

Socio-Economic benefits from ESA Technology Transfers

Infographics from 13 Case Studies

2022

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IMAGE PROCESSING OPTIMISATION WITH WIDE-RANGING APPLICATIONS

ESA-funded image processing techniques applied to improve a low vision aid

Cloudflight's code optimisation expertise, developed in Austria for analysing satellite imagery, was applied to enhance the underlying technology of UK-startup GiveVision's SightPlus device, designed to help those living with untreatable sight loss (~190 million people globally)



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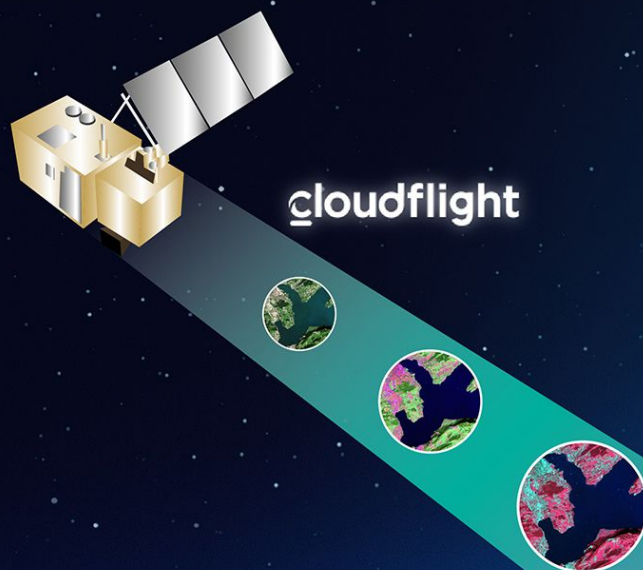
Generalisable technology with a **wide range of potential applications** (e.g. toll collection)

A **valuable demonstrator** for Cloudflight to market its services to **new customers**

Potentially large energy savings through code optimisation when applied in **data centres**

Faster image processing (from 300ms to 50ms per frame), improved usability (no lags)

Lower processing requirements
(70% reduction in code volume - SightPlus case)



Enabled a **compact & lighter device**, with **longer battery life** (usage time)

Gave SightPlus increased visibility, opening **new market opportunities**

ADDITIONAL USE CASES



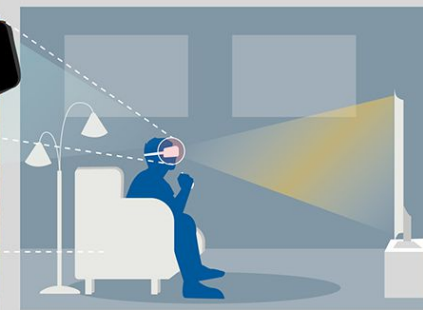
LOGISTICS



AEROSPACE



MOBILITY



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DRONE CAPTURE USING RAPIDLY RETRIEVABLE NETS

From capturing orbital debris to removing rogue drones from secure spaces

Italian Engineering firm STAM is developing a net-firing gun, Drone Catcher, based on ESA-funded research to remove space debris, to tackle the growing problem of disruption caused by illegally-flown drones at public events



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APPLICATION USE CASES



HOSPITAL



AIRPORT



PRISON

Avoided costs from disruption to entertainment events (e.g. the 33-hour drone-related closure of Gatwick airport in 2018 cost £50-70m)

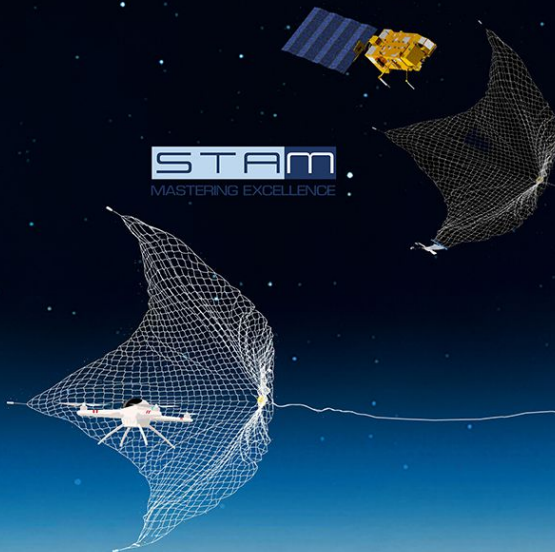
Ensures **crowd safety**: Drones quickly retrieved in one piece, never lower than 3m above the ground

Cost-effective solution: Economical technology and, unlike competitors, is automatic & unmanned

A **ready-to-go solution**: Once installed, Drone Catcher can be automatically activated to quickly respond to a threat

Supports prosecution: Capture is non-destructive, allowing evidence to be retrieved from the drone

Potentially **life-saving benefits** from varied applications (e.g. protecting hospital helipads or national security assets)



CONTINUOUS WIRELESS MEDICAL MONITORING

From monitoring astronauts in space to fetuses in utero



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Dry electrode technology, initially designed by Swiss organisation CSEM to monitor ESA astronauts' health whilst floating in microgravity, allows foetal cardiologists to isolate and continuously monitor a foetal heartbeat on an electrocardiogram (ECG)

Non-invasive ECG of foetal heart enabled using wireless dry electrodes

Supplemental monitor for **foetal arrhythmia** affecting 1-2% of pregnancies, and 10-20% of foetal cardiologist referrals

Continuous ECG monitoring provides **earlier insights** to decision-making for medical intervention

Unique monitoring capability for pregnancies in **isolated, rural communities** 1 in 15 women >30km from maternity unit (France)

New European technology addressing the **global telehealth market**, forecasted to be worth **€190 billion by 2025**

Facility of home monitoring means **more comfort** and peace of mind, and **fewer and shorter hospital visits**

Increased data stimulates **cardiological research** on foetal heart reactions over time

Potential to be a **wide-reaching supplementary solution in 2-3 years**, and a dominant replacement within 10 years



CSEM



ADDITIONAL USE CASES



SCUBA
DIVERS



SEIZURE
MONITORING



ELITE
ATHLETES

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RECYCLING GREY WATER

Space technology relieving water scarcity on Earth

Using technology created for ESA's MELiSSA Project (to build a closed life support system), French company Firmus successfully commercialised spin-off technology FGWRS, a terrestrial grey water (non-toilet wastewater) recycling system



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Recycles up to 80% of grey water. Water scarcity will affect up to ~6bn people by 2050

Affordable solution
Targeted cost payback in 5 years through reduced water bills

Sustainability brand image
~90% of consumers have switched to more sustainable purchasing over the last 5 years

Generating momentum around closed-loop solutions,
spinning ideas back to space sector



Simple user interface
Real-time data on water savings

In combination with partner tech, offers **significant energy savings** (~50% of thermal energy recovered from shower water at Roland-Garros)

Creation of new Monégasque **spin-off company**, creating **highly-skilled jobs**



APPLICATION USE CASES



EVENTS



HOTELS



OFFICE

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EARLY DETECTION OF DATA ANOMALIES TO SUPPORT DECISION-MAKING

Using satellite-grade algorithms to reveal market intelligence across many domains



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KETTY, a machine learning solution developed by Italian firm SATE with ESA funding to detect anomalies in satellite telemetry data, has been used to improve the performance of Austrian IT specialists eMentalist's event detection platform for SMEs

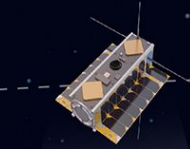
Market insights for European SMEs often lacking data analytic capacity (poor quality data costs the U.S. economy €3 trillion per year)

A **valuable demonstrator** of KETTY capabilities for future customers

Enables **informed decision-making** by end users (from trends in market intelligence to reliability of technological components)

Highly reliable: No false 'anomaly detected' alarms from analysing data

» SATE «



eMentalist.ai

Generalisable algorithms with a **wide range of potential applications**

International collaboration, facilitating **knowledge transfer** between engineers

Accelerated development in growing markets for SATE & eMentalist

APPLICATION USE CASES



OIL



CARS



REAL ESTATE



HEALTHCARE

EARLY WARNING OF DATA ANOMALY



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AUTONOMOUS SAFE LANDING FOR DRONES

ESA planetary landing technology guiding drones down to Earth without a bang

Canadian SME NGC Aerospace adapted their Hazard Detection and Avoidance software for lunar landers to enable autonomous safe landing site identification and selection for large unmanned aerial vehicles (UAVs)



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Autonomous landing capabilities from planetary landers enable an entirely **new applications market for large UAVs**

First-of-a-kind capabilities in a **commercial UAV market** forecasted to grow at **~30% annually**

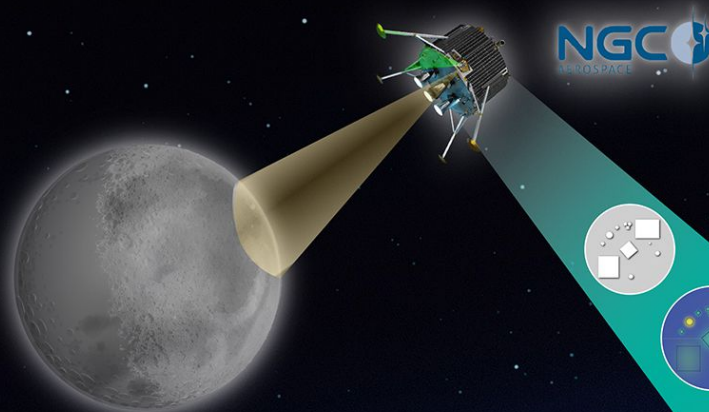
'Critical' technology
for drone industry to tackle the unplanned landing challenge now

Unmanned flight mitigates pilot shortages, increases precision, and **reduces fuel consumption by up to 90%**

Potential for **economic growth** through commercial applications such as precision agriculture and deliveries

Reduced risk and increased capabilities
- emergency landing, low visibility operations

Environmental and societal impacts
through applications including disaster mitigation and search & rescue



APPLICATION USE CASES



EMERGENCY SERVICES



LOGISTICS & DELIVERY



PRECISION AGRICULTURE



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AUTOMATIC TEXTILE RECOGNITION

Using optical technology to increase efficiency and automation at home

Slovenian firm SkyLabs developed its spectroscopy technology, supported by ESA, into an AI-supported miniature textile composition and colour recognition apparatus that can be integrated into IoT-connected home appliances, such as a washing machine



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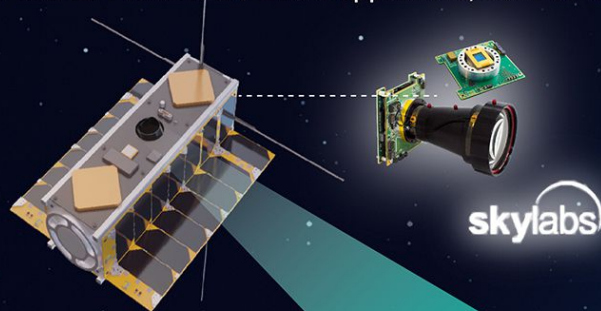
Automatic selection of optimal temperature and water settings matched to textile,
reduces excess water and energy use

Automatic programme selection will simplify processes and provide an
enhanced user experience

Extends clothing lifespan
through reducing damage from inappropriate cycle selection or errors in loading

Provides **enhanced experience** and enables **greater independence** for
visually impaired people

Innovative capabilities for a global **smart washing machine market** forecasted to grow from €7bn today to **€23bn in 2026**



skylabs

Manufacturer Gorenje plans to include in all
800,000 machines produced annually in the future

Development of production line will provide
new, high-skilled jobs

ADDITIONAL USE CASES



DRY
CLEANING



INDUSTRIAL
LAUNDRY



gorenje



IoT connectivity for home appliances enables
continuous improvement and updating, keeping appliances up-to-date

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PIGGYBACKING SENSORS ON COMMERCIAL AIRCRAFT

A 'constellation of airplanes' producing high-resolution imagery with rapid revisit rates

Luxembourgish firm SkyfloX is developing ESA-patented ORCA (Optical and RF Constellation on Aircraft) to equip commercial aircraft with small sensors (weighing less than a small suitcase), forming the 'missing layer' for a range of EO and telecommunication applications



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High-refresh high-resolution imagery supports **environmental monitoring** and **disaster response** (e.g. forest fires, oil spills, flooding)

Airlines can extract unexploited value of their existing operations to **off-set their environmental impact** by supporting climate action monitoring

Complementary data for a wide range of solutions that address EU climate action and environmental policies

A cost-effective solution, with potential to open new market segments for EO data

Provides high spatial and temporal resolution data in a **sustainable, accessible and affordable manner**, supporting the democratisation of EO applications

New European competitor in the EO data and services market (forecasted value: **€5.5 billion by 2031**)

Creates **new synergies** between civil, defence and aerospace industries, in line with the **EC's Action Plan**



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MOBILE AUTONOMOUSLY DEPLOYABLE SOLAR POWER GENERATOR

Rapidly deploying on-demand power to communities in need

Using ESA-patented modular deployment technology, originally designed to deploy very large support structures in space, Spanish firm POLAR Developments (a COMET spin-out) offers near-instantaneous high capacity photovoltaic generators wherever power is needed, autonomously



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Compact, lightweight, 'plug-and-play'

solutions that are easily transported, deployed **within hours**, with no specialised operator

Green Container has **~180% more capacity**

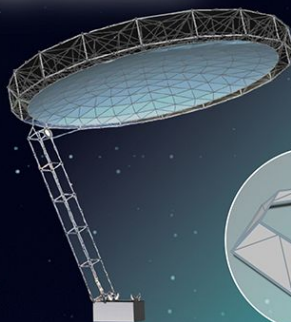
than competitors in terms of volume to stow a kilowatt peak (kWp/m³)

Green Container energy is **~30% cheaper** than

competitors in price per kilowatt peak (€/kWp)

New European tech **spin-out company** created, forecasting **20 new jobs by 2026**

Promotes **sustainability** as a **green energy** solution replacing traditional fuel generators



APPLICATION USE CASES



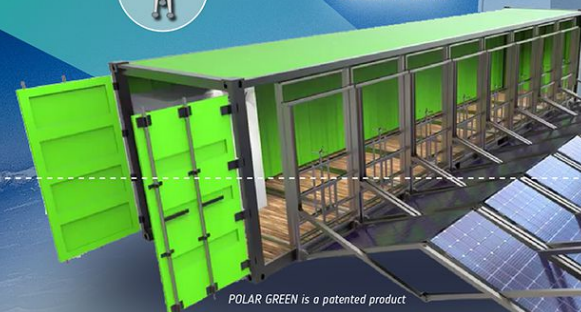
REFUGEE CAMP



EMERGENCY SERVICES



AGRICULTURE



POLAR GREEN is a patented product



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ELECTRIFIED WASTEWATER RECYCLING

Using space technology to make hygienic and sustainable toilets

URIDIS innovative electrochemical water treatment technology, developed under ESA's MELiSSA project (to build a closed life support system) is being used by Belgian company HYDROHM to treat urine on Earth, saving water and recovering valuable nutrients



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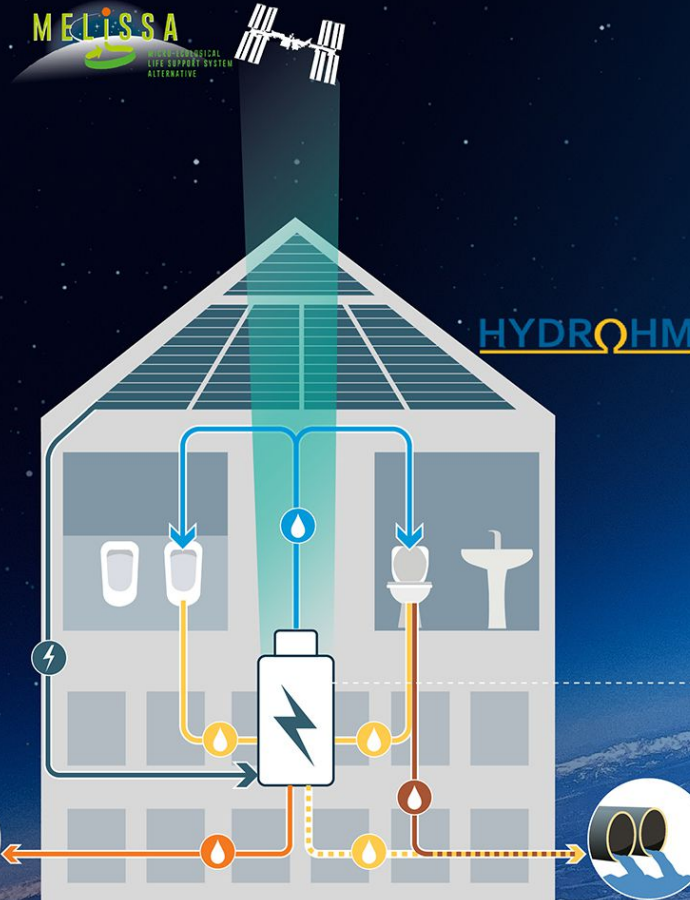
Up to 60% water savings
(traditional toilets use up to 13 litres per flush)

Improved **toilet hygiene** due to disinfecting nature of treated flush water

Successful **Ghent University spin-off** company created with potential for rapid growth

Reduced treatment load, saving up to **~40% less energy** & up to **~50% less GHG emissions**

Nutrients recovered from human urine could replace **1/4 of global fertiliser production**



Sustainable using green energy, and no heavy chemicals

Cost recouped in just 7 years for high usage toilets (e.g. offices or hospitals)

Helps customers to promote a **sustainable brand image** in a practical and visible manner

APPLICATION USE CASES



PUBLIC TOILETS



HOTELS



OFFICE

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CITIES AS SPACESHIPS

Closed-loop urban farming for the city of Amsterdam

Municipal wastewater can be a valuable resource for nutrients and water reuse. This project, led by SEMiLLA and facilitated by ESA uses MELiSSA technology to recover nutrients and clean wastewater for use in vertical farming.



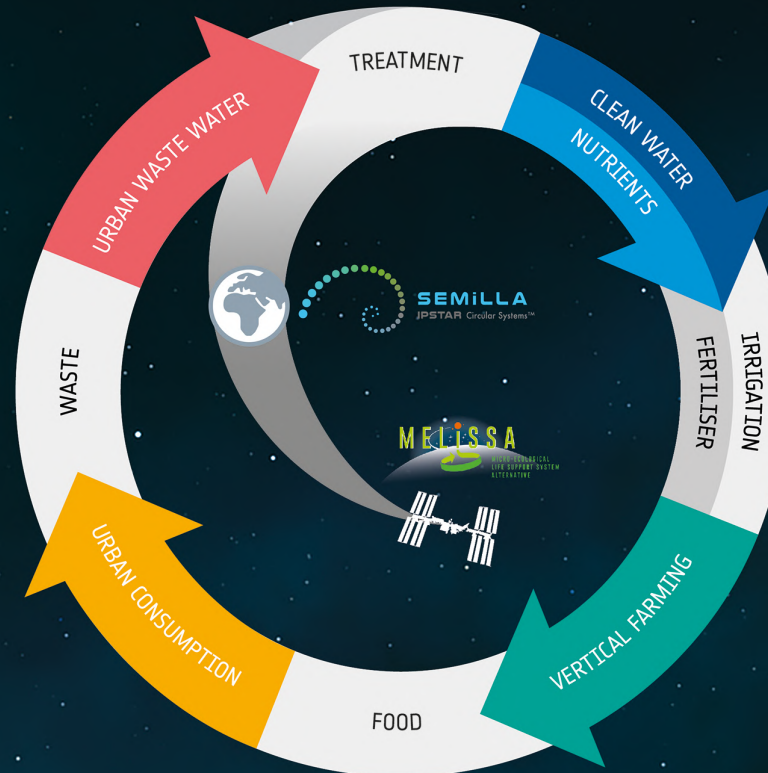
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Estimated reduction of
600,000 tonnes of CO₂
(3% of Amsterdam city total)

Estimated economic benefit of
€600 million and **1,200 jobs**

Reduction in food waste

Net-negative carbon
emissions food supply



New open point raceway reactor
is **10X cheaper** than existing
closed photobioreactors

80% - 90% of wastewater
can be recovered

Each **1 tonne** of organic waste
can produce **30kg** of salad

GROWx can produce **1 tonne**
of salad per **1m²** per year

FUTURE AIRCRAFT COMPOSITE FIREWALL

Using space-grade materials to enhance next generation aircraft

A new composite bulkhead concept, an important part of the shell protecting satellites onboard ESA's Ariane 5 and 6 launch vehicles, is being redeveloped for use aboard aircraft on Earth.

New composite concept uses a
Carbon Fibre Reinforced Polymer (CFRP) bulkhead

60% reduction in **assembly labour costs** as a result of
a quicker and smoother assembly process

At least **30% total cost saving** from combined hardware
(1 part replacing 30 parts plus 100s of fasteners) and assembly savings

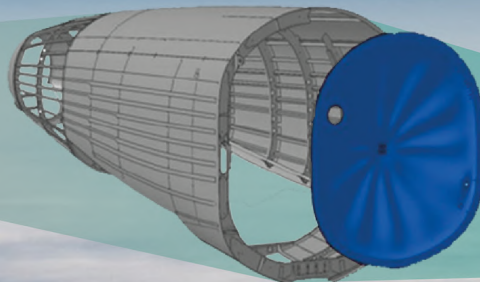
30% lower mass in comparison to the
titanium aircraft firewall baseline solution

Faster assembly of planes enables Airbus to
fulfil more orders

CFRP concept could be **extrapolated** to the
Rear Pressure Bulkhead

New firewall could result in **cost savings of
several € millions** for Airbus

AIRBUS



AIRBUS



AUTOMATING COMPLEX SYSTEMS

Space-style control rooms for terrestrial industries



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With the support of ESA, EATOPS are applying automatic code generation techniques, initially developed for controlling constellations of satellites, to enable a centralised oversight of energy provider installations in offshore wind farms, natural gas production and crude oil extraction.

EATOPS developed control panels for an autonomous lunar surface mission, scheduled April 2022.

DRAWING CODE converts engineering drawings to software, reducing 10,000 programming hours to hundreds

Reduced waste and risk of errors e.g. automatic fault scenario recognition foresees issues ahead of time

ESA first made use of autocoding for the experimental Proba-1 satellite

EATOPS have multiplied their turnover five-fold

A more intelligent control system and new digital twin possibilities without significant cost increases



EATOPS