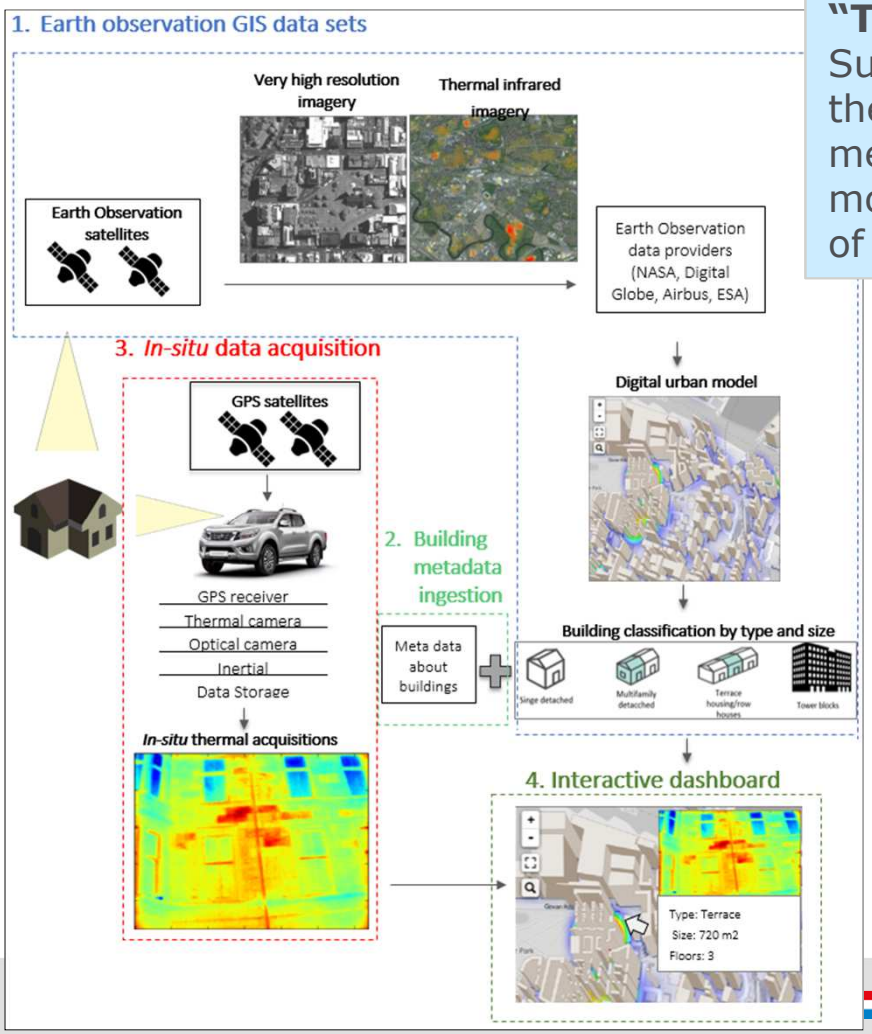
**SatCom**: direct reception of EUMETCast weather information, transmission of local measurements (meteo stations, cloud cameras),

*Market: USA, China, India, Australia*

*Value proposition: better weather and energy production forecasts, higher income*

# Example "ThermCERT"

business.esa.int/projects/thermcert




**"ThermCERT – Thermal Certification of Buildings":** Support detection and assessment of buildings with poor thermal performance for installation of ECO efficiency measures, enabling assessors to navigate the building stock more effectively and install insulation measures in the areas of greatest benefit.



## Added value of space assets:

**SatEO:** VHR optical, multispectral and potentially thermal infrared data for wide area data sets to down-select properties of highest ineterest, 3D building objects from VHR (< 1m resolution) images

**SatNav:** geotaging of thermal images taken from the in-situ vehicular scans, positioning will be enhanced with inertial measurement system for accuracy of less than 1m.

*Market: UK, Europe*

*Value proposition: 60% reduction of detection effort, Penalty avoidance for missed installation targets*

# → APPLICATIONS - HEALTH

European Space Agency (ESA) actively involved for many years in promoting the development of Telemedicine applications.

More than 120 health-related projects (www.esa.int/health) have been carried out so far by ESA, half of which dealing with Telemedicine:

- Emergency consultations
- Tele-consultation and tele-homecare
- Continuing medical education
- Distributed environment for medical simulation
- Clinical research & access to patient multimedia databases
- Tele-Epidemiology

These activities have exploited the capabilities of:

**Satellite Communications**, to link healthcare professionals and patients wherever they are placed

**Satellite navigation**, to localise and help the guidance of medical emergency teams on the field

**Earth observation**, to extract environmental data relevant to human health and contribute to building up health risk maps

**a combined use of these above capabilities** together **with technologies initially developed for manned space flight** but also useful on Earth (e.g. robotized tele-echography via satellite).

# Example "B-LiFE"

business.esa.int/projects/b-life

CTMA
Centre de Technologies Moléculaires Appliquées

esa

## B-LiFE - Biological Light Fieldable Laboratory for Emergencies

ESA IAP - ARTES 20 Project coordinated by the CTMA

B-LiFE has the support of the Belgian Civil Protection - Belgian Home Affairs

### Integration of Space Applications

**Satellite Communication**

**Capacities :**

- Real time communication between field teams and command and control centers
- Real time communication with remote experts
- Broadband links for data, voice and video
- Real time availability of evidence based results for decision makers

**Resources :**

- Emergency.lu services
- Commercial satellites

**Partner :**

SES TechCom

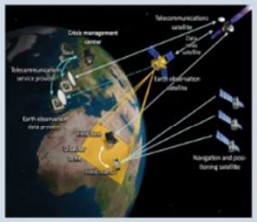
**Satellite Navigation**

**Capacities :**

- Geolocation of collected samples
- Tracking of field teams and equipment

**Resources :** GPS - GALILEO - EGNOS

**Partners :** Aurea Imaging, Eonix, Nazka Mapps



**Data Integration**

**Capacities :**

- Integration of analytical data, geolocation, mapping and reporting

**Resources :** Autonomous infrastructure for telecommunication, data bases and servers

**Partners :** Eonix , SES TechCom

**Earth Observation**

**Capacities :**

- Geographical information and maps of crisis area
- Site selection and monitoring

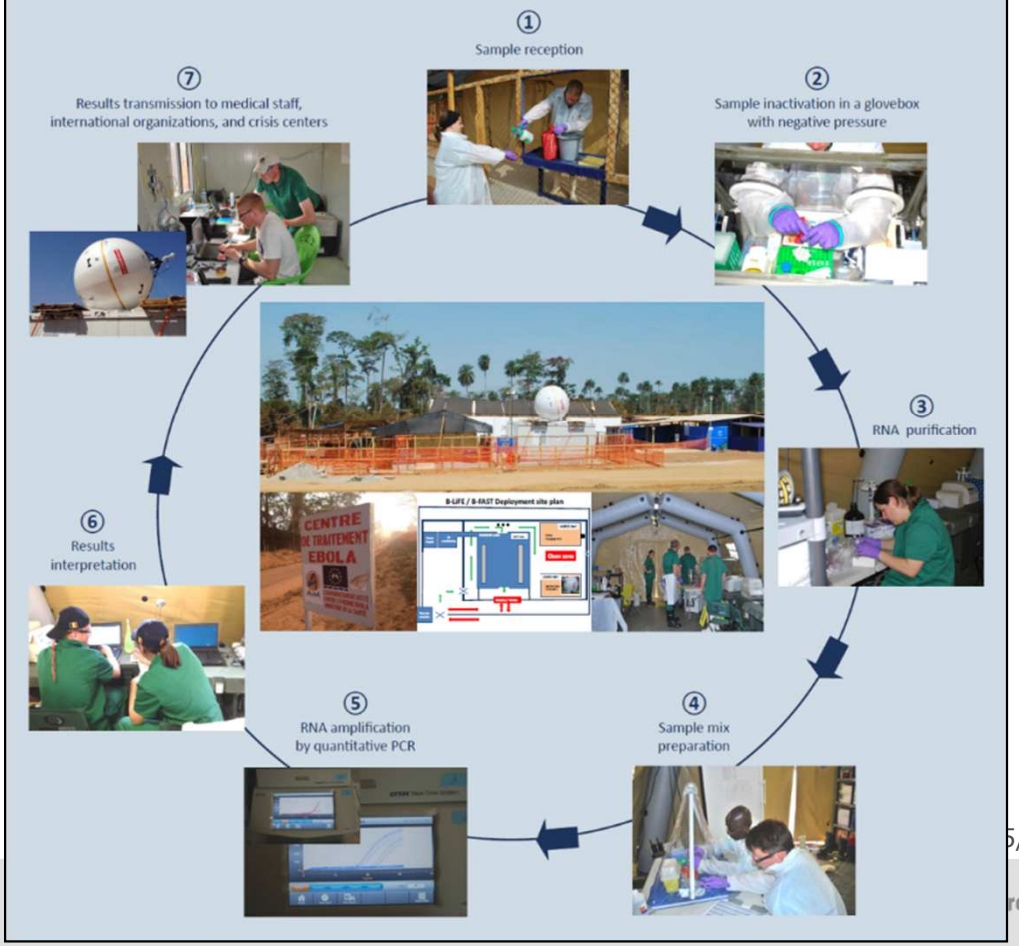
**Resources :**

- GMES / Copernicus services
- Remote sensing satellites
- Unmanned Aerial Systems

**Partners :**

Aurea Imaging, Nazka Mapps

## Ebola Sample Pathway in the B-LiFE Mobile Laboratory in Guinea






# Example "B-LiFE"

business.esa.int/projects/b-life

**B-LiFE provides services for a fast management of biological crises (e.g. Ebola outbreak in 2014-2015). It relies on extra features provided through space assets:**

- Real-time communications with home base, stakeholders and families of field teams
- Real-time transmission of analytical results, reports for stakeholders and requests for logistics support
- Real-time bidirectional communication with remote experts
- Broadband links for large dataset transfer
- Geographical information & maps for laboratory site selection during pre-deployment
- Site monitoring during pre-deployment and during the mission
- High-resolution maps for ensuring team safety and security
- Utilisation of Unmanned Aerial System to provide complementary data
- Generation of (dynamic) epidemiological maps
- Geolocation of samples
- Geolocation and tracking of teams and equipment deployed on the field

S A T C O M

E O

G N S S


**Target users**

- Laboratory Operators (UCL/CTMA)
- NGOs
- National and international institutions (Health ministries, Civil Protection, WHO, DG ECHO)

# Example “Amazon”

business.esa.int/projects/amazon

TEMPUS PRO
More Than Just a Monitor

esa



**Real-Time Satellite Based Telemedicine Service** for professional clinical users in remote locations making use of multiple space assets (Satcom, Satnav).

Highly compact medical device with conventional vital signs monitoring and defibrillator features offering also telemedicine capability (remote diagnosis).

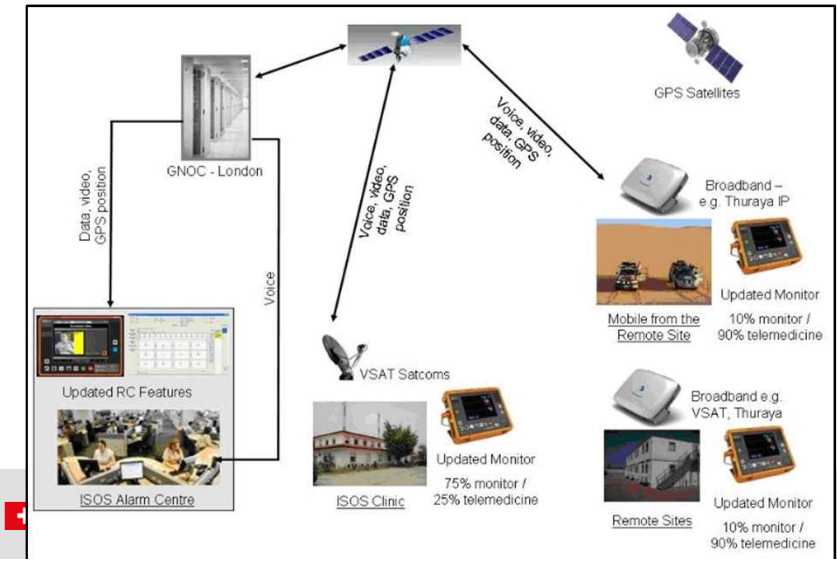
This provides economies of scale, simplifies training and reduces the amount of equipment that is required at each site.

Multimodal space-based services (satellite broadband / narrowband and terrestrial communication capabilities, location-based patient information, including VoIP, streaming of data and medical imagery, video, GPS positioning)

*Company: RTD Ltd (UK)*

*Target Customers:*
- *Governmental & private Emergency Medical Services entities*
- *Organisations involved in managing commercial healthcare in remote locations, e.g. iSOS or their customers*

*Target Users:*
- *Professional medical personnel (including military medics)*



# Example "SmartCare"

business.esa.int/projects/smartcare

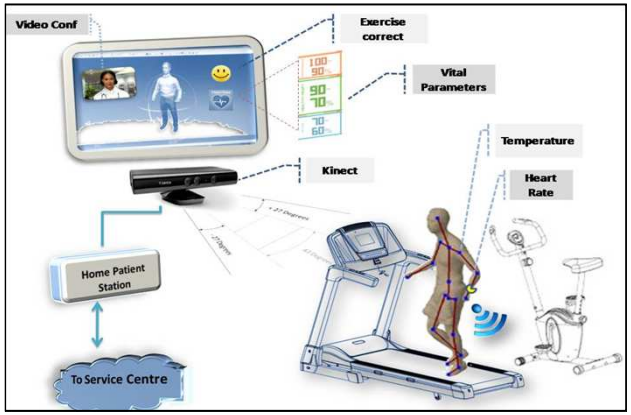
**Satellite enhanced Multi-channel e-health Assistance for Remote Tele-rehabilitation and CAREgiving:** SmartCARE is an ICT platform of advanced e-health services where physicians and patients with neurological impairments meet and manage daily activities. SmartCARE IHC (Integrated Home Care) services allows a constant verification of the therapeutic process without requiring the on-site presence of medical staff


SmartCARE service/system provides:

- "Serious game" supporting rehabilitation procedures such as recognition, reorganization, classification, association, attention and calculation, by moving upper and lower limbs
- Extract quantitative measures, regarding both cognitive and kinetics aspects of the rehabilitation practice
- Allows the therapist to remotely monitor and assess the patient's recovery using quantitative data on both cognitive and neuromotor performance

*Consortium: IT*

*Target Customers:*
- *Patients*
- *Carers*
- *Public and private health service providers*


Patient running rehabilitation exercise

# Example "Mercury"

business.esa.int/projects/mercury

**Mercury:** service providing the end-to-end secure transmission of medical images through the use of multiple space asset (Satcom, Satnav) from remote mobile Breast Screening Units direct to Central Hospital image reading desks.



Simple one-touch service installed on breast screening vans used in cancer prevention and detection.

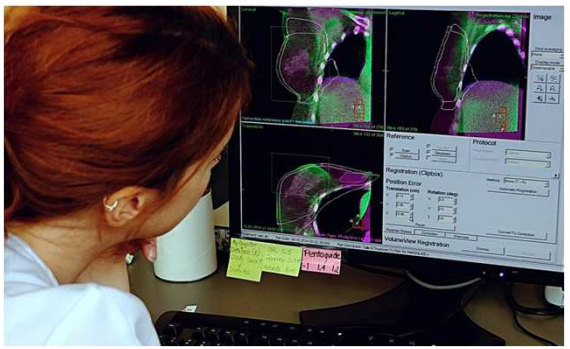
The service packages and transmits clinical data from the X-ray imaging device direct to hospital databases via satellite so radiologists can start their diagnoses earlier.

Satcoms saves time and costs, reduces data losses, increases security and enables 10–20% more women to be screened per day.

*Target Customers:*
- *Health service providers*

**SatNav:** GNSS data (date and location) embedded into the patient medical data; useful for identification purposes, auditing, mobile units tracking, as well as anonymous statistical mapping of breast cancer.

**SatCom:** transporting large amounts of data from one location to another, eliminating physical data transfer.

# Example "VECMAP"

business.esa.int/projects/vecmap

**VECMAP** (Vector Mapping): provides a cost and time efficient system for mapping and predicting vector-related health risks in order to help prevent and reduce the spread of vector-borne disease.

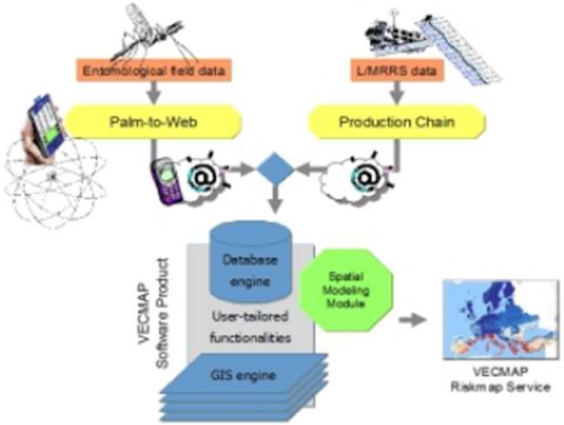

The service reduces the spread of vector-borne diseases. This is achieved by:
- Providing precise information of disease vector presence
- Enabling efficient management of vector invasions
- Directing nuisance control efforts in terms of place and time eg. just after the hatching of eggs.

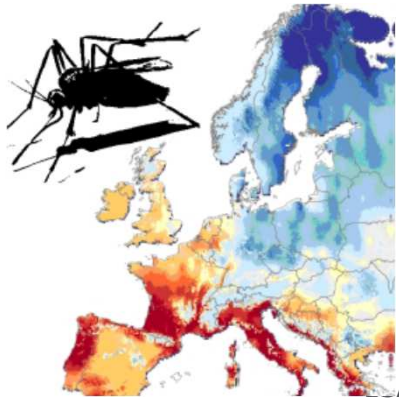
The service also reduces costs to public health authorities through:
- Mapping and prediction efficiencies
- Disease prevention

*Target Customers:*
- *national public health agencies*
- *regional mosquito controllers*

**SatEO:** Earth observation data:Environmental data (e.g. soil moisture, surface temperature, vegetation, land use) for temporal & spatial prediction models: eco-climatic envelope, landscape and habitat

**SatNav:** to geo-localise ground data like mosquito traps, field inspectors/teams to locate/control areas at risks, and support accurate follow-up



# → EDUCATION

# Example "Sway4Edu"

business.esa.int/projects/sway4edu

**"Satellite ways for education":**
Satellite based ICT (Information and Communication Technology) solution to support Capacity Building activities in Africa in the areas of a) Electoral Cycles, b) Food Security, c) Education


*Targeted Users:*
*Economic Community of Central African States (ECCAS) ;*
*Farmers of DRC;*
*Teachers of remote schools in SA and Italy*

- Electoral eTraining services to electoral management bodies of the Economic Community of Central African States (ECCAS) to support their electoral cycles,
- Rural Radios assisted radio services for secure and sustainable agricultural development in the Democratic Republic of Congo (DRC),
- Effective eLearning services to support education in rural schools in South Africa (SA) and Italy

## Education

- Assist rural children and teachers to be more techno savvy and become aware of the benefits that information and communication technologies bring
- Develop awareness amongst local youth, as well as amongst the wider community members, of the importance of preserving their local wildlife heritage and to adopt a more sustainable approach to daily
- Nineteen satcom-enabled schools in the rural area of Mpumalanga in South Africa and 3 schools in a rural area of the Basilicata Region (Italy) have been involved for the development of competences in IT and in the preservation of the natural environment

Minister of Education of the Mpumalanga Province in South Africa, Singita, principal and student of the Babati school and ESA


# → BUSINESS APPLICATIONS – OVERVIEW POLAND 2017 - TODAY

## ➢ Kickstart Studies:

- 06/2017-02/2018: "GSOT - Geolocation Support For Outdoor Tourism" [Naukozercy Lena Kazmierczak (PL)]
- 08/2017-02/2018: "GNSS based Yacht Parking System" [FHU Grunwald (PL)]
- 09/2017-04/2018: "Kyek - multisensory probe" [Seleris (PL)]
- 09/2017-03/2018: "TILQ-AP - Temperature Indexes Life Quality - Ageing Population" [Blue Dot Solutions (PL)]
- 12/2017-07/2018: "SHOW - Senior Helps Others Wisely" [Mesh Metrics (PL)]
- 02/2018-10/2018: "Satellite Fruit Control System" [I-NET.PL SP. J. JANOWSKI & SZULWIC (PL)]
- 02/2018-10/2018: "ClimField" [WASAT SP (PL)]
- 04/2018-10/2018: "SAMIPS - Satellite Appl. for detection & Monitoring of Invasive Plant Species" [WASAT SP (PL)]
- 05/2018-10/2018: "ASPEN – Accelerometric System for Pavement Evaluation" [Heller Consult SP (PL)]
- 08/2018-12/2018: "BFPaaS - BVLOS UAV flight planning platform" [Creotech Instruments (PL)]
- 05/2018-10/2018: "SAT-DEFO" [SATIM Monitoring Satelitarny (PL)]
- 07/2018-12/2018: "PASST - Precise Apiculture Supported by Space Technology" [AGROMAP Adam Ciecko (PL)]
- 11/2018-(06/2019): "Activity Time" [Brand Technology Paweł Czartoryski" (PL)
- 12/2018-(06/2019): "MET - Maritime Educational Trip [Naukozercy Lena Kazmierczak" (PL)]

# → BUSINESS APPLICATIONS – OVERVIEW POLAND 2014 - TODAY

## ➢ Feasibility Studies:

- 03/2014-06/2015: "IWBSF – Integrated Web-Based Services for Forestry" [SmallGIS (PL)]
- 04/2016-10/2017: "DART – Direct AiR Transport" [ITTI (PL, prime), Instytut Lotnictwa (PL), Aeroklub Polski (PL), MLabs (PL)]
- 04/2017-04/2018: "Assessing the potential of future maritime applications in the context of VDES" [Creotech Instruments (PL, prime), Gdynia Maritime University (PL), National Institute of Telecommunications (PL), Excodus (PL)]
- 01/2018-12/2018: "AUDROS - System & Service Demonstration of Autonomous Drone Services in CBRNe" [BizGarden (CZ, prime), GINA Software (CZ), VVU (CZ), Cervi Robotics (PL)]
- 09/2016-09/2017: "InsuTrax - Heavy Load Vehicle Insurance Services" [ATENA S.A. (PL, prime), Blue Dot Solutions Ltd (PL)
- tbd: "SoURCE - Service of Utility Risk/Cost Evaluation" [I-Net.PL (PL, prime), JW Real Estate Marek Walacik (PL)]

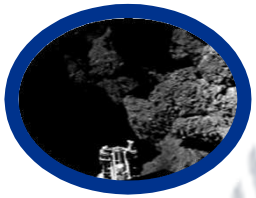
# → BUSINESS APPLICATIONS – OVERVIEW POLAND 2014 - TODAY

## ➢ Demo Projects:

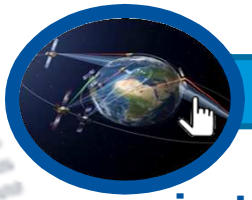
- 07/2014-05/2018: "EUROPORT - Optimizing Intermodal Freight Transport through European Ports" [GMV Innovating Solutions (PL, prime), GMVVIS SKYSOFT (PT), TIS.pt (PT)]
- 08/2015-07/2017: "IWBSF – Integrated Web-Based Services for Forestry" [SmallGIS (PL)]
- 08/2015-05/2018: "SIS-REM: Safety and Information Systems for Ski Resorts in Emerging Market" [BizGarden (CZ, prime), GINA (CZ), Alpstein (DE), Cervi Robotics (PL)]
- 11/2015-11/2018: "ISSWIND – Integrated Supporting Services for Wind Industry" [GMVIS SKYSOFT (PT, prime), GMV Innovating Solutions (PL), HERMESS (NL)]
- 04/2015-tbd: "ASAP - Advanced Satellite-based Advisory service for Precision farming" [IGiK (PL, prime), PTWP (PL), Agrotechnology S.A. (PL), GEOMATIC Michal Wyczalek (PL)]
- 12/2015-tbd: "Enhanced Logging Operations (TIKKA) - Satellite Based Tools for More Efficient Logging Operation Planning" [SmallGIS (PL)]
- 09/2016-tbd: "FertiSat - Satellite-based Service for variable rate nitrogen Application in Cereal production" [Wasat (PL, prime), Warsaw University of Life Science (PL), Polski Farmer (PL)]
- tbd: "OASIS - airborne wind energy - affordable safety & autonomy services" [Ampyx Power (NL, prime), MetOffice UK (UK), Xignum (PL)
- tbd: "ASPEN2 - Accelerometric System for Pavement Evaluation" [Heller Consult SP (PL)]
- tbd: "AUDROS - System & Service Demonstration of Autonomous Drone Services in CBRNe" [BizGarden (CZ, prime), GINA Software (CZ), VVU (CZ), VTUL (CZ), Cervi Robotics (PL)]

technology

navigation



exploration

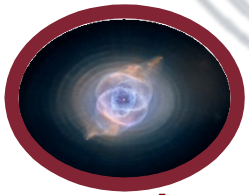



telecommunications (TIA)

human spaceflight

operations

ARTES



space science

earth observation

launchers

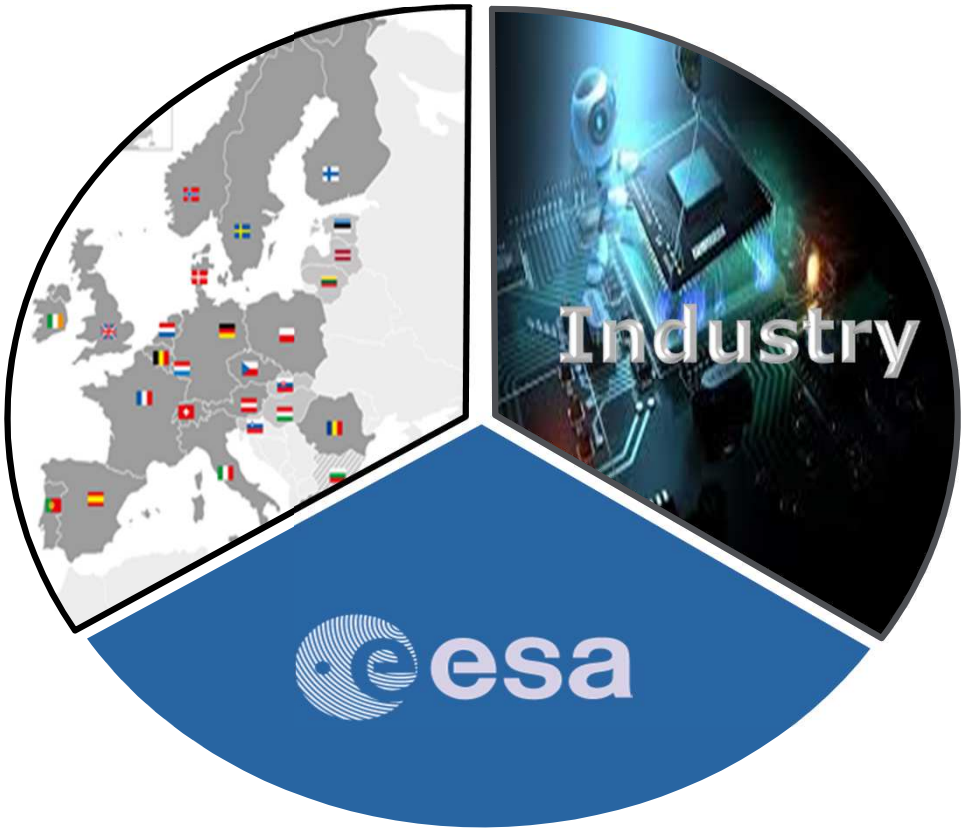
**ARTES = Advanced Research in TElecommunications Systems**

**Objectives:**

- Improve the capability and competitiveness of the ESA Member States' infrastructure companies in the world commercial satellite communications market
- Improve the capability and competitiveness of the ESA Member States' service companies in the downstream market.

*TIA: Telecommunications and Integrated Applications Directorate*
*ARTES: Advanced Research in Telecommunications Systems*

# → ARTES PROGRAMME: BASED ON PARTNERSHIP




- **National Delegates** contribute funding & authorise activities
- **Industry & institutions**(1) develop technology and products(2) for the world market
- **ESA** shares the risks and manages the contracts and activities
- **Industry** retains IPR & brings the end result to market

*(1) within ESA Member States participating in ARTES*
*(2) Any hardware, software, system or sub-system, service or application*

# → ARTES 4.0 AT SPACE 19+

a) **Activity Areas** (under discussion with Member States)

FP

**Future Preparation**

**Core Competitiveness**

**Partnership Projects**

**Business Applications Space Solutions**

b) **Strategic Themes** (under discussion with Member States)

# → STRATEGIC THEMES IN ARTES 4.0

**To address objectives of high societal/economic value.**

## ✓ Satellite for 5G (S45G)

New generation of communications is key to support Digital Transformation, with integration of satellite with terrestrial telecom networks.

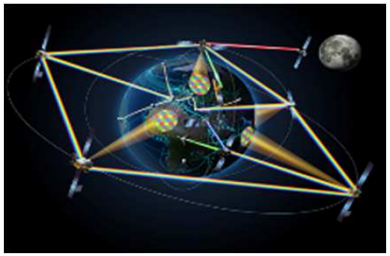

## ✓ Space Systems for Safety and Security (4S)

Innovative solutions to societal challenges and security of European citizens. Aiming at coherence with EU GOVSATCOM as anchor customer.


## ✓ ScyLight - Optical Communication

Cutting-edge technology at frontier of knowledge and with technological challenges yet to be mastered.

Foster Industry capability to respond to upcoming markets and provide solutions for European strategic needs.



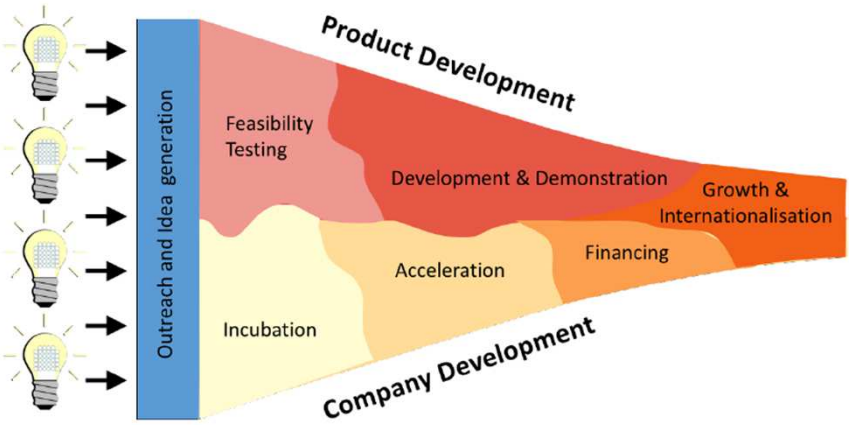
# → ARTES "BUSINESS APPLICATIONS SPACE SOLUTIONS (BASS)"

**Objective:**

- promote the utilization of space in a multiplicity of economic market sectors
- promote the growth of the space downstream industry
- create Socio-Economic Benefits in ESA Member States

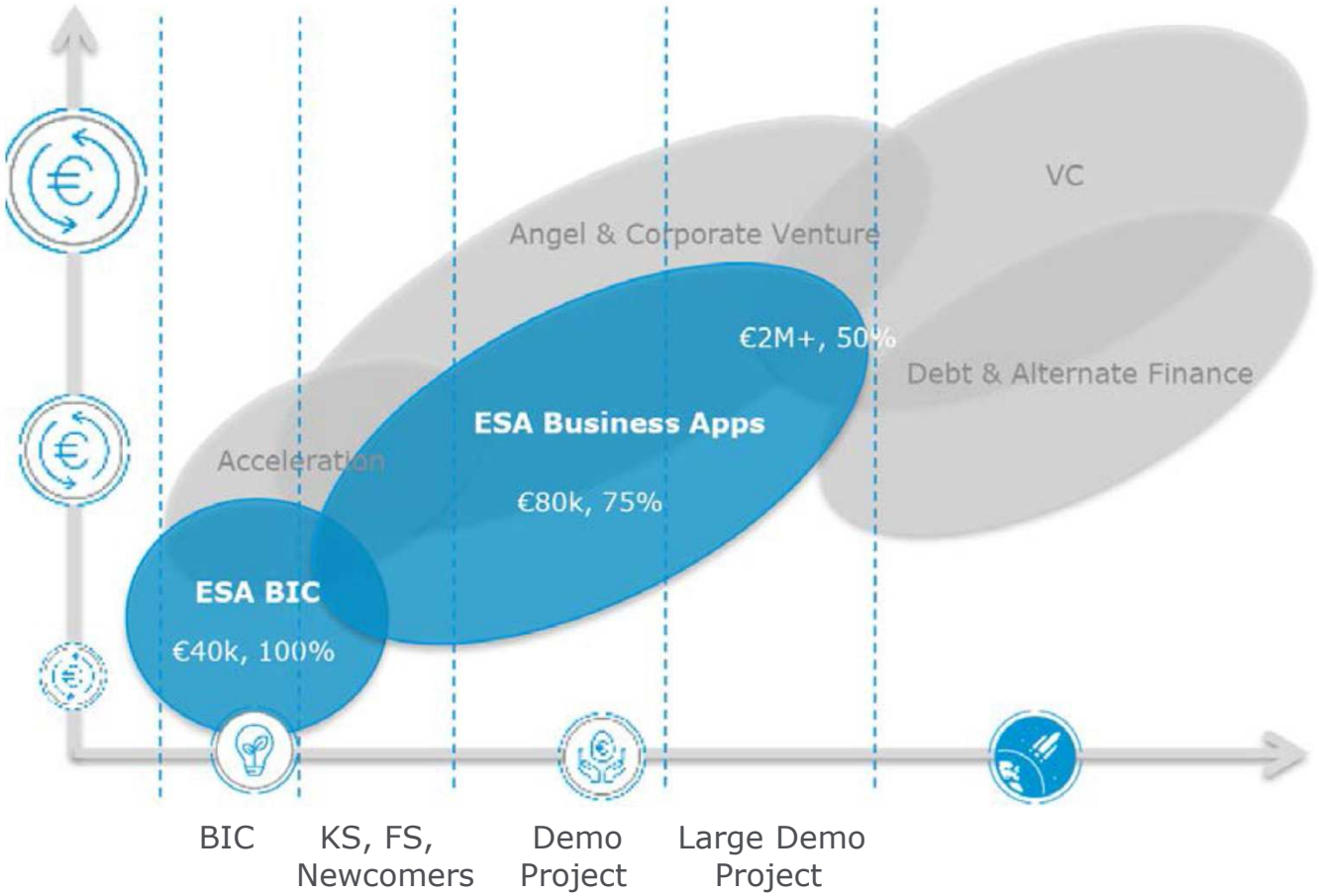
**Range:**

- Application Activities (Business Applications):
  - Feasibility Studies (incl. Kickstart Studies)
  - Demonstration Projects
- Business Services (Space Solutions)
  - ESA BIC and Space Solutions Centers
  - 3rd Party Finance (ESA Investor Forum)




**Websites:** https://business.esa.int and https://www.esa.int/spacesolutions

# → OUR POSITION

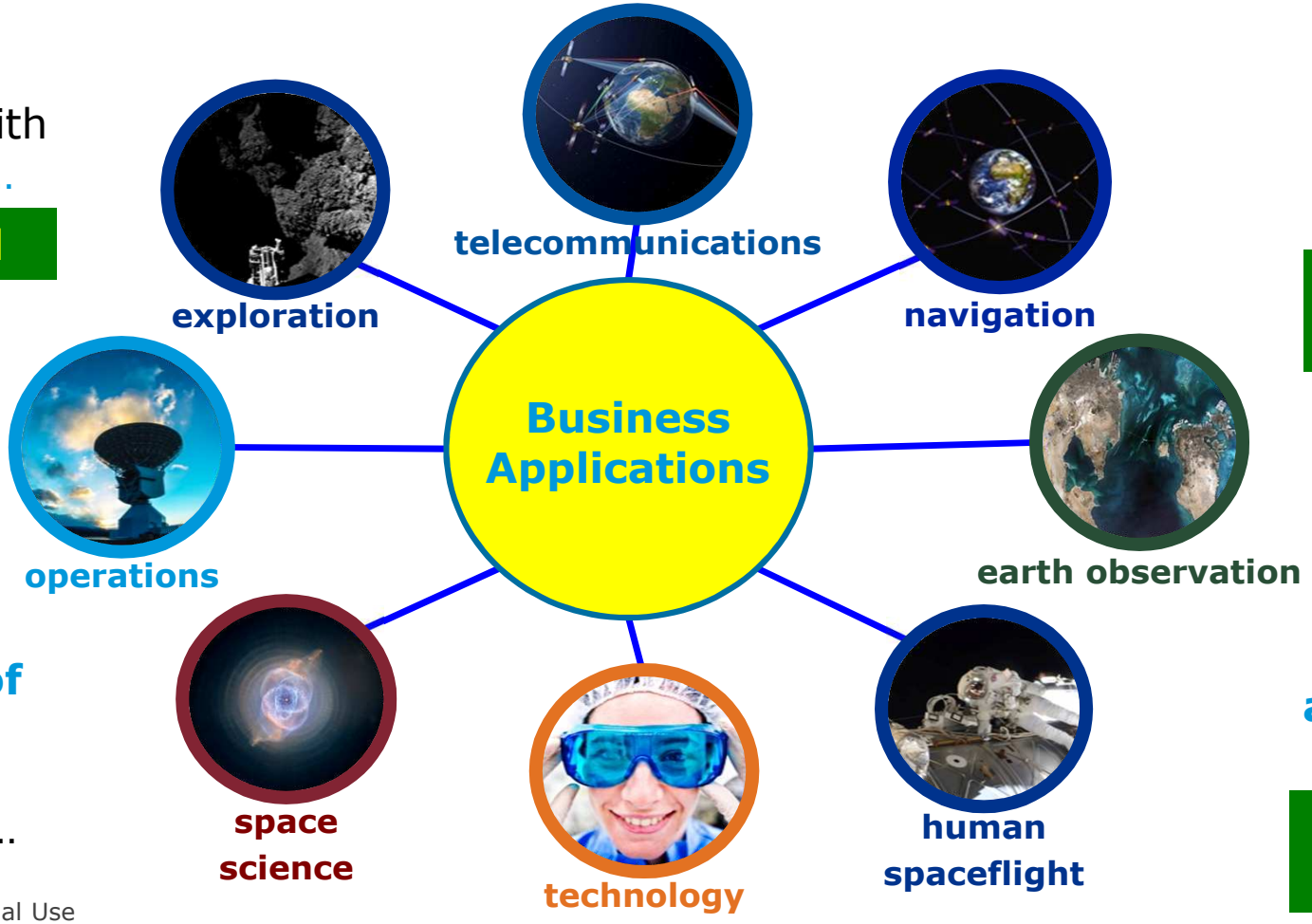


# ESA BUSINESS APPLICATIONS

In close partnership with **end users** …

**market pull**

… through **integration of space with non-space** technologies …



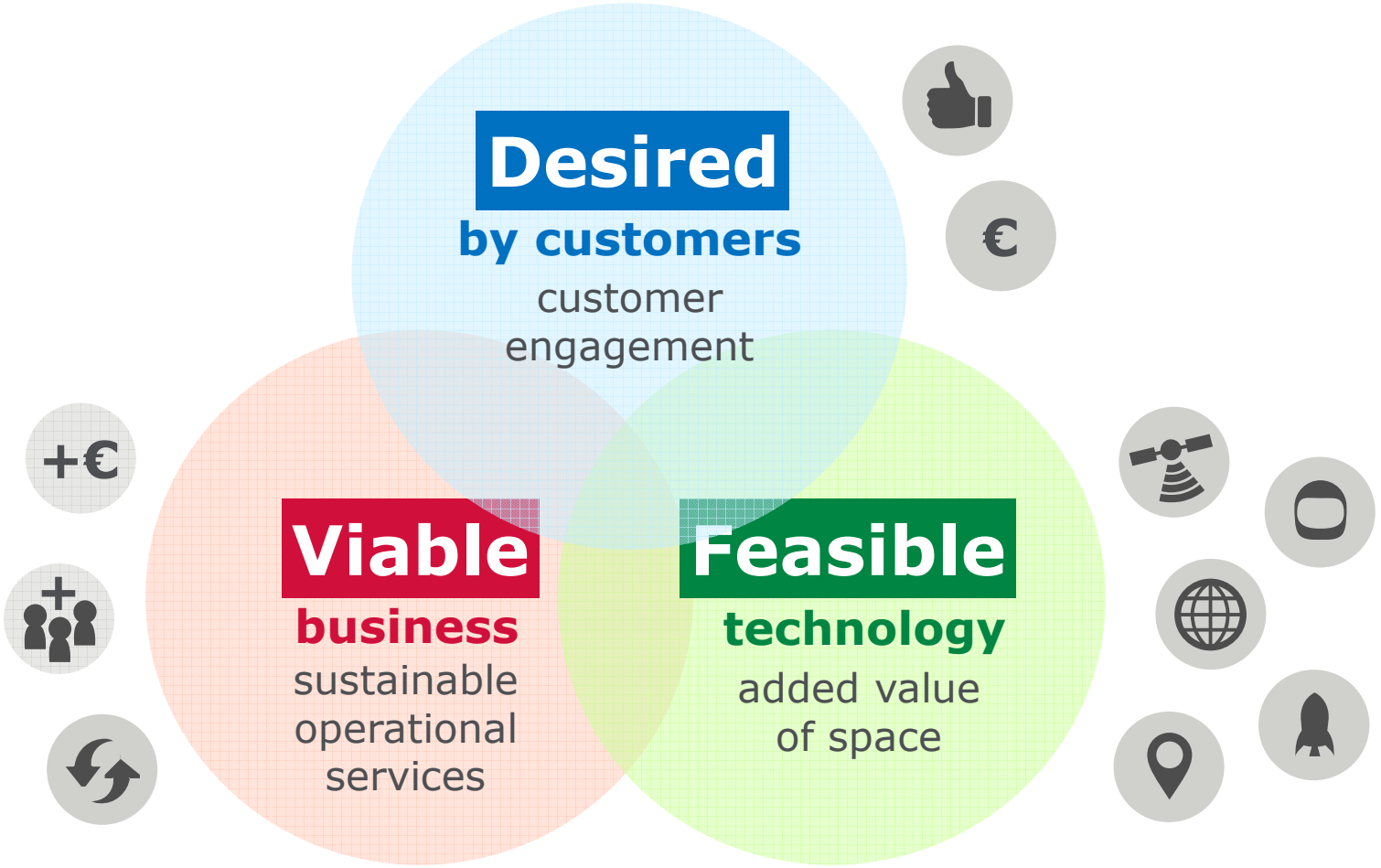

… foster the utilisation of **existing space capabilities** …

**operational, reliable**

… to develop **sustainable applications and services.**

**business development**

# → LOOKING FOR PROMISING SERVICES



# → GOAL AND CHALLENGE

Service development with the aim of becoming operational

# → WHAT ESA OFFERS

## We'll work together to make your idea commercially viable

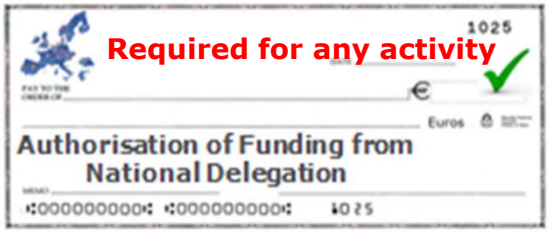
Zero-Equity Faunding (€60k-€2M+)

Tailored Project Management Support (technical & business)

Access to Our Network & Partners (incl. Investors)

Brand Credibility

# → FUNDING OPPORTUNITIES




**Kickstart (AO-xxxx)**

BA initiated themes (75% funded at 60 k€)
Workplan H2/2019: Biodiversity, Future Internet, Predictive Maintenance, Environmental Crimes

**Feasibility Study (AO-xxxx)**

BA initiated studies (funded up to 100%)
Workplan end 2019 / begin 2020: Plastic-less society, Decommissioning of energy assets, Green buildings, Ports of he future, Digital health in developing economies

Customer Demand → **Feasibility Study (AO-9305)** → **Demonstration Project (AO-9305)** → Operational Service

AO-9305: Continuous Open Call for co-funded industry initiated proposals

Customer Driven Business Opportunity

Validated Business Case for Minimum Viable Service

Validated Minimum Viable Service

# → FUNDING OPPORTUNITIES – KICKSTART STUDIES

## Kickstart Studies

➢ Thematic calls aiming at exploring the viability of new application/service concepts)

- *Aiming for Newcomers (esp. SMEs)*
- *Simplified application process: fixed proposal length of 20 pages (template)*
- *Multiple contracts, selection depending on subject and quality*
- *Intro webinars weeks ahead of each theme call (information on website **business.esa.int/kick-start**)*
- *Theme call opening period of 6 weeks*
- *60 k€ (75%) ESA funding*
- *Study duration of 6 months*
- *Focus on customer engagement, business case, technical feasibility*

# → BUSINESS APPLICATIONS – KICKSTART STUDIES - OVERVIEW

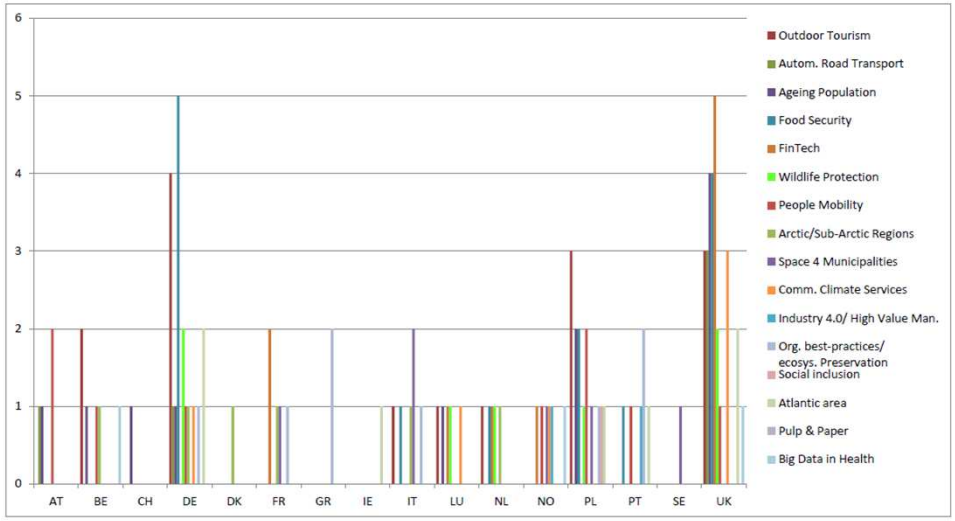
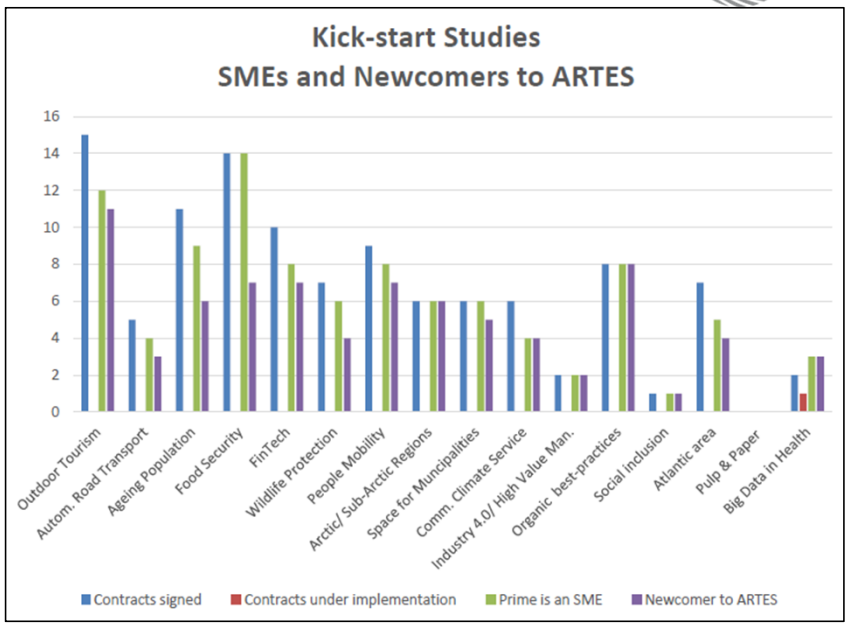
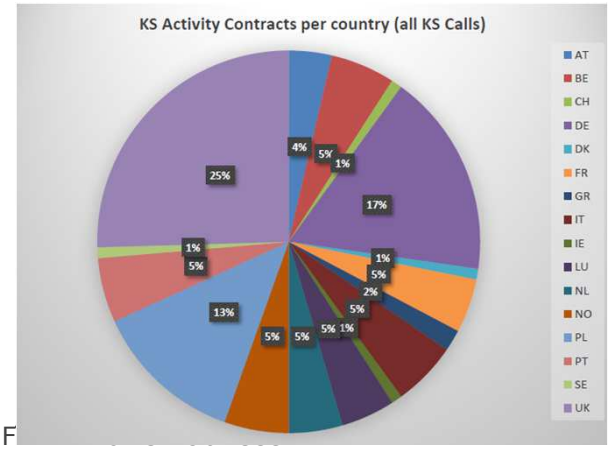
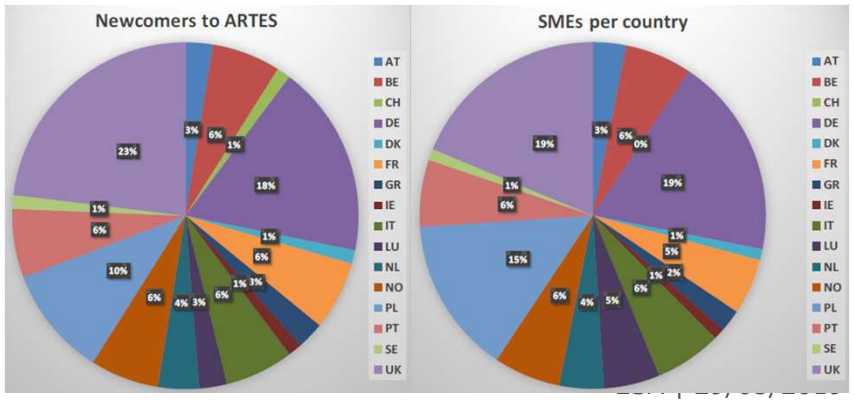



*Figure 1: Kick-Start Activity Contracts Awarded per Country and per KS Call*




Number of contracts: 110



# → FUNDING OPPORTUNITIES – KICKSTART STUDIES

**Currently open (AO-9889):**
**"Artificial Intelligence – Consumer Goods, Business and Industrial Services ", 13 May – 21 June 2019**

*Topics of relevance (examples): retail, electric utility, manufacturing, transport and logistics, healthcare, social goods*

**ESA collaboration with Amazon Web Services, Vodafone, Toilet Board Coalition:**
**All have launched in parallel web-based challenges encouraging innovative start-ups and businesses**

Coming next as sub-themes:
**AI - Social Impact** (25 Jun - 30 Aug 2019), Webinar 12 Jun 2019 (11:00 CEST)
**AI - Infrastructure** (2 Sep - 11 Oct 2019), Webinar 28 Aug 2019 (11:00 CEST)
**AI - Environment and Natural Resources** (14 Oct - 29 Nov 2019), Webinar 1 Oct 2019 (11:00 CEST)

**Currently open (AO-9893): "Space4Sport", 21 May – 1 July 2019**
**https://business.esa.int/space4sport**

*Topics of relevance (examples): sports tourism and fan engagement, sports facilities, sports equipment and vehicles, athlete endorsement, sports coaching, sports medicine, animals and their upkeep*

# → FUNDING OPPORTUNITIES – KICKSTART STUDIES

## Kickstart Studies – Workplan 2nd Semester 2019

Biodiversity: 2 Sep - 25 Oct 2019

topics of relevance e.g. agriculture, aquaculture and marine ecosystems

Future Internet: 28 Oct 2019 - 6 Dec 2019

topics of relevance e.g. manufacturing, e-health, training and education, personal services, logistics, creative industries

Predictive maintenance: 9 Dec 2019 - 31 Jan 2020

topics of relevance e.g. manufacturing, infrastructure, transport sector, oil & gas

Environmental crimes, with sub-themes:

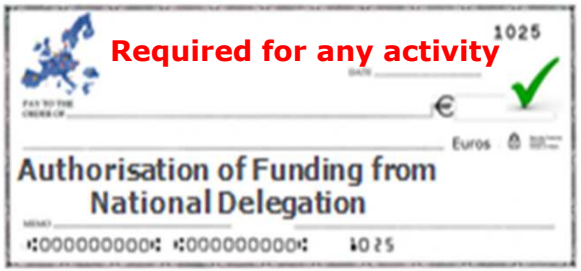
1. Environmental Quality: 2 Sep - 11 Oct 2019
2. Poaching and Trafficking: 14 Oct - 30 Nov 2018
3. Natural resources: 2 Dec 2019 - 24 Jan 2020

**Further information (incl. webinars) in due time on: https://business.esa.int/kick-start**

# → FUNDING OPPORTUNITIES – FEASIBILITY STUDIES

## Feasibility Studies – Workplan 2019 (competitive tenders)

- Cybersecurity and Space Based Services (end Q2/2019)
- Plastic-less society (Q3/2019)
- Decommissioning of energy assets (Q3/2019)
- Green buildings (Q3/2019)
- Ports of the future (Q3/2019)
- Digital health in developing economies (Q3/2019)




For all ESA initiated studies discussions with potential stakeholders are ongoing
Funding: 200 kEuro per study, multiple contracts possible (quality!)
Duration: 12 months

# → "CYBERSECURITY AND SPACE APPLICATIONS"
## PLANNED TENDER FOR FEASIBILITY STUDY PROPOSALS

**Goal: investigate new services and solutions in the area of cyber security enabled by Space (SatCom, SatNav, SatEO) and/or enhancing end-to-end cyber security of Space based applications**

**Target domains**

Public Safety, Transport (maritime, land, air, incl. autonomous vehicles), Critical Infrastructures, Energy, Financial services

**Targeted technical areas and solutions**

- **Prevent** (cyber risks forecasting and assessment, penetration testing, cyber intelligence)
- **Protect** (cybersecurity solutions/procedures design & development, validation & verification, certification)
- **Detect** (cyber security incidents monitoring and detection)
- **Respond** (cyber security incidents management, system restoration)

- Solutions combining space with **AI-ML, IoT, QKD, etc** encouraged

Stakeholders engaged by ESA

# → "CYBERSECURITY AND SPACE APPLICATIONS"
## PLANNED TENDER FOR FEASIBILITY STUDY PROPOSALS

**Objectives**

Assess **technical** feasibility and **economic** viability of **space** based services for cybersecurity

Get **anchor customers commitment** towards service implementation and **sustainable operation,** and validate **value proposition**

Define a **roadmap** for services **implementation** and **demonstration** (potentially through a follow-up ESA co-funded project)

***€ 200K, 100% funded, duration 12 months***
***To be issued end Q2 2019***
***x parallel contracts***

**More information to come soon:**
**https://business.esa.int/funding**

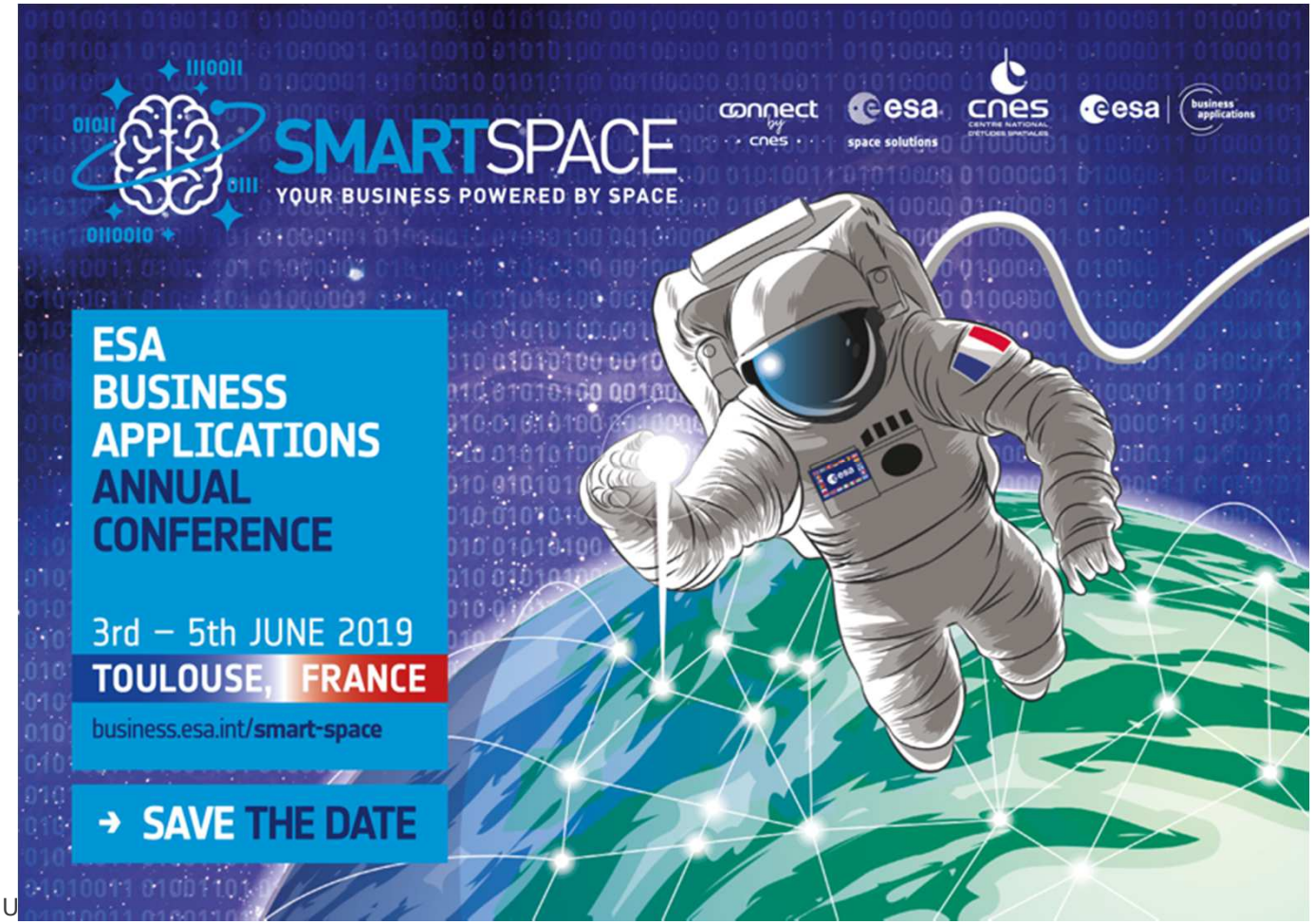
# → FUNDING OPPORTUNITIES – 5G RELATED INITIATIVES


**Currently open (AO-9569): until 26 Oct 2019**
**"Applications integrating space asset(s) and 5G networks in the Groningen region" (call for feasibility studies)**

**Collaboration between ESA and Economic Board Groningen:**
**(https://business.esa.int/news/ESA-5Groningen-Collaboration):**
- objective is to develop and pilot new service concepts within 5G networks
- in the thematic areas of healthcare, transport, energy, agriculture and the environment
- additionally, specific use cases based on the needs of stakeholders in the Groningen region
- 5Groningen pilots benefit from satellite information and services as additional element to 5G
- businesses from the ESA network are able to use 5G networks functionalities

Similar agreements made recently with A) Roma Capitale (IT) and B) University of L'Aquila (IT)
Proposed thematic calls: 1) Law enforcement and emergency response, 2) Cultural heritage, 3) Structural monitoring, 4) Intelligent transport
More information to come soon on our website: **https://business.esa.int/funding**

# FYI: ANNUAL CONFERENCE “SMART-



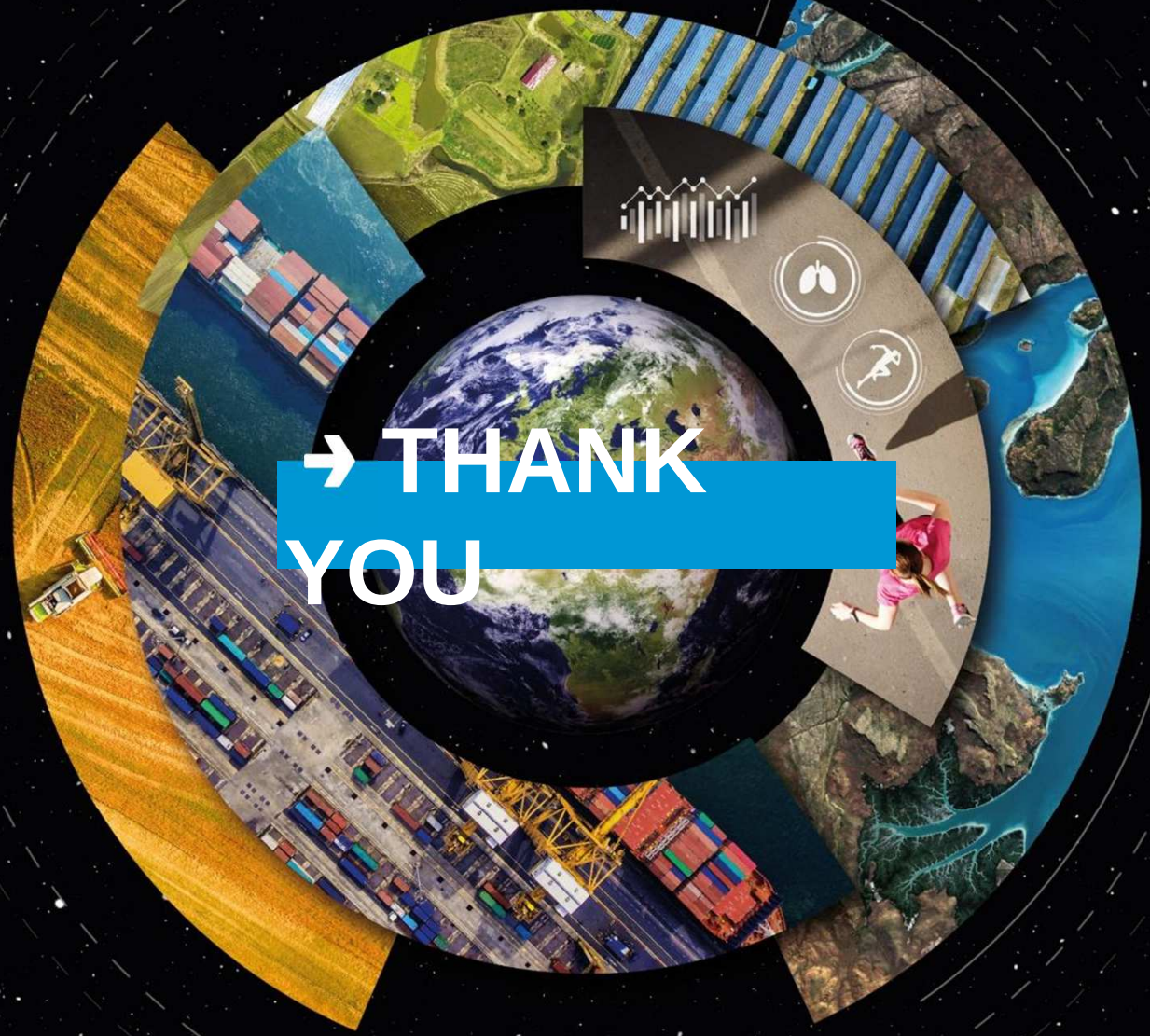

**Further information (registration, agenda, accommodation) under**

**https://business.esa.int/news/smart-space**

# → REFERENCES

- ESA Business Applications Annual Conference
- IAP Website: **business.esa.int**
- "Activity Pitch Questionnaire" and various proposal templates on **business.esa.int/documents**
- IAP Open Call for co-funded activities (AO-9305) online on EMITS: **emits.esa.int**
- IAP tender for Kick-Start activities online on EMITS: **emits.esa.int,** as well: **business.esa.int/kick-start**
- Information on IAP Open Competitive Tenders online on
  - IAP website **business.esa.int/intended-tenders/all**
  - EMITS at the time of publishing **emits.esa.int**
- IAP Proposal Guide on **business.esa.int/proposal-guide**
- Project web pages of studies and projects on **business.esa.int/projects**
- IAP general email address: **business@esa.int**

# → Q&A



# → THANK YOU

Norbert Hübner
norbert.huebner@esa.int
29 May 2019

European Space Agency

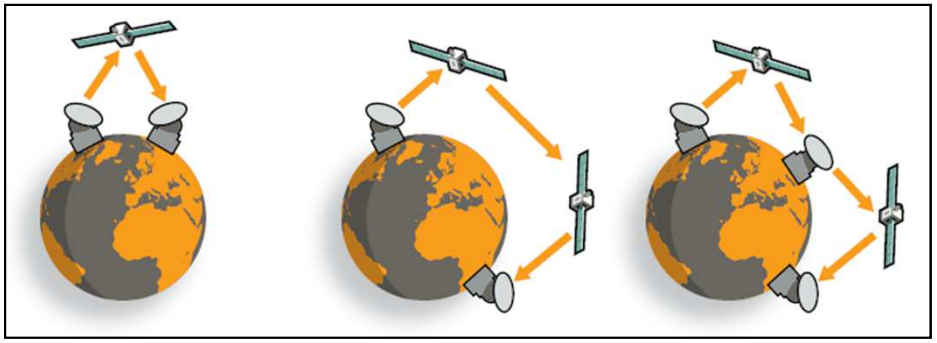
# → SATCOM - BASICS

**Communication Satellites** are essentially relays, allowing information to be passed around the globe via space in a number of ways. They can connect People and devices in different locations anywhere on Earth. Data transfer rates currently range from 15kbps to 10Mbps though in the future we will see transfer rates around the 100Mbps* mark.

* Viasat announcement 26 Jun 2018

Example cost for mobile services:
- Voice call = 1€/min
- Word document (100kB) = 0.50€
- Image (1MB) = 5€
- 1 min video (20 MB) = 100€

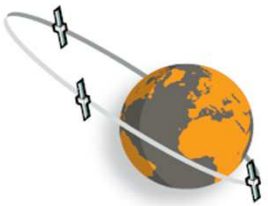
Costs for fixed services are cheaper



**They use 3 types of orbits:**

Only 3 **GEO** satellites are needed to provide coverage to most of the Earth, the exception being the poles. Once an antenna is pointed at a GEO satellite, a constant connection can be established, making them perfect for streaming data.

**LEO** satellite constellations (a group of several satellites) can provide continuous cover to one location. There are usually multiple satellites moving in and out of sight of a given position at any time.

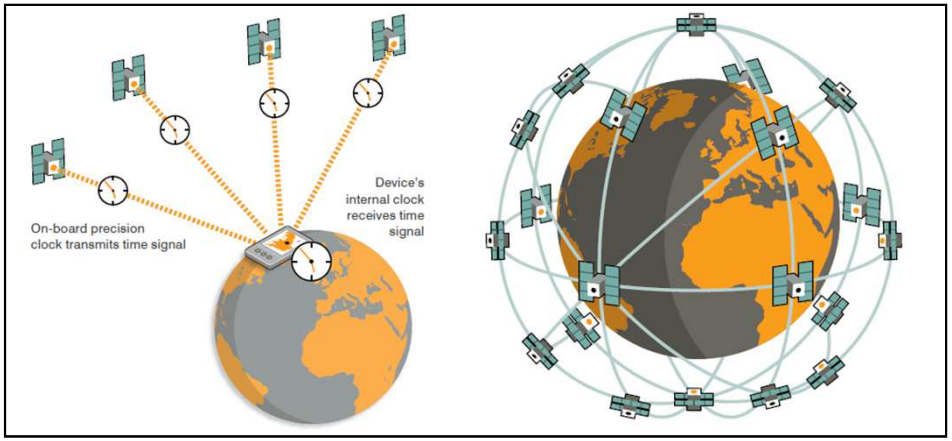


**HEO** satellites can be used to provide constant signal to areas where GEO satellites are unable. They have slow speed at the top of the orbit meaning they can provide coverage to one location for long periods of time.

Types of data

# → SATNAV - BASICS

**Global Navigation Satellite Systems (GNSS)** provide us with two essential pieces of information: position and time.
Navigation by satellite requires a minimum of four satellites. Due to their distribution around the globe, one will normally be in view of at least 10 at any one time.



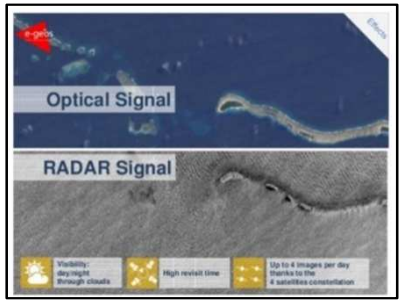

Examples of utilisation:

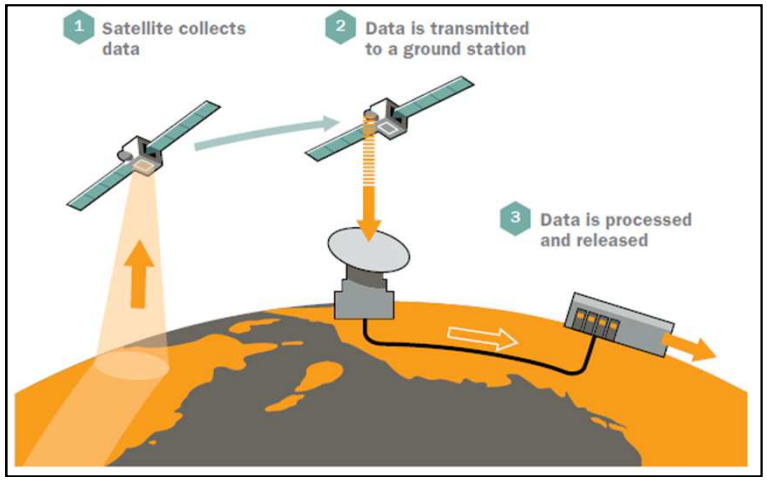
# → SATEO - BASICS

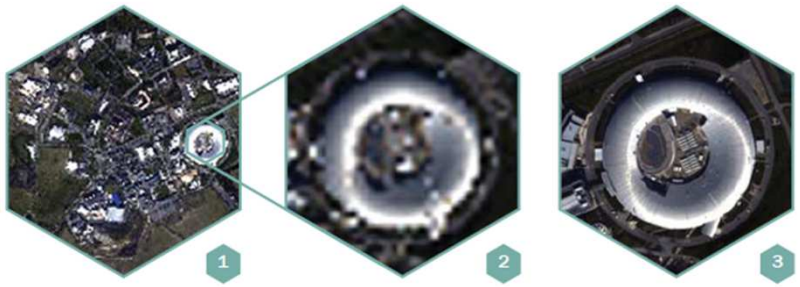
https://business.esa.int/newcomers-earth-observation-guide

**Earth Observation (EO) satellites** help us to monitor our environment, manage our resources, respond to global humanitarian disasters and enable sustainable development. They provide essential information on a vast number of areas, e.g. land use, crop health, air quality.

**Spectral resolution**.
Different materials interact in different ways with each Wavelength. For each type of object to observe there will be an optimum wavelength.




1. 10m resolution
2. 10m resolution zoomed
3. 0.5m resolution of the same area

The width of the area viewed by the satellite is termed the **swath width**. Satellites with different swath widths have different revisit times, which is the time between observations at the same point on the Earth. Typically large swath satellites can revisit the same location with a higher frequency but lower resolution.