SATELLITES GOING LOCAL

CULTURE EDITION

2019-2020

eurisy

ACTING COLLECTIVELY TO BRIDGE SPACE AND SOCIETY

Eurisy would like to thank the contributors to this publication for their readiness to share their experiences, and the time and effort they have put into helping Eurisy to produce this collection of good practices.

FOREWORD

DEAR READER,

Eurisy continues to highlight the contributions of satellite applications to address societal needs. This new issue of Satellites Going Local aims to raise awareness on some of the possible uses of satellite applications to better manage historical cities, help monitor and safeguard cultural heritage for the future generations, and enable creative minds to generate new ways to experience culture.

Culture is what shapes our identities and enables us to interact with the world. According to research published by the European Commission, the cultural and creative sectors in Europe generate approximately €509 billion in value added to to the European Union's Gross Domestic Product, representing 5.3% of the EU's total. The sector also employs more than 12 million full-time jobs, equivalent to 7.5% of Europe's workforce. Moreover, the cultural and creative sectors have proven more resilient to economic downturns, simultaneously generating positive impacts for other sectors.

Satellite applications are already used operationally by public administrations, private companies and NGOs active in the cultural and creative fields. Nevertheless, many professionals operating in these sectors are not always aware of the features and potential of satellite applications, nor of the available datasets. The stories collected in this booklet are meant to stimulate awareness and exchange of knowledge among those who are already using satellite applications and those who are interested in them. They also aim to inspire public and private actors to come up with increasingly innovative and useful services in the cultural and creative sectors.

We hope this publication will let you see culture and creativity from a new perspective, through the lens of satellite technologies!

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President of Eurisy

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INTRODUCTION

Culture is the foundation of our identity. Our modern society stems from thousands of years of cultural exchanges among the inhabitants of the Planet. Our cities, monuments, cultural sites, languages and traditions stand as a testament of such complex interrelations.

Satellites can provide valuable information to help safeguard such assets and traditions. Following the 2003 UNESCO/ESA agreement to use space technologies to preserve World Heritage properties, many national space agencies have joined the initiative. The European Union has also seized the opportunity to put Sentinel Earth Observation data to work towards safeguarding cultural heritage worldwide.

Indeed, Satellite Imagery can help scientists detect archaeological sites, retrace our ancestors' footsteps and monitor risks threatening heritage sites, such as climate change, deforestation, agriculture, pollution and uncontrolled urban sprawl. In areas affected by conflict or natural disasters, Satellite Imagery can even be the only available tool to monitor cultural heritage.

Historical cities are also threatened by climate change and demographic concentration. To face these challenges, regional and local authorities need ad hoc skills, data and integrated policies. Satellite Imagery allows cities to have a holistic view of soil, land and land use, offering precious data to spot, map and monitor archaeological deposits and to better support urban planning and maintenance of the public space.

Satellite Navigation can support different public services, such as transport, waste management and civil protection operations. It can also help city managers to improve the management of tourist flows, and it is already integrated in numerous mobile apps promoting tourism and civic engagement. Also, Satellite Communications can help historical cities in remote areas to access a fast internet connection.

More recently, satellite data and signals have also found applications in creative industries. An unforeseen spill over effect for those building our first satellites. The possibilities of using mobile apps to safeguard and inform on tangible and intangible heritage are endless. They include apps for interactive visits to historical places and geo-located games. Moreover, artists and entrepreneurs are joining in to experiment using satellite-based data and signals to express their art.

This non-exhaustive collection of examples gives an overview of the satellite solutions available and of the actors in the cultural and creative sectors. We hope these examples will be inspirational, and will pave the way for a more general discussion on ways to facilitate access to satellite data and services for the professionals working in these fields, overcoming technical, legal and policy bottlenecks.

ENDORSEMENTS

ANGELA COLONNA

UNESCO Chair Holder on Mediterranean Cultural Landscapes and Communities of Knowledge, University of Basilicata, Italy

"UNESCO Chairs work to strengthen the role of culture in implementing the 2030 UN Agenda for sustainable development.

I greet this publication as a useful means to raise awareness on the potential of digital technologies, and of satellite applications in particular, to preserve cultures, shape new forms of cultural identity and change the interactions between local and global."

MICHEL PRAET

Head of the EU Relations Office of the European Space Agency's Brussels Office, Belgium

"This publication takes note of new convergences between disciplines, space and culture, that too often are artificially split and gives an opportunity to all of us to fully understand them.

Space data could and should be a tool to have a larger view of what culture could bring to us. Indeed, in Europe we need more cultural data for a better space policy; and more space data for a better culture policy ."

ARIANNA TRAVIGLIA

Coordinator of the IIT Centre for Cultural Heritage Technology (CCHT@Ca'Foscari), Italy

"Satellite applications are providing more and more a key support in archaeological research, flanking more traditional methods to preserve and protect our cultural heritage.

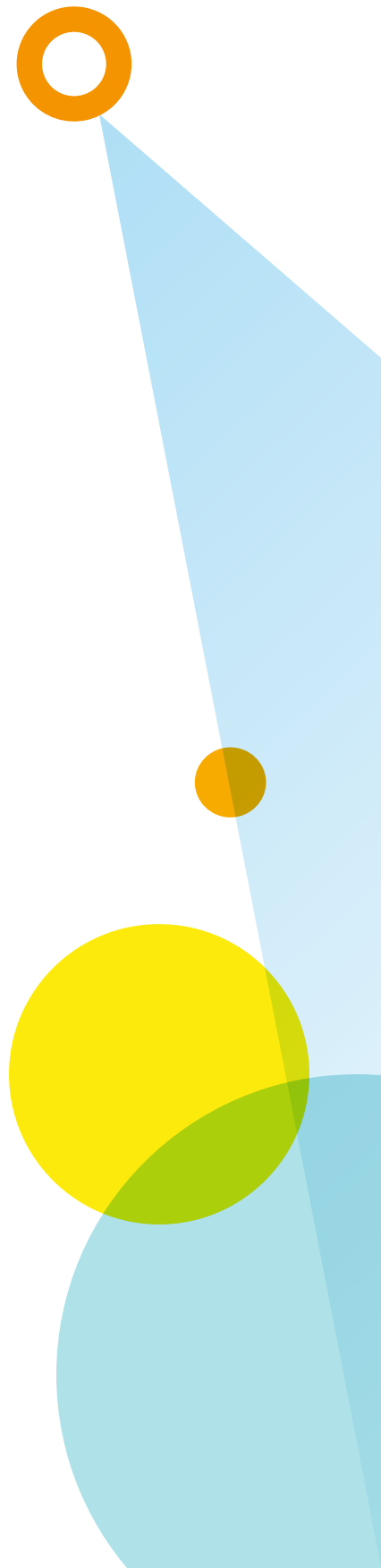
I strongly appreciate the work and efforts of Eurisy on this topic. It is crucial to actively promote the use of Earth Observation technologies in the archaeological and cultural sectors and encourage the definition of a new agenda of collaboration between these domains. The hope is that such efforts will bring a strong cooperation and interoperability ensuring that our cultural heritage is secured for the future generations."

ORIANA GRASSO

DG for Internal Market, Industry, Entrepreneurship and SMEs of the European Commission, Belgium

"The EU Earth Observation programme, Copernicus, has changed the way we look at the Earth and is providing precious information and tools to both safeguard and capitalise on culture.

I welcome this publication as a tool to make civil society aware of the potential uses of space technologies, including the Galileo programme, and to encourage new ideas to use space to innovate in the cultural field."



MANAGING HISTORICAL CITIES

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AMSTERDAM

Earth Observation data for bridge monitoring

The Municipality of Amsterdam uses InSar data to monitor historical bridges and buildings along the quays and plan maintenance works.

On an area of 219.4 km^2, the Amsterdam city is the most populated in the Netherlands, counting roughly 860 000 residents. The city has approximately 1 600 bridges and 900 km of quay walls, shores, banks, talus, inclines and slopes, 600 km of which are managed or owned by the Municipality.

CONTRIBUTOR: ANNEMARIJ KOOISTRA, DEPARTMENT OF ENGINEERING, CITY OF AMSTERDAM, THE NETHERLANDS

Heavy traffic and frequent renovation works can threaten the stability and structural integrity of bridges, quay walls, and buildings.

The Department of Engineering of the City of Amsterdam is responsible for urban planning and infrastructure maintenance, including assessing the structural integrity of bridges and quay walls.

To ensure the integrity of these assets and plan maintenance works accordingly, the Department needs frequent and up-to-date data on deformation of structures and soil. This information is essential to assess traffic impact on bridges and prioritise maintenance works where they are needed.

To assess the structural safety of bridges and the integrity of the buildings, the Department of Engineering of the City of Amsterdam decided to work with SkyGeo and use satellite-based data to measure and map deformation of the infrastructure and the buildings.

First, InSAR (Interferometric synthetic aperture radar) data were acquired to map movements in the city area. InSAR data provide accurate information on deformations of structures and roads with a millimetre precision. This information can be used, among other things, to predict the impact of groundwater level reduction on buildings.

Data collected through satellite observation were further validated through field measurements. The data validation process was also supported by the students of the Delft University of Technology and the University of Salerno.

So far, InSAR data allowed the Department to assess deformations of 100 bridges and nearby buildings along the quay walls.

The City will use such information to prioritise maintenance works and prevent damages to the assets' integrity, hence possibly saving a considerable amount of time and resources on field measurements.

The Netherlands Environmental Assessment Agency estimates that the costs for repairing the damage and the frequent maintenance of the infrastructure in urban areas can amount to €5.2 billion by 2050. Earth Observation can thus play a crucial role in the future to reduce the spending of public administrations on infrastructure monitoring and maintenance.

Currently, the Department of Engineering of the City of Amsterdam is exploring ways to extend the use inSAR satellite data to also study the past and current behaviour of buildings that are close to planned construction sites. Indeed, satellite data allows the Department to foresee the sensitivity of buildings to soil movements and damages that could be caused by heavy works around the buildings.

CONTACT: WWW.AMSTERDAM.NL

GREECE

Satellite imagery helps enforce property rights

Satellite images prove to be an important tool to fight the spread of illegal structures in the Greek landscape.

In Greece, buildings without a valid construction permit represent a major threat to the beauty of the landscapes and the safety of the residents.
For the past decade, periodic amnesties allowed homeowners to declare unlicensed structures and pay a fine. Penalties however did not put an end to the phenomenon.

CONTRIBUTOR: VANA GIAVI, MANAGING DIRECTOR, TOTALVIEW, ATHENS, GREECE

In Greece, illegal buildings affect both natural and historical heritage. To protect the country's green and cultural richness, the Greek Government looked for a cost-efficient and time-saving tool to support the Ministry of Environment in identifying illegal structures.

In 2011, the Greek Government moved forward in its efforts to crack down on illegal constructions with a new law. The law contained guidelines and rules to tackle illegal buildings in the country. It aimed to motivate property owners to voluntarily declare structures without permits and obliged them to legalise in case they wanted to sell or make any official changes to their property.

The Greek Ministry of Environment, responsible for applying building regulations and permits, turned to the Greek geo-information company TotalView for a solution. Together they built a tool that would allow the Ministry to ensure compliance with the new procedures listed in the aforementioned law.

TotalView worked with European Space Imaging to help local authorities in Mykonos, Santorini, Paros, Antiparos, Athens, Rhodes, and Crete respond to the new legal requirements. During the pilot phase, started in 2012, the service allowed the authorities to identify and demolish 132 buildings illegally built and/or altered before or after 2011.

WorldView-2 and DigitalGlobe's image archives include images dating back to 2000 – a sufficiently long timeline to adequately track if a construction permit has been respected.

Satellite Imagery allowed the Ministry to identify illegal buildings and assess their compliance with construction permits. Based on this information, the Ministry of Environment is today able to impose the right penalties and fines for any illegal structures.

Moreover, satellite images also count as legal proof of the legitimacy or illegitimacy of these buildings. Thus, the images support cadastral offices and territorial planners to preserve the integrity of the urban and natural landscapes.

Today, the system based on Satellite Imagery is routinely used by the Ministry. Land owners in Greece were made aware that building structures are monitored and this resulted in a decrease in the number of new illegal buildings being erected after 2011 across the country.

Citizens' awareness and engagement with satellite information increased as well. Should a private citizen want to declare the existence of illegal structures, Satellite Imagery needs to be included to verify the accuracy of the declarations made.

CONTACT: WWW.TOTALVIEW.GR

BOLOGNA

Satellite Navigation to smoothen public bus traffic flows

In the city of Bologna, buses are now equipped with a Satellite Navigation system to guarantee a more efficient management of traffic flows.

The Italian city of Bologna, capital of the Emilia Romagna region, counts a population of about 375 000 people. The city registers about two million movements every day: 45% of them are internal; 28% and 27% are respectively the percentages of exchange and crossing movements in town.

CONTRIBUTOR: CARLO MICHELACCI, DEPARTMENT OF MOBILITY , MUNICIPALITY OF BOLOGNA, ITALY

Traffic congestion can affect movements around and across town, while impacting negatively on everyday ordinary activities.

Bologna represents an example of a congested city. Considering that the city is too small to have an underground system, finding an alternative solution to provide an efficient above-ground public transportation service was necessary to facilitate urban mobility.

The Sustainable Mobility Sector, part of the Land Management Department of the Municipality of Bologna, is responsible for carrying out planning policies and infrastructure interventions to favour sustainable mobility.

In 2005, the Department of Mobility equipped city buses with a satellite-based positioning system that gives them green light priority.

The Automatic Vehicle Location (AVL) system relies on GNSS transmitters on public buses that regularly communicate their position to a central unit. The messages received by the central unit are automatically retransmitted to communicate the expected arrival times at the bus stops.

More recently, the Municipality developed the local observer system Urban Traffic Optimisation by Integrated Automation (U.T.O.P.I.A.).

Bologna's centralised traffic light system adapts to traffic flows in real time, relying on the information provided by the AVL system and by a network of sensors placed under the street pavement, which monitor the number of cars on the street.

Two minutes before approaching the traffic lights (detected through GNSS), buses send a message to the sensors nearby, allowing the central control unit to adapt the traffic light phases in real time so as to give priority green light to buses.

The priority request is generated considering the buses' predictive travel and arrival time schedule at bus stops. The priority requests are forwarded to the U.T.O.P.I.A. centre, while the updated requests are forwarded to the intersection controller who will provide the priority.

The green bus priority system ensures the punctuality of buses' arrival times while smoothing city traffic and reducing commuters' travel time.

Since 2012, the travel data collected from public buses through Satellite Navigation are open and freely available online. The next challenge for the municipality is to also introduce the green light priority system on the taxi routes in the city centre.

CONTACT: WWW.COMUNE.BOLOGNA.IT

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ATHENS

LastQuake: an App to engage citizens in earthquake early warning

A mobile application can speed up earthquake monitoring through crowdsourced information.

The Mediterranean region hosts a number of historical cities that can be particularly vulnerable to earthquakes. Greece is one of the most seismically active countries in the area. In 1999, a 5.9 magnitude quake not far from Athens killed 143 people.

CONTRIBUTOR: RÉMY BOSSU, SECRETARY GENERAL, EURO-MED SEISMOLOGICAL CENTRE, BRUYÈRES-LE-CHÂTEL, FRANCE

The Euro-Mediterranean Seismological Centre (EMSC) is a non-governmental organisation tasked with collecting data from seismological observatories in 81 institutes across 57 countries. EMSC collates data to locate earthquakes in almost real time, in order to alert concerned populations and the public authorities responsible for activating rescue forces in the briefest time.

To detect earthquakes that can be felt by humans, the EMSC relies on the use of the word "earthquake" on Twitter in various languages and it closely monitors its website traffic, as well as on the use of its mobile app, LastQuake. By compiling this information, the EMSC can automatically detect felt earthquakes before seismic information is available (typically within 15 to 90 seconds).

The LastQuake app allows earthquake witnesses to report seismic events directly to the EMSC and to automatically locate the epicentre and assess damages through their smartphone built-in GNSS receiver. It can be downloaded free of charge and is currently being used by 360 000 people worldwide.

When using the app, witnesses are asked to report about the perceived shaking or the damages seen through a set of user-friendly cartoons. Through the app, they have also the possibility to share geo-located photos and videos of the affected areas.

By combining mobile and internet technologies, the EMSC is able to provide the public with real-time information on seismic events and post-earthquake safety tips. The app also allows users to send messages via SMS to their family and friends to confirm they are safe and to share information on social media.

Within a few minutes, the information supplied through the app allows the EMSC to automatically map the earthquake's impact with eyewitnesses acting as real-time motion sensors.

On 15 January 2018, the LastQuake app allowed the EMSC to detect a 4.4 magnitude earthquake close to Athens (Greece) in 24 seconds thanks to 544 real-time testimonies. Seismographers needed 292 seconds to detect and locate the same event.

CONTACT: WWW.EMSC-CSEM.ORG

SAFEGUARDING, PROMOTING AND VALUING CULTURAL HERITAGE


© travelbook

MATERA

Visiting the city's ancient rupestrian churches with 3D technologies and 5G connectivity

Thanks to 5G connectivity, the virtual reconstruction of Matera's rupestrian churches can be accessed by anyone remotely.

One of the oldest inhabited cities in the world, Matera is known for the historical "Sassi", ancient cave houses dating to the Palaeolithic period. The Sassi, together with the Park of Rupestrian Churches, were included in the UNESCO World Heritage list. In 2019, Matera is one of the European Capitals of Culture.

CONTRIBUTORS: RAFFAELE SANTANGELO, GEOCART-DIGITAL LIGHTHOUSE, AND FRANCESCA SOGLIANI, HEAD OF THE POST- GRADUATE SCHOOL OF ARCHAEOLOGICAL HERITAGE, UNIVERSITY OF BASILICATA, MATERA, ITALY

The ongoing roll-out of 5G connectivity across the globe will depend on satellite telecommunication networks. In 2018, TIM, Fastweb and Huawei won a tender from the Italian Ministry of Economic Development to test and showcase potential applications of 5G connectivity.

The #BariMatera5G project aims to test the potential of 5G connectivity in the cities of Bari and Matera in a number of sectors, including smart cities, environmental protection, tourism and culture.

The project foresees an investment of over 60 million Euros over a four years' period and relies on the involvement of 52 local and regional partners. The Post-Graduate School of Archaeological Heritage of the University of Basilicata and Geocart-Digital Lighthouse, two associated companies specialised into aerial and ground surveys, 3D Virtual Reality and multimedia, are amongst the partners joining the project.

Using laser scanning and photogrammetry techniques, Geocart-Digital Lighthouse put together a digital 3D reconstruction of the rupestrian churches of Matera. The School of Archaeology complemented the visuals with details on the churches' history.

Thanks to 5G supported connectivity, Matera's rupestrian churches can be visited remotely through Multiplayer Virtual Tours.

Indeed, the 5G network allows for multiple persons in different locations to meet with a local guide in a virtual reality environment. Together they can start an immersive 3D visit through some of the reconstructed points of the Sassi, the rupestrian complex of Madonna delle Virtù and San Nicola dei Greci and the Crypt of the Original Sin – all UNESCO World Heritage sites.

The 5G network installed in Bari and Matera will have a transmission capacity 10 times higher than that of the current 4G technology. During the virtual tour, 5G allows for the quick download of a large amount of data while visitors are free to move around the planned areas, manipulate available objects, and interact with each other. They can even appreciate details that are no longer present in reality (e.g. decorations of a church gone lost or damaged).

The virtual reality experience allows people to visit places which are difficult to access or remote. In the future, this experience could be made available in museums, schools and even on moving trains everywhere.

CONTACTS: WWW.DIGITALLIGHTHOUSE.IT ; WWW.PORTALE.UNIBAS.IT

PALMYRA

Monitoring sensitive cultural heritage sites from space

Earth Observation can help assessing damages to cultural heritage sites, such as the intentional ones carried out recently by ISIL in Syria.

Because of its position between Europe and Asia, Palmyra, in Syria, was a global centre of trade and a landmark between different western and eastern cultures. Palmyra is listed in the UNESCO World Heritage in Danger List and is the most iconic picture of the conflict in Syria.

CONTRIBUTORS: DANIELE CERRA, SIMON PLANK, GUNTER SCHREIER, GERMAN AEROSPACE CENTRE (DLR), GERMANY

In periods of war, political instability, or after a natural disaster, Satellite Earth Observation Imagery can represent the only reliable, non-invasive information source to monitor cultural heritage.

Satellite Earth Observation imagery offers archaeologists a precious tool to monitor changes to archaeological sites over time.

The intentional damage to local cultural heritage sites carried out in 2015 by ISIL caused worldwide indignation. The destruction has been broadcast by media worldwide, pinpointing the need for prompt, safe and non-invasive damage detection and assessment surveys.

Between 2015 and 2017, ISIL destroyed the biggest part of the Palmyra Old Town, including the Temple of Bel, the Temple of Baal Shamin, the Arch of Triumph, and several columns in the Valley of the Tombs.

To assess the damage suffered by the Palmyra site, the German Archaeological Institute (DAI) asked the German Aerospace Centre (DLR) to analyse a series of satellite images of the site over a one-year period.

Damage detection was carried out manually by analysing pre-disaster and post-disaster satellite data. Data analysts also used automatic image processing algorithms to speed up the search over large areas of interest and highlight potential damages.

Based on the analysis of the images, the DLR put together a chronological map of the induced damage to the site.

The images revealed consecutive damage, carried out before and in-between the satellite image acquisition timeframes in August and September 2015 (highlighted respectively in light blue and red in the rounded image).

The texture of a target spotted by satellites is represented by the distribution of pixel values in its surroundings. The texture changes abruptly from smooth to rough whenever a structure is damaged or collapsed, and when the shadows projected by a building disappear.

This facilitates a semi-automatic detection of damage, which helped the DAI to decide on and plan its support for reconstruction works once the site became accessible again.

Once ISIL was expelled, UNESCO was given the task to restore the site to its former glory. Several countries and EU institutions also pledged funding and expertise to expedite restoration works which began in 2017.

Considering the past difficulties in collecting clear information on the site's status, Satellite Imagery remained a crucial tool to support damage monitoring. Moreover, satellite remote sensing may also provide valuable information to trace the illegal looting of artefacts from the site.

CONTACTS: : WWW.DLR.DE ; WWW.DAINST.ORG

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SCOTLAND

Historic Environment Scotland: Using satellite data to protect heritage from climate change

Satellite Navigation, Imagery and analysis provide HES with the data needed to monitor and maintain cultural heritage on the coastline.

Historic Environment Scotland (HES) is the public body responsible for investigating, caring for and promoting Scotland's historic environment.
Over 300 properties are in their direct care, including Edinburgh Castle, the Neolithic settlement at Skara Brae, and Fort George, which together attract more than five million visitors per year.

CONTRIBUTOR: MAIRI DAVIES, CLIMATE CHANGE MANAGER, HISTORIC ENVIRONMENT SCOTLAND, EDINBURGH, UNITED KINGDOM

One fifth of Scotland's coastline is at risk of erosion and climate change has accelerated the process. Since the 1970s, the erosion rate has doubled and the proportion of retreating coast increased by 39%, threatening a significant number of prehistoric and historic sites on the Scottish coastline.

In 2012, HES, the Heritage Lottery Fund and the University of St. Andrews granted an aid to Scotland's Coastal Archaeology and the Problem of Erosion (SCAPE) to launch the Scotland's Coastal Heritage at Risk Project (SCHARP).

Within SCHARP, over 1 000 volunteers were mobilised to collect information about the condition of sites on the coast. Relying on the Satellite Navigation system built into their mobile devices and a mobile app, the volunteers updated existing data on 35% of Scotland's coastline.

A "sites at risk" map, hosted on the SCHARP website, provides access to all data collected. This information was added to the National Record of the Historic Environment in Scotland (Canmore) and provided HES, local authorities and archaeologists with a tool for improved management of the vulnerable heritage on the coast.

In 2015, HES and SCAPE joined Dynamic Coast, a pan-government initiative funded by the Scottish Government and supported by Scottish National Heritage, aimed at building an evidence base of coastal change across all of Scotland's erodible shores.

First, Dynamic Coast developed a GIS map of coastal changes since the 19th century, primarily through analysis of existing maps and remote sensing imagery. In its second phase, the project aims to measure and model the full extent of the intertidal zone (the area where the land meets the sea) to understand which stretches of coast and historic assets are most at risk.

The project team is analysing the Sentinel-2 satellite's full catalogue of optical data. This is then compared with historical maps, modern and legacy aerial imagery and surveys of the vegetation edge to map, measure and model coastal changes.

"The advantage of using satellite data is residents in the level of semi-automation that is possible, meaning that a very high quality assessment can be made with a tiny fraction of the resources that would have been needed in the past", says Mairi Davies, Climate Change Manager at HES.

The web-maps, summaries and reports are available on the web portal of the project and are used by HES to monitor the heritage sites and buildings under their care and to plan and prioritise interventions.

In 2019, to further explore the potential of satellite applications, HES launched a project in partnership with the European Space Agency (ESA) and Moniteye to trial the use of GNSS and of data from the Sentinel-1 satellites to monitor some of the cultural heritage sites in their care.

CONTACTS : WWW.HISTORICENVIRONMENT.SCOT/CLIMATECHANGE ; WWW.SCHARP.CO.UK/SITES-AT-RISK
WWW.DYNAMICCOAST.COM

IRAQ

Using satellite images to assess damage to heritage sites

The use of satellite images proves to be important in the monitoring and analysis of cultural heritage status in the occupied regions of Iraq.

Iraq has more than 10 000 cultural heritage sites, ranging from the 5 500-year-old cities of Sumer to the archaeological remains of the Akkadian, Babylonian, Assyrian, and Parthian empires. During the civil war of 2014-2017, several cities were occupied by Al-Qaeda and the Islamic State of Iraq and the Levant (ISIL).

CONTRIBUTORS: MARCELLO MORETTI, OPERATIONS MANAGER AND EPIFANIO PECHARROMÁN, IMAGERY ANALYST / TEAM LEADER, EUROPEAN UNION SATELLITE CENTRE, MADRID, SPAIN

Iraqi cultural heritage sites have suffered greatly from military activities, organised looting, illegal excavations and trafficking of cultural objects across the country.

The entire world witnessed with astonishment the destruction of irreplaceable cultural treasures and the United Nations General Assembly adopted two resolutions on Saving the Cultural Heritage of Iraq in 2015.

In the same year, the discovery on ISIL's Syrian compound of 700 ancient artefacts raised some doubts on the authenticity of the destructions claimed by ISIL. Some doubted that the monuments and artefacts destroyed were copies and not the originals, which were instead traded on the illegal market to fund the activities of ISIL.

The European Union Satellite Centre (SatCen) is an official Agency of the European Union, providing geo-intelligence products and services resulting from the exploitation of space assets and collateral data to support the decision making and actions of the EU in the field of Common Foreign and Security Policy (CFSP).

In February 2018, the SatCen received a request from the EU Counter-Terrorism Office & PRISM (Prevention of Conflict, Rule of Law, Integrated Approach, Stabilisation and Mediation) to verify and assess the damage to cultural heritage in some of the urban areas controlled by ISIL in Iraq.

The resulting information was aimed to fight looting of Iraqi cultural heritage, to support the EU Advisory Mission on the Security Sector Reform in Iraq, and help archaeologists continue their work in these areas. These included the Balkuwara Palace area of Samarra, the ruins of the ancient city of Nimroud, the elevated mound of Tepe Gawra, the remains of the ancient city of Ninive, the Mosque of Nabis Yunes, and the remains of the ancient city of Dur Sharrukin (today Khorsabad).

The Centre analysed 117 satellite images of these sites in Iraq, in search of any damage or evidence of looting.

By comparing satellite images taken before, during and after the occupation, the SatCen was able to verify and analyse the destruction of several antique buildings and classify the identified damage in three categories: possible looting (illegal excavation and plundering of an archaeological site for gaining profit, i.e. selling), fundamentalist damage (linked with the presence of ISIL in the area), and military damage (such as defence positions, revetments or trenches within archaeological sites).

The use of Satellite Imagery has helped to verify, detect and classify in detail the damages sustained over time. A wide range of stakeholders, from local authorities to archaeologists, have been invited to use the data and complement them with their own, in order to fight illegal looting and help the reconstruction and preservation processes within the damaged areas.

CONTACT: WWW.SATCEN.EUROPA.EU

CREATING INNOVATIVE, ARTISTIC AND CULTURAL EXPERIENCES

MARSEILLE

N+N Corsino: Expanding the choreographic space

Two choreographers based in France used Satellite Imagery as the scenario for a dance movie and Satellite Navigation to locate Virtual Reality dancers through mobile apps.

Nicole and Norbert Corsino are choreographers and researchers based in France.
Associated under the name "N+N Corsino", their artistic research focuses on the interactions between body movements and landscapes.
Their works are often inspired by literary works and aim to boost their spectators' imagination.

CONTRIBUTOR: NORBERT CORSINO, CHOREOGRAPHER AND RESEARCHER, N+N CORSINO, MARSEILLE, FRANCE

Back in 1989, Nicole and Norbert Corsino used Satellite Imagery for the first time in some of the scenes of the movie they directed and staged: Un avion, presque au milieu du lac (A seaplane, not quite in the middle of the lake).

The movie is a dance show centred on the concept of limits between air and water. Shot in Lugano, Locarno and Marseille, the movie has been realised with images taken with regular cameras (on land and from a seaplane) and with satellite images provided by the French National Centre for Space Studies (CNES).

The images were processed by I.S.T.A.R. (Stereoscopic Images Applied to Relief), a research company based in Sophia Antipolis, the oldest and biggest European technological park. Corsino used Satellite Imagery to expand the scenario of the movie and animate scenes that give the impression of a seaplane landing on the port of Marseille, a quite improbable event in the real world.

In 2009, N+N Corsino created the mobile app Soi-Moi (Self as Me). The app is a game based on 12 choreographies processed with the interactive integration of iPhone tools: accelerometers, photo, video and touch screen. The space where the user is (e.g. a room, a beach or a field) becomes the backdrop for digital characters, silhouettes of men or women, stylised animals, etc. walking or moving on the surfaces and objects surrounding the user.

In Soi-Moi, GNSS data was integrated in some of the scenarios of the app, changing the colours of the 3D characters according to the position of the user. If the user is close to the sea, colours are warmer, while at more than 150 meters, e.g. on hills or at the 20th floor of a building, they become colder, taking on blue/violets tones.

The most recent creation of N+N Corsino is Self-Patterns, the first choreographic navigation in Augmented Reality, a free mobile application based on ten patterns, where the users become the authors of their shootings and of the dancers' itineraries in augmented spaces.

The dancers played ten short choreographies and their movements were then recorded in motion capture. When the application is launched, through the screen of their phones, the users see the avatars of the dancers moving in the spaces they are looking at in real life.

Each shooting is geo-located and the two choreographers plan an exhibition in which they will ask ten people to interpret the virtual choreography in ten different spots. Thanks to Satellite Navigation, they will be able to classify the short movies according to their location and the time they were shot, arranging them in a narrative order.

The app has been developed within the framework of the France-Romania Cultural Season 2019.

CONTACT: WWW.NNCORSINO.COM

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FLORENCE

Gamification to help managing tourist flows

A mobile application combines arts, gamification and Satellite Navigation to mitigate tourist pressure in the centre of Florence and direct visitors towards alternative itineraries.

The city of Florence, in Tuscany, has a population of 383 083 inhabitants. The Historic City Centre is a UNESCO World Heritage Site since 1982. Considered as the cradle of Italian arts and literature, the city attracts millions of tourists from all over the world. In 2018 alone, 10,6 million tourists visited Florence.

CONTRIBUTORS: FABIO VIOLA, TUOMUSEO, AND CARLOTTA VIVIANI, ECONOMIC ACTIVITIES AND TOURISM DEPARTMENT, CITY OF FLORENCE, ITALY

The majority of tourists in Florence are concentrated in the UNESCO Heritage Historic City Centre, an area of approximately 5 km^2.

The Economic Activities and Tourism Department of the Municipality is responsible for promoting and managing tourism in Florence. The main challenge for the Department is to sustain the cultural offer of the City, while mitigating the side effects of tourist pressure on the historical center.

To mitigate overcrowding, the Department decided to take measures to guide tourists towards alternative thematic itineraries.

Among the measures implemented, the Department launched Firenze Game, a mobile app combining digital gaming and city tours. Targeting schools and kids up to 12 years old, the app aims at stimulating players to learn more about the city of Florence while supporting the need of the Municipality to delocalise tourists from major attractions.

Firenze Game, available for free, relies on Satellite Navigation to guide players around different itineraries, challenging them to look closely at Firenze's hidden beauties and its less known stories.

Players can create their avatars and then challenge their friends. Each player has a set of cards, classified by historical periods. The places, symbols and historical figures featured on the cards help the player discover Florence's curiosities and stories.

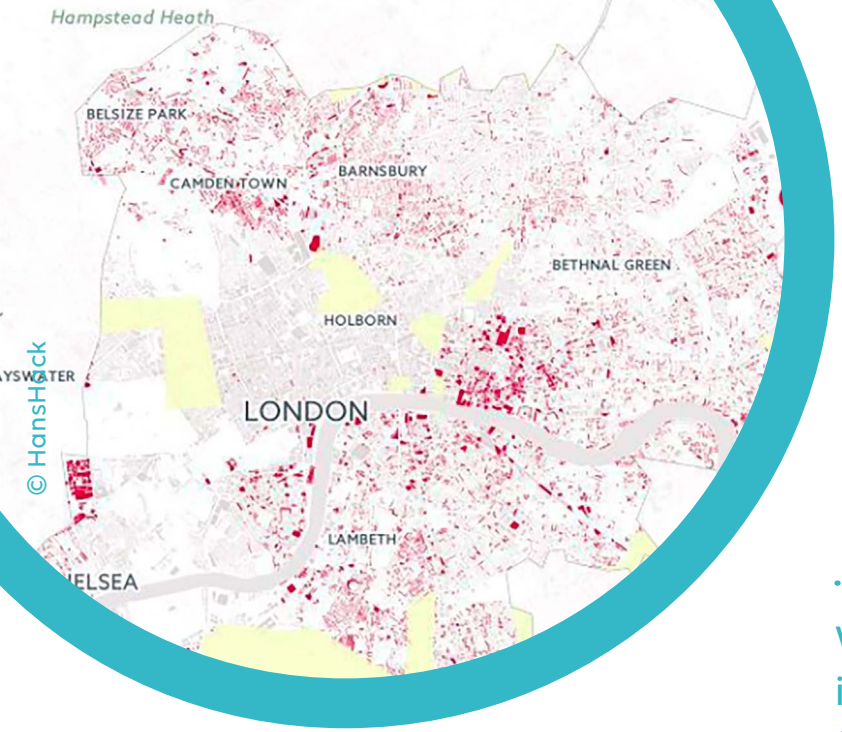
While moving around the city, cards are automatically unlocked through geo-located check-ins. Players can gain new cards by localising themselves close to squares, monuments and museums. The more unknown or remote a location is, the more the value of the cards to be collected increases.

The app has been developed so as to allow the Tourist Department to autonomously update and add maps. These can be redrawn from scratch with geo-referenced information.

Geo-localisation turns the digital gaming experience into a physical one. A cross between PokemonGo and a sticker album, Firenze Game merges the digital and analogical worlds to offer dedicated touristic and educational experiences to youngsters. At the same time, the app represents an innovative way to manage tourist flows in a smart and engaging fashion.

The app was developed in Italian and English by the Municipality of Florence, with Linea Comune, Muse and Digital Fun/TuoMuseo, an international collective of artists, game designers, developers, sound designers and 3D animators.

CONTACTS: WWW.COMUNE.FI.IT ; WWW.TUOMUSEO.IT



ALEPPO

Hans Hack: When Satellite Imagery becomes a powerful communication tool

Satellite Imagery can serve as a basis for data visualisation, challenge our perspectives and stimulate reflection on our world.

With a background in Heritage Conservation, Hans Hack works with JavaScript, open data sources and whatever might come handy to tell stories.
Based in Berlin, he works for museums, foundations, newspapers, NGOs, graphic design studios, and artists.

CONTRIBUTOR: HANS HACK, DATA VISUALISER, MAPMAKER AND ARTIST, BERLIN, GERMANY

Maps are quite a powerful tool to communicate on research findings to the general public.

Hans Hack uses aerial or satellite images as a first layer for many of his artistic or graphic projects.

As an example, in the "Alpen" project, he took satellite images of cities that are mainly flat, like Berlin, London, Hamburg, and Brussels, and then modified them to exaggerate their heights. In these 3D city maps, all elevation data has been hugely increased in scale to give users the perception of how their cities would look like on hills or mountains.

"Reprojected Destruction" is a data visualisation project relying on Satellite Imagery to sensitise the public to the damage suffered by the city of Aleppo.

For this project, the artist found inspiration in a satellite-based map published by the United Nations Operational Satellite Applications Programme (UNOSAT) of the United Nations Institute for Training and Research (UNITAR).

The satellite-based map of Aleppo was created between November 2010 and September 2016. These images showed the percentage of buildings damaged in the area since the beginning of the Syrian war. In six years, more than 40%, a total of 33 521 structures have been damaged as an outcome of the war.

As a geographical reference point, Hans superposed the Citadel of Aleppo on that of the Museum Island in Berlin and the Tower of London. He then showcased the re-projected percentage of destruction on some randomly selected buildings.

In Hans' London map, the Tower of London, the City Hall, the Palace of Westminster, Buckingham Palace, the Olympic Stadium, King's Cross station, and Tate Modern were razed, while Camden, Islington, Dalston and Hampstead were decimated.

"What is important to me is to use technology to sensitise people on issues that I believe are relevant to understand today's world", Hans says.

To do so, in the future he plans to continue using Satellite Imagery for data visualisation projects, while he is also getting interested in the possibilities offered by artificial intelligence and machine learning.

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WAKEFIELD

Yorkshire Sculpture Park: Satellite Navigation brings sculptures to life

Sculpture Cam, an app based on Satellite Navigation data, offers a unique experience to the visitors of a park in the United Kingdom.

Yorkshire Sculpture Park (YSP) is an open-air museum in West Yorkshire. The park covers more than 200 hectares and hosts one of the largest exhibitions of bronze statues in Europe. Unlike similar parks, the YSP has a changing exhibition programme, allowing visitors to closely observe works by British and international artists.

CONTRIBUTOR: LUNA MAURER, STUDIO MONIKER, AMSTERDAM, THE NETHERLANDS

Museums and exhibition centres are experimenting with new technologies to change the way visitors interact with artworks.

Digital and mobile technologies can offer museum or exhibition visitors new ways to actively engage with culture and artworks. Indeed, devices as common as smartphones can allow us to know more about a piece of art, the artist who created it, or the space where it is exhibited.

In the United Kingdom, the Yorkshire Sculpture Park (YSP) wanted to broaden its audience using new media and digital technologies. In 2017, the Park asked the Amsterdam-based interactive media design studio Moniker, to come up with an innovative way to offer visitors an immersive tour of the Park's sculptures.

This became Sculpture Cam: a collaborative social game that visitors can play while inside the park. Users need to open their browsers on the web app and turn on the in-built geo-location service of their tablets or smartphones.

Players are then challenged to find ten sculptures in the park, including works by Barbara Hepworth, Henry Moore and Sophie Ryder, based on their silhouettes and on the Satellite Navigation system embedded in their devices. Once they spot a sculpture, they will have to find the angle matching the silhouette on their screen and photograph it with their smartphones or tablets. When visitors submit their pictures, they are rewarded with an animation showing all the angles of the statues photographed by different visitors together with a curiosity or a fun fact about the artist behind the sculpture.

The sculptures in the park are geo-tagged via Satellite Navigation in the browser and photographed using Web Real Time Communication.

Thanks to the app, the tablets or smartphones of the visitors of the Yorkshire Sculpture Park turn into collaborative 3D scanners, which capture and collect the peculiar views of each visitor. All the pictures taken are collected and showcased on a screen in the Park's museum.

With Sculpture Cam, the Yorkshire Sculpture Park is able to offer a distinctive experience to its visitors, widening access and participation to both arts and digital technologies.

The web app was developed by Moniker with support from The Space, the England Arts and Culture Council and the BBC. It has been used by almost 3 000 visitors, while the website counts more than 25 000 visits. In the future, the app might also include Augmented and Virtual Reality features to further enrich the visitor's experience.

CONTACTS: WWW.YSP.ORG.UK ; WWW.STUDIOMONIKER.COM

PREVIOUS EDITIONS

Eurisy has been publishing "Satellites Going Local: regions, cities and SMEs share good practice" since 2011.

The objective of the publication is to encourage regions, cities and SMEs to make the most of European investments in space, by learning from their peers how to use satellite applications in many different sectors, and by following suit.

This publication, and its online counterpart – Eurisy's database of good practices – (www.eurisy.org/good-practices.php), is an important resource in Europe which systematically and regularly collects "satellite success stories" – examples of how satellite navigation, imagery and communication are used in practice, shared by the users themselves.

Today, Eurisy is still searching for success stories exploring new sectors to bring satellite technologies closer to society.

For previous editions, and more good practices in your country and field of interest, visit www.eurisy.org

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