EARTH OBSERVATION & NAVIGATION. LAW AND TECHNOLOGY

eds. MARLENA JANKOWSKA,
MIROSŁAW PAWEŁCZYK, SŁAWOMIR AUGUSTYN
& MARCIN KULAWIAK

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Wydawnictwo Ius Publicum

EARTH OBSERVATION & NAVIGATION. LAW AND TECHNOLOGY

Z serii *Geo&IP Series* ukazały się dotychczas:

1. *AI: Law, Philosophy and Geoinformatics*, red. M. Jankowska, M. Pawełczyk, M. Kulawiak, Warszawa 2015
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3. *Geoinformacja. Prawo i praktyka*, red. M. Jankowska i M. Pawełczyk, Warszawa 2014

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Geo&IP Series
Warsaw, December 2017

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Projekt okładki
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Skład i łamanie
Marlena Jankowska, Krzysztof Mordarski

Proofreading
Dermot McNally

UNIWERSYTET ŚLĄSKI
W KATOWICACH

Projekt finansowany przez Uniwersytet Śląski w Katowicach z dotacji dla Młodych Naukowców „Regulacje prawne dla nowych technologii lokalizacyjnych" przyznanych dla dr. Marleny Jankowskiej w latach akademickich 2016/2017 oraz 2017/2018 (This project was financed by the University of Silesia in Katowice from the Ministerial Grant for Young Scholars "Legal regulations for new localisation technologies", obtained by Dr. Marlena Jankowska for the academic years 2016/2017 and 2017/2018).

ISBN: 978-83-946766-9-8

Język: angielski
Tom: książka stanowi niezależną całość, ale też tom IV serii Geo&IP

Wydawca: IPG wraz z fundacją Ius Publicum oraz fundacją IIP

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tel. +48 783 805 806
fundacja@iuspublicum.pl
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List of Abbreviations

API	Application Programming Interface
AuT	Autonomous Things
BICES	Battlefield Information Collection and Exploitation Systems
C4ISR	Command & Control; Computers & Communications; Intelligence, Surveillance & Reconnaissance
CAA	United Kingdom's Civil Aviation Authority
CCTV	Closed Circuit TeleVisionTelevision
CLMS	Copernicus Land Monitoring Service
CoC	Convention on Cybercrime signed in Budapest on 23.11.2001
CODA	Copernicus Online Data Access
CoE	Council of Europe
CSCDA	Copernicus Space Component Data Access
CSD	Coalition Shared Database
DGCA	Director General of Civil Aviation
DIA	Defense Intelligence Agency
DJI	DàJiāng Innovations Science and Technology Co., Ltd.
DoITT	Department of Information Technology and Telecommunications
DOD	United States Department of Defense
EASA	European Aviation Safety Agency
ECHR	European Convention for the Protection of Human Rights and Fundamental Freedoms
EGNOS	European Geostationary Navigation Overlay Service
EGNOS	European Geostationary Navigation Overlay System
ENISA	European Union Agency for Network and Information Security
EO	Earth Observation
ESA	European Space Agency
FAA	Federal Aviation Administration
FOSS	Free and Open Source Software
GAGAN	GPS-Aided GEO Augmented Navigation
GBAS	Ground Based Augmentation System
GDPR	General Data Protection Regulation
GEO	Geosynchronous Equatorial Orbits
GIS	Geospatial Information Systems
GMES	Global Monitoring for Environment and Security
GNSS	Global Navigation Satellite System
GPS	American Global Positioning System, A-GPS (Assisted GPS)
GUI	Graphical User Interface
HANE	High Altitude Nuclear Explosions
ICAO	International Civil Aviation Organization
ICCPR	International Covenant on Civil and Political Rights
ICT	Information and Communication Technologies

IERS	International Earth Rotation Reference Systems Service
ILBS	Indoor Location-Based Services
IoIT	Internet of Intelligent Things
IoT	Internet of Things
IPS	Indoor Positioning Systems
ISR	Intelligence, Surveillance and Reconnaissance
LAAS	Local Area Augmentation System
LBS	Location-Based Services
LEO	Low Earth Orbit
LULC	Land Use and Land Cover
MAJIIC	Multi-intelligence All-source Joint ISR Interoperability Coalition
MEO	Medium Earth Orbit
MODA	Mayor's Office of Data Analytics
MTOM	Maximum Take-Off Mass
NEO	Near-Earth Objects
NFC	Near Field Communication
NGA	National Geospatial-Intelligence Agency
NMEA	National Marine Electronics Association
NSA	National Security Agency
PET	Privacy-Enhancing Technologies
PIT	Privacy-Invasive Technologies
PPP	Precise Point Positioning
PPP	Public Private Partnership
RFID	Radio Frequency Identity
RP	Relative Positioning
RPAS	Remotely Piloted Aerial Systems
RPV	Remotely Piloted Vehicles
RTLS	Real-Time Location Services
SBAS	Satellite Based Augmentation System
SLD	Style Lawyer Descriptor
SPP	Single Point Positioning
SSA	Space Situational Awareness
SSN	Space Surveillance Network
SST	Space Surveillance and Tracking
sUAS	Small Unmanned Aircraft Systems
UAS	Unmanned Aircraft Systems
UAV	Unmanned Aerial Vehicle
UDHR	Universal Declaration of Human Rights
UGV/UGS	Unmanned Ground Vehicle or System
USV	Unmanned Surface Vehicle
UTC	Coordinated Universal Time
UUV	Underwater Unmanned Vehicle
WAAS	Wide Area Augmentation System

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Introduction

This is the fourth book published in the Geo&IP Series. This time the main topics are the issues of Earth Observation (EO) and Navigation, which have been discussed from both the technological and the legal angle. This book is the child of many people who shared one idea: that new technologies need new legal regulations. In order to realise the latter, one needs a fully-fledged knowledge of the former. This book was written by a group of prominent authors from Australia, India, Germany and Poland. The editors can only hope it becomes a useful tool in the hands of scholars, practitioners and enthusiasts of geo-sciences and legal studies.

The book begins with an introduction to discoverology, authored by Piotr Homola, who spends a few words on different approaches to creating science. To this end, he describes the ideas of innovatics, choiceology, errology and questiology as well as the idea of making the optimum use of collaborative creativity.

The next part is devoted to EO with a special focus on Space Surveillance and Tracking, GNSS and ESA. Sławomir Augustyn sheds some light on the idea of Space Situational Awareness and its components as essential and integral parts of space operations. The next author, Krzysztof Bruniecki, discusses positioning methods and techniques based on the Global Navigation Satellite System by example of collected data and their analysis. This topic is further addressed by Marek Ogryzek and Ewa Solanowska-Ratajczak, who focus on Copernicus Data access and terms of use.

This is followed by a section related to navigation and smart city architectures, introduced by Mohd Shoab and Kamal Jain using examples of such cities as New York City, London, Dubai, Singapore and Seoul. These authors seek to identify standards of smart city architecture. This topic is brought further by Thomas Liebig in more general terms with regard to the methods of wayfinding in a city.

The remaining sections relate widely to Unmanned Aerial Vehicles, one of the most exciting subjects of discussion with regard to data collecting, data security and privacy. Sanatan Kulshrestha opens with an introduction to different kinds of unmanned vehicles, their history and functionality. Then, Anuj Tiwari, Surendra Kr. Sharma and Kamal Jain devote a few words to the military purposes

EAVs serve, with special focus on new technologies, such as remote sensing data acquisition. Ralph Thiele continues this topic with regard to Big Data and C4ISR (Command & Control; Computers & Communications; Intelligence, Surveillance & Reconnaissance). This discussion is followed by Marlena Jankowska and Mirosław Pawełczyk, who shed some light on EU policy for the security of information gathered by unmanned vehicles.

The aspect of privacy issues is widely discussed by George Cho, Michał Barański, Maciej Giermak, Marlena Jankowska and Mirosław Pawełczyk.

This book also contains a chapter from Marlena Jankowska and Damian M. Bielicki, who propose a change to the law covering a new neighbouring right for satellite data.

The book concludes with a chapter containing chosen excerpts from the most important legal documents related to the topic.

Dr. Marlena Jankowska

Warsaw, 8.12.2017

A letter from China

Earth Observation has become an important part of space policy throughout the European Union and for other players in the world, such as the People's Republic of China, Korea and the United States of America. The People's Republic of China has been developing Earth Observation space systems for more than twenty years. It should be mentioned that China developed not only the Fengyun (Wind and Cloud), Haiyang (Ocean), Ziyuan (Resources), Yaogan (Remote-Sensing) and Tianhui (Space Mapping) satellite series, but also a constellation of small satellites for environmental and disaster monitoring and forecasting. Moreover, Chinese satellites also exchanges data with LANDSAT-5, Japanese JRS-1, French SPOT, European Union ERS 1 and 2, and Canadian remote-sensing satellite.

Along with the explosion of the technology in the field of Earth Observation, it is imperative to inquire thoroughly the legal issues of data acquisition as well as the terms of use of data. The development of the space sector along with the use of data is very much based on proper data policy. As is well-known, in many countries, each organization sets the rules of data sharing on its own, which does not stimulate rapid growth in this sector.

The book "Earth Observation & Navigation. Law and Technology", eds. M. Jankowska, M. Pawełczyk, S. Augustyn and M. Kulawiak, designed to guide the reader through methods of research, methods of collecting data, terms of use, the application of unmanned aerial vehicles and protection of geodata, brings these topics together, touching on EO issues in a proper way and showing the directions and expectations for the upcoming couple of years.

I strongly recommend this piece of research to anyone interested in Earth Observation and geoinformation because it is a great deal of work from a group of prominent authors across the globe.

Prof. Dr. YU, Xiang
Director of the Chinese-German Institute for Intellectual Property,
Huazhong University of Science and Technology / HUST

Wuhan, Dec. 22, 2017
People's Republic of China

Part I

Discoverology and innovatics – research in the 21st century

Chapter 1

Introduction to discoverology

Piotr Homola

1. Introduction

The road to technology leads through the application of basic science results, and basic science results are nothing other than ground-breaking basic science discoveries. Do you like your satnav system? Thank Einstein! Although humanity is seemingly doing extremely well at technological development, you can never claim that we could not do any better. Want to drive an anti-gravity vehicle as seen on your favorite Sci-Fi film? Sure, O.K., just wait for a corresponding discovery, apply the results and there we are. But wait... might this particular discovery have already been made? Is it possible that something that sounds so incredibly ground-breaking, like an anti-gravitation effect, could be missed by the community of science professionals? Yes, unfortunately it is. Simply because of how incredible it seems. Let us illustrate the point by reminding of one of the drawbacks in the process of acknowledging science results as discoveries. The drawback known as the Semmelweis effect[1] is rather poorly known among scientists, as it concerns a story that is shameful for the community claiming to be the elite of humanity. Dr. Ignaz Semmelweis (1818-1865) discovered that child-bed fever mortality rates reduced ten-fold when doctors washed their hands between patients and, most particularly, after an autopsy. He proposed washing hands between patients as a good practice in 1861, although he was unable to provide a scientific explanation. His hand-washing suggestions were rejected by doctors of his time, interestingly also for non-scientific reasons. For instance, some doctors refused to believe that gentlemen's hands could transmit disease. Semmelweis's discovery was widely accepted only in the early 1900's, nearly four decades after his death. Such a lack of acknowledgement of new knowledge is today known as the Semmelweis effect. A metaphor for a certain type of human behavior, the Semmelweis reflex-effect is characterized by rejection of a new knowledge because it contradicts entrenched

[1] M. Mortell, H. H. Hanan, E. B. Tannous, M. T. Jong, *Physician 'defiance' towards hand hygiene compliance: Is there a theory–practice–ethics gap?*, Journal of the Saudi Heart Association. 25 (3), 2013, pp. 203–208.

Part II

Earth observation – SST, GNSS, ESA

Chapter 2

Space Situational Awareness, sensors – selected aspects

Sławomir Augustyn

1. Introduction

Space situational awareness (SSA) is an essential and integral part of space operations. Situational awareness is defined as an adaptive, externally directed consciousness. Situational awareness has recently gained considerable attention as a practice – it is related to the safe operation of the complex dynamic system.

Although the Space Surveillance Network (SSN) is currently the single best source of SSA in the Word, this system does not provide the level of SSA currently needed to support space operations. The lack of geographical sensor distribution and coverage outside of the Earth's sphere are significant limitations of the SSN. The existing large number of individual sensors across the globe and smaller sensor networks, which already provide some level of SSA data to various users, could also provide data to support the synergy of many countries needed for SSA. These sensors are being developed for a variety of missions, including space surveillance missile warning, missile defence, testing and other scientific applications[1].

One of the most dangerous factors in the space area is debris. Space debris poses the principle threat to orbiting satellites, which can potentially be damaged or destroyed. In order to mitigate the consequences of space debris, the spacecraft operators need to know the locations of other satellites and of debris, in order to enable any evasive action that may be necessary. Taking SSA into consideration, there is a need to develop and demonstrate a new method and a new vision of Technologies for observing and tracking debris and alerting satellite operators who control our vital weather, navigation, telecommunication and science research satellites[2].

That is the motivation behind the development of Space Surveillance and Tracking (SST), which is the ability to detect and predict the movement of space debris in orbit around Earth. The figure below indicates the current components of SSA (figure1).

[1] www.esa.int/.../Space_Situational_Awareness/SSA_Programme_..., as of 30.12.2017.
[2] www.esa.int/Our_Activities/.../Space_Situational_Awareness_..., as of 30.12.2017.

Chapter 3

High precision and accuracy using low cost GNSS receivers and supporting technologies

Krzysztof Bruniecki

1. Introduction

This chapter focuses on methods and techniques of positioning, based on the highly accurate and precise Global Navigation Satellite System (GNSS), which are available at a relatively low price. In this context, a comparison of different positioning methods provided by the free and open source software (FOSS) package called RT-KLIB is given. Other aspects related to price reduction are also considered, including availability and selection of hardware (receiver, antenna, etc.) and market growth. The theoretical comparison of positioning methods is illustrated with their in-situ evaluation using a low-cost GNSS receiver. The evaluated receiver (i.e., u-blox LEA-6T) provides different types of information including raw carrier phase measurements, therefore it allows us to obtain a very high precision of positioning by means of relative positioning algorithms. As the source of reference data for relative positioning, the services from the ASG-EUPOS system were used. ASG-EUPOS is a Polish GNSS augmentation system consisting of a network of GNSS base stations. It provides real-time corrections as well as post processing services for the entire territory of Poland.

2. GNSS Systems

One of the most important aspects of satellite based positioning and navigation is its precision and accuracy. Although precision and accuracy are different quality indicators in this paper, the terms are used interchangeably. As of today, the precision of GNSS ranges from sub millimetre to the hundreds of meters' level depending on the techniques and methods being used. The first prominent (and most popular) GNSS system is the American Global Positioning System (GPS),

Chapter 4

ESA satellite images classification in GIS for land cover and land use changes – legal and technical issues

Marek Ogryzek, Ewa Solanowska-Ratajczak

1. Introduction

The Copernicus Programme, the former GMES program (Global Monitoring for Environment and Security) – the world's largest earth observation programme, is directed by the European Commission in partnership with the European Space Agency (ESA). It aims at achieving a global, continuous, autonomous, high quality, wide range Earth observation capacity. Providing accurate, timely and easily accessible information to, among other things, improve the management of the environment, understand and mitigate the effects of climate change, and ensure civil security[1].

The objective is to use multi-source data to get timely and quality information, services and knowledge, and to provide autonomous and independent access to information in relation to the environment and security on a global level. In other words, it pulls together all the information obtained by the Copernicus environmental satellites, air and ground stations to provide a comprehensive picture of the "health" of the Earth. The geo-spatial information services offered by Copernicus can be grouped into six main interacting themes:

- land monitoring,
- marine environment monitoring,
- atmosphere monitoring,
- emergency management,

[1] T. Wiatr, G. Suresh, R. Gehrke, M. Hovenbitzer, *Copernicus – Practice Of Daily Life in a National Mapping Agency?*, The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, Volume XLI-B1, 2016 XXIII ISPRS Congress, 12–19 July 2016, Prague, Czech Republic.

Part III

Augmented navigation – smart cities, policies, opportunities

Chapter 5

Augmented navigation system deciding trends and policies for smart city development

Mohd Shoab, Kamal Jain

1. Introduction

In recent decades, humanity have witnessed dramatic increases in the precision of location information. Information and Communication Technologies (ICT) revolutionize the ways different urban sectors communicate and interact. Augmented navigation systems have emerged as one of the most promising solutions for developing better and more sustainable cities, Smart Cities, as they are commonly called. This approach offers the possibility of combining real sceneries with digital representations of places of interest and services for a given itinerary. The system offers several functionalities, from conventional and virtual map viewing to orientation-based functionalities that augment navigation capabilities and favour virtual exploration of a given area of interest.

The smart city concept pops up frequently in the context of urban development. In this chapter, we present a sketch of the rudiments of what constitutes a smart city, defined as a city in which ICT is merged with the traditional Global Positioning System, coordinated and integrated using new digital technologies to form precise Augmented Navigation System. The main purpose is to investigate these issues in order to improve accessibility in Smart Cities.

2. Navigation

"*Navigation is a technique which focuses on tracking and controlling the movement of a person/vehicle from one place to another place.*"

Navigation started with seamanship, which is the art of directing a ship in open sea by determining its position and course with the traditional practice of geometry, astronomy or some special navigation instruments. Many people from different

Chapter 6

Smart navigation – opportunities, risks and challenges of situation-aware, predictive navigation

Thomas Liebig

1. Introduction

With the emergence of smart cities, trip computation received increased attention. While conventional trip computation algorithms minimize a static cost function and provide an optimal route for an unrealistic uniform traffic situation with constant costs, traffic situations are not uniform, but vary over time, e.g. at rush hour commuters cause traffic jams on streets which are almost empty at night. The integration of various sensor systems (e.g. crowdsourcing, video cameras, automatic traffic loops[1]) in the smart city ecosystem enables incorporation of real-time measurements into intelligent traffic systems and their future predictions.

Situation-aware route planning is gathering increasing interest. The proliferation of various sensor technologies in smart cities allows the incorporation of real-time data and its predictions into the trip planning process. Nowadays, it is possible to create information systems for individual multi-modal trip planning that incorporates predictions of future (public transport) delays in routing. Future delay times are computed by a spatio-temporal prediction model. The information used by the system can be based on a stream of current vehicle positions, infrastructural data, or even social media messages. One possible prediction model is made possible by Spatio-Temporal Random Fields. The conditioning of spatial regression on intermediate predictions of a discrete probabilistic graphical model allows incorporation of historical data, streamed online data and a rich dependency structure at the same time.

[1] F. Schnitzler, A. Artikis, M. Weidlich, I. Boutsis, T. Liebig, N. Piatkowski & A Gal, *Heterogeneous stream processing and crowdsourcing for traffic monitoring: Highlights* [in:] *Joint European Conference on Machine Learning and Knowledge Discovery in Databases*, Springer Berlin Heidelberg 2014, p. 520-523.

Part IV

UAVs – Functions, opportunities, information security and legal framework

Chapter 7

Unmanned Systems – evolution and emerging role in humanitarian assistance and disaster relief

Sanatan Kulshrestha

1. Introduction

The ever-growing types of Unmanned Systems include unmanned aircraft, ground robots, underwater explorers, satellites, and other unconventional structures. However, it excludes ballistic or semi-ballistic vehicles, artillery, and cruise missiles[1]. The Military has been at the forefront of the design, development and deployment of unmanned systems. The rapid developments in electronics, extra strong and ultralight materials, communication technologies, sensors, computers and software has led to extraordinary progress in unmanned vehicles and their utilisation in the civilian arena. The aim of this chapter is to provide a perspective into the evolution of various types of unmanned vehicles and their transition from the military arena to the civil space especially as far as search, rescue, and disaster relief efforts are concerned.

2. Evolution of Unmanned Aerial Vehicles

Unmanned Aerial Vehicles (UAVs), formerly called 'drones', can be classified as pilotless target aircraft (PTAs), reconnaissance vehicles, or weapon delivery systems. According to the US Department of Defence[2] an unmanned aircraft is an aircraft that does not carry a human operator and is capable of flight with or

1 *Unmanned Aircraft Systems Roadmap 2005-2030*. U.S. Department of Defence, https://fas.org/irp/program/collect/uav_roadmap2005.pdf, as of 12.10.2017.

2 *Joint Publication 1-02, Department of Defense Dictionary of Military and Associated Terms.* U.S. Department of Defence. 8 November 2010 (As Amended Through 15 February 2016). https://fas.org/irp/doddir/dod/jp1_02.pdf, as of 12.10.2017.

Chapter 8

Emerging opportunities and challenges in UAV enabled Earth observations and remote sensing technology

Anuj Tiwari, Surendra Kr. Sharma, Kamal Jain

1. Introduction

Unmanned Aerial Vehicles (UAVs) have received early, rapid, and widespread adoption for military purposes. As these military systems grow in maturity, a number of UAV systems with various onboard sensors have been developed for civilian applications such as homeland security, forestry fire monitoring, quick response for disaster and research etc. Recent developments in the vehicles themselves and associated sensing systems transform these platforms into an ideal Remote Sensing System for earth observations. More elaborately, the UAV remote sensing system is based on UAV which has both the common characteristics of aerial remote sensing and its own unique features. Compared with manned aerial vehicles, remote sensing systems with the platform of UAV can work all-day and all-weather and perform flight tasks in high-risk areas. Moreover, UAVs can operate rather close to the object and acquire images with resolutions of a few centimeters, providing sufficient earth observations. UAV platforms, imaging and sensing systems facilitate unique capabilities in Earth observation for both research and operational monitoring purposes.

This research aims to understand the various characteristics of this emerging technology that make it the most promising geospatial and attribute data collection tool in the GIS community. But using UAVs is not without challenges, since many applicable regulations have not yet been modified to take these UAVs into account. This is less of a problem for small, low altitude systems than for high altitude, long endurance platforms. It is expected that a complete integration of UAVs in the airspace will take another five to ten years. So, our focus is not only to cover various opportunities but also to have a detailed look over at various challenges that need to be incorporated while designing policies for this promising earth observation technology.

Chapter 9

Lifting the fog – Big Data in networked ISR Systems

Ralph Thiele

1. Improving awareness

In today's world, complexity can be the greatest challenge or the greatest asset. Time sensitive targeting has always been prevalent in operations, evolving from artillery spotting during the First World War, hunting for V1 and V2 sites in the Second World War, Scud-hunting in the Gulf War, and into current operations with the use of UAVs. Yet during this evolution, the time available to find a target and prosecute has reduced significantly, despite a marked increase in both the amount of information being transmitted and the range between the target and decision maker.

Naturally, political and military decision makers strive to make complexity an asset and build the infrastructure to achieve superior situational awareness and to act on it in real-time. The impact that Big Data can have for providing timely situational awareness, actionable intelligence and thus effective decision making will very probably be a key success factor. Data collection has become a critical aspect in today's security and military operations. However, modern security forces are finding it hard to effectively analyse and exploit all the data collected within the given multisource, hybrid security environment.

The C4ISR[1] world has been struggling recently to keep up with a quantum shift in technology affecting their capabilities. Command & control encompasses all functions necessary for the planning of operations from plan development to mission execution and exploitation. Communications & Computers provides

[1] The acronym of C4ISR stands for Command & Control; Computers & Communications; Intelligence, Surveillance & Reconnaissance. It summarizes systems and components that were treated separately in the past, but in today's security environment they have become well-orchestrated for supporting operations in a time sensitive manner from plan development to mission execution and exploitation.

Chapter 10

The security of information obtained using UAVs in military and humanitarian actions – general remarks on aviation policy in the EU

Marlena Jankowska, Mirosław Pawełczyk

1. The UAV as an information platform – the implications of the Internet of Things, drone technology and big data

1.1. Seamless interconnection

In September 2017, a message circulated around the world that the US Army had grounded its DJI drones over security concerns. It had purchased small consumer drones, manufactured by the Chinese producer DJI, to use in the field. As noted in one of the Internet releases, "previously hackers have been able to jailbreak some DJI drones to control and modify things like safety features on the devices. Some reports have also indicated that DJI can gather location, audio, and even visual data from user flights. It's unclear what data DJI can access without customer consent, but location and media data from an Army drone could potentially reveal extensive information about US military operations. Even if the Army isn't specifically concerned about DJI or the Chinese government accessing this data, it may be worried that other parties could intercept any data linked to DJI"[1]. The concern about such drones' cyber vulnerabilities turned out to be much exaggerated, however it showed the extent of the security consideration that arise every time a military or humanitarian drone is used.

The vision of seamlessly interconnecting trillions of devices is becoming reality. Special services have been developed to enable the exchange of information, about physical objects, flowing from websites, databases and sensors. Moreover, the services are built such that they can trigger activities and control the objects by special actuators. As noted by P. Ibach, M. Malek and G. Tamm, "through the spa-

[1] L.H. Newman, The Army Grounds its DJI Drones Over Security Concerns, as of 8.07.2017, available at: https://www.wired.com/story/army-dji-drone-ban/, as of 3.11.2017.

Part V
Privacy

Chapter 11

Navigation technologies: privacy, personal freedoms and policy

George Cho

1. Just a second

When the clock ticked over on December 31, 2016 time was delayed by a second because of the scheduled addition of the 'leap' second by the International Earth Rotation Reference Systems Service (IERS) (2016).[1] A leap second is occasionally needed to ensure that the Coordinated Universal Time (UTC), the official measure of time, stays in synchrony with changes in the Earth's rotation.[2] Without such corrections navigation equipment and computer systems can become inaccurate.[3] Leap seconds are always added or removed either at the end of June or December each year. The addition or subtraction of the leap second is announced well ahead to enable plans are put in place to ensure accuracy of time-dependent systems. Financial systems, airline bookings and scheduling, and general navigating equipment can be affected by inaccurate time signals.

We are taught that in Biblical times the Three Wise Men navigated their way using celestial bodies to find the manger. It is probable that they looked to skies for guidance. In modern times we still look to the skies for artificial celestial bodies such as satellites for data and information to help in navigation. Any fluctuation in the capture, transmission and receipt of the satellite data within differences of millionths of a nanosecond may result in all kinds of navigational and information systems errors.

However, modern technology has brought about a new dilemma. The new dilemma can be characterised as that of Jeremy Bentham's *panopticon* – the blanket capture by on-board satellite sensors of everything – animate and inanimate objects

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1 International Earth Rotation and Reference Systems Service (IERS) 2016 at https://datacenter.iers.org/web/guest/eop/-/somos/5Rgv/latest/16, as of 12.10.2017.

2 J. Aron, *A tiny bit more time'* at https://www.newscientist.com/article/2096394-time-for-more-2016-leap-second-will-be-added-to-years-end/, 2016, as of 12.10.2017.

3 See S. Knapton, *Leap Second confuses Twitter and Android, Telegraph (UK)* 1 July 2015 at http://www.telegraph.co.uk/news/science/science-news/11710148/Leap-Second-confuses-Twitter-and-Android.html, as of 12.10.2017.

Chapter 12

Protection of employees' geolocation data in EU law

Michał Barański, Maciej Giermak

1. Introduction

Geolocation data appears to fall into the conceptual scope of geoinformation, understood as "information obtained through the interpretation of geospatial data". However, only a small part of this range is filled[1]. For example, in the Polish literature, geoinformation is defined as "information about the location, geometric properties and spatial relations of objects, which might be identified in relation to the Earth", however, the concept of an object is used in its broad sense[2].

Collection of geolocation data should generally be reduced to determining the location (position) of an object at a particular time using the most commonly used electronic devices, and this is how geolocation data will be understood in the context of this study.

It should be noted that employee monitoring, understood as an employer's observation of employees in any way, encompasses many different forms of employee control[3]. Among these, due to newly emerging technological solutions, particu-

[1] See M. Jankowska, M. Pawełczyk, *The notion of geospatial information – several preliminary remarks, spatial information and public information* [in:] M. Jankowska, M. Pawełczyk (eds*.): Geoinformation law and practice*, Warsaw 2014, p. 1 and the literature quoted there.

[2] Ibidem.

[3] According to the definition of monitoring set out in the code of practice on the protection of workers' personal data, drawn up by the International Labor Organization (ILO), monitoring „includes, but is not limited to, the use of devices such as computers, video equipment, sound devices, telephones and other communication equipment, various metods of establishing identity and location, or any other method of surveillance". See Protection of workers` personal data. An ILO code of practice, Geneva 1997, p. 1, http://www.ilo.org/wcmsp5/groups/public/---ed_protect/---protrav/---safework/documents/normativeinstrument/wcms_107797.pdf, referred to as ILO Code of practice.

Chapter 13

UAVs, privacy and cybersecurity – European legal perspective

Marlena Jankowska, Mirosław Pawełczyk

1. Introduction

The emergence of new technologies that we are witnessing day to day has already been a subject of interest for the European Union for some time. However, the legal concerns that have emerged in connection with technological change were not framed in one legal act nor a bundle of a few interconnected legal documents. On the contrary, the EU has drafted and promulgated a great many new legal acts referring to issues related to privacy, security and cybersecurity of both personal and non-personal data, collected and stored by any means and by any actors. The only feature that connects these issues is new technology, which makes the perspective very broad. Given, however, that new technology has emerged in a number of guises, for instance Wi-Fi, UAVs, RFID, CCTV, the relevant legal acts cannot always be easily found and grouped. Moreover, the legal acts may belong to different branches of law: civil, administrative and criminal, which makes a general overview of legal documents even more complicated and obsolete due to the fact that the legal acts were subject to many changes, especially in 2016 and 2017. Therefore, this chapter intends to give a clearer and more logical order to the legal provisions governing the data gathered by UAVs in terms of cybersecurity in Europe.

2. CoE Conventions

Regulating cybersecurity at the European level took place in a two-fold way. On the one hand, through the main body striving at securing privacy and data, the Council of Europe (CoE) and on the other hand through the European Union. One of the first legal documents addressing these issues was the *Convention for the Protection of Individuals with regard to Automatic Processing of Personal Data,*

Part VI

Geodata – a new IP object?

Chapter 14

Remote sensing geodata satellite downlinks as a new neighbouring right

Marlena Jankowska, Damian M. Bielicki

1. Introduction

Current research on geospatial data may lead to an observation that we are witnessing the birth of a new field of science called 'geo-information'. Similarly to the evolution of space law and cyber law, geo-information uses an analogy to other legal disciplines[1]. However, legal aspects of geo-information are an increasingly separate subject taught in the course of legal studies and its scope – just like space law – evolves, creating its own foundations and structure in the legal sciences. To date, there is already a huge number of technical publications on geo-information. They more often reference to different legal aspects of law, including the intellectual property rights. Sadly, the referencing is often very general, taking quite as dogma that a digital map is subject to legal protection, without coming into detail.

In 2006, the Commission of the European Communities stressed out in its Green Paper that patents may cover inventions relating to the methods used by Global Navigation Satellite Systems (GNSS). Upon widespread use of GPS and other receivers for commercial and non-commercial users, the potential to generate revenue from

[1] According to Z. Ziembiński: „You have to accept the fact that the separation of the individual disciplines within the legal sciences, followed in a very spontaneous and often random manner. In recent decades, because of the speed of social change associated with rapid transformations of economic life, [...] has led to a significant diversity of views on this matter", Z. Ziembiński, *Metodologiczne zagadnienia prawoznawstwa*, Warszawa 1974, p. 68; P. Parent, R. Church, *Evolution of Geographic Information Systems as Decision Making Tools*, San Francisco 1988, p. 63-71; P.K. McCormick, *Neo-Liberalism: A Contextual Framework for Assessing the Privatisation of Intergovernmental Satellite Organisations* [in:] P.K. McCormick, M.J. Mechanick, *The Transformation of Intergovernmental Satellite Organisations*, Leiden-Boston 2013, p. 29, 32; E.E. Weeks, *Outer Space Development, International Relations and Space Law: A Method for Elucidating Seeds*, Newcastle upon Tane 2012, p. 90-91; W. Balogh, *Institutional aspects* [in:] Ch. Brünner, A. Soucek (ed.), *Outer Space in Society, Politics and Law*, Wien New York 2011, p. 205-206;

Part VII
Bright regulatory future

Chapter 15

Towards the future – imminent developments for smart city, UAVs, privacy

Marlena Jankowska, Mirosław Pawełczyk

1. European Innovation Partnership on Smart Cities and Communities: Initiative 'From Planning and Implementation to Scaling up of Smart Cities'

Integrated Planning Policy & Regulation Action Cluster [1]

Initiative 'From Planning and Implementation to Scaling up of Smart Cities'

Synopsis

Moving from smart city 'pilots' to mainstream fully-justified business-as-usual smart city programmes is a current necessity. Cities experience similar challenges and obstacles when implementing plans. Providing structure that helps to assess what is common and transferrable; and offering practical guidance material can substantially help build confidence, and accelerate the uptake of more common smart city solutions.

The goal of this initiative is to co-create a **Smart City Guidance Package (SCGP)**. This will support the implementation and design of smart city strategies and plans by making best use of capacity and by sharing knowledge and experience. Moreover, it will capture and develop practical tools to support the implementation of smart city strategies.

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[1] http://eu-smartcities.eu/sites/default/files/2017-10/Integrated-Planning-Policy-and-Regulation.pdf, as of 30.10.2017.

Editors

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Marlena has written extensively in the field of civil, copyright, geoinformation, commercial and public procurement law (over 100 academic papers).

Guest lectures at foreign universities: University of Hertfordshire (UK, June 2013), Nottingham Law School at Nottingham Trent University (UK, February 2014), University of Nantes (France, March 2015), University of Palermo (Italy, May 2016), Melbourne Law School at University of Melbourne (Australia, March 2017), Faculty of Law at University of Hong Kong (Hong Kong, March 2017).

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In the academic year 2016/2017 was granted a 4-month research stay at the University of Technology Sydney (Australia) as a visiting scholar (Endeavour Research Fellowship).
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Krzysztof Bruniecki received an MSc in the field of computer science in 2006 at Gdansk University of Technology (GUT). In 2012, he received his PhD for the dissertation titled "The integration of spatial data from airborne and spaceborne imagery acquisition platforms in near-real time systems" (in Polish). He currently works as Assistant Professor at GUT. His research interests include software development, computational methods and optimization for a variety of problems related to the geographic context. These methods are often based on advanced processing of different types of data using robust algorithms adjusted to problem-specific computational capacity. He is experienced in the processing of positional measurements, satellite, airborne and terrestrial imagery and LIDAR point clouds as well as in the fusion of different types of data. Currently, he is working towards increasing the positional quality of GNSS, vision-based, and multi-sensor integrated navigation systems using low-cost ubiquitous mobile devices and taking advantage of their computational capacity and additional sensors.

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Dermot McNally – PROOFREADING

Dermot McNally was born in Dublin, Ireland, and studied Electronic Engineering at Dublin City University before commencing a career centred on the Internet and on Web Applications in particular. He is a co-founder of Directski.com, an online tour operator specialising in ski holidays. As CTO of Directski.com, Dermot created the booking workflow and custom back end application engine that was among the first worldwide to support full online booking of complex package holidays.

Afterwards, he went on to become CTO of Mapflow, a Dublin company providing specialist geospatial software to the Insurance industry. Mapflow is now a part of LexisNexis Risk Solutions where Dermot occupies the role of Product Champion.

Maps, in particular digital mapping, are a major area of interest, both professionally and for leisure. Dermot is a veteran contributor to the OpenStreetMap project that builds and maintains a Free and Open map data set of the whole world. OpenStreetMap is a crowd-sourced project, a model also known as Volunteered Geographic Information (VGI). He is a board member of the OpenStreetMap Foundation and a member of the project›s Licence Working Group.

Reviews

Recenzja wydawnicza książki pt. *Earth Observation & Navigation – Law and Technology* pod dr. Marleny Jankowskiej, dr. hab. Mirosława Pawelczyka, dr. hab. Sławomira Augustyna i dr. Marcina Kulawiaka

Publikacja zbiorowa przedłożona mi do recenzji wydawniczej wymaga poczynienia kilkuuwag wstępnych. Wybór tematyki – obserwacja Ziemi i nawigacja w kontekście technologii i prawa – obejmuje bardzo aktualne zagadnienia związane z pozyskaniem i wykorzystaniem przestrzennych danych cyfrowych, w tym z danych satelitarnych, z uwzględnieniem aspektów prawnych, a w szczególności prawa własności intelektualnej.

Naukowy charakter rozprawy jest mocno osadzony na praktycznych aspektach obserwacji Ziemi w zarówno w ujęciu prawniczym jak i technicznym, co adresuje bardzo ważne potrzeby związane z wykorzystaniem nowych technologii. Połączenie tych dwóch aspektów w ramach jednej publikacji było poważnym wyzwaniem postawionym przed redaktorami i w mojej opinii redaktorzy z tego zadania wywiązali się właściwie tworząc spójną publikację.

W przedstawionej mi wersji maszynopisu część artykułów ma charakter prawniczy. Wśród nich należy zwrócić uwagę na tekst M. Barańskiego i M. Giermaka dotyczący prawnych aspektów ochrony danych osobowych pozyskanych w drodze przesyłania informacji geolokalizacyjnej oraz też na tekst M. Jankowskiej dotyczący mechanizmów ochrony danych przestrzennych pozyskiwanych z przestrzeni kosmicznej. Interesujący jest także tekst G. Cho, który opisuje nowe ujęcie prawa do prywatności w świetle technologii geolokalizacyjnych. Druga grupa artykułów poświęcona jest aspektom technicznym. Warto zwrócić uwagę na tekst K. Brunieckiego, który w przystępny sposób przybliża technologię GNSS i zagadnienia dotyczące precyzji pozyskiwanych danych. Dlatego też proponuję, by ten artykuł umieścić jako jeden z pierwszych. Także w dość ogólnym lecz ciekawym tonie M. Shoab oraz K. Jain opisują zastosowanie technologii nawigacyjnych w kontekście inteligentnych miast (*smart city).* Tematyka pozwala także szerzej opisać techniczne zastosowanie i usytuowanie prawne bezzałogowych statków powietrznych zwanych powszechnie dronami. Tekst dotyczący aspektów technicznych stosowania dronów przygotowali A. Tiwari, S.K. Sharma oraz K. Jain, z kolei o aspekty prawne tematyka ta została uzupełniona przez M. Jankowską i M. Pawełczyka.

Adam Zagórecki, Ph.D.
Senior Research Fellow
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Shrivenham, 14.09.2017

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Earth Observation (EO) is gaining ever more attention, though academic studies on technical and legal aspects of data acquisition remain few and far between. It is clear that the rapid increase in the number and diversity of data gathering methods supported by Unmanned Aerial Vehicles will gain more attention with time.
With this in mind, the editors of this book, scholars at the Faculty of Law and Administration at the University of Silesia in Katowice, came up with the idea of gathering specialists from Military University of Technology in Warsaw, Gdansk University of Technology, University of Canberra, Shaqra University in Saudi Arabia, Indian Institute of Technology Roorkee, Technical University of Dortmund, University of Warmia and Mazury as well as EuroDefense (Germany) and StratByrd Consulting to discuss the rules of creating EO databases supported by new technology tools.
It is believed that a common editorial scheme will contribute to a better understanding of the actions taken on the geo-information market, and will become a platform for exchanging ideas and experiences of many representatives of universities, public administration and business. This is the fourth book published in the *Geo&IP Series* devoted to various aspects of GI and IP law.

The scientific nature of the dissertation is strongly embedded in the practical aspects of earth observation in both legal and technical terms, which addresses the very important needs related to the use of new technologies. Combining these two aspects in one single publication was a serious issue for the editors and, in my opinion, the editors of this book actually met this challenge by creating a coherent publication.

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Projekt finansowany przez Uniwersytet Śląski w Katowicach z dotacji dla Młodych Naukowców „Regulacje prawne dla nowych technologii lokalizacyjnych" przyznanych dla dr. Marleny Jankowskiej w latach akademickich 2016/2017 oraz 2017/2018 (This project was financed by the University of Silesia in Katowice from the Ministerial Grant for Young Scholars „Legal regulations for new localisation technologies", obtained by Dr. Marlena Jankowska for the academic years 2016/2017 and 2017/2018).

Partnerem wydania jest

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Cena: 149 zł