INTEGRATION OF UNMANNED AIRCRAFT SYSTEMS INTO CIVIL AVIATION: A STUDY OF THE U.S, SOUTH AFRICA AND KENYA

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Submitted in fulfilment of the requirements for the award of the degree of:

DOCTOR OF LAWS (LLD)

IN PUBLIC, CONSTITUTIONAL AND INTERNATIONAL LAW

IN THE SCHOOL OF LAW

at the

UNIVERSITY OF SOUTH AFRICA

SUPERVISOR: PROFESSOR: DIRE TLADI

OCTOBER 2020

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DECLARATION

I declare that this thesis, titled ‘Integration of Unmanned Aircraft Systems into Civil Aviation: A Study of the US, South Africa and Kenya is my original work and that all the sources used or quoted have been indicated and acknowledged through complete references. In addition to this, the thesis has never been presented to any other University for examination.

……………………………………………………

MANANA WANYONYI EDISON RODGERS

DEDICATION

This work is dedicated to my beloved family. First, to my late mother, Doris Nabaloyo (RIP), who, for over half a century, doggedly trudged on the path against deprivation to raise her children and give them an education. Secondly, to my amiable wife, Catherine Kagendo, who has steadfastly stood by my side, together with our lovely children: Michelle, Abigail, Hope, and Neema.

Finally, to my siblings, Peter, Santos, Gellas, Collins & Brian.

ACKNOWLEDGMENT

Building on my wide experience and exposure in the aviation industry, I embarked on pursuing further studies in this discipline at a doctoral level, from a more practical lens.

I am grateful to my earlier supervisor, Professor Casper Waschefort, a former lecturer and Professor of International Law at the University of South Africa, now based in the United Kingdom (UK). Prof. Waschefort closely walked with me from the onset and aided me in developing this topic and shepherding my Doctor of Laws (LLD) project proposal through approval process. I salute you Prof, for your invaluable guidance. This was, by far, unchartered waters, and I am all too glad to make original contributions to the body of knowledge and scholarship in this field.

I am also indebted to Professor Van Der Bijl, my Master of Laws (LLM) supervisor, who encouraged me to enrol for doctoral studies. Her wisdom and encouragement emboldened me day after day to take up the challenge. Her scholarly insights shaped my legal mind to appreciate the diversity of International Criminal Law.

In equal measure, I wish to pay special tribute to my current supervisor, Professor Dire Tladi, Professor of International Law at the Department of Public Law and Institute for International and Comparative Law in Africa, University of Pretoria; Member of the International Law Commission and former Special Adviser to South Africa’s Minister of International Relations and Cooperation. I am perpetually indebted to your selfless commitment and sharp legal mind that has, in a big way, helped to hone my intellectual and critical approach to legal issues. You have always been at hand to provide timely feedback and offer impeccable guidance. Words cannot express my gratitude, but please accept my most humble word of thanks.

To my family, especially my beloved wife Catherine Kagendo, who once legitimately complained that ever since we met, more than 15 years ago, I have been a career student. Nonetheless, she always sympathized with me and wished I could take a break and created more time for her and the family. My dear, I will be forever grateful for your understanding that worked magic on my drive and motivation as I embarked on the long, arduous academic journey the countless hours away from home, and sacrifice of family resources.

To my four little girls: Michelle, Abigail, Hope and Neema: thank you for being disciplined and for sympathizing with Dad whenever he was under intense pressure to meet timelines. May you all grow to be scholars of repute!

To my late mother Doris (RIP): thank you Mum for being such an inspiration to many even as you struggled with cancer in our Nairobi house. It was my earnest prayer that you could live long to see the fruits of your selfless labour. As for my siblings, Peter, Robert, Gellas, Collins, and Brian, the late Mildred and Frank, I salute each one of you for supporting me and always standing shoulder to shoulder in our pursuit to quench the urge for knowledge, even as we gallantly fought the yoke of abject poverty. Together we have made it. Let us keep the fire burning. To our cousin, Priscila: thank you for babysitting and taking good care of us during our tender years. Bravo to our dear father Josephat Okuri Manana for being a father figure.

Special tribute goes to my former teachers at St. Antony Boys Sirisia High School: Sabwami Keya (SK), Weresia, Mwaturo, Mutundu, Wakachala, Barasa, Melemele, Kwarula (RIP), Masafu, Kasili, Lukhanyu, Wakoli, among others; and my classmates: Inno, Sikuku, Wafula, Sululu, Tenge, Muliro, Imosha, Mutoro, Nabiswa, Manyasi, Lumbasi, Sitati, and many others. Thank you, guys, for coming together to fundraise for me to enrol for the Kenya Certificate Secondary Education (KCSE) examinations, which subsequently saw me continue with studies. Thank you, Brother Peter Wamalwa, for aiding Mum in paying part of my fees. I am also grateful to friends and well-wishers who, again, raised funds that enabled me to pursue Law at the University of Nairobi. Special thanks to the team that organized the fundraiser at the Law School, University of Nairobi, led by: Peter, Wambaya, Santos, Ann Muchiri, Lillian, Betty, Siboe, Joseph & Richard Wataka, Nancy, Cate Kagendo, Kivuva, Muli, Makunda, Saleh Chemaswet, Kirimi, Pauline, Nancy, Wanjuki, Arwings, Nilesh Shaa, Nderi, Titus, Chepseba, Ombati, Kundu, Wanyonyi, Joseph Wafula, Ms Wakhungu, Mohamed Wangusi, Caro, Mr/Mrs Ndiema among others; and another team in the US led by Ian Wetzel and Ali Nusbaum,(now attorneys in the US): bravo, buddies for your generosity and kindness that saw me continue with my law studies.

To the families of Matthew Barasa Wamalwa /Joy Mwende, John Mukholi and Ian Werunga, thank you for offering me shelter in your houses when I had no place to stay in Nairobi. To my friend Agina, my learned friends Francis Wanjia, Emily Muthoni, Bosire, Wakiaga, Leonard Sang, Zandoko Amboko, Mutheu, Nelson Otieno, Faith Simiyu, Lyla Latif, Dr. Ken Obura and my former roommate at the University of Nairobi, Kennedy Siboe: thank you all for accepting to review and critique my work.

To Professor F.D.P Situma of the University of Nairobi's Law School: I thank you profoundly for agreeing to read and critique the original draft that pushed me into more research to refine this work. I equally, appreciate Professor Tom Ojienda, for finding time to peer review this thesis and offering valuable critique. Thank you Professor Kithure Kindiki for your scholarly advice and encouragement.

To my undergraduate contemporaries, at the University of Nairobi's Law School, and who are undertaking doctoral studies across the world: Faith Simiyu, Lyla Latif (at Cardiff University), Paul Ogendi (at University of Pretoria), Felix Odhiambo (at

UDSM), and Silas Jakakimba, Evelynn Asala and Francis Kariuki (at University of Witwatersrand): thank you buddies for the unwavering support and during the entire encouragement academic journey.

To all those who took good care of me while on my many academic trips to South Africa, such as Lindiwe, Meluleki (MM), Ken and Raj, please receive my heartfelt appreciation.

I wish to most sincerely recognize my current employer, the Kenya Airports Authority and specifically former and current colleagues: George Muhoho (former Managing Director), Matthew Wamalwa (former Deputy Managing Director), Stanley Mutungi (former Head of Aviation Security & Safety, who recommended my employment), Ken Kaunda, Agnes Owour, Judy Kerich, John Tito, Victor Arika, Joy Nyaga, Margret Munene, Jecinta Wafubwa, Matthew Kabetu, George Kamau, Grace Munga, Sirai, Yatich Kangugo, Amos Chena, Charles Rombo, Peter Miano, Patrick Nyoki, Samuel Langat, Shahin Mastu, Esman, Naphtali Oseko, Machio, Ngaina, Joab Shivoko, Joyce Kaumbutho, Maloba, Lavene Esiaba, Rashid Abudllahi, Victor Njeru, Caro Muthinja, Amutala, Kithuka, Ombete, Willy Biwott, S, Biwott, Wala, Gertrude, Seline Adoch, Margret Tanui, Evelyn Muriithi, Margret Okello, Peter Ndirangu, Muchugu, Ogoye, Joash, Mathews, Paulyne, Luseka, Wakoli, Lusweti, Emma, Margret Wekesa, Damaris, Sabina, Ayisi, Ms Muthoka, Wafula, Ngigi, Fred, Mwenda, Rose, Lucy Ndiko, Eng Gichuki, Adasa, Wasike, Malemo, Nyotu, Kisang, Karanja, Opondo, Chewa, Mohamed, Eric Kiraithe, Brig, (RTD) Ofulah, Col Kaleli, Dr. Kalai, Dr Koros, Dr Namanda, Jonah, Antony Njagi, Janet Chemeli (currently at ICAO head office in Montreal, Canada), Justus Kabaka (of (ICAO Regional Office in Nairobi) among others, not forgetting friends from Kenya Civil Aviation Authority (KCAA) namely, James Kandere, Millicent Henga, Wanja, Chweya, Nakasanga, Hellen, Kuchio, Ogola, Malanga, Lawrence Amukono, Muthoni (RIP), Denis and Cyril. Please accept a special mention for being wonderful colleagues and orienting me to the exciting aviation industry.

To the late Harvey Agumba (RIP), my Bachelor of Laws (LLB) dissertation supervisor: I pay special accolade to you for sharpening my legal research skills. To my friends, Matias Adasa, Lillian, June and Lucy Ndiko: thank you for your unrivalled ICT skills, which you gladly offered in forever. To my learned friend, Allen Mukuki: thank you for introducing me to Professor Dr. Wolf Muller-Rostin, a Professor of Air and Space Law in Europe, who provided me with numerous academic literature on International Aviation Law. Professor Muller-Rostin, please accept my profound gratitude for your scholarly advice and referral to Benjamyn Scott, of the Institute of Air and Space Law at the Cologne University, who has also been very helpful in offering professional advice in this field, which admittedly has few experts at doctoral level.

Special gratitude also goes to Captain Gilbert Kibe, the Director General of Kenya Civil Aviation Authority, for granting my interview request, from which I gained useful insight towards the compilation of this thesis. Distinct mention goes to members of staff at the East Africa School of Aviation (EASA) library, a place where I always called home and study abode. Thank you, Nick and your colleagues for maintaining the habitable library environment. Equally, much appreciation to the management of Ethiopian Airlines' Kenya office, for offering me rebate air tickets to travel to South Africa for my Summer School and conferences.

Finally, I am grateful to David Ndung'u, Cosmas Butunyi and Lawrence Amukono for giving this work the much-needed editorial touch, in addition, Patrick Nyoki, thank you for acceding to read entire manuscript. You are all dear to me, and I thank you most immensely.

God bless you all.

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ABSTRACT

The rapid increase and popularity of Unmanned Aircraft Systems (UAS) in civil usage around the world is due to their versatility. With advancement in technology across the globe, there are UAS of different sizes and capabilities in the market. It is imperative to note that the use and operation of UAS have numerous merits and equally, potentially poses serious risks to aviation safety, unlawful interference with States' security as well as invasion of the privacy of persons. This reality poses a challenge to integration of UAS into the civil airspaces of different States.

Accordingly, the international community developed the Chicago Convention that provides the principal framework to address the threefold concerns. At the international level, however, there is lack of a unified system of regulation of UAS. Consequently, the Chicago Convention requires States to develop national institutions and legal frameworks to not only effectively address these concerns, but also create a delicate balance between national security and right to privacy.

This thesis evaluates how the legal, institutional and policy frameworks for UAS in the US, South Africa and Kenya have addressed the current needs and challenges in operation and integrating them into regulatory frameworks for civil aviation. It follows that the three States have developed constitutional frameworks, legislation, regulations, policies and strategic plans as they seek to address the challenges that emanate from integrating UAS into the civil aviation airspace. This encompasses ineffective enforcement mechanism of regulations.

The thesis maps out experiences of integration in the three countries, emanating from research goals including investigating the extent to which existing international regulatory frameworks address the threefold concerns. The study establishes that the common thread running through UAS regulation is each country's unique issues and paths to integration. Additionally, that the approach for integration of UAS into civil aviation needs be gradual and pragmatic. For this reason, this thesis recommends the development of institutional capacity, coordination and funding, and increase in regional efforts to revamp UAS integration efforts into civil aviation.

KEY TERMS

Integration, UAS, International Law, US, South Africa, Kenya, Civil Aviation, Chicago Convention, ICAO, FAA, KCAA, SACAA, regulation, legal, Institutional, policy, framework, Safety, Security, Privacy, Annex ,Circular

LIST OF ABBREVIATIONS AND ACRONYMS

AC	Advisory Circular
ACAS	Automated Collision Avoidance System
AFCAC	African Civil Aviation Commission
AFTM	Air Traffic Flow Management
AIC	Aeronautical Information Circular
AIP	Aeronautical Information Publication
AIS	Aeronautical Information Services
AMISOM	African Union Mission in Somalia
ANS	Air Navigation Services
ASAS	Airborne Separation Assurance System
ASL	Air and Space Law
ASSR	Aviation Safety Standards and Regulations
ASTC	Aviation Security Training Centre
ATC	Air Traffic Control
ATM	Air Traffic Management
ATMS	Air Traffic Management Services
ATOs	Approved Training Organizations
AU	African Union
AUVSI	Association for Unmanned Vehicle Systems International
BC	Before Christ

CA	Communications Authority
CAA	Civil Aviation Authority
CASR	Civil Aviation Safety Regulations
CDL	Common Data Link
CFR	Code of Federal Regulations
COA	Certificate of Operations
CCS	Command and Control System
DGPS	Differential Global Positioning System
DHS	Department of Homeland Security
DOD	Department of Defense
Dr.	Doctor
EAC	East African Community
EASA	European Aviation Safety Agency
EASA	East Africa School of Aviation
ECOWAS	Economic Community of West African States
EEZ	Exclusive Economic Zone
EPA	Environmental Protection Agency
EPIC	Electronic Privacy Information Centre
EU	European Union
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulation

FBI	Federal Bureau of Investigations
FINSA	Flight in Non-Segregated Airspace
FIR	Flight Information Region
GPS	Global Positioning System
GNSS	Global Navigation Satellite System
HALE	High Altitude Long Endurance
IBID	*Ibidem*, in the same place (Immediately preceding footnote)
IAL	International Air Law
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
ICCPR	International Covenant on Civil and Political Rights
ICJ	International Court of Justice
ICT	Information and Communication Technology
ICL:	International Customary Law
IL	International Law
JAA	Joint Aviation Authority
JKIA	Jomo Kenyatta International Airport
JPDO	Joint Planning and Development Office
KCAA	Kenya Civil Aviation Authority
KDF	Kenya Defence Forces
KG	Kilogram

KJ	Kilojoules
KM/H	Kilometre per hour
KWS	Kenya Wildlife Service
LLB	Bachelor of Laws
LLD	Doctor of Laws
LLM	Master of Laws
MPS	Minimum Performance Standard
NAS	National Airspace System
NCASC	National Civil Aviation Security Committee
NCAQCP	National Civil Aviation Quality Control Programme
NASA	National Aeronautics and Space Administration
NATO	North Atlantic Treaty Organization
NCASP	National Civil Aviation Security Programme
NIS	National Intelligence Service
NLCB	No Country Left Behind
OAS	Organization of American States
OAU	Organization of African Unity
OCGA	Official Code of Georgia Annotated
PANS	Procedures for Air Navigation Services
PhD	Doctor of Philosophy
R&D	Research and Development

RC	Remote Control
RCP	Required Communications Performance
RNP	Required Navigational Performance
ROA	Remotely Operated Aircraft
RPA	Remotely Piloted Aircraft
RPV	Remotely Piloted Vehicles
RTCE	Regional Training Centre of Excellence
SACAA	South Africa Civil Aviation Authority
SADL	Situational Awareness Data Link
SADC	Southern African Development Community
SA-CATS	South African Civil Aviation Technical Standards
SASCASSOA	South African States Civil Aviation Safety and Security Oversight Agency
SARPs	Standards and Recommended Practices
SMM	Safety Management Manual
SMS	Safety Management System
SSP	State Safety Programme
SUPRA	Mentioned above
TSA	Transportation Security Agency
TVET	Technical and Vocational Education and Training
UA	Unmanned Aircraft

UAS	Unmanned Aircrafts Systems
UAV	Unmanned Aerial Vehicle
UAVS	Unmanned Aerial Vehicle Systems
UDSM	University of Dar es Salaam
UK	United Kingdom
ULC	Uniform Law Commission
UN	United Nations
US	United States
UTM	Unmanned Traffic Management
USPC	Unmanned Systems Program Committee
UVS	Unmanned Vehicle Systems
VMC	Visual Meteorological Conditions
VHF	Very High Frequency

Abbreviations of Journal Names

AASL	Annals Air & Space Law
ABAJ	American Bar Association Journal
ADR	Africa Defence Review
AFMCE	Atmospheric Flight Mechanics Conference and Exhibit
AJIC	African Journal of Information & Communication
AJME	Australian Journal of Multi-disciplinary Engineering

ALP	Aviation Law and Policy
AMA	Academy of Model Aeronautics
BIGSPP	BIGS Policy Paper
CJTL	Columbia Journal of Transnational Law
CS	Communications and Strategies
CLSR	Computer Law & Security Review
CTAWP	CTA Working Paper
CYILA	Chinese (Taiwan) Yearbook of International Law and Affairs
DJLJ De	Jure Law Journal
DPLR	DePaul Law Review
ESPIP	European Space Policy Institute Perspectives
HJLPP	Harvard Journal of Law and Public Policy
IAPA	Impact Assessment and Project Appraisal
IJAAA	International Journal of Aviation, Aeronautics and Aerospace
IJAL	International Journal of Air Law
IJAST	International Journal of Applied Science and Technology
IJC	International Journal of Computers
IJCAS	International Journal of Control, Automation and Systems
IJCL	International Journal of Constitutional Law
IJARCET	International Journal of Advanced Research in Computer Engineering & Technology

IJRS	International Journal of Remote Sensing
JAAER	Journal of Aviation/Aerospace Education & Research
JAG	Journal of Public Administration and Governance
JAL	Journal of Air Law
JALC	Journal of Air Law and Communication
JATWW	Journal of Air Transportation World Wide
JFM	Journal of Fluid Mechanics
JIS	Journal of Intelligent Systems
JLIS	Journal of Law of International Sea
JSDD	Journal of System Design and Dynamics
JSS	Journal of Strategic Security
JTEP	Journal of Transport Economics and Policy
JTL	Journal on Transportation and Logistic
JTS	Journal of Transportation Security
KJLJ-JBSD	Kenya Journal of Law and Justice: Justice Be Our Shield and Defender
KLI	Kluwer Law International
McGill LJ	McGill Law Journal
MLR	Michigan Law Review
MNA	Mobile Networks and Applications
NDLR	North Dakota Law Review
PLBIR	Privacy Laws and Business International Report

PPTE	Periodica Polytechnica Transportation Engineering
SL	Scitech Lawyer
SLR	Syracuse Law Review
TAJ	The Aeronautical Journal
TCLJ	The Cambridge Law Journal
TPIA	The Politics of International Aviation
TFSC	Technological Forecasting and Social Change
ULR	Uniform Law Review
YASL	Yearbook of Air and Space Law

CHAPTER ONE

INTRODUCTION AND OVERVIEW OF THE STUDY

1. Background

This thesis focuses on integration of unmanned aircraft systems into civil aviation with specific study of the US, South Africa and Kenya. Unmanned Aircraft Systems (UAS) are aircraft and their associated elements, which are operated without pilots on-board.[1] UAS also describe a category of remotely piloted aircraft used for non-recreational purposes and intended for commercial, military, governmental, or scientific purpose.[2] The UAS either fly autonomously or are remotely controlled. As a system, the UAS has four critical elements, namely: the command, control, communication system, and a ground crew who control the aircraft.[3] UAS is not a precise term and is sometimes referred to as unmanned aircraft, Unmanned Aerial Vehicles (UAV), remotely piloted vehicles and remotely operated aircraft or drones.[4]

Generally, UAS are identified by a number of titles such as Remotely Operated Aircraft (ROA), as previously used by the FAA and the National Aeronautics and Space Administration (NASA), of the United States (US), Unmanned Aircraft (UA) or Drones. Other terms that have been employed are: Remotely Piloted Vehicles (RPV), a term used during the pre-Gulf War times, Remotely Piloted Aircrafts (RPA), also commonly known as UAV, are used mostly by the military in many European countries.[5] Sometimes, the difference in terminology is associated with how UAS are operated. For example, if they are operated from a remote-control centre, they

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[1] ICAO Circular 328-AN/190 explanation of terms p x. See also FAA "UAS operations in the U.S. National airspace system- international operational guidance" htpp:// www.uavn.com /images/AFS-400 (Date of use: 10 November 2015).

[2] Yenne B *Attack of the drones: a history of unmanned aerial combat* (Zenith Print 2004) 13.

[3] US Department of Defense "Army Unmanned Aircraft Systems Roadmap 2010-2035" https://fas.org/irp/program/collect/uas-army.pdf (Date of use: 10 October 2019). See also K Nonami *et al Autonomous flying robots, unmanned aerial vehicles and micro aerial Vehicles* (Springer Science and Business Media 2010) 13.

[4] De Garmo MT Issues *Concerning Integration of Unmanned Aerial Vehicles in Civil Airspace* (The MITRE center for advanced aviation system development, Mclean Virginia 2010) 11.

[5] Newcome L *Unmanned aviation: a brief history of unmanned aerial vehicles* (American Institute of Aeronautics and Astronautics 2014) 20.

may be referred to as RPA.[6] However, for purposes of this thesis and to ensure uniformity, the term UAS is used to represent all these pilotless aircraft, except where specific circumstances necessitate an analogous term.

From the hypotheses provided shortly under this chapter, the US has a longer history of interactions with UAS and, hence, is the country most likely to have robust provisions and legislative steps on regulation of UAS. Studies suggest, however, that the US still experiences challenges regarding implementation of the existing regulatory framework in areas such as oversight of UAS, Sense and Avoid Technology (capability of UAS to detect other aircraft while airborne and avoid crash), standardization of safe UAS operation, and data collection, among others.[7]

South Africa has made strides in development of a robust regulatory framework for UAS, and also rates high in the implementation index by the ICAO scheme through incorporation of visibility, provision for extended visual line-of-sight operations and development of technical guidance materials.[8] Even so, States such as South Africa, that have made strides in developing regulatory frameworks, still face serious implementation challenges, such as effective enforcement mechanism.[9] First, the registration system in South Africa does not provide for means of approving and registering UAS models for private operation and operation by community-based organizations. The deficiency leads to loopholes that could expose the South African citizenry to safety and security challenges.[10] Secondly, the South African civil airspace is yet to fully integrate commercial operation of UAS. The South African

[6] Newcome *Unmanned Aviation* 20.
[7] Shima T and Rasmussen S *UAV cooperative decision and control: challenges and practical* approaches (Society of Industrial and Applied Mathematics Philadelphia 2009) xix.
[8] South African Civil Aviation Authority "South African Civil Aviation Authority Technical Guidance Material for RPAS Part 101" http://www.caa.co.za/Pages/RPAS/Remotely%20Piloted%20Aircraft%20Systems.aspx (Date of use: 28 March 2017).
[9] Ingham LA, Jones T and Maneschijn A "Considerations for UAV design and operation in South African airspace" (2006) 110 *TAJ* 695- 699.
[10] Ingham, Jones and Maneschijn "Considerations for UAV" 2006 *TAJ* 698.

regulatory framework also has the effect of precluding UAS from eligibility of being certified for commercial operation in airspaces that have not been segregated.[11]

In Kenya, UAS are not yet fully integrated into the civil aviation legal framework due to their sparing use. However, since 2016, the Kenya Civil Aviation Authority (KCAA) has made significant progress, driven by applications for licenses for the use of robotic aircraft for shooting films, relief services and commercial purposes. This has necessitated the need to bring their use under the civil aviation legal framework. By 6 October 2017, KCAA, which is the government agency responsible for regulating the aviation industry in Kenya, drafted UAS regulations to provide for licensing and registration of UAS, as well as make privacy provisions. The opportunity for integration and regulation of UAS-related issues were, however, short-lived when the regulations were declined by Parliament on 26 June 2018 for non-compliance with existing laws as well as inadequate security provisions and public participation during formulation was deemed insufficient as per the requirements of Article 10 of the Constitution of Kenya 2010, and section 5 of the Statutory Instruments Act, No 23 of 2013.[12] These challenges, including non-adherence to protection of rights to privacy as enshrined under Article 31 of the Constitution of Kenya, fines and penalties not aligned to the parent Act among others, have caused Kenya to lag behind other African countries, such as South Africa, in integration and regulation of UAS.[13] It was until 30 March 2020 that Kenya finally established new UAS regulation.

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[11] Ingham, Jones and Maneschijn "Considerations for UAV" 2006 *TAJ* 698.

[12] Mutai E and Otuki N "MPs annul drones rules over concerns of security, fines" 2018-6-18 *Business Daily* https://www.businessdailyafrica.com/corporate/shipping/KCAA-s-revised-drones-rules-set-for-Parliament/4003122-5135554-vc3c0p/index.html (Date of use: 29 September 2019).

[13] Andae G "Kenya flies behind peers in drones regulation" *2019-9-18 Business Daily* https://www.businessdailyafrica.com/corporate/tech/Kenya-flies-behind-African-peers-in-drones-adoption/4258474-5278452-fvbplqz/index.html (Date of use: 6 October 2019).

This brief, and admittedly preliminary description of the legal frameworks in the US, South Africa and Kenya suggests the regulation of UAS remains in flux and evolution with technological advancement. These domestic regulations will have to be developed in line with regulatory framework in international law, comprised mainly of the Chicago Convention, 1944 as well as regulatory instruments adopted by ICAO such as ICAO Annexes, Standards, and Recommended Practices. This thesis assesses experiences and approaches of integrating UAS into the international civil aviation legal framework, in particular in the three countries. In doing so, this thesis explores current international and domestic regulatory regimes in these countries that apply to UAS operations. Specifically, it does so through highlighting safety, security, privacy, and related challenges that are experienced both in the substance and application of the respective domestic legal frameworks. The overall goal is to come up with best practice models to suggest for adoption by the frameworks as they evolve towards ultimately achieving safe, full and sustainable integration of UAS in respective civil airspaces.

The study further makes a specific case that in spite of immense promise shown by UAS use, a number of issues have to be addressed before they can be integrated into civilian or commercial use in Kenya. Foremost among them is expansion of binding UAS regulation framework, overcoming inherent challenges facing the integration process, harnessing regional initiatives and development of sufficient institutional capacity to deal with safety, security and privacy challenges. The next section of this chapter rationalizes the general need for regulation of UAS and introduces various regulatory approaches.

2. Rationale for UAS Regulation

2.1 Overview of UAS Legal Foundation

It is now over a century since the adoption of the Paris Convention on International Civil Aviation of 1919 whose provision, under Article 15, allowed for regulation of pilotless aircraft. The proviso also informed the spirit of Article 8 of the Chicago

Convention of 1944 and the ICAO framework that was adopted 25 years later. This reaffirmation of the previous position, coupled with the fact that the adoption of the two Conventions was made under the widely recognized United Nations (UN), demonstrates a consensus at the global level on the need to regulate UAS and have them integrated into civil aviation. The effect of this consensus has cascaded to and influenced domestic frameworks of some UN member States. A review of the FAA Modernization and Reform Act of 2012 of the US, South Africa's Civil Aviation Act No.13 of 2009 as amended in 2015, and Kenya's Civil Aviation Act No. 21 of 2013, as amended in 2016, for example, shows that law reform in the area of civil aviation has increasingly tended towards regulation of UAS. The next part is generally dedicated to a brief discussion on the justification and actual dimensions of the necessity to regulate the UAS.

2.2 General Justification

The following are the reasons that generally necessitate the regulation of UAS. The reasons may vary in terms of extent and scope of motivation for regulation depending on the individual circumstances of each of the 193 member States of ICAO.

2.2.1 Expansion in use of UAS

UAS were used for military purposes from the 1920s, when the first remotely controlled craft, known as *Sperry Messenger,* was built.[14] However, current uses of UAS have expanded immensely. For example, in the mid-1990s, the first non-military UAS began being used for environmental monitoring.[15] Since then UAS have attracted a growing demand for civilian and commercial users for law enforcement, search and rescue, reconnaissance, intelligence gathering,

[14] Nunes A and Laursen T "Identifying the factors that led to the Ueberlingen mid-air collision: implications for overall system safety" (Paper delivered to the 48th Annual Chapter Meeting of the Human Factors and Ergonomics Society 20 September 2004 New Orleans) 3.

[15] Nunes and Laursen *"identifying the factors"* 3.

firefighting, and agriculture. Other emergent uses are survey, mapping, combating poaching, wildlife preservation, and scientific research.[16]

The phenomenon is generally attributed to the fact that UAS are a cheaper option for certain tasks, compared to manned aircrafts. Secondly, UAS are less affected by human factors such as fatigue, and are less likely to put a pilot's life at risk when monitoring phenomena like violent crime, hostile environments such as volcanic eruptions, securing pipelines and oil facilities, and spotting fires.[17]

Due to demand and expansion in use of UAS, some civil airspaces that were previously monopolised by manned aircrafts have had to accommodate UAS. Alongside the increased use is the increase in number of UAS. These related phenomena might endure the future of civil aviation. For instance, as Farber predicts, by the end of 2020, the US may have 30,000 UAS occupying its national airspace.[18]

The phenomena are, however, not without their challenges. When UAS is integrated into a busy national airspace environment, it raises safety issues, including risks of collision and environmental pollution. Security concerns arise since UAS can be launched from anywhere. Consequently, they can present security challenges, as they become easy tools for criminals through which perpetrators of crime can easily disguise their intentions and thus defeat the investigation capacity of a criminal justice system. Thirdly, UAS phenomenally provide a rich ground for unauthorised surveillance with potential to violate people's privacy right, testing and experimenting weaponry that could cause loss of life and destruction of property.

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[16] Nunes and Laursen *"identifying the factors"* 4.

[17] Polkowska M "Latest National Regulations on Unmanned Aircraft Systems in Military and Civil Aviation in Poland" 2012 *ESPIP* 60.

[18] Farber HB "Eyes in the Sky on constitutional and regulatory approaches to domestic drone development" (2014) 64 SLR *Syracuse Law Review* 11.

For effective provision of these concerns, all aircraft are expected to meet certain minimum safety and regulatory requirements. Such a reassurance requires development of a regulatory framework that defines approaches and standards, while creating or granting powers to institutions to monitor and implement such approaches and standards. For instance, the regulatory framework would bespeak that UAS must have ability to avoid collision with other aircraft or what is known as Sense and Avoid Technology.[19]

The urgent need for regulatory provisions is further exacerbated by recent trends of UAS' use in land surveying and adjudication and a further plausible prediction of possibility of future expansion of UAS to other important activities, such as documentation of heritage.[20] The effect of this trend and predicted future use on regulation is twofold. First, growth of the uses continues to broaden the regulatory issues around unmanned aircraft and, consequently, how they should be mapped. Secondly, it evidences the multifaceted interests that must be considered when regulating UAS.

2.2.2 New, Increased Concerns and Associated Challenges in UAS Use

There is an urgent need for regulation of UAS, in order to tackle the challenges that exist in the entire aviation chain. Although the major challenges will be discussed at length in chapter two of this thesis, it is worth highlighting some of the concerns, albeit preliminarily, which justifies the need for more effective regulation and integration of UAS in civil aviation. The challenges can be categorised into three. First, safety challenges that arise from design and use of UAS making them prone to accidents, technological challenges including inadequacy in Sense and Avoid Technologies, lack of protective frequency spectrum, and prohibitive insurance

[19] Marshall D "Unmanned Aerial Systems and International Civil Aviation Organization Regulations" 2009 *NDLR* 693.
[20] Marshall *Aerial Systems* 693.

costs.[21] Despite the increase in number and use of UAS, there is lack of adequate Command and Control System (CCS) as well as Unified Traffic Management (UTM) amongst developing States, which hinders compliance. This means that provisions for requirements that cannot be complied with would turn progressive approaches into effective bans, which may be perilous in the long run.

Secondly, there are security challenges that relate to possible misuse or cyber-hacking of data and information owing to capabilities of global positioning system technology in every UAS. The challenges are exacerbated by the potentially dirty, dull and dangerous nature of uses of UAS. The manifestations for these challenges mostly occur in cases where UAS is used in monitoring or espionage and imaging, among other uses. Other security challenges emanate from the versatility in UAS use, which enables them to be launched or propelled from anywhere thus raising security dangers. Other security challenges stand out due to the nature of air traffic control in the use of UAS together with its general risk of them falling into private hands.

Thirdly, there are privacy concerns. Ideally, privacy assurance at the international level is necessary as an extension of the human rights-based approach derived from international human rights treaties.[22] Traditionally, privacy assurance in the use of UAS has been under attack owing to use of traditional photography, where people can be photographed or observed from the sky without their consent. There have also been challenges caused by possibility of flight of UAS over residential areas. There is the possibility that an unregulated or under-regulated overflight can cause breach of private life for members of the public. Since UAS can be cheaper, quieter, and easy to access and use, it can be a notorious 'eye in the sky' which further deepens and widens the possibilities of violating privacy rights of the citizenry

[21] Marshall *Aerial Systems* 693.
[22] UN General Assembly, Universal Declaration on Human Rights 10 December 1948, 217 A (III), Article 12 and UN General Assembly, International Covenant on Civil and Political Rights, 16 December 1966 99 UNTS 171, Article 17.

compared to the previous traditional photographic technologies. The challenge is even graver, currently, since UAS is increasingly gaining high and sophisticated operation capabilities.

Already the threat has been the subject of live debate in countries like the US where Robert Mueller, a former Federal Investigations Bureau (FBI) Director, told the US Congress that UAS deployed for surveillance and procedures were being developed for their use in law enforcement.[23] This confession is a clear indicator of the develop and implement policy guidelines to ensure that such practices do not unduly compromise people's fundamental rights, such as right to privacy, as enshrined in different constitutions. Such a policy, for instance, would contemplate data protection and cybercrimes under principal legislations of various States because UAS operation may be manipulated for unauthorised purposes hence exposing data held by third parties to risk. The regulatory framework should also provide what privacy means and move away from overreliance on the constitutions for protection of the right to privacy.[24]

2.2.3 Technological Advancement

Notably, the relationship between law and technology has been an interesting one. Use of technology in operation of UAS complicates its regulation, thus necessitating every dynamic rule to contemplate and deal with constantly emerging issues. Whereas the law should govern technology, it seems to lag behind. Rawich, for example, argues that the ongoing development and use of UAS show that "law regulating UAS lags behind technology, it does not lead it."[25] This statement is even more relevant today regarding UAS regulation, owing to higher cases of computer

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[23] Mattingly P "FBI Chief admits Agency uses Drones in Domestic surveillance" https://www.washingtonpost.com/world/national-security/fbi-uses-drones-in-domestic-surveillance-mueller-says/2013/06/19/d51d40da-d925-11e2-a9f2-42ee3912ae0e_story.html (Date of use: 11 June 2016).

[24] Thompson R *Domestic Drones and Privacy: A Primer* (Congressional Research Service Washington 2015) 6.

[25] Rawich TM "Integration of unmanned aerial vehicles into the national airspace" 2009 *NDLR* 597-622.

automation, evolution of the internet, high-definition imagery and smart technology, which all mean more can be done virtually by remote control.

The information, communication, and transport systems in the world have become more ubiquitous and undergone improvements from what they were in 1944 during the development of the Chicago Convention. During the formulation and adoption of the Chicago Convention, the world relied on pre-information technology systems. Much has changed now with the design, uses and manufacturing of UAS and other activities associated with its architecture. For instance, there has been an increase in the use of sophisticated computer systems to operate UAS, which currently seem to increase the potential intrusion into privacy and, by extension, cyber security concerns more than was the case during adoption of the Chicago Convention. Therefore, even though the Chicago Convention contemplated regulation of pilotless aircraft, it did not take technology into consideration.

The need for integration of UAS into the civil aviation regime has emerged because its development and use has tremendous potential to completely change the way human beings live, travel, fight and eat.[26] This adds the perspective that besides challenges in the incorporation of ICAO-bound Standards, Annexes and Recommended Practices, there is also a chance that the law might never catch up with technology. The recognition of this limitation underpins the spirit of Article 37 of the Chicago Convention that envisages that once an international standard has been set, it would be upon contracting States to develop their own domestic rules to implement it. The Convention seems to recognize that reliance on State action will enable legal actions to keep pace with technological changes.

[26] Gupta SG, Gonge M and Jawadhiya P "Review of Unmanned Aircraft System" 2003 *IJARCET* 1646.

As Stocker *et al* aptly state, the envisaged integration can only be achieved formally through adoption of standards developed by ICAO under the provisions of Article 37 of the Chicago Convention.[27] States such as South Africa, and lately Kenya, on 30 March 2020, that have successfully tried to incorporate regulation of UAS in accordance with ICAO Annexes, Standards and Recommended Practices still grapple with challenges of implementation and enforcement as discussed in detail in chapters Five and Six of this thesis. This justifies why some authors, such as Marcontelli, opine that most UAS regulatory frameworks are largely conservative.[28] Since each country has its own unique steps and experiences in integration of the use of UAS, it suffices to state that new technological issues lead to new legal issues affecting the aviation industry and which motivate this study.[29]

2.2.4 Failure by Courts to fill Regulatory Gaps

Surveillance by UAS is anticipated to expose citizens to law enforcement agents who are permitted to gather unprecedented amounts of information. It could also lead to a security threat where States spy on one another.[30] These privacy and security challenges leave citizenry in a precarious position. Executive arms of States are fond of attempts to justify their actions whenever there is a public uproar about security, safety and privacy concerns. In such circumstances, protection of the citizenry can only be assured through judicial intervention. However, as Kerr ably notes, courts have been slow in assessing constitutional effects of new technology, such as that of UAS.[31]

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[27] Stocker C *et al* 'Review of the current state of UAV regulations' (2017) 9 *Remote sensing* 459.

[28] Marcontelli D and Douglas S "Why the Use of Drones Still Faces Big Regulatory Hurdles" 2018-9-10 *Forbes* https://www.forbes.com/sites/oliverwyman/2018/09/10/why-the-use-of-drones-still-faces-big-regulatory-hurdles/#529c17ea1c0d (Date of use: 5 October 2019).

[29] Hayhurst KJ *et al*, "Unmanned aircraft hazards and their implications for regulation" in *Aviation History and Unmanned Flight* (Twenty-Fifth Meeting of Digital Avionics Systems' Conference 15 October 2006).

[30] McAuliff M "FBI's Robert Mueller: Drones are in use in US" 2013-6-19 *Huffingtonpost* http;//www.huffington post.com (Date of use: 12 October 2018).

[31] Kerr SO "The Fourth Amendment and new technologies: Constitutional myths and the case for caution" (2004) 102 *MLR* 86. Kerr discusses challenges which need to be dealt with before courts resolve how the Fourth Amendment applies to actual searches not to technologies that merely have the potential to conduct searches, hence courts are reluctant to pass on how the privacy rights applies to a technology until when the technology has been presented.

2.3 UAS Regulatory Approaches

From the foregoing discussion, it is apparent that there are three regulatory issues that run through this thesis. The first issue is that whatever the approach, an effective regulatory regime must seek to properly balance and address safety, security and privacy challenges that arise from the use of UAS.

Secondly, redress for the challenges must be balanced to ensure that neither public nor individual interests are arbitrarily compromised. For instance, overemphasis on security challenges has capacity to compromise privacy concerns by members of the public.

Thirdly, in order to regulate UAS comprehensively, other than the public-private interests balance, there is need to ensure a careful balance of the interests of all stakeholders. Some of the notable stakeholders are flight operators, end-users, aviation authorities, and the States. Any State's regulatory authority, irrespective of the diverse nature of the approaches that they may adopt, can consider these regulatory issues.

Generally, different States adopt different approaches in overall regulation of UAS. The difference results from the fact that countries face real struggles in integrating UAS into the civil aviation framework.[32] There are a number of approaches to the regulation of UAS depending on the extent of regulation and tools employed for regulating UAS operations. Owing to this, the approaches may overlap and are not

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[32] Jones T, *Internationality Commercial Drones Regulation and Drones Delivery Services* (RAND Corporation 2017) vii & 4.

mutually exclusive. Different approaches to regulation of UAS that are endorsed by different authors[33] are explained below.

2.3.1 Outright Ban

Outright ban is an approach under which UAS are completely prohibited in the territory under the jurisdiction or control of a State. Under this approach, there is no single chance of use or licensing of UAS within the jurisdiction of the State. This approach has been adopted by countries such as Cuba.[34] The practice in most countries suggest that the total ban may occur on certain types of categories of UAS. An example of this approach was when the Republic of South Africa banned the use of camera UAS in 2014.[35] For this category of the UAS, no permits could be issued by the South African Civil Aviation Authority (SACAA). Another case is the, New York City ‘aviation’ law as adopted in New York City—Administrative Code § 10-126. The code, when read together with New York City Restriction of 2017, makes flying UAS within New York an offence.[36] The code, for instance, requires members of the public to report matters of UAS use to the police.[37] However, there have been efforts to amend this law by the New York City Council members, Paul Vallone, and Justin Brannan who proposed an amendment to the administrative code in January 2018. The amendment aims to legally allow, but overly restrict UAS flying in New York City. Considering UAS technological benefits such as use for marketing, inspection of buildings, recreational and hobbies among others, perhaps it is high time for New York City policy makers to have a relook at ‘avigation’ law, which appears unaffectedly outmoded as there is desire to exempt UAS from such provision.[38] The challenge is, however, with such a dense population and high

[33] Jones *Internationality* 6.
[34] Jones *Internationality* vii.
[35] https://www.uasvision.com/2014/06/05/south-africa-civil-aviation-authority-bans-camera-uas/ (Date of use: 16 July 2020).
[36] New York City—Administrative Code § 10-126, Section 6 (c). It provides that: It shall be unlawful for any person navigating an aircraft to take off or land, except in an emergency, at any place within the limits of the city other than places of landing designated by the department of transportation or the port of New York authority.
[37] New York City—Administrative Code § 10-126, Section 6 (3) (g).
[38] According to Collins English dictionary, avigation is defined as aerial navigation.

buildings in New York City, it may be tough for drone pilots to comply with FAA's flying over people rule.[39]

2.3.2 Effective Ban

Another regulatory approach by countries is the effective ban. An effective ban is an approach where a State allows for licencing of the use of UAS. However, the licensing is not liberal, but restricted, such that it achieves the same results as the outright ban. The goals are to present a picture that operation of UAS is possible within the jurisdiction, but the operational processes are strategically mounted with bureaucracies to ensure that practical achievement of the operation is usually impossible. This is done through deliberate creation of technical hurdles in sanctioning certain allowable UAS activities. The restrictions do not, however, amount to a total ban when the conditions are complied with. From the experience of the US, this approach is ideal when a State is transitioning from total ban. An example was when the US was opening a window for exportation of weaponed UAS.[40] Previously, the US had banned the exportation of weaponed UAS. Nevertheless, currently, licensing and approvals are possible, but certain action such as illegal surveillance is prohibited. Further, the export of unarmed version, under the new policy, is limited only to US contractors.[41] The ban need not come from the State or the aviation regulatory authority. In some instances, the National Service Park has also banned use of the UAS on land and waters administered by it.[42]

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[39] The US' Federal Aviation Regulations, Part 107 Section 107.39 provides that: "No person may operate a small unmanned aircraft over a human being unless that human being is: Directly participating in the operation of the small unmanned aircraft; or Located under a covered structure or inside a stationary vehicle that can provide reasonable protection from a falling small unmanned aircraft".

[40] Trible S "US open door to armed UAS exports" https://www.flightglobal.com/us-opens-door-to-armed-uas-exports/115939.article (Date of use: 16 July 2020).

[41] Trible https://www.flightglobal.com/us-opens-door-to-armed-uas-exports/115939.article (Date of use: 16 July 2020).

[42] https://www.nps.gov/articles/unmanned-aircraft-in-the-national-parks.htm (Date of use: July 2020).

2.3.3 Permissive Approach

The third approach is a permissive approach.[43] The permissive approach is nearly opposite of the outright ban due to its more liberal approach compared to other regulatory approaches. The more liberal approach does not, however, translate into lack of regulations. Such an approach may still adopt regulatory framework, consisting of manuals, policies and rules on licensing, registration and insurance, that are worded in a straightforward manner with step-by-step processes that are easy to follow by applicants throughout the UAS value chain. The permissive approach can be further divided into either full permission or *ad hoc* permission. *Ad hoc* permission allows the State to evaluate applications for certification on a case-by-case basis.

A permissive approach, as opposed to an effective ban approach, envisages that straightforward rules and laws are to be supported with adequate State actions in matters that include investment in infrastructure, trainings and UAS-based pilot examinations, as well as insurance to ensure safety measures are enhanced. In other words, countries that adopt and apply this approach must do all they can to ensure there are human and technical skills and expertise.[44]

[43] https://www.gcaa.gov.ae/en/Pages/uas_old.aspx (Date of use: 2 January 2019).
[44] Jones *Internationality* 6.

2.3.4 Wait-and-See Approach

Lastly, States that have not done much in regulation for UAS have adopted a wait-and-see approach.[45] Those adopting this approach first observe how regulations are applied in other jurisdictions before they can think of applying them in their respective jurisdictions.[46] While the wait-and-see approach is what countries ideally do in the first stages of UAS regulation, such countries with usually do this for the long term and not as a precursor to immediate legal and policy development.

3. Problem Statement

This study is motivated by the increase in the use of UAS technology without the necessary integration into civil aviation by a unified single international legal regulation. The void has caused several challenges that are worsened by some States' failure to implement national policy and regulatory framework for UAS. For States that have attempted to enact regulations, continue to face, safety, security and privacy challenges including difficulties in compliance and enforcement, slowing down the process of integrating UAS into civil aviation. Technological advancement of UAS and need for effective legal framework to respond to the influx into the airspace is a matter of urgent international and domestic legal concern that needs to be addressed as a matter of priority to catch up with the ever-changing technology.

UAS of the near future are likely to be bigger in size, and with ability of application in many sectors including carrying cargo and people, thus posing real safety challenges arising from possibility of accidents, increased avenues for terrorism and continued intrusion of privacy. Currently, the UAS-related safety, security and privacy concerns have been facelifted and diversified in such a manner and form

[45] Jones *Commercial Drones Regulation* 4.
[46] Ozerov A "Drones for Railway Infrastructure Monitoring" 2019-12-16 *International Union of Railways* https://www.unescap.org/sites/default/files/Item8_UIC_0.pdf (Date of use: 16 July 2020).

that are beyond contemplation of drafters of the Chicago Convention as well as the adopting State parties as at 1944. The possible future response to these concerns can first be deduced from the international legal framework for regulation of international civil aviation.

The international conventional framework, which is the basis of harmonization and coordination efforts of integrating UAS into the civil airspace, is difficult to implement partly because it relies heavily on soft law, without which the conventional law is incomplete. The Convention, which refers to UAS, is the Chicago Convention, in which Article 8 refers to pilotless aircraft (equivalent to UAS). The Article is rudimentary, however, as it merely states that a pilotless aircraft cannot be used devoid of a pilot over and above the territory of a contracting party without special authorization from the host State. Further, Article 8 of the Chicago Convention specifically states that it is the duty of every State to provide security and safety within its borders. The Chicago Convention does not, however, define a pilotless aircraft or its classification. Such a definition would have been vital for purposes of designing a regulatory framework. The Convention only refers to conditions through which a pilotless aircraft is to be permitted into another country's airspace in a manner that is cognisant of security and safety considerations.[47]

In order to fill the highlighted *lacuna* existing in the hard law, ICAO has developed soft laws, such as UAS Circular No. 328 of 2011 as a guiding material to member States to provide for among others, the legal framework for regulation of UAS, its systems, and personnel.[48] However, the framework developed under the Circular does not fully fill this void, but is more of a guide for State parties to the Chicago Convention. This and other ICAO adopted instruments, whose status in international law and binding force is considered at chapter Three, are not themselves treaties.

[47] Chicago Convention, Article 8.
[48] ICAO Unmanned Aircraft Systems (UAS) Circular No 328 AN/190, Chapters 1-7.

Further, there is a *lacuna* in the substantive provisions. The international framework, despite its inherent challenges, only focuses on safety and security of pilotless aircraft, but there is general tardiness regarding UAS-specific provisions providing assurances on the right to privacy. These challenges seem to continue to inhibit ability of the civil aviation international law framework to respond to current and future safety, security and privacy concerns in use of UAS.

As a result of the above implications, challenges in the international frameworks have yielded several implementation challenges in domestic jurisdiction of State parties to the Chicago Convention. All frameworks in the US, South Africa and Kenya continue to face enforcement challenges. In Kenya, for example, the initial UAS Regulations gazetted on 6 October 2017, annulled in June 2018 followed with a prohibition to fly legal notice No. 75 of 2019 thus backtracking on regulation of private, commercial and recreational use of UAS,[49] although the nullification has since been remedied with gazettement of the Kenya's UAS Regulations on 30 March 2020. It is clear that for several years, as the research progressed, Kenya did not have UAS regulation. Conspicuous during the period of lack of the regulation, was that Kenya lost some opportunities to take risk-based approaches in regulation of UAS activities.[50]

Moreover, States have been domesticating the ICAO Standards at different times as the US's, FAA Modernization and Reform Act was in the year 2012,[51] South Africa's Civil Aviation Act [52] and the Kenya's Civil Aviation Act.[53] This shows the differential approach by State parties, which is based on, among others, the laxity

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49 Andae https://www.businessdailyafrica.com/corporate/tech/Kenya-flies-behind-African-peers-in-drones-adoption/4258474-5278452-fvbplqz/index.html (Date of use: 6 October 2019).

50 See ICAO "Development of UAS Regulation" https://www.icao.int/safety/UA/UASToolkit/Pages/Narrative-Regulation.aspx> (Date of use: 16 July 2020).

51 FAA Modernization and Reform Act of 2012 Public Law No 112-095

52 Civil Aviation Act 13 of 2009 (as amended in 2015).

53 Civil Aviation Act No. 21 of 2013 (as amended in 2016).

in adopting the SAPRs developed by ICAO. Regrettably, the challenges continue to represent lost opportunities for domestic regulation of UAS, which can otherwise be fast, flexible and considerate to circumstances of each country when considering safety, security and privacy issues in use of UAS.

Some States that have tried to embrace the integration and regulation of UAS, such as Kenya, are faced with the challenge of striking a balance between respect for human rights, including right to privacy and public participation on the one hand, and the need to ensure safety, security and privacy, on the other. Other States, such as South Africa, despite making positive steps towards integration, are still faced with other execution challenges around timelines, annulment of regulations, limited approach in regulation by regulators, technicalities in passing laws, and conservative nature of regulatory authorities, among others, thereby, delaying the process of integrating UAS into civil aviation.[54] Further, existing regulatory framework is devoid of adequate provisions to address all challenges that come with ubiquity of UAS use.

In addition, there is a problem concerning application of UAS for civilian purposes and whether they can be successfully flown without violating national or international aviation law.[55] This is further compounded by the reality that without a uniform international legal framework for UAS, operators are subjected to numerous national and international regulations and standards. Even laws created by the international framework do not seem to fully mitigate issues arising therefrom.

Another identified challenge is that no specific study has been commissioned to analyse regulations of major UAS users, considering rapid growth of the aviation

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[54] L A. Ingham, *Consideration for a roadmap for the operation of UAV in South Africa Airspace* (PhD Thesis Stellenbosch University 2009) p 1-47. Also see Africa Goes Digital, training Africa's Pilots in homogenized regulatory environment (Africa Union and NEPAD) (Date of use 6 October 2019).

[55] Marshall *Aerial Systems* 693.

industry across the globe. This research, therefore, aims to analyse the extent to which international law has responded to integration of UAS into civil aviation, and how the US, South Africa and Kenya have responded in their domestic legal frameworks, towards incorporating ICAO international standards on the regulation of UAS and their respective levels of success in this endeavour. It aims at identifying the challenges associated with UAS operations and providing a roadmap for integration of UAS into civil aviation, with an opportunity for the two African States to draw lessons from the US, which has a longer history of UAS usage. Evaluation is significant taking into cognizance the increased use of UAS, which seems to have become indispensable, not only for military purposes, but also for civilian applications.

To address the legal problem occasioned by the absence of unified international UAS regulation, the thesis looks at how international aviation law and domestic laws in the US, South Africa and Kenya have responded to challenges of safety, security and privacy in their pursuance of integration of UAS into civil aviation.

4. Hypotheses

At the beginning of the study, the thesis hypothesized that the existing international regulatory framework for UAS is inadequate in addressing UAS- related challenges of safety, security, and privacy hence States are required to develop their own domestic legislations to address the challenges. Further, it hypothesized that the domestic legal, institutional and policy frameworks for UAS in the US, South Africa and Kenya experience safety, security and privacy challenges in their respective paths to the full integration of UAS use into civil aviation. Lastly, it was the author’s hypothesis that the long history of US jurisdiction with the UAS puts it in a good position to provide lessons that can be drawn by South Africa and Kenya regarding achievement effective enforcement mechanisms and assure safety, security and privacy protection.

5. Research Questions

The analysis of this research sought to answer the following research questions:

1. To what extent does the existing international regulatory framework address current UAS-related challenges of safety, security, privacy?
2. What are the rights and obligations of States in addressing those challenges under international law?
3. How have legal, institutional and policy frameworks for UAS in the US, South Africa and Kenya addressed current needs and challenges in operation and integrating them into regulatory frameworks for civil aviation?
4. What are the possible recommendations to aid faster and safer integration of UAS into civil aviation by the US, South Africa and Kenya?

The scope of the research and the research questions have been answered through analysis in subsequent chapters. The study analyses current and future status of the UAS in order to highlight current and potential future challenges. The study then proceeds, based on rules of international air law as found in treaties and customary international law, to determine whether these rules can contribute to addressing some of the operational challenges relating to UAS, such as safety, security, and privacy protection. In particular, the requirements of Article 37 of the Chicago Convention on domestication of international standards is analysed. On this basis, it proceeds to analyse domestic regulations on UAS in the US, South Africa and Kenya.

The motivation for the choice and focus of this study is the fact that States whose legislative frameworks are subject of analysis have varying pedigrees with regulating UAS. The US has had the longest experience, followed by South Africa and Kenya, respectively. It is expected that these varying degrees of experience are likely to offer lessons in responding to regulation process and not entirely for comparative purposes.

6. Conceptual Framework

In undertaking this study, the author identifies that certain concepts run across the research whose terms are important to appreciate from the onset. Suffice to note that the approach of the study is primarily informed by unity of the concepts of sovereignty of airspace and the doctrine of commingling.

6.1 Sovereignty of Civil Airspace

Sovereignty of States is the idea of exclusive control that a State has over its territory.[56] It also represents the independence of the State in regard to international relations.[57] The territory of the State includes land, airspace and territorial waters adjacent thereto. The *Black's Law Dictionary'* definition speaks more to the nature of this principle whereby the State sovereignty is not only representing a supreme power but also an absolute authority above a property or State.[58] This means that aviation authorities have the power to regulate the airspace, including one that is used by the unmanned aircraft systems.[59]

State sovereignty as recognized under different international law instruments must be respected by other countries across the world.[60] Traditionally, governance of civil airspace has been dominated by a rule that States could not contend with anything less than complete sovereignty over their airspace, unless with exception of right of innocent passage.[61] Since then, the customary law rule has been that aircraft of one State have a right to fly over the high seas, but not over the territory or territorial sea of another State.[62] However, there are exceptions to this general rule in two principal

[56] Gevorgyan K "Concept of state sovereignty: modern attitudes" (Proceedings of Yerevan State University 2014) 432.
[57] Gevorgyan "State sovereignty" 433.
[58] See Black's Law Dictionary 6th ed.
[59] Black's Law Dictionary 6th ed.
[60] The Chicago Convention of 1944, Articles 1 and 2.
[61] Dinu MC "State Sovereignty in the Navigable Airspace" (1950) 17 *JALAC* 43.
[62] Dinu "Navigable Airspace" 43.

instances. The first instance when State whose territory is being overflown gives prior authorization, achieved either through bilateral or multilateral agreements among States. This exception is reaffirmed by the Chicago Convention of 1944, which provides that every State has complete and exclusive sovereignty over the airspace above its territory.[63] The second exception occurs in instances of innocent passage.[64]

6.2 Commingling Concept

In the field of international aviation law, commingling is a regulatory concept that appreciates the need to allow operation and regulation of both UAS and manned aircraft within the same airspace, instead of only allowing domination by manned aircraft. The concept has received overwhelming support from literary works of Bartsch, who notes that an attempt to regulate manned aircraft in isolation from UAS cannot be desirable.[65] Further, application of the concept has had a huge and long judicial history and has been affirmed as applicable to aviation rules by courts and authors. Generally, interpretations have been in favour of laws that regulate UAS operations. It has thus influenced the favour of most arguments for integration of UAS into civil airspace from a regulatory perspective. However, application of the principle has been controversial and not conclusive, as its premise seems to suggest.[66]

Amidst the challenge, there is no doubt that the concept still applies to motivate application of State laws to UAS operations. This was affirmed in the Australian case law of *Airlines* of *New South Wales Pty Ltd v New South Wales.*[67] In this Australian case, the High Court of Australia affirmed that commonwealth law could extend to regulate interstate air navigation. The court also noted that there is nothing that

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[63] The Chicago Convention of 1944, Articles 1 and 6.

[64] The Chicago Convention of 1944, Article 5 and UN Convention on the Law of the Sea of 1982, Article 19.

[65] Bartsch R *International Aviation Law* (Ashgate Publishing London 2012) 19.

[66] Bartsch R *International* 19 quotes the opinions of Learned Justices Evatt and McTierman JJ.

[67] HCA 3, (1965) 113 CLR 54.

prevents commonwealth laws from prescribing measures and mechanism of UAS operations. The motivation of the regulation, the court concluded, would be to ensure safety and efficiency.[68]

The commingling concept now applies to UAS operations in both the United States and Africa.[69] Considering this concept, therefore, defining an aircraft in terms of lateral size and shape for the purposes of regulation, is highly misplaced. In any event, the laws and courts do not intend to have manifestly unjust result of imbalanced regulation of manned aircraft alone in the airspace.[70]

7. Literature Review

The Literature review for this doctoral thesis, was conclusively reviewed in the research proposal. Hence, existing literature that was relied upon to build this thesis has been integrated into the body of the thesis, hence the absence of a dedicated chapter on literature review. The reviewed literature includes writings of other scholars mooted from the main concerns identified under the problem statement and research questions. There is a lot of literature that has focused on current and future challenges that come with UAS operations.

From a previous review of existing literature and conceptual framework, there seems to be less focus on the regulation of UAS operation in Africa. The existing literature encapsulates the body of knowledge on UAS regulations discussed in subsequent chapters. The literature aids in understanding development in the use of UAS operations, and how the regulations have at their best, tried to resolve safety, security, and privacy challenges in the process of flying UAS.

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68 Mulero *et al* "Remotely piloted aircraft systems as a rhinoceros anti-poaching tool in Africa" (2014) 9(1) *PloS one* 21.
69 Mulero *et al* "Remotely piloted Systems" 21-23.
70 See *Green v. Bock Laundry Machine Co., 490 U.S. 504 (1989)* for more exposition on the principle against non-absurdity.

8. Significance of the Research

Available literature by various scholars focuses on potential uses and general challenges of UAS. Examples include authors such as Masutti, who has focused on evolution of the uses of UAS from the military to civil use, which are on the verge of sporadic increase,[71] Similarly, Saurabh Anand writes on the general challenges and risks that the use of the UAS has been associated with.[72] Further, Rawich notes that operational risks posed by use of UAS are exacerbated as earlier stated by the fact that whereas the law is always trying to, it has not succeeded in catching up with technology. These challenges are, therefore, real in this era of digital information where UAS is viewed as a moving target, with technology also moving at a rapid pace.[73] In the African context, Mulero *et al* recites similar challenges and makes a case for effective regulation to expand use of UAS into other activities such as regulation of poaching.[74] The authors conclude that for the system to work well, identified challenges have to be tackled to fully integrate use of UAS in civil aviation.

There has, however, not been a specific focus on safety, security and privacy concerns represented by the UAS from a perspective of three different jurisdictions, an aspect that this thesis seeks to add to existing literature by providing an analysis of the approach taken by the US, South Africa and Kenya, with respect to integration of UAS into civil aviation. This thesis, therefore, contributes to the limited academic research available and contributes to the existing body of knowledge on South Africa, Kenya and, by extension, African continent in the field of regulating UAS and efforts to enact policy that integrates it into civil aviation. Further, the thesis looks at insights that the two African States can share or adopt from the US, which has had the most expansive experience emanating from its many years of experience in

[71] Masutti A "Regulation of Unmanned Air System Use in Common Airspace" 2012 *Journal of Law of International Sea* 2.
[72] Saurabh A *Domestic Use of Unmanned Aircraft Systems: An Evaluation of Policy Constraints and the Role of Industry Consensus Standards* (ASTM International Washington 2007) 3.
[73] Rawich "Integration" 597.
[74] Mulero *et al* "Remotely piloted Systems" 69.

dealing with UAS. The research will provide invaluable information to the public who could be absorbed in the field of UAS as operators, manufacturers, stakeholders or ordinary citizens.

9. Research Methodology

9.1 Secondary Materials

This is desktop research. The researcher collected secondary materials in the forms of scholarly books, journal articles, conference papers, bulletins and through library searches. Secondly, the author utilized desktop research involving access and doctrinal evaluation of preposition of doctrines of legal concepts and principles including delivered judgements, statutes and rules applicable to integration of UAS into civil aviation in the US, South Africa and Kenya. Further, through the desktop research, the study has combed through the legal framework on regulation of UAS at the international, regional, sub-regional and State levels of the chosen States.

9.2 Case-Study

The thesis has adopted a proportional analysis. It an analytical analysis of three countries, namely: the US, South Africa, and Kenya. The researcher visited the three jurisdictions to appreciate and observe first-hand application of UAS into different airspace and how regulation has been developed in response to integration of UAS into civil aviation. The choice of US is informed by its extensive involvement with regulation of UAS, which provides an avenue for lessons to pick from. South Africa and Kenya, with their varying approaches to UAS and rates of compliance with international standards, provide an avenue for ease of comparison, with results that can possibly inspire other countries on the African continent in reference to SACAA and KCAA.[75]

[75] The rationale for the visits to the three countries and make observations was informed due to the technical nature of the study to learn from persons with proven record of accomplishment and expert opinion on the standards of policy and regulation of UAS in the aviation industry

10. Structure of the Thesis

The thesis is divided into eight chapters, each dealing with a specific and unique aspect of UAS integration into civilian aviation in response to the formulated research questions. Chapter One sets out the background and basis for the study. Chapter Two discusses the background to the evolution of use and expansion in design and other specifications of UAS in order to create a general understanding of current safety, security and privacy challenges that necessitate a regulatory framework. Chapter Three analyses how the international framework has responded to specific safety, security and privacy issues, together with associated challenges, and ends with a verdict on whether the framework is a perfect system of regulation.

The three subsequent chapters Four, Five and Six focus on the historical, institutional, policy and legislative experience of the United States, South Africa and Kenya regarding their respective historical redress of the security, safety and privacy concerns of UAS use and operation. The analysis of the experience in chapter Four is deliberate, since it builds the background to certain deducible lessons applicable to South Africa and Kenya as analysed in chapters Five and Six.

Chapter Seven provides a synthesis of the outcomes of the study regarding the challenges of safety, security and privacy as well as lessons that can be learnt from the experiences of the United States, South Africa and Kenya. Lastly, chapter Eight provides general conclusions regarding the effectiveness of the approaches taken by the respective States. It proffers recommendations for ICAO, South Africa and Kenya, the United States and regional economic communities particularly EAC and SADC concerning integration of UAS into civil aviation. In addition, provides and suggests areas of further research

and the impact of international and domestic regulatory frameworks. The views and opinions of experts did not influence writing of the thesis but only aided in broadening the mind of the researcher due to deep expertise and immense background on the development of regulatory landscape for UAS.

CHAPTER TWO

ABILITIES OF UAS, HISTORICAL EXPANSION AND INTEGRATION CHALLENGES INTO CIVIL AVIATION

1. Introduction

This chapter presents functioning capabilities of unmanned aircraft system, from the perspective of their use in war,[1] historical development, recognition in treaties and the practice of States. It examines the current and potential uses of UAS, emerging from their increase in civil airspace.[2] It further analyses the phenomena of uses of UAS such as environmental and agricultural monitoring, surveillance, and security operations, and examines their nexus with and impact on the safety and security concerns for the use of UAS. Beyond safety concerns, are other necessary concerns, such as the need to protect privacy and to ensure security of users and other civilians. Additionally, this chapter discusses possible efforts that one aimed at regulating unmanned aircraft system; and finally, it describes challenges inherent during operation of UAS, namely: safety, security, and privacy in integrating them into civil aviation.

2. Design and Functioning Capabilities of UAS

Design and size of UAS may have different rules applicable to them hence, the importance of this section on abilities and components of UAS. The thesis examines how UAS are made and operated in order to appreciate its competencies in the airspace, dynamics of licensing, height limitation of operations, and intensity of impacts on inherent safety, security and privacy issues.

[1] Blom JD *Unmanned aerial systems: A historical perspective* (Combat Studies Institute Press 2010) 65.

[2] Bart E *Pilotless drones: Background and considerations for congress regarding unmanned aircraft operations in the national airspace system* (CRS *Reports for Congress* 2012) 7.

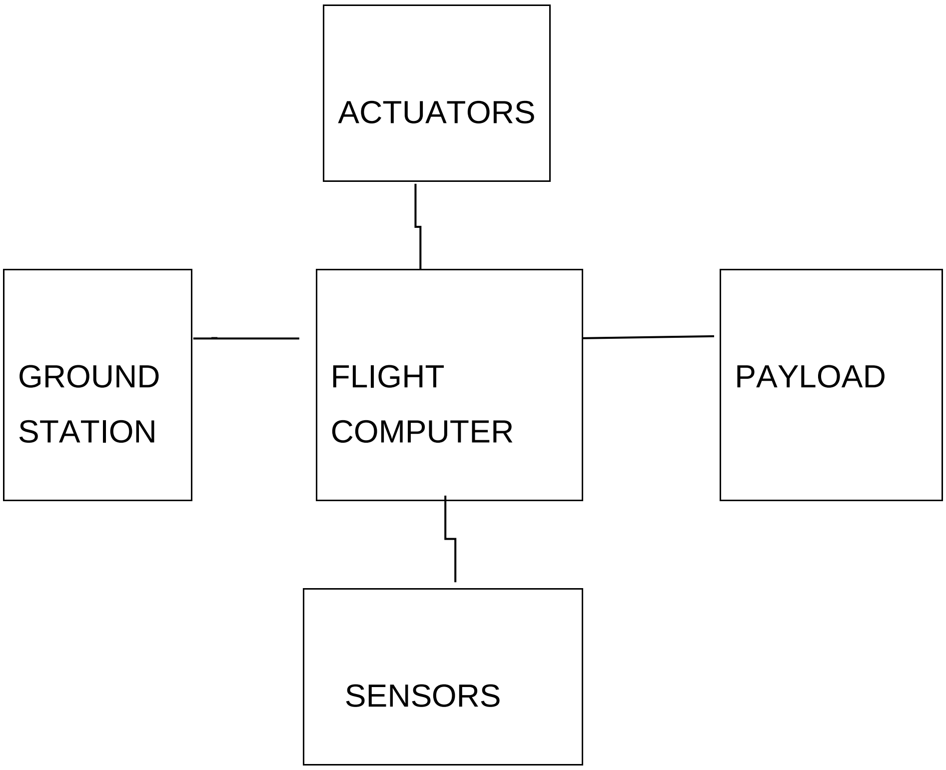
2.1 Elements of UAS

UAS comprise of three features, namely: the UA, ground control station, and the operator.[3] UA is an aircraft that is flown without a pilot, with a pilot stationed on the ground or flown by pre-programmed flight plans or a dynamic automation system that is capable of carrying lethal and non-lethal payloads (high and low resolution cameras/video) high reconnaissance, equipment, weapons and generally, any equipment required for the mission.[4]

2.2 Flight Computer/ Aircraft Control System

Figure 1: UAS Avionics

The figure below represents the avionics of the UAS. The actual operations of these avionics are discussed below:[5]



[3] Gundlach J *Designing unmanned aircraft systems: a comprehensive approach,* (American Institute of Aeronautics and Astronautics 2012) 43.

[4] HaiYang C and YangQuan C "Autopilots for small unmanned aerial vehicles: A survey" 2010 *IJCAS* 54.

[5] Ellen1 R *et al* "An investigation into the next generation avionics architecture for the QUT UAV project" http://eprints.qut.edu.au (Date of use: 16 June 2016).

Flight Computer or aircraft control system is the flight control and aircraft control system that is used to fly the UAS.[6] It is either a two-way data link radio for remote control or an on-board computer with GPS navigation connected to the aircraft control system. Flight and operating system control includes the control station, communication link, data terminal, launch and recovery systems, ground support equipment and air traffic control.[7]

Payload can either be high or low-resolution cameras/video cameras, day and night vision equipment, high power radar, electronic sights, relay systems, warfare machinery (ESM, ECM and ECCM) as required by the UAS to succeed. The need for endurance in UA requires high fuel consumption, which lowers the payload by between 10 and 20%.[8]

Sensors are used to provide basic functioning and capacity to maintain motion in the absence of human input, radar, photo/video camera, IR scanners. Sensors have a laser target designator for guiding missiles and shells. Sensing payloads on UA include intelligence collection, reconnaissance and target acquisition that provides not only support but weapon delivery due to its ability to detect and identify targets depending on constraints on rules of engagement and enhancing accuracy.[9]

[6] Ellen *et al* http://eprints.qut.edu.au (Date of use: 16 June 2016).
[7] Bilbao J "How to design an Unmanned Aerial Vehicle with great efficiency in the use of existing resources' 2008 *IJC* 2.
[8] Austin R, Wiley J and Chichester S *Unmanned Aircraft Systems UAVs Design, Development:* (Wiley Publishers 2010) 6.
[9] Austin R, Wiley J and Chichester S *UAVs Design* 6.

Navigation sensors and microprocessors constitute a critical element in UAS for purposes of navigation to accomplish the set missions. Processors allow and enable UAS to fly devoid of a human interface.[10] Aircraft on-board intelligence refers to the totality of information-gathering equipment placed in a UAS. The amount of intelligence put in a UA depends on the complexity of the task it is meant to accomplish and the oversight role of human beings. However, these technologies are not well developed, thus, their utility and reliability is limited.[11]

2.3 Control Types

Since a major characteristic of unmanned aircraft is that it operates without an operator sitting inside the cockpit, control is done by some other mechanisms. The most common forms of controlling the UAS are ground control (remote piloting), semi-autonomous and autonomous forms or a combination of two or more of these.[12] These forms are briefly discussed below.

2.3.1 Ground Control (Remote Piloting)

UAS that is controlled from the ground is also known as a remotely piloted vehicle. It thrives on uninterrupted input from the operator. RPV are sophisticated radio-controlled aircraft that use the same basic techniques discussed in preceding paragraphs. A few modern UAS are completely remotely controlled. Between the 1980s and 1990s, a rapid development of remote-controlled techniques and programmes enabled establishment of guidance systems for UAS. Since the 1990s, however, the trend has been towards creation of more autonomy for UAS.[13]

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[10] Nonami K *et al Autonomous Flying Robots, Unmanned Aerial Vehicles and Micro Aerial Vehicles* (Springer New York 2010) 7.
[11] Nonami K *et al Autonomous Flying Robots* 10.
[12] Nonami K *et al Autonomous Flying Robots* 10.
[13] Nonami K *et al Autonomous Flying Robots* 10.

2.3.2 Semi-Autonomous

Semi-autonomous control of UAS or guidance system is more commonplace. The control requires "ground input during critical portions of the flight such as take-off, landing, weapons employment and some evasive manoeuvres."[14] This system allows the operator to fully control the aircraft in pre-flight, take-off, landing and operations near the base. As soon as it gets airborne, the autopilot kicks in allowing the craft to fly along pre-programmed way points.[15]

2.3.3 Fully Autonomous

Control that is fully autonomous may not require human beings to accomplish any of its missions, because it consists of a sophisticated autopilot, allowing it to fly itself on programmed flight paths without interference for almost all missions.[16] The task of the operator is purely to monitor the system. Where an UA is fully automated, an on-board computer controls the aircraft with minimal human intervention.[17]

2.3.4 Autonomous

The hallmark of UA is autonomy of its operations, infrastructure and communication facilities. Autonomy is the ability of an agent to carry out a mission independently without human involvement, other than in an oversight capacity.[18] Decisions on-board the UAS are made by an autonomous system or delegated to an autonomous system or sub system having autonomous capacity or learning systems as part of the automated system.[19] To guarantee smooth flight, advanced control techniques such as neutral network, fuzzy logic, and sliding mode control have been used.[20]

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[14] Nonami K *et al Autonomous Flying Robots* 14.
[15] Nonami K *et al Autonomous Flying Robots* 19.
[16] Nonami K *et al Autonomous Flying Robots* 15.
[17] DeGarmo M *Issues Concerning Integration* 11.
[18] Fernández EG *Management System for Unmanned Aircraft System* (Masters Thesis Universitat Politècnica de Catalunya 2010) 67.
[19] https;//www.caa.co.uk (Date of use: 23 January 2017).
[20] Gupta SG "Review of unmanned aircraft system (UAS)" 2013 *IJARCET* 1650.

Advances in wireless networks and micro-mechanical systems have enabled usage of inexpensive micro-autopilots.[21]

3. Classification of Civilian Unmanned Aircraft Systems

Arising from the increased use, variety, size and function of UAS, classification may be necessary and convenient for lawmakers in coming up with a regulatory framework. However, as it is aptly stated by Watts *et al*, no universal classification does exist due to the diversity in capability, size and operations of UAS.[22] Some States with regulatory framework for UAS have conveniently developed different classification systems based on UAS size among other parameters.[23]

For starters, there are applications that are purely for military purposes and those that could be classified as being for civilian use. At a general level, civil UAS are categorized according to the payload of the system provided in the subsequent diagram as shown in Tables One and Two annexed to this thesis. There are other parameters such as endurance, radius of operational area, purpose and tasks performed whether dirty, dull or dangerous. For military purpose UAS, the classification is, as correctly stated by Arjomandi, mostly based on parameters of the altitude and wing loading capacity.[24]

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[21] Fernández EG *Management System* 67.

[22] Adam W *et al* "Unmanned aircraft systems in remote sensing and scientific research: Classification and considerations of use" 2012 *Remote Sensing* 1671-1692.

[23] Section 2.2.7 of ICAO Manual on Remotely Piloted Aircraft System of 2015 provides that categorization of RPA may be important for the purpose of a proportionate application to safety risk management, certification, operational and licensing requirements. RPA may be categorised according to criteria such as take- off mass (MTOM), kinetic energy, various performance criteria, area of operations, capabilities. Work is underway in forums to develop categorization scheme.

[24] Arjomandi M "Classification of Unmanned Aerial Vehicles" http://www.academia.edu/2055673/Classification ofUnmannedAerialVehicles2007 (Date of use:10 October 2017).

The next part is limited to a discussion of the common parameters for classification of both civil and military UAS. These parameters are performance specifications, level of endurance, maximum altitude, altitude, endurance, and wing loading capacity and those that are unique to the military UAS. These classifications are discussed in sufficient detail below.

3.1 Classification by Performance Specifications

Classification under the performance parameter evaluates varying ranges of performance capabilities based on maximum weights of carried elements and fuel per UAS.[25] There range from the small ones called micro UAS to the large ones with a wider reach, also called global UAS. Under this classification, five categories are recognized: super heavyweight, heavyweight, medium weight, light weight, and micro weight UAS, as performance is influenced by weight.[26] The super heavyweight is capable of carrying a heavy load of more than 2 tons. Examples are the X-45, Darkstar,[27] Predator B[28] and the Global Hawk.[29] The category of heavyweight refers to UAS that have a weight of between 200 kg and 2,000 kg such as the 60 Hummingbird and the Fire Scout. The medium weight category has UAS weighing between 50 kg and 200 kg. The fourth category is the lightweight, which comprises UAS of weights between 5 and 50 kg, such as the Dragon Eye; whereas the micro-weight category has a weight range of less than 5 kg such as the Silent Eyes.

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[25] Jessica H *et al* "Flying qualities specifications and design standards for unmanned air vehicles" 2008 *AFMCE* 6555.
[26] UAS Manufactured by Teledyne Ryan.
[27] UAS Manufactured by Lockheed Martin.
[28] UAS Manufactured by General Atomic.
[29] UAS Manufactured by Northrop Grunman.

The above information can be summarized into the table below:

Designation	Weight Range	Example
Super Heavy Weight	Above 2,000 kg	Global Hawk
Heavy Weight	Between 200-2,000 kg	A160 Hummingbird
Medium Weight	Between 50-200 kg	Raven
Light Weight	Between 5-50 kg	Dragon Eye
Micro Weight	Below 5 kg	Silent Eyes

Table 1: Classification by performance specifications.

3.2 Classification by Endurance

The parameter of UAS endurance describes the ability of a UAS to attain and remain airborne.[30] This is important since it is the ability to stay airborne that determines a UAS' range of operations.[31] High endurance UAS such as Global Hawk has capacity to be used in far off areas of between 1,500 and 2,200 kilometres away. The medium range UAS are the most common types of UAS, with an endurance of about 24 hours and a range of 100 to 400 kilometres. Examples of medium range UAS are the Shadow 600 or the Predator.[32] The last category is the low endurance that can stay airborne for only 5 hours or less. Ideally, a higher endurance translates to a commensurate operational range.

[30] Shawn G and Renaud J "Optimized unmanned aerial vehicle with wing morphing for extended range and endurance' 2002 *Symposium on Multidisciplinary Analysis and Optimization* 668.
[31] Shawn G and Renaud J "Optimized" 668.
[32] The UAS was manufactured by General Atomic.

This classification is critical when a UAS has to be used for a mission that is far from the launch site.[33] The depth of the challenges and concerns that come with the use of UAS obviously has a bearing on how long the UAS can be airborne. As such, lawmakers and policymakers around the areas of UAS use and operations should consider the parameter.

Table 2 below summarizes the information on different types of classification by endurance:

Designation	Endurance	Range	Example
High Endurance	Above 24 hours	Between 1,500 km– 22,000 km	Predator B Global Hawk
Medium Endurance	Between 5-24 hours	Between 100-400 km	Shadow 600
Low Endurance	Less than 5 hours	Less than 100 km	Pointer

Table 2: Classification by endurance

3.3 Classification by Maximum Altitude

Altitude is the vertical distance between a reference datum to the point or location of UAS.[34] UAS in general have a maximum operational altitude, which is the highest altitude within which a UAS would operate optimally.[35] Flight ceiling is an important performance criterion in the context of its applications. Those who fly below that are, generally, called low altitude UAS, also known as micro-UAS.[36] Ordinarily, military UAS would require low visibility to ensure that they avoid detection by adversaries.[37]

[33] Xiao-yd HU "Development of High-Altitude Long Endurance UAV Propulsion Technology" 2006 *Gas Turbine Experiment and Research* 4.
[34] Adam W *et al* "Remote Sensing" 1614.
[35] DeGarmo M *Issues Concerning Integration* 11.
[36] Thomas P *et al* "UAS traffic management (UTM) concept of operations to safely enable low altitude flight operations" in *Unmanned Aircraft Systems (UAS) Traffic Management (UTM)* (16th AIAA Conference on Aviation Technology Integration and Operations Conference 3 June 2016) 3292.
[37] Thomas P *et al* "Traffic Management" 3292.

For that matter, UAS that can operate at high altitude is preferred for military operations. UAS operations such as reconnaissance or imaging similarly require high altitude as it provides a better chance of making high quality pictures.[38]

As Watts *et al* rightly states, there are three categories of UAS based on the parameter of maximum altitude.[39] The first category comprises low altitude UAS, which has capacity to fly up to an altitude of 100 metres. This category of UAS is purely experimental. The second category under this classification is the medium altitude UAS with a maximum altitude of 1,000 to 10,000 metres. The last category is the high altitude UAS, that can fly over 10,000 metres and better suited for reconnaissance and imaging.

Table 3 below summarizes categories of UAS under classification by maximum altitude:

Designation	**Maximum Altitude**	**Examples**
Low altitude	Below 1,000 m	Dragon Eye
Medium altitude	Between 1,000-10,000 m	Finder
High altitude	Above 10,000 m	Darkstar

Table 3: Classification by altitude[40]

3.4 Classification by Endurance and Altitude

This classification scheme combines endurance and altitude parameters as separately explained above. Generally, classification by endurance and altitude comprises nine categories of UAS. The categories are Handheld, Close, NATO

[38] Thomas P *et al* "Traffic Management" 3292.
[39] Adam W *et al* "Remote Sensing" 1614.
[40] Adam W *et al* "Remote Sensing" 1614.

type, Tactical, Medium Altitude Long Endurance, High Altitude Long Endurance, Hypersonic, Orbital, and CIS Lunar Earth-Moon Transfer.[41]

The nine categories of UAS differ in terms of endurance and altitude, with an increase along numerical expression from low altitude to low endurance. Handheld have an altitude of 2,000 feet or 600 metres, with a range of 2 km.[42] The close type has an altitude of 5,000 feet or 1,500 metres and a range of up to 10 kilometres. The North Atlantic Treaty Organization (NATO) type UAS, has an altitude of up to 10,000 feet or 3,000 metres with a range of 160 kilometres. Medium Altitude Long Endurance UAS has an altitude of up to 30,000 feet or 9,000 metres and a range of over 200 km.[43] High Altitude Long Endurance UAS has an altitude of over 30,000 feet with an indefinite range of distance.[44] Hypersonic types are high speed UAS, further classified into supersonic and hypersonic. Supersonic UAS have speeds of between Mach 1-5, while Hypersonic UAS have speeds of beyond Mach 5.[45] Hypersonic UAS have altitudes of 50,000 feet or 15,200 metres or suborbital altitude with a range of over 200km. Orbital UAS have a low earth orbit altitude with speeds of beyond Mach 25.[46]

The table below summarizes the categories of the UAS in terms of endurance and altitude.

Category	Range	Altitude
Handheld	2 km range	2,000 Ft (600 m)
CLOSE	Up to 10 km range	5,000 Ft. (1,500 m)

[41] Peterson ME "The UAV and the current and future regulatory construct for integration into the national airspace system" 2006 *Journal of air law and commerce* 522-551.
[42] DeGarmo M *Issues Concerning Integration* 11.
[43] DeGarmo M *Issues Concerning Integration* 11.
[44] DeGarmo M *Issues Concerning Integration* 11.
[45] Freeman NC "On the theory of hypersonic flow past plane and axially symmetric bluff bodies" 1956 *JFM* 366-387.
[46] DeGarmo M *Issues Concerning Integration* 12.

NATO type	About 160 km range	10,000 Ft. (3,000m)
Tactical	-	-
MALE	Over 200 km range	Up to 30,000 Ft. (9,000 m)
HALE	Indefinite range	Over 30,000 Ft.
HYPERSONIC	Over 200 km,	50,000 Ft. (15,200 m) or suborbital altitude
ORBITAL	Over Mach 25	Low earth orbit
CIS	Lunar Earth	Moon Transfer

Table 4: Classification by range and altitude

3.5 Classification by Wing Loading Capacity

Wing loading capacity is the capacity of the total area of an UAS that is divided by the area of the wing often measured in Ounce square foot.[47] UAS classification by wing loading capacity comprises three categories: low, medium and high. The formula for arriving at the wing loading capacity is as shown below:

$$\boldsymbol{Total\ Wing\ Loading\ Capacity} = \boldsymbol{UAV\ Total\ Weight}\ (\boldsymbol{kg})/\ \boldsymbol{AV\ Total\ Wing\ Area}\ (\boldsymbol{m}^2)$$

UAS with wing loading capacity of below 50 kg/m^2 are considered to be of low loading, while those with wing loading capacity of between 50 kg/m^2 and 100 kg/m^2 are considered to be of medium loading capacity. UAS with wing loading capacity

[47] J Thomas et al 'AirSTAR: A UAV platform for flight dynamics and control system testing' (2006) (25th AIAA Aerodynamic Measurement Technology and Ground Testing Conference) 3307. An Ounce square foot is recorded as oz.ft2. For conversation purposes**,** 1 g.m2 = 0.379686 oz.ft2.

of over 100 kg/m^2 are high loading capacity. Table 5 below summarizes the various categories of high and low loading capacity for UAS.

Designation	Wing loading kg/m^2	Examples
Low Loading Capacity	Below 50 hours	Predator B
Medium Loading Capacity	Between 50-100 hours	Silver Fox
High Loading Capacity	Above 100 hours	Pointer

Table 5: Classification by wing loading capacity.

3.6 Classification of Military UAS

Military UAS is a type of UAS, which is used to support operational, tactical and strategic operations of the military.[48] UAS have been used for military applications since the Second World War. For example, in 2005, application of UAS for military onslaught in Iraq reached 100,000 flight hours. This creates another classification scheme that relates to the various roles of the mission as well as the size and capability of the military UAS. They include micro-aerial vehicles, local area support vehicles, tactical area support vehicles, and theatre area support vehicles.[49] These classifications of military UAS are dependent upon the environment, which determines the level of autonomy and capacity of manoeuvrability required for purposes of accomplishing the mission at hand.[50]

[48] Vachtsevanos GV and Valavanis KP "Military and civilian unmanned aircraft" 102.
[49] http://www.nasa.gov (Date of use: 9 October 2019)
[50] http://de.calameo.com (Date of use: 9 October 2019).

3.7 Other Classifications

According to Arjomandi's panoptical views, there are other parameters for classification of UAS such as engine, which further yields various categories such as Turbofans, two strike, Piston Rotary, Turboprop, Push and Pull, Electric and Propeller. These categories do not fall under the classifications cited above.[51] The other possible parameters are based on power or thrust loading, which is defined by the amount of weight a UAS can lift.[52] It is, however, different from the parameter of performance arrived at by calculating the ratio between the thrust and its weight.

The import of the above highlighted classifications inevitably suggests that any effective UAS regulatory framework must not only focus on omnibus prohibitions and prescriptions. Instead, such a framework ought to be comprehensive to cater for differences in the weight load, performance capacities, and use among others. For instance, use of the UAS for strategic military operations raises more security issues. In addition, UAS that are more likely to fly at a high-altitude risk exposing the citizenry to possible intrusion into their privacy. Subsequent chapters shall analyse how international law and some domestic frameworks have tried to cause a distinction in regulation of the different classes of UAS.

4. Brief History of UAS

Apart from the discussion on the various classifications of the UAS, the history of manned aircraft and UAS is useful to the study as it informs the invention and development of air transport and aircraft. Since the invention of the first manned aircraft by the Wright Brothers in 1903, unprecedented leaps have been made in the aviation industry. The development of UAS use, which was originally preceded by scepticism, has surged especially after the impetus given by the nature of World War I, during and after the war into the Cold War era up until now.

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[51] http://de.calameo.com (Date of use: 9 October 2019).
[52] http://de.calameo.com (Date of use: 9 October 2019).

4.1 Early History of Manned Aircraft

The idea of flying has intrigued man since the beginning of civilization.[53] That humans could fly was first contemplated more than 2,500 years ago in Greece and China.[54] Pythagoras and Archimedes conceptualized studies on autonomous mechanisms for various applications. Archytas from the city of Taranta created the earliest known and recorded flying machine or Tarentum in Southern Italy, known as Archytas or Tarentine,[55] and in 425 BC, became the first engineer to build a mechanical landing craft, which flew for about 200 metres.[56]

During the same era, the Chinese documented the idea of a vertical flight aircraft. For many years, the Chinese had experimented with many flying machines like hot air balloons, rockets and kites. In 1483, Leonardo da Vinci designed an aircraft capable of hovering, controlled by its aerial screw or gyroscope.[57] Later on, in 1508, da Vinci developed a mechanical bird with ability to flap its wings.[58] Over two centuries later, the first hot air balloon flew in 1782. The balloon was designed by the Montgolfier Brothers and was considered the first unmanned flight. Many more flying aircraft were developed in the period 1860 to 1909, initially focusing on vertical take-off and landing craft arising from limitations posed by the steam engine.

In the 18th Century, there was general scepticism that man could fly through the air with equipment that was heavier than air. In 1895, Lord Kelvin commented that flight with machines that were heavier than the air was impossible. Thomas Edison, who held similar views, was convinced that possibilities of the airplane had been exhausted and that humanity ought to turn elsewhere in innovation.[59] Apart from the

[53] DeGarmo M *Issues Concerning Integration* 4.
[54] DeGarmo M *Issues Concerning Integration* 3.
[55] DeGarmo M *Issues Concerning Integration* 12.
[56] DeGarmo M *Issues Concerning Integration* 12.
[57] http://www.hiller.org/ (Date of use: 19 June 2016).
[58] DeGarmo M *Issues Concerning Integration* 12.
[59] DeGarmo M *Issues Concerning Integration* 1.

impossibility presented by authors of the 18th century, others, such as Simon Newcomb, believed that the purported flights were not practical and, if anything, insignificant.[60] With this scepticism, it was apparent that the end of the 18th Century was marked with uncertainty as to whether manned aircraft were needed in the airspace and whether the aviation industry meant anything to humanity.

The uncertainty was only tucked in the early days of the 20th Century. On 17 December 1903, the world witnessed a remarkable event, by way of the first manned aircraft flight by the Wright Brothers.[61] The flight, which took place at Kitty Hawk, North Carolina, set in motion mechanisms aimed at improving transportation, comfort, capability for pilots, as well as safety in the industry.[62] This was a historic moment because other than its pioneering role, it kick-started a long journey for the aviation industry culminating in the diverse entity it has become today.[63] It put to rest the issue of uncertainty, which was cultivated by the authors in the 18th Century. Since then, the use of unmanned aircraft has reached unprecedented levels.

4.2 Development of UAS

Unlike development in the use and operation of the manned aircraft, the development of UAS has been largely associated with wars or military campaigns, testing and part of weaponry tools.[64] They have also been comparatively more spontaneous.[65] The first recorded use of UAS was in 1871, when the Austrian army dropped bombs in Venice, Italy, using unmanned balloons.[66] Current trends in UAS technologies, however, trace their origin to the First World War.[67] More development took place during the inter-war years between 1918 and 1939, the Second World

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[60] DeGarmo M *Issues Concerning Integration* 1.
[61] Klaus RA *Development of a Sense and Avoid System for Small Unmanned Aircraft Systems* (MS Thesis Brigham Young University 2013) 3761.
[62] Wright W "The Wright Brothers' Aeroplane" 1916 *TAJ* 100-106.
[63] Wright W "Aeroplane" 1916 *TAJ* 104.
[64] Suraj GG, Ghonge MM, and Jawandhiya M "Review of unmanned aircraft system (UAS)" 2013 *IJARCET* 1646-1658.
[65] Suraj GG, Ghonge MM, and Jawandhiya M "Review" 1651.
[66] Michaelides-Mateou *et al*, "Flying into the Future with UAVs: The Jetstrea Flight" 2014 *ASL* 113.
[67] Keane JF and Carr SS "A Brief History of Early Unmanned Aircraft" 2013 *JHAPLTD* 558-571.

War, the Korean War and the Vietnam War. There was further use of UAS in the Yom Kippur War of 1969, the Egypt-Israeli War of 1973, the first and second Persian Gulf Wars and the war against terror in Afghanistan.[68]

During the First World War, the focus of unmanned aircraft system technology was on manufacture of aerial torpedoes.[69] The Korean War also involved experimentation in missions, sensors and munitions to enable strikes and reconnaissance for military commanders. Subsequently, in the 1950s, there was a shift towards development of cruise missile and UAS.[70] The use of UAS, however, highlighted two major weaknesses. First, the crew was unable to launch and recover the UAS as upon striking the target, it was destroyed instantaneously. The second challenge was difficulty of stabilizing the UAS while airborne.[71] These challenges necessitated further development of UAS with better abilities and modern technology into what we see today.

5. Current and Potential Use of Unmanned Aircraft System (UAS)

The history of use of UAS shows that early traditional uses were confined to warfare. Subsequent developments, from the 1910s to date, evidence an increase in deployment of the UAS, not only for warfare, but also for varied military reasons, such as intelligence gathering, surveillance, reconnaissance, border patrol, counter-terrorism operations, and airstrikes.[72] Progressively, there has been an upsurge in the use of unmanned aircraft systems in civilian aviation for research, crowd control and homeland or internal security. The history of military use of UAS, therefore, continues to operate alongside the civilian use.

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[68] Cole C *Drone Wars Briefing* (Drone Wars UK Oxford 2012) 558-571.
[69] Cole C *Briefing* 569.
[70] Fahrney DS and RADM U "The Birth of Guided Missiles" (Paper delivered at Conference of US Naval Institute December 1980) 54–60. Cruise missile refers to a one-way lethal munitions designed to strike specific targets. 1980.
[71] Cole C *Briefing* 564.
[72] Koldaev A and Sokut S "Russia Military Conservatism in Relation to Industry" 2005 *UAV Systems, The Global Perspectives* 100-104.

Owing to the increase in civilian uses, UAS have potential to be used in missions that are not conducive or safe for human beings (pilots) to operate in. As Koldaev correctly notes, these missions have certain chemical, biological, radiological and nuclear properties which present difficulties in their use.[73] It is what he summarizes as “dull, dirty and difficult missions.”[74] In its analysis, this thesis adopts Koldaev’s distinction on the missions due to its convenience in highlighting peculiar safety, security and privacy issues that arise from each category of the missions. It is no doubt that the paradigm shift in use, operation sizes and, consequently, mission have deepened the concerns about safety, security, and privacy.

5.1 Dull Operations

Dull operations can be defined as operations, which would be shunned by human for reasons of being boring.[75] UAS are preferable for use in dull operations because of their virtual ability to operate for long missions and to observe risk incidences to the tune of about 30 to 40 hours.[76] These tasks can be automated if need be, as they only require oversight rather than continuous and consistent human presence. The tasks comprise observations of patterns of life, surveillance of fixed locations, support of services over electronic warfare, relaying communication and aerial refuelling.[77] They could also raise other complex and sensitive tasks that are unlikely to be undertaken by a simple task platform.[78]

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[73] Koldaev A and Russia S “Military Conservatism” 100.
[74] Koldaev A and Russia S “Military Conservatism” 100.
[75] Judson J “Future Unmanned aircraft to do the ‘dull’ and ‘dangerous’ work” 2018-3-26 *Defence News*. https://www.defensenews.com/digital-show-dailies/global-force-symposium/2018/03/26/future-unmanned-aircraft-to-do-the-dull-and-dangerous-work/ (Date of use: 22 December 2019).
[76] Office of the Secretary of Defense “Unmanned Aerial Vehicles Roadmap 2002-2027” http://oai.dtic.mil/oai (Date of use:18 October 2017).
[77] Gupta SG “Review” 1646.
[78] Gupta SG “Review” 1646.

One of the most common dull operation is the internal security and border control. Further, UAS have a potential to be used in civilian tasks like internal/ homeland security, monitoring of the coastline and the provision of security in public gatherings. This operation is evident in the US. After the terrorist attack of 11 September 2001, surveillance became a critical issue for UAS,[79] particularly for State institutions that require constant surveillance. Accordingly, the US patrol is operated under the Customs and Border Protection, along the border with Mexico and Canada.[80] The UAS is preferred for ability of some UAS to carry out about 30 hours' monitoring mission, which requires services of up to 10 manned helicopters.[81]

In the US still, the use of technology to secure and monitor coastlines has been applied to enhance border patrol along the US coastline for a long time now. For example, the General Atomics MQ-9 Reaper is used along the Arizona-Mexico border to isolate not only persons entering the country illegally, but also those involved in smuggling.[82] Growth of insecurity from terrorism as illustrated by the 9/11 debacle increased demand for UAS. In the US as stated earlier, the use of UAS for security purposes is restricted to customs and border surveillance on the US/Mexico and US/Canada borders. For customs and border protection, Predator has filled gaps in surveillance where the terrain is difficult.[83]

The services offered include sustained border coverage, which has significantly reduced risks of fatigue and harm to border agents.[84] They are equipped with infrared and high-resolution imaging equipment have been used to monitor drug smuggling along the Pacific Ocean, off the coast of El-Salvador. Unmanned aircraft

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[79] Padgett T "Using Drones in the Drug War' *2012-6-8 Time* http://www.time.com (Date of use: 15 October 2017).

[80] Haddal CC and Gertler J *Homeland Security: Unmanned Aerial Vehicles and Border Surveillance* (Library of Congress Washington DC Congressional Research Service 2010) 8.

[81] Haddal CC and Gertler J *Homeland Security* 8.

[82] Customs and Border Protection Agency "U.S. Customs and Border Protection UAS Overview'' http://www.cbp.gov (Date of use: 4 December 2016).

[83] Haddal CC and Gertler J *Homeland Security* 88.

[84] Haddal CC and Gertler J *Homeland Security* 88.

systems are also deployed by law enforcement agencies for purposes of facial recognition forward-looking infrared imaging.[85] UAS help the police respond to emergencies, conduct surveillance, search and rescue especially during bad weather; as well as traffic monitoring, nuclear, biological and chemical sensing and tracking.[86]

Another possible dull mission is agricultural monitoring. Unmanned aircraft systems technology has a role to play in agriculture, such as monitoring soil erosion, crop maturity, frost mitigation and application of fertilizers.[87] In Japan, for example, robotic helicopters attached to UAS are used to monitor more than 10% of that country's rice farms, driven by the Fuji Heavy Industry. Yamaha has also developed UAS that is used in chemical spraying, with more than 8,000 pilots in 2007.[88]

UAS are chosen for such missions because of their efficiency in image-taking. This is so since UAS can also fly pre-determined flight paths and take accurate pictures of target flight.[89] Accordingly, high-resolution vineyards and coffee field images that show crop maturity have been developed using UAS.[90] The efficiency results from UAS' use of technologies that include airborne platforms, thermal infrared imaging technology, and data telemetry. Others are development of algorithms that track tagged wild animals as well as monitor wildlife inventory.[91]

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[85] Carr EB "Unmanned aerial vehicles: Examining the safety, security, privacy and regulatory issues of integration into U.S Airspace" https://www.e-education.psu.edu/geog892/sites/www.e-education.psu.edu.geog892/files/sp-Drones-long-paper.pdf (Date of use: 14 October 2017).

[86] DeGarmo M *Issues Concerning Integration* 11.

[87] UAV Markets Space Consulting "UAV Agriculture and Wildlife Management" http://www.uavm.com (Date of use: 23 November 2016).

[88] Kenzo N "Prospect and recent research and development for civil use autonomous unmanned aircraft as UAV and MAV" 2007 *JSDD* 124.

[89] Jensen et al "The Use of an unmanned aerial vehicle as a remote sensing platform in agriculture" 2011 *AJMDE* 139-146.

[90] Johnson LS "Collection of ultra-high spatial and spectral resolution image data over California vineyards with a small UAV" (Paper presented to the International Symposium on Remote Sensing of the Environment. Honolulu 2003) 1-3.

[91] ResearchGate "UAV collaborative and UAV applications: fire management -project overview" http://www.uav-applications.org/projects (Date of use: 15 October 2017).

Secondly, the use of UAS can be comparatively cheaper. There is evidence that UAS have helped farmers detect crop growth and blight at a cost that is 25-50% less than that of fixed wing aircraft.[92] Consequently, farmers are able to save money, time and resources. All these show the potential of UAS in agriculture and wildlife conservation.

Thirdly, UAS can be used for scientific research. The research often requires data to be collected over long periods. Specific types of UAS fixed with advanced technological systems are preferred for the research due to their high endurance capacity.[93] In comparison to satellites, UAS have superior sensor capabilities suitable for collecting data.[94] They are able to collect atmospheric data in air columns using inbuilt instruments, thus offering a broad basis of data than could be collected using satellite.[95] These added advantages have enabled humans to gain insights into atmospheric science that was previously thought to be the preserve of science fiction. This potential, however, is only realizable if UAS is fully integrated into existing civil aviation legal and policy framework. In the words of Ali Mazrui, it is safe to state that:

> "Globalization is much more than the Information Superhighway and the new expansion of international markets. Globalization consists of all the forces, which are pushing the world towards becoming a global village. Globalization is the villagization of the globe."[96]

From this perspective, therefore, the UAS technologies are here to stay and States must adopt it for the benefit of humankind in scientific research.

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[92] Caumont A "Start-Up" 28-11-2016 *Washington Post http://www.washingtonpost.com* (Date of use: 23 November 2016).

[93] Hagenauer B "Ikhana UAV gives NASA new science and technology capabilities*" 2007-3-29 NASA Press Release* http://www.nasa.gov (Date of use: 2 December 2016).

[94] Skrzypietz J *Unmanned aircraft systems for civilian missions* 2012 *BIGSPP* 18.

[95] Reuder J "UAS" in *Atmospheric research: reality visions challenges* (Paper presented at the 17th UAVNet Workshop 12 October 2009 Brussels) 22.

[96] Ali Mazrui is academic professor, and political writer on African and Islamic studies and North-South Relations. 1933-2014

Fourthly, dull missions may take the form of environmental monitoring. UAS have become pivotal in complementing existing satellite installations to increase capacity for monitoring climatic, and specifically, rainfall patterns.[97] They are equally useful in navigating environments that are dangerous to human beings, such as volcanic activities.[98] This capacity for measurement of geophysical processes that relate to natural hazards, such as aerosols, gas levels in the clouds, changes in the ozone layer, pollution, quality of air, water vapour, composition of vegetation, and coral reefs, is unrivalled. They are also used in monitoring emissions, which pollute the ozone layer, oxygen and carbon dioxide levels in the clouds, soil moisture, extreme weather observation, and forecasting.[99]

5.2 Dirty Missions

A dirty mission is a mission that is chemically contaminated or has potential of radioactivity.[100] Potential of use of UAS in dirty missions results from its preference at times of peace and in hostile environments that are unsuitable for manned aircraft. For example, after an atomic bomb was dropped in Hiroshima and Nagasaki in Japan during the World War II, use of manned flights would have been impossible due to the risk of exposure to radioactive materials that cause grievous harm to different life forms. Admittedly, sampling and observation of chemical, biological, radiological and nuclear weapons is best suited for the unmanned aircraft system so long as it is fitted with appropriate sensors, with a choice of either small and portable systems for local tactical use, or large aircraft sized systems for global monitoring purposes.[101] With regard to civilian use, fire brigades apply UAS to

[97] Efron S *The use of unmanned aerial systems for agriculture in Africa can it fly* (PhD Dissertation Pardee Rand Graduate School 2015) 5.
[98] D Gonzales D and Harting S *Designing unmanned systems with greater autonomy using a federated, partially open systems architecture approach* (Rand National Defence Research Institute Santa Monica 2014) 23.
[99] Gonzales D and Harting S, *Designing* 61.
[100] National Air and Space Museum "Drones Doing Dirt and Dangerous Jobs" https://airandspace.si.edu/stories/editorial/drones-doing-dirty-and-dangerous-jobs (Date of use: 22 December 2019).
[101] Gupta SG "Review" 1654.

locate fires in remote areas or those with huge smokes and flames. In such cases, it makes it possible and convenient for successful approach and containment.[102]

5.3 Dangerous Missions

Dangerous missions can be defined as missions that enter airspaces of conflict or spaces with contestations.[103] In military terms, a dangerous mission refers to one that may be used to suppress an enemy's air defense.[104] Operations, such as reconnaissance in enemy territory, are dangerous in the sense that they could expose manned aircraft to unnecessary risk. Thus, unmanned aircraft systems are preferred for such missions. Consequently, less expensive UAS are used to destroy enemy positions or force the enemy to expend a large number of missiles.[105] The potential for UAS to replace dangerous missions, such as delivery of tactical supplies and identification of improvised explosive devices, is therefore unlimited owing to increase in areas in which manned aircraft would be unsuitable for use owing to the obvious risks to human life.

6. Civilian Application of Unmanned Aircraft Systems (UAS)

From the above analysis, it is clear that UAS has been emerging as a new evolutionary component to civil aviation, thus offering innovative and exciting opportunities for day-to-day operations. Some of the available solutions to humankind are identified above. These include management and prevention of disasters, fire-fighting missions[106] as well as real time assessment of extent of

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[102] Cole C *Briefing* 558.
[103] Judson https://www.defensenews.com/digital-show-dailies/global-force-symposium/2018/03/26/future-unmanned-aircraft-to-do-the-dull-and-dangerous-work/ (Date of use: 22 December 2019).
[104] Judson https://www.defensenews.com/digital-show-dailies/global-force-symposium/2018/03/26/future-unmanned-aircraft-to-do-the-dull-and-dangerous-work/ (Date of use: 22 December 2019).
[105] O'Connell ME *Drones under International Law* (International Debate Series Whitney Harris World law Institute 2010) 1.
[106] Mika P *Emergency Service Use of UAS* (UAS Yearbook – UAS: The Global Perspective 2009/2010) 137.

damages.[107] For example, during the 2010 Haiti earthquake, UAS were used for long hours to collect data on the disaster.[108] With such gathered information, especially by the aid of high-resolution photography, it was possible to locate ideal areas for landing and take-off by response teams. Another example is when in 2011, UAS known as High Altitude Long Endurance (HALE) were used to fly over the Fukushima Daichi Nuclear Plant in Japan to assess the extent of damage after the country was hit by a tsunami.[109]

Further, the UAS' emerging role in inspections and border controls, scientific research, environmental and agricultural monitoring cannot be gainsaid. In Kenya, for example, actual attempts have been made to have UAS integrated in tracking cattle, directing security personnel and surveillance to locate rustlers and stolen cattle.[110]

Accordingly, UAS applications and uses have become an integral part of the life of citizens. This obviously draws from the importance of their role in gathering information and ability to be used in salvaging shipwrecks, airplane crashes or victims, which are common occurrences of the 21st Century.[111] Accordingly, if the UAS are well utilised and regulated, they could play a huge role in bridging the information and technological gaps that were traditionally considered insurmountable.

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[107] O'Connell ME *International Law* 2.

[108] Petcoff RP "Global Hawk Collects Reconnaissance Data During Haiti Relief Efforts" *2010-1-15 US Air Force Press Release* https://www.af.mil/News/Article-Display/Article/118014/global-hawk-collects-reconnaissance-data-during-haiti-relief-efforts/ (Date of use: 4 December 2016).

[109] Petcoff https://www.af.mil/News/Article-Display/Article/118014/global-hawk-collects-reconnaissance-data-during-haiti-relief-efforts/ (Date of use: 4 December 2016).

[110] Odido D and Madara S "Emerging technologies: use of unmanned aerial systems in the realization of Vision 2030 goals in the counties" 2013 *IJAST* 107.

[111] Odido D and Madara S "Emerging" 107.

The need to be deliberate in the utilization and regulation of UAS is widened by the fact that most countries are gradually recognizing new and future activities for survey, mapping and other uses of UAS.[112] Kenyan researchers, such as Mbote and Muruingi, project potential use of UAS in the mapping and surveying in areas that are far away from town.[113] UAS is increasingly becoming an integral means of determining and surveying distribution of various species and habitat owing to its ubiquitous aerial activities. Through its activities, UAS can be used to plan, fly, visualize, process, and deliver various data, which is then essential for land mapping.[114] Advanced UAS also utilize Global Positioning System, which uses baselines and records kinematic observation with a higher degree of accuracy in surveying and mapping as compared to traditional means. The UAS are also convenient for mapping due to their speed in data collection, collation and delivery.

According to Bolebruch, UAS type mdLiDAR3000, for instance, is preferred for its ability to survey approximately four acres of land in just 18 minutes.[115] This is a speed that normal ground survey cannot match. As such, UAS offer opportunity for potential achievement of the much needed security in any country's property market. Chad's position is affirmed by Bryan Phillip who observes, "UAS is a viable alternative to the traditional methods of land surveying owing to its capability and versatility."[116] In his thesis, he correctly concludes that the flight time for UAS is comparatively shorter when compared to traditional methods.[117]

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112 Odido D and Madara S "Emerging" 107.

113 Kameri-Mbote P and Muriungi M "Potential contribution of drones to reliability of Kenya's land information system" 2017 *AJIC* 159-169.

114 Walter V "Small unmanned aerial system mapping versus conventional methods" 2017 *CTAWP* 5.

115 https://www.microdrones.com/en/integratedsystems/mdlidar/mdlidar3000/?gclid=CjwKCAjwsMzzBRACEiwAx4lLG0I8cwr1VXYedXAB6U3PmzGwXLDhItULEHqj8uTMPcicAJTIuNwBgBoCxUIQAvD_BwE (Date of use: 19 March 2020).

116 Phillip FB *Unmanned aerial systems for surveying and mapping: cost comparison of UAS versus traditional methods of data acquisition* (Masters Dissertation University of Southern California 2015) 1-49.

117 Phillip FB *Mapping* 41.

7. Challenges of Integrating UAS into Civil Aviation

The increase in civilian use and ownership of the UAS under different mission capabilities calls for an urgent need for their integration into civil aviation and regulation, especially owing to related technological developments. Rawich, for example, argues that the ongoing development and use of UAS shows that the law regulating UAS always lags behind technology.[118] The statement is a pointer to related struggles in integrating UAS into the national airspace in different jurisdictions.

Already, a positive step regarding recognition of the need for integration of UAS has been made. For instance, the ICAO Global Air Traffic Management Operational Concept recognizes that UAS is an aircraft according to Article 8 of the Chicago Convention. This view was subsequently endorsed by the 35th Session of the ICAO Assembly of 28 September to 8 October 2004. Ordinarily, therefore, one would expect the manned and unmanned aircraft to be integrated in the civil airspace.[119]

Certain concerns, however, lead to segregation of the UAS in order to lessen dangers. Some challenges are practical. For example, the use of UAS for survey and mapping continues to encounter the challenges of the high cost associated with hiring such services and instances of bad weather, characterized with unclear visibility.[120] This comes with the additional challenge of meeting the visual line of sight in expansive tracts of land.

[118] Rawich “Integration” 600.
[119] Marshall DM “Dull, Dirty, and Dangerous: The FAA's regulatory authority over unmanned aircraft operations issues” (2007) 10 *AVP* 105.
[120] Baseline Equipment Company “How to use GPS or Oland surveying” https://www.baselineequipment.com/gps-land-surveying-equipment (Date of use: 19 March 2020).

Even more disturbing are safety, security, and privacy concerns, which were previously mild in the early usage of UAS during the First and Second World Wars, but have since been emboldened.[121] As Yeonmin correctly notes, the emboldening results from, among others, obvious growth in agitation amongst the citizenry, legislation, and judicial interpretation.[122] These agitations and developments are very well demonstrated in analysis of the domestic UAS laws of the United States, South Africa, and Kenya in chapters Four, Five and Six, respectively of this thesis. Despite these developments, prospects of growth in the use of UAS rates high owing to its ability to downsize risks and wade through missions that would otherwise be unfavourable to humans. [123]

7.1 Safety Challenges

From the history of the use of UAS, it is clear that safety of manned and unmanned aircraft ought to be accorded similar importance. The laws on investigation of incidents should be similar to both types of aircraft.[124] Owing to the differences in uses and design of the aircraft, the processes would, however, take different dimensions.[125] For instance, while investigation in manned aircrafts would consider the embankment and disembankment of people, the one on UAS would be effective if it considered the opening and shutting of the primary propulsion system.

The main safety challenge concerns the design of UAS and in particular sense and avoid. Instructively, safety management is defined, under ICAO Annex 19 and UAS Circular 328 –AN/190 under Clause 2.16, as being the state in which possibility of harm to persons or property damage is reduced and maintained at or below an

[121] Finn RL and Wright D "Unmanned aircraft systems: surveillance, ethics and privacy in civil applications" 2012 *CLSR* 184-194.
[122] Cho Y "Lost in debate: The safety of domestic unmanned aircraft systems"' 2014 *JSS* 38-56.
[123] Stansbury S. and Manan A. "A Survey of UAS technologies for command, control, and communication (C3)" 2008 *JIRS* 8.
[124] Sharma R.S. "Investigation into unmanned aircraft system incidents in the National Airspace System" 2016 *IJAAA* 2.
[125] Sharma R.S. "Investigation" 2.

acceptable level through a continuous process of hazard identification and safety risk management.

The design challenges arise from visual issues which can best understood via a comparative approach. For manned aircrafts, there is a wide range of laws that guide air traffic control, including use and maintenance of visual ranges. UAS, however, faces difficulties in ensuring safety, owing to difficulty in operating them in civilian airspace due to limited control and operational capacity.[126] Further, UAS has unique characteristics in terms of size and performance that require turbulence avoidance criteria. UAS are designed with capacities based on the weight, that is, smaller or bigger. Some of the UAS have low loading capacity that can operate for more than 50 hours, while others can operate within a range of 2 kilometres under altitude of 2,000ft (600m).[127]

Some have capability for indefinite range over 30,000 ft. Such differences provide challenges in cases where an operator is supposed to maintain visual sight of the UAS and yet it has ability to go beyond visual sight. This means that the ground UAS operator might not avoid air collusion or be in control of the safety of other air or ground operators.

Sense and avoid capability of the UAS refer to the capability of an aircraft to remain well clear from, and avoid collisions with, other airborne traffic.[128] In respect to manned aircraft, it is the ability of the pilot operating the instrument to observe flight rules or visual flight rules required and to manoeuvre to avoid another aircraft and circumvent air accidents.[129] Sense and avoid provides functions of self-separation

[126] Levush R *Regulation of Drones: Comparative Summary* (The Law Library of Congress Global Legal Research Center Washington DC 2016) 86.
[127] Levush R *Regulation* 86.
[128] Klaus RA *Development of a sense and avoid system for small unmanned aircraft systems (*Masters Dissertation Ira A. Fulton College of Engineering and Technology 2013) 4.
[129] Klaus RA *Development* 6.

and collision avoidance to establish an analogous capability required by manned aircraft.[130]

This challenge is unique for UAS. For manned aircraft, Sense-and-Avoid system already exists in civil aviation, based on a transponder concept known as global navigation satellite system.[131] This is a communication, navigation and surveillance system capable of calculating own position while transmitting the same information to other units within the vicinity.[132] This information is what is used in collision avoidance. The global navigation satellite system transponder is critical for separation and avoidance, pilot-in-command and autonomous operation.[133] The system has successfully been used by both civilian and military UAS. These technical developments are necessary for all UAS to achieve successful integration into civilian use.

Conversely, to meet operational requirements, UAS should be able to meet standards of manned aircraft, such as Sense and Avoid capability, radar, visual sighting, separation standards and pilot behaviour, which are combined for safe operation of manned aircraft. Unlike manned aircraft, Sense and Avoid technologies for UAS are immature and undeveloped, meaning that standards would have to be developed to match those of manned aircraft in order to harmonize integration of UAS into civil aviation.[134] This is despite the fact that UAS are increasingly reporting adoption of Sense and Avoid technology.

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130 Geyer C, Singh C, and Chamberlain L "Avoiding collisions between aircraft: State of the art and requirements for UAVs operating in civilian airspace" (2008) *Carnegie Mellon University* 9. The sense and avoid system function where the UAS take appropriate action to prevent an intruder from penetrating the collision volume. Action is expected to be initiated within a relatively short time horizon before closest point of approach. The collision avoidance function engages when all other modes of separation fail.

131 GNSS "Transponder" http://www.lfv.se/ans/card (Date of use: 4 November 2016).

132 GNSS http://www.lfv.se/ans/card (Date of use: 4 November 2016).

133 Klaus *Development* 6.

134 Spriesterbach T *et al* "Unmanned aircraft system airspace integration in the national airspace using a ground-based sense and avoid system" 2013 JHAPLTG 572-583.

Safety concerns during the use of civilian UAS are of utmost priority especially for airspace that is not segregated. The requirements for an effective collision avoidance mechanism as well as a Sense and Avoid mechanism cannot be over-emphasized.[135] With such a facility, a pilot in command would easily access information to facilitate collision avoidance. Pilots in command also require technical assistance to enable them detect and avoid collision similar to what a manned aircraft uses in accordance with virtual flight rules.[136] This would help in ensuring safety for all concerned and if all fails, an automatic system should take over to ensure collision avoidance. The technical assistance given to the pilot for purposes of Sense and Avoid would enable the UAS pilot-in-command to maintain visual meteorological conditions, detect conflicting traffic, while interacting with conflicting traffic in accordance with the right-of-way rules and ensure automatic collision avoidance in the event of loss of control data-link.[137] Despite these challenges, the potential for civilian UAS use is on the rise. This is informed by the relative advantages held by UAS over manned aircraft. However, for full integration, more needs to be done to improve safety of the UAS, other aircraft and property on the ground.[138]

One of the areas that seems to require the law to quickly follow technology is adherence to Annex 2 of the Chicago Convention.[139] According to the Annex, all aircraft must bear nationality and registration marks of a contracting State. However, some contracting States do not have specific regulations that address unique characteristics of UAS. The condition persists, despite the fact that UAS by nature

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[135] Klaus *Development* 6.
[136] Klaus *Development* 6.
[137] EUROCONTROL "Specifications for the Use of Military Unmanned Aerial Vehicles as Operational Air Traffic Outside Segregated Airspace" https://www.eurocontrol.int/publication/eurocontrol-specifications-use-military-unmanned-aerial-vehicles-operational-air (Date of use: 30 September 2020).
[138] EUROCONTROL https://www.eurocontrol.int/publication/eurocontrol-specifications-use-military-unmanned-aerial-vehicles-operational-air (Date of use: 30 September 2020).
[139] Milde M *International air law and ICAO* (Eleven International Publishing 2008) 69. Milde takes a position that the rules of air may not be legally bonding but have consequences which make them binding in practice.

may fly across boundaries of different States. This is because the Chicago Convention was adopted with manned aircraft in mind and did not envisage application of UAS in civil aviation.

Another concern is that development of UAS technologies was not made in contemplation of airworthiness standards. For that matter, material property, structure design standards, decision reliability standards, and other requirements, would need to be evaluated in line with civil airworthiness standards for manned aircraft. As currently constituted, UAS operations are done according to performance characteristics totally at variance with manned aircraft. This is with respect to size, speed, or other flight capabilities.

Similarly, some UAS are incapable of providing the benefit of Sense and Avoid technology that remains an important defence against mid-air collisions.[140] Although the concept of 'Sense and Avoid' is not expressly provided for in ICAO regulations, it is noted that UAS should exercise vigilance in detecting circumstances that would lead to collisions because some of them lack automated collision avoidance systems.[141]

Owing to the design issues and characteristics, UAS pose a challenge to global regulators since international civil aviation law is based on concepts of safety and security in civil aviation that depend on a pilot operating an aircraft from within.[142] The way UAS are designed, removal of a pilot, as is the case, causes significant operational, technical, legal and operational challenges.[143] This calls for States to urgently introduce legislation that allow integration of unmanned aircraft into civil

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[140] See Annex IV to the European Commission (EC) Regulation on Common Rules in the Field of Civil Aviation 216 of 2008, Articles 3(a) and (4).

[141] https://www.icao.int/Meetings/anconf12/Document%20Archive/an02_cons%5B1%5D.pdf> (Date of use: 6 November 2019).

[142] Havel BF and Mulligan JQ "Unmanned aircraft systems: a challenge to global regulators" 2016 *DLR* 107.

[143] Gupta SG "Review" 1645.

aviation. Majority of contracting State parties to the Chicago Convention, of 1944 that are supposed to provide flight information lack policies and regulations that address challenges of UAS, such as safety of other airspace users.

7.2 Security Challenges

ICAO Annex 17 defines civil aviation security as a concept of safeguarding international civil aviation against acts of unlawful interference. Another danger is the potential of UAS falling into the hands of criminals, posing real vulnerability to national security.[144] For example, with UAS, terrorists are able to launch more precise attacks. Although security and safety under ICAO are provided under Annexes 17 and 19, respectively, there is a close correlation between the two since they concern damage and hazards. In fact, it has been touted by some authors that divorcing the two makes the airspace insecure. However, while safety is concerned with the design issues raised by the sense and avoid technology, the security concerns external acts caused by individual, legal persons or other States as threat to the UAS or its operators.

The security threats are faced as a result of a number of reasons regarding the nature and use of UAS. First, the potential uses of UAS in security such as communications, imaging and monitoring pose security threats. Ordinarily, proper security in the use of UAS is achieved when a pilot is able to ensure interconnection between unmanned aircraft and a control system. Unlike most aeroplanes that have compartments for flight crew that can monitor security, UAS are more exposed to sabotage and interference without the knowledge of the host State. Secondly, the UAS are less restricted in their nature compared to manned aircraft. According to Kine, it is this restriction, together with limited inspection, coupled with its ubiquity that leaves it more exposed to possible cases of intrusion, and interference. Even ICAO, which administers the Chicago Convention, recognizes these as serious

[144] Warwick G *"*Civil UAVs Need GPS anti-spoofing, but who pays. Aviation week*"* http://www.aviation week.com (Date of use: 15 October 2017).

integration challenges, hence development of the ICAO Circular on Unmanned Aircraft Systems in 2011 to help address this.[145]

Thirdly, unlike manned aircraft, whose areas for landing and take-off are easier to determine and control, UAS differ in the systems they employ for take-off and landing. Some take off in a vertical gradient like helicopters, others are hand-launched, while others are dispatched from remote stations such as high seas. Whereas this versatility enables them to be launched from almost any location, it creates a security concern as they could be used as conveyors of dangerous substances, including chemical and biological weapons. The concern over technological advances, especially in controlling these gadgets once licensed, has led to reluctance in freely licensing them due to security threats. [146]

Fourthly, maintaining security generally becomes a challenge for UAS operations due to its expanded uses and operations. As for military uses, the challenge is maintenance of the air traffic control systems and exclusion of classified information. For civil uses, the history and development in uses and expansion of classification with different weights and performance capabilities present security challenges of collision and, thus, potential air traffic accidents, some intentionally targeting manned aircraft.[147]

Regarding its nature and scope, the UAS' security challenges are posed to citizenry, States and the international community. These challenges border on policy, guidance, and regulation. An effective regulation system, whether at national, regional and international level must, therefore, ensure security of ground control station and data link. Based on the above exposition, it is clear that the security

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[145] Kine TS *Enhancing combat survivability of existing unmanned aircraft systems* (Naval Postgraduate School Monterey CA 2008) 19.
[146] Milde M *Air law* 207.
[147] Milde M *Air law* 92.

challenges principally arise from lack of command and control and unmanned traffic control. Policies for integration UAS should therefore address the two issues by detailing controlling of pilot station, biometric access to aircraft, minimum-security standards, data and communication links, among others. Despite these, there continues to be challenges regarding the two issues.

7.2.1 Lack of Command and Control System

Command and Control System is a technological system used by security forces to monitor and control movement of manned aircrafts. This system cuts across safety and security and has capacity to identify and destroy a manned aircraft while airborne in case they gain unauthorized access to another country. Most of the UAS lack capability to connectivity of the pilots in command to the UAS.[148] Lack of this capability brings to the fore security challenges to countries that may not have erected such installations.

7.2.2 Lack of Unmanned Traffic Management

Unmanned traffic management (UTM) is ideally a safety measure tool but cuts across security as well. It is an advanced traffic management ecosystem under development for autonomously controlled operations of UAS.[149] It is a digital system that can monitor increased activity based on digital sharing of each operator's scheduled flight details in a digital form. Under the system, each user of an aircraft obtains a situational awareness of airspace, unlike what happens in today's air traffic control.[150] UTM works as a networked collection of services that communicate together based on common rules. Rather than relying on centralized control, these frameworks around the world will use the principle of distributed authority, which

[148] Franke *et al* "Inverting the operator/vehicle ratio: Approaches to next generation UAV command and control" (Paper presented to the Conference of AUVSI Unmanned Systems North America 2005) 1.
[149] Sándor Z "Challenges caused by the unmanned aerial vehicle in the air traffic management" 2019 *PPTE* 96-105.
[150] Sándor Z "Traffic management" 96.

opens up the system to more service providers who can adapt as the market evolves and needs change. The system is useful for collision avoidance as a safety measure and, additionally, plays a major role in providing security countermeasures.

The UTM has the capability to detect where UAS' command and control centre is located for tracing those that enter other countries' territory.[151] Unfortunately, most States do not have UTM systems installed for UAS within their jurisdictions to detect unauthorized entry of UAS. This makes such States vulnerable to external intrusion by UAS and interference without their knowledge, hence, infringing on State sovereignty. At the centre of regulation of aviation is the principle of State sovereignty, as affirmed in both the Chicago Convention, Article 1 and Article 2 of the United Nations Charter of 1945.

In a nutshell, this challenge presents a paradox in the use of UAS as security tools and threats at the same time. This adds a novel perspective to regulation. The perspective is the delicate balance in regulatory framework for UAS. On one hand, the regulation should not be too restrictive to deny its role of being used as a security tool. On the other hand, it must not be too liberal to turn it into a security threat.

7.3 Privacy Challenges in UAS Operations

The UAS have capacity to use Global Positioning System (GPS) technology to take aerial photos. This coupled with the ability to fly above residential areas increases chances of taking photos containing confidential information without the consent of those on the ground. These systems can also be hacked in this era of increased cybercrime activities,[152] and can lead to leakage of information on location, among

[151] Prevot *et al* UAS traffic management (UTM) concept of operations to safely enable low altitude flight operations (Paper presented to the *16th AIAA Conference on Aviation Technology, Integration, and Operations Conference* 2016) 3292.
[152] Zhi Y et al "Security and Privacy Issues of UAV: A Survey" 2020 *MNA* 95-101.

others. The effects on privacy may be devastating when the photos or information find their way into phone-based or computer-based social applications.

For unmanned aircraft systems, the danger of privacy is much graver. Unlike manned aircraft that are not effective for dull operations, UAS, often preferred for such operations, potentially turn into privacy threats. One origin of such potential is their ability to fly at comparatively lower levels compared to the manned aircrafts. Accordingly, current and potential uses, such as filming and delivery of goods, could be turned into malicious uses that infringe on the right to privacy. A case in point is the admission by the FBI that it used UAS to follow up citizens' protests in Baltimore in 2018.[153] These 'eyes in the sky' have privacy implications owing to their intrusive nature. Historically, the kind of intrusion began in the 1960s with the use of reconnaissance UAS. Other than the capacity for dull operations, the privacy implications have been made graver with the UAS technology leading to cyber security, hacking or even cyber terrorism, which are threats to protection of personal data.

Unlike safety and security issues that have largely been dominated by States owing to the potential effect on their sovereignty, privacy issues largely affect individual rights and agitations of civil societies. It is noteworthy that, as expected, most agitations have been in favour of embracing restrictive rules to widen enjoyment of privacy concerns.

As a consequence of the persistence of the above occurrences, there has been a challenge in use of UAS and ensuring that they meet human rights standards under international law. Indeed, the United Nations system recognizes that member States must respect the peoples' right to privacy. For instance, the Universal Declaration

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[153] INFOSEC "Beware of the drone! Privacy and security issues with drones" https://resources.infosecinstitute.com/privacy-and-security-issues-with-drones/#gref (Date of use: 23 December 2019).

of Human Rights[154] offers protection from arbitrary interference with individual's privacy, family, home or correspondence. This is further affirmed under Article 17 of the International Covenant on Civil and Political Rights (ICCPR).[155] Article 5 of the American Declaration on the Rights and Duties of Man Article 11 of the American Convention on Human Rights[156] both recognizes this right. Article 11 of the Convention provides for the States' responsibility to protect the right of privacy in cases of surveillance.

As for Africa, there are several instruments such as the African Charter on Human and Peoples Rights, 1981 and Article 4 of the Protocol to the African Charter on Human and Peoples' Rights on the Rights of Women which guarantee the right to life through which privacy right is guaranteed.[157] Further, African regional economic communities, such as the Economic Community of West African States (ECOWAS) and Southern African Development Community (SADC), have made significant steps in promoting protection of the privacy of the people.[158] The organizations have also entered into agreements on privacy of data as well as adoption of model laws.[159] Specifically, SADC has come up with a model SADC Model Law on Data Protection,[160] while ECOWAS has the Supplementary Act, both of which protect the peoples' right to privacy.[161] Explicitly, Article 19(1) of the Act provides that information, communication and technology systems should respect the privacy and liberties of citizens.[162] On its part, EAC recognizes the principle of human rights as

[154] UN General Assembly Resolution 217 A (III) of 10 December 1948.
[155] UN General Resolution 2200A (XXI) of 16 December 1966 UNTS 171 (entered into force 23 March 1976).
[156] Rodriguez K, Hernandez V and Jara C "The Inter-American Legal Analysis: The 13 Principles and the Inter-American System for the Protection of Human Rights" https://necessaryandproportionate.org/americas-legal-analysis (Date of use: 22 September 2019).
[157] The Africa Union (AU) Protocol to the African Charter on Human and People's Rights on the Rights of Women of 21 July 2003 (entered into force 2005) (hereinafter referred to as the Maputo Protocol), Article 4(m).
[158] Mabika V "Privacy and Personal Data Protection Guidelines for Africa" *2018-8 ITU* https://www.itu.int/en/ITUD/CapacityBuilding/Documents/IG_workshop_August 2018 Presentations/Session%207_Verengai%20Mabika.pdf (Date of use: 30 September 2020).
[159] Graham G and Georges M "African regional privacy instruments: Their effects on harmonization" 2014 *PLBIR* 19-21.
[160] The SADC Model Law on Data Protection of 2010.
[161] https://www.statewatch.org/news/2013/mar/ecowas-dp-act.pdf (Date of use: 2 September 2019).
[162] ECOWAS Supplementary Act of 2007, Article 19(1).

a fundamental and operational principle governing its integration.[163] Respect to privacy is one such key right that is envisaged by the commitments.[164]

From the preceding discussion, it is clear that the spirit of these international frameworks promotes the position that respect for personal data is vital for the protection of human life. As such, the right to privacy forms the foundation of other rights, including the right of access to information, human dignity, and right to life. It is also related to the right to self-determination, which means the right to do what a person wants, including who to associate with. Important decisions are influenced by the protection of the right. This right is interconnected with security and safety concerns. First, while the right to privacy is often claimed by citizens, security and safety are always the first line of defence for the State. In most instances, the former is sacrificed at the altar of the latter. No wonder, States have been reluctant to uphold privacy, especially when it compromises State security and safety concerns.

7.4 Other Challenges inhibiting Integrating UAS into Civil Airspace

There are challenges that cannot be conveniently categorized under the three main ones already discussed above. First, absence of consensus on regulatory framework from a global front is a major obstacle to achieving full integration of UAS into civil aviation across several regions. The challenge is that ICAO, which is the UN's specialized agency for regulation of aviation in the whole world, only provides materials and circulars to guide States to enact their own domestic UAS regulations. However, there continues to be enforcement setbacks, such as the inability to provide sanctions on member States, which have not implemented the guidelines in enacting UAS regulations.[165]

[163] The Treaty for the Establishment of the East African Community of 1999 (entered into force 2000) (hereinafter referred to as the EAC Treaty 1999), Articles 6(d) and 7(2).

[164] *Media Council of Tanzania an Others v Attorney General of the Republic of Tanzania* App 5 EA 2019 (EACJ).

[165] Marcontelli D and Douglas S https://www.forbes.com/sites/oliverwyman/2018/09/10/why-the-use-of-drones-still-faces-big-regulatory-hurdles/#529c17ea1c0d (Date of use: 5 October 2019).

Secondly, there is general lack of effective data collection and sharing among States concerning UAS operation. This makes it difficult for States to share the data collected and disseminated by UAS, a situation that is perhaps compounded by lack of consensus on policy formulation and co-operation among neighbouring States.

Thirdly, although States are required by ICAO to establish agencies responsible for civil aviation with mandate on oversight, such civil aviation authorities continue to lack sufficient manpower and mechanism to deter unauthorised or unlicensed operation of UAS.[166] In addition, aviation personnel are not everywhere to monitor and prosecute those found to be in violation of the State's aviation rules.

8. Conclusion

The development of UAS makes its integration into the civil airspace inevitable. There are potential applications in security and environmental surveillances, which further points to the extension of the need for its integration in future. The UAS uses, whether traditional or modern, can be conveniently classified as recreational, dull, dirty and dangerous operations. These operations greatly distinguish UAS operations and uses from those of manned aircraft. Moreover, manned aircraft have operations and uses that are less intrusive and have more elaborate laws governing specific aspects, such as traffic control, visual sighting, take-off and landing management, as well as Sense and Avoid technologies.

Owing to the structural differences and versatility of UAS, there is bound to be safety, security, and privacy challenges that arise from use of UAS and its ultimate integration in the national airspace. Little attention, and sometimes, absence of

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[166] Barnhart C *et al* "Demand and capacity management in air transportation" 2012 *EURO JTL* 135-155.

standards for the training of air traffic controllers on UAS, ineffective policy for data collection and information sharing and poor oversight, among others, raise safety and security concerns that slow down the process of integration.

Also noteworthy is the possible push and pull between governments, the international community, and civil societies in advocating for, and balancing, the safety, security and privacy concerns arising from use of UAS. For example, the human rights approach taken in furtherance of privacy concerns must compete with sovereignty of States, which is a cardinal principle of international relations recognized in the United Nations Charter of 1945. The battle of wits can take an interesting turn in cases of countries, such as the US, South Africa, and Kenya, where there is a guarantee of rights to security, safety and privacy in the national constitutions.

The next chapter is dedicated to providing an overview of the international civil aviation law and institutional framework, with focus on how the international law has provided redress of above identified safety, security and privacy challenges.

CHAPTER THREE

INTERNATIONAL LAW RESPONSE TO CHALLENGES IN UAS REGULATION

1. Introduction

This chapter addresses the regulatory framework in international law for UAS, in particular how the international framework addresses the challenges identified in the previous chapter on safety, security and privacy. The chapter analyses the existing international legal and institutional frameworks applicable to civil aviation and those regulating UAS. The prevailing legal framework consists mainly of treaty law. The treaty law framework includes the Chicago Convention of 1944 and various decisions and instruments adopted by ICAO. Such instruments include Annexes to the Chicago Convention developed as Standards and Recommendations Practices (SARPs).

In addition, analysis of other sources of law, including customary international law that complement the relevant international law, as set out in the treaties, is also discussed. As a roadmap, the analysis of the framework is made with a view to describing, assessing, and drawing conclusions on how the existing international legal structure has developed to address the threefold challenges of safety, security, and privacy issues in the field of civil aviation.

2. Background to International Law and Rules Applicable to Civil Aviation Architecture

As an overview, the legal framework and principal conventional law on regulation of UAS at an international plane is the Chicago Convention. The Convention lays down the core principles for regulation of international air transport and addresses the concerns of security through Annex 17 and safety Annex 19.[1] At the time of its adoption in 1944, the Chicago Convention envisaged the creation of a specialized

[1] The Convention on Civil Aviation of 7 December 1944 15 UNTS 295 (entered into force 4 April 1947) (hereinafter referred to as the Chicago Convention), Article 37 (a), (c), (e), (f) and (g).

institution, vested with support, advisory and organizational roles in achieving international cooperation.[2] The need for such a body immediately became paramount and led to the establishment of Provisional ICAO in 1945, succeeded by ICAO, effective from 4 April 1947.[3]

2.1 Overview of the Chicago Convention of 1944

Since the Paris Convention of 1919, treaty law was the primary source of aviation law. As stated above, the principal conventional law governing aviation is the International Convention on Civil Aviation adopted in 1944, also known as the Chicago Convention that established ICAO. The Convention was adopted in 1944 to replace the Paris Convention of 1919. ICAO plays a pivotal role, since it is the conventional basis for dealing with aviation issues at international, regional, sub-regional and State levels.

From the commencement of the Convention, the principle of sovereignty under international law, safeguarding equality and mandate of States emerges as a fundamental right and obligation of every State. By the time the Chicago Convention was coming into effect in 1945, the new world order established under the United Nations in that year had reaffirmed the right to sovereignty, equality and territorial integrity of States. The principle was maintained in the Chicago Convention as articulated under Article 1, which provides that:

> "Every State has complete and exclusive sovereignty over the airspace above its territory". Further, and in order to eliminate any ambiguity on definition of the State territory, Article 2 of the Convention defines the territory of each State to mean land areas and territorial waters adjacent thereto under the sovereignty suzerainty, protection or mandate of such State".

[2] The Chicago Convention, Article 43 provides for creation of ICAO and its and organs while Article 44 outlines its objectives.

[3] https://www.icao.int/about icao/History/Pages/default.aspx (Date of use: 11 July 2020).

The relevant scope of the Chicago Convention is set out in Articles 3, 8, 9 and 12. The twofold nature of the Convention is worth noting. First, is the transboundary nature of the Convention, which emanates from the fact that aircraft move across boundaries of different States. Secondly, Article 3 is instructive that it applies only to civil aircraft and not State aircrafts, which category also includes the military aircrafts. The excluded category of aircrafts is regulated by the rules of international humanitarian law as well as respective domestic laws of different countries. The delimitation of State aircrafts is necessary for avoidance of doubt since the Convention adopts a use-based approach in delimiting its scope of application to dedicated military rules. It is also possible that the distinction was made for convenience and to avoid complexity of laws due to the difference in functioning of the civil and military aircrafts.

Regarding the civil aircraft, the Chicago Convention applies to both manned and unmanned aircraft. Similar to manned aircraft, UAS require special authorization to fly through the airspace of contracting States. The Convention is instructive, at Article 8, its substantive provisions apply to pilotless aircraft, which it refers to as 'aircraft capable of being flown without a pilot.' The Article repeats the spirit of the provisions of Article 15 of the Paris Convention. Specifically, Article 8 of the Chicago Convention reads as follows:

> "No aircraft capable of being flown without a pilot aircraft shall be flown without a pilot over the territory of a contracting State without special authorization by that State and in accordance with the terms of such authorization. Each contracting State undertakes to ensure that the flight of such aircraft without a pilot in regions open to civil aircraft shall be so controlled as to obviate danger to civil aircraft".

From the provision of Article 8, it is clear that the original intention of the drafters was to create a special authorization requirement for pilotless aircraft to operate. It is envisaged that such authorization is provided in each State's rules and regulations. As such, it forms part of 'the rules and regulations relating to the flight and manoeuvre of aircraft' for every aircraft as envisaged under Article 12 of the Convention, which provides as follows:

> "Each contracting State undertakes to adopt measures to ensure that every aircraft flying over or manoeuvring within its territory and that every aircraft carrying its nationality mark, wherever such aircraft may be, shall comply with the rules and regulations relating to the flight and manoeuvre of aircraft in force. Each contracting State undertakes to keep its own regulations in these respects uniform, to the greatest possible extent, with those established from time to time under this Convention. Over the high seas, the rules in force shall be those established under this Convention. Each contracting State undertakes to ensure the prosecution of all persons violating the regulations applicable*".*[4]

Accordingly, the reading of Article 8 together with Article 12 of the Convention, brings out two principal perspectives of the regulatory approaches and obligation of States under the Chicago Convention. First, it is now unequivocal that the Convention applies to the pilotless aircraft. Despite its existence since 1944, for some time, it was not clear whether other provisions of the Chicago Convention could apply to UAS. However, one may argue that this *lacuna* is cured by chapter 1 of Annex 6 to the Convention regarding Operation of the Aircraft, which expands the definition of an aircraft to include, any machine that can derive support in the atmosphere from the reactions of the air other than reactions of the air against the earth's surface. Presently, ICAO, through its Eleventh Air Navigation Conference of 2003, has settled it that the Convention is applicable to the pilotless aircraft, which include UAS. [5]

The second perspective is that the Convention grants a wide discretion to States to make regulations regarding what, in their circumstances, would amount to a special authorization for flight and operation of pilotless aircraft. Despite the wide discretion,

[4] The Chicago Convention, Article 12.
[5] https://www.icao.int/SAM/Documents/2003/ANCONF11SEM/ANConf11PREP_Ip03.pdf (Date of use: 24 December 2019).

the contracting States are still obligated to keep their own regulations in conformity with the rules established under the Chicago Convention to the greatest possible extent.

Currently, enforcement of these rules and procedures by contracting States has been effective for manned aircraft due to coordinated communications to control towers. There has, however, been a challenge concerning unmanned aircraft systems since some of them are not identified by radar systems to allow effective enforcement applicability. It may, perhaps be attributed to admittedly lack, by the drafters of the Convention, of contemplation of more technological developments in respect of UAS. It is commendable, however, that the member States to the Chicago Convention contemplated future need for amendments of the Standards by ICAO from time to time and as may be necessary.[6] In order to support effective implementation of the Chicago Convention, it states as follows in Article 37:

> *"*Each contracting State undertakes to collaborate in securing highest practicable degree of uniformity in regulations, standards, procedures, and organization in relation to aircraft, personnel, airways and auxiliary services in all matters in which such uniformity will facilitate and improve air navigation"*.*[7]

Pursuant to Article 37 of the Convention, ICAO has developed 19 Annexes. The Convention's provisions obligate contracting States to put in place local mechanisms to domesticate ICAO Annexes.[8] The Convention further recognizes that implementation must be through establishment of civil aviation authorities by

[6] The Chicago Convention, Article 37.
[7] The Chicago Convention, Article 37.
[8] Annex 17 to the Convention on International Civil Aviation 9 ed, (2011) (hereinafter "ICAO Annex 17). The ICAO Annex 17 provides that each State shall put measures in place in their respective States, example the under the general principals of ICAO Annex 17 dealing with aviation security it is provided under clause 2.1.2 of chapter two that: each Contracting State shall establish an organization and develop and implement regulations, practices and procedures to safeguard civil aviation against acts of unlawful interference taking into account the safety, regularity and efficiency of flights.

the contracting States. The authorities are given mandate to provide legislative framework and oversight concerning airspace of their respective States.

Before addressing additional substantive and normative aspects of the framework, the chapter will provide a descriptive analysis of the institutional framework underpinned by ICAO, also recognized under section 38 of the Statute of the International Court of Justice to regulate the security and safety aspects of UAS. The next part shall address the structure, including the organs, as well as the various decisions that ICAO makes which contribute to the strengthening of the normative framework.

3. Institutional Framework of ICAO

Having discussed the Chicago Convention as the specific international law and rules applicable to civil aviation, this section focuses on the relevant institutional framework under ICAO created by the Chicago Convention as a responsible entity to regulate and administer matters of civil aviation including UAS across the world.

3.1 ICAO Instruments and Legal Status

Before delving into the establishment functions and organs, it is important to understand the different instruments developed by ICAO. Currently, ICAO has a high ratification rate of 193 member States that develop SARPs which are documented as part of the Annexes to the Chicago Convention. Once documented, they become international standards. Pursuant to Article 37 of the Convention, State parties undertake to collaborate to ensure they achieve the ‘highest practicable degree’ of uniformity in the SARPs. The test of ‘highest practicable degree’ may *prima facie* be understood to give a leeway for States to opt-out of some of the Recommended Standards and Practices. Contextually, however, the same standards also apply to the binding rules of the air. Secondly, in ordinary meaning, it is an obligation of the States to comply; deviations under Article 38 can only be done in good faith in accordance with the international rules of interpretation of treaties.[9] Further, on this second rationale, the provision of Article 92 of the Chicago Convention unequivocally invites States to which it is open for ratification, to adhere to it. The two premises, therefore, mean that the level of undertaking of States in respect to the Standards is not envisaged to be discretionary on the member States by virtue of the opt-out mechanisms provided for under Article 38 of the Chicago Convention alone. In any event, international law requires States to adhere to the treaty obligations in good faith owing to the operation of the principle of *pacta sunt servanda* which guides States in the implementation of treaty obligations.[10]

Another key pointer to the binding nature of the Standards and Recommended Practices is the consensual nature of adoption and amendments to the Annexes to the Chicago Convention. The procedure of adoption and amendment of Annexes is an exemption to the general majority decision rule by the Council set out under Article 52 of the Convention. Article 90 (a) prescribes a two-third majority of the Council to adopt or amend an Annex. Subsequently, a majority of the member States, acting in their individual capacities, have to approve the amendment or adoption.[11] Antwerpen, correctly affirms that the Standards and Recommended Practices are legally binding by virtue of principles and interpretation of international law.[12] For Milde, binding nature of the Standards and the Recommended Practices can also be easily inferred by implication owing to their inescapable and inevitable effect.[13]

[9] Vienna Convention on the Law of Treaties of 23 May 1969 UNTS 331 (entered into force 27 January 1980).
[10] Vienna Convention on the Law of Treaties 1969, preamble and Articles 2(1) (a) and 26.
[11] Chicago Convention, Article 90.
[12] Niels V "Cross-border provision of air navigation services with specific reference to Europe: safeguarding transparent lines of responsibility and liability" 2008 *KLI* 32.
[13] Milde M *Air law* 117.

In addition to the above, the formulation of all the Standards and Recommended Practices stipulated in the 19 Annexes, shows that it is only in respect of the international standards that any State variance has to be reported under that Article which may result in supplements to the Annexes. [14] This is a pointer that the two main categories of instruments have different legal statuses, position that elevates the legally binding status of the standards above those of the Recommended Practices and ICAO policies. Practically, the Standards have more elevated binding status since unlike the Recommended Practices, they attract the immediate and unconditional obligation to inform ICAO.[15]

ICAO also develops Manuals and Circulars, which are necessary for regulation of the various aspects of UAS. Adherence to the ICAO resolutions in form of policies and manuals, has not been expressly recognized as attracting the undertaking of compliance by States in the Convention. As such, they are generally not binding, but are guidance materials only save for instances where they are adopted by States through other multilateral agreements.[16] This does not, however, mean that the same can be simply disregarded by States. Milde agrees that these ICAO resolutions cannot be ignored with impunity.[17] The author's compelling rationale is that ICAO resolutions are like the inevitable force of gravity, compliance with which is almost unavoidable in practice since there are enormous consequences attached to failure to do so.[18]

3.2 ICAO: Main Functions and Organization

ICAO is established under Article 43 of the Chicago Convention. ICAO was originally conceived to be an organization with the capacity to enter into arrangements with any general organization. After the establishment of the United Nations in 1945,

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[14] See the chart of flow of standard-making process at https://www.icao.int/about-icao/AirNavigationCommission/Documents (Date of use: 11 July 2020).
[15] See Niels V "Cross-border" 32 for more discussion on this.
[16] Niels V "Cross-border" 32.
[17] Milde M *Air law* 117.
[18] Milde M *Air law* 117.

ICAO became a specialised agency of the United Nations in 1947.[19] This was pursuant to the Assembly decision made to Article 64 of the Chicago Convention to get into international arrangements. Since then, the independent and autonomous agency has been vital in providing guidance towards regulation of UAS at the international level. It has been responsible for development of international consensus on a number of issues relating to security, safety and privacy in UAS-related activities through development of SARPs, manuals, circulars and policies in civil aviation.

The main focus of ICAO when undertaking its duties is ensuring aviation safety and security, and by extension privacy concerns for the orderly management in the international civil aviation sector, enhancement of efficiency, capacity and environmental protection, building capacity of member States, among other functions.[20] ICAO works with member States to continually develop consensus about efficiencies in the management of civil aviation.

The major decisions by ICAO, which contribute to the development of the normative framework on UAS regulation are made through its structures. The structure has three principal organs, namely the ICAO Assembly, ICAO Council and lastly, the ICAO Secretariat. The ICAO Assembly is responsible for recommendation of policies on new standards and guidance to other bodies. Since the Assembly has all member States to ICAO, it provides an avenue for the obtaining of consensus on development of policies to guide innovative areas such as integration of UAS into civil aviation. The Council adopts the standards, recommended practices, and has investigative and dispute resolution powers. The Secretariat is headed by a Secretary General who through its staff at the head office in Montreal, and the regional offices, is responsible for day-to-day the running of the affairs of ICAO.

[19] The ICAO Assembly Resolution A1-2 which authorized the relationship.

[20] The Chicago Convention, Article 43 establishes ICAO and Article 43 provides the Objectives of ICAO.

3.3 ICAO Structure and Organs

Structurally, ICAO is an international organization. It enjoys legal capacity in the territory of the 193 member States to the extent that it enables it to conduct its functions.[21] As already set out, ICAO's decision-making powers in terms of rulemaking and enforcement is executed through the ICAO Assembly, ICAO Council, ICAO Secretariat, which are the principal organs of the organization.[22] The organization and functions of the various organs are discussed below.

3.3.1 ICAO Assembly

The ICAO Assembly is the key policy-making organ established under chapter VIII of the Chicago Convention.[23] It consists of all ICAO member States that are entitled to attend, for deliberations, ordinary meetings convened by the ICAO Council every three years or such extraordinary meetings as may be convened upon request by at least a fifth of member States.[24] The Assembly is responsible for recommendation of policies on new standards and guidance to organs of ICAO. Since the Assembly has all member States to ICAO, it provides an avenue for the obtaining of consensus on development of policies to guide innovative areas of aviation. The Assembly also appoints the ICAO Council, considers and implements the decisions of the Council.[25] It can also delegate or revoke such delegation of powers to the Council.[26] Its mandate includes undertaking the functions under the Chicago Convention, which are not a reserve of the ICAO Council. Unless the Convention stipulates otherwise, the general rule is that majority of votes cast by delegates of each member State makes Assembly decisions.[27]

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[21] Chicago Convention, Article 47. See also Sochor E "Decision-Making at ICAO: Who Governs the Governing Body?" 1991 *TPIA* 1.
[22] https://www.nationsencyclopedia.com/United-Nations-Related-Agencies/The-International-Civil-Aviation-Organization-ICAO-STRUCTURE.html (accessed on 11 July 2020).
[23] https://www.icao.int/Pages/default.aspx (Date of use: 12 July 2020).
[24] https://www.icao.int/abouticao/assembly/Pages/.(Date of use: 11 July 2020).
[25] See Chicago Convention, Article 49(a)-(k).
[26] The Chicago Convention, Article 49(a)-(k).
[27] https://www.icao.int/Pages/default.aspx (Date of use: 12 July 2020).

3.3.2 ICAO Council

The ICAO Council is established under chapter IX of the Chicago Convention as a permanent, body. The ICAO Assembly elects the members of the Council, who serve a three-year term.[28] The election to membership of the Council aims to represent the contribution of States in air transport, and major geographical locations of the world.[29] A President of the Council who is elected from among the member States and serves a three-year renewable term, heads the council.[30] The President is not a representative of the member States but of the Council.[31]

The main rule-making function of the ICAO Council is to adopt Standards and Recommended Practices that are ratified by the Assembly.[32] It also has investigative and dispute resolution powers. ICAO plays a key role in implementation of Standards and Recommended Practices through its mandate to receive notifications of deviance from the international standards and procedures under Article 38 of the Convention.[33]

[28] https://www.icao.int/Pages/default.aspx (Date of use: 12 July 2020). See also The Chicago Convention, Article 50(a).

[29] Chicago Convention, Article 50(b). The category of contribution has two sub-categories, which are contributors of chief importance and largest contributors in air transport.

[30] The Chicago Convention, Article 51.

[31] The Chicago Convention, Article 51(c).

[32] The Chicago Convention Article 37.

[33] The Chicago Convention, Article 38 provides that:- Any State which finds it impracticable to comply in all respects with any such international standard or procedure, or to bring its own regulations or practices into full accord with any international standard or procedure after amendment of the latter, or which deems it necessary to adopt regulations or practices differing in any particular respect from those established by an international standard, shall give immediate notification to the International Civil Aviation Organization of the differences between its own practice and that established by the international standard. In the case of amendments to international standards, any State, which does not make the appropriate amendments to its own regulations or practices, shall give notice to the Council within sixty days of the adoption of the amendment to the international standard, or indicate the action which it proposes to take. In any such case, the Council shall make immediate notification to all other states of the difference which exists between one or more features of an international standard and the corresponding national practice of that State

Any decisions differences, which are lower than international standards, are recorded as part of supplements to the Annexes hence having a binding effect on specific member States filing the differences.

This ‘difference system’ *prima facie* appears to be a missed opportunity of achieving uniformity of UAS regulation at the international stage since it allows for the application of two sets of rules to States towards complying with Article 37 of Chicago Convection. It must not be lost, however, that the system can still achieve the harmonization of the UAS regulatory approaches in the long term since it recognizes the inevitably unique circumstance of each States and allows them to take a progressive path to catch up with others towards an ultimate uniformity.[34]

The Council as it carries out directions of the Assembly,[35] is, mandated to issue infraction notices to the States who fail to comply with its determinations or recommendations. In case of any further failure, the Council is mandate to report such non-adherence by States to the ICAO Assembly.[36] The decisions of the council are made by majority of votes cast by members unless the members are party to an issue under consideration.[37]

3.3.3 ICAO Secretariat

The Secretary General, appointed by the Council, heads the ICAO Secretariat. The Council makes provisions for other appointments of the Secretariat staff.[38] The seat of the Secretariat is seated at Montreal, Canada. The Secretariat also functions through regional offices in Nairobi. Paris, Dakar, Mexico, Lima and Bangkok in order

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[34] Hsu YM “A New International Legal Order” 2016 *CYILA* 231-234.
[35] Chicago Convention, Article 54(d).
[36] The Chicago Convention, Article 54(j) and (k).
[37] The Chicago Convention, Articles 52 and 53. Instances of adoption and amendment of Annexes under Article 92 of the Convention is one such an exemption which requires two-thirds.
[38] The Chicago Convention, Article 54(h).

to coordinate the day-to-day running of the affairs of the Organization.[39] The day-to- day running of the secretariats operations is conducted through the Air Navigation Bureau, Technical Cooperation Bureau, Bureau of Administration of Services, Legal Services and External Relations Bureau, all under the office of the Secretary General.[40] There are also various Sections that deal with audits and programmes. The personnel appointed in the Office of the Secretary General, have international legal character and conduct their activities with independence.[41]

3.4 ICAO and UAS-specific Instruments

Through the concerted efforts of the organs as discussed above, ICAO develops different instruments to regulate the UAS. These UAS instruments are contained in relevant Standards, Recommended Practices and ICAO Resolutions, which include ICAO policies, procedures, manuals, and circulars. The instruments are vital for the achievement of the overall ICAO's role.[42] The SARPs developed by ICAO Council are contained in 19 Annexes to the Chicago Convention that regulate different aviation issues of safety and security in aviation.

The Annexes dealing with rules of the air, units of measurement, aircraft nationality and registration marks and airworthiness contain international standards. The others, which contain both international standards and recommended practices, are Annexes on meteorological services, aeronautical charts and operation of aircrafts. Others are Annexes on air traffic services, aerodromes, search and rescue, facilitation, environmental protection, security, aeronautical services, safest transportation and safety management. The aim of the Annexes is to achieve State

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39 https://www.nationsencyclopedia.com/United-Nations-Related-Agencies/The-International-Civil-Aviation-Organization-ICAO-STRUCTURE.html (Date of use: 11 July 2020). See also The Chicago Convention, Article 58.

40 For full view of the structure of ICAO Secretariat, see https://www.icao.int/DownloadDocsFix/Organigramme_en.pdf (Date of use: 12 July 2020).

41 The Chicago Convention, Article 59.

42 Hsu YM "Legal Order" 234.

collaboration in securing uniformity in regulations, standards and procedures in relation to aircraft, personnel and airways to improve air navigation.

The law mandates ICAO to issue resolutions governing various aspects of UAS. These resolutions take the form of policies, procedures, manuals and circulars. These instruments provide guidance materials to States.[43] In this category, ICAO mainly authorizes circulars envisioned to harmonize concepts, terms and co-ordinate guidance of regulatory evolution.[44] Particularly, the circulars have three main purposes: First, to apprise States of the emerging ICAO perspective on the integration of UAS into non-segregated airspace and at aerodromes, aid in consider action of fundamental differences from manned aviation that such integration involves. The circulars also encourage States to help with the development of ICAO policy on UAS by providing information on experiences associated with these aircraft.[45]

So far, ICAO has adopted UAS-related circulars and manuals, such as, Circular 330 AN/189 on Civil/Military Cooperation in Air Traffic Management of 2011, Manual on RPAs, Doc 10019 AN/507 of 2015, and Circular 328-AN/190 on Unmanned Aircraft Systems adopted in 2011[46]. The substance of the rules stated in these circulars and manuals are discussed in the next part on international rules. As Antwerpen correctly notes, policies, manuals and circulars are complementary to the SARPs in the Annexes.[47]

[43] Niels V "Cross-border" 32.
[44] The Chicago Convention, Article 54 (I) of Chicago Convention one of the mandatory functions of the Council is to Adopt, in accordance with the provisions of chapter VI of this Convention, International Standards and Recommended Practices; for convenience, designate them as Annexes to this Convention; and notify all contracting States of the action taken
[45] Niels V "Cross-border" 32.
[46] Zafar MA *et al Design and development of effective manual control system for unmanned air vehicle'* (Paper presented to the *3rd International Conference on Computer Research and Development* 2011) 349-353.
[47] Zafar MA *et al Design* 350.

Notably, ICAO has mechanism for implementation of instruments through its organs as discussed above to impose sanctions, however, Article 6 of the Convention would be invoked by other States for not having faith in their safety system. Suffice to note, at this stage, that the ICAO Assembly can disqualify a member State that does not comply with the Standards and Recommended Practices.[48] However, this power has not been exercised to date.[49] On the other hand, ICAO Council has put in place a reporting mechanism that monitors compliance at State levels through legislation, and receives notification of instances of deviance from the standards.

Related to the reporting are research procedures, which forms ICAO's implementation approach of development of metric of performance, performance evaluation on safety and security audits. These audits usually take the form of Universal Safety Oversight Audit Programme (USOAP) and Universal Security Audit Programme (USAP). The audits, therefore, present an ideal opportunity for the organization to coordinate compliance by making practical recommendations to aviation authorities to adopt the existing standards. The 'effective implementation' scores of every country are available online, and this has a capacity to catapult the rate of compliance.[50] It is obvious, however, that with the high number of contracting States to the Chicago Convention, the ICAO audit team is overstretched. Such a strain on skill and human capital risks reduces the quality of audits as an oversight tool to promote safety, security and privacy assurance.

The implementation is donned with challenges of participation of fewer member of States in reporting of deviances from the Annexes and submission of substantive comments in case of amendments.[51] Against the backdrop of these challenges, ICAO in 2015, adopted the strategic objective that no country should be left behind in implementation of the standards. The ICAO Council launched the 'No Country

[48] https://www.icao.int/abouticao/assembly/Pages/. (Date of use: 11 July 2020).
[49] https://www.icao.int/abouticao/assembly/Pages/. (Date of use: 11 July 2020).
[50] https://www.icao.int/safety/pages/usoap-results.aspx (Date of use: 26 December 2019).
[51] Niels V "Cross-border" 33.

Left Behind' (NCLB) campaign. The aim of the initiatives under the campaign is to assist States to effectively implement ICAO Standards, Recommended Practices and Resolutions.[52]

3.5 ICAO and Partnerships Relevant for UAS Regulations

In response to integration of unmanned aircraft system into civil aviation and addressing the identified challenges in chapter Two of this thesis on safety, security and privacy, ICAO works through cooperation and partnerships with other organizations. Among the most prominent ones are global organizations such as the World Meteorological Organization, World Tourism Organization, International Maritime Organization, and World Health Organization, among others.[53]

In addition to these global organizations, ICAO collaborates with and gets support from regional organizations. These bodies are pivotal in ICAO's role of regulation of aviation safety, security, efficiency and related matters. ICAO, for instance, recognizes that the European Civil Aviation Conference, an intergovernmental organization of 44 European States, aids this role through creation of forum for understanding of policy and harmonization of ICAO-adopted aviation Standards and Recommended Practices amongst member States.[54] The partnership in this regard includes further liaison with the European Organization for the Safety of Air Navigation and the Council of Europe.

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[52] https://www.icao.int/annual-report-2015/Pages/all-strategic-objectives-nclb-initiatives.aspx> (Date of use: 12 July 2018).

[53] https://www.icao.int/safety/RunwaySafety/GRSS2011/Pages/PartnersandSupporters.aspx (Date of use: 16 July 2020).

[54] https://www.icao.int/safety/RunwaySafety/GRSS2011/Pages/PartnersandSupporters.aspx> (accessed on 16 July 2020). See also https://www.ecac-ceac.org (Date of use: 30 September 2020) for more information on the operation of the European Civil Aviation Conference.

In Africa, ICAO partners with the African Civil Aviation Commission (AFCAC). The Commission is a specialised organ of the Organization of African Unity (OAU) responsible for civil aviation matters in Africa.[55] The Constitutive Conference convened by ICAO and the OAU in Addis Ababa, Ethiopia, initiated the AFCAC in 1969.[56] Thereafter, the AFCAC became the specialized agency of OAU / AU on 11 May 1978.[57] Article 2 of the AFCAC Constitution, provides for establishment of AFCAC as the specialized agency of the African Union (AU) responsible for civil aviation matters.

Another key arrangement is partnerships at State levels. In the USA, for example, ICAO partners with the FAA, which is principally responsible for regulation of civil aviation in the United States of America. ICAO cooperates with FAA, as well as non-governmental organizations, key among them, the International Air Transport Association (IATA).

Lastly, ICAO works through established regional offices. For example, relevant to this research, is its Eastern and South African Office, located at Gigiri in Nairobi, Kenya. In terms of the regional cooperation, ICAO has mandated the creation of Regional Aviation Safety Groups (RASG) to serve as regional cooperative forums integrating global, regional, sub-regional, national and industry efforts in continuing to enhance aviation safety and security worldwide. RASGs develop and implement work programmes that support regional performance frameworks for the management of safety on the basis of the Global Aviation Safety Plan. RASGs build on the work already done by States, and existing sub-regional organizations. ICAO equally, encourages pooling of technical resources through Regional Safety Oversight Organisations (RSOOs) such as East Africa Civil Aviation Safety and

[55] Abeyratne R "The future of African civil aviation" 1998 *JATWW* 30-49.
[56] Abeyratne R "The future" 43.
[57] Abeyratne R "The future" 30.

Security Oversight Agency (CASSOA) in a bid to develop safety oversight framework.

These robust steps for ICAO's international cooperation are commendable. One principal concern, however, is inadequate mechanism by the regional bodies to provide avenues for the partnerships with ICAO on UAS integration into civil aviation and regulation enforcement especially regarding the African States under this study.[58] Despite their role in the development of regulations, encouragement of Member State to domesticate the international framework for aviation regulation as well as regulation of audits on safety of aviation, the East Africa Community's Civil Aviation Safety and Security Oversight Agency (CASSOA) still lack these partnership arrangements with ICAO.[59] Lubner considers the implications of this role by noting, the other side of the coin, that the partnerships are pivotal for strengthening of regional aviation bodies that has the potential of acting as a binding force for member States in efforts to seek regional integration of UAS into civil aviation.[60]

The author in agreeing with Lubner's views expressed above[61] notes that a practical example can be obtained from the US. Since the Organization of American States is the oldest regional organization, the partnership arrangement between ICAO and FAA, should inspire further partnerships with these continental or sub-regional entities especially in light of the comparative successes that FAA has made in regulation of aviation, which will be discussed in the next chapter. In any event, the EAC Treaty of 1999 contemplates adoption of common policies at the sub-regional level to achieve collaboration with ICAO.[62]

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[58] https://www.icao.int/safety/RunwaySafety/GRSS2011/Pages/PartnersandSupporters.aspx (Date of use: 16 July 2020).
[59] Abeyratne R "The future" 30
[60] Lubner B *et al* "The Continuing Challenge of Aviation Safety in Africa" (Paper presented to the 16th International Symposium on Aviation Psychology 2010) 80.
[61] Lubner B *et al* "Continuing Challenge" 80.
[62] EAC Treaty 1999, Article 92(3)(a).

Indeed, such cooperation could offer an important avenue for ICAO to take advantage of the geographical proximity and interdependence of Regional Economic Communities (RECs). To harness compliance with safety, security and privacy issues arising from use of UAS as has been the case with the European Union civil aviation organizations whose partnership arrangements with ICAO are perused though not relevant under the scope of focus for this study.[63] This would be so considering that Article 37 of the Chicago Convention relies heavily on the discretion of States for implementation of its convention and the annexes thereto. In the author's analysis, owing to the transboundary nature of UAS flying across nations, the sub-regional economic blocks offer opportunity to encourage members to comply with safety, security and privacy measures supporting the process of integration of UAS into civil aviation.

A further challenge is that despite this well thought out idea behind establishment of the AFCAC many decades ago, little efforts have been made towards creating unified regulation for UAS in the African continent that binds member States.

Even if the challenges were to be addressed, regional economic communities unfortunately seem to suffer from some other challenges that must first be sorted out to create meaning to the envisaged, and of course much needed, collaboration with ICAO. First, there are issues of capacity. For instance, despite entry of South Sudan into the East African Community, CASSOA[64] is yet to create an office within its organizational structure to specifically deal with UAS in the six East African States. The entity also has a lean organizational structure. [65] For example, CASSOA

[63] The Chicago Convention, Article 65 on arrangements with other international bodies. It provides that:- The Council, on behalf of the Organization, may enter into agreements with other international bodies for the maintenance of common services and for common arrangements concerning personnel and, with the approval of the Assembly, may enter into such other arrangements as may facilitate the work of the Organization.
[64] EAC Treaty 1999, Article 92.
[65] http://www.cassoa.org/cassoa/> (Date of use: 21 January 2018).

had only 21 members of staff by the year 2020, serving the entire East African region with the mandate to provide oversight in the six EAC partner States.[66] It is also grossly underfunded making it difficult to execute its other mandates, which include ensuring that UAS entering the region are documented, this data is shared among member States and complies with safety management systems as provided for under ICAO's Annex 19. The situation is not any better in the SADC. SADC has made no effort to establish a regional civil aviation agency such as South African States Civil Aviation Safety and Security Oversight Agency (SASCASSOA). Nevertheless, recent SADC efforts have led to establishment of an Interim SADC South African Safety Organization (iSASO), specifically to deal with civil aviation regulations within the sub-region. The organization is yet to be ratified by all the member States to have full force of the law among them. Moreover, emphasis is on safety without much focus on how to address security and privacy challenges. While the step is commendable, the lack of a substantive organization is a serious setback in cooperation efforts by ICAO.[67] It denies the SADC member States an opportunity to galvanize support and to assist and encourage members in complying with ICAO Standards and Recommended Practices in the manner envisaged under Article 4(b) of the Constitution of AFCAC, which is a continental civil aviation regulator.

This partnership contrasts with the continental position in the US, which has FAA as the body responsible for aviation functions.[68] FAA has established unified UAS regulations as are discussed in chapter Four of this study. The same lessons from the US are a near replica of the European Union, under the European Aviation Safety Agency (EASA), which has the mandate of developing aviation regulations for EU member States.[69]

[66] http://www.cassoa.org/cassoa/> (Date of use: 21 January 2018).
[67] The Chicago Convention, Articles 65 and 77.
[68] The Chicago Convention, Article 65 and 77.
[69] See Button K *et al* "African decolonisation and air transportation" 2015 *JTEP* 626-639.

4. International Air Law Responses to Regulation of UAS Challenges

This section provides substantive elements of the chapter on how existing international law framework has provisions that regulate safety, security and privacy issues arising from the use of UAS. These provisions are located in different frameworks as already pointed out in this chapter. This part discusses how the rules of international law including the Conventions, Annexes and other instruments address safety, security and privacy challenges that were identified and expounded in chapter Two of this thesis.

4.1. International Response to Aviation Safety in UAS Regulation

Aviation safety is defined under ICAO Annex 19[70], Safety Management Manual Doc 9859, ICAO Annex 2 on Rules of the Air and Circular 328-AN/190[71] as the state in which the possibility of harm to persons or of property damage is reduced to, and maintained at or below, an acceptable level through a continuing process of hazard identification and safety risk management.[72] From the definition, it emerges that the obligation of ensuring the safety of UAS is a two-fold process. It involves identifying safety risk and managing the risk. The risk management aspects encapsulate reactive and proactive approaches to management of safety concerns.[73] As noted in chapter Two of this study, the challenge of safety in the use of UAS arises from the lack of sense and avoid technology in some UAS. When such technology lacks in UAS, there are increased chances of collision. The international general rule is that the UAS use and operation must be safe and not compromise the lives of others.[74] In full realization of this general rule, a framework for redressing safety challenges was contemplated by the contracting parties through the establishment

[70] Annex 19 on Safety Management to the Chicago Convention (hereinafter referred to as ICAO Annex 19).

[71] ICAO Circular on Unmanned Aircraft Systems No. 328-AN/190 (hereinafter refered to as ICAO Circular No. 328-AN/190). See section 2.16, 2.17, 2.18, 2.19, 2.20 and 2.21

[72] See Safety Management Manual Doc 9859. Glossary and definition of terms at p vii.

[73] ICAO Annex 19, Paragraph 2.16.

[74] ICAO Circular 328-AN/190, Section 2.8 provides that: The principal objective of the aviation regulatory framework is to achieve and maintain the highest possible uniform level of safety. In the case of UAS, this means ensuring the safety of any other airspace user as well as the safety of persons and property on the ground.

of frameworks for aviation safety in the Chicago Convention.[75] Instructively, as elucidated above, the Chicago Convention established the ICAO, with mandate to regulate air safety, communication and technological aspects of international civil aviation, including aspects of UAS.[76] Article 8 of the Chicago Convention specifically provides the basis for regime of special authorization of aircrafts. The objective of the special authorization is to prevent obvious safety concerns arising from possibility of accidents and collisions if the pilotless aircrafts are left to operate unregulated in the airspace.

Still under the Chicago Convention, the contracting parties to the Convention are obligated to allow flights of non-scheduled aircrafts into their territories.[77] However, this obligation, which translates into a right on the operators of the aircrafts, may be limited, in case of movements where the States deem inaccessible. The limitation is at the discretion of the State, which can only be exercised on grounds of safety.

Similarly, under Article 9(a) of the Chicago Convention, public safety considerations inform the basis upon which countries may restrict or prohibit the flying of aircrafts. However, the discretion of the States has limitations and cannot be exercised when it is unreasonable in terms of extent or rather prevent aviation. Other than prohibited areas, circumstances such as public safety and emergency, without express prohibitions communicated to ICAO, may warrant a limitation on the right for aviation provided there is no discrimination of the aircrafts on nationality basis.[78]

[75] The Chicago Convention, Article 3 (d) which provides that: The contracting States undertakes when issuing regulations for their State aircraft, that they will have due regard for the safety of navigation of civil aircraft

[76] The Chicago Convention, Article 44.

[77] The Chicago Convention, Article 5.

[78] The Chicago Convention, Article 9(b).

The safety considerations are traced to the airports of member States, who are required to have navigation facilities and meteorological service for safety of aviation.[79] Similar considerations are to be made by the States when imposing the cargo restrictions provided under Article 35(b) of the Chicago Convention. In order to breathe more life into the stated provisions, ICAO is established with objective of ensuring 'safe and orderly growth of international aviation[80] and to 'promote safety of flight in international air aviation.'[81] Further, ICAO is mandated to adopt and amend SARPs from time to time, as discussed in subsequent section of this part. Particularly, the Chicago Convention recognizes that the standard may deal with, among others:

> "…such other matters concerned with the safety, regularity, and efficiency of air navigation as may from time to time appear appropriate."

From the above analysis, it is clear that the Chicago Convention's approach is establishment of broader frameworks for safety. The mechanism contemplated under Article 44(a) as read with 44(h) are dependent on the ICAO's development of relevant SARPs. Regarding the other restrictions and prohibitions of flights, the measures for their achievement are significantly dependent on discretionary regulations developed at State levels. An example is Article 9, which begins with the words,

> '…each contracting State may, for reasons of military necessity or public safety, restrict or prohibit.'[82]

Lastly, the provisions of Article 15 of the Chicago Convention on requirement of facilities and meteorological services at the airports for safety, largely excludes the UAS which have the capability of being launched from anywhere and not necessarily from an airport.

[79] The Chicago Convention, Article 15.
[80] The Chicago Convention, Article 44(a).
[81] The Chicago Convention, Article 44(h).
[82] The Chicago Convention, Article 9(a).

Other than the broader framework, the Convention recognizes and regulates two other practical activities that have a bearing on mitigating safety concerns for UAS use. The first one is the certification of airworthiness envisaged under Article 31 of the Chicago Convention. Before an unmanned aircraft system is certified, it should be issued with a certificate of airworthiness, declaring it fit for flying.[83] This means that every aircraft engaged in international navigation shall be provided with a certificate of airworthiness, issued or rendered valid by the State in which it is registered.[84] A certificate of airworthiness is a measure of an aircraft's suitability for safe flight, only applicable to certified UAS. It is conferred on an aircraft by the national aviation authority of a respective State and is maintained, subject to performance of the required maintenance actions. Until such a time that this requirement is harmonized, States continue to apply different criteria for certification.[85] For example, it has not been effectively possible to offer all UAS with certificates of airworthiness, due to rapid technological revolutions as many find themselves in the market without going through the procedural certification process. More often, they are used in social gatherings to take photographs without airworthiness authorization, a *lacuna* that has partly been associated with absence of UAS regulations or proper enforcement mechanisms.

The second practical regulation of safety is pegged on licencing requirements. These requirements are made under Article 32 of the Chicago Convention. The article provides that:

> "pilot of every aircraft and the other members of the operating crew of every aircraft engaged in international navigation shall be provided with certificates of competency and licenses issued or rendered valid by the State in which the aircraft is registered."[86]

[83] The Chicago Convention, Article 31.
[84] The Chicago Convention, Article 31.
[85] ICAO Annex 8.
[86] The Chicago Convention, Article 32(a).

Licensing is the authorization of defined events otherwise prohibited out of the hazards that would occur if poorly performed. This means that the licensing has safety of operation as one of its prime considerations when a decision to grant a licence is made by competent authorities. Applicants for a license must meet certain standards that are commensurate with complexity of the event to be performed.[87]

The two practical activities of certification of airworthiness and licencing, without more, do not inspire full safety with regard to the sense and avoid technologies. From a plain reading of the provisions of Articles 31 and 32 of the Convention, the provisions focus on the 'international aviation'. This technically leaves out of its scope, the concerns relating to safety of domestic uses of UAS. Particularly, Article 32 of the Convention addresses the 'crew members' in licencing subjects despite that being uncommon for UAS.[88] Ideally, aviation safety demands that remote pilots and other UAS crew need to be trained in safety, with proper qualifications, appropriate licenses or certificates of competence to provide a modicum of integrity in safety of the civil aviation system they eventually are part of. With little focus on the main conventional law, some States continue to operate without clear guidelines regarding pilots operating UAS.[89]

More practically, the ICAO has also developed two relevant ICAO Annexes, which are Annex 2 on the Rules of the Air and a manual known as Safety Management Manual Doc 9859 providing guidance to States to develop their domestic legal framework supports Annex 19 on Safety Management, this Annex. Also relevant to safety is the ICAO's UAS Circular No. 328 AN 190. The Circular is instrumental since it has rationalized the application of safety considerations to UAS to member States.[90]

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[87]The Chicago Convention, Article 32(a).

[88] Pepin E "Development of the National Legislation on Aviation since the Chicago Convention" 1957 *JALC* 1.

[89] ICAO Annex 19, Paragraph 4.13.

[90] ICAO UAS Circular No. 328 AN 190. Section 2.16, 2.17, 2.18, 2.19, 2.20 and 2.21

Annex 19 was developed to, among others, help achieve the two dimensions of safety. The Annex consisted of two programmes and systems, the first one being State Safety Programme (SSP) and Safety Management System (SMS). The two concepts are divided as between operators of UAS and the State, and are both aimed at ensuring that the sky is safe to all users.

State Safety Programme (SSP) is a programme through which ICAO ensures that States set of regulations and activities, with objective to improve safety of the airspace.[91] The Programme as a mandatory system recognizes the acceptable levels of safety in aviation practice. It is a system through which the civil aviation authorities, having regard to size and resource of the aviation system, regulate, monitor and administer safety.[92] The key areas of regulation include oversight of safety, which comprises monitoring of elements of safety oversight functions like areas of significant safety concerns and high safety risks. Others are risk management, safety assurance and safety promotion. It, therefore, contemplates the conduct policy formulation based on safety information such as identification of hazards and safety arising from management, conduct of stakeholder awareness and internal audits.[93]

The programme is very vital since it supports rule-making processes in the 193 ICAO member States in matter safety. Particularly, SSP supports an analysis of potential effects of safety of UAS and other third parties such as service providers regulated by civil aviation authorities.[94] This is in addition to determining the role of 'equivalent level safety' and 'acceptable means of compliance' in their possession. The SSP processes on safety assurance, risk management, and promotion are

[91] ICAO Annex 19, Paragraph 2.19.
[92] ICAO Annex 19, Paragraph 2.19.
[93] https://www.iata.org/en/training/courses/state-safety-program/tcvg90/en/ (Date of use: 22 July 2020).
[94] https://www.iata.org/en/training/courses/state-safety-program/tcvg90/en/ (Date of use: 22 July 2020).

designed to be proactive in addressing hurdles that the use and operation of UAS pose while in the air; in other words, they are part of countermeasures from a legal perspective that address challenges regarding UAS safety operations.

Second, the Safety Management System (SMS) is a system to be adopted by the stakeholders. It flows from the SSP for each State on the basis of which it instructs the stakeholders to develop their respective SMS.[95] Service providers and operators under oversight of the State's implementation of ICAO Annex 19 that requires all contracting States to domesticate safety management measures within their jurisdiction establish the system, which targets a systematic approach to management safety through creating efficiency in organizational structures, accountability, policies and procedures, the SMS.

The SSP and SMS are, therefore, inseparable. Persons, be they a pilots of UAS or manned aircraft, are required to bear similar responsibilities of being knowledgeable about rules of the air, flight performance, planning and loading, human performance, navigation, operation procedure and principles of flight.[96] They have to get flight instruction, demonstrate skill and expertise as well as be licensed. Of necessity, also, they would need to be proficient in the language of radiotelephony as well as meet the required medical fitness levels. For purposes of UAS, the latter could be modified through integration of regulations to ensure that those who operate UAS meet the basic levels of space proficiency.

Further, SSP and SMS, require States to establish bodies with oversight of the safety mandate at the national level. The authorities specifically are responsible for extending safety considerations to UAS responsibility of giving assurance of

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[95] https://www.iata.org/en/training/courses/state-safety-program/tcvg90/en/ (Date of use: 22 July 2020).

[96] ICAO Annex 19, Paragraph 2.15.

introduction of UAS within the civilian airspace.[97] Further, SSP and SMS have influenced regulation of personal licencing in some ICAO member States, in effect helping to achieve integration of UAS into civilian application. This translates to personnel licensing harmonization in a single airspace across national and regional boundaries.[98]

Without a pilot, the SSP and SMS aside, UAS may still experience challenges in meeting safety requirements such as introduction of technology for detection and avoidance, command and control, communication with ATC and prevention of unlawful interference.[99] The interference may occur because UAS have no pilot on board and there may be no capacity to communicate with ATC and seek clearance before landing at an airport. The Chicago Convention attempts to resolve this challenge by imposing UAS regulation and stipulation of conditions under which UAS can operate. The import of Article 8 of the Convention is to prohibit flying of pilotless aircraft over territories of other States without authorization.

In addition to ICAO Annex 19, the Annex 2 on the Rules of the Air[100] is instrumental in ensuring safety in civil aviation. The Rules stipulate the responsibilities of the pilot-in-command to ensure the operation of the aircraft complies with rules of the air and punishes those who violate them. The pilot-in-command of unmanned aircraft systems is the person controlling it while airborne and has final authority over it.[101] The rules apply whether the pilot is on board or at a remote location in the case of unmanned aircraft systems. Further, it is the responsibility of a pilot operating a UAS

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[97] Provided in relevant ICAO Annex 6 on Operation of Aircraft to the Chicago Convention (hereinafter referred to as ICAO Annex 6); Annex 11 on Air Traffic Services to the Chicago Convention (hereinafter referred to as ICAO Annex 11" and Annex 14 on Aerodromes Design and Operations to the Chicago Convention (hereinafter referred to as the ICAO Annex 14).

[98] The Chicago Convention, Article 8 on pilotless aircraft. It provides that each contracting State to ensure use of UAS by any contracting State shall be controlled to obviate danger to civil aircraft.

[99] ICAO Annex 19, Paragraph 2.15.

[100] Annex on the Rules of the Air to the Chicago Convention (hereinafter referred to as ICAO Annex 2).

[101] ICAO Annex 2, Paragraph 2.3.1.

to undertake a handing over process even where the aircraft is in flight.[102] Others are avoidance of collisions and development of flight plans, provision of signals and obtaining of air traffic control clearances.[103]

However, there is a challenge as regards the difficulty of implementing the ICAO Annex 2. This is so since in UAS, remote pilots may be separated by long distances and expected to hand over to pilots in far-off places. Addressing hand over responsibilities by remote pilots is made even more complex by the reality that remote pilots may be operating from completely different States or even the high seas.[104] The other obvious challenge brought about by ubiquity in the use of UAS is the difficulty to develop and submit a flight plan, to be used for filming, for example. As it stands, therefore, there are impediments to the full attainment of safety in licensing and regulation of UAS. It is notable that this might be a missed opportunity since rules of the air are, by nature, binding upon member States to the Chicago Convention.

Further, safety considerations also underpin the power of the States under international law which according to Cooper, include jurisdiction over airspace and unilateral right to admit or deny entry, freedom over high seas, right of innocent passage, nationality of aircrafts, among others.[105] The above position in conventional, SARPs and the international customary law are supported by court opinions that consider safety as the basis for regulation of UAS. For instance, the *Libyan Arab Jamahiriya v United Kingdom*[106] also known as the *Lockerbie case* has been instrumental in defining safety laws in the aviation sector. Though this case was applicable to manned aircrafts, the principles developed by the court would still apply to the UAS in the current framework under the Chicago Convention.[107]

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[102] ICAO Annex 2, Paragraph 2.3.1.
[103] ICAO Annex 2, Paragraph 3.3-3.6.
[104] ICAO Annex 2, Paragraph 3.3-3.6.
[105] See Cooper JC *"Backgrounds of International Air Law"* 1965 *YASL* 3.
[106] *Libyan Arab Jamahiriya v United Kingdom* 1992 88 (ICJ) Rep 3 [578].
[107] Bouve C "Regulation of International Air Navigation under the Paris Convention" 1935 *JAL* 299.

Perhaps, the only notable limitation is that the effect of the binding nature of the judgments are limited to those specific cases and respective parties alone.[108]

Safety concerns are also addressed through traffic clearances, which ensure flight completeness. In regards to the traffic management, it is clear that when the Chicago Convention was adopted, there was an agreement between parties that relates to traffic management. The Agreement stipulated at Article 12 of the Convention partly states as follows:

> Each contracting State undertakes to adopt measures to ensure that every aircraft flying over or manoeuvring within its territory and that every aircraft carrying its nationality mark, wherever such aircraft may be, shall comply with the rules and regulations relating to the flight and manoeuvre of aircraft there in force.

The reference to 'aircraft carrying the nationality marks' under Article 12 of the Convention applies extraterritorially. This is a major achievement in ensuring that foreign UAS do not cause mayhem or disruptions in the aviation airspaces of other countries. However, the implementation of the provision is heavily dependent on development of laws at national levels and consequent harmonization of the said laws that are to be implemented through the enforcement of the criminal laws.[109]

Further, the Chicago Convention requires aircraft that are engaged in international navigation to fulfil certain conditions, one of which is carrying documents aboard.[110] These documents include: certificate of registration, certificate of airworthiness, appropriate licenses for each crew member, journey logbook, aircraft radio station license; if carrying passengers, a list of their names, places of embarkation and destination, and if it is for cargo, a manifest and detailed declarations of the cargo

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[108] The United Nations Charter of 26 June 1945 1 UNTS XVI (entered into force 24 October 1945) (hereinafter referred to as the UN Charter).
[109] The Chicago Convention 1944, Article 12.
[110] The Chicago Convention 1944, Article 29.

should be provided.[111] Other than, for purposes of identification, certification and ownership, the documents are meant to ensure safety of the aircraft, its crew and property, and persons on the ground. The list of passengers would allow for easier identification in circumstances where an accident occurs. Declaration of cargo would ensure that only legal and not contraband cargo is carried.[112]

The above regulatory approaches under Article 29 of the Chicago Convention may, however, prove difficult to enforce when dealing with UAS as at the moment, there are no cases of them carrying people. Specifically, the alternative of fulfilling the documentation requirements of Article 29 of the Convention would be challenging for UAS. For example, whereas it would be easy for manned aircraft to carry specified documents on board the aircraft, carrying paper-based documents on board UAS is neither practical nor appropriate. In this context, electronic or alternative versions of the documents would need to be considered.[113] Secondly, it is commonplace that in the event an accident happens, most aircraft end up being burned completely, including paper-based documentation. It is, therefore, important to have a regulatory framework that ensures that advanced technology is fixed to UAS with backup to servers on the ground, which can be retrieved in case of accidents.

Regarding the implementation of the above provision, as Pevot *et al* notes, the international response to the safety is still faced with challenges of unmanned traffic management. Generally, UAS would require an advanced traffic management ecosystem under development for autonomously controlled operations of UAS to ensure safety in entry into the airspace.[114] Ideally, the system comprises a system that can monitor increased activity based on sharing of each operator's scheduled flight details in a digital form. Unfortunately, most UAS lack these systems.

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[111] The Chicago Convention 1944, Article 29.
[112] ICAO Annex 2, Paragraph, 2.1.1 also makes similar requirements.
[113] ICAO Annex 119, Paragraph 4.1.1
[114] Prevot *et al* “UTM” 3292.

That notwithstanding, the international response under Article 8 of the Chicago Convention contemplates that the UAS must operate in the same airspace with the manned aircrafts. As noted in chapter Two, this categorization may be disruptive since the UAS comes in different shapes and may operate in much lower altitudes which the aviation airspace was not originally designed to handle. This leads to concern over safety issues in entry of UAS into the airspace.

The rule of the air is to reduce the safety risks that may arise. Part 3.6 in particular deals with control of air traffic. It specifically provides as follows:

> "An air traffic control clearance shall be obtained prior to operating a controlled flight, or a portion of a flight as a controlled flight. Such clearance shall be requested through the submission of a flight plan to an air traffic control unit."

The import of the word 'shall' makes it mandatory for the requisition of the air traffic control clearance to be obtained when a person submits an air traffic control plan after submission of flight plans by civil aviation operators including operators of UAS. Despite the provision, the requirements of ICAO Annex 2 still compellingly direct toward two conclusions on implementation challenges. First, some of the requirements for flight plans and flight clearance to pilots in command may be impracticable for certain uses of UAS. Secondly, the idea of control as stipulated in the Chicago Convention and ICAO Annex 2 do not specifically provide for the command and control system. Accordingly, it depends on the State resources and the design of the UAS to fully implement these provisions that are pivotal for safety in the airspace.

In order to further cure the challenges that relate to the unmanned traffic management in the ICAO Annex 2, ICAO developed Circular No. 328 AN 190. The Circular requires pilot-in-command to ensure operation of the aircraft complies with rules of the air and punishes those who violate them. The pilot-in-command for unmanned aircraft systems is the person controlling it while airborne and has final authority over it.[115] This applies, whether the pilot is on-board or at a remote location in the case of unmanned aircraft systems. Further, it is the responsibility of a pilot operating a UAS to undertake a handing over process even where the aircraft is in flight.[116] Other responsibilities are avoidance of collisions and development of flight plans, provision of signals and, obtaining of air traffic control clearances.[117]

The ICAO has, over the years, developed a series of traffic rights, known as Freedoms of the Air, which continue to form the basis of rights exchanged in air services negotiations today.[118] This study contends, however, that this principle and its effect on UAS may present a contradiction since although UAS may interact like manned aircraft, there are certain inconsistencies exist in the latter such as non-co-operation and non-compliance, which may complicate management of air traffic with current regulatory challenges.[119]

The above provisions speak to the general rules on safety and do not specifically address the challenge of lack of the sense and avoid technology for some UAS. The rule that specifically addresses the issue is the UAS principle of responsibility and accountability. Under this principle, it is expected that UAS missions will still need persons who are accountable, regardless of whether they are called commander or pilot.[120] From a legal perspective, action must be taken against persons or legal entities responsible for operations, in case of foul play. Particularly, the principle

[115] ICAO Annex 2, Paragraph 2.3.1
[116] ICAO Annex 2, Paragraph 2.3.1.
[117] ICAO Annex 2, Paragraph 3.3-3.6.
[118] Manual on the Regulation of International Air Transport (Doc 9626, Part 4)
[119] DeGarmo M *Issues Concerning Integration* 8.
[120] De Garmo *Issues Concerning Integration* 8.

appreciates that the UAS involves novel technologies, hence the need to create mechanisms to ensure responsibility and accountability in design, manufacture, maintenance and operations, equal to those of manned aircraft, even though the person in command is on the ground.[121]

4.2 International Response to Aviation Security in UAS Regulation

The overall international commitment to the field of aviation security is deducible from the preamble to the Chicago Convention as conceptualised and anchored under ICAO Annex 17, which defines security as the act of safeguarding international civil aviation against acts of unlawful interference.[122] As noted in chapter Two of this thesis, the security issues that concern the use of UAS arise from interference with State sovereignty, cyber-attacks, lack of command controls among other factors.

Generally, international air law has, over time, evolved to combat such acts in the aviation field, concerning manned aircraft and by extension the UAS. Traditionally, State security is assured through protection and affirming of territorial integrity and State sovereignty as principles of international relations.[123] It is based on sovereign equality principle affirmed under Article 2 (1) of the United Nations Charter of 1945. It is, therefore, the responsibility of each State to uphold security within her jurisdiction. So pivotal is the principal that State security, also termed as 'public security,' has been the basis of limitation of human rights and fundamental freedoms in the international bill of rights.[124]

[121] De Garmo *Issues Concerning Integration* 8.
[122] See ICAO Annex 17.
[123] Chicago Convention, Articles 1 and 2.
[124] See example acrimonious passage of the Kenya security amendment Act No. 19 of 2014.

As regards to specific aviation security, the Chicago Convention places security as the pivot upon which the regulation of civil aviation is based. This is evident from paragraph 1 of the preamble, which recognizes the future power of international cooperation in the aviation field in developing friendliness. The same paragraph has it that the abuse of the cooperation may be a threat to 'general security'. The preamble to the Chicago Convention, therefore, contemplates a future where civil aviation can foster friendship and understanding among nations. At the same time, it appreciates threats to security and prohibits acts of unlawful interference against orderly civil aviation.[125] Thus, whereas it promotes the desire for peaceful co-existence among nations, it is also alive to the need for overall regulation for peaceful co-existence. In the ordinary sense the general security referred to in the preamble is broader than the State sovereignty and public security concept in the United Nations Charter. This means that the Chicago Convention goes over and above the traditional view of State sovereignty and considers global security as a serious consideration in the regulation of aviation.

Other than the broad recognition, the Chicago Convention is more specific on the activities that need to be taken to avoid the much-feared backlash in global security. Article 33 of the Convention provides as follows:

> "Certificates of airworthiness and certificates of competency and licenses issued or rendered valid by the contracting State in which the aircraft is registered, shall be recognized as valid by the other contracting State, provided that the requirements under which such certificates or licenses were issued or rendered valid are equal to or above the minimum standards which may be established from time to time pursuant to this Convention."

Still on security, Article 33 establishes the basis for the licensing and certification of operations of the UAS in the airspace. The Article forms the basis of recognition, and a further stipulation that such certificates must be of equal or above minimum

[125] Chicago Convention, Article 4.

standards in another State.[126] Article 17 of the Convention that makes requirement for nationality marks of the State in which they are registered supplements the provision on certification and airworthiness. The Article States that “Aircraft have the nationality of the State in which they are registered.”

The security issues can also be ensured through the utilization of partnerships and agreements between ICAO and other geographical security organizations.[127] Instructively, Article 64 of the Chicago Convention provides as follows:

> “The Organization may with respect to air matter that are within its competence directly affecting the world security by vote of the assembly enter into appropriate arrangements with any general organization set up by nations of the world to preserve peace.”

The provision enables ICAO to utilize the pre-existing security organization and thus save on financial and human capacity when dealing with the security challenges. Additionally, dealing with regional organization may be much more efficient in terms of enforcement and ease of development of consensus on action based on a pre-existing agreement, which member States are obliged to adhere to by the principle of *pacta sunt servanda*.

Regarding further development of standards, procedures and regulation in the areas of security the Chicago Convention contemplates these areas on airworthiness of aircrafts, and registration and identification as falling under the domain of the ICAO for adoption and amendment SARPs under Article 37(e) and (f) respectively. True to this higher calling, the ICAO adopted the ICAO Annex 17. The Annex regulates the security concerns through security programming and requirement of nationality marks.[128] The nationality of an aircraft has not only become an important part of civil

[126] Chicago Convention, Article 33.
[127] Chicago Convention Article 64
[128] Chicago Convention, Art 17 & 20

aviation and bilateral air transport agreements, but also the multilateral transit and transport agreements.[129] It is for this reason that substantial ownership and effective control requirements have effectively precluded adoption of the maritime law notion of “flags of convenience” into international aviation. Addressing nationality of aircraft is thus a key principle of the Chicago Convention.

ICAO Annex 17 also supplements the requirements of nationality marks in Article 17 of the Convention by its specifications for minimum-security standards for display of aircraft marks to indicate appropriate nationality and registration.[130] This makes it much easier to trace unmanned aircraft systems in the air, especially in circumstances where they end up intruding into airspace territories of other States without authorization.

Whereas implementation of nationality requirements, especially through identification marks and height requirements is easily achievable in manned aircraft, this may not necessarily be the case for UAS. For instance, some UAS are too small to affix identification marks. Thus, UAS may need alternative modes of complying with the provisions of Article 17. This deficiency continues to negatively impact on the regulation of security of operation of unmanned aircrafts. Until these alternatives are well defined and stipulated, as discussed under the chapter on safety, the predicament is likely to persist.

ICAO has lately diversified its role in assistance of States, initiation of policy initiatives as well as focusing on conduct of security audits. This has led to further development of Aviation Security Manual Doc 8973, and lately, ICAO UAS Circular 328-AN/190. The ICAO Council first adopted the Aviation Security Manual Doc 8973 in March 1974. The focus on civil aviation under the Manual and not international

[129] Chicago Convention, Art 66.
[130] Chicago Convention, Arts 17, 18 and 19 on Nationality of Aircraft, dual registration and National laws governing aircraft registration respectively.

aviation is a reflection of aim of ICAO to assist the States at their domestic levels in compliance and in taking steps towards the implementation of the security measures as a means of building the ultimate consensus at the international level.[131] Since then, there has been increased focus on the audits, which has led to the development of the Universal Security Audit Programmes (USAP) that are managed and coordinated by the Aviation Security section within ICAO.[132]

Under this guidance on the evolving nature of security, States have the responsibility for ensuring security of passengers, crew and ground personnel; this means that appropriate civil aviation authorities are mandated to develop National Civil Aviation Security Committees that will oversee establishment of programmes such as the National Civil Aviation Security Programme, National Civil Aviation Security Quality Control Programme and National Civil Aviation Security Training Programme.[133] Hence individual member States are obligated to put in place such measures as to uphold security within the country and specifically the aerodromes.

The ICAO Circular 328-AN/190, on the other hand, was designed as a guidance document for ICAO member States to develop UAS regulations in conformity to security.[134] It is instructive that the Circular called on States to provide comments, particularly with respect to its application and usefulness.[135] The Circular, therefore, represents an effort to proceed with development of fundamental international regulatory framework through SARPs, with supporting procedures for air navigation

[131] https://www.icao.int/Security/Pages/default.aspx?p=12 (Date of use: 22 July 2020).
[132] https://www.icao.int/Security/Pages/default.aspx?p=12 (Date of use: 22 July 2020).
[133] ICAO Annex 17 on Security to the Chicago Convention (hereinafter referred to as the ICAO Annex 17), Paragraph 2.1.2. It provides that: Each Contracting State shall establish an organization, develop, and implement regulations, practices and procedures, to safeguard civil aviation against acts of unlawful interference taking into account the safety, regularity and efficiency of flights. See also ICAO Annex 17, Paragraph 3.1.1 which provides that: Each Contracting State shall establish and implement a written national civil aviation security programme to safeguard civil aviation operations against acts of unlawful interference, through regulations, practices, and procedures, which take into account the safety, regularity and efficiency of flights.
[134] ICAO Circular 328-AN/190, Paragraph 5.32.
[135] ICAO Circular 328-AN/190, Paragraph 5.32.

services and guidance material, to underpin routine operation of UAS throughout the world in a safe, harmonized and seamless manner comparable to that of manned aircraft operations.

Other than the laws developed under the auspices of the ICAO, the idea of security is a key component of the explosive management framework through its International Explosives Technical Commission. The Commission is the custodian of the Technical Annex to the Convention on the Making of Plastic Explosives Convention of 1991.[136] Notably, this multilateral anti-terrorism treaty was developed for purposes of detection, prohibition, conveyance and prevention of manufacture and storage of unmarked plastic explosives. The Convention specifically targets the manufacturing of aircrafts and, as such, makes no serious distinctions between manned and unmanned aircrafts in its application. The restriction under the Convention is limited, however, to restrict plastic explosives to individuals who are the current high number of users of UAS. Further, ICAO has stated that cyber-attacks on air navigation facilities could constitute an offence under the Beijing Convention for the Suppression of Unlawful Acts Relating to International Civil Aviation.[137] It illegalizes transport of Biological, Chemical, and Nuclear weapons and related materials, which UAS can easily transport, or hijackings and attacks on air navigation facilities by coercion or technological means.

Further, the law on security may also draw from the international custom of State sovereignty. In this respect, Article 1 of the Chicago Convention states as follows:

> "The contracting States recognize that every State has complete and exclusive sovereignty over the airspace above its territory".

According to Brown *et al*, the principle of State sovereignty provides that every State has, to the exclusion of all other States, independent and absolute right to permit or

[136] https://www.icao.int/Security/Pages/default.aspx?p=12 (Date of use: 22 July 2020).

deny access into the area recognized as its territory, and similar right to control all activities within such territory.[138] Article 1 of the Chicago Convention is the basis for reaffirmation of the principle, which first featured under Article 1 of the Paris Convention of 1919. By doing so, the Chicago Convention codified the customary international law.

From the overview of the operation of the sovereignty principle and its embodiment in the treaty law and international custom, it is evident that application of the principle majorly targets very large aircraft systems. Even though it applies to UAS, the limitation may be abused. For instance, authorization can be seen as a limitation of innocent passage that may sometimes be invoked by a State against an enemy State. Such an instance can limit achievement of the provisions of Article 8 that only target the removal of all circumstances that obviate danger. The other challenge in the application of the principle is sovereignty itself. This arises from a common argument that the reasons States adopt national laws to complement ICAO Annexes and Circulars on security is to ensure efficient use of airspace, individual States still have a responsibility to recognize each other's right to fly through national air territory.

The other duty is to utilize certain areas of national land territories, as well as territorial waters, such as landing grounds and harbours. As a result of these dynamics, there is a school of thought that argues, and compellingly so, that airspace ought to be treated as belonging to humanity without exception and thus subject to international regulation. [139] Owing to the logical arguments above, it is submitted that leaving all these aspects of authorization to domestic regulation on prior authorization processes is self-defeatist and may amount to many UAS being

[138] Brown C et al *State sovereignty as social construct* (Cambridge University Press 1996) 88.
[139] Pepin E "The legal Status of the Airspace in the Light of Progress in Aviation and Astronautics" 1956 *McGill LJ* 70.

discreetly gunned down by some States in the pretext of maintaining national security.

Other than State sovereignty, other international customs relevant to aviation security are the right of innocent passage and its exemptions under international law of the sea. Under this law, it is the duty of the originating State to ensure aircraft exercising the right of transit or passage navigate or fly immediately through or over the passage of another State.[140] More so, the State given the right of way must refrain from any activities, other than those that are incidental to their normal modes of continuous and expeditious transit, unless rendered necessary by *force majeure* or necessity.[141]

Additionally, general principles recognized by the civilized nations also form a necessary regulatory framework for aviation security. Particularly relevant is the general principle of sovereignty of the airspace, with its limitations. This principle has been responsible for provision of requirement of specialized authorization to operate UAS in the territory of another State as required under Article 12 of the Chicago Convention. The Article, which is a restatement for Article 15 of the Paris Convention, limits the right of passage to the airspace above the open sea, a free airspace with principles ruling aviation in this space being similar to those applicable at sea level. The rule is based on the public law rule that prohibits a State from exercising power over another State's territory.

The overall international legal framework outlined above is useful for the protection of the UAS from illegal seizure. It is dependent on States to determine privileges to which such aircraft may be entitled, and such States are reciprocally responsible for

[140] Solomon S "The Right of Innocent Passage and the 1958 Geneva Conference on the Law of the Sea" 1966 *CJTL* 96.
[141]The Chicago Convention, Article 39(1).

the international good conduct of such aircraft in ensuring that the manned or unmanned aircraft are in good condition or not used to create insecurity.

The mode of implementation and monitoring of the international security mechanism may, however, be inefficient in regulation of UAS for three principal reasons. First, congruence of the security programmes with airport plans is impossible for most UAS that can be launched from remote places. The second challenge is that the mechanism for protection under ICAO Annex 17 may be difficult to implement since ownership of UAS is increasingly becoming personal, and more so for civil UAS, to which the Chicago Convention applies. Even the more expansive amendment to the Aviation Security Manual may be limited in application since UAS may not have in-flight security personnel or passengers as envisaged by the manual.

Additionally, the success of the regulatory mechanism is dependent on the presence and efficiency of control and command systems for UAS. To date, however, and as discussed in chapter Two of this study, there are outstanding challenges related to the control and command systems.[142] Though this is the case, the Chicago Convention still does not directly address the issue of command and control of the UAS. This partly explains why the UAS-specific Circular issued by ICAO recognizes that the challenges are inevitable.[143] The persistent challenges for lack of system cannot, however, be overlooked at the international level owing to real security threats that may arise from exercise of freedom of overflight over high seas as provided for under Article 87(1) of the UN Convention on the Law of the Sea.[144]

Thirdly, security challenges could also arise from the right of transit passage, which is recognized under Article 38, as read together with Article 3 of the Law of the Sea Convention. The right allows exercise of the freedoms of navigation and overflight,

[142] Chapter Two, section 7.2.1 of this thesis.
[143] ICAO Circular Circular No. 328-AN/190, Paragraph 2.15.
[144] Convention on the Law of the Sea Convention of 1982.

exclusively for purposes of continuous and expeditious transit through an international strait between one part of the high seas or an Exclusive Economic Zone which may pose practical threats to State security as regard the use of UAS, when they are abused.

4.3 International Response to Privacy Challenges in UAS Regulation

As discussed in chapter Two of this thesis, the privacy concerns on use of UAS are real and practical. They majorly concern the challenges of potential privacy breaches caused by the UAS that may be used for secret traditional photography. The threat arises from the fact that UAS have capacity to use global positioning system (GPS) technology to take aerial photos owing to their ability to fly above residential areas.

At the time of enactment of the Chicago Convention, the contracting parties were conscious of possible privacy concerns arising from UAS operations. Comparatively, redress of the concern is not as prominent as aviation safety and security matters since there is not a single provision that expressly mandates the State parties to develop any regulation to reassure the privacy concerns in UAS use. The regulation of privacy issues can, however, be inferred by implication from the reading of some provisions of the Convention. Indeed, Article 36 of the Convention emphatically provides on this issue, albeit from an approach of a right of the State. It provides as follows:

> "Each contracting State may prohibit or regulate the use of photographic apparatus in aircraft over the territory."

The reference to possible State regulation of aerial photography in Article 36 of the Chicago Convention strongly imputes the regulation of the privacy. The actual import of Article 36 of the Convention, however, is not to expressly prohibit the traditional photography of operations of aircrafts, including UAS, operating over territories of other States. What the provision does is to grant the obligation on the States to develop frameworks for putting this into effect. Again, this means that prior to development of the contemplated regulation, the protection of privacy rights may not be fully assured without the contemplated domestic regulations to be adopted by States as per Article 36 of the Chicago Convention.

Secondly, the approach on protection of privacy through regulation of traditional photography seems to be archaic and not in touch with the 21st Century challenges. First, the photography is not only targeted at attacking other States. Secondly, other than the traditional photography concerns, there are other information and communication technologies that can negatively affect the privacy rights which are not expressly recognized under Article 36 of the Chicago Convention. For example, it does not contemplate the challenge of cyber-attacks, which may target the systems of the very UAS, control towers or radars.

It is possible that ICAO has an avenue to overcome the challenges set out above through further regulation of the provisional powers to develop standards and recommended practices and procedures as well as its organizational objectives for promotion of all aspects of aviation under Articles 37 of the Chicago Convention. However, a closer reading of the Article evidences what might just be another case of the non-dominant position of redress for privacy concerns under the Chicago Convention. Article 37 addresses the areas in respect of which ICAO can develop international standards and recommended practices. The topical standards and recommended practices for which Annexes can be adopted, as listed at Articles 37(a)-(k) do not *prima facie* expressly recognize privacy concerns in the use of UAS. The only possible means of developing regulations, standards and, procedures on privacy is pursuant to the Provision of Article 37 of the Chicago Convention that reads in part as follows:

> "…To this end the International Civil Aviation Organization shall adopt and amend from time to time, as may be necessary, international. Standards and recommended practices and procedures dealing with...and such other matters concerned with the safety, regularity, and efficiency of air navigation as may from time to time appear appropriate."

This means that when ICAO considers developing a standard or recommended practice, it can only do so in reliance to its miscellaneous power to do so on 'such other matters concerned with regularity, and efficiency of air navigation as may from time to time appear appropriate.' In so doing, ICAO can further justify a possible development of a privacy framework action as moulded on its objectives under Article 44(i), which is to 'promote generally the development of all aspects of international civil aeronautics'.

However, hitherto, the ICAO has not developed any Annex to deal with the issue of privacy. The activities on regulation of privacy remain largely dormant at the international plane. The matters are largely left to be dealt with within the real State sovereignty. But even then, the audits which ICAO use to ensure compliance at those State levels only target safety and security of aircraft operations and use and not privacy compliance .

The scanty framework in the principal international Convention does not, however, mean that the victims of breaches or threats of privacy breaches may be without distress. Indeed, such actual or potential victims have resort to the international human rights discourse for protection and remedies. Particularly relevant are human rights instruments such as the Universal Declaration of Human Rights,[145] and International Covenant on Civil and Political Rights (ICCPR).[146] Article 17(1) of the

[145] UN General Assembly, Universal Declaration on Human Rights 10 December 1948, 217 A (III).
[146] UN General Assembly, International Covenant on Civil and Political Rights, 16 December 1966 99 UNTS 171.

ICCPR is particularly important since ICCPR is a binding Convention. It provides as follows:

> "No one shall be subjected to arbitrary or unlawful interference with his privacy, family, home or correspondence, nor to unlawful attacks on his honour and reputation."

The import of the above provision, is that except as may otherwise be limited in accordance with the applicable laws or derogated as under Article 4 of the ICCPR,[147] States are under an obligation to among others respect, protect and fulfil the freedom from arbitrary or unlawful interference with a person's rights without distinction. This is a reaffirmation of the declaration at Article 12 of the Universal Declaration of Human Rights, 1948 that imposes similar prohibitions against interference.

Accordingly, reliance on international human rights treaties is thus pivotal in regulation of activities of State aircrafts, which are otherwise excluded from the application of the Chicago Convention by virtue of Article 3. The appurtenant challenge, however, is the fact that the international human rights discourse addresses the States and not UAS operators. It thus relies on the State action to develop laws, policies and regulations, aimed at protection of privacy issues. Indeed, the challenges are laid bare in literature that shows that the UN member States remain sceptical about low levels of adoption of the universal standards.[148] A common thread that cuts across the development in the uses, sizes, functioning and history of UAS is the potential challenges associated with sovereignty, technological and technical underpinnings. This is evident from the lack of an international law convention or Annex on the privacy matters relating to cybercrime matters, which have an increasing potential to infringe on privacy rights.

[147]See UN General Assembly, International Covenant on Civil and Political Rights, 16 December 1966 99 UNTS 171, Article 4(2) on the list of articles on non-derogable rights.

[148] Mark E, and Alison LY "Privacy international in the Supreme Court: jurisdiction, the rule of law and parliamentary sovereignty" 2019 *TCLJ* 490-496.

As a result of the scepticism, the regulation of UAS differs from one jurisdiction to another and, as such, the international treaties may not achieve uniformity. The available prospects of integrating UAS in civil aviation arise from the support extended by ICAO to member States in discharging their rights and obligations. Subsequently, some countries have taken, or are taking steps in addressing the challenges through their domestic legislation and regulations.

5. Conclusion

This chapter has addressed the regulatory framework in international air law for UAS and in particular, how the international framework addresses safety, security and privacy challenges identified in chapter Two of this thesis. It is established that international civil aviation law framework under the Chicago Convention, enjoys support of 193 States, delineates mandatory application and interpretation of Article 8 to apply it to UAS. Though the Convention's provisions were compellingly couched to give prominence to regulation of manned aircrafts, they too can be extended seamlessly through the principles of fairness and transparency to apply to similar safety, security and privacy concerns in their application to the UAS. Comparatively, however, the mention of redress for privacy concerns is scanty and limited to traditional photography issues.

The deficiency notwithstanding, it is clear that the regulation of safety and security issues have been widely addressed through ICAO's framework developed by way of adoption and amendment of SARPs pursuant to Article 37 of the Chicago Convention. Specifically, the ICAO framework targets both proactive and reactive regulation of the three aspects of UAS use. Despite the developments, certain practical challenges in development of higher standards of compliance for ICAO in requirement of autopilot software, management of air traffic, management and command control systems for UAS and the little attention given to the privacy concerns in the framework for regulation under the Chicago Convention, 1944 abound. Despite the challenges, the international human rights discourse has significantly shaped the redress for certain UAS concerns for privacy in order to fill the existing gap. Accordingly, other than the Chicago Convention, the full and effective redress of the safety, security and privacy challenges arising from UAS depends on further development of frameworks under ICAO, customary international law, and the international human rights discourse.

Chapters Four, Five and Six discuss how specific States have dutifully responded to the absence of unified international UAS regulation in dealing with identified challenges of safety, security and privacy in their national jurisdictions.

CHAPTER FOUR

LEGAL, POLICY AND INSTITUTIONAL FRAMEWORK FOR REGULATION OF UAS IN THE UNITED STATES OF AMERICA (US)

1. Introduction

This chapter examines the regulatory framework of UAS in the US. It analyses how the framework addresses safety, security, and privacy challenges inherent in the use of UAS. Specifically, it reviews the different safety, security, and privacy concerns arising from dirty, dull and dangerous missions of UAS in the US, as explained in chapters One and Two of this thesis. The purpose of this chapter is to further analyse how, and to what extent, the US jurisdiction has adopted the international legal framework detailed in chapter Three, in order to address challenges associated with integration of UAS into civil aviation. The chapter evaluates the history of UAS regulation in the US, specific UAS guidelines, institutional and policy framework provided by the Federal Aviation Administration (FAA) as well as the role of courts in harnessing and addressing safety, security, and privacy concerns.

2. History and Background of Regulation of Civil Aviation in the US

According to Carr, the US is considered one of the most developed States technologically and economically, coupled with advanced legislative framework for UAS.[1] Because of this advancement, UAS has become commonplace in the US airspace, and with development in technology, so has been the challenge of balancing demands of safety, security and privacy in Federal and State laws, regulations and economic interests.[2] Given her technological advancement,

[1] Carr EB https://www.e-education.psu.edu/geog892/sites/www.e-education.psu.edu.geog892/files/sp-Drones-long-paper.pdf (Date of use: 14 October 2017).

[2] Carr EB https://www.e-education.psu.edu/geog892/sites/www.e-education.psu.edu.geog892/files/sp-Drones-long-paper.pdf (Date of use: 14 October 2017).

leadership, and many years' interactions with UAS, the US can potentially provide experiences on integrating UAS into the civil airspace.

The history of regulation of the civil aviation industry in the US commenced in the early 19th Century. A host of other countries, such as South Africa and Kenya, were beneficiaries of the regulations developed by the US. As Heymann correctly notes, the September 11 incident was a turning point in regulation of aircrafts in the US.[3] After the 11 September 2001 disaster, where manned aircraft were used as weapons of mass destruction to crash into north and south towers and World Trade Centre respectively, such incident has not happened in any other country ever since. The US undertook a massive security rearrangement to allow proper information sharing among agencies dealing with security, alignment of entities including customs, border control, immigration and aviation, which were placed under Homeland Security, to address uncoordinated security operations including aviation security. These policy changes ultimately led to the passage of the FAA Modernization and Reform Act[4] in 2012, marking the starting point in addressing challenges related to aircraft regulations for smooth integration into civilian aviation.[5]

It is noteworthy that even in the US where development and use of UAS is advanced, a most recent and dedicated legislation in the name of Federal Aviation Modernization and Reform Act was only enacted in 2012, three years before commencement of this study. The Act mandated the Federal Aviation Authority to develop and implement comprehensive procedures that would enable UAS integration into the national airspace system by September 2015.[6] Hitherto, FAA was developing such polices, standards, advisory circulars, notices and orders

[3] Heymann PB "Civil liberties and human rights in the aftermath of September 11" 2001 *HJLPP* 441.

[4] FAA Modernization Reform Act of 2012 (Congress Public Law No.112-095) (hereinafter refered to as the FAA Modernization Reform Act).

[5] Elias B *Pilotless drones: Background and consideration for congress regarding unmanned aircraft operations in the national airspace system* (Congressional Research Service Washington DC 2012) 8.

[6] http://www.FAA.gov (Date of use: 4 July 2017). The National Airspace System (NAS) is the common network of U.S. airspace; air navigation facilities, equipment and services, airports or landing areas. Included are system components shared jointly with the military.

designed to improve airspace safety and this remains work in progress.[7] Despite its considerable and comparative success, FAA is faced with the challenge presented by the dire need to create an environment that would spur technological innovation, while at the same time developing a regulatory framework that guarantees safety for all aviation stakeholders. This is critical because, whereas the integration process is incomplete, operators of recreational UAS continue to use distinct rules for model aircraft in violation of the FAA Modernization and Reform Act.[8]

The US has a long history with UAS dating back earlier than the Air Commerce Act.[9] In the pre-1926 regime, the aviation sector took a two-pronged dimension through the common law from State and local court decisions, as well as statutory law enacted at the State level.[10] In the mid-1920s, a view was developed that it was necessary for federal law to regulate the aviation industry through adoption of statutes and regulations at the federal level.[11] Prior to the above development in 1934, the Department of Commerce renamed the Aeronautics Branch as the Bureau of Air Commerce with the objective of underlining the growing significance of aviation to the nation.[12] Among the aims of the renamed Bureau's tasks was to promulgate all-inclusive federal air commerce rules.[13]

The drafters of the initial federal law were of the view that the scope of rules should encompass all frontages of aviation, that is, the aircraft, the airmen involved in aircraft operation (the pilots and mechanics), and the rules of the air.[14] The experts

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[7] FAA "Advisory Circular on Reporting of Laser Illumination of Aircraft" https://www.Faa.gov (Date of use: 18 July 2018).

[8] The US Integration of civil UAS in National Airspace System Road Map of 2013. See also Secretary of Transportation "Unmanned Aircraft System (UAS) Compressive Plan: A Report on Nation's UAS Path Forward of September 2013" https://www.hsdl.org/?abstract&did=746317 (Date of use: 1 October 2020).

[9] Air Commerce Act of 1926.

[10] Logan GB "The Present Status and the Development of Aviation Law" (2013) *JAL* 510.

[11] Logan GB "Present" 510.

[12] https://www.FAA.gov (Date of use: 18 July 2018).

[13] https://www.FAA.gov (Date of use: 18 July 2018).

[14] The US Department of Commerce Information Bullet Number 7.

modelled American federal law on the principles itemized in the draft description from the Aerial Navigation Convention.[15] The Bureau of Air Commerce recommended laws requiring that every aircraft shall be provided with:- (a) a certificate of registration, (b) a certificate of airworthiness, (c) certificates and licenses of the commanding officer, pilots, crew and log books.

Arising from the above development and the fact that aircraft could naturally navigate State and national boundaries, a uniform aviation law was ideal compared to a patchwork comforter of local laws.[16] Uniform regulation at the federal level was a logical preference due to the fundamental requisite to standardize aviation for military purposes.[17] Owing to the failure by the US Constitution to expressly define aerial jurisdiction, the government realized that there was an urgent need to legislate on it so as not to interfere with the inherent concept of federalism.[18]

In the aftermath of Congress' decision not to ratify the Treaty of Versailles, President Woodrow Wilson excluded production of the Aerial Navigation Convention to the Senate for debate.[19] In 1920, the American Bar Association adopted a resolution that aeronautics is within the admiralty jurisdiction of the United States and should be entertained accordingly.[20] Upon failure of this proposal, as there was precedence that transport by air was distinguishable from transport by sea, the American Bar Association sought other means to create federal jurisdiction over the skies. In 1922, the American Bar Association mooted an idea of endorsing a constitutional amendment.[21]

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[15] The Convention Relating to the Regulation on Aerial Navigation of 13 October 1919 (entered into force 15 June 1929).
[16] Lee FP "The Air Commerce Act of 1926" 1926 *ABAJ* 371.
[17] Lee FP "Air Commerce" 376.
[18] Lee FP "Air Commerce" 375.
[19] Lee FP "Air Commerce" 372.
[20] https://legal.un.org/ilc/documentation/english/ASIL_1947_study.pdf (Date of use: 1 October 2020)
[21] https://www.americanbar.org/products/inv/book/184862428/ (Date of use: 23 January 2020).

Ultimately, the constitutional amendment was deemed unrealistic and air law was divided along two paths - regulatory legislation that was nearly exclusively a federal responsibility, and non-regulatory legislation that is primarily a State responsibility.[22] For lack of a decisive federal action, the Uniform Law Commission, also known as the National Conference of Commissioners on Uniform State Laws,[23] undertook consideration of the necessities for durable State-level aviation law.[24] Set up in 1892, the Uniform Law Commission was tasked with providing States with non-partisan professional advice, with the Commission conceiving well-drafted legislation to bring clarity and stability to critical areas of State statutory law. This was a State-supported body that represented true worth for States providing services that most of them could not otherwise afford or duplicate.[25] To conform to values of federalism, each State willingly adopted a uniform State law for aeronautics which explicitly barred navigation of any aircraft otherwise than in conformity with the federal traffic rules.[26] The legislative step was thus a key assurance of safety and security concerns that would ordinarily arise from use of aircraft.

Practically, beginning in 1926, the United States enjoyed a uniform aviation law system with federal laws such as the Air Commerce Act[27] being applicable to flying, commercial, non-commercial, intra-State and inter-State.[28] Specifically, the objective of the Air Commerce Act was to establish federal regulations regarding aircraft, aviators, navigation facilities and establishment of aircraft regulations together with the Commerce Department's related rules. The uniform aviation law system was, however, donned with a serious setback since the time of its formation fell within the era of *Lochner v New York.*[29] This was an era of Commerce Clause

[22] Lee FP "Air Commerce" 372.
[23] The Commission is also called National Conference of Commissioners on Uniform State Laws
[24] MacCracken WF "The Growth of Aeronautical Law in America" 1930 *IJAL* 418.
[25] http://www.uniformlaws.org (Date of use: 18 August 2018).
[26] http://www.uniformlaws.org (Date of use: 18 August 2018).
[27] Air Commerce Act of 1926.
[28] Lee FP "Air Commerce" 418.
[29] See generally *Lochner v. New York* 1905 US 198 (SC) [45].

jurisprudence when the Supreme Court of the US made it a common practice to strike down economic regulations.[30] Despite this era ending in 1937, judicial activism played a key role in the development of the uniform aviation law system. The courts did this through application of liberal interpretation of the constitutionality and applicability of the Air Commerce Act, with a view to harnessing its objective of ensuring aviation safety. In addition, cardinal to the judicial activism during the *Lochner* period is the expansion of otherwise narrow interpretation in order to protect personal liberty, which had a bearing on both security and protection of privacy rights.

Beginning with the Air Commerce Act, the federal government preserved the concept that the basic privilege to fly be limited only by the fitness of the aircraft and operating personnel in the interest of safety to those participating in aeronautics and to persons on the ground.[31] This is a compelling indication that the adoption of the Air Commerce Act was underpinned with the overall intention of ensuring safety in all flights. The Act provided for the means of ensuring safety, which is by issuance of certificates of airworthiness and licenses to competent pilots and flights. It is, however, possible that the safety requirements could be potentially abused owing to the much discretion granted to States in granting the flights as privileges.[32]

After the passage of the Air Commerce Act of 1926, efforts were made to establish air procedures.[33] The Air Commerce Regulations of 1928 represent an inclusive set of rules developed shortly thereafter to ensure high-quality elementary engineering, manufacturing, repairs, and operation of aircraft.[34] All these requirements focused on safety of operation of UAS. Subsequently, the US Congress passed the Civil

[30] For more information on how the period represented constitutional crisis, see Choudhry S "The Lochner era and comparative constitutionalism" 2004 *IJCL* 2.
[31] Fang FD "Legal Basis of the Civil Air Regulations" *JALC* 9.
[32] Fang FD "Legal Basis" 9.
[33] Fang FD "Legal Basis" 12.
[34] Fang FD "Legal Basis" 12.

Aeronautics Act,[35] the Federal Aviation Act,[36] and the Department of Transportation Act.[37] These statutes organizationally streamlined the Bureau of Air Commerce into Civil Aeronautics, the Federal Aviation Agency, and eventually the Federal Aviation Administration (FAA). These federal provisions continued to apply with no discrimination between the commercial and non-commercial utility in design of aircraft.[38] The efforts have since culminated into development of the Federal Aviation Modernization and Reform Act of 2012.

3. The Current Framework for US' Response to Regulation of UAS

The US has embraced the international approach through which it was involved in discussions that culminated to the adoption of the Chicago Convention and the ICAO framework.[39] It did actively participate in the development of the framework through its invitation of 55 States, out of which 54 attended. The conference, approved the Chicago Convention, signed by 52 States as it ended on 7 December 1944.[40]

Under the international legal framework, the US is a party to the Chicago Convention, meaning that the US is mandatorily obliged to follow the binding rule of the air contained in both Article 12 and Annex 2 on Rules of the Air, In addition, it has to adhere to civil aviation security and safety as provided in ICAO Annexes 17 and 19 respectively.[41] Additionally, the US is party to the Convention relating to

35 Civil Aeronautics Act of 1938.

36 Federal Aviation Act of 1958.

37 Department of Transportation Act of 1966.

38 See US Code of Federal Regulations, Title 14, § 23 on Airworthiness Standards: Normal, Utility, Acrobatic, and Commuter Category Airplanes and § The US Code of Federal Regulations, Title 14, § 25 on Airworthiness Standards: Transport Category Airplanes).

39 https://www.icao.int/about-icao/History/Pages/default.aspx (Date of use: 28 December 2019).

40 https://www.icao.int/about-icao/History/Pages/default.aspx (Date of use: 28 December 2019).

41 https://www.icao.int/about-icao/History/Pages/default.aspx (Date of use: 28 December 2019). Specifically, the US Signed Chicago Convention on December 7, 1944 consented to be bound with the Convention on 9 August 1946 and the Convention was effective on 4 April 1947.

Unification for Rules relating to International Carriage by Air, also the known as Warsaw Convention among other relevant treaties.[42]

At the domestic level, the Constitution is the supreme law of the US. It addresses myriad matters that form the basis for the regulation of safety, security and privacy in UAS operation albeit at a high level. The US has a unique experience with UAS regulation as its constitutional structure as a federal State means that regulation and management of UAS is dealt with at four levels – two at the federal level and two at the State level.

Under 49 U.S. Code § 106, the administrator who is the head of FAA, has authority under the Act to make additional rules, regulations, circulars and bulletins. Particularly this power is recognized at section 2 (A) (iii) of the Code provides that:

> "except as otherwise provided in paragraph (3), the administrator has power of promulgation of regulations, rules, orders, circulars, bulletins, and other official publications of the administration."

The import of the above provision of 49 U.S. Code § 106 is that the issuing circulars towards operation of UAS are meant to be legally binding to the operators unless there are contrary intentions or provisions for the same.

Under the constitutional framework, another relevant statute of relevance to this study as already mentioned is the Federal Aviation Modernization and Reform Act. This Act was enacted after a raft of amendments to the aviation safety provision through the Public Law 112-95 of 14 February, 2012 by the US Congress. The Acts

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[42] As adherence of the US deposited at Warsaw July 31 July 1934 and entered into force 9 October 1934.

make provision for regulation of civil aviation. Specifically, sub-title B of Title III of the Act makes provision for regulation of UAS.

The FAA Modernization Reform Act defines an aircraft as any contrivance invented, used, or designed to navigate or fly in the air.[43] This definition is also confirmed under the FAA Regulations, where an aircraft is defined as a device that is used or intended to be used for flight in the air.[44] Specifically, the Act also defines unmanned aircraft as follows:

> "an aircraft that is operated without the possibility of direct human intervention from within or on the aircraft."[45]

The UAS fits into the above definitions by virtue of being a device to be used for flying in the air. The regulatory approach is even much more definitive since the Act differentiates the small-unmanned aircraft and public unmanned aircrafts systems depending on their weight and use.

It is noteworthy that in 2014, the National Transportation Safety Board pronounced itself on a decision, which brought UAS within the ambit of aircrafts, affirming the already established definition.[46] The decision affirmed the grip and jurisdiction of FAA over UAS.[47] The affirmation of the applicability of the definition is a big plus for the pragmatic approach that the US has taken in implementing the spirit of Article 15 of the Paris Convention as later contained in Article 8 of the Chicago Convention.

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[43] US Code of Regulations, Title 49, § 40102(a) (6).
[44] US Code of Regulations, Title 14, § 1.1.
[45] The FAA Modernization Reform Act, Section 331(8).
[46] https://www.lmc.org/resources/drones-municipal-use-and-regulation/ (Date of use: 1 October 2020).
[47] https://www.lmc.org/resources/drones-municipal-use-and-regulation/ (Date of use: 1 October 2020).

Lastly, the Community-based Guidelines on Safety of Operations and Safety Code that have been published by the Academy of Model Aeronautics are also important in complementing the efforts of FAA in regulation of safety issues regarding use and operation of UAS.

4. Overview of Federal Aviation Administration

The overall mandate of integrating UAS into the US national airspace is bestowed upon the FAA as the national civil aviation authority under[48] the Federal Aviation Administration Act of 1958.[49] FAA as an administration is part of the US Department of Transportation Security Administration that established FAA.[50] Accordingly, the control of activities and personnel of the FAA is done by the Secretary of Transportation pursuant to section 106(f)(1) of Title 49 U.S Code.

FAA has the overall statutory mandate to ensure the safety and security of the national airspace.[51] It undertakes this solemn obligation through the regulation of all matters pertaining to aircraft, airmen, most categories of airline employees, commercial or common carrier operations, airports, and, more prominently, use of national airspace. The mandate extends to promotion of safe flight of civil aircraft in the airspace.

4.1 FAA Organs

The Administrator and Deputy Administrator, who are citizens of the United States and are appointees of the US President with an experience in the field of civil aviation, to head FAA.[52] The officers are independent and coordinate with the office

[48] The FAA Modernization Reform Act, Sections 331-313.
[49] Federal Aviation Act of 1958 (Congress Public Law Number 85-726).
[50] https://www.faa.gov (Date of use: 27 April 2017).
[51] The US Code of Regulations, Title 49, §§ 40101(a) (1), 40103(b), 44701(a) (2012).
[52] The US Code of Regulations, Title 49, §§ 106.

of Secretary of Transportation together with the respective staff to regulate and enforce the aviation issues in the US.

In pursuance of its mandate, FAA has created a UAS Integration Office.[53] The mandate of the institution is set forth in the FAA Modernization and Reform Act. The UAS Integration Office established six UAS test sites, published the Integration of Civil UAS in the National Airspace System Roadmap, expanded use of small UAS in the implementation plan and the UAS comprehensive plan, and simplified the certificate of waiver or authorization process.

The UAS Integration Office was mandated to achieve integration of UAS by 2015. Accordingly, by December 2015, FAA announced that all UAS weighing more than 250 grams, flown for any purpose, must be registered with FAA. However, the focus is not on full integration, but rather on safe integration. There is the realization that such a process will have to be incremental, and not drastic, to give room for its effectiveness hence the development of the integration roadmap. This approach seems to be well thought out since it appreciates the unique circumstances of the UAS as opposed to taking an over-ambitious step of full integration.

The integration of UAS into the civil airspace which is envisaged under section 332 of the FAA Modernization and Reform Act is aimed at uniting the following entities: the UAS Integration Office, Department of Defense, National Aeronautics and Space Administration and the MITRE Corporation to work closely in achieving the integration. The UAS Integration Office continues to perfect processes of collecting safety data while the six test sites provide data collected during operations. The development of safety management documents is aimed at facilitating understanding and mitigate hazards that could arise from integration.

[53] https://www.FAA.gov.UAS (Date of use: 1 July 2018).

Another critical organ of the FAA is the Office of the Rule-making. This office is the repository for the published regulatory documents by FAA. The office also provides the avenue for public participation in the rule-making processes undertaken by FAA.[54] Further, regarding the small UAS, there is in place a Small UAS Aviation Rulemaking Committee that was established to formulate rules aimed at facilitating integration of UAS into the national airspace, in a controlled manner.[55]

4.2 Rule-making by FAA

Of all the regulatory tools adopted by FAA, the rule-making stands out and has power to formulate proposals that are critical to integration of UAS into civilian airspace for effective management of airspace use, aviation experience, climate, geography and location of ground infrastructure, research needs, risk, and safety.[56] FAA's jurisdiction and rulemaking powers are derived from Title 49 of the United States Code.[57] Particularly, the Administrator of the FAA is mandated to:

> "…the promulgation of regulations, rules, orders, circulars, bulletins, and other official publications of the Administration;"

Henceforth, FAA embarked on the task of creating policy statements, orders, notices, handbooks and manuals, and directives.[58] Particularly, pursuant to the above cited mandate, FAA, as through its Office of Rulemaking, sought to take other statutory roles to achieve a countrywide geographic and climatic diversity by developing regulatory and operational procedures and standards that would not only guide integration of UAS technology as well.[59] Such procedures and standards

[54] https://www.faa.gov/regulations_policies/rulemaking/ (Date of use: 15 September 2020).
[55] https://www.faa.gov/regulations_policies/rulemaking/ (Date of use: 15 September 2020).
[56] Nevada Legislative Counsel Bureau "Research Brief on Unmanned Aircraft Vehicles" https://www.leg.state.nv.us/Division/Research/Publications/ResearchBriefs/UAS.pdf (Date of use: 1 October 2020)
[57] US Code of Federal Regulations, Title 49, § 44702 (a) and § 40103 (b).
[58] https://www.faa.gov/regulations_policies/rulemaking/ (Date of use: 15 September 2020).
[59] https://www.faa.gov/regulations_policies/rulemaking/ (Date of use: 15 September 2020).

include Advisory Circulars (AC) published by FAA as binding documents that provide guidance for conducting UAS operation in the US national airspace, since the US government has exclusive sovereignty over her airspace.[60]

Further, FAA develops aviation policies and regulations that form the basis for safety and security through development of guidance systems, personnel and skill development, operations, and procedures.[61] Through the regulations, all aircrafts are now required to meet the regulatory requirements for air navigation facilities, equipment and services, airports or landing areas, aeronautical charts, information and services, rules, and processes, technical data, workers, and materials.

Another critical tool is the development of advisory opinion and airworthiness directives by the FAA.[62] A technical standard could be created to address a technical problem emanating from the attention of FAA advisory circulars to advise the aviation committee on issues of regulation. Airworthiness Directives, on the other hand, are legally enforceable.[63]

The Circulars that are developed to give effect to the Federal Aviation Regulations are generally non-regulatory in nature and therefore non-binding in the strict sense, they only provide guidance and precautions on issues.[64] The decision of the court in the case of *FAA v. Raphael Pirker,*[65] demonstrates this position. This was a motion of appeal filed by the respondent (Pirker), a US citizen challenging an earlier order for a civil penalty in the sum of $10,000 in favour of the FAA. The device in

[60] US Code of Federal Regulations, Title 49, § 40103.
[61] US Integration of Civil Unmanned Aircraft Systems in the National Airspace System Roadmap of 2013.
[62] An example is The US Department of Transportation and Federation Aviation Administration Airworthiness Directive 2014.
[63] https://www.faa.gov/regulations_policies/airworthiness_directives/ (Date of use: 29 December 2019).
[64] https://www.faa.gov/regulations_policies/airworthiness_directives/ (Date of use: 29 December 2019).
[65] *FAA v Raphael Pirker* 2013 EA-5730 (NTBS).

question was a commercial *Ritewing Zephyr* powered glider aircraft' in the vicinity of the University of Virginia. According to the FAA, the device was a UAS within the definition of the US laws and regulations. Since it was operating for commercial purposes, it came under the purview of FAA regulations. However, the respondent contended that FAA, the complainant, did not have jurisdiction and regulatory authority over model aircraft operators hence the decision ought to have been dismissed. While agreeing the with respondent's motion, the Board, cited among others that model aircrafts operation by the respondent was only subject to FAA voluntary compliance with Safety Guidelines in FAA Advisory Circular on Model Aircraft Operating Standards.[66] Secondly, the Board noted that at the time of the respondent's model aircraft operation, there was no enforceable FAA rule classifying model aircraft.

The above stated position does not, however, mean that the Advisory Circulars may be ignored with impunity. Indeed, the historical timelines when the *Raphael Pirker case (supra)* was decided is significant. First, it was a period before the enactment of the FAA Modernization and Reform Act. It is provided under Section 336 of the Act that exemption of model UAS operators be determined by adherence to conditions attached to model UAS aircraft, the most important one being for recreational or purposes of hobby.[67] From this thesis' analysis, it would appear that if the *Raphael Pirker* case was decided after 2012, the respondent would have been found in violation of Section 336 of the Act, which was not in existence at the time of the judgment. The exemption envisaged in the Act is, however, not absolute. For instance, when the model of UAS changes its use to commercial purposes, it shifts status to a civil UAS, and therefore requires a special authorization certificate in experimental category.[68]

[66] FAA Advisory Circular on Model Aircraft Operating Standards No. 91-57.
[67] Henshon M "Case notes: *FAA v. Pirke"* 2014 *SL* 26.
[68] The Code of Federal Regulations, Title 14, § 21.175(b).

In the same vein, the FAA issues advisory tools known as policy statements touching on UAS.[69] These policy statements have the full force of the law.[70] Of relevance to this study are statements on the UAS. Notable among the statements is the 'UAS statement 05-01,[71] whose aim is to clarify a statement that was carried in the Federal Register on 6 February, 2007 titled, 'unmanned aircraft operations in the national airspace system'[72] and 'interim operational approach guidance 08-01.'[73]

Apart from the use of policy statements, FAA has also been able to utilize the use of notices. Other than road notices and statements, is a mandate to publish roadmaps. It has published roadmaps, wherein it has consistently asserted that it has overall mandate to regulate national airspace and aviation in general. There is diverse opinion that there is little difference between published roadmaps[74] and policy statements. However, a roadmap is more practical and has timelines in the redress of UAS security and safety concerns compared to policy statements. From the wording alone, roadmaps are more coordinated, distinguishable, and therefore important in the regulation of aviation. It provides, *inter alia,* broad timelines, tasks and considerations needed to enable UAS integration into the national aviation system for the planning purposes of the expanded UAS community. The roadmap has built a basis for the national aviation airspace transition from UAS accommodation to UAS integration. It has also provided a strategy to align proposed agency actions with the Congressional mandate in the FAA Modernization and Reform Act of 2012. The roadmap too has a unique provision that tasks FAA to consider incorporating lessons and related findings in successive periodicals to

[69] The Code of Federal Regulations, Title 14, § 21.175(b).
[70] Gonczy ST *Federal Aviation Administration (FAA) airworthiness certification for ceramic matrix composite components in civil aircraft systems* (MATEC Web of Conferences 2015) 2.
[71]https://www.faa.gov/documentLibrary/media/Notice/N_JO_7210.889_Unmanned_Aircraft_Operations_in_the_NAS.pdf (Date of use: 1 October 2020).
[72]https://www.faa.gov/documentLibrary/media/Notice/N_JO_7210.889_Unmanned_Aircraft_Operations_in_the_NAS.pdf (Date of use: 1 October 2020).
[73] FAA, Aviation Safety Unmanned Aircraft Program Office Interim Operational Approval Guidance No 08-01 of 2008.
[74] The US Integration of Civil UAS in the NAS Roadmap of 2013.

include further refined goals, metrics, and target dates to address the ever-changing UAS technological landscape.[75]

Other than the roadmap example, after 2007, the FAA published various notices such as the “inspection and maintenance programme requirements for airworthiness certification of unmanned aircraft operating under 55 pounds,[76] aviation-related videos or other electronic media on the internet;[77] and sporting event temporary flight restrictions.[78] Other notices are on “education, compliance and enforcement of unauthorized UAS operators,[79] at least seven orders[80] two additional advisory circulars,[81] three guidance documents[82] four legal interpretations[83] and one special rules on interpretation.[84]

4.3 Partnerships by ICAO

Generally, under section 220 of the FAA Modernization and Reform Act of 2012, the Administrator of the Federal Aviation Administration is mandated to enter into partnerships on regulation of civil aviation with regard to Nextgen technologies. Currently FAA recognizes its partnership with ICAO. Particularly, FAA is an active participant of the ICAO Dangerous Goods Panel meetings. Accordingly, it also participates in the revision and updating of the Technical instructions for the Safe Transport of Dangerous Goods. The latter expressly admits that FAA is a pivotal partner in the area of regulation of civil aviation.[85] It, trains small and middle-sized

[75] Integration of Civil UAS in the NAS Roadmap, Section 2.2.1.
[76] http://www.faa.gov Notice/N_8900.291.pdf (accessed 3 July 2017).
[77] http://www.faa.gov Notice/N_8900.291.pdf (accessed 3 July 2017).
[78] US Department of Transport “Federal Aviation Administration FDC. NOTAM 4/3621, Sporting Event Temp. Flight Restriction” https://www.faa.gov/uas/regulations (Date of use: 2 July 2017).
[79] http://www.faa.gov (Date of use: 4 July 2017).
[80] http://www.faa.gov. (Date of use: 4 July 2017).
[81] US Department of Transport “Identification and Registration Marking” http://www.Faa.gov (Date of use: 2 July 2017).
[82] https://www.FAA.gov/uas/regulations policies (Date of use: 2 July 2017).
[83] https://www.Faa.gov/ (Date of use: 2 July 2017).
[84] https://www.FAA.gov/uas (Date of use: 2 July 2017).
[85] https://www.icao.int/safety/RunwaySafety/GRSS2011/Pages/PartnersandSupporters.aspx (Date of use: 15 September 2020).

enterprises, and makes contribution towards the success of the ICAO's Safety Oversight System Project. It also contributes towards the success of the ICAO's programme for regional technical cooperation, called the Multi-regional Civil Aviation Assistance Program.[86] The partnership, among others, supports the collaborative approach that the FAA takes towards its integration efforts in respect of the UAS into the national aviation system.[87]

5. US' Domestic Response to Safety, Security and Privacy Concerns of UAS

After a brief discussion of the domestic legal framework and institutional mechanism of FAA, the following part turns to the substantive issues and responses to challenges experienced in operation of UAS, namely: safety, security and privacy as identified in chapter Two of this thesis.

5.1 The US Response to Safety Concerns of UAS

As discussed in chapter Two, aviation safety is one of the challenges to integration of UAS into civil aviation. Even the US has recognized that safety issues in the use of UAS abound. Statics by the US Accountability Office reports indicate that since 2014, over 6,000 cases of unsafe use of UAS have been recorded.[88] It is against this backdrop that the US leverages on its active participation in and membership of ICAO to ensure compliance with safety requirements under the Chicago Convention and ICAO Annex 19.[89]

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[86] https://www.icao.int/WACAF/Documents/APIRG/APIRG%2022/WPs%20-%20FINAL%20ENG/WP%2051%20-%20%20U.S%20UAS%20Integration%20Update%20-%20FAA.pdf (Date of use: 15 September 2020).

[87] ICAO "Update on US. Unmanned aircraft systems integration activities" (Paper presented to the Twenty-Second Meeting of the AFI Planning and Implementation Regional Group 29 July- 2 August 2019 Accra) 3.

[88] US Government Accountability Office "Unmanned Aircraft Systems" https://www.gao.gov/key_issues/unmanned_aerial_systems/issue_summary (Date of use: 9 February 2020).

[89] See chapter Three, section 4.1 on exposition of the specific safety requirements.

The subsequent part details how the US legal framework responds to these live safety challenges associated with the operation of UAS. The principal framework is provided under the FAA Modernization and Reform Act and the US Code of Federal Regulation. The framework is also complemented by the FAA Advisory Circulars. The application of the framework to the UAS generally has been affirmed by court in *Philadelphia Indemnity Insurance Co v Hollycal Production Inc et al*[90] where the Supreme Court noted the fact that a drone is unmanned does not make it less of an aircraft which can be subject of regulation.[91] The import of this judgment for the purpose of safety is that safety precaution applicable to manned aircraft should be applicable to UAS as well.

Section 335 of the FAA Modernization and Reform Act is instructive of general safety considerations regarding the integration of UAS into the national civil aviation airspace of the US. The section provides as follows:

> "The Administrator of the Federal Aviation Administration shall carry out all safety studies necessary to support the integration of unmanned aircraft systems into the national airspace system"[92]

The import of this rule is that the general safety consideration must be made in a prospective manner considering the level of development in technology regarding the use and operation of UAS at any given time. Part 5 of the Code of Federal Regulations is more elaborate on how the safety goals can be achieved. The Code creates mandatory obligations for development of safety management system as being prerequisite for grant of operator certificates. Part 5.51 provides in this regard as follows:

> "A certificate holder must apply safety risk management to the following: (a) Implementation of new systems. (b) Revision of existing systems. (c) Development of operational procedures. (d) Identification of hazards or

[90] *Philadelphia Indemnity Insurance Co v Hollycal Production Inc et al* 18-768 SA (2018) 7 (SC) [4].
[91] *Philadelphia Indemnity Insurance Co v Hollycal Production Inc et al* 18-768 SA (2018) 7 (SC) [4].
[92] FAA Modernization and Reform Act, Section 335.

ineffective risk controls through the safety assurance processes in subpart D of this part."

The formulation of rule 5.51 is couched in mandatory terms. Secondly, the avenues for the use of the system is expansive and futuristic since it is not allowed for revision in event of change in circumstances. Further, the FAA has made strides, through rule-making, to further this general assurance of aviation safety in the area of the mandates of the service providers. It has done so through issuance of Advisory Circulars. These Advisory Circulars generally provide guidance materials but are not strictly binding on the public.[93] For the purposes of standardization and complementariness of the principal statute, it is a compelling communication of the best practices of operations.[94]

Of particular relevance is FAA Advisory Circular on Safety Management Systems for Aviation Service Providers,[95] air carriers are obligated to apply SMS founded on Part 5 of the Code of Federal Regulations.[96] Explicitly, this Advisory Circular offers an account of governing requirements, guidance, and approaches of developing and executing Safety Management Systems. Chapter Three of the Circular provides the minimum contents of the management systems to conclude regulatory requirements, summary of process, setting out of safety objectives and scalability. Part 3.3 mandates the service providers to develop a safety policy that provides for among others accountability and authority responsible for safety risks. Under this part, FAA requires aviation organizations to adopt policies that reflect the safety culture, open reporting, vigilance, information sharing and risk reduction. Also relevant are the requirements under Part 3.4 of the Circular, which imposes an

[93] https://www.faa.gov/regulations_policies/advisory_circulars/index.cfm/go/document.information/documentID/74299 (Date of use: 22 July 2020). See paragraph 3 on explanation of AC systems.

[94] https://www.thebalancecareers.com/what-s-an-advisory-circular-and-why-should-youcare282774#:~:text=Advisory%20circulars%20can%20be%20directional,Standardization%20is%20one%20common%20reason (Date of use: 22 July 2020).

[95] FAA Advisory Circular on Safety Management Systems for Aviation Service Providers No. 120-92B.

[96] The circular (AC) offers material for title 14 of the Code of Federal Regulations (14 CFR) part 121 carriers.

obligation on service providers to develop a system for safety risk management including the maintenance of the risk register to be used in monitoring aviation safety risks.

The passage of the Advisory Circular is an effort that reflects that adoption of safety risk management and assurance goals and domestication of international guidance material developed by ICAO as set in the chapter Two of ICAO Circular No. 328-AN/190. The safety provisions are very elaborate and easy to understand. They take a step-by step approach to highlight the would-be contents of a safety policy in a more robust manner than is provided for in section 2.19 of the ICAO Circular No. 328-AN/190.

The framework in the Circular recognizes that the recreational UAS can enjoy the statutory exemption from the safety management systems, a requirement that may pose safety challenges. In this respect, the FAA Advisory Circular on Model Aircraft Operation[97] that was cancelled in 2015 represented efforts of the FAA to adopt provisions of ICAO Circular No. 328-AN/190. It will be recalled that this Circular is discussed in chapter Three of this thesis, and addresses safety concerns through regulation of operations, personnel licencing, provision of rules of the air, certification and surveillance, among others.[98] The FAA Advisory Circular, now amended and replaced with Advisory Circular on Exemption for Limited Recreational Operations for Unmanned Aircraft,[99] offers a non-binding guidance to operators of UAS used for recreational purposes. Generally, the Circular pronounces its aim of ensuring safety of operators through offering of interim safety

[97] FAA Advisory Circular on Model Aircraft Operating 91-57.
[98] See chapter Three, section 4.1 of this thesis.
[99] The FAA Advisory Circular now amended and replaced with Advisory Circular on Exemption for Limited Recreational Operations for Unmanned Aircraft No. 91-57B of 2019 (hereinafter refered to as the AC 91-57B).

guidance to such operators.[100] Principally, paragraphs 7(1) of the Circular states in part that:

> "FAA assumes owners and operators of unmanned aircraft are generally concerned about safety and willing to exercise good judgment when flying their aircraft. However, basic aeronautical knowledge and awareness of responsibilities in shared airspace are not common knowledge"

The import of the regulation is to recognize that even the recreational flyers of UAS must be conscious of the safety concerns arising from the UAS operations. The guidance further includes the need to fly strictly for recreation, following safety guidelines, keeping UAS in line of sight, providing a way to manned aircrafts and avoiding controlled airspace.[101] The Circular supports ICAO's initiatives and the US legal framework as described in section 44809 of Title 14 to the Code of Federal Regulation providing exception for limited recreational operations of UAS.

The model UAS flyers and recreational flyers subject to the FAA Advisory Circular on Exemption for Limited Recreational Operations for Unmanned Aircraft[102] in the second scenario, are subject to a complementary regulatory framework created under the Safety Code.[103] The Safety Code as established by the Academy of Model Aeronautics is relevant with regard to setting up of actual safety standards that must be met for flyers who are members of the Academy.[104] Instructively, at the first

[100] The AC 91-57B, Section 1 and The Code of Federal Regulations, Title 49, § 44809.

[101] Advisory Circular 91-57B, section 7.1.3 provides that Aircraft is flown within the Visual Line of Sight (VLOS) of the Person Operating the Aircraft or a Visual Observer Co-Located and in direct communication with the operator. This means that either the recreational flyer or the visual observer must have eyes on the aircraft at all times to ensure it is not a collision hazard to other aircraft or people on the ground. The assistance of a visual observer is generally optional but is helpful in ensuring the recreational flyer is able to check instruments for extended periods. The assistance of a visual observer is necessary if the recreational flyer wants to use first person view (FPV) devices that allow a limited view of the surrounding area from the perspective of a camera aboard the aircraft. See also FAA AC 91-57B, sections 7.1.4 – 7.1.8.

[102] FAA Advisory Circular on Exemption for Limited Recreational Operations for Unmanned Aircraft No. 91-57B of 2019.

[103] The Academy of Model Aeronautics Safety Code of 2018.

[104] Academy of Model Aeronautics (AMA) is a nationwide organization representing model aircraft enthusiasts with its headquarters in Muncie and that was established in 1936.

paragraph of the Code is an affirmation by members not to 'fly a model aircraft in a careless or reckless manner.' Further, an operator of a small UAS would also be required to maintain and inspect it before each flight to guarantee safety of the operation.[105]

Further, the FAA Advisory Circular on Aviation Safety Action Programme,[106] also establishes safety rules that mandate reporting of safety information by employees. These rules are applicable to the UAS regulation, just like manned aircrafts, repairers and controlling pilots or persons who launch them. These categories of persons, including operators of chase aircrafts, may be at prime positions to undertake the reporting obligation imposed by the Circular. The requirement under the Circular is an integral part of the safety management envisaged by chapter Two of the ICAO Circular No. 328-AN/190. For instance, information obtained would be critical for risk management and as a preventive measure to avoid accidents. Since the Circular envisages that the programmes will be voluntary between carriers and UAS operators, the rate of compliance is likely to be higher. However, the voluntariness of the programmes may be a challenge since it means that carriers could opt not to negotiate or agree on a programme. One such implementation challenge would be an increase in UAS that can be launched from any place and thus, in the event of investigation, tasks provided under Section 6(4) of the Circular may overstretch the capacity of the FAA.

Other specific safety standards relate to the visual line of sight requirements. Particularly, section 333(b) of the FAA Modernization and Reform Act, 2012 that makes provisions for rules governing UAS sets, among others, the following as a parameter for assessment of UAS:

[105] The Code of Federal Regulation, Title 14, section 107.15 (a) & (b).

[106] FAA Advisory Circular on Aviation Safety Action Programme (ASAP) No. 120-66B. It replaced ASAP AC NO. 120-66 and 120-66A.

> "…operation within visual line of sight do not create a hazard to users of the national airspace system or the public or pose a threat to national security."

The provision of the Act, however, has a *lacuna* for its non-definition of the visual line of sight. Part 107.31 of the US Code of Federal Regulations fills this *lacuna* by not only recognizing but also defining a visual line of sight as capability of vision that is unaided by any device other than corrective lenses, the remote pilot in command, the visual observer (if one is used), and the person manipulating the flight control of the small unmanned aircraft system must be able to see the unmanned aircraft throughout the entire flight.

Regarding the model UAS, the Safety Code of 2018 established by the Academy of Model Aeronautics makes provision for model aircrafts to operate within the line of sight of the operator, as already indicated above. Other associated requirements are operation five miles away from the airport, remaining clear of people or stadiums and 400 feet above the ground. The last parameter is repeated as a requirement for model aircrafts available in Section 336 of the FAA Modernization and Reform Act, 2012. Lastly, the members of the Academy of Model Aeronautics solemnly affirm in the code in personal terms expressly that:

> "I will not operate any model aircraft while I am under the influence of alcohol or any drug that could adversely affect my ability to safely control the model."[107]

The safety conditions provided above are all aimed at achieving safety requirements and are in tandem with Part 2.21 of the UAS Circular No. 328 by ICAO, which requires safety rule making, policy development and oversight. It is notable, however, that the requirement for non-operation 400 feet above the sea level is well

[107] The Academy of Model Aeronautics Safety Code of 2018, Paragraph 3.

justified for safety reasons but, it seems to be insufficient, since it does not address issues of visibility. Even the FAA Advisory Circular on Surface Movement Guidance and Control System regarding that could have addressed the visibility issues but only addresses safety issues at the airports and is therefore inapplicable to UAS. Further, the need to maintain a visual line of sight, though well intentioned, may continue to inhibit full integration efforts since the technologies may be a recipe for segregation.[108] For the requirement of visual line of sight by FAA Modernization and Reform Act to be achieved, an accompanying "chase" aircraft must maintain visual contact with the UAS. Though the intention of the chase aircraft is plausible that is, to serve as its 'eyes' when operating outside airspace that is restricted from other users, it does not seem to make practical sense given that UAS can be launched from anywhere and not designated airports as is the case with manned aircrafts.

The other standards relate to the sense and avoid technology. It may be recalled that this is the technology, which enables the UAS to detect and give way to the manned aircrafts to avoid safety challenges that may arise from collisions with other aircrafts or things. Already the analysis of the international framework on the provision of sense and avoid facilities in paragraph 5.2 of the ICAO Circular No. 328-AN/190, shows that sense and avoid is not limited to other aircrafts. The rules also envisage collision avoidance from other things and hazards. Fulfilling the requirement for UAS against other hazards including bird strikes, or attacks by eagles on hunting mission, might however be an uphill task unless given the deficiency in the regulatory framework and systems capability.[109]

The provisions of section 336 of the FAA Modernization and Reform Act, 2012 are instructive. They require model aircrafts to fly safely and ensure no interference with manned aircrafts. Subsection 336(4) and (5) of the FAA Modernization and Reform

[108] ICAO Circular No 328328-AN/190, Paragraph 3.15.

[109] The rationale is that the framework on recognition of hazards that are contained in Advisory Circulars on Hazardous Mountain Winds and Their Visual Indicators, Generic Glideslope Indicators, Maintenance of Airport Visual Facilities, Visual Flight Rules and Runway Visual Range all target manned aircrafts and not UAS.

Act, 2012 both of which appear to be mutually dependent provide the following as parameters for recognition and regulation of model aircrafts:

> “the aircraft is operated in a manner that does not interfere with and gives way to any manned aircraft; and (5) when flown within 5 miles of an airport, the operator of the aircraft provides the airport operator and the airport air traffic control tower (when an air traffic facility is located at the airport) with prior notice of the operation (model aircraft operators flying from a permanent location within 5 miles of an airport should establish a mutually-agreed upon operating procedure with the airport operator and the airport air traffic control tower (when an air traffic facility is located at the airport.”

The Safety Code established by the Academy of Model Aeronautics is also relevant for its requirement that all Academy of Model Aeronautics must ‘not interfere with and will yield the right of way to all human-carrying aircraft using AMA’s See and Avoid Guidance and a spotter when appropriate’. Since failure to give way to manned aircrafts is actionable under the FAA Modernization and Reform Act, the salient provisions set out above are authoritative representation of the requirements by ICAO Circular No 328-AN/190. Specifically, the requirements resonate with the spirit of paragraphs 2.9 and 2.15 of the ICAO Circular No 328-AN/190 and which require development of regulatory framework that requires UAS to have systems and facilities that ensure detection and avoidance of collisions.

Certification of small UAS weighing below 55 pounds: a proprietor is allowed to apply for a Certificate of Waiver, which allows the small UAS to deviate from certain operating rules if the FAA is satisfied that the proposed operation is permissible under the rule. The exclusion of Small UAS regarding the model aircrafts, however, obviously seems to be limiting on mandate of FAA, at least from the plain reading of the Act. This resonates with the FAA’s argument that if the exclusion clause were broadly applied, it would diminish or limit its statutory mandate of ensuring safety and security in the aviation sector. However, when looked at in the bigger picture, model operators are excluded from the reach of FAA to the extent that they remain within narrow limits of hobby users, the careless and reckless ones would pose grave danger to all airspace users, as well as those on the ground.[110] The exclusion of the small UAS, therefore, is justified.

There is an existing technological challenge since consensus is yet to be reached by the FAA on standards of technology that would enable UAS to detect and avoid other aircraft and maintain a link between airports and the UAS.[111] Secondly, though UAS pilots require constant link to ground aircraft control crew, the UAS in the US lack technology to prevent 'lost link.' As a result, disruptions created between the ground operator and the UAS become serious safety concerns. Even the learned judges in the case laws referred in this chapter were not able to agree regarding UAS' emerging technologies, which need to be accepted and addressed as globalization takes centre stage.[112]

Another notable regulatory issue with safety underpinnings is airworthiness in civil aviation. It shall be recalled that as discussed in chapter Two of this thesis. An aircraft is said to be airworthy only when its conditioning and design support safe operation. The existing challenges in this area as appertains to UAS was the design challenges, which often compromise efficiency of regulation of safety during operation. In respect of these challenges, the ICAO developed ICAO Annex 8 on Airworthiness of Aircraft that, among others, require, maintenance of safety and survival equipment to support the system software. This section now proceeds to describe how the US addresses the airworthiness issues.

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[110] FAA Interpretation of the Special Rule for Model Aircraft Federal Register of 2014.

[111] U.S. Department of Transportation https://www.oig.dot.gov/sites/default/files/FAA%20Oversight%20of%20Unmanned%20Aircraft%20Systems%5E6-26-14.pdf (Date of use: 2 October 2020).

[112] See divergence of opinion of judges in *Dow Chemicals v the United States* 1986 476 US 227 (SC).

The airworthiness issues are dealt with under Sections 303 and 333 of the FAA Modernization and Reform Act. The regulatory framework under this principal legislation is complemented by the Circular on Propeller Instructions for Continued Airworthiness, and Circular on Instruction for Continued Airworthiness Academy of Model Aeronautics' Safety Code.

The FAA Modernization and Reform Act makes provision for regulation of design and production or aircrafts through a certification system provided in section 303 of the FAA Modernization and Reform Act. The certification done under the authority of the Administrator targets to certify compliance with minimum requirements for aircraft, aircraft engines, propellers, and appliances with the requirements and minimum standards prescribed in section 44701(a) of the Act.

The FAA Modernization and Reform Act, is also committal on providing further design specifications for the model aircrafts. As per, Section 333(3) of the FAA Act, a model aircraft is limited to not more than 55 pounds unless otherwise certified through a design, construction, inspection, flight test, and operational safety program administered by a community-based organization. For model aircraft flying that are within provision of the FAA Modernization and Reform Act, are complemented by Safety Code, of 2018 established by the Academy of Model Aeronautics they further commit to 'only fly models weighing more than 55 pounds, including fuel, if certified through AMA's Large Model Airplane Program.'[113]

The most relevant Circular that complements the provision on the FAA Circular on Propeller Instructions for Continued Airworthiness[114] generally provides that any operation within controlled airspace would require permission of an air traffic

[113] The Academy of Model Aeronautics Safety Code of 2018, Paragraph 7.

[114] FAA Advisory Circular on Propeller Instructions for Continued Airworthiness No 35.4-1 (hereinafter referred to as the FAA AC No. 33.4-1). In addition, Civil UAS are currently accommodated with experimental certificates under FAA Order on Airworthiness and Certification of Unmanned Aircraft Systems and Optionally Piloted Aircraft No 8130.34D.

controller. However, due to lack of training, air traffic controllers lack the tools that allow them to safely manage the airspace, just as they do with manned aircraft. This has potential negative consequences as air traffic controllers are forced to segregate UAS from manned aircraft due to lack of sufficient information particularly on speed, capacity and rates of climb on the UAS.[115] The situation may even be worsened by the fact that air traffic controllers lack training on how to address this lost link.[116]

The other relevant Circular is the Circular on Instruction for Continued Airworthiness.[117] Part 5 of the Circular provides for the general provision that requires the holders of approvals for aircraft designs to furnish their instructions on continued airworthiness to the owners of the aircraft either when it is delivered or when the certificate of airworthiness is issued. The import of this obligation is to ensure that the airworthiness is not only ensured through design approvals at manufacture and design stages, but also continued during the subsequent period of use by the aircraft's operators.

Additionally, the Circular on Instruction for Continued Airworthiness[118] limits the discretion of the applicants for the certification processes. It creates a layer of approval of the certification programs by the FAA in respect of the applications for the design approvals and type certification. Furthermore, FAA issues special

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[115] FAA Order on Unmanned Aircraft Operations in the National Airspace System (NAS) No N JO 7210.846

[116] The Air Traffic Safety Action Program is a voluntary safety reporting program for air traffic personnel that enable them to report air traffic safety events and retain confidentiality.

[117] FAA AC No. 33.4-1. Also see The US Code of Federal Regulations, Title 14 on Airworthiness standards for existing aircraft are codified with processes described for FAA type certification in FAA Order 8110.4 and airworthiness certification in FAA Order 8130.2. The FAA has the authority and regulations in place to tailor the design standards to specific UAS applications, and plans to use this authority until further experience is obtained in addressing the design issues that are unique to UAS. Generally, the FAA cannot issue an exemption from specific statutory mandates such as requiring airworthiness certificates. The statutory provision in 49 U.S.C. 44807, sets aside that prohibition. This allows the FAA to grant relief to a petitioner from the requirement to hold an airworthiness certificate for the UAS when certain criteria are met.

[118] FAA AC No. 33.4-1.

airworthiness certificates to community operators on a case-by-case basis for experimental or certain restricted categories. These are particularly issued to UAS manufacturers and researchers. The basis of this issuance is to enable research and development, flight-testing, crew training, market surveys, product demonstration as well as other commercial applications under the purview of Section 333 exemptions.

Other than the certification requirements, the US also utilizes the licensing and authorization mechanism as a means for enforcement of safety of UAS. Part 11 of Title 14 of the Code of Federal Regulations and FAA Modernization and Reform Act mainly provides for authorization and certification of flying. Under these provisions, the FAA authorizes non-hobby or recreational UAS operations.[119] In the US, the UAS flights are required to be operated by authorized aircraft (certified or exempted), validly registered, with a certified pilot, in addition to FAA authorization (Certificate of Waiver or Authorization).[120] Again, these terms are envisaged by Article 8 of the Chicago Convention to be within the jurisdiction of the sovereign. The first category of operators of UAS comprise the Government and public bodies.[121] The FAA allows such operators to be granted authority to operate aircrafts, for as long as a Certificate of Authorization has been issued to them.[122]

Further, under the provisions of Section 333 of the FAA Modernization and Reform Act, operations by petition can only be guaranteed upon satisfaction by FAA that the flight will be safe,[123] including weighing less than 55 pounds, flying below 200 feet above the ground, and being far from airports, in compliance with the Certificate of Authorization can only guarantee operations by partnership. Other commercial UAS

[119] FAA Advisory Circular on Certification process for Agricultural Aircraft Operators Document Information No 137-1B (hereinafter referred to as the FAA AC 137-1B), Section 1.9 exemption to The US Federal Code of Federal Regulations, Title 14, Part 137.
[120] Carr B *Unmanned aerial vehicles: Examining the safety, security, privacy and regulatory issues of integration into US airspace* (National Centre for Policy Analysis Dallas 2014) 29.
[121] Carr B *Examining* 30.
[122] Carr B *Examining* 29.
[123] US Department of Transportation http://www.transportation.gov (Date of use: 30 June 2017).

operating under the proposed rules are allowed to fly if they operate between sunrise and sunset when visibility is possible or within 3 miles.[124] Under the proposals, UAS would fly below 500 feet above the ground with a maximum speed of 100 kilometres per hour.

Public aviation operators are required to be licensed pilots. Operators who make applications for public UAS are taken through a process of review to ensure the intended operation in the interest of the public, they are safe and do not endanger the safety of other traffic, or persons on the ground. Issuance of a Certificate of Authorization is limited to 60 business days. Though Article 3 of the Chicago Convention limits its operation to State aircrafts, the functional definition seems to be pegged on ownership and not use. This approach enables the regulation of public operators of UAS even in cases where public operators lease the UAS from private individuals.

The framework adopts slightly different rules regarding authorization of commercial UAS.[125] These individuals are issued with a short-term certificate placed under experimental category in Title 14 of the Code of Federal Regulations.[126] Under these provisions, it is the experimental category requirements that tick the safety issues. This category is important because one of the key parameters for passing it is safety before the individuals can obtain a Special Authorization Certificate to operate the second category. It also appears to be the notable difference with the UAS public operator's authorization that only requires pilots to be licenced without imputing the categories. The difference is underlined by a presumption that safety issues are more prevalent in civil and commercial uses as opposed to public uses. Though the presumption may be debatable, it is worth noting that the experimental airworthiness

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[124] US Department of Transportation http://www.transportation.gov (Date of use: 30 June 2017).
[125] US Department of Transportation http://www.transportation.gov (Date of use: 30 June 2017).
[126] The US Code of Federal Regulations, Title 14, § 21.175(b).

certificate means that the UAS should not be used to carry passengers, cargo, or even for hire, according to the FAA Order 8130.34B.

Under these provisions, the regulations governing commercial authorization of UAS fall into three categories, namely: those that are solely operated for recreational purposes; small UAS that weigh less than 55 pounds and used for purposes other than recreation; and UAS weighing over 55 pounds, which require an exemption under Section 333 of the FAA Modernization and Reform Act. The authorization draws from, the provisions of Article 8 of the Chicago Convention, which place the special authorization mandate on the sovereign States.

Further, the framework adopts unique rules for authorization of model aircrafts for purely recreational or hobby utilities.[127] Though they essentially do not require FAA authorization, they must comply with strict rules, pursuant to FAA Advisory Circular 91-57. Unlike public and civil UAS that require FAA approval to operate, model aircraft do not require any such approval. They are, however, required to operate in a manner that is safe and within the confines of the law as stipulated in Section 336 of the FAA Modernization and Reform Act. The provision requires the model UAS to be capable of being sustained in the atmosphere and to ensure that they are strictly flown for hobby or recreational purposes, in accordance with society safety rules, and in compliance with giving way to manned aircrafts.

It is possible that periods for seeking of waivers and permissions may not be convenient, owing to the increasing uses of UAS in the airspace, which may sometime require emergency response. It could still be argued that the matters may as well be best left to planning by the FAA. To such a school of thought, categorization of the UAS as highlighted is, therefore, convenient for planning purposes. Such division in thinking has the capacity to derail achievement of

[127] Carr B *Examining* 17.

minimum requirements needed for safe operation of UAS as envisaged in Part 2.3 of the ICAO UAS Circular 328 of 2011.

The framework for regulation under the FAA Modernization and Reform Act, 2012 is complemented by FAA Advisory Circular on Reporting Laser Illumination of Aircraft, FAA Orders[128] that make provisions for prohibition of directing a laser pointer at an aircraft by unauthorized individuals addressing aviation safety and security challenge of possible attacks on aircraft. The FAA Advisory Circular on Reporting Laser Illumination of Aircraft, requires reporting of incidents of unauthorized illumination. Aircrew are required to report illumination incidents with details of colour, altitude, among others. The crew are also required to mitigate the incidents through reporting, filling FAA Laser Beam Exposure Questionnaire and deviating from flight paths with prior clearance. The framework is also the basis of initiatives to ensure both safety and security of aircraft.

The framework for regulation of safety is further boosted by the provision by Community-based Guidelines on Safety of Operations and Safety Code published by the Academy of Model Aeronautics. The Code generally stipulates guidelines on safety in flights including those of UAS.[129] The FAA appears cognizant of the non-binding nature of the guidelines. As such, it has used them as a basis for its collaboration with some community-based organizations for recreational purposes and recognized them as having force of law within that domain, purpose and area.[130] These guidelines enable development of rules at the community level for owners of

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[128] FAA Order on Air traffic Control No JO 7110.65 and FAA Order on Facility operation and Administration No JO 7210.3.

[129] FAA Advisory Circular on Exemption for Limited Recreational Operations of Unmanned Aircrafts No 91-57B, Section 7 (2) and (3).

[130] FAA Advisory Circular on Exemption for Limited Recreational Operations of Unmanned Aircrafts No 91-57B, Section 1. It provides that "purpose of this advisory circular (AC) provides interim safety guidance to individuals operating unmanned aircraft, for recreational purposes under the statutory exception for limited recreational operations of unmanned aircraft (Title 49 of the United States Code (49 U.S.C.) § 44809). The Circular restates the statutory conditions to operate under the exception and provides additional guidance on adhering to those conditions. Per 49 U.S.C. § 44809, recreational flyers may only operate under the statutory exception if they adhere to all of the conditions listed in the statute.

the model UAS weighing less than 55 pounds to support the FAA framework.[131] Larger or heavier UAS are also covered so long as their design, construction, inspection, flight-testing and operational safety programs are administered under the rubric of community-based organizations.[132]

The guidelines play an important role in creating the distinction between aircraft models based on use and capability. This is effective in the regulation of model aircrafts, since it is clear that the distinguishing feature of a model aircraft is not size but its use and capabilities. The use of community-based organization is the basis of the public and community involvement. The Safety Code published by the Academy of Model Aeronautics further bolsters effectiveness of such initiatives. The Code requires creation of awareness, education and participation of the public in safety matters as a means of addressing the safety challenges associated with UAS operation.

From the foregoing discussion, it suffices to conclude that FAA has made legislative steps towards an effective and express regulatory framework and standardization for safe UAS operation in areas of certification, standards of air traffic procedures for safe management of UAS with manned aircraft or even adequate air traffic control-training programme for UAS. Despite these accolades, authors such as Jiang *et al* observe that one challenge that stands out in respect of all the promising efforts is the fact that format of reporting to UAS regional inspectors on authorization and overseeing operations has not been clarified.[133] This leads to the conclusion that FAA's effectiveness in managing oversight is wanting. Unless the FAA

[131] FAA Advisory Circular on Exemption for Limited Recreational Operations of Unmanned Aircrafts No 91-57B, Section 7.1.1, 7.1.2 and 7.1.2.1.

[132] FAA Advisory Circular on Exemption for Limited Recreational Operations of Unmanned Aircrafts No 91-57B, Section 7.1.1, 7.1.2 and 7.1.2.1.

[133] Jiang T *et al* "UAS traffic management: Concept of Operation and System Architecture" 2016 *IJTST* 123-135.

addresses these barriers, integration of UAS into civil aviation will continue to be slow and with low safety standards.[134]

5. 2 The US Response to Security Concerns of UAS

It will be recalled that the security challenges of UAS at the international plane were regarded to arise from the possible use of the UAS in activities that cause unlawful interference, including spying and attacks to aviation infrastructure that threaten the territorial integrity and sovereignty of another State.[135] While the challenge is real owing to the development in UAS technology and uses, the traditional means of achieving security in aviation through arming of pilots, use of sniffer dogs and data management and storage are largely inapplicable to most UAS. This explains why the analysis in chapter Two of this thesis rationalized the need for UAS specific security measures and regulations.[136]

It was noted that against the backdrop of such challenges, the Chicago Convention made robust albeit general provisions of ensuring aviation security as a whole. In recognition of its dynamism, it donated the powers to the ICAO to develop standards relating to security, which ICAO did through promulgation of the general standards through ICAO Annex 17 and Aviation Security Manual Doc (8973). Additionally, ICAO No. 328328-AN/190 makes specific provision on security applications and surveillance of UAS.

This part discusses how the US domestic framework responds to these security challenges. Generally, the US regulatory framework requires UAS to comply with general security requirements prescribed by the FAA.[137] The framework is provided

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[134] https://www.oig.dot.gov/sites/default/files/FAA%20Oversight%20of%20Unmanned%20Aircraft%20Systems%5E6-26-14.pdf (Date of use: 2 October 2020).
[135] See chapter Two, Part 7.2 of this thesis for more exposition.
[136] See chapter Two, Part 7.2 of this thesis.
[137] Carr B *Examining* 20.

under Title 49 of the US Code of Federal Regulations, FAA Modernization and Reform Act as complemented by the FAA Advisory Circulars, Orders and Guidance Materials.

Under Title 49 of the US Code, FAA has the overall responsibility of protecting aircrafts in the airspace. Section 40103(a) of the Code states that the US has the exclusive sovereignty of its territorial airspace.

Accordingly, this provision affirms the spirit of Article 1 of the Chicago Convention thus forming the basis for control and exclusion of UAS activities that can cause unlawful interference. Further, in order to assure UAS security surveillance by the FAA officers, section 40108 of the Code provides for the power of the Administrator of the FAA to operate schools for the training of officers and staff.[138]

FAA Modernization and Reform Act provides security as key regulation of UAS. Specifically, section 33(b) of the Act provides for the general rules for certain unmanned aircraft systems. It recognizes that in making an assessment of the UAS, the Secretary of Transportation must consider if the UAS poses a threat to national security. Section 333(b) (1) goes further to list the factors that form the basis for this assessment such as operations capability, or proximity to airports or populated areas. It is only after the UAS is assessed as not to pose national threat that certificate of operation can be issued unless otherwise excluded from the process of application for reasons of statutory waiver or recreational nature of the operation. Additionally, the framework of the FAA Modernization and Reform Act on certification and authorization discussed in the section on safety is crosscutting and aids in planning and design of aviation security.

[138] The US Code of Federal Regulations, Title 409, Section 40108(a).

The, FAA Modernization and Reform Act, 2012, recognizes the role that is played by the United States Department of Homeland Security. This boosts the support to deal with evolving security measures with the rise in cases of international terrorism. The role of the department specifically comes in handy by providing screening of devices and enforcement of security protocols.[139] The department has put in place more heightened surveillance to ensure creation of a baseline for aviation security.

The provisions of the FAA Advisory Circular on Foreign Air Carrier Security, 1982, complement the framework under the FAA Modernization and Reform Act, 2012. Generally, the Circular stipulates conditions to be met by foreign carriers in the US.[140] The provisions require submission of Security Program that apply to operations of aircrafts. The Circular also prohibits dangerous and deadly weapons aboard aircrafts. Part 6 of the Circular specifically provides as follows:

> "Although foreign air carriers are not required to submit their security programs, the Administrator for approval, each such carrier is required to submit, upon his request and in accordance with applicable law, information in with respect to the security program applicable to its operations and the implementation thereof…"[141]

The provision does not make it necessary to submit the security programme. However, that the Administrator may require the submission of the security programs at any time he imputes an obligation of the carriers to maintain the security programmes. Further, as the scope is such that the requirement applies to all foreign carriers with requisite permit, no distinction is made between State or civil or manned or unmanned aircrafts. The provision on screening, however, majorly applies to manned aircrafts, reason being that they land at designated airports where passengers, cargo and baggage are screened at the terminals unlike UAS which land in remote places that have no screening facilities unless such UAS are

[139] Homeland Security "Remarks for the Council for New American Security" https://www.dhs.gov/news/2017/06/28/remarks-council-new-american-security-conference (Date of use: 6 February 2020).
[140] FAA Advisory Circular on Foreign Air Carrier Security No.129-3.
[141] FAA Advisory Circular on Foreign Air Carrier Security No.129-3, Part 6.

scheduled to specifically land at an airport, this is not always the case.[142] UAS Circular's requirements act as response mechanism for bomb and piracy threats arising from aircrafts through security inspections, the countermeasures such as bomb disposal facilities, sniffer dogs, expert search are challenging and not easily available in all places where UAS operate, launched or land.

The FAA Guidance on Recommended Trainings and Advisory Circular on Foreign Air Carrier Security further complement the FAA Advisory Circular on Foreign Air Carrier Security.[143] This Guidance material generally addresses the security concerns through preventive trainings. Specifically, it stipulates the requirement of training for members of the crew who operate aircrafts. The trainings target areas such as anti-hijack. The FAA Guide further harnesses the training requirement for private flyers.[144] The integration of the trainings is also achieved through the Circular on Pilots Schools, Certification and Compliance. The provision of the Act requires maintenance of training records of students, and harmonization of training syllabus. Requirements such as training on ground control are relevant to UAS. Since training is a preventative approach to security threats, the Guidance material serves to complement the basic security knowledge imparted in schools. The uniformity in trainings is laudable, since it makes compliance with security regulations much easier.[145]

Additionally, the FAA passed the Small UAS Regulations, 2016. Under these Regulations, an operator of small UAS with a certificate is required to undergo refresher courses that entail passing a recurrent knowledge exam after every 24 months.[146] Operators with visible physical and mental handicap likely to affect safety or security are not allowed to operate a UAS, although a medical certificate is not a

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[142] FAA Advisory Circular on Foreign Air Carrier Security No 129-3, Section 8 on screening of passengers and property.
[143] FAA Advisory Circular on Foreign Air Carrier Security No 129-3, Section 8.
[144] FAA Advisory Circular on Federal Aviation Administration No 150/5000-16.
[145] The US Code of Federal Regulations, Title 61.
[146] The US Code of Federal Regulations, Title 14, Part 107.

mandatory requirement. Further, under the Regulations, should one choose to use operator or observers, they would be restricted to flying or observing one UAS at a time.[147]

Lastly, the security assurance is also evident through the development of the National Strategy for Aviation Security in December 2018 after a revision of the previous 2007 version.[148] The Strategy provides that the development of and the need to keep up with the UAS technologies is a key motivating factor for its development.[149] The material documents two main strategies: one, the protection of the vital United States National Interest, which covers the protection of the homeland, American people, American way of life as well as its prosperity. The second strategy is achievement of the desired End-State, which is a secure aviation ecosystem through proper coordination and integration planning.[150]

The security assurance recognizes the need to protect the US and its global interest in aviation ecosystem, through detecting deterrence and prevention of terrorist, criminal and hostile acts whether by physical, spectrum or cyber means.[151] This means that the strategy guides the stakeholders to combat the acts of illegal interference. Other security-related aims of the strategy are to maximize aviation ecosystem security provision of high security standards implemented an efficient manner balanced with safe efficient movement of cargo and people. Thirdly, it seeks to enhance, resilience, mitigate damage and expedite recovery to mitigate damage and expedite recovery from an attack on aviation ecosystem, and fourthly, to effectively engage international, domestic and private sector partners to ensure safety and security receives active engagement among agencies, the private sector and international stakeholders.

[147] The US Code of Federal Regulations, Title 14, Part 107.
[148] The National Strategy for Aviation Security of 2018.
[149] The National Strategy for Aviation Security of 2018, Page 1.
[150] The National Strategy for Aviation Security, 2018, Page 2.
[151] The National Strategy for Aviation Security, 2018, Pages 7-10.

From the foregoing analysis, it is evident that the regulation of UAS through the frameworks for approval, security programmes and trainings play a key role in ensuring security of the UAS in the US. These arrangements mirror the spirit of ICAO Annex 17 and the ICAO Guidance in its Security Manual by focusing on mitigating security risks from a preventive angle. Despite its most likely robust systems, the US' response to aviation security, in general, has been termed as inadequate especially after the failed and attempted terrorist attacks such as the September 11 incident. This limits full achievement of the need to consider technological solutions as provided in SARPs, ICAO Annex 17 and ICAO Global Aviation Security Plan. Ron particularly identifies the major issues that run across attacks to be the inability by institutions to develop machinery necessary to deal with new technological development in the aviation sector.[152] This has been witnessed especially, after the September 11 attacks.

The following section highlights the extent of the privacy challenge and steps that have been taken by the US in addressing them.

5.3 The US Response to Privacy Concerns of UAS

It shall be recalled that chapter Two of this thesis identified that a major privacy challenge in the international plane as regards the UAS use is its potential to cause, or be used as a tool of aerial photography and thus potentially cause intrusion to privacy.[153] It was further explained that the potential arises from UAS' ability to be overflown over people or private property. Notably also, the international law response depended heavily on international human discourse through enforcement of relevant State obligation to respect, protect and fulfil the rights under international

[152] Ron R "Improving Airline Security in the United States" 2011 *Combating Terrorism Center* 1.
[153] See chapter Two, Section 7.3 of this thesis for more exposition on this. Cavoukian A *Privacy and drones: Unmanned aerial vehicles* (Information and Privacy Commissioner of Ontario Canada 2012) 2.

instruments have among them being the ICCPR.[154] This part discusses how the domestic framework in US addresses these privacy concerns.

At the domestic level, the US is no stranger to privacy concerns relating to UAS. A specific concern for the public in the US is the ability of law enforcement agencies, especially the FBI, to spy on members of the public, and in the process violate the right to protection from unreasonable search and seizures. Other concerns arise from potential and actual threats or breaches to the right to privacy for persons who are likely to be affected by searches and seizures. This danger also exists from neighbours and other civilians who may capture video and steal photos for unauthorized use owing to the increased use of the UAS for civilian purposes in the US.

In order to avert the challenges, the US Constitution is the most superior law that sets the stage for the general protection of the privacy rights. The Fourth Amendment to the Constitution provides as follows:

> "The right of the people to be secure in their persons, houses, papers, and effects, against unreasonable searches and seizures, shall not be violated, and no Warrants shall issue, but upon probable cause, supported by Oath or affirmation, and particularly describing the place to be searched, and the persons or things…"

The import of the Constitutional provision is not only to recognize the right to privacy but also to create the mandatory due processes to be followed before the right to privacy is limited through legal means and in deserving cases only. Secondly, the provision makes approach of prohibiting the acts whose effect is to interference with the security of privacy. The probable breach from use of UAS is thus one such act which is prohibited in the Fourth Amendment to the US Constitution. That the Constitution is the supreme law means that anyone can resort to it in terms of

[154] See chapter Two, Section 7.

interpreting federal laws or overriding the provisions of a State law on privacy issues in cases of any inconsistency.

Under Title 49 of the US Code of Regulations, the Secretary of Transportation has powers to make Regulations to prevent unwarranted invasion of personal privacy during the process of the security activities of an aircraft use.[155] These and concerns for privacy were, however, couched around regulation of passenger records obtained through screening and other means to protect the passengers on board aircrafts and had little relevance to the privacy concerns of UAS use.

The privacy protection underpinnings are also provided under the FAA Modernization Reform Act, 2012. AS held by some authors, it is worth noting that even then, Title III, Part B, which is dedicated to addressing the provisions on privacy protection, has no specific express provision on assurance against privacy invasion.[156] The rules may only be implied from a not so farfetched provision such as Section 336 of the FAA Modernization and Reform Act. Specifically, Section 336(a) provides that:

> "Notwithstanding any other provision of law relating to the incorporation of unmanned aircraft systems into Federal Aviation Administration plans and policies, including this subtitle, the Administrator of the Federal Aviation Administration may not promulgate any rule or regulation regarding a model aircraft, or an aircraft being developed as a model aircraft, if the aircraft is flown strictly for hobby or recreational use;"

The above requirement for strict adherence to purpose of flight can be interpreted to mean that they cannot be used for other purposes such as intrusive surveillance. However, even if the application by implication were possible, it suffers the limitation of being applicable to model aircrafts alone. The upshot of the foregoing is that the

[155] The US Code of Federal Regulations, Title 49, § 40119 (b)(A).

[156] Ison DC "Privacy, restriction, and regulation involving federal, state and local legislation: more hurdles for unmanned aerial systems (UAS) Integration?" 2014 *JAAER* 24.

US principal framework under the law in Title 49 of the US Code as amended by the FAA Modernization and Reform Act, 2012 has not sufficiently addressed the challenge of privacy restrictions related to use of UAS. The challenge of inadequacy, therefore, reflects similar inadequacy in the Chicago Convention that, as discussed in chapter Three of this thesis, only apply to the privacy assurance in the most marginal form.

The Academy of Model Aeronautics Safety Code of 2018 attempts to cure the regulatory inadequacy set out above by providing guidance on how the members of the Academy can ensure protection of the privacy of others during operation of model aircrafts. Under Paragraph 4 of the Code, the members solemnly affirm to avoid flying directly over unprotected people, moving vehicles, and occupied structures. Other relevant affirmation reads as follows:

> "I will not fly a powered model outdoors closer than 25 feet to any individual, except for myself or my helper(s) located at the flight line, unless I am taking off and landing, or as otherwise provided in AMA's Competition Regulation."[157]

Though the complementary regulation under the Safety Code, 2018 is express, it suffers from a lack of binding effect. However, having been developed in 2018, some 6 years after the FAA Modernization and Reform Act, 2012 was enacted, it is a representation of the current recognition of the need for regulation of the privacy concerns of UAS.

Overall, the lack of binding aviation-specific instruments at the federal level may be attributed to the existence of divided opinion among law enforcers and the public on extent of regulation of privacy.[158] This is elucidated by the sharp distinction in

[157] The Academy of Model Aeronautics Safety Code of 2018, Paragraph 8.

[158] National Research Council *Engaging privacy and information technology in a digital age* (National Academies Press 2007) 150.

opinion and approaches by parties to a case in which the Electronic Privacy Information Center filed a brief for *amicus* stating that intrusion of the privacy of iPhone users was necessary to prevent crime.[159] On its part, Apple contested the order by court stating that forming a software to access a locked iPhone was unlawful and unconstitutional, and would in itself be undermining the security of the people, and hence create a bad precedent for the American people.[160] A notable impact of the continuing tension regarding the UAS-specific federal protection of privacy rights is that focus has been put on regulation at the States' level.

Some States in the US have taken measures to address uses of UAS with impact on privacy.[161] Georgia and Louisiana are among the States with laws that prohibit people from peeping into others private activities or lives through windows or doors for purposes of spying upon or invading that privacy. The Official Code of Georgia[162] provides that a person violates privacy rules when they go about undertaking surveillance upon the premises of another.[163] Since the UAS can be deployed for surveillance purposes, the Code directly applies to regulation of UAS activities. This is confirmations that the US has statutory laws aimed at safeguarding individuals' privacy.

The State of Virginia, on its part, has a statute that criminalizes creation of photos and video images of non-consenting persons who have reasonable expectation of privacy.[164] Mississippi State also has a statute that criminalizes photographing,

159 Electronic Privacy Information Center "Apple v. FBI" https://epic.org/amicus/crypto/apple/ (Date of use: 23 September 2019).

160 Electronic Privacy Information Center https://epic.org/amicus/crypto/apple/ (Date of use: 23 September 2019).

161 US Integration of Civil Unmanned Aircraft Systems in the National Airspace System Roadmap of 2013 is a guide outlining FAA's plans for integrating UAS into the NAS over a 5-year period.

162 Official Code of Georgia of 2017, Section 16-11-60

163 Official Code of Georgia of 2017, Section 16-11-60.

164 Virginia Criminal Law Statute, Section 6 where it is a cause of action for criminal trespass. This could be relevant if the perpetrator trespassed or installed technology in the victim's home or workplace that was tantamount to trespass in procuring images. See also The Code of Virginia § 18.2-386.1.

taping or filming a person against his or her expectation of privacy.[165] These laws form part of the framework for regulation of UAS use and operation, since UAS have the capacity to invade private spaces and capture images. Therefore, these statutes could be inferred to cover images taken by UAS. Of importance from these legislations is express prohibition of acts that limit enjoyment of the right to privacy. They also uniformly seem to set the standard that a person is worthy of protection if he has a reasonable expectation of privacy. Of course, such a test would require analysis on a case-by-case basis.

Even in the light of the constitutional protection, the State-level laws are equally important since they entail unique directions taken by States in creating a delicate balance between protection of privacy and enhancement of security from crime as well as social violence. Another importance of the State laws on privacy protection is the particularity of how State laws would operate and their exemptions. This is however, not without challenges owing to the possibility of multiplicity of laws and hence a huge potential for conflict between the laws that make goals of harmonization and integration of UAS into the national system more challenging.

Regarding the implementation of the existing legal framework, the US federal and State courts have made remarkable judicial steps towards the recognition of the protection of the privacy rights. The steps that are discussed shortly, are indicative of promising prospects of overcoming the practical challenges arising from scanty federal provisions on privacy protection in respect of UAS in the US.

[165] Mississippi Criminal Code of 2013, Section 97-29-63. The Code makes provisions on photographing or filming another without permission where there is expectation of privacy; when victim is adult; when victim is a child under the age of sixteen year.

In the State of Georgia, the Court, addressed itself to the privacy concerns in the case of *Smith v State.*[166] In this case, Donald Smith was found guilty of being a peeping tom and the finding affirmed by the Court of Appeal of Georgia. Under the Georgian Code, a peeping tom was a person who invaded privacy by peeping through a door or window. The facts of the case were that police officers were dispatched to an apartment complex in response to a suspicious call. They found Smith standing in a secluded dark patio, three feet away from the window to an apartment, looking at two people he did not know. He was arrested and tried with compelling witness accounts of similar conduct previously. Although the *Smith* case did not concern UAS, it is relevant to violation of privacy by advanced technology of UAS. If the use of normal eyes to peep by a peeping tom can be determined as breach of privacy, it follows, therefore, that in the era of technological advancement, the UAS that has eyes from the sky should, due to the use of progressive technology, infringe on the right to privacy. Therefore, given the sophistication of today's UAS, it could be peeping tom, or the tool used by peeping toms. The principle, in this case, is still relevant regarding violation of people's privacy from a vantage point with aid of innovative equipment, such as use of UAS.

At the federal level, the US Supreme Court has addressed specific concerns regarding the right to privacy.[167] From the Court's decisions, an emerging trend has been laid out in determining whether UAS observations and impact on privacy are constitutional or not. Case law suggests that the court considers a number of factors which help to assess whether the use of a UAS raises constitutional questions. The first factor is whether UAS is in manageable airspace. Others are whether there is undue disturbance on the ground below, in terms of noise or wind; whether imaging systems used on the UAS can be taken from inside the home; whether violation was excessive; and whether the plaintiff has reasonable expectation of privacy.[168] These factors play a big role in determining whether a court can find that the use of a UAS actually or potentially violates civil liberties, and privacy in particular to an extent

[166] *Smith v State* 1999 238 US 605 (Ga. App) [2].
[167] Parker R *A definition of privacy* (Routledge London 2017) 84.
[168] *Smith v State* 1999 238 US 605 (Ga. App) [2].

warranting the protection by the Constitution of the US. These are demonstrated by the cases below.

5.3.1. Dow Chemical, Ciraolo, and Riley 476 U.S. 227, 229 (1986)

Dow Chemical v the United States[169] concerned the action by the Environmental Protection Agency (EPA) to observe a chemical plant from the sky above. When Dow Chemical denied EPA physical access to inspect the plant, the agency hired a commercial photographer to take pictures from the sky, but within lawfully navigable airspace,[170] as there were barriers that blocked observation of the vegetation from the ground. The surveillance took place within the concealment of structures, until a chemical plant was eventually discovered.[171] When the matter went to court, the Supreme Court held that shooting photos above the ground of a developed vegetal convoluted from navigable airspace was not a search forbidden by the Fourth Amendment.[172]

In its verdict, the Supreme Court deliberated on the superiority of features exposed in the photos,[173] the technology used, and the place that was surveyed. The Court recognized hypothetical limits by stating, "Surveillance of private property by using vastly sophisticated reconnaissance kit, not commonly obtainable to the public, such as satellite technology, might be constitutionally prohibited by absence of a warrant".[174]

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[169] *Dow Chemicals v the United States* 1986 476 US 227 (SC).
[170] *Dow Chemicals v the United States* 1986 476 US 227 (SC).
[171] *Dow Chemicals v the United States* 1986 476 US 227 (SC) [239].
[172] *Dow Chemicals v the United States* 1986 476 US 227 (SC) [239].
[173] *Dow Chemicals v the United States* 1986 476 US 227 (SC) [238]. The mere fact that human vision is enhanced does not give rise to constitutional problems.
[174] *Dow Chemicals v the United States* 1986 476 US 227 (SC) [238].

An analysis of this quotation shows that the majority opinion held the view that ordinary photography was not a Fourth Amendment search because it was not complemented by a physical trespass and the equipment used was not the most sophisticated form of technology available to the Government. The majority's reasoning has been rightly criticized for being capable of abandoning Katz principles. The principles which originated form the Supreme Court ruling in the case of *Katz v United States,*[175] expanded the Fourth Amendment on protection of people against unreasonable search making a redefinition of what constitutes searches and seizures with regard to the protection of the Fourth Amendment of the US Constitution. The decision in the *Dow case* premised its conclusion on the technique of search rather than the latitude of the right being safeguarded. It is not a surprising that this was the basis of Justice Powell's dissension, contending that its justification would lead to the wearing away of the right to privacy.[176] The authority in the dissension shows that use of physical trespass would not be mandatory when determining if objects, including UAS, have committed breach of privacy rights. Secondly, since UAS utilize complex technology, the sophistication concept discussed by the majority opinion justifies its regulation to prevent privacy breaches.

5.3.2 Electronic Privacy Information Centre (EPIC) v. FAA

Electronic Privacy Information Centre (EPIC) v FAA[177] arose out of FAA's rule promulgated under the FAA Modernization and Reform Act, in which Congress directed FAA to consider whether certain UAS could be safely integrated into the national airspace and to establish prerequisites for their safe operation. EPIC, who petitioned the FAA to create privacy safeguards prior to deployment of commercial UAS in the US in 2014, opposed this directive. The FAA responded to EPIC's petition, arguing that UAS privacy implications did not raise instant safety concerns. The FAA further stated that privacy concerns would be considered part of the project, and not prior to it as suggested by EPIC. By 2015, when the FAA announced rulemaking on commercial UAS, they stated that privacy issues were beyond the

[175] *Katz v United States* 1967 389 US 347 (SC).
[176] *Dow Chemicals v the United States* 1986 476 US 227 (SC) [238]. 107.
[177] *Electronic Privacy Information Centre (EPIC) v FAA* 2018 No 16-1297 US (D.C Cir.).

scope of the rulemaking. EPIC promptly filed a suit against the FAA challenging its denial of EPIC's appeal and the FAA's failure to embrace privacy in the small UAS rulemaking.

The D.C Circuit dismissed EPIC's petition on the technicality that EPIC had failed to establish standing on the matter, as well as technicalities in the drafting of the affidavits. The FAA finalized the Small Drone Rulemaking in 2016, unfettered, and EPIC filed another suit challenging the FAA's failure to address privacy in the Small Drone Rulemaking.[178] Technically, the court lost a prime opportunity to pronounce itself on the place of privacy issues on regulation of UAS. Since the opportunity had availed itself, this was the proper forum for the court to pronounce itself on issues such as FAA's administrative role to regulate use of cameras and other sensors extraneous to self-operation of the UAS. Despite the lost opportunity, it remains to be recognized that it is significant for the courts to consider capabilities of cameras attached to UAS as prohibited by Article 36 of the Chicago Convention to help protect right to privacy, which is fundamental to all citizens.

5.3.3 Carpenter v. the United States

The *Carpenter v the United States*[179] was an appeal from the Sixth Circuit Court. It related to the cell-site location information, which is generated automatically or intentionally by phone users. The police had used data from the cellphone of a confessing accused person. The purpose was to obtain additional information on the call logs to pin down other members of an organized robbery gang. Usually, such usage was sanctioned by provisions of the Stored Communication Act. The Act, which generally protects private content and related information, also provides for an exception where there are reasonable grounds to believe that the material is the subject of criminal investigations. This position had been affirmed in previously

[178] https://epic.org/privacy/litigation/apa/faa/drones/ (Date of use: 2 October 2020).
[179] *Carpenter v the United States 2018 No. 16-402, 585 US (SC).*

decided cases, which affirmed exception to the general rule. One thing was clear from the previous jurisprudence that the police did not require any warrant to obtain such information, even if it involved a third party. In that spirit, the police requested for information from the telecommunication company on the site locations of the persons.

The issue for determination was whether the police required the telecommunication companies to generate a warrant to access geological information of cell phone users. This issue would be resolved with a determination of a sub-issue on whether the search as per Section 2703(d) orders are searches within the meaning of the Fourth Amendment to the U.S. Constitution. The trial magistrates ruled that the search was not unconstitutional. The same was affirmed on appeal, where the Sixth Circuit Court stated that cell-site location information was business data not within the Fourth Amendment definition of search. The appellant was dissatisfied with the finding and appealed to the Supreme Court, seeking an order of *certiorari*.

The majority of the learned judges considered the origin and importance of the Fourth Amendment and noted that the influence of new technology on privacy rights through intrusive monitoring has redefined obtaining data on site-location. For instance, phone details are now so detailed that conveying them amounts to significant features of almost Global Positioning System (GPS)-like intrusion to the human anatomy since it keeps tabs on a person's every movement. All these issues were seemingly beyond the previous decisions in *the United States v Mille*[180] and *Smith v. Maryland*.[181]

[180] *United States v Miller* 1939 307 US 174 (SC).
[181] *Smith v Maryland* 1979 442 US 735 (SC).

The principles in the case are relevant to the regulation and integration of UAS into civil aviation, owing to the use of modern technology. It is instructive, for example, to note that the court distinguished the current matter with other previous cases involving articles in cars and banknotes, as well as traditional history of writs and subpoenas. The dissenting opinion was majorly based on classification of the cell-site location information as a business record by the dissenting justices and affirmation of the traditional third-party principle. The dissenting judges feared that the approach by the majority would water down surveillance as a governmental administrative tool.

Though the Supreme Court was non-committal on time, it did hold that a seven-day intrusion was enough to be intrusive and thus fall within the ambit of the Fourth Amendment Search. The Court held that a warrant is required for obtaining Section 2703(d) orders, unless in deserving emergency cases, and consequently issued a request for *certiorari.* This is the most recent case dealing with digital privacy to which the use of UAS, though not explicitly addressed, fits very well. It is possible that even at the time that the courts had used the *Smith* case, there was an emerging opinion in the United States that aggregation of information, which is more intrusive, infringes on the privacy guarantees under the Fourth Amendment to the U.S. Constitution. Perhaps this is the thread of reasoning that inspired the Supreme Court. The majority decision was made on a 5-4 basis by the learned justices. That shows that the issues on digital privacy, though laid to rest, are still heavily contested. It is doubtful the decision can be applied to specific issues in the regulation of privacy issues in UAS, given the decision of Roberts, CJ that the court was not disturbing the previous case laws or even disrupting surveillance by the State. It is apparent, however, that the middle ground taken by the majority was based on the need to build consensus on somewhat divisive opinions.

The restriction in UAS usage is a reflection of the regulatory framework in the US being in infancy stage.[182] These rules allow FAA to make informed assessment of technical development of UAS to facilitate emergence of regulatory frameworks that ensure a secure national airspace system.[183] The FAA is alive to the State of manufacture and maintenance of UAS that are not at par with manned aircraft and, therefore, amount to security and safety risks while operating in the air without proper monitoring. Despite the requirements, there is a practical challenge, since most UAS pilots are neither trained nor certified and are unfamiliar with rules of the air that should ensure safety and security for all users of the national airspace system.[184]

6. Other Cross-Cutting Challenges in Integration of UAS into Civil Aviation

6.1 Challenges of Enforcement of Safety and Security Regulations

The FAA has the mandate to promote voluntary compliance with its regulations by educating individual operators on how to ensure safe operation under existing laws.[185] It uses a number of tools in the enforcement process such as cautionary warnings, letters of correction as well as civil penalties.[186] The FAA is empowered to take enforcement measures against any unauthorized UAS user who endangers the safety of the National Airspace System (NAS).[187] The role of the State and local rule enforcement agencies cannot be underestimated since they are usually the first to detect, deter, investigate and, as appropriate, enforce conduct that amounts to unauthorized UAS operations.[188]

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[182] FAA Strategic Plan for the Financial Year 2019-2022.
[183] The US Integration of Civil Unmanned Aircraft Systems in the National Airspace System Roadmap of 2013, Section 3.
[184] The US Integration of Civil Unmanned Aircraft Systems in the National Airspace System Roadmap of 2013, Section 3.
[185] Cracknell AP "UAVs: Regulations and law enforcement' 2017 *IJRS* 8-10.
[186] Cracknell "Law enforcement" 9.
[187] Cracknell "Law enforcement" 8.
[188] By applying any laws falling within the enforcement authority of the law enforcement agency in question.

In terms of the actual inspections, the FAA aviation safety inspectors are foot soldiers who make follow-up on unauthorized UAS operations.[189] However, the inspections are not without challenges. As Byrnes and Kalas note, these inspectors are hampered by lack of capacity in terms of numbers, underfunding and inability to cover very long distances.[190] From the outset, activities of the FAA could very well fall within the ambit of criminal law enforcement, in which case, the FAA needs to be cautious so as not to mix the two issues.[191] It should instead serve public interest through co-ordination, mutual understanding, and co-operation between government agencies that operate under the umbrella of law enforcement.

From the analysis in this thesis, it appears that many violations of the FAA's regulations could be addressed by administrative enforcement, which even the FAA agrees with and rationalizes by the fact that some federal criminal statutes are implicated by UAS operators.[192] Similar to any criminal and civil action, success in enforcement would depend on clear appreciation of the facts and the event. To the extent that the FAA is thin on the ground, development of an accurate factual report that is contemporaneous with the event is impossible under the current set up. The remedy is in using other law enforcement officers who may be first responders in the event of an unauthorized UAS usage. Although they are not experts like aviation safety inspectors, they can provide valuable assistance to the FAA through identification of witnesses, interviews and documentation. The information given to safety inspectors can be used to, among other things, contact witnesses on any investigative action taken by the FAA.

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[189] Fallon Jr and Richard H "Enforcing aviation safety regulations: the case for a split-enforcement model of agency adjudication" 1990 *ALJ* 389.

[190] Byrnes PT and Kalas MJ "FAA Admits UAS are a Severely Underfunded Mandate" https://www.jdsupra.com/legalnews/faa-admits-unmanned-aircraft-systems-i-37914/ (Date of use: 2 October 2020).

[191] Byrnes PT and Kalas MJ https://www.jdsupra.com/legalnews/faa-admits-unmanned-aircraft-systems-i-37914/ (Date of use: 2 October 2020).

[192] The US Code of Federal Regulations, Title 49, Section 4471.

Apart from the FAA, other law enforcement agencies are equally well placed to identify suspected operators of UAS, participants and support personnel.[193] Their involvement has been rationalized by their potential ability to view and record the location of the event by taking pictures at close range. The pictures may be helpful in describing the lighting, weather pattern, any damage, identity sensitive locations, events or activities that help the FAA protect sensitive and restricted airspaces. Practically, the US has been using local area enforcement officers who work closely with the FAA regional officers and any such officers who are close to the event and witnesses it, may notify one of the FAA Regional Operation Centres to facilitate initiation of investigations.[194] All this data can be presented as evidence in any future investigation of a UAS safety requirement violation.

Local enforcement officers may likewise help in identifying and preserving public or private security systems that provide photographic evidence of UAS activity including video and still pictures. These systems do not store data permanently and may need to be reset automatically to erase such data. Law enforcement can interfere with resetting and in the process preserve the data that can be used as evidence. To the extent that all these items are within reach of law enforcement, officers' toolbox is a positive sign. This does not, however, paint the full picture. For example, whereas the FAA has enforcement mandate, its capacity to execute is limited. This is partly due to reliance on other government agencies to gather evidence. When unauthorized UAS activity occurs in remote places where real evidence is hard to get, it undermines the process of gathering evidence.

6.2. General Design Challenges

Although design of UAS identified in chapter Two of this thesis, is a safety challenge, the extent under which they are designed, can cause both safety and security challenge. In the US, design approval holders, modifiers, and civil aviation

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[193] Cracknell "Law enforcement" 10.

[194] FAA Modernization Reform Act 2012.

authorities are required to regulate chemical oxygen installations. Provisions of Section 25.795 of the Code of Federal Regulations and the Advisory Circular on the Chemical Oxygen Generator require that design of aircraft's chemical oxygen generators must be tamper proof. Such designs must be secure to prevent misuse of the chemical gas that can be used to cause unlawful interference against civil aviation. Designers of aircrafts including UAS are required to install tamper-evident features for ease of detecting tampering with the installation as a security counter measure.[195]

These cross-cutting challenges of both safety and security requirements mirror the provisions of Part 5.33 of the ICAO UAS Circular that requires tamper proof in the design of UAS. It is noted, however, that regulations can only be effectively implemented with a multi-agency approach that includes the FBI, Department of Homeland Security, and Transportation Security Administration. The dependence on these government agencies may prove to be a challenge when the UAS in question is publicly operated. Secondly, though the requirements on chemical oxygen generation may be considered at the design and manufacturing stages, implementation, that requires human intervention, may be challenging since most UAS are pilotless.

6.3 Other Challenges of Integration of UAS into Civil Aviation

Overall, the process of integrating UAS into civil aviation has made great progress in the US. The passage of the FAA Modernization and Reform Act in 2012 gave impetus to this process by granting the FAA broad mandate to publish a 5-year roadmap, establish six test ranges and to integrate UAS into the national airspace

[195] FAA Advisory Circular on the Chemical Oxygen Generator provides guidance for an acceptable means of showing compliance with the requirements of The Code of Federal Regulations, Title 14, Section 25.795(d). Particularly, Section 25.795(d) requires each chemical oxygen generator or its installation to be designed so it meets one of several criteria. The means of compliance described in this document provides guidance to supplement the engineering and operational judgment that must form the basis of any compliance findings relative to a COG installed on an airplane.

system by September 2015, which was not achieved as anticipated. The FAA was also required to mitigate safety research to facilitate the integration process, and eventually address challenges of UAS requirements that are highlighted in the Act.

In its mission, the FAA has encountered other practical technological, regulatory and management barriers in its endeavour to integrate UAS in a safe and secure manner.[196] One regulatory barrier relates to inefficiencies in framework for data collection, analysis and sharing. In particular, it has been reported that the FAA does not even access data held by the Department of Defence due to concerns of its sensitivity.[197] These outlines the difficulties encountered by the FAA and how its efforts are undermined. Therefore, the FAA has not been effective in collecting and analysing UAS safety data that would enable identification of risks. This is partly due to failure by the FAA to develop procedures that would ensure all UAS incidents are not only reported but tracked and processed for data sharing with the US Department of Defense, which is the largest user of UAS.

Secondly, it relates to the delay in schedule of integration. As set out above, the deadline had been set for September 2015. To accomplish this, the FAA issued a roadmap to guide the integration process for a period of 5 years. To the extent that the agency is behind schedule, it has implications for unresolved safety, security and privacy issues. Seventeen UAS-related provisions were cited in the Act, whereas the FAA has met deadlines for nine provisions, 8 provisions critical for the integration are yet to be fully implemented. Deadlines that have been met relate to: UAS Test Sites, publication of a UAS Roadmap, submission of a comprehensive UAS plan, simplified certificate of authorization process and the Arctic Plan.[198] Of the remaining eight provisions, the FAA has encountered delays on the issue of a

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[196] U.S. Department of Transportation https://www.oig.dot.gov/sites/default/files/FAA%20Oversight%20of%20Unmanned%20Aircraft%20Systems%5E6-26-14.pdf (Date of use: 2 October 2020).

[197] https://www.govinfo.gov/content/pkg/GAOREPORTS-GAO-02-77/html/GAOREPORTS-GAO-02-77.html (Date of the use: 1 October 2020).

[198]https://uas.noaa.gov/Portals/5/Docs/Library/FAA-sUAS-Arctic-Implementation-Plan-2012.pdf (Date of use: 28 September 2020).

final rule on "Small UAS" that was to be delivered by August 2014 and safe integration of civil UAS into the National Airspace System (NAS) whose set deadline was by September 2015 but not attained.

Lastly, is the challenge of conflict between State and local laws. State, local and municipal jurisdictions could have different requirements on standards for UAS such as overflights, which may lead to conflict. This calls for the different levels to work together. Other areas in which State and local laws need to work together include limitations of UAS on flight altitude, flight paths, operational bans, and regulation of navigable airspace.[199] In areas where there have been gaps, federal courts have stepped in to regulate some of these issues.[200] For instance, the court had an opportunity to intervene in the case of *Montalvo v. Spirit Airlines.*[201] In this case, the 9th Circuit Court cited *City of Burbank v Lockheed Air Terminal Inc*[202] with approval and held that due to "the interdependence of these factors" what Congress enacted in respect of these was "a uniform and exclusive system of federal regulation."[203]

Other than the judicial intervention, consultation is also critical in harmonizing equipment and training to support UAS aviation safety measures, such as geo-fencing.[204] State and police power in land use, zoning, privacy, trespass, law enforcement, and operations however remain constant and thus not subject to federal regulation.[205] In order to ensure uniformity on these areas, in respect of the *Montalvo* case, is inapplicable. The FAA has identified certain common laws that

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199 Federal Aviation Administration "Office of the Chief Counsel, State and Local Regulation of Unmanned Aircraft Systems: UAS Fact Sheet" https://www.faa.gov/news/updates/?newsId=84369 (Date of use: 2 October 2020).

200 See the cases of *City of Burbank v Lockheed Air Terminal* 411 U.S. 624 (1973), *Skysign International Inc. v City and County of Honolulu* 2002 276 F.3d 1109 US (9th Cir.) [1117], *American Airlines v Town of Hempstead* 1968 398 F.2d US 369 (2d Cir.) and *American Airlines v City of Audubon Park* 1969 407 F.2d US 1306 (6th Cir.)

201 *Montalvo v. Spirit Airlines* 2007 508 F.3d 464 US 471 (9th Cir.) [471].

202 *City of Burbank v Lockheed Air Terminal Inc* 1973 411 U.S. 624 (SC) [638-39].

203 *City of Burbank v Lockheed Air Terminal Inc* 1973 411 U.S. 624 (SC) [638-39].

204 *Med-Trans Corp. v Benton* 2008 581 F. Supp. 2d US 721 (EDNC) [740]*; Air Evac EMS, Inc. v Robinson, 486* 2007 F. Supp. 2d US 713, 722 (MD. Tenn.) [713].

205 *Skysign International Inc. v City and County of Honolulu* 2002 276 F.3d 1109 US (9th Cir.) [1115].

are permissible at both State and local levels with respect to obligation for police to obtain a warrant prior to using a UAS for surveillance. These common laws specify that UAS may not be used for voyeurism, hunting or fishing, interfere with or harass an individual who is hunting or fishing and attaching firearms or similar weapons to UAS.[206]

7. Conclusion

The US has its unique and long interaction with UAS, which makes its inclusion in this study meaningful. After enactment of the Air Commerce Act of 1926, its first commitment to UAS regulation at an international level was demonstrated in 1944 when it galvanized support for adoption of the Chicago Convention within the American soil. Since then, the US has had experience in development of the regulation, institutional frameworks and providing integration of UAS into civil aviation, with its turning point being in 2012. Series of legal enactments and deliberate amendments to cover the UAS framework have further reshaped the ability of its framework to respond to safety, security and privacy concerns in the use of UAS. Also instrumental is the active FAA whose regulatory framework, including advisory opinions and circulars, have incrementally improved the depth and width of UAS regulation. Its provisions on airworthiness, visual line of sight, safety standards and safety management systems have enabled effective safety and security systems in UAS regulation. The security programmes and trainings under its framework also largely mirror the ICAO-based framework. UAS regulation is further, strengthened, by involvement of stakeholders through community-based organizations. Self-regulation is a lesson that African countries can learn in their pursuance of integration of UAS into civil aviation.

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[206] Federal Aviation Administration https://www.faa.gov/news/updates/?newsId=84369 (Date of use: 2 October 2020).

The safety, security and privacy assurances, though in place, have had a setback regarding two principal issues. First, is the lack of UAS-specificity in privacy regulation for UAS has to some extent been addressed by judicial activism which further strengthens the existing UAS framework. The second challenge is due to elusive Sense and Avoid technology, which still occurs to some UAS, despite America's comparatively advanced technology. Other challenges that affect the full potential for safety, security and privacy assurance are: understaffing of aviation safety inspection; certain conflicts on regulatory framework between State laws and the federal law; and ineffective data collection and sharing. These challenges inhibit the UAS legal and policy frameworks in the US from speaking to the current needs and challenges in UAS operations, as well as UAS integration process.

CHAPTER FIVE

LEGAL, POLICY AND INSTITUTIONAL FRAMEWORK FOR REGULATION OF UAS IN SOUTH AFRICA

1. Introduction

This chapter provides an analysis of the regulatory framework for regulation of the UAS in South Africa. Specifically, it examines how the framework has been effective in addressing safety, security and privacy concerns arising from use of UAS as discussed in chapter Two of this thesis. The chapter approaches the analysis by providing a brief background, overview of the legal and institutional legal framework principally under the South African Civil Aviation Act, 13 of 2009 and under South African Civil Aviation Authority (SACAA) respectively. It then critically analyses salient regulatory provisions vis-à-vis their efficacy in addressing safety, security and privacy concerns, before finally providing a conclusion on observations made through the chapter.

2. Background of Regulation of UAS in South Africa

It has been said that South Africa has used RPAs for military and civilian applications, which include the Denel Aerospace for surveillance missions and high-speed target practice, Advanced Technologies and Engineering for artillery fire correction missions.[1] It is in civilian application that remotely piloted aircraft continue to grow, for instance, in election monitoring, crime prevention and weather forecasting.[2] Growing demands have also been recorded in firefighting, health, disaster management, pollution control, radio broadcasts and regulation of poaching. [3]

[1] Republic of South Africa Department of Transport White Paper on National Civil Aviation Policy of 2017, p 119.
[2] *Oliver D* “History of South Africa UASs” 2015 *ADR* 1-5.
[3] Republic of South Africa Department of Transport White Paper on National Civil Aviation Policy of 2017, Pages 119- 121.

This growth has presented South Africa with challenges, with respect to the need to ensure that remotely piloted aircraft are operated safely, without harming the public and affecting national security, and in a way that would protect areas of national, historical, or natural importance.[4] Some of these challenges arise from the fact that the UAS has to operate in a national airspace, which has previously been dominated by manned aircraft regulation.[5] Other challenges, such as privacy concerns arise from the use, structure and formation of the UAS.

The shift towards civilian applications, being a recent phenomenon in South Africa and its present challenges have had an impact on the regulatory framework. At some point in early 2015 during development of the proposal for this thesis, there was the challenge of absence of UAS regulatory framework though efforts were in place to establish the regulations. This had a negative impact on integration efforts. Later on, South Africa started to develop UAS regulations. Generally, regulation of UAS lagged behind because it lacked the like history that had so much shaped regulation of manned aircraft. Despite this setback, there has been the realization that the integration of the UAS into the national airspace is inevitable given its ubiquity and increase in uses.

Development of specific regulation in South Africa of unmanned aircraft systems began, albeit mildly, when the Air Traffic and Navigation Services came up with a guidance document to regulate UAS movements in 2002.[6] Two years later, the South Africa Joint Aviation Authority Committee and its counterpart, the EUROCONTROL UAS Taskforce developed guiding principles for development of such concepts as it did in 2002.[7] Since the report's principles were developed by the Taskforce in 2004 just around the same year when the Guidance Document was

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[4] Levush R *Regulation of Drones* (Global Legal Research Center Washington 2016) 1.

[5] Ingham LA, Jones T, and Maneschijn A "Considerations for UAV design and operation in South African airspace" 2006 *TAJ* 698.

[6] Ingham LA *Considerations for a roadmap for the operation of unmanned aerial vehicles (UAV) in South African airspace* (PhD dissertation Stellenbosch University, 2008) 5.

[7] Unmanned Aerial Vehicle Operations in the RSA – Guidance, ATNS/HO/UAV WF, Johannesburg, 2002.

developed, it influenced development of the concept that had been commenced by South Africa. In a nutshell, the Taskforce recommended that development of UAS had to be guided by the laid down applicable principles of UAS regulations, as espoused in chapter Three of this thesis, that guide in regulations for integrating UAS into civil aviation, including fairness, equivalence, responsibility and accountability, and transparency.[8] The benefit of applying the principles in drafting UAS regulations is that once agreed upon, they aid in ensuring that the UAS are airworthy and operate efficiently in terms of sharing of responsibilities and improving overall chances of safety and security in use and operation.[9]

A roadmap to UAS integration and regulation started in earnest in 2006, building on the works commenced in 2002 as pointed out above, when the SACAA established a Co-ordination Committee.[10] The Committee brought together stakeholders in the UAS sector (air traffic controllers, manufacturers, academia and operators) to provide input in formulating UAS regulatory framework.

Currently, the regulatory framework arises from regulations adopted by the spheres of national, provincial and local governments established by the Constitution of the Republic of South Africa.[11] The three spheres, though separate entities, are distinct. That is, distinctive and interdependent. Just as Goitom correctly notes, the functions of the distinct governments is interdependent since conduct both legislative and executive functions.[12] Accordingly, regulation of UAS is within command of the national government but with some delegated authority.

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[8] Ingham et al 2006 p 698
[9] South African Civil Aviation Authority UAV Task Force Final Report of 11 May 2004, Pages 11-14.
[10] Ingham LA *Considerations* 11.
[11] Constitution of the Republic of South Africa, 1996, Section 40. See also chapters 6 and 7 establishes provincial and local levels of government respectively.
[12] Goitom H "Regulation of drones: South Africa" https://www.loc.gov/law/help/regulation-of-drones/south-africa.php (Date of use: 2 January 2019).

3. Overview of Current South African Framework for Regulation of UAS

From analysis of available literature, it is evident that South Africa is a very active participant in the international scene, as far as regulation of UAS is concerned.[13] The pace with which the country acted in ratification and domestication of the Chicago Convention demonstrates its commitment to the framework of laws provided by the Convention and Agreement to be guided by the subsequent framework envisaged to be developed under the ICAO framework.

Notably, South Africa is a member of the ICAO. Arising from this membership, South Africa was appointed to the Remotely Piloted Aircraft Systems Panel, established by ICAO in 2014.[14] The duties of the panel include to coordinate, develop standards, recommend practices, support air navigation services, and guidance materials, and facilitate a safe, secure and efficient integration of UAS into the civilian airspace.[15] South Africa has also, in the past, been appointed Chair the ICAO Aviation Security Panel. This appointment too is demonstration of its deep levels of commitment in as far as integration of the UAS into its civil airspace is concerned. By being part of the panel that coordinates and develops SARPs and Procedures on safety, security and integration, South Africa has a moral obligation imposed on it to comply with developing UAS regulation for the purpose of integrating them into civil aviation.

The effect of the outlined membership is that the international legal framework provided by the Chicago Convention and the SARPs developed by ICAO through Annexes and Circulars apply to South Africa to the extent of their varying degrees of binding nature, as discussed in chapters Two and Three of this thesis. The international framework, therefore, imposes on South Africa the obligation to domesticate international conventions into its own national law. Further, bilateral

[13] South Africa is a state party to the Chicago Convention, having appended her signature in 1 March 1947, about a month after the convention's inception on 4 April 1947.
[14] Goitom https://www.loc.gov/law/help/regulation-of-drones/south-africa.php (Date of use: 2 January 2019).
[15] Goitom https://www.loc.gov/law/help/regulation-of-drones/south-africa.php (Date of use: 2 January 2019).

and multilateral trade agreements are binding documents among member States. South Africa is a signatory to, among others, the Convention for Suppression of Unlawful Acts against the Safety of Civil Aviation,[16] and the Cape Town Convention of 16 November 2001.[17]

Emanating from the aforementioned international legal regime, there was need for specific measures to address emerging challenges of UAS. The objective of the Cape Town Convention was to offer international protection to all member States against dangers associated with airspace.[18] The Convention gave effect to international standards in certain categories relating to mobile equipment and the associated rights, which include flying equipment, such as UAS.[19]

At the sub-regional level, SADC member States are yet to develop a specialised agency to deal with security and safety of civil aviation in the region.[20] Although SADC was not part of the focus of the study, it is established that each SADC member State is left do develop her own local regulations, based on the framework provided by ICAO. The outlines of international conventions and treaty provisions apply to South Africa by virtue of its ratification; thus, such Conventions apply and are domesticated as a source of law.

In terms of South Africa's domestic legislative framework, the Constitution of the Republic of South Africa of 1996 is the supreme law, which outlines functions of several bodies with legislative authority such as parliament, provincial and local

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16 Convention on Suppression of Unlawful Seizure of Aircraft, Convention relating to Unlawful Acts Relating to International Civil Aviation of 10 September 2010 (entered into force 1 July 2018).

17 Cape Town Convention on International Interests in Mobile Equipment of 16 November 2001 (entered into force 1 March 2006).

18 Goode R "From acorn to oak tree: the development of the Cape Town Convention and Protocols" 2012 ULR 599.

19 Goode R "From Acorn" 599.

20 Abeyratne R "The future of African civil aviation" 1998 *JATWW* 30-49.

governments or general spheres.[21] All these bodies while making, applying and interpreting aviation laws, must do so in accordance with the constitutional principles. Other than the validation, the Constitution also provides for fundamental human rights, which UAS regulation must not overlook.[22] For example, it provides that everyone has the right to privacy, which includes the right not to have (a) their person or home searched, (b) have their property searched, (c) have their possessions seized, or (d) have the privacy of their communications infringed.[23] This means that while undertaking regulation for integration of UAS into civil aviation, the South African Parliament, in addition to performing its legislative role, must take cognizant of this Bill of Rights.

The South African UAS legal framework is generally designed to address safety, security and privacy in the aviation industry. The overall legislative framework is the Civil Aviation Act,[24] which evidences the legislative commitment to safety and security.[25] The Act allows for enactment of regulations and other subsidiary legislation to supplement and provide more details on implementation of the Act. In particular, Section 163 of the Civil Aviation Act is the legal basis for the SACAA to develop technical standards and rules for civil aviation in a manner that provides opportunities for UAS to operate in a safe and responsible environment. The operators would, however, need to convince the SACAA, using their manuals and other documents, of their capacities. The regulations are introduced to pilots of the remotely piloted aircraft, who have to be trained and familiarized with aviation rules and regulations and to the theoretical framework of remotely piloted aircrafts and all practical training.[26]

[21] Constitution of the Republic of South Africa, 1996, chapters 4 and 6 on the role of Parliament and of local Government respectively.
[22] Constitution of the Republic of South Africa, 1996, Section 14.
[23] Constitution of the Republic of South Africa, 1996, Section 14.
[24] Civil Aviation Act 13 of 2009 (hereinafter referred to in this chapter as the Civil Aviation Act).
[25] Civil Aviation Act, Section 72(1).
[26] Civil Aviation Act, Section 163.

Principally, the Civil Aviation Act of 2009, as amended from time to time, makes provisions for aviation safety, accidents and investigations procedures, approvals of land rights for reconnaissance, establishment of the institutional frameworks, among others. The Act further mandates the Minister responsible for aviation to make provisions regarding qualifications of operators, designation of functions to bodies, restriction of airspace, and institutions, classification, identification and development of appropriate technical, safety, security and development standards.[27] An initial overview of the Act reveals that it does not have provisions that are UAS specific. This is so, despite the clamour for UAS integration, having kicked off seven years before the Civil Aviation Act was enacted.

However, it is worth noting the definition of aircraft under Section 1 of the Civil Aviation Act refers to:

> "any machine, which can derive support in the atmosphere from the reactions of the air."

The above cited definition includes any UAS, at least by implication. Such a conclusion for inclusion of UAS in the definition is supported by circumstances surrounding the Amendment Act. Since the Act was subsequent to efforts of the development of Guidance Document in 2002, Principles of the Taskforce Report in 2004 and subsequent development of a roadmap for integration in 2006, was certain, therefore, that the drafters of the Act had in mind regulation of the UAS in mind when drafting the definition of aircraft.[28] Its approach, therefore, was to spell the general rules that would be applied with necessary modifications.

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[27] SACAA Act, s. 163.

[28] See Unmanned Aerial Vehicle Operations in the RSA – Guidance, ATNS/HO/UAV WF, Johannesburg, 2002 and South African Civil Aviation Authority UAV Task Force Final Report of 11 May 2004 already provided in the prior historical analysis.

Overall, the commitments under the Amendment Act reflect the international framework since it seeks to achieve the objectives in the Standards and Recommended Practices of the ICAO, whilst considering the local context. It is safe to conclude, therefore, that the mandate of SACAA relates to aviation safety, security and by extension privacy during oversight of airspace, airports, operations and personnel.

4. Institutional Framework of South Africa Civil Aviation Authority and Other Institutions

The South African Civil Aviation Act[29] established the SACAA. When the Act was amended in 2009, the Civil Aviation Act made provisions for the institution and specifically recognized it under its Section 71. The institution has mandate to draft civil aviation regulations, technical standards for airworthiness and operation of non-type certified aircraft. It is clear from the preamble of the Civil Aviation Act that it targeted expansion of the mandate of the SACAA, as far as safety and security oversight functions are concerned. These functions are handled at policymaking level, as well as day–to-day functioning of the SACCA that rests in the office of the Director General and staff of SACAA.[30] Whereas the Director General answers to the Minister of Transport on matters of civil aviation, safety and security, the officer also answers to the Board on matters within the jurisdiction of the Board.[31] The functions of SCAA are performed by the Director General and staff appointed by the former.[32]

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[29] South African Civil Aviation Authority Act 40 of 1998 (hereinafter in this chapter referred to as Civil Aviation Authority Act).
[30] Civil Aviation Act, Section 85.
[31] Civil Aviation Act, Sections 86 (3) (a) and (b).
[32] Civil Aviation Act, Sections 73(4) and Sec 87 (a)-(f).

The SACAA also contributes to overall regulation of South Africa's domestic air law through development of UAS regulatory requirements in the form of Aeronautical Information Circulars, Technical Standards, coming up with strategies, licencing, and oversight of flight inspections and conducting regular reviews.

The regulatory requirements, standards, procedures and strategies enumerated in Section 73 of the Civil Aviation Act, form the basis of implementation of provisions of the South Africa Civil Aviation Act as progressively amended. The, SACAA takes a critical position in the overall implementation of the aviation law as far as it relates to UAS. Through the regulatory requirements, it can do what the law cannot do: that is, providing specifics on the regulation for practical application. Specifically, they provide an avenue for the South African domestic regulatory framework to redeem itself by having a differential approach from the general approach adopted by the Civil Aviation Act, 2009 in which no UAS-specific provisions on safety, security and privacy have been made. In establishing these regulatory requirements, SACAA collaborates with other institutions with international best practices, particularly the FAA and the European Union (EU).[33]

SACAA has a further mandate of conducting comprehensive aviation industry audits and surveillance, such as assessment of safety and security-related decisions taken by industry management at all levels for their impact on aviation safety and security.[34] This very important mandate is complemented with the monitoring role, as well as implementation and enforcement of aviation policies such as the National Aviation Security Programme, which is discussed below.[35] Additionally, the SACAA is involved in conducting regular and timely assessment of international safety and

[33] https://www.icao.int/environmental-protection/pages/ICAO_EU.aspx (Date of use: 4 October 2020).
[34] Civil Aviation Authority Act, Section 73(1)(d).
[35] Civil Aviation Act, Section.73(1)(f).

security trends and developments, as well as ensuring compliance with ICAO Annexes and Rules.[36]

Other than providing oversight on safety and security of remotely piloted aircraft (UAS) and the national enforcement, as a regulatory agency of the UAS under the Civil Aviation Act, SACAA[37] has the legal responsibility of ensuring enforcement of the binding nature of regulation in relation to safety and security operations in the process of integrating UAS into the national airspace, in line with ICAO Guidelines. One of the most important roles is development of enforcement mechanisms that ensure compliance with existing international and country laws, guidelines, orders, circulars and other standards.

From the ministerial level, a principal regulation, which is relevant to the study, is the Remotely Piloted Aircraft Systems Regulations.[38] The regulations were developed in May 2015 through the Ministry of Transport, which issued regulations governing UAS. These were implemented on 1 July 2015.[39] No doubt, the same was a product of the consultative structures of the SACAA as envisaged by Section 156 of the Civil Aviation Act after successful amendments to the South Africa's Civil Aviation Regulations[40] that had deficiencies as the Civil Aviation Act in as far as specificity in regulation of UAS was concerned. The regulations make provisions that border on safety, security and privacy concerns of UAS operation. It prescribes where the UAS can be operated, prohibited places, the operational weight and distance above the earth's surface.

[36] Civil Aviation Act, Section 72.
[37] Civil Aviation Act, Section 73(1) (b).
[38] Eighth Amendment of the Civil Aviation Regulations of 2015, Government Notice R444/2015 of May 27, 2015 (hereinafter referred to as the Civil Aviation Regulations (Eight Amendment).
[39] Civil Aviation Regulations (Eight Amendment), Part 101.
[40] South Africa Civil Aviation Regulations of 2011 (effective June 2012) (hereinafter referred to as Civil Aviation Regulations).

The development of the RPAs Regulations through the Civil Aviation Regulation (Eighth Amendment), in conjunction with the Ministry of Transport, shows that SACAA has taken the driver's seat and was undeterred by the then *lacuna*, in the development of UAS legal frameworks. With this achievement, the only challenge that seems to stare at the framework is the ubiquity of number and uses that, has led to creation of toy aircrafts. These past strides, led to universal recognition, and it is almost predictable that South Africa is up to the task in tackling inherent challenges.

Other than development of regulations, SACAA has the mandate to make requisite proposals before forwarding them to Parliament, the arm responsible for making laws.[41] This role requires the SACAA to be very effective in development of the law through investment in research and studies, as well as drafting. The SACAA employs an inclusive approach when dealing with issues appertaining to UAS. Such initiatives include involvement of local stakeholders[42] such as State organs, the military, airport operators, universities, research institutions, UAS manufacturers, UAS associations and prospective operators in general.[43]

All these mandates are expansive and is reflective of the role played by ICAO in providing international framework for aviation regulation. SACAA is, therefore, the backbone of formulation, adoption, implementation and monitoring of UAS-specific laws in South Africa. As a consequence of its and other concerted efforts, South Africa has been posting good reports on corporate governance that translates to prudent financial performance in compliance with the requirements of Section 71 of the Civil Aviation Act. The SACAA act is credited with the rise in the South Africa's

[41] Civil Aviation Act, Sections 42 (1) (a) & (b), 42 (2), 43 & 44.
[42] Constitution of the Republic of South Africa, 1996*,* Sections 118 and 152 (e). It provides for Local Government structure and States that local communities and community organization need to be encouraged to be involved in matters of local government.
[43]https://www.icao.int/Meetings/RPAS/RPASSymposiumPresentation/Day%202%20Workshop%206%20National%20Regulations%20Sam%20Twala%20%20South%20African%20Civil%20%20Aviation%20Authority%20(SACAA).pdf> (Date of use: 8 November 2019).

level of compliance with the international framework as urged by scholars before the development of the Civil Aviation Act.[44]

Other than SACAA, there are other governmental institutions created under the Civil Aviation Act to implement and enforce South Africa's legal framework on civil aviation, and UAS in particular. They include the Department of Transport, and the Civil Aviation Authority Board, with mandate provided by the SACAA.[45]

These institutions work together, especially through issuance of regulations, technical standards and circulars. Section 73 of the Civil Aviation Act mandates the Department of Transport and the Civil Aviation Authority to develop regulations, technical standards, guidance materials and circulars with import to govern UAS, Under Section 163 of the Civil Aviation Act and Part 101 of the Civil Aviation Regulations, the Director of Civil Aviation is mandated to provide other technical standards on UAS known as the South African Civil Aviation Technical Standards (SA-CATS)[46] that took legal effect in July 2015.[47] The Director of Civil Aviation also provides a number of Aeronautical Circulars that relate to remote pilot licensing, requirements for application of remote pilot licenses, training and aviation examinations applicable to UAS.[48] These instruments make it possible for regulation of operation by private, commercial, corporate and non-profit operators.

Also complementing these other bodies are provincial and local governments that regulate the use of public areas by UAS and ensure safety of citizens. This is achieved through enactment of local laws touching on safety and other aspects of the UAS. One major area of the contribution is development of regulation on

[44] Ingham LA *Considerations* 45.
[45] Civil Aviation Act, Section 75.
[46] South Africa Civil Aviation Technical Standards 101 (SA-CATS 101) of 1 July 2015 (hereinafter referred to as SA-CATS 101).
[47] Civil Aviation Regulations (Eighth Amendment), Section 5.
[48] http://www.caa.co.za/RPAS%20AICs/AIC%20007-2015 (Date of use: 10 September 2018).

permission to operate. UAS operators are required to comply with provincial and local authority laws pertaining to permission to operate.[49] It is however expected that the provisions of the permissive laws shall not violate the framework provided by SACAA.

In the build-up to the appreciation of the safety, security and privacy prospects and challenges in UAS regulation in South Africa, the next part introduces the classification of various UAS currently in use and recognized in the country.

5. Classification of UAS

The classification of unmanned aircraft systems in South Africa takes the form of commercial, corporate and non-profit UAS operations. The impact of the difference is subjection to different standard of regulation of safety, security and privacy. Notwithstanding the safety, security and privacy challenges, the South Africa's regulatory framework envisages minimum regulatory frameworks as discussed below.

5.1 Commercial, Corporate and Non-profit Operators

When the use of a UAS is concerned with commercial outcome, interest or gain, it becomes a commercial operation. Corporate operations are by firms. Non-profit use can be for no economic gains, whether by individual or by corporate body[50] Whereas private operators of UAS are in a class of their own, the commercial, corporate and non-profit UAS are on the other hand exposed to stricter regulations. The three operators share certain rules and restrictions but some technical and operational requirements depend on the type of operation as shown in Table 6 below.[51]

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[49] Constitution of the Republic of South Africa, 1996, chapters 6 and 7 establishes provincial and local levels of government respectively.
[50] Ingham LA *Considerations* 45.
[51]Civil Aviation Regulations (Eight Amendment), Section 101.01.5.

5.2 Private Operations

The Civil Aviation Regulations define private operations as “the use of remotely piloted aircrafts for an individual’s personal and private use, where there is no commercial outcome, interest or gain.”[52] There are additional restrictions under the regulation including private operations only being conducted with class 1A or class 1B. Class 1A is defined as UAS that is less than 1.5kgs in weight, while class 1B is a UAS that is not more than 7kgs in weight.[53] Both classes 1A and 1B are required by the Civil Aviation Act and UAS regulations (SA-CATS 101) to fly at a height less than 400 metres.

To facilitate regulation, South Africa has further classified the UAS in terms of weight, impact, energy, operational height above the ground, rules of flight and areas of operation.[54] UAS regulation in South Africa classifies UAS operatives under operators, pilots and persons who maintain them.[55] These classifications reflect the classifications provided in chapter Two of the thesis and is for regulatory efficiency.

[52] Civil Aviation Regulations (Eight Amendment), Section 101.01.5.
[53] Civil Aviation Regulations (Eight Amendment), Section 101.01.5.
[54] Civil Aviation Regulations (Eight Amendment), Section 101.01.5. The classification criterion of UAS is defined in the South Africa categories.
[55] Civil Aviation Regulations (Eighth Amendment), Section 101.01.1.

Operation of Commercial, Corporate and Non-profit UAS

	Commercial	Corporate	Non-Profit
Air Service License (ASL)	X	_	_
RPAS Operator Certificate (ROC)	X	X	X
RPA Letter of Approval (RLA)	X	X	X
RPA Certificate of Registration (CoR)	X	X	X
Remote Pilot License (RPL)	X	X	X

Table 6: Source of diagram 2015 SACAA RAPS Regulation

CLASS	**UAS CLASSIFICATION**			
	LINE-OF-SIGHT	**ENERGY(KJ)**	**HEIGHT (FT)**	**MTOM (KG)**
Class 1A	Restricted visual line of sight/ visual line-of-sight	Less than-15	Less than-400	Less than-1.5
Class 1B	Restricted visual line of sight **/** visual line-of-sight	Less than-15	Less than-400	Less than-7
Class 1C	Visual line-of-sight**/** extended visual line-of-sight	Less than-34	Less than-400	Less than- 20
Class 2A	Visual line-of-sight**/** extended visual line-of-sight	Greater than-34	Less than-400	Less than-20
Class 2B	**EXPERIMENTAL/RESEARCH**			

Class 3A	Beyond visual line-of-sight	Greater than-34	Less than- 400	Less than-150
Class 3B	Visual line-of-sight/ extended visual line-of-sight	Any	Less than-400	Less than- 150
Class 4A	Beyond visual line-of-sight	Any	Less than-400	Less than-150
Class 4B	Any	Any	Any	Less than-150

The following part of this chapter trains its focus on substantive issues of safety, security and privacy in use of UAS as identified in chapter Two of this thesis, and how they are redressed under South Africa's legal, policy and institutional framework.

6. Responses to Challenges Identified as Safety, Security and Privacy

6.1 South Africa's Response to Safety Concerns of UAS

Aviation safety as provided for under ICAO Annex 19 and Safety Management Manual (Doc 9859) arise from the design as well as the capability challenges regarding sense and avoid technology hence the need to mitigate safety risks. Generally, the safety of aircraft and people on the ground is considered an important attribute of civil aviation in South Africa, through myriad provisions of laws including Part 101 of the Civil Aviation Regulations inserted through the Civil Aviation Regulations as (Eighth Amendment) and other SACAA Circulars and Standards.[56]

[56] Timothy R "A comparative global analysis of drone laws: best practices and policies." in *the future of drone Use* (TMC Asser Press Hague 2016) 302.

The regulatory framework for operation of UAS aims at managing them in the civilian airspace with emphasis on safety and training.[57]

The regulatory framework envisages ensuring the safety of UAS use through licensing of remote pilots. Under the Civil Aviation Regulations (Eighth Amendment), any person who desires to operate a commercial, corporate or non-profit UAS is required to have a valid remote piloting license.[58] A remote piloting license falls into three categories, namely: remote pilot license (airplane), remote pilot license (helicopter) and remote pilot license (multi-rotor).[59] The remote pilot license is further rated in three ways depending on the mode and nature of operations. These categories are as follows: visual line-of-sight operations; extended visual line-of-sight[60] operations and beyond visual line-of-sight operations.[61] These categories of UAS in the pilot system ensure that the regulatory system is able to respond to the unique safety issues arising from the different categories of classifications of UAS operations.

Other than the regulation under the wide categorization, the general rules that apply for one to be granted a licence have certain safety underpinnings. For example, according to SACAA, it is required that the applicant must be 18 years, have requisite training from an approved school, whether local or approved and validated foreign training.[62] The validation of foreign training is a critical to ensure harmonization of skills and competencies to licenced pilots of UAS. The South African system has put in place a Recognition for Prior Learning (RPL) Assessment,

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[57] Hofmeyr CD "Here is why South Africa's new drone regulations are ridiculous" https://businesstech.co.za/news/general/92072/here-is-why-south-africas-drone-regulations-are-ridiculous/ (Date of use: 8 July 2017).

[58] Civil Aviation Regulations (Eighth Amendment), Section 101.03.1.

[59] Civil Aviation Regulations (Eighth Amendment), Section 101.03.1.

[60] SA-CATS, Section 101.01.1 defines an extended visual line of sight as an operation below 400 feet above ground level in which an observer maintains direct and unaided visual contact with the remotely piloted aircraft at a distance not exceeding 1,000 meters from the pilot.

[61] SA-CATS, Section 101.03.1.

[62] SACAA "Remotely Piloted Aircraft Systems: Pilot Licensing and Instructor Rating" http://www.caa.co.za/Pages/RPAS/RPAS%20pilot%20licensing.aspx (Date of use: 7 September 2020).

which aids in determining whether the applicants have the requisite qualifications.[63] These assessments are viewed as very essential given the UAS are likely to attract a number of users who have training from foreign aviation schools. UAS licensing for commercial operations are issued under three categories: airplane, helicopter and multi-rotor.[64] Additional rating may also be endorsed on a license just like in manned aircraft in terms of visual line of sight operations, extended visual line of sight operations and beyond visual line of sight operations.

Also inherent to the safety is requirements bordering on communication. The regulations premise remote pilot licencing on satisfaction by an applicant of the requirement for radiotelephony communication as well as English proficiency of other levels.[65] Indeed, the communication requirements are vital, since communication is an essential part of aviation safety both for manned and unmanned aircraft systems. For instance, Krivonos, citing previous literature notes that the overall objective of communication is to prevent aviation accidents from taking place by ensuring free and efficient flow of correct and ideal aviation information.

It is evident that apart from recognition of the importance of communication, the requirements were formulated against a backdrop of reports that most aviation accidents arose from communication mismatches.[66] Accordingly, the South African framework adopted a similar regulatory approach to ICAO's when it introduced English Proficiency tests in March 2011 through Advisory Circular 153AN/56. Such

[63] SACAA "Remotely piloted aircraft systems: pilot licensing and instructor rating" http://www.caa.co.za/Pages/RPAS/RPAS%20pilot%20licensing.aspx (Date of use: 7 September 2020).

[64] SACAA http://www.caa.co.za/Pages/RPAS/RPAS%20pilot%20licensing.aspx (Date of use: 7 September 2020).

[65] See SACATS, Section 101.03.2 on Remote pilot license: training, examination and application for RPL requirements.

[66] http://aviationenglishway.com/2019/03/31/the-importance-of-an-effective-communication-in-aviation/> (Date of use: 4 January 2020).

emulation is important since there are no crew members in UAS and as such, the communication is pegged on the remote pilot.

Also relevant for effective monitoring is the periodicity of the UAS pilot license. The licence is issued for a period of two years for commercial operators. For private operators, the period is one year.[67] The differentiation recognizes bureaucracies to obtain the licence for the former. If one wishes to extend the deviation, there is a requirement to re-submit the application for purposes of renewal.[68] Other than this, ordinary renewals are done on an annual basis. During such renewals, applicants are required to take refresher courses. No doubt, such courses aid the pilots to be conversant with changes introduced by SACAA. The refresher courses are, however, not centralised and can be offered by various training centres. The refresher course training strategy helps in preserving the capacity of SACAA for other important regulatory mandates since the training schools are already regulated through a proper certification process. The regulatory approaches to licencing remote pilots is a good step towards achievement of the safety of navigation obligations under Article 3(3) of the Chicago Convention.

The licencing requirements are further supported by provisions on trainings. Overall, the institutions created under the Act and the general framework are pivotal in aiding the South African framework to reflect the approach envisaged by the ICAO Circular No. 328-AN/190 and ICAO Annex 1, which all view training as part of the larger licencing and thus important for aviation safety.[69] The Civil Aviation Act gives more prominence to the need for training as a means of achieving the overall aim of safety in South Africa. Under Section 31(9) of the Civil Aviation Act, staff of the Aviation Safety Board are required to be trained in order to achieve objective investigation of

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[67] https://www.droneitsa.co.za/remote-pilots-licence-rpl/ (Date of use: 7 September 2020).
[68] Civil Aviation Regulations (Eighth Amendment), Section 101.03.6.
[69] See Burger CR and Jones T “Adapting existing training standards for unmanned aircraft: finding ways to train staff for unmanned aircraft operations” (Paper presented to the International Aerospace Symposium of South Africa (IASSA) 26-28 September 2011Centurion South Africa).

accidents and making of safety recommendations among other key functions outlined in Section 30 of the Civil Aviation Act.

Part 101 of the Regulations introduced by the Civil Aviation Regulations (Eighth Amendment) requires actual implementation and training to be conducted by recognized institution. An analysis of the training standards and requirements shows that they are aligned to include aeronautical information and operational components, as envisaged under Part 7.9 of the ICAO Circular No. 328-AN/190. Specifically, SACAA Aeronautical Information Circular makes provisions for aviation training organizations that engage in conducting UAS training. It prescribes the scope of procedure manuals for such institutions, training curricula and extends it to apply to UAS with necessary modifications.[70] These requirements are monitored through approval systems for any extension beyond the scope of approval. Other than the trainings, the test centres are only those approved by the Director of SACAA.[71]

Other than the pilots, also pivotal is the training of the observers. Under the Civil Aviation Act, an observer is defined as "a trained and competent person designated by the operator who, by visual observation of the remotely piloted aircraft, assists the remote pilot in the safe conduct of the flight."[72]Accordingly, the training requirements and extension of use of flight curricular in the Advisory Circular 008/2015 is a step in the right direction in harmonization of the flights or manned and unmanned aircrafts systems as envisaged by Part 2.12 of the ICAO Circular No. 328-AN/190. However, despite such significant strides, the extension for the curriculum does not seem to take cognizance of the differential training needs for operators of UAS. Perhaps for expediency, the framework should adopt the spirit of

[70] SACAA Aeronautical Information Circular No 008/2015 of 23 July 2015 (hereinafter referd to as the AIC 008/2015), Paragraph 2.
[71] South Africa Civil Aviation Act, Section 88 (5).
[72] Civil Aviation Act, Section 2 (g).

Part 7.4 of the ICAO Circular No. 328-AN/190 where the training for UAS operators is done on a need basis, which is not the case currently.

The third aspect of safety regulation in South Africa is certification of the UAS. From the reading of the meaning accorded to the word 'operator' in the Civil Aviation Act, it is clear that it includes a remote pilot and other persons involved in air services. For UAS, certification is to be granted to operators, whether individually or by artificial entities. The Regulations require that any person who operates a commercial, corporate or non-profit UAS should have a UAS operator certificate.[73] An analysis of the previous tables evidences that operating a UAS in South Africa is heavily restricted because one would first need to be registered, receive a number of licenses, approvals and certificates to be allowed into the airspace.

For commercial operators, the requirements for certification are more stringent since a prospective operator would be required to apply for and obtain air service license from the Air Service Licence Council as a pre-condition for obtaining an UAS operator certificate.[74] This requirement, however, does not apply to corporate and non-profit operators. The application for the UAS operator certificate is a five-step process similar to that followed by ICAO and involves pre-application, formal application, document evaluation, demonstration and inspection, and certification. Compliance with the safety and security issues are monitored through a renewal process. For instance, the UAS operator certificate is issued for a period of one year. Again, as Dalamagkidis, Valavanis and Piegl observe, the annual yearly period appears to be the standard for renewal of most licences for ease of planning by the State.[75]

[73] Civil Aviation Regulations (Eighth Amendment), Section 101.04.1.
[74] Civil Aviation Regulations (Eighth Amendment), Section 101.04.1.
[75] Dalamagkidis K, Kimon PV and Piegl LA *On integrating unmanned aircraft systems into the national airspace system: issues, challenges, operational restrictions, certification, and recommendations* (Springer science & Business Media 2011) 2.

While the certification regulation for commercial operations are more stringent, implementation of these measures has come under scrutiny in the recent past. For instance, in July 2018, Ragongo and Caboz, questioned whether the Drones' Fireworks that was organized by Absa and Intel had the requisite permission from SACAA.[76] Questions arose from the public who viewed the fireworks consisting of 300 drones were incongruent with twenty licences that had been issued to commercial operators in 2018. This was so since strictly speaking, in order to achieve the goals of safety, it is envisaged that each drone for commercial purpose should be individually licenced prior to certification.[77] The instance led to a realization that the certification process could be abused by a possibly liberal approach, which could peg certification on an operator and not the number of drones.

Other than the requirement for certification, the conditions in the certification exercise have safety underpinning. First, it is the responsibility of the holder of UAS operator certificate to develop an operator's manual, which is then forwarded to the Director of Civil Aviation for approval.[78] The regulations go further to state what ought to be included in the manual. These include type and scope of operations, including the manner in which each type of UAS and operation will be safely conducted. Such operators are required to strictly comply with changes only implemented with approval of the Director General of SACAA. Compliance with the manual provisions is to be complemented with development of commensurate safety management system. These safety standards and requirements are to form the basic minimum guide for the staff of the UAS operators. It focuses on the basic operator level promises and gives a wider utilization of the manuals by respective staff of the operators. These prospects are, however, dimmed by bureaucracies in the application and approval processes. For instance, O'Connell, who owns a drone company called Timeslice, has been quoted to say that obtaining a letter of approval

[76] Ragongo T and Caboz J "Was Absa's drone show illegal" https://myofficemagazine.co.za/was-absas-drone-show-illegal/ (Date of use: 7 September 2020).
[77] Ragongo T and Caboz J https://myofficemagazine.co.za/was-absas-drone-show-illegal/ (Date of use: 7 September 2020).
[78] Civil Aviation Regulations (Eighth Amendment), Section 101.04.5.

took the company nearly two years.[79] Such delays cause timelines of non-certification, which may open avenues for non-compliance with the safety requirements.

The regulations appear to recognize different types of entities and complexity of their operations and require that the safety programme system should reflect such complexities. From an analytical point of view, the regulations would be much more effective if the safety management is based on the type of UAS, as opposed to the size of the operator. Such a system would ensure assurance of identification of potential safety hazards and risks, appropriateness, and effectiveness in safety management activities as envisaged by ICAO Circular No. 328-AN/190 and ICAO Air Safety Manual AN/959.[80]

The fourth issue related to UAS safety is registration for certified private UAS operators wishing to engage in commercial, corporate non-profit operation, the Civil Aviation Regulations require an application for, and approval by the Director of Civil Aviation Authority, a letter of approval and certificate of registration.[81] The operator who applies for a letter of approval is required to submit the following documents: standard design, safety level documentation and demonstration of the safety systems. The operator, who wishes to apply for approval to operate UAS, is required to submit the UAS manufacturers' operating manual to the Director of Civil Aviation.[82] For UAS in Classes 1 and 2, it is mandatory to provide information on UAS type, structure, composition, flight envelope capability, UAS dimensions/measurements and mass, together with drawings, mass and balance, payloads (specific or generic), use of frequencies, remote pilot station, ground support equipment and flight recovery system.[83] As Mashinini correctly observes,

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79 https://www.businessinsider.co.za/absa-has-been-breaking-sa-drone-laws-and-is-about-to-put-on-an-illegal-spectacular-for-its-big-reveal-today-2018-7 (Date of use: 4 October 2020)

80 See chapter Three, section 4.1 of this thesis on analysis of these instruments regarding safety n UAS use.

81 SA-CATS, Sections 101.02.1 and 101.02.4.

82 SA-CATS, Sections 101.

83 SA-CATS, Sections 101.02.2.

these levels of documentation mean that when the change of use takes place, the major consideration for the Director should be the safety that the shift in use has on identifiable group of people and the general public.[84]

The requirements are so thorough that even at the time of submitting the above documentation, information pertaining to actual performance of the UAS should be submitted as well. These information include maximum altitude, maximum endurance, maximum range, airspeed (take-off, cruise, landing, stall, maximum), maximum rate of climb, maximum rate of descent, maximum bank angle, turn rate limits, propulsion system (such as engine/motor, fuel, electrical, hydraulic, pneumatic, gas, solar).[85] The thorough approach helps in discouraging change of use from the original design from a regulatory approach.

The fifth issue relating to safety is the regulation of UAS operation to the line of sight of the remote pilot or underground flight manager. A visual line of sight is a straight line within which an operator of UAS has and can maintain a clear human or mechanical view of the UAS operating in the airspace. Maintaining the UAS within the visual line of sight ensures optimal safety by reduction of cases of accidents and collisions with other aircrafts. On the other hand, when UAS operates outside the prescribed visual range, it is said to be beyond visual line of sight. This second phenomenon presents safety challenges but require proper legal framework to manage to maintain a critical balance between the safety interests and the need for autonomy of operation of UAS.

[84] Mashinini N "The processing of personal information using remotely piloted aircraft systems in South Africa" 2020 *DJLJ* 140-158.

[85]Mashinini N "The processing" 142.

A remote pilot is expected to maintain direct unaided visual contact with the UAS to manage the flight and satisfy separation and collision avoidance requirements.[86] Under Section 2 (i) of the Civil Aviation Act, a restricted visual line-of-sight means an operation within 500 metres of the remote pilot and below the height of the highest obstacle within 300 metres of the UAS, in which the remote pilot maintains direct unaided visual contact with the UAS to manage its flight and meet separation and collision avoidance responsibilities".[87]

The Civil Aviation Act, 2009 does not, however, define the term Beyond the Visual Line-of-Sight in its interpretation section.[88] The definition was addressed in the 2015 Regulation after the Eight Amendment.[89] The interpretation section was amended by inserting the definition of Beyond Visual-Line of-Sight to mean an operation in which the remote pilot cannot maintain direct unaided visual contact with the UAS to manage its flight and to meet separation and collision avoidance responsibilities visually. The Amendment Regulation also extended visual line of sight to mean operation below 400 feet above ground level in which an observer maintains direct and unaided visual contact with the remotely piloted aircrafts at a distance not exceeding 1000 metres from the pilot.[90]

It is a legal requirement that private operations are carried out in restricted Visual-Line of-Sight.[91] An operation within the restricted Visual-Line-of-Sight is an operation conducted within 500 metres of the UAS pilot and below the height of the highest obstacle within 300 metres of the UAS. As Linchant *et al* observes, the purpose of this restriction is to minimise chances of air crashes amongst unmanned aircraft or with the manned aircraft. The requirement is thus intended to ensure

[86] Mashinini N "The processing" 144.
[87] See also Mashinini N "The processing" 143.
[88] Civil Aviation Act, Section 2.
[89] Civil Aviation Regulations (Eight Amendment).
[90] Civil Aviation Regulations, Regulation 2(f).
[91] Civil Aviation Regulations (Eighth Amendment), Section 101.01.

safety of the airspace.[92] In more specific terms "within 500 metres of the remote pilot and below the height of the highest obstacle within 300 metres of the UAS, in which the remote pilot maintains direct unaided visual contact with the UAS to manage its flight and meet separation and collision avoidance responsibilities."[93]

The import of the provisions is that a UAS that operates beyond the Visual-Line-of-Sight may cause air accidents with manned aircraft using the same flight path. As such, operations are prohibited, unless conducted within controlled airspace that does not have other flying aircraft. It is for this reason that Section 101.05.11 (1) of the South Africa Civil Aviation Technical Standards prohibits UAS operation beyond Visual-Line-of-Sight unless the holder has UAS operator certificate and gets approval of the Director. The Director has powers to approve beyond Visual-Line-of-Sight operation, subject to meeting the RPAs operations requirements under Subpart 5 of the South Africa Civil Aviation Regulations on Technical Standards.[94]

Specifically, Section 101.05.11 (3) of Regulation 101, provides that persons who are approved by the Director to operate beyond Visual-Line-of-Sight should only conduct their activities below 400 feet above surface level. At this level, they are noticeable and easy to control, and thus prevent accidents and collisions. The operator is expected to operate within strict compliance of the height allowed unless otherwise approved by the Director. All these express limitations and restrictions operate to ensure that there is no abuse of power by the Director, which can pose a threat to the safety of the people.

[92] Linchant J *et al* "Are unmanned aircraft systems (UAS s) the future of wildlife monitoring? A review of accomplishments and challenges" 2015 *Mammal Review* 239-252.
[93] Civil Aviation Regulations (Eighth Amendment), Section 101.01.
[94] Civil Aviation Regulations (Eighth Amendment), Section 101.05.11 (2).

Despite the requirement for licencing, certification, training, approvals and caution through visual line of sight, the South African legal framework recognizes the inevitability of accidents and collisions. As such, it imposes insurance obligations on the UAS operators. Under the framework, a UAS operator certificate holder should carry third party liability insurance to enable him/her pay compensation for any damage caused to a third party.[95] The insurance is an assurance against security risks that may arise from the use of UAS.

Other than the specific considerations for safety, there are also other threads of general safety considerations that run through the web of regulatory framework in South Africa. Accordingly, and flowing from the jurisdiction of SACAA to develop technical standards provided under Section 163 of the Civil Aviation Act, 2009, the SACAA has developed standards on safety.[96] These standards address issues on who can operate a UAS, how and when. Specifically, under this framework, persons who operate UAS should ensure that it is in a fit-to-fly condition, and the pilot should be a holder of a license.[97] The fitness to fly for UAS is much different from manned aircrafts, since it does not have crew and neither does it have a cockpit. The fitness to fly here would mean considering the planned travel vis-à-vis how far the UAS can fly, ability to return home, ability to fly with low fuel or power as well as the status of inbuilt software for the UAS.

Other external considerations that influence the fitness to fly include weather conditions, the guarantee of compatibility and only one pilot should control interoperability with which the aircraft is connected to in all phases of flight, and remotely piloted aircrafts at any given moment.[98] Interoperability is the ability to communicate with diverse types of UAS within the airspace and air traffic control systems for manned aircrafts. This requirement is a significant step towards the

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[95] South Africa Civil Aviation Technical Standards (SA-CATS), Section 101.04.12.
[96] SA-CATS, Section 101.04.12.
[97] SA-CATS, Section 101.04.12.
[98] SA-CATS, Section 101.05.9(1).

integration and harmonization calls in the ICAO UAS Circular since it gears towards creation of a singular unmanned aircraft system traffic management (UTM) with that of manned aircrafts. While these requirements are evidently aimed at addressing safety measures as per the requirement of ICAO Annex 19, they also address the challenges associated with aviation security as provided for under ICAO Annex 17 to curb acts of unlawful interference with civil aviation or criminal activities,[99] to be discussed separately.

The other factor is the language of the air training and education. Radio communication use is an important safety requirement for UAS operations, bearing in mind that communication and information are key to aviation safety. The type of operation being undertaken by the UAS operator determines the restrictions relating to radio communication. Except for restricted Visual-Line-of-Sight operations, no UAS shall be operated unless the pilot has a functioning air-band radio in his or her possession, tuned to the frequency or frequencies applicable to the air traffic service unit providing services or controlling such area or airspace or to aircraft in such area or airspace.[100] The entire operation of the UAS is required to be conducted using a radio line of sight,[101] which, is a direct electronic, point-to-point contact between a transmitter and a receiver.

Other requirements are necessitated by the prevailing circumstances of the operation.[102] Section 101.05.16 (2) of the Regulation requires that the air-band radio has the required output and be configured in such a way that the range, strength of transmission and quality of communication extends beyond the furthest likely position of the UAS from the pilot.[103] For Visual-Line-of-Sight, Extended Visual-Line-

[99] See chapter Three, section 4.2 of this thesis on the analysis of the ICAO Annex 17. It may be recalled that Section 2.1.2 of the Annex provide that provides that each contracting State shall establish an organization and develop and implement regulations, practices and procedures to safeguard civil aviation against acts of unlawful interference taking into account the safety, regularity and efficiency of flights.

[100] Civil Aviation Regulations (Eight Amendment), Section 101.05.16 (1).

[101] Civil Aviation Regulations (Eight Amendment), Section 101.05.16 (1).

[102] Civil Aviation Regulations (Eight Amendment), Section 101.05.16 (1).

[103] Civil Aviation Regulations (Eight Amendment), Section 101.05.16 (2).

of-Sight and Beyond Visual-Line-of-Sight operations, the pilot is obligated during the registration of the UAS as a call-sign, to make the required radio calls, indicating the altitude, location and intended operation of the UAS in that area and at such intervals as are required in order to ensure adequate separation from other aircraft is maintained.[104]

In addition to the above general considerations in safety precautions for operation of different categories of UAS, the regulatory framework in South Africa encompasses certain prohibitions. UAS-related activities that are prohibited include using unmanned aircraft systems to tow other aircraft; performance of acrobatic displays, and flying in formations.[105] Operators of private UAS are further restricted from using them for certain purposes that would endanger the public.[106] They are also prohibited from flying within 10 kilometres of an airfield or restricted airspace (sensitive areas such as nuclear power stations, police stations, crime scenes or courts of law).[107] Other restrictions are with respect to releasing, dropping, delivering or deploying of objects. On analysis however, due to advancement in technology, UAS are likely to be used for delivery of many items including drugs and foodstuffs to remote areas, hence prohibition on delivery to fall falling short of the intended legislative purpose.

If outside a controlled airspace, the operator should comply with the technical requirements for operation using command inputs, ability to remain clear from obstacles or any other hazards, and take appropriate action to execute collision avoidance from such obstacles or other aircraft wherever necessary. These are vital precautions aimed at reducing air crashes and civil liabilities to the owners who could be at fault, if the area is void of other air traffic or the operation occurs in specifically segregated airspace; or measures to mitigate other aircraft, obstacles or

[104] Civil Aviation Regulations (Eight Amendment), Section 101.05.16 (2).
[105] Civil Aviation Regulations (Eight Amendment), Section 101.05.10.
[106] Civil Aviation Regulations (Eight Amendment), Section 101.05.10.
[107] Civil Aviation Regulations (Eight Amendment), Section 101.05.10.

hazards. In addition, the Director of Civil Aviation can command and control data link frequency appropriate for effective operation and data gathering.[108]

Further, the framework prohibits a commercial, corporate and non-profit UAS from using a public road or public grounds as take-off or landing grounds. An UAS can be allowed to operate within 50 metres of a public road so long as the operator is an UAS operator’s certificate holder with permission of the Director General.[109] In South Africa, it is prohibited to operate (UAS) overhead or at a lateral distance of 50 metres from any person, unless one is a qualified UAS operator with a valid certificate.[110] Lastly, a UAS operator must show operational capabilities, ability to command the UAS, to control airspace that follows a predetermined course or group of waypoint inputs.[111] These are the assurances that limit chances of causing accidents. The efficacy of these provisions is left to implementation of the institutions created under the framework.

Generally, no person is allowed to operate an UAS over a public road, along the length of a public road or at a distance of less than 50 metres from a public road. There are three exceptions to this rule. Such a person should be a holder of an UAS operator’s certificate; the operation should have been approved by the Director in the operator's operations manual; in the case of operations over a public road, such road is closed for public use and reasonable care taken to ensure the safety of road users and pedestrians in the event of loss of control of the UAS. It appears that the regulatory limitation is generally a safety and security measure aimed at safeguarding the lives of road users.

[108] Civil Aviation Regulations (Eight Amendment), Section 101.05.11.
[109]Civil Aviation Regulations (Eight Amendment), Section 101.05.15 and 101.05.2.
[110] Civil Aviation Regulations (Eight Amendment), Section 101.05.12.
[111] Civil Aviation Regulations (Eight Amendment), Section 101.05.12.

All the above mentioned general regulatory prohibitions and relaxations, have safety and by extension security underpinnings. A review of the prohibition in other countries and States, such as Nevada, shows that they are considered to have effect to the public. This explains why all these prohibitions can only be relaxed when a UAS operator certificate holder receives approval of the Director of Civil Aviation. In approving these operations or granting waivers, the requirements reflect the international regulations of drones, which prevent use of UAS in highly populated areas. In South Africa, therefore, the Director of Civil Aviation is guided by certain requirements determined by whether the operation takes place in a controlled or uncontrolled airspace.[112]

Also relevant are standards relating to the regulation of night operations. UAS operations at night refer to operations conducted between 15 minutes after sunset and 15 minutes before sunrise, as provided in the publication *Times of sunrise, sunset and local apparent noon of the South African Astronomical Observatory* or a similar publication issued by a recognized astronomical observatory.[113] The general rule is that UAS may not be operated at night except in restricted Visual-Line-of-Sight operation or by a qualified person who is a holder of UAS operator's certificate, and as approved by the Director in terms of sub-regulation 101.05.12 (1).[114] At the very minimum, a holder of an UAS operator certificate intending to operate at night, shall, only do so subject to compliance with the requirements prescribed in the South Africa Civil Aviation Technical Standards.[115] Section 101.05.12 (2) of the Regulations specifically provide that "An UAS may not be operated at night in controlled airspace except as approved by the Director as prescribed in Regulation 101.05.3."[116]

[112]Civil Aviation Regulations (Eight Amendment), Section 101.05.11.
[113] https://www.esrl.noaa.gov/gmd/grad/solcalc/ (Date of use: 4 October 2020).
[114] Civil Aviation Regulations (Eight Amendment), Section 101.05.12 (1).
[115] Civil Aviation Regulations (Eight Amendment), Section 101.05.12 (2).
[116]Civil Aviation Regulations (Eight Amendment), Section 101.05.12 (2).

The UAS can operate in airfield and controlled zone under the following condition: fitted with transponder that is capable of displaying the unique code issued to them, unless otherwise exempted by the Director of Civil Aviation. For ease of monitoring compliance with conditions of waiver, it is a requirement that the UAS should be fitted with an altimeter, capable of displaying to the operator, the UAS altitude above ground level. It should also be fitted with functioning lights, installed in such a way that they are visible from both below and above the UAS.[117] The components referred to above should at all times be "serviceable and functioning" and failure to meet one of these standards can lead to cancellation of the operation.[118]

In spite of the foregoing general prohibitions in controlled spaces, some authors such as Percy, have correctly noted that certain exceptions to the rule enumerated above exist.[119] For example, it is not a requirement that private operations get approval and registration. Many people in South Africa are in possession of UAS that are not registered and they use them for recreational purposes. Similarly, they do not hold a personal licensing operator certificate and maintenance requirements. The category of private UAS is also exempted from rules that regulate conveyance of dangerous goods as well as other safety requirements. For instance, they do not have to be in a "fit to fly' condition.[120] Other exceptions are extended to the regulations and reporting of flight time, use of flight logbooks, power services, first aid kit and fire extinguishers.

Operation in controlled airspace refers to designated dimensions with an air traffic control service provided to UAS pilots in accordance with the airspace classification in the Civil Aviation Regulations.[121] The regulations prohibit operations in controlled airspaces where sensitive installations are situated[122] such as military bases,

[117] SA-CATS, Section 101.05.3.
[118] SA-CATS, Section 101.05.3.
[119] Percy S *Regulating the private security industry* (Routledge 2013).
[120] Mashinini N "Processing" 142.
[121] SA-CATS, Section 101.05.3 (1).
[122] SA-CATS, Section 101.05.3.

airports, police stations and State Houses.[123] The prohibition does not, however, rip off powers of the Director of Civil Aviation to waive any requirement in some circumstances.[124] The power of the Director of Civil Aviation to exempt as provided under the Act is meant to aid in efficient and effective operations of UAS on case-by-case basis. This model is like the US one, as discussed in the previous chapter. The power to exercise this limited mandate is available where there is a visual meteorological condition, airfields traffic and controlled zones that are not more than 400 feet.

6.2 South Africa's Response to Security Concerns of UAS

Regarding UAS, aviation security deals with the protection from possible use in conducting acts that cause unlawful interference to the State or even to the UAS system itself. In this regard, as Abeyrante observes, security in use of UAS remains a challenge in South Africa even as the country devises measure of integration of UAS into civil aviation.[125] This part principally analyses Part 5 of the Civil Aviation Act of 2009 to determine how the South Africa's requirements for the nationality marks, registration and certification of RPAs pilots, training and approval systems and framework of development of programmes aim at addressing the issues of actual and potential interferences.

Generally, aviation security is defined as safeguarding civil aviation against acts of unlawful interference. This is reflective of the approach taken by international air law specifically ICAO Annex 17 and ICAO Doc 8973. The framework upholds the principles of State sovereignty and territorial integrity under Articles 1 and 2 of the Chicago Convention through its requirement that all aircrafts must have nationality marks for easy identification and registration.[126]

[123] SA-CATS, Section 101.05.3.
[124] SA-CATS, Section 101.05.3.
[125] Abeyratne R "Civil unrest and airport and aviation security" 2011 *JTS* 285-294.
[126] SA-CATS, Section 101.0.2.4.

South Africa's regulatory frameworks recognize the need for aviation security by taking several regulatory approaches. First, it regulates registration of national marks of the UAS to address the challenge of unlawful interference identified in chapter Two of this thesis. At the outset, all UAS registered in South Africa are considered to have the nationality of South Africa.[127] The regulations require that an identification plate should be ingrained on the UAS, comprising the registration and nationality marks.[128] Other than being ingrained, the regulations require displaying of marks, with the correct colours and fonts, location, allocation and specification. It is only after the ingraining and displaying of the marks that an aircraft passing over the Republic of South Africa can be certified to operate.[129] The regulations, therefore, directly underpin the Rules of the Air provisions under Article 8 of the Chicago Convention, which makes the nationality marks very crucial in implementation of the Rules of the Air provisions. The requirement is, therefore, a positive move towards compliance with the binding provisions of the Rules of the Air contained in ICAO Annex 2 to address both security issues.

The subsequent sub-section addresses the civilian UAS operators who use the South African airspace and are regulated by the Civil Aviation Act and Regulations.[130] The scope of the Civil Aviation Regulations extends to Classes One and Two, as demonstrated in the tables already provided in this chapter i.e. those measuring less than 20 kilogrammes, UAS, owners, operators, pilots and those, which maintain them.[131] These fall into three categories, namely: private operators, commercial, corporate and non-profit operators. However, it does not extend to autonomous unmanned aircraft,[132] unmanned free balloons and their operations, or other types of aircraft that cannot be managed on a real-time basis during flight. This

[127] This is compliance with Section 101.02.4.
[128] SA-CATS, Section 101.02.4.
[129] SA-CATS, Section 101.02.4. 2 (1) (a)-(d).
[130] SA-CATS, Section 101.02.4. 2 (1) (a)-(d).
[131] SA-CATS, Section 101.02.4. 2 (1) (a)-(d).
[132] Civil Aviation Regulations, Regulation 1.01.1 provides that an unmanned aircraft that does not allow intervention in the management of the flight.

includes aircraft operated in terms of Part 94 of the Civil Aviation Regulations, which addresses the operation of "non-type certificated aircraft",[133] model aircraft,[134] and toy aircraft.[135]

Equally, training and authorization are important security measures in South Africa. The 2015 Regulations prohibit flying of UAS 10 kilometres close to vital strategic installations such as military base without permission from the Director of SACAA.[136] This rule prevents the possibility of use of the UAS to compromise the security of the State.

Instructively, the SACAA has a Certification and Training arm as well as a training department. The training department sets standards, and regulates all trainings, as well as providing adequate oversight. For instance, under the standards, the training and training centres are required to focus on aviation security procedures and processes.[137] The training packages are tailored to ensure planning, coordination and conducting procedures under ICAO Annex 17. The design of courses pursuant to Parts 109 and 110 of the Civil Aviation Regulations are aimed at integrating ICAO SARPs to curb unlawful interferences within the meaning of ICAO Aviation Security Manual.[138]

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[133] A non-type certificated aircraft is any aircraft that does not qualify for the issue of a certificate of airworthiness in terms of Part 21 and shall include any type of certificated aircraft that has been scrapped, of which the original identification plate should have to be removed and returned to the applicable aviation authority and is rebuilt as a full-scale replica.

[134] Civil Aviation Regulations, Section 1.01.1 defines a model aircraft" as a heavier-than-air aircraft of limited dimensions, with or without a propulsion device, unable to carry a human being and to be used for competition, sport or recreational purposes rather than UAV developed for commercial or governmental, scientific, research or military purposes, and not exceeding the specifications as set by the federation.

[135] Toy aircraft is a product falling under the definition of aircraft, which is designed or intended, for use in play by children.

[136] Civil Aviation Regulation (Eight Amendment), Section 101.05.10 (3) (a)-(d).

[137] Civil Aviation Act, Sections 75 (m) (i), 103 (j), 155 (e) (i-v), f (i- iv). Also see SA-CATS, Regulation 101.03.3 (1-4), 101.03.4 (1-4), 101.03.5 (1-4) and 101.04.1 (i)

[138] Civil Aviation Act, Section 155 p (iii).

On its part, the certification department undertakes the noble role of standard setting, reviewing of regulation and certification of screening. Just as is the case with the screening processes developed under the US framework, the screening may not be effective for the regulation of UAS operations. The review mandate is relevant in order to ensure that the law tries, as much as possible, to keep up with technological development. Of relevance to security is that a holder of an UAS operator certificate has additional mandate to take security measures in use of an UAS. The specific mandate includes conduct of background and periodic criminal record checks on persons working with UAS.[139]

Registration is also a pivotal security measure put in place by South Africa. Part 101 of the Civil Aviation Regulations introduced by the Civil Aviation Regulations (Eighth Amendment) recognizes security challenges that may be caused by proliferation of UAS into the airspace. It thus provides for registration of imported UAS. Under these Regulations, in case the UAS leave the airspace, they have to be re-registered.[140] The conditions of the re-registration are geared towards meeting security standards by accounting for UAS that re-enter the airspace of South Africa. Secondly, the UAS can only be registered when it is not already registered in another State. In my view, this condition is well calculated to prevent the susceptibility of the airspace of the Republic of South Africa to instances of espionage.

Notably, ownership of the UAS is a critical element during registration. This is an important security measure to ensure that the UAS are not used to commit crime anonymously and enables ease of tracking for accountability by owners should such criminal activities actually take place. Further, it makes it possible that a person with a criminal record may be restricted under the laws for the country's security. Further, Part 101 of the Civil Aviation Regulations, 2015 approaches the security issue from a responsibility point of view in cases of corporate ownership of UAS operations.

[139] SA-CATS, Section 101.04.8.
[140] Civil Aviation Regulations (Eight Amendment), Part 101 Regulations.

For instance, the Regulations require disclosure of directors and resolutions or founding statements for a company or a closed operation to acquire an UAS respectively. In respect of according responsibility of security to an identifiable group, renewals of registration certificates require proof trusteeship granted by the High Court.

Related to cooperate ownership of UAS also, the firms must produce South African identity to be allowed to own an UAS. That means than a foreign national, save for one who owns a pilot licence, cannot be part of the directorship of a company that owns a licence. This restrictive approach is meant to weed out instances of foreign ownership that may compromise the security of the State.

While this is a plausible approach especially against the backdrop of the September 11 attacks in the US, the restrictive security approach may seem to be imbalanced with the development objectives of regulation of UAS that, as Nonnecke observes, are equally vital objectives of UAS regulations.[141] The limitation may also conflict with the practice since the nature of the UAS is such that it is more likely to be owned by foreigners, either individually or as a firm, than nationals are.

Another security measure is inspection of UAS as per Part 101.04.9 of the Civil Aviation Regulations (Eighth Amendment). Under this framework, the UAS are required to undergo tight inspections to ensure that there are no armaments that threaten the security or sovereignty of the State. It is obvious that such inspections are heightened depending on the relationship with a country and the times of peace or war. All these are prerogatives of the Republic that are granted to it by virtue of Article 8 of the Chicago Convention.

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[141] Nonnecke BM "Hitting or Missing African UAS Objectives? An Evaluation of Universal Access and Service (UAS) Policy Guidelines for Developing Countries" 2012 *CS* 121-141.

Additional effort in ensuring security is a long-term requirement for carriers, operators, providers of traffic and navigation services in the aviation sector to develop their aviation security programmes.[142] The role of the Civil Aviation Security Department of SACAA is critical in ensuring that there is harmony in the provisions through its consideration and approval of the participants' security program.

Other than the participants' security programmes developed under Section 111 of the Civil Aviation Act, South Africa has developed a comprehensive National Security Programme. The programme maps out training and certification issues and ensures that instances of unlawful interference with the aircrafts, including UAS, are weeded out. The programme provides the basis for coordination of actions of international organizations, government departments and involvement of private actors, such as carriers in aviation security. The programme also provides for effective communication between bodies for effective regulation.[143] The coordination basis of the programme is pivotal in arresting threats of terror attacks that require multi-role playing. The approach is the surest way of dealing with current security challenges that entail technological sophistication.

Further, the South African framework achieves the security objectives through certain general geographical restrictions and functional requirements regarding operation of the UAS. In order to comply with security measures, the regulations prohibit operations in controlled airspaces; controlled airspaces are grounds where sensitive installations are situated[144] such as adjacent to or above nuclear plants, prisons, military bases, airports, police stations, crime scenes, courts of law, State

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[142] SA-CATS, Section 101.04.5.

[143] South African Civil Aviation Authority "National Security Programme http://www.caa.co.za/Pages/Aviation%20Security/National-AVSEC-programme.aspx (Date of use: 9 February 2020).

[144] Civil Aviation Régulations (Eight Amendement), Section 101.05.3.

Houses and national key points of strategic installation.[145] These are areas that deal with matters touching on the territorial integrity of the State.

Although the Civil Aviation regulations prohibit UAS operations in controlled airspaces, the Director of Civil Aviation may waive this requirement in some circumstances.[146] The power of the Director of Civil Aviation to exempt as provided under the Act is meant to aid in the efficient and effective operations of UAS only. This means that the discretion is obviously limited if it can impact on compromising the aviation security, which explains why the exemption is done on case-by-case basis. The intention to limit the discretion by the Director is evidenced by the express provision of instances to which it can be exercised as visual meteorological condition, airfields traffic and control zones that is not more than 400 feet. Further, even if the Director'' discretion is exercised in respect to the three areas, the permission to operate in airfields and controlled zones is still subjected to statutory limitations requiring that the UAS be fitted with transponder that is capable of displaying the unique code issued to them, unless otherwise exempted by the Director of Civil Aviation.[147] The restriction on the controlled airspaces and in the exercise of discretion to allow under this framework follows the model of regulation in the US as discussed in the previous chapter.

6.3 South Africa's Response to Privacy Concerns of UAS

The Civil Aviation Act does not expressly address the specifics on the assurance of the right to privacy in the UAS use. It only sets out the provision generally as a right to be considered in its monitoring. Indeed, it is not so prominent when compared to the objectives of safety and security that are specifically addressed in distinct parts of the Act. This is reflective of the international framework to the UAS issues, which is also comparatively marginal in respect to provision on privacy.

[145] Civil Aviation Régulations (Eight Amendement), Section 101.05.3.
[146] Civil Aviation Régulations (Eight Amendement), Section 101.05.3.
[147] Civil Aviation Régulations (Eight Amendement), Section 101.05.3

Chapter 7 of the Civil Aviation Act, which makes provision for monitoring of regulatory compliance, however, mentions the right. Specifically, Section 145 makes provision on the powers and manner of conduct of searches and seizures, and powers of arrests for offences provided under the Act. Section 145(1) of the Act envisages monitoring of the Act through conduct of warrantless searches on aircrafts. The Act obligates the monitoring officers to ensure that any search contemplated be conducted with strict regard for decency and order and with respect for each person's right to dignity, freedom, security and privacy.[148] This means that all the entries and inspections under the Act must also be conducted in a manner that upholds the right to privacy. These provisions are a glimpse of hope of setting standards of respect for the right in the UAS operations.

The mention of the respect for the right in the monitoring and enforcement sections of the Civil Aviation Act is indicative of the reactive approach taken in the respect for the right to privacy. It does not envisage taking of active steps to ensure, for instance, that operators' manual contains provisions on the respect of right to privacy. A more proactive approach is found in the regulation that limits the operation of UAS to a lateral distance of 50 metres from any structure or public road. This is aimed at helping to prevent clandestine uses of UAS to invade the right to privacy.[149]

There are other instances when SA-CATS addresses the issues of negligent and reckless operation of UAS. The second part of Section 101.05.9 of the Regulations prohibits any person from operating UAS in a negligent or reckless way, as to jeopardize safety of any person, property or other aircraft in the air or on the ground. Since privacy invasion is a means of jeopardizing property or a person, it can be said that the right, and its guarantee, can be inferred. There are many such

[148] Civil Aviation Act, Section 145(13).
[149] Civil Aviation Regulation (Eight Amendment), Section 101.05.03.

examples that form the above analysis of substantive provisions on safety operations that go a long way in ensuring there is no violation of people's right to privacy.

The requirement under Section 101.01.7 (d) of the Civil Aviation Regulation (Eight Amendment), which obligates pilots to observe all statutory requirements relating to liability, privacy and other law enforceable by any other authorities further exacerbate the requirements set out above. This part, therefore, invites all the operations of UAS to comply with the provision on the protection of the right to privacy as encapsulated in Section 14 of the Constitution of the Republic of South Africa.

Instructively, the South African Constitution provides safeguards concerning privacy of every citizen. People's right to privacy include the right not to have their person or home searched, their property searched, their possessions seized or their communications infringed.[150] Obviously, such rights can be limited by law, in case those limitations are reasonable in a just and open society based on human rights equality and freedom.[151] Further protection of these rights is discussed in the human rights instruments, both at the international and continental levels that are applicable to South Africa. As discussed in the overview of the framework, the challenge that the African Charter on Human and Peoples Right does not have provisions for privacy specific to UAS is a limitation on continental efforts, as far as South Africa is concerned. As noted in the same part, however, the application of human rights treaties, which have codified the international custom, are buffer for protection of the right to privacy regarding the use and operation of UAS.

[150] Constitution of Republic of South Africa, 1996, Section 14.
[151] Constitution of Republic of South Africa, Section 7 (3) and 36 (1) & (2).

7. General Challenges in Regulation of UAS in South Africa

The steps set out above evidence significant legislative steps in provision for the safety, security and privacy provisions in South Africa, albeit with the inherent challenges set out under the respective subheadings. Other general gaps identifiable under the existing framework are discussed below.

7.1 Exclusion of Toy Operators

As described above, the South African UAS Regulatory framework only applies to the RPAs. The definition of an RPA under the Civil Aviation Regulations, as amended in 2015, covers unmanned aircrafts while expressly excluding toy and model aircrafts. The regulations only apply to private, commercial, corporate and non-profit operations of certain players. That it excludes autonomous UAS, non-type certified aircraft, model aircraft and toy aircrafts, further creates a challenge in the path of integration and harmonization of UTM for UAS. While the practice of exclusion of model aircrafts is in line with the framework under the ICAO, the objective of exclusion of toys in South Africa is based on the fact that they are used for hobbies. With the ubiquity in UAS use, almost a decade after the laws were made and amended, such toy aircrafts can be used for clandestine activities, irrespective of their weight and size. They, therefore, are a potential threat to safety, security and privacy of the users and the public. Further, the exclusion is reported to cause a lot of confusion amongst citizens of South Africa, which leads to breaking aviation laws related to UAS.[152]

7.2 Lack of Provisions on Community - Based Organizations

Further, and unlike in the US, South Africa has no provision for community-based organizations that can seek UAS approvals for its members. This leaves a window through which unscrupulous operators can fly UAS to the detriment of safety and

[152] Khyanyile N "Fun with a Warning" https://www.news24.com/SouthAfrica/News/fun-with-a-warning-20190204-2 (Date of use: 4 January 2020).

security of civil aviation in general, and UAS in particular. It is also a missed opportunity to complement the enforcement capacity of SACAA owing to the latter's limited capacity. In this thesis analysis, therefore, SACCA should consider practice and adopt it in the local community as once involved, they help in oversight and reporting incidences.

Practically, the exemption may pose such challenges as interception of UAS for criminal activities, which may in effect violate people's right to privacy as protected by Section 14 of the South African Constitution. However, as a way of comparison, the US case appears to have an advanced way of dealing with this category, by giving mandate to community-based organizations where members join hands to form their own local organizations and seek authorization from FAA, which partners with such organizations on bases of recreational purposes and approval of operations.

7.3 Wide Powers of the Director of Civil Aviation

Though the powers of the Director of Civil Aviation are limited in terms of grant of permission for use of UAS in the controlled places, the Director still has broad powers of publishing technical standards and sole responsibility for safety and security among others.[153] These powers enable the exercise of discretion in exempting pilot licensing requirements, including allowing operation in a controlled airspace. Ideally, one individual, given the rapidly rising nature, classes and use of UAS should not exercise all these powers. Therefore, this thesis suggests that the exercise of such discretion should be seriously limited to reduce exposure of civil aviation to the desires of one individual with potential of abuse to the detriment of the entire civil aviation sector. Formation of a security committee involving a multi-agency or an appeal panel could suffice in cases where one is dissatisfied by decisions made by the Director General. Perhaps the case of Absa drones' fireworks

[153] Civil Aviation Act, Section 86(3)(a).

permissions over Johannesburg is an example of a ticking time bomb on the ability to manufacture a UAS's disaster through this challenge in the regulatory framework.

7.4 Implementation Challenges

The mandate to monitor and enforce compliance with the aviation law is provided at section 113 of the Civil Aviation Act. Under this section, the SACAA is empowered to enter, inspect and examine any aircraft, place and premises.[154] Further, it considers the information furnished by the operators, considers books and documents, and has power to conduct seizures and inspections, liaison with criminal enforcement agencies, among others for the proper administration of the Civil Aviation Act. Increase in the use of UAS means that there is an increase in the number of engaged inspectors and investment in training and creation of awareness. All these require hefty funding.

Despite the legal and institutional framework, together with the regulatory provisions and implementation, there persists certain challenges that could backtrack the regulation of UAS use.[155] The SACAA fulfils important roles but faces numerous hiccups ranging from workforce constraints and resultant enforcement challenges. For example, many UAS are imported into the country while some are declared at port of entry; however, some do not declare them at customs for registration and monitoring purposes, hence providing difficulties in effectively enforcing compliance of required civil aviation standards.[156]

[154] Civil Aviation Act, Section 113(1)(a).

[155] Lindiwe Nchabelenga is a lawyer and an Inspector at South Africa Civil Aviation Authority. Ms Lindiwe, who is national civil aviation inspector for SACAA, traces the source of this challenge to the overstretching in the institutional capacity.

[156]Mngadi M "Two Lebanese brothers in court for Hezbollah drone export case" https://www.news24.com/news24/southafrica/news/two-lebanese-brothers-in-court-for-hezbollah-drone-export-case-20180226-2 (Date of use: 4 October 2020).

Further implementation challenge is supported by evidence of recent reports from the mainstream media in South Africa. An example is the case involving two Lebanese and two South African citizens arrested in January 2018 and arraigned in Kempton Park Magistrate's Court for allegedly illegally exporting components of drones to Hezbollah in Lebanon.[157] The accused persons were charged in court for illegally exporting UAS components to the Hezbollah, which is classified as a terrorist organization. The case is yet to be litigated and concluded at the time of writing this thesis. However, *prima facie*, the case depicts some of the challenges experienced with slow stride of implementation of UAS regulation, hence the urgent need for SACAA to put its house in order and get the UAS integration into effective operations to avert and mitigate such risks. The existence of these challenges shows that SACAA has not been able to maintain a critical balance between integration and criminal law administration. Specific challenges in the implementation are expounded below.[158]

7.5 Absence of Southern African Civil Aviation Safety and Security Organization

The ICAO-led framework recognizes that safety and security activities and programmes can be better harnessed at regional and sub-regional levels. In other words, it would be meaningful to have South Africa with a higher compliance rating when its neighbours have lower rating so as to harness regulatory peer influence amongst the States. It is for this reason that ICAO has rolled out an initiative for Regional Aviation Safety Groups through the ICAO Regional Offices.[159]

As briefly highlighted above, Member States to SADC lag behind as appertains to establishing a regional body to unequivocally deal with civil aviation within the sub-regional bloc. The effort seen in establishing the Interim South African Safety

[157] Mngadi https://www.news24.com/news24/southafrica/news/two-lebanese-brothers-in-court-for-hezbollah-drone-export-case-20180226-2 (Date of use: 4 October 2020).

[158] https://mybroadband.co.za/news/gadgets/126654-12-things-you-need-to-know-about-south-africas-new-drone-laws.html (Date of use: 10 November 2019).

[159] https://www.icao.int/safety/SafetyManagement/Pages/Regional-Aviation-Safety-Groups-(RASGs).aspx (Date of use: 4 January 2020).

Organization by SADC with reluctance of entire membership ratification is backtracking in effect, as compared with their East African counterparts who have CASSOA at the sub-regional level. This challenge is further exacerbated by the fact that Africa is yet to establish African regional UAS regulations, as discussed in chapter Three of this thesis. In view of such circumstances, a Southern African States' civil aviation body could be useful in regulating civil aviation within the SADC region in helping to address safety, security and privacy challenges associated with movement of UAS across the boundaries.

The need for such regional activities is also necessitated by the potential negative effects of not having one. Failure to take up such regional opportunities may result in possibilities of clandestine UAS movements into neighbouring countries within a regional economic community, with less developed or no UAS regulations, and thus compromise the safety, security and privacy in the use and operation of the UAS in South Africa. It is projected that regulation at the regional and sub-regional States would address issues including general aviation safety and security with a segment dealing with UAS registration, certification, and compliance, among others through creating a basis for development and harmonization of UAS regulatory mechanism, systems and steps.

8. Conclusion

The movement for regulation of UAS in South Africa, which started mildly in 2002, gained momentum in 2011. It is remarkable that the framework has specific and express provisions for UAS established in 2015. It is also commendable that unlike in the US, there are no reports of conflicts between the State and federal laws on regulation. South Africa has a three-sphere government structure that enables it to adopt a US-like structure of regulation, albeit with lack of community-based organizations. Additionally, the South Africa's active participation in ICAO Security Panel puts it ahead as regards moral obligation to comply with safety and security measures in the ICAO-based framework. This adds onto its adoption of the Chicago

Convention, although lack of SADC-based civil aviation regulations seems to backtrack its sub-regional efforts in as far as safety and security is concerned.

The substantive provisions of the Civil Aviation Act, 2009, the regulations thereunder and robust framework of circulars issued by SACAA, are particularly relevant in regulating safety, security and privacy issues, which significantly mirror the international approach envisaged under the ICAO framework. Despite the development of a robust legal and institutional framework, together with a high rate of ICAO-participation, which gives rise to a higher rate of compliance with ICAO framework compared to other African countries, South Africa is still grappling with lack of an efficient legal framework. For instance, the framework does not adequately address the UAS-specific issues of privacy. This is a serious challenge since the constitutionally backed right to privacy is too general and does not address the challenges caused by recent technological developments in aviation, which need to be captured under the Regulations. Regarding safety, exclusion of toy operators of UAS from the Regulations has serious safety implications, which may surpass its justification.

The institutional legal frameworks for implementation of the law have played an important role in defining standards, guidelines, monitoring and licensing of UAS. Whereas the Regulations have gone a long way in providing a regulatory framework for UAS, its current design has loopholes regarding power of the Director of SACAA. The implementation challenges related to weak links in the institutional framework have overreaching effects in compromising safety and security. These challenges affect potential uses of the UAS. Consequently, the UAS legal and policy frameworks in South Africa, without the integration roadmap within the country and the region, do not fully speak to current needs and challenges in UAS operations, as well as integration development. Generally, South Africa has made fundamental progress towards integration of UAS into civil aviation.

CHAPTER SIX

LEGAL, POLICY AND INSTITUTIONAL FRAMEWORK FOR UAS IN KENYA

1. Introduction

This chapter provides a reflective analysis of the regulatory framework for regulation of UAS in Kenya. It seeks to analyse how Kenya Civil Aviation Authority (KCAA) has been effective in addressing safety, security and privacy concerns arising from the use and challenges of UAS as discussed in chapter Two of this thesis as a way of integrating UAS operation into civil aviation airspace. It forms the basis for a proportional analysis with the assurances provided in the US as discussed in chapter Four and in South Africa as discussed in chapter Five of the study. The chapter approaches the analysis by providing a brief background, overview of the legal, policy and institutional framework, principally under the Civil Aviation Act, No. 21 of 2013 and KCAA Amendment Act of 2016 respectively. It then critically analyses the salient regulatory provisions within the regulatory framework vis-à-vis their efficacy in addressing the safety, security, and privacy concerns associated with UAS operations in civil aviation.

The chapter forms basis for analysis of Kenya's UAS regulatory framework with other jurisdictions that are subject of the study to aid the integration process. The term Remotely Piloted Aircraft Systems (RPAs) is used interchangeably with UAS because it is what featured in Kenya's previous legal and policy framework.

2. Background to Regulation of UAS in Kenya

Use of UAS is on the rise in Kenya, primarily for civilian applications.[1] UAS have traditionally been used in Kenya for various purposes, namely: remote sensing, aerial photography, surveying, disaster management, communication, protection of fisheries and forest resources, coastguard, locust control, research and development, oil and mineral exploration.[2] Currently, these uses have increased to cover issues of wildlife management and agriculture. Wildlife management pioneered the use of UAS technology from *Unmanned Innovation Inc* in Kenya at the Ol Pejeta Conservancy to control poaching.[3] This came against a backdrop in realization of timing inadequacies in traditional methods of poaching control.[4] Overall, the results have been very positive, in terms of combating poaching.[5]

Another area that is increasingly gaining more attention and traction is control of cattle rustling amongst nomadic communities such as the Pokot, Maasai, Turkana and the Samburu, among whom livestock keeping is the main economic activity.[6] Attempts have been made to integrate UAS in tracking cattle, directing security personnel and surveillance to locate rustlers and stolen cattle. Researchers in Kenya such as Mbote and Muriungi project potential use in the mapping and surveying in areas that are far from town.[7]

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[1] The Civil Aviation Act (Remote Piloted Aircraft Systems) (UAS) Regulations of 6 October 2017 Legal Notice No 269 (annulled) (hereinafter referred to as the 2017 RPAs Regulations) had allowed Kenyans to own UAS for sports, private activities and commercial purposes. KCAA has now developed a roadmap on how to re-introduce the regulation back to operation. Also see Andae G "Kenya flies behind peers in drones regulation" *2019-9-18 Business Daily* https://www.businessdailyafrica.com/corporate/tech/Kenya-flies-behind-African-peers-in-drones-adoption/4258474-5278452-fvbplqz/index.html (Date of use: 6 October 2019).

[2] Andae https://www.businessdailyafrica.com/corporate/tech/Kenya-flies-behind-African-peers-in-drones-adoption/4258474-5278452-fvbplqz/index.html (Date of use: 6 October 2019).

[3] Wright W "Aeroplane" 106.

[4] Odido D and Madara S "Emerging" 112.

[5] Odido D and Madara S "Emerging" 112.

[6] Odido D and Madara S "Emerging" 113.

[7] Kameri-Mbote P and Muriungi M "Potential contribution" 172.

The increased civil use of UAS in Kenya is partly fuelled by the government's long-term and short-term development policies,[8] whose realization is pegged on infrastructural, scientific, technological and innovation development.[9] Other than government policy, Kenya has an ambitious agenda in land, human resource development, security and public sector reform.[10] However, the intended reforms have encountered numerous obstacles, such as identified sources of insecurity as conflicts and cattle rustling require government counter-measures to address them.[11] In addition to such 'traditional' conflicts, there are emerging crimes, such as terrorism, piracy and cybercrime that the government has been fighting. This requires sophisticated technology, such as UAS, to help the police respond to growing insecurity. Obviously, increase in traditional uses cause concerns of safety, security and privacy of the members of the public and users of the UAS in such operations.

On the other hand, use of UAS by the military is not widespread, but there are scattered instances of use in the sector. For example, the Kenya Defence Forces (KDF), in 2012, acquired an UAS at a cost of $9.86 million to support its operations in the operation led African Union Mission on Somalia (AMISOM),[12] in Somalia and targeted at weakening the Al-Shabaab militia group camps, which have been undertaking terrorist attacks against Kenyans.[13] The US military has on a number of occasions, used Kenya's airspace to launch attacks against terrorist targets in Somalia.[14] Kenya too, has undertaken several strikes against AlShabaab hideouts

[8] Government of Kenya Vision 2030 of 2007.

[9] http://www.president.go.ke/2017/12/12/speech-by-his-excellency-hon-uhuru-kenyatta-c-g-h-president-and-commander-in-chief-of-the-defence-forces-of-the-republic-of-kenya-during-the-2017-jamhuri-day-celebrations-at-the-moi-international/ (Date of use: 10 November 2019).

[10] See Ronald HK "Managing the public sector in Kenya: reform and transformation for improved performance" 2012 *JAG* 128-143.

[11] Wright W "Aeroplane" 107.

[12] AMISSOM refers to the African Union Mission in Somalia.

[13] Otuki N "Kenya buys Sh1bn pilotless aircraft in war on Al-Shabaab" *2012-2-25 Business Daily* https://www.businessdailyafrica.com/economy/Kenya-buys-Sh1bn-pilotless-aircraft-in-war-on-Al-Shabaab .(Date of use: 4 June 2018).

[14] Olingo A "Kenya now drafts regulations, joins Rwanda to allow drones into its airspace" 2016-4-17 *The East African* https://www.theeastafrican.co.ke/news/ea/Kenya-joins-Rwanda-to-allow-drones-in-its-airspace-/4552908-3162800-13jswqt/index.html (Date of use: 10 November 2019).

in Somalia resulting in casualties, in an effort to eliminate piracy along the Kenya-Somalia border and stamp out terrorism in general.[15] The Kenyan framework has not attempted to adopt regulation on such military operations. Indeed, the long title of the Civil Aviation Act is clear that the Act is only concerned with orderly development of civil aviation in Kenya.

3. Legal Framework and Foundation to Regulation of UAS in Kenya

Kenya ratified the Chicago Convention in May 1964. Accordingly, the country is bound by obligations of State parties concerning regulations found in Article 11 of the Convention. Kenya is a member of ICAO thus bound by the ICAO Annexes, Standards and Recommended Practices (SARPs) such as ICAO Annex 17 on security and Annex 19 on Safety Management System (SMS): the Annexes are domesticated through development of National Civil Aviation Security Programmes and State Safety Programme (SSP) respectively. Kenya gets support through ICAO guidance materials such as Aviation Security Manual (Doc 8973), Aviation Safety Manual (Doc 9869), Manual on Remotely Piloted Aircraft Systems (RPAs) (Doc 10019 AN/507) of 2015, ICAO UAS Circular No. 328-AN/190 of 2011, and Circular 330 AN/189 on Civil/Military Cooperation in Air Traffic Management of 2011. This international instruments applicability mirrors other jurisdiction already discussed under this thesis. Kenya has ratified several Conventions and numerous treaties in relation to civil aviation, as briefly highlighted below.

Pursuant to Article 2(6) of the Constitution of Kenya, the Conventions ratified before or after the promulgation of the Constitution in 2010 by Kenya automatically form part of Kenyan law. Kenya is a party to the Convention on Suppression of Unlawful Seizure of Aircraft, Convention relating to Unlawful Acts Relating to International Civil Aviation,[16] Protocols Relating to an Amendment to the Chicago Convention,

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[15] Olingo https://www.theeastafrican.co.ke/news/ea/Kenya-joins-Rwanda-to-allow-drones-in-its-airspace-/4552908-3162800-13jswqt/index.html (Date of use: 10 November 2019).

[16] Convention on Suppression of Unlawful Seizure of Aircraft, Convention relating to Unlawful Acts Relating to International Civil Aviation of 10 September 2010 (entered into force 1 July 2018).

Convention on the International Recognition of Rights in Aircrafts,[17] Convention on International Interests in Mobile Equipment (The Cope Town Convention) and the Protocol on the Convention on International Interest in Mobile Equipment on Matters Specific to Aircraft Equipment (the Cape Town Protocol), Convention on Unification of Certain Rules Relating to International Air Carriage signed at Warsaw in 12 October 1929 as amended by the Haque Protocol of 1955 (the Warsw Convention), the Convention for the Unification of International carriage by Air , signed at Montreal on 28 May 1999 (the Montreal Convention) and Convention on Compensation for Damage Caused by Aircraft to Third Parties,[18] among others. As an example, Kenya domesticated the Cape Town Convention and the Cape Town Protocol by enacting the International Interest in Aircraft Equipment Act No. 27 of the 2013, which gives the High Court of Kenya jurisdiction in respect of claims brought under the same. The provisions of these Conventions are binding on Kenya by virtue of the good faith principle and the principle of *pacta sunt servanda*.[19] Kenya, therefore, draws from the spirit of international law to provide guidance for State parties to develop regulations that enable integration of UAS operations in civil aviation in their respective jurisdictions and to assure safety, security and privacy concerns.[20]

At the continental level, Kenya is a member of the African Union and a party to the Africa Union (AU) Constitutive Act.[21] Like South Africa, which is also a member of Africa Union, at domestic level, Kenya is guided by the Constitution. The Constitution recognizes the institutional framework under the Africa Civil Aviation Commission, a specialized agency of the African Union. The Commission takes lead in fostering liberalization of air transport and compliance with the ICAO framework.[22] The institutional framework of the Africa Civil Aviation Commission forms the basis

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[17] Convention on the International Recognition of Rights in Aircrafts of 19 June 1948 UNTS 4492 (entered into force 17 September 1953).

[18] Convention on Compensation for Damage Caused by Aircraft to Third Parties of May 2009.

[19] Vienna Convention on the Law of Treaties of 1969, Preamble and Articles 2(1) (a) and 26. *Pacta sunt servanda* is a *latin* idiom which may be translated to mean treaties must be complied with or agreements once made must be kept.

[20] See chapter Three, sections 4.1-4.3 on the international law reps0osne to safety, security and privacy concerns to UAS use and operations.

[21] Constitutive Act of the African Union of 2001.

[22] Constitution of the Africa Civil Aviation Commission of 17 January 1969 (entered into force 17 March 1972) (as Revised in 2009), Article 3.

of cooperation with regional economic blocs or communities and ICAO to ensure that aviation matters of mutual interests are settled.[23] It is noteworthy that the commission is mandated with the overall responsibility of safety, security and environmental protection in the aviation sector within the African continent, among other functions.

At sub-regional level, Kenya is a member of the East African Community since it ratified the EAC Treaty of 1999. Article 92 of the EAC Treaty of 1999 requires Kenya to harmonize its laws and policies on civil aviation in order to prove efficiency of the aviation sector as a support sector to other sectors of the economy. The Treaty requires Kenya to ensure that the aviation transport systems are safe and efficient. Further, the country is obligated to ensure maintenance of a high level of security for air operations, including joint searches.[24] The EAC has created a framework through the Civil Aviation Safety and Security through the EAC Civil Aviation Safety and Security Oversight Agency Act.[25] The only challenge regarding implementation is the fact that the EAC laws do not have a direct applicability and absolute supremacy over the national ones owing to the provision of Article 8(2) of the Treaty for the Establishment of the EAC, of 1999, which requires the States to develop domestic laws to give effect to those of the EAC.

At the domestic level, the substance of civil aviation law can be traced from as early as the 1970s. The Kenya Civil Aviation (Amendment) Act[26] was enacted in 1970 and over time, underwent amendments in 1977 through to 1979, resulting in the establishment of Kenya Civil Aviation Authority (KCAA) as an autonomous body taking over the functions of the Directorate of Civil Aviation.[27]

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[23] Constitution of the Africa Civil Aviation Commission of 17 January 1969 (entered into force 17 March 1972) (as Revised in 2009), Article 17.
[24] EAC Treaty 1999, Article 92 (3) (m).
[25] See EAC Civil Aviation Safety and Security Oversight Agency Act of 2007, Sections 1, 2 and 3(a).
[26] The Kenya Civil Aviation (Amendment) Act, chapter 394, Laws of Kenya
[27] See Cap 394 Lok now repealed that formed KCAA.

In terms of its regulatory approach post-2010, Kenya adopts a devolved governance structure with one national government and 47 county governments that operate distinctively, albeit interdependently.[28] Under the Fourth Schedule to the Constitution of Kenya, 2010, civil aviation, under the larger umbrella of transport and communications, is the function of the national government. Generally, the national government had not lived to regulation of UAS within this larger mandate up to 2017. Accordingly, the UAS integration into non-segregated (civilian) airspace in Kenya, for a long time and especially in the pre-2013 legal regime, remained a challenge due to a *lacuna* in a binding UAS regulatory framework in Kenya.

In 2013, there developed an urgent need for law reform in the response mechanism for safety, security and privacy provisions relating to, among others, UAS. This led to development of principal civil aviation regulatory framework, primarily set out in the Civil Aviation Act of 2013.[29] The Act defines an aircraft as "any machine that derives support in the atmosphere from reactions of the air other than reaction of the air against the earth's surface, and includes all flying machines, aeroplanes, gliders, seaplanes, rotorcrafts, airships, balloons, gyroplanes, helicopters, ornithopters and other similar machines but excludes State aircraft''.[30] This definition did not expressly provide for the regulation of operation of UAS. Such an application could, however, be drawn by strong implication owing to the inclusive nature of the definition which covered 'other machines' such as balloons and other aircrafts. Further, regarding the exclusion of State aircrafts, both the Civil Aviation Act, 2013 and the Civil Aviation (Amendment) Act, of 2016 are categorical that the laws apply to the civil aircrafts. The application of the rules to State aircraft is possible through the direction of the Cabinet Secretary responsible for Transport as under Section 3(2) of the Civil Aviation Act, 2013 is applicable only for expediency of regulation of State aircrafts but does not in any way mean that military UAS are subjected to the

[28] Constitution of Kenya, 2010, Article 6 (3).

[29] The Civil Aviation Act 21 of 2013 (hereinafter referred to as the Civil Aviation Act), Section 83 repealed the Civil Aviation Act Chapter 394 Laws of Kenya.

[30] The Civil Aviation Act, Section 2 (j).

regulatory frameworks under the Civil Aviation Act, 2013 and Civil Aviation (Amendment) Act, 2016.[31]

The principal law under the Civil Aviation Act, 2013, recognizes the application of international Conventions. The envisaged Conventions are numerous, and include protocols, and any Annexes thereto relating to civil aviation, to which Kenya is a party. It is upon the Board of the Kenya Civil Aviation Authority to make legislative proposals for giving effect to the international Conventions and instruments.[32]

Three years after the enactment of the Civil Aviation Act, 2013, Parliament enacted the Civil Aviation (Amendment) Act[33] which introduced a raft of legal changes in the regulation of civil aviation in Kenya. One notable change was the provision of the definition of unmanned aerial vehicle to mean:

> "a pilotless aircraft is flown without a pilot-in-command on-board and is either remotely or fully controlled from another place (ground or another aircraft, space) or programmed and fully autonomous."[34]

This definition is expansive as it envisages both the manner of control and operations of UAS. Secondly, and for the first time in a legislative enactment, the 2016 Amendment Act provided an express recognition of UAS under Kenyan aviation law requiring regulation. Henceforth, the amendment law of 2016 represents a great stride as far as formal recognition, and integration of the UAS into the Kenyan civil airspace is concerned in achieving the spirit of Article 3 of the Chicago Convention.

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[31] Section 3(ii) of the Civil Aviation Act provides that: The provisions of this Act shall not, except where expressly included or if the Cabinet Secretary so directs by order published in the Gazette, apply to state aircraft or to any class or classes of state aircraft.

[32] The Civil Aviation Act, Section 15(3)(a)(ii).

[33] The Civil Aviation (Amendment) Act 42 of 2016 (hereinafter refered to as the Civil Aviation (Amendment Act).

[34] The Civil Aviation (Amendment Act), Section 2.

Additionally, the Constitution of Kenya[35] provides fundamental safeguards with a bearing on regulation of use, manufacture and operation of UAS. Specifically, it has a Bill of Rights that recognizes and protects, among others, the right to privacy. Under chapter Four of the Constitution (Bill of Rights), enforcement of the right can be done through a petition to the High Court on an allegation that the right has been infringed, breached or threatened.[36]

The Kenyan legal framework gets support from a number of legislations that acknowledged regulation of civil aviation as far as it relates to use, manufacture and operation of UAS. Kenya has a specific law on enforcement of data protection. The Data Protection Bill, was finally enacted into Law after passing by Parliament on 7 November 2019, and assented to by President Uhuru Kenyatta on 8 November 2019. The Data Protection Act[37] enhances privacy rights as enshrined under the Kenyan Constitution.[38] The latest passage of the law comes against a backdrop of many reported instances in which human rights groups have reported excess surveillance over the Kenyan airspace by UAS.[39] Other relevant national legislations relating to the implementation and enforcement of the integration of UAS into the Kenyan national aviation airspace are the National Security Council Act,[40] Kenya Airports Authority Act,[41] Security Laws (Amendment) Act[42] and Regulations made under them. Other relevant Regulations are the Kenya Civil Aviation (Security) Regulations,[43] Civil Aviation (Air Operator Certification and Administration) Regulations,[44] Civil Aviation (Operation of Aircraft) Regulations,[45] These regulations

[35] Constitution of Kenya, 2010.
[36] Constitution of Kenya, 2010, Article 23(1).
[37] Data Protection Act 24 of 2019.
[38] Constitution of Kenya, 2010, Article 31 (c) and (d).
[39] Privacy International "State of Privacy Kenya" https://privacyinternational.org/state-privacy/1005/state-privacy-kenya (Date of use: 29 September 2019).
[40] National Security Council Act 23 of 2012.
[41] Kenya Airports Authority Act No 3 of 1991.
[42] Security Laws (Amendment) Act 19 of 2014.
[43] Kenya Civil Aviation (Security) Regulations of 2015 as amended in 2020
[44] Civil Aviation (Air Operator Certification and Administration) Regulations of 2013.
[45] Civil Aviation (Operation of Aircraft) Regulations of 2013.

were amended in 2018 to Civil Aviation (Operations of Aircraft for Commercial Air Transport) Regulations, 2018 and Civil Aviation (Rules of the Air) Regulations.[46]

Flowing from the legislative developments through the Civil Aviation (Amendment) Act, 2016, the Cabinet Secretary for Transport and Infrastructure, being responsible for civil aviation, has mandate to enact civil aviation regulations including those of regulating UAS. The development of regulations on implementing particular provisions for UAS under the 2016 Civil Aviation (Amendment) Act was immediately kick-started. In October 2017, the 2017 Civil Aviation (Remotely Piloted Aircraft Systems) Regulations were developed by the KCAA. The Regulations applied to a wide spectrum of dealings in remotely piloted aircrafts, ranging from manufacturing, assembly, procurement, importation, testing, operation and maintenance of the aircraft.[47] The scope of the Regulations covered all remotely piloted aircraft except State aircrafts, unmanned free balloons or airships and toys that operate within an aerodrome, not less than 500 metres from the aerodrome boundaries. Generally, the registration of the aircrafts was based on categorizations and classification, which puts currency on use and weight respectively, from class 1A to class 3C.[48] The operations were categorized into personal, commercial and recreational purposes of use of RPAs.

The 2017 RPAs Regulations were short-lived as Parliament adopted a report of the Committee on Delegated Legislation on 26 June 2018 in its second session, and pursuant to the provisions of section 15 of the Statutory Instruments Act[49] and Standing Order 210 (4) (b) of 2018, annulled them in entirety for reasons of inadequate public participation during development, as required by the Statutory Instruments Act. Also suffering a similar fate in terms of suspension was the Kenya Civil Aviation Policy though not under parliament's mandate for revocation. Its main

[46] Civil Aviation (Rules of the Air) Regulations of 2013.
[47] The 2017 RPAs Regulations, Regulation 3.
[48] The 2017 RPAs Regulations, Regulation 4.
[49] Statutory Instruments Act 23 of 2013.

objective is to support operation of UAS in a safe, secure, harmonized and seamless environment equal to manned operations.[50] The suspension was a missed opportunity for the security measures that were practically beefed up through authorization systems at the Ministry responsible for Transport and Department of Defence headquarters under the policy. It was also a missed opportunity for security measures through practical steps for cancellation of permits in light of State safety interests that were necessary to complement the Civil Aviation (Rules of the Air) Regulations and Civil Aviation (Safety Management) Regulations.

Despite the annulled 2017 RPAs Regulations, there are certain cross-cutting reassurances of safety, security and privacy issues relating to UAS that can be obtained from myriad Regulations that have been passed pursuant to provision of Section 82 of the Civil Aviation Act. They include the Civil Aviation (Rules of the Air) Regulations,[51] the Civil Aviation (Airworthiness) Regulations,[52] and the Civil Aviation (Personnel Licensing) Regulations.[53] In addition, instrumental in the regulatory framework is the Kenya National Civil Aviation Security Programme and Safety programmes.

From the historical perspectives on development and law reform set out above, it is clear that the integration of UAS into civil aviation had been thrown into a limbo, for the intervening period between end of June 2018 and March 2020. During this period, KCAA had to embark on addressing the issues raised by Parliament such as observance of public participation in all counties, and providing measures to address safety and national security while adhering to Constitutional right to privacy. In order to preserve the status quo, in the intervening period, the Cabinet Secretary for Transport, Infrastructure, Housing, Urban Development and Public Works, through Kenyan Gazette Legal Notice No 76, on 26 March 2019 published

[50] Republic of Kenya Policy on Remotely Piloted Aircraft Systems of 2017.
[51] Civil Aviation (Rules of the Air) Regulations of 2013.
[52] Civil Aviation (Airworthiness) Regulations of 2013 (as amended in 2016).
[53] Civil Aviation (Personnel Licensing) Regulations of 2013

prohibition to fly and operate Unmanned Aircraft, effectively stopping usage of UAS within the Kenyan airspace until such a time when new regulations were to be enacted.

Further, as Captain. Kibe[54] posits, after the nullification of the 2017 RPAs regulations, the first meeting by UAS Working Group was held on 11 September 2018, to provide a roadmap and strategy to the Cabinet Secretary for Transport, Infrastructure, Housing, Urban Development and Public Works, the Attorney General, and Parliament on how to expedite the UAS regulation. The roadmap took into account the views of Parliament such as enhancing security, privacy concerns, undertaking public participation in all counties, and adherence to the Statutory Instrument Act.[55]

By December 2019, KCAA had concluded the public participation exercise in compliance with the directive of Parliament by capturing concerns raised and conducting a workshop in Nairobi.[56] In April 2020, the process of redevelopment and public consultations on the Regulations culminated into the Cabinet Secretary for Transport, Infrastructure, Housing, Urban Development, and Public Works promulgating the Civil Aviation (Unmanned Aircraft Systems) Regulations,[57] 2020, through gazettement in the Kenya Gazette Supplement No. 34 Legislative Supplement No. 22, issued as Legal Notice 42 of 2020. This was in the exercise of the powers conferred to the office by Section 82 of the Civil Aviation Act No. 21 of 2013.

[54] This was an interview with Director-General KCAA that was conducted on 11 September 2018.
[55] Act No 23 of 2013.
[56] Authors' interview with Director-General during the Civil Aviation Safety and Security Oversight (CASSOA) 5th Symposium held Burundi on 27 -28 February 2020.
[57] Civil Aviation (Unmanned Aircraft Systems) Regulations Legal Notice No 42 of 2020 (hereinafter referred to as the 2020 UAS Regulations).

The 2020 UAS regulation regulates various UAS activities such as import, export, manufacture, assembly, and testing of UAS. It has five parts that regulate various aspects of certain operations of the UAS in Kenya. Part I addresses categorization of operation and registration of UAS. Part II provides for categorization of operation and registration of UAS. Part III provides for the operation of UAS. Part IV addresses issues of security. Part V focuses on miscellaneous issues. The substantive contents make provisions for several issues of safety and privacy to be discussed shortly after institutional framework.

4. Institutional Framework:

4.1 Organs, Structure and Key Functions of KCAA

The Civil Aviation Act establishes certain institutions responsible for implementation of provisions relating to regulation of UAS. Part III of the Act makes provision on duties of operators and concerned stakeholders in ensuring safety of persons on board. These safety and security concerns are implemented through enforcement of criminal sanctions, most of which are robustly described in Part V of the Act. The Act also creates a National Civil Aviation Administrative Review Tribunal to deal with grievances on licensing and ensure consumer protection.

Even more pivotal is the establishment of the KCAA. The Authority's main objective is efficient and economic planning, developing and managing civil aviation, and regulation and operation of safe civil aviation systems in Kenya. The institutional discussion of the authority and its nexus with the above objectives as set out in Section 6 of the Civil Aviation Act is discussed below.

KCAA is established under Section 7(1) of the Civil Aviation Act. The Board of Directors, established under Section 13 of the Act, governs the Authority. The KCAA

Board is composed of the following: The Chairperson, who is appointed by the President; the Director-General, appointed under Section 19 of the Act; Principal Secretary in the Ministry responsible for matters relating to civil aviation or his/ her representative; Principal Secretary to the National Treasury or his/her representative, Principal Secretary in the Ministry responsible for matters relating to internal security or his/her representative. Other members of the Board are persons, not being public officers, who are appointed by the Cabinet Secretary through a competitive process, and who are to be independent upon appointment and maintain such independence during their term of service on the Board. To ensure efficacy in the discharge of their mandates in relation to the safety, security and privacy issues, the additional persons are brought on board on account of their demonstrable expertise, professional knowledge and experience in accountancy, auditing and aviation law or business and management.[58]

In addition to the Board, KCAA discharges its mandate through the support of four directorates, three operational and one support, namely: aviation safety standards and regulations, air navigation services, East African School of Aviation and corporate services. The first three provide the services, which are core to the mandate of KCAA, while corporate services provides support services delivery. The directorates have departments, which though not a creation of the law, are designated for convenience in the day-to-day operations of civil aviation matters, and enforcement of the above explained mandate. The departments are critical in creation of assurance in the safety, security and privacy fronts for use of UAS.

The role of the Board, as is the case in South Africa, is policy formulation whereas the responsibility for the day-to-day running of the KCAA is bestowed upon the Director General of the Authority, who exercises all powers and discharge of all functions of the Authority with control over personnel and activities.[59] The other

[58] Civil Aviation Act, Section 7.
[59] Civil Aviation Act, Section 20.

general duties of the Board are outlined in the Act to include oversight of KCAA in financial matters such as remuneration and general administrative matters. It ensures that the safety and security of civil aviation, and UAS in general, is done in accordance with existing legislation.[60] The specific duties of KCAA are establishment, co-ordination and maintenance of State safety and security programmes, certification of aircraft operators, enforcement of approved technical standards of aircraft, licensing and monitoring of aeronautical personnel, provision of technical services for the design, installation, and modification of electronic, radio and other equipment used in the provision of air navigation services.[61] In execution of the mandates related to safety and security of aviation in Kenya, KCAA Board and Management work in conjunction with the National Civil Aviation Security Committee and Airport Security Committees.

The conduct of KCAA's duties is done within two broad mandates, which are oversight mandate and a mandate of enforcement. The oversight mandate includes ensuring integrity of the systems, equipment and facilities of the Authority, issuance and dissemination of publications referred to in the regulation, production of accurate, timely, comprehensive and relevant air transport information for planning and decision-making. The Authority is also responsible for approving, certification and licensing of aircraft maintenance organizations and regulation of aviation training institutions in Kenya. This is in addition to the establishment, management and operation of training institutions for purposes of the Authority, registration of rights and interests in aircraft, planning, development and formulation of the airspace master plan for safe and efficient utilization of the Kenyan airspace, establishment, co-ordination and maintenance of State aviation safety and security programme, licensing and certification of aerodromes, regulated agents and air navigation service providers.[62]

[60] Civil Aviation Act, Sections 15 and 16.
[61] Civil Aviation Act, Sections 15 and 16.
[62] Civil Aviation Act, Sections 15 and 16, Section 7(P-U).

The oversight mandate of KCAA, on the other hand, takes an economic perspective as it includes protecting consumer and environmental rights, and ensuring fair trading practices by giving effect to the Chicago Convention and other international agreements relating to civil aviation, to which Kenya is party; and performance of such other functions as may, from time to time, be conferred on it by the Cabinet Secretary or by any other written law.[63]

This double package of mandates evidently grants KCAA a full-fledged power to execute its legislative functions. KCAA has made steps to tailor-make its mandate and functions to achieve safety and efficiency. For instance, KCAA's consumer protection initiative is based on its commitment to provide a safe and efficient civil aviation environment that contributes to the achievement of Kenya's developmental objectives, as articulated in Kenya Vision 2030.[64] Despite the optimism, scholars like Waithera note possible challenges of lack of adequate funding as having a potential to compromise the achievement of this mandate.[65]

The listed modes of appointment to the KCAA Board confirms the position of Section 4(3) of the 2013 Act, as State agency, with the mandate to ensure safety, security and privacy concerns regarding aircrafts including UAS.[66] Should the government seriously consider the plans for privatization in future, it ought to follow the ICAO

[63] Civil Aviation Act, Sections 15 and 16, Section 7 (V-AA).

[64] The Aviation Consumer Protection Section of KCAA was established in 2004 with the objective to ensure that all Aviation Consumers obtain the best services and value from the service providers within the aviation industry. The section is also responsible for informing, educating and protecting consumers and thus ensuring services provided in the aviation industry are of the highest standards, comparable to that in other parts of the world and hence consumers are informed of their rights and responsibilities. See more information on https://www.kcaa.or.ke/about-us/consumer-protection (Date of use: 4 October 2020).

[64] The Kenya Vision 2030 was launched in 2008 by the President Mwami Kibaki aims to transform Kenya into a newly industrializing, middle-income country providing a high quality of life to all its citizens by 2030 in a clean and secure environment.

[65] Waithera EN *Factors Influencing Aviation Safety: The Case of Kenya Civil Aviation Authority* (Master of Arts thesis University of Nairobi 2015) 3.

[66] https://www.iata.org/en/pressroom/pr/2018-06-05-04/ (Date of use: 13 January 2020).

Privatization Policy, which Kesharwani notes has significant benefits once all the safeguards are met.[67]

As is correctly noted by Waithera, KCAA has, since its establishment in 2002, continued to implement its mandates. This is, however, not without challenges, chief among them being inadequate funding.[68] Be that as it may, KCAA is still recognized as playing a critical role of ensuring that an appropriate civil air transport framework is established and sustained as an enabler of air transport infrastructure.[69]

Further, and in order to overcome these challenges in discharge of its mandate, KCAA is undertaking various projects with the aim of delivering on its part to Kenya Vision 2030 national development blueprint that targets to making Kenya a middle-income nation by the year 2030. It is doing this through aligning organizational structure to strategy, recruitment, training and retention of competent staff, right-sizing and resourcing the organization appropriately, achieving international safety and security compliance, re-organization of the airspace and modernization of air traffic management systems.[70] In addition, KCAA is in the process of providing infrastructural development for aviation medical centre for aviation medical examination training, medical examiners for licensed medical doctors to conduct medical examination for medical fitness of pilots who are eligible for issuance of medical certificates as required under the current UAS 2020 Regulation second schedule r 20 (3) r. 1(c) & r 3.

[67]Kesharwani T "Privatization in the Provision of Airport and Navigation Services" https://www.icao.int/Meetings/AMC/MA/1999/aps/01_kesharwani.pdf (Date of use: 13 January 2017).

[68] Waithera *Influencing Aviation* 3.

[69] Kenya Civil Aviation Authority Strategic Plan 2012/13-2016/17, Page 6.

[70] Kenya Civil Aviation Authority Strategic Plan 2012/13-2016/17, Page 6.

As far as implementation is concerned, KCAA's mandates include licensing of air services, provision of air navigation services, establishment and maintenance of a system for the registration and marking of civil aircraft, securing sound development of the civil aviation industry in Kenya, advising the government on matters concerning civil aviation, and co-ordination and direction of search and rescue services. KCAA is mandated to facilitate and provide necessary support for aircraft accident and incident investigations conducted by the Chief Investigator, carrying out investigations on incidents that are not classified as accidents and serious incidents, the safety, security, economic and technical regulation of civil aviation and dealing with incidents of unlawful interference with aviation security.[71]

4.2 Partnership with ICAO

Under section 8(2) (d) of the Civil Aviation Act, the KCAA is mandated to enter into partnerships with any person, agency or authority within and outside Kenya for the purposes of achieving its objectives and delivering on its mandates. Pursuant to this provision, KCAA has partnered with ICAO with a view to addressing safety and security issues arising from the civil aviation management. Consequently, KCAA staff have been active participants in the ICAO meetings on regional aviation safety.[72]

The partnership extends to training at the East Africa School of Aviation (EASA) that has its curriculum addressing safety and security issues in civil aviation operations. ICAO uses the school directorate of KCAA as centres for excellence worldwide. It is one in less than ten across the world. EASA has the following training departments; aviation business management, aviation safety and security, air navigation, services maintenance and curriculum development unit.[73] The school is also the training wing

[71] Civil Aviation Act, Section 7 (a-k).
[72] See ICAO "Report of the Fourth Meeting of the Regional Aviation Safety Group for Africa-Indian Ocean" (Nairobi 12-13 October 2017) 1-32.
[73] East Africa School of Aviation "East Africa School of Aviation-ICAO Regional Training Centre of Excellence" easa.ac.ke (Date of use: 18 September 2018).

of KCAA as an Approved Training Organization. Other institutions are the, ICAO Aviation Security Training Centre and the Government Safety Inspector Training Centre that is endorsed by ICAO, and accredits the school, both as an institution and its curriculum.[74]

4.3 KCAA and Regional Cooperation

KCAA is an active player in the development of the regional efforts for regulation of safety and security aspects of civil aviation at the East African Community level. It cooperates with the East Africa Civil Aviation Safety and Security Oversight Agency (CASSOA). At the sub-regional level, is the EAC Air Transport Facilitation Committee to oversee the harmonization of national laws of EAC Partner States towards reflecting the ICAO Annex 17 on Aviation Security and Annex 19 on Safety.[75] Going by statistics, the CASSOA is ranked as a higher performer in oversight of safety issues in the world and only comes second to the European counterpart organization.[76]

Other than in EAC, KCAA has made significant strides in the aviation security through partnerships with other aviation stakeholders. For example, it partners with IATA through the latter's safety and security programmes. Kenya is a partner to the IATA Secure Freight Pilot Program, which aims at security of flights and cargo.[77] KCAA, through EASA, partners in training with International Air Transport Association (IATA), the institution that provides training associated with airlines.

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[74] KCAA "About EASA" https://www.kcaa.or.ke/easa/about-easa> (Date of use: 11 September 2020).
[75] Makau H "Best Practices to Enhance Cooperation and Collaboration between Aviation Security and Customs" in *Enhancing Air Cargo Security and Facilitation* (Paper presented to the ICAO-WCO Joint Conference 16-17 April 2014 Manama Bahrain)1-10.
[76] CASSOA "Aviation Safety: A Collaborative Approach" in *Symposium Report* (Paper Presented in the 4th EAC Aviation Symposium 1-2 February 2018 in Crowne Plaza Nairobi) 5.
[77] Makau H "Cooperation" 5.

The next part of this chapter trains its focus on substantive issues of safety, security and privacy in use of UAS as identified in chapter Two of this thesis, and how they are redressed under the Kenyan policy and legal framework.

5. Response to Safety, Security and Privacy Challenges in UAS Operations

5.1 Kenya's Response to Aviation Safety in UAS Operations

It shall be recalled that safety challenges principally arise from the design of UAS regarding the sense and avoid technology. Safety of aircraft has been a key legislative regulatory issue since the development of the KCAA Aviation Policy. The Policy made further safety assurances by requiring any person operating or controlling UAS operations to undergo training and familiarize with relevant rules and procedures applicable within any airspace through which the aircraft may be flown.[78]

Further, the Policy required that any UAS be operated in a manner that minimizes hazards to persons, property or other aircraft and in accordance with conditions specified by the Authority from time to time.[79] Such rules would be critical to ensure that operating an UAS in civilian airspace is controlled to limit danger to civil aircraft in accordance with the Civil Aviation (Rules of the Air) Regulations and the UAS Regulations.

Under the Civil Aviation Act, it is clear that the mandate of the KCAA includes establishing, coordinating and enhancing State Safety Programmes. Part III of the Act generally lays prohibitions of all persons from engaging in acts that imperil safety of the aircraft. This provision was implemented through criminal sanctions of a fine to the tune of two million shillings.[80] Under section 20 of the Act, the Director General

[78] The 2017 RPAs Regulations, Regulation 29. Also see the annulled aviation policy
[79] 2020 UAS Regulations, Regulation 54.
[80] Civil Aviation Act, Section 46(1)-(2).

was to audit the performance of the State Safety Programmes and hold executives accountable to such programmes. Section 10 of the Civil Aviation (Amendment) Act, 2016 amended the Section 20 of the 2013 Act to introduce the power of the Director to establish a safety oversight system and to prohibit flights in unsafe conditions.[81]

Additionally, the regulation of aviation trainings had underpinnings of safety. The Civil Aviation Act imposes an obligation on KCAA to approve, licence and certify training institutions.[82] The Director General is mandated to establish schools to offer training in the aviation industry.[83] The Authority has come up with the Civil Aviation (Approved Training Organizations) Regulations,[84] 2013 that govern the application, issuance, renewal, suspension and revocation of licences and certificates to the Approved Training Organizations. A review of the criteria for training institutions, which is Appendix 18 of the National Safety Programme, shows that authorizations of government agencies and other safety agencies must be obtained. Besides EASA, other licenced training institutions that consider safety as a key aspect of their training programmes are the Kenya School of Flying, Moi University School of Aerospace and Sciences, Think Aviation Training, Nairobi Flight Training, Mombasa Aviation Training Institute, Valentine Air Services, Ninety-Nine Flying School and KQ Pride Centre.

Under the 2020 UAS Regulations, safety of UAS use and operation is a key consideration in registration and licensing of UAS in Kenya.[85] This explains why categorization of the UAS is the basis of licensing due to safety risks posed by operations of the UAS.[86] Any amendment to the Remote Aircraft Operators Certificate can only be approved, if it is necessary, for the safety of commercial operations of the UAS. It is a general requirement for operation of UAS that requests

[81] Civil Aviation (Amendment) Act, Sections 10(b) and (c).
[82] Civil Aviation Act 2013, Section 3B (q).
[83] Civil Aviation Act, Section 5A(2)(v).
[84] Civil Aviation (Approved Training Organizations) Regulations of 2013.
[85] 2020 UAS Regulations, Regulation 4(c).
[86] 2020 UAS Regulations, Regulation 5.

for authorization to include aeronautical safety communications frequencies equipment.[87] Safety is also considered when KCAA considers and takes the decision for cancellation, revocation, or variation of such authorizations.[88]

The 2020 UAS Regulations offer myriad assurances of safety in all the operations provided in its scope. For instance, it is incumbent upon operators and owners to ensure that the remote piloted aircraft system is airworthy.[89] This means that all the UAS operating in the Kenyan airspace are required to meet the standards of safe operation depending on type and design. This goal is achieved by providing an additional general obligation on owners and operators to operational control and safety of operations as well as compliance with the request for information by KCAA, which include issuing certificate of aircraft's airworthiness, licences, authorization certificates, operations speeds, and capabilities such as communication, frequency and sense and avoid systems.[90]

The provision of sense and avoid systems set out above represents a notable improvement in the 2020 UAS Regulations as they were not provided under the annulled 2017 RPAs Regulations. Despite this effort, challenges still persist as the regulation refers to adherence to rules of air mainly applicable to manned aircraft In appreciating the fact that not all UAS have capability to detect and avoid other aircraft, the regulation provides for remote pilots to maintain awareness so as to see and avoid other aircraft and yield the right of way to all aircraft and vehicle, which may not be practical in some incidences where UAS fly beyond sight of the operator. The challenge is exacerbated by challenges arising from lack of unmanned traffic management (UTM) system that could help collision avoidance with capability to detect where command and control centre of UAS operation are located,[91] the

[87] 2020 UAS Regulations, Regulation 23(2)(l).
[88] 2020 UAS Regulations, Regulation 22(1)(a).
[89] 2020 UAS Regulations, Regulation 12.
[90] 2020 UAS Regulations, Regulations 23 (1)(a) and (d).
[91] Jeaneret C and Rambaldi G *Drone governance: a scan of policies, laws and regulations governing the use of unmanned aerial vehicles (UAVs) in 79 countries* (CTA 2016) 14.

communication link enhances both safety and security of the airspaces by way of interception of unauthorised intrusion of UAS.

Despite the challenges regarding sense and avoid systems, it is not lost that the obligation on operators demonstrates an approach the KCAA is starting at the lowest level of compliance, which is with the operators and owners whose safety considerations are supposed to complement its requirements when exercising the oversight mandate. The general compliance ensures that there is reduction of accidents and collisions with other UAS as well as manned aircrafts.

In order to practically achieve these safety concerns, the 2020 UAS Regulations impose certain limitations on safe operations of UAS. For instance, Regulation 24 provides the vertical height limit of operation of UAS. Specifically, it prohibits the operation of UAS 400 feet above ground level or at night and must be fitted with cameras and operate with Visual Meteorological Conditions. The Regulation also requires that the distance from other vessels, buildings, trees in lateral and vertical distances must not fall below 50 metres. This provision imposes reasonable care on UAS operators to ensure safety of road users and pedestrians. The Air Navigation Service Providers are mandated to provide for procedures that ensure integration of UAS as regards aviation safety.[92] The KCAA has mandate to impose further operating restrictions on UAS in the interest of safety.[93] These restrictions were evidently geared to preventing accidents that can be caused by collisions with things borne of nature.

During their operations, the operators of UAS are obligated to use sight to ensure they avoid collisions with other aircrafts and must at all times yield the right of way.[94] This rule guides how the UAS integrates into the civil aviation airspaces in relation

[92] 2020 UAS Regulations, Regulation 36(2).
[93] 2020 UAS Regulations, Regulation 38(1)(a).
[94] 2020 UAS Regulations, Regulation 31(1).

to other manned aircrafts and is based on the rationale that their way can be easily diverted by the pilot in command with comparative ease when compared with that of manned aircrafts. The pilots too, through the UAS owners and operators, are obligated, apart from medical compliance, to ensure that they do not consume alcohol or psychoactive substances less than 8 hours prior to reporting on duty.[95] In additions, the pilot must have UAS system pilot certificate issued pursuant to Regulation 19.

In an apparent realization of the inevitability of accidents even with strict adherence to the above set, out safety means, the Regulations make provisions on obligations during the happening or after the occurrence of an accident relating to UAS. The Regulations envisage use of emergency procedures, command and control, and air traffic control communication by operators of the UAS.[96] A challenge that may don the achievement of this requirement is that, Kenya has not yet established a command and control system (CCS), which is a necessary element in integration of the UAS into the national civil airspace. CCS is a technological system used by security agencies to ensure that UAS flying in the national airspace of the country are identified immediately they enter the country's national airspace.[97] The technology is important for Kenya to ensure that her airspace is safe from acts of unlawful interference to civil aviation.

The operations on aerodromes are regulated restrictively by KCAA.[98] Should accidents happen, there arises an obligation to report the same to KCAA so as to aid the investigations carried out by the Authority.[99] Another reactive approach is through provision of insurance. The current framework for regulation of UAS at Regulation 40 addresses issues of insurance against third party injuries. Regulation 40(4) appears to provide some exemption, by providing that KCAA may dispense

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[95] 2020 UAS Regulations, Regulation 44.
[96] 2020 UAS Regulations, Regulations 23(2)(n), 35(1) & 36.
[97] Jeaneret C and Rambaldi G *Drone governance* 14.
[98] 2020 UAS Regulations, Regulation 26.
[99] 2020 UAS Regulations, Regulation 25(1).

with the requirement for insurance depending on the category of UAS, meaning small UAS may operate without comprehensive insurance. Insurance protection is important, otherwise non-observance of liability means other aircraft, persons and property on the ground are exposed to unnecessary danger linked to lack of third-party claims and compensation by insurance companies.

The safety requirements permeate the organizational arrangements for commercial operators of UAS. For example, in terms of staffing, a commercial UAS operator is required to have an accountable manager responsible for its SMS.[100] Such a system is an approach to managing safety of UAS use and operation, through organizational structures, policies, and procedures.[101] In developing the system, the regulations address adequacy issues by requiring certificate holders to design the system in a manner, that commensurate with the size and complexity of their operations.[102] The Regulations are definitive as stipulates the standards of an effective safety management system. For instance, such a system must identify actual and potential safety hazards, develop remedial actions and mechanisms for continuous assessment of its appropriateness.[103]

The Regulations also have provisions for training of persons undertaking private UAS operations only through authorized training centers.[104] In an apparent recognition of risks that result in the operation of commercial UAS, the Regulations provide additional requirements for training of the pilots of UAS for commercial use.[105] For commercial operators, they are required to comply with additional requirements of the Remote Aircraft Operators Certificate (ROC) including adequate staffing, ownership and safety requirements.[106] Generally, training as provided for under Regulation 21 of 2020 UAS Regulation is expected to equip one with the

[100] 2020 UAS Regulations, Regulation 38.
[101] 2020 UAS Regulations, Regulation 2.
[102] 2020 UAS Regulations, Regulation 19.
[103] 2020 UAS Regulations, Regulation 2.
[104] 2020 UAS Regulations, Regulation 21(1).
[105] 2020 UAS Regulations, Regulation 45.
[106] 2020 UAS Regulations, Regulation 14(1)-(3).

competencies for award of the remote pilot certificate. An applicant for a remote pilot certificate under Regulation 20(1) of the 2020 UAS Regulations must demonstrate a level of knowledge appropriate to privileges granted to such holder, in the following disciplines: air law, UAS general knowledge, flight performance, planning and loading, human performance, meteorology, navigation, operational procedures, and principles of flight related to UAS and radiotelephony. In addition, he or she must pass a skills test to demonstrate ability and competency to perform as a remote pilot of the specific UAS category and associated UAS, the relevant procedures and manoeuvres appropriate to the privileges granted.[107]

Overall, KCAA is responsible for the implementation of the safety provisions and requirements. It reserves the power to conduct surveillance and inspections to ensure compliance accountability. The provisions of the Act are implemented through offences and general penalties fines not exceeding one million shillings for each offence or to imprisonment for a term not exceeding one year, or to both.[108]

5.2 Kenya's Response to Aviation Security in UAS Operations

As discussed in chapter Two of this thesis, security concerns principally arise from the threats of national interference caused by the traffic management and command control challenges. In response to this challenge, the KCAA developed an Aviation Policy in relation to UAS. Kenya's Aviation Policy was designed to promote and facilitate civil aviation by ensuring provision of an effective regulatory framework for UAS operations throughout the country. Its main objective being to support operation of UAS in a safe, secure, harmonized and seamless environment equal to manned operations.[109] However, just as the 2017 RPAs Regulation, the Policy suffered the fate of suspension by Parliament. Parliament recommended that until the questions raised on security, public participation, and privacy were addressed,

[107] 2020 UAS Regulations, Regulation 20(1) as read with the Second Schedule the Regulations.
[108] 2020 UAS Regulations, Regulation 51(2).
[109] Republic of Kenya Policy on Remotely Piloted Aircraft Systems of 2017, Page 1.

the Policy remained suspended. In the analysis of the researcher, a Policy is an internal KCAA document and not a law made by Parliament, hence Parliament had no *locus* to nullify it, such action was therefore, *null and void ab initio and ultra vires*.

Despite this uncertainty, certain perspectives are derivable from the Policy. Discussion of these glimpses is necessary since the adopted Regulation did not deviate so much from the Policy. Overall, Kenya's Policy on UAS was consistent with the country's proposed legislation framework, which provides, *inter alia,* that all persons, institutions or entities with intent to import, test, operate, procure, manufacture or assemble UAS must apply for authorization from the KCAA as provided under the then 2017 RPAs Regulations.[110] The authorization could only be subject to prerequisites of security clearance and approval by the relevant ministry.[111] Evidently, the focus of the authorization was on maximization of security in the use of UAS.

Further security measures were placed in the Policy with a requirement of approval from the Department of Defense headquarters, including UAS for civil use. The purpose of the involvement of the Ministry of Defence is to ensure that there are background checks on owners of the UAS. This condition could obviously prove difficult for private applicants seeking registration of UAS as the facility is a restricted area where civilian visitors are subjected to stringent security clearance before placing their requests.[112] From this analysis, the provision appeared to be a policy and administrative problem invented by government officials within military circles for fear of the insecurity that UAS could pose in the national airspace if they were allowed lenient approval status.

[110] 2017 RPAs Regulations, Regulation 6 (2).
[111] 2017 RPAs Regulations, Regulation 6 (2).
[112] See Wanjala R 'Drones in Kenya" 2015 *KJLJ-JBSD* 62-78.

Regarding exports and general removal of UAS out of the country, the Policy proposed prohibition of any Kenyan registered UAS from being taken out of the country without authorization by KCAA. All UAS are expected to have adequate security to protect the system from unauthorized modification, interference, corruption or control/command action.[113] In other words, UAS were to operate strictly in accordance with rules governing the flight of manned aircraft and meet infrastructure requirements applicable to the class of airspace, within which they intend to operate, save for where KCAA provides otherwise.

The analysis of the Policy inevitably leads to the conclusion that it placed more prominence on regulation of imports and exports, more than on the actual operations of the UAS in the country. Accordingly, the stringent measures and obstacles that it introduced to deter applicants or importers did not, and still does not, in any way address the central problem of UAS operation. What follows is illegal importation of UAS and unauthorised use. The possible consequences are that Kenya could experience an influx of unlicensed UAS operating in her airspace. Moreover, the Department of Defence does not have clearly outlined procedure of vetting applicants. Lack of such procedures may be ground for possible arbitrary action. The arbitrariness may be exacerbated by lack of coordinated databases between authorities dealing with crime and criminal investigations and the Ministry of Defence. Once the Policy comes back to life, stakeholders can take opportunity and ensure it is synchronised with the yet to be established National Security Policy and the National Security Strategy on UAS. Specifically, they should, at the earliest opportunity, ensure that the security Policy on UAS has convergence with the civil aviation policy on UAS to avoid conflict of polices and eliminate any *lacuna* in law relating to operation of UAS in Kenya.

[113] Republic of Kenya Policy on Remotely Piloted Aircraft Systems of 2017, Page 1.

Currently, under the principal legislation, is clear that the mandate of the KCAA expressly recognized under Section 7(1) (j) of the Civil Aviation Act includes dealing with incidents of unlawful interference and ensuring aviation security.

With regard to the regulatory support to the principal statute, it is noted that prior to the development of the 2020 UAS Regulations, general security issues in civil aviation were dealt with under the Civil Aviation (Security) Regulations of 2015 as amended in 2020, which set of Regulations was undergoing review at the time of writing this thesis.[114] Specifically, Part III of the Regulations imposed obligations on aircraft operators to develop security programmes and security training programmes. These programmes would be aligned to the National Civil Aviation Programme developed by KCAA.[115] Further, Regulation 35 provided that the responsibility for security rested with the operator who was under an obligation to ensure that its staff and personnel are trained, aware of and comply with the National Civil Aviation Security Programme. Additionally, Regulation 47 recognized the enforcement power of the KCAA in preventing acts of unlawful interference in respect of aircrafts when the Authority acts are based on reliable information.

The 2020 UAS Regulations have established a raft of UAS specific security measures. For instance, the Regulations provide that only adult Kenyan citizens or residents or persons, and both levels of government have capacity to own UAS.[116] This means that anonymous ownership that may compromise the security of the country is not allowed.[117] For non-nationals, it is the residence of that particular person at the time of application that matter, it means that the person's stay in Kenya musts be authorized under any written law. The change of ownership amongst the permissible groups must be notified to KCAA. KCAA is required to approve importation and exportation of UAS through issuance of permits.[118] This too is an

[114] Civil Aviation (Security) Regulations of 2015 as amended in 2020
[115] Civil Aviation (Security) Regulations of 2015, Regulations 9, 10, 13, 14, 21 and 22.
[116] 2020 UAS Regulations, Regulation 6. (1), (b)- (c). and 3.
[117] 2020 UAS Regulations, Regulation 6. (1) (a).
[118] 2020 UAS Regulations, Regulation 7(2).

opportunity to weed out visible circumstances of imports that are used for espionage.

Under Regulation 8, UAS manufacture must obtain prior authorization with additional requirement for security clearance. Although the Regulations are not express on how the clearance should be done, it is expected that the NIS, which is the disciplined civilian intelligence agency under the Constitution of Kenya 2010,[119] would do the clearance.

Apart from permit and approval systems for manufacture and imports export, security assurance is provided for through requirement of prior registration for operation or ownership of the UAS. For prior registrations issued by KCAA, the Authority considers security clearance similar to that of the manufacturing processes.[120] Regulation 43 mandates the holders of the remote aircrafts operator's certificate to complement KCAA's mandate of conducting of background checks, checks on criminal records of its personnel, develop interference detection systems, and protect integrity of their UAS. Further, they are mandated to train personnel and designate a coordinator responsible for security issues.[121]

The registration is not final and a registration status may be changed by KCAA for reasons known to the law pursuant to the provision of Regulation 10. This Regulation offers an avenue for the consideration of provision of other legislations, already set out in the discussion on domestic framework above that aims at safeguarding national security interests to deregister UAS when it compromises the security of Kenya.

[119] See Constitution of Kenya, 2020, Article 242 on the role of NIS
[120] 2020 UAS Regulations, Regulations 8(1) and (2).
[121] 2020 UAS Regulations, Regulation 43(a)-(h).

Apart from the security approvals provided in dealing applications under the Regulations, there are additional security requirements for operators to have security procedures.[122] The procedures must be developed in accordance with the Civil Aviation (Security) Regulations, 2013 (now under review) requirements set by KCAA.[123] Specifically, they must show the practice to be taken to avoid interference. Compliance with the procedures is to be boosted with security surveillance by KCAA that target avoidance of unauthorized use and unlawful interference.[124]

5.3 Kenya's Response to Privacy Challenges Associated by Operations of UAS.

It shall be recalled that the privacy concerns of UAS arise from their ability to flow close to buildings, properties and homes. Kenya addressed its mind to this challenge in its Aviation Policy, which was advanced in the protection of the right to privacy. The Policy required that operations of UAS be such that they do not cause an infringement on privacy of individuals or entities.[125] The protection of the right to privacy, however, birthed a huge gap since the Policy, excluded issues pertaining to State aircraft, unmanned free balloons or airships, and operations in which more than one UAS are managed by a remote pilot station at the same time.[126] Under the Policy, in the interest of aviation safety, authorization given for operation of UAS may be withdrawn or cancelled.[127]

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[122] 2020 UAS Regulations, Regulation 45.
[123] 2020 UAS Regulations, Regulation 45.
[124] 2020 UAS Regulations, Regulation 47.
[125] See Constitution of Kenya, 2010, Article 31 on right to privacy and safeguard. The policy and regulation should therefore provide that any person conducting operations using UAS fitted with cameras shall operate them in a responsible way to respect the privacy of other persons and their property as outline in the Constitution.
[126] Republic of Kenya Policy on Remotely Piloted Aircraft Systems of 2017.
[127] Republic of Kenya Policy on Remotely Piloted Aircraft Systems of 2017. Also see the aviation policy on authorization

The Constitution of Kenya, 2010 is the principal law on the protection to right to privacy. Article 31 of the Constitution, provides that:

> "Every person has the right to privacy, which includes the right not to have, their person, home or property searched, their possessions seized, information relating to their family or private affairs unnecessarily required or revealed or the privacy of their communications infringed."[128]

Unlike the case with safety and security as set out above, the Civil Aviation Act did not make specific provision on how the respect to this right ought to converge with operation of UAS. The Civil Aviation (Amendment) Act did not remedy the situation either. It was only until the 2020 UAS Regulations were developed that the privacy provision was made regarding regulation of UAS operations in the Kenyan airspace. Regulation 53 of the 2017 RPAs Regulations had provisions on privacy of persons and property.[129] It provided a general provision requiring any person conducting operations using remotely piloted aircraft system fitted with cameras to operate them in a responsible manner, and in a way as to respect the privacy of other persons and their property. Under the defunct Regulations, surveillance was required to be with the consent of the person or owners of property unless the same was for newsgathering. In respect of privacy protection, imaging technology fitted on the UAS should be used for investigations, research, and no other purposes that can breach privacy.

The UAS 2020 Regulations make provisions for the protection of privacy rights on various activities related to UAS. Specifically, the Regulations prohibit equipping a UAS system with an imaging device to conduct surveillance.[130] Any use of such a system for taking images of persons must be done with written consent of the person.[131] The same prohibition extends to use of such imaging device to record an

[128] Privacy International https://privacyinternational.org/state-privacy/1005/state-privacy-kenya (Date of use: 29 September 2019).
[129] 2017 RPAs Regulations, Regulation 54(1).
[130] 2020 UAS Regulations, Regulation 41.
[131] 2020 UAS Regulations, Regulation 41.

image of a privately owned or leased real property or such owner, licensee, invitee with intent to conduct surveillance.[132]

The Regulations resolve the difficulty of testing intention by setting the standard of a reasonable expectation of privacy upon the operators of UAS. Such a reasonable expectation arises where a person or property is not observable by a person located at the ground level in a place where they have a legal right to be.[133] The Regulations also recognize instances of exception to the general protection of the reasonable expectation of privacy. These instances include mapping and evaluation of the earth's surface, investigations of forests, Search and Rescue, and investigation of vegetation or wildlife.[134] There is a rider, however, that each of the exemptions can only be exercised with prior approval of KCAA.[135] Authors such as Nader *et al* imply that these scanty provisions on privacy in respect of UAS regulation is still suspect owing to the recent technological changes.[136] It seems to be a carry-over of concerns arising from the annulment of the 2017 Regulations. It, therefore, misses the ideal situation where, the focus is that the safety, security and privacy should be addressed in a balanced manner, which does not compromise any one aspect.[137]

As for its implementation, there still exists scepticism regarding the impact of the use of UAS on privacy. This particularly arises from the Kenyan legal and legislative history in respect of rights. Privacy International that shed more light on this issue has noted the Kenyan trend that is increasingly giving a chance for conduct of surveillances that have real potential to further limit the right to privacy.[138] The organization attributes the trend to the coming into force of the National Intelligence

[132] 2020 UAS Regulations, Regulation 41(2).
[133] 2020 UAS Regulations, Regulation 41(3).
[134] 2020 UAS Regulations, Regulations.41 (4) (a)-(d).
[135] 2020 UAS Regulations, Regulation 42(4).
[136] See 2017 RPAs Regulations, Regulations 47, 48 and 49 on security provisions and Regulation 53 on privacy.
[137] See Nader M *et al* "Unmanned aerial vehicles applications in future smart cities" 2020 *TFSC* 1-17.
[138] Privacy International https://privacyinternational.org/state-privacy/1005/state-privacy-kenya (Date of use: 29 September 2019).

Service Act,[139] the National Security Council Act, Cap. 206 (Act No. 23 of 2012); and the Prevention of Terrorism Act, No. 30 of 2012. The NIS Act allows the NIS to limit privacy in the course of its investigations and monitoring activities.[140] The Prevention of Terrorism Act (POTA) on the other hand provides the authorities with wide powers to limit the right. For instance, it provides that the right can be limited in cases of investigations into terrorist acts, detection and prevention of terrorism.[141]

The challenges in practice were evidenced more recently when Parliament, in what was witnessed a chaotic process, passed the Security Laws (Amendment) Act in 2014.[142] The Act grants powers to national security organs to intercept communications, which powers have an effect of limiting the right to privacy, as guaranteed under the Constitution of Kenya. As a countermeasure, constitutional courts are always open to strike down any infringement of privacy rights as protected under Article 31 of the Constitution of Kenya 2010.

Even more worrying is the refrain by the Civil Aviation (Unmanned Aircraft Systems) Regulations, 2020 from making positive obligations regarding protection of the right to privacy. The provisions on respecting right to privacy are too general and may be the origin of poor implementation when stakeholders start interacting with the law.

The limitations, are however, cured by the robust provision on data protection provided through the Data Protection Act[143]. Since the Act is clear on the obligation of collectors of personal data including such issues as disclosure, it provides a good tool for privacy reassurance with respect to current technological advancements pending promulgation of the UAS Regulations. Another positive development to the protection of privacy is development of the Computer Misuse and Cybercrimes

[139] National Intelligence Service Act 28 of 2012.
[140] National Intelligence Service Act 28 of 2012, Section 6.
[141] Prevention of Terrorism Act 30 of 2012, Section 35.
[142] Security Laws (Amendment) Act 19 of 2014.
[143] Data Protection Act 24 of 2019.

Act.[144] This Act has set out certain constitutional objectives, at Section 3 that are geared towards achieving, among others respect for the right to privacy. It provides for offences against the integrity, confidentiality, and availability of data, computer-related and content-related offences that may impact negatively on the privacy of data in the computer systems and networks. These bodies of laws protect citizenry rights to ensure that information relating to their families or private affairs are not unnecessarily required or revealed and complement the existing framework under the 2020 UAS Regulations.

5.4 Implementation of the Response Mechanisms

Generally, the Regulations are implemented through criminal sanctions. Failure to comply with the directions under the Regulations attracts a fine not exceeding one million shillings for each offence or to imprisonment for a term not exceeding three years, or to both. Contravention of the provisions of the Third Schedule attracts fines in millions of shillings and imprisonment terms, or both.[145] The general penalty provided for under the Regulations is a fine not exceeding two million shillings or an imprisonment term not exceeding three years or both. In my view, however, the fines may not be effective in deterring commission of crimes by the owners or operations of UAS that are engaged in large commercial enterprises who may end up paying the fine without much difficulty despite not being proportionate to the extent of harm caused. However, this view is theoretical since no such instance has manifested itself in the Kenyan jurisdiction. Additionally, the oversight role of KCAA and CASSOA and the Kenyan courts is also pivotal in the implementation of the provisions set out under this chapter.

[144] Computer Misuse and Cybercrimes Act 5 of 2018.
[145] 2020 UAS Regulations, Regulation 51.

6. Other UAS Integration Challenges

6.1 Institutional and Operational Challenges of UAS Integration

Whereas Kenya has made tremendous progress towards regulating UAS through promulgation of regulations and active participation at the international level, this has not been without challenges. Kenya's policy and regulatory framework related to UAS have been in existence for a short time compared to the United States and South Africa.

KCAA is the sole Authority or institution with oversight mandate over aviation matters. The Board of Directors is constituted under the Act to complement and implement the process of integrating UAS into civilian airspace. But since the Board does not work on full-time basis, the technical civil aviation functions are handled by a Director-General and his/her technical staff. The import of section 10(3) of the Civil Aviation Act is that the Director General of KCAA retains wide powers in respect of oversight, safety and security, while carrying out administrative functions of the institution. Indeed, the section also explains that the Director General is at the core of the creation, operationalization and implementation, and monitoring of the safety oversight system. The system has much wider roles including licensing, development of technical guidance, surveillance and resolution of safety concerns.

Despite the expansive roles that relate to the UAS, KCAA has six staff members who are currently stationed in an established office, specifically dedicated for registration of UAS.[146] Their prime challenge at the time of this research is lack of capacity to undertake registration of the UAS. Secondly, by May 2020, KCAA had not made progress concerning integration of UAS into civil aviation. There is need, therefore, for concerted in awareness efforts or campaign to be undertaken with a view of ensuring that the UAS in possession of the public are registered. It should concern everyone that the pace at which the regulation is being implemented

[146] Author's interview with the Director General KCAA on 11 September 2018.

compromises the safety of users, stakeholders, operators of UAS, UAS operations and manned aircraft in general.

6.2 Inadequate County Governments' Involvement

The Constitution of Kenya, 2010 establishes 47 County Governments, which are listed in the First Schedule of the Constitution. The Fourth Schedule of the Constitution recognizes transport and communication as a mandate of the National Government. No such mandate is granted to the 47 devolved units. The legal framework too does not apportion any clear role and responsibility to the county governments with regard to UAS operation oversight, the reason being aviation is not a devolved function. This phenomenon is exacerbated by inadequate enforcement machinery, as KCAA is yet to benefit substantially from the capacity of the devolved units. Accordingly, KCAA has not been able to factor into 2020 UAS regulation Community Based Organization for self-regulation as is the case with the US.

There is recognition that the devolved units ought to play a role. For instance, Parliament, courtesy of the Hansard dated 26 June 2018, clarifies the need for involvement of county governments, citing lack of stakeholder participation in all counties while annulling the established 2017 UAS Regulations,[147] despite the fact that most UAS activities occur in areas under the jurisdiction of the devolved units or county governments. These sentiments by Parliament resonate with the provisions of Part 2 of the Fourth Schedule of the Constitution, which mandates the county governments to be at the forefront in organizing communities for participation at various levels of governance.

[147] Constitution of Kenya, 2010, Article 118. The provision facilitates public participation and involvement in the legislative and other business of Parliament and its committee. Also see Article 189 which calls for cooperation between national and county Governments.

6.3 Insufficient framework for Public Participation in UAS Regulation

That public access and participation that is a requirement as per Article 118 of the Kenya Constitution is perhaps the clearest testimony that citizens in rural areas, who are likely to be affected by operations of UAS, must be given a chance to give their views with regard to legislation of UAS regulations. The Constitution places public participation as a Constitutional principle of good governance.[148] This is incorporated and further elaborated in statutes[149] as well as case laws in Kenya.[150] It would appear that involvement in cases concerning the aviation sector would be by way of availing them to create an opportunity to air their opinion or present the same by way of memorandum.[151] It is expected that if members of the public were involved, they would air their views on matters to do with fees they are levied regarding registration and operation of UAS, which include reporting authorised operations.

The intent and purpose of the participation is both to fulfil the Constitutional requirements as well as to ensure that KCAA develops a document that captures the aspirations of stakeholders such as the public, military, police, aviation operators, manufactures, policy makers, intuitions of higher learning among others.

A review of the Civil Aviation Act of 2013 as amended in 2016, reveals tardiness in substantive provisions for public participation. While this thesis appreciates that Kenya has an elaborate, albeit inadequate, framework for public participation,[152] the analysis projects that having such substantive provision would be necessary given the unique positioning of civil aviation and most importantly the use and operation of UAS. As such, even the practice does not evidence realization of the full potential of consultation of communities especially in designing the rescue missions and

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[148] Constitution of Kenya, 2010, Article 10(2) (b).
[149] See Statutory Instruments Act 23 of 2013.
[150] See *Robert N Gakuru & another v Governor Kiambu County & 3 others* [2013] eKLR.
[151] https://www.afrocave.com/public-participation-kenya/ (Date of use: 4 November 2019).
[152] See Mwenda AN *et al* "Trends in consultation and public participation within environmental impact assessment in Kenya" 2012 *IAPA* 130-135.

accident management and response. The lack of such enthusiasm within civil aviation led to the annulment of the 2017 RPAs Regulations.

It is instructive to note that Parliament cited non-compliance with provisions of the Statutory Instruments Act, No. 23 of 2013, which is the statute that creates the basis for public participation in the promulgation of statutory instruments such as UAS Regulations.

7. Conclusion

Kenya has actual and potential civil uses of UAS. It has robust legal, policy, and institutional framework for the civil aviation. In recognition of safety, security and privacy concerns related to aviation, research has established that Kenya has made significant legislative efforts to integrate UAS into the civilian aviation airspace through adoption of the Civil Aviation Act and the amendments in the Civil Aviation (Amendment) Act and a myriad of other Regulations. The legislative and institutional frameworks form the basis for domestication consequential compliance with international standards of civil aviation established under the Chicago Convention and further elaborated by frameworks developed under the auspices of ICAO.

Secondly, the establishment of the Kenyan institutional framework, coordinated by the KCAA, is an important milestone. Institutionally, KCAA has responded positively in terms of addressing the general civil aviation safety and security through provision of legislative rules and policy formulations. Although the larger fabric of the regulatory framework is not specifically dedicated to UAS operations, they govern the day-to-day the aviation in Kenyan airspace. Previous lack of UAS-specific framework had a major setback in the achievement of the full potential of aviation safety and security, and at the same time adhering to safeguards of right to privacy as identified in chapter Two of this thesis, The chapter has credited the KCAA for showing great interest in regulation of UAS through the RPAs 2017 Regulations, though as noted above, the credit suffered a major setback when the interest expressed through gazettement of the Regulations was shot down in Parliament in June 2018. The chapter concludes that the events of 2017 challenged the achievement of Kenya's roadmap for integration of UAS into the civil airspace. This created a catch-22 situation, in which Kenya, for several years did not have UAS regulation in place, to check the increasing number of UAS in her airspace.[153] Evidently, the lack of regulations spilled over to posing threats to safety and security, coupled with actual violation of the right to privacy, due to the potential of existing illegal operations of UAS in her airspace. Of all these challenges, the privacy concerns seem to be more prominent due to the government's approach of increasingly limiting the right to privacy through adoption of legislation on national security among other issues. KCAA on its part responded positively with a quick fix of issues raised by Parliament, this culminating into the Cabinet Secretary finally gazetting the new UAS law on 30 March 2020. The regulation considers adherence to safety, security and privacy concerns with a view to smoothening the legal path to integration.

[153] Kenya did not have an effective UAS regulation after annulment of RPAs regulation of 2017 in June 2018 until 30 March 2020.

CHAPTER SEVEN

SYNTHESIS OF OUTCOMES REGARDING INTEGRATION OF UAS INTO CIVIL AVIATION IN THE US, SOUTH AFRICA AND KENYA

1. Introduction

As a secondary lens, this chapter looks at frameworks from the perspective of International Aviation Law, and its adoption to domestic legal, policy and institutional framework. The chapter analyses how the current legal responses developed separately to deal with UAS' associated challenges of safety, security and privacy rights assurances in South Africa and Kenya. It is clearly established that the US has a long history of interaction with UAS, hence the approach to discuss the legal responses of the two African States at different stages of developing UAS regulation against lessons from the US. The chapter also analyses the notable safety, security and privacy challenges experienced by the States before finally making concluding remarks.

2. Lessons Learnt

Though there is no single unified international legal instrument that deals with all aspects of the UAS, other than the Chicago Convention. Article 8 of the Convention, through recognition of UAS, is a step in the right direction. The framework is complemented with Soft laws developed by ICAO such as SARPs, with varying levels of biding effect, towards implementation of its provisions of regulation, and play a key role towards the integration process. The international framework is aimed at inspiring regional and domestic response to, among others, challenges concerning integration of UAS into respective national aviation airspaces. From the analysis of how the three States considered in this thesis have developed and adopted the international framework, it is clear that other than other commonalities including establishment of regulatory authorities, there is incongruence in the domestic response to regulation of UAS in terms of legislative history and developments, timelines and reasons for amendments of aviation laws.[1] The incongruence, notwithstanding, it is clear that the States can learn from one another, or may showcase to other States not discussed in this thesis, certain lessons towards effective integration of UAS into their respective national aviation systems. These are divided into three limbs as discussed below.

The first limb relates to the lesson that the States can learn from each other. The first lesson regards the need for public participation. Though the three States covered herein had general constitutional frameworks for public, private sector and stakeholder engagement, the same is wholly inadequate in the regulation of UAS issues. Instructively, UAS has unique stakeholders such as manufacturers, developers, exporters, importers, owners, pilots, operators of different categories, members of the public and the Government. Their involvement is necessary since redress for UAS safety, security and privacy concerns mainly targets them or they interact with UAS in one way or another.

The Kenyan framework can borrow from South Africa, for instance, regarding the participation of the public in the nomination and evaluation in the appointment of members to the Aviation Safety Investigations Board. The decision by the Kenyan Parliament to annul the 2017 RPAs Regulations for reasons of non-compliance with public participation exposes the need for Kenya to consider public participation in regulation of use, regulation, monitoring and operation of UAS.

South Africa too can learn more lessons to make the public participation aspect more meaningful. Of particular concerns is with respect to provision for public participation on substantive procedural and rule-making processes. This provision requires and limits the rates of participation in rule-making to accredited

[1] See chapters Four, Five and Six of this thesis on analysis of the history and substantive provisions of principal laws under FAA Modernization Reform Act, South Africa’s Civil Aviation Act and Kenya’s Civil Aviation Act respectively.

representatives, advisers, experts and observers but leaves out key stakeholders in the value chain of UAS, including members of the public in whom the safety, security and privacy concerns converge.

The second lesson regards the need for enhancement of capacity at the regulatory authorities of the three States. Unlike the US, the study has established that both SACAA and KCAA have less than six staff each, stationed in their offices, overseeing UAS applications and registration. These countries need to take cue from the US in order to overcome often-glaring logistical problems for effective oversight and enforcement of the provision of the framework on safety, security and privacy regulations.

Thirdly, is the lesson that the devolution of the regulatory phenomena is a pivotal approach in ensuring efficacy. This, however, depends on the constitutional framework for such devolution functions. For instance, in the US, the regulation is done at Federal and State levels. The same is true for South Africa, which does regulation of UAS at the national and local government spheres. Kenya, on the other hand has a different constitutional make-up where civil aviation is a sole mandate of the national government and not devolved to county governments.

Fourthly, is the need for development of regional and sub-regional agencies dealing with UAS regulation. This is necessary both to complement the regulatory work of ICAO and to aid in harmonization of approaches among sub-regional organization participants. East Africa, Civil Aviation Safety and Security Oversight Agency (CASSOA), in particular, has proved to be effective in respect of Kenya in supplement operations of the institutional frameworks for implementation of UAS regulatory framework within East Africa. South Africa could take this lesson within the regional organization of Southern African Development Community (SADC) to provide mechanisms of obtaining regional consensus on regulatory and oversight issues. For Southern African Development Community, doing so may start with expression of political goodwill through ratification of Interim Southern Africa Safety Organization (iSASO).

The second limb is the lessons that may be learned from the US' framework for assurance of safety, security and privacy concerns related to UAS. These lessons are particularly important because the US has longer experience regarding use UAS and established UAS specific regulations.

First, it shall be recalled that the general classification of UAS depends on their performance specifications, endurance, maximum altitude, altitude, wing loading capacity, among other considerations. The US regulatory framework adopts a unique classification of UAS in a manner that upholds robust classification with different classes attracting varying safety, and security obligations.[2] The South African and Kenyan systems can emulate the framework for certificate of waivers in order to ensure that at all material times the regulation of UAS is proportionate to the risk of the operation in question. This focus will ensure a safety risk assessment based approach, which avoids use of a lot of resources in monitoring UAS, whose operations and circumstances pose no obvious safety risk, as contemplated under the ICAO Circular 330 AN/189 on Civil/ Military Cooperation in Air Traffic Management of 2011.[3]

Secondly, there is need to ensure gradualism and pragmatism in the approach for integration of UAS into the civil airspace. From the US' perspective, the lesson relates to focus on safe rather than full integration through the US' phased-in approach. For instance, despite interacting with the UAS in the early 1900s, the FAA

[2] See chapter Four, section 5.3. It explains that section 333 of the FAAMR Act allows an operator of a UAS weighing less than 50 pounds to apply for a certificate of waiver, which allows the equipment to deviate from certain operating rules where the FAA is satisfied that the proposed operation does not pose security challenges

[3] See chapter Three, section 4.1 of the thesis which analyses the Circular as requiring that the operation of UAS be regulated in a manner that is proportionate to the risk of the operation in question.

Modernization and Reform Act, which provides for operation of the model aircraft, was only adopted in 2012. The pragmatism involves the information of policy and legal development with history to ensure that the country does not get it wrong. From the regulation of UAS in the US, it is clear that their proper integration into civil aviation systems works on the understanding that UAS operations should not increase risk to other airspace users, persons and properties on the ground. That is why, the US premises its process on a safe rather than full integration. In other words, full integration, that is not safe, is self-defeatist and at all times the two objectives should be simultaneous. South Africa and Kenya can learn to ensure that they do not wait for disaster attacks such as the US September 11 attacks to shape their policy, legal and regulatory discourse regarding UAS security countermeasures.[4] Given their relatively lower levels of experience of UAS, the US practice offers a best learning opportunity for South Africa and Kenya to embrace pragmatics in their laws and regulations, or at least in the implementation of their UAS policy formulation and laws.[5]

Thirdly, is the lesson related to flexibility. From the US' perspective, unlike in South Africa and Kenya, flexibility is reflected in the recognition of community-based organizations that are allowed to form local units, through which FAA allows them to establish guidelines on the operation of small model UAS. The regulator, however, retains the overall mandate. The approach allows the FAA to concentrate on regulation of huge commercial UAS and other recreational UAS that pose serious safety, security and privacy risks and leave the rest such as for recreational purposes that require less supervision to community-based-organizations like clubs.

[4] See chapter Four, section 2 of the thesis on legislative gradualism through development of Air Commerce Act of 1926 Air Commerce Regulations of 1928, Civil Aeronautics Act of 1938 the Federal Aviation Act of 1958 and the Department of Transportation Act of 1966.

[5] See chapter Five, section 2 on the thesis on the history of the US civil aviation industry.

Fourthly, the US has provided more robust and proactive frameworks on redress of the sensitive matter of security in aviation which is worthy of emulation.[6] FAA has been comparatively more creative in development of the relevant Committees, frameworks under Advisory Circulars, Orders and Programmes that complement the provision of principal legislations aimed at addressing UAS safety and security challenges.[7] Already, South African and Kenyan framework have emulated the US system with varying levels of robustness.[8]

Lastly, is that judicial activism is necessary in filling the void and inconsistences in the substantive provision for redress of privacy concern in international and domestic frameworks. Analysis of the US regime shows that the country's courts have risen to the occasion and been able to interpret the law in a manner that protects the right to privacy. In the wake of worrying trend of legislations that restrict the right to privacy, Kenyan and South African courts may learn this lesson to protect the rights of the vulnerable person regarding breach of privacy in UAS operations. The positive judicial activism as evidenced in selected case law discussed under this thesis.

The third limb regards the lessons that can generally be learnt by States not discussed in this thesis. The first lesson is that there is an urgent need for clear and harmonized domestic standards for policy and regulation of UAS in all States to achieve integration into civil aviation. This urgency arises not only from owing to the emergence of new issues around sense and avoid technology, command control,

[6] Chapter Four, section 5.2 discussion on Title 49 of the US Code and FAA Modernization and Reform Act, 2012.

[7] Chapter Four, section 5.2 of the thesis provides analysis of Advisory Circular on Reporting Laser Illumination of Aircraft and orders such as FAA Order JO 7110.65, FAA Order No. JO 7210.3, FAA Order JO 7110. See also South Africa's and Kenya's National Civil Aviation Security Committee (NCASC), National Civil Aviation Security Programme (NCASP) and National Civil Aviation Quality Control Programme (NCAQCP).

[8] Chapter Four, section 5.2 of the thesis provides analysis of the South African Framework under National Civil Aviation Security Committee (NCASC), National Civil Aviation Security Programme (NCASP) and National Civil Aviation Quality Control Programme (NCAQCP. See also chapter Five on Kenyan Framework under Security Amendment Act 19 of 2014, National Police Service Act Chapter 84 Laws of Kenya, Prevention of Terrorism Act 30 of 2012, South Africa Police Service Act 57 of 2008.

UAS traffic management (UTM) and protection of privacy, but also unique physical capabilities and its actual and potential uses. In addition, the development of the standards is necessary to complement the international framework for proper functioning and implementation. Notably, in taking the envisaged regulation, States may adopt different naming for the UAS since it is the relevance and efficacy of regulation, and not merely the name, that is important.

Secondly, in taking the regulatory approaches in respect of UAS, an outright ban should not be an option for addressing the safety, security and privacy concerns of UAS.[9] The research identifies three step approach of: segregate, accommodate and integrate approach depending on UAS capacity and the risks posed by the UAS. This is because, the States that have been analysed in this thesis have shown that UAS not only has several cost, time and efficiency in a wide array of activities, but also recorded a projection of possible evolution into human and cargo transportation capabilities that may further heighten the existing concerns raised under this study.[10]

Thirdly, owing to the elusive nature of regulation of UAS, States must strive hard to adopt the international framework for regulation including use of guiding material developed by ICAO for UAS and increase activities and partnerships with ICAO, supported by other international agencies as contemplated under Article 65 of the Chicago Convention regarding agreements with other international bodies. This will offer a vital complementary system for efficient implementation of programmes and approaches towards integration of UAS into the national airspace of the respective States. Regarding implementation of this lesson, States may want to emulate the active participation by South Africa in the ICAO Council which additionally imposes on the State, a moral obligation to comply with effective implementation index of the

[9] Chapter One, Section 2.3.1 of the thesis on the explanation of ‘outright ban’ regulatory approach.
[10] See discussion on the justification for regulation of UAS use in chapter One, section 2 of the thesis.

existing regulatory framework and providing continual policy and legislative improvement.[11]

The fourth lesson is on the direct correlation between economic development and regulation of aviation matters including UAS concerns since policy, regulatory mechanisms and approaches for integration of UAS require proper planning and investment of resources not readily at the disposal of the underdeveloped and developing countries. States should, therefore, ponder about the sustainable economic development and the UAS integration planning in order to achieve sustainable regulatory results containing efficient enforcement. An example is the US, a developed country that has been able to develop sense and avoid systems, and address the technological bases of safety, security and privacy concerns of UAS with comparative ease.[12]

2.1 Safety Challenges

With respect to the safety challenges, the international law under the Chicago Convention and ICAO framework of Annex 19 has robust provision on the safety assurances. Where necessary, in respect of the States, the framework is complemented by other international instruments that are differentially ratified by States.[13] At the domestic level, the three States considered in this thesis have adopted the legislative frameworks that regulate certification, authorization, remote pilot licencing, training and maintenance of visual line of sight to ensure the safety of UAS operations.[14] In other words, the States to varying degrees and through their respective aviation regulatory institutions regulate skills and behaviour of operators

[11] Chapter Five, section 3 of the thesis analyses the institutional framework of SACAA which provides details of SACAA's partnership with ICAO.

[12] Chapter Four, section 2 of the thesis provides the history and background of regulation of civil aviation recognizes the technological and economic developments of the US.

[13] See chapter Three on analysis if international framework, Chicago Convention, ICAO Annexes 2 & 19, ICAO Circular No 328 AN 190, and complementary framework under Hague Convention on the Suppression of Unlawful Seizure of Aircraft, 1970.

[14] See respective analyses under chapter Four, section 5.1, chapter Five, section 6.1 and chapter Six, section 5.1 of the thesis.

as tools for ensuring that safety of UAS use is assured as a means of achieving integration of UAS into civil aviation airspace.

In both South Africa's and Kenya, necessary filings of safety levels and systems precede the authorization for use of UAS. The licensing of the skills is classified depending on the level of risks associated with the weight and use of the UAS. Moreover, the licensing requires authorized training, medical examination and attainment of majority age. South Africa licensing classification is comparatively more robust since it recognizes additional safety parameters.[15] Another difference is the measurements regarding the maintenance of the visual line of sight.[16]

Analysis of the regulatory regimes reveal that the States have developed some form of regulation regarding the design of the UAS together with the development for the sense and avoid technologies to ensure avoidance of collision as the UAS is integrated into the respective national aviation systems. Simply put, the States to a varying degree regulate the design, specifications and the operational systems of the UAS in order to ensure compliance with the set safety standards as well as management of UAS systems. Both South Africa and Kenya regulate the carrying of dangerous materials.[17] Although they recognize the need for the sense and avoid in the UAS integration plans, the technology presents implementation challenges to the two jurisdictions for small UAS.[18] Another common challenge is non-regulation of environmental concern of noise arising from UAS in both States.

[15] Chapter Five, section 5 of the thesis expounds the classification based on parameters such as impact, energy, operational length above the ground, rules of flight and air operation.

[16] Chapter Five, section 6.1 of the thesis explains that in South Africa, the UAS operation within restricted Visual-Line-of-Sight is an operation conducted within 500 metres of the UAS pilot and below the height of the highest obstacle within 300 metres of the UAS. Under the discussion in chapter Six, section 5.1, of the thesis, the Kenyan minimum which is set at the minimum of 400 feet from the ground level.

[17] Chapter Five, section 6.1of the thesis expounds the South Africa's provisions on regulation of dangerous goods with only private UAS is exempted. Same is the case for Kenya as under chapter Six, section 5.1 of the thesis albeit with focused on the impact on aviation insurance.

[18] For Kenyan implementation challenges are explained under chapter Six, section 6. South African challenges relating to toy and community-based organizations are at chapter Five, section 7 of the thesis.

With respect to the authorization, design and specifications as well as systemic requirements, the States are inspired by the ICAO Regulations. It will be recalled that South Africa and Kenya have domesticated ICAO Annex 19 on Safety Management System that regulates safety among member States, supported by ICAO Safety Management Manual and ICAO circular 328-AN/190 that serves as a sources of information and guidance in development of aviation State Safety Programme (SSP), safety regulation and policies.

2.2. Security Challenges

With respect to aviation security challenges, the international law has responded through assertion of the State sovereignty in regulation of civil aviation matters in international instruments as enshrined in the Chicago Convention Articles 1(sovereignty) and 2 on territoriality. In safeguarding aviation security, States operate under customary international law based on general State practices such as right of overflight.[19] Moreover, the frameworks provide for commitments in providing authorization mechanism, programmes and audit processes for assurance of addressing security challenges as provided for under ICAO Annex 17 and Aviation Security Manual (Doc 8973). At the domestic levels, the States considered in this thesis have developed rules to create a balance between recognition of lawful use of UAS and the regulation of related unlawful acts that pose a threat to national security. Principally, these rules such as National Civil Aviation Security programmes and several regulations relate to the assertion of State sovereignty as the basis for authorization. The States assert the principle of sovereignty of the State as basis of their regulation of security concerns of UAS activities. Further, South Africa and Kenya provide for mandatory provisions for registration of UAS and authorization as well as adherence to security programmes.

[19] Chapter Three, section 2 of this thesis provides a background of analysis on the international framework for regulation of UAS.

In Kenya, however, there is an even more robust multi-agency approach where the active involvement of other security agencies and the Department of Defence, is pivotal in the regulation of UAS. This high-level security measure taken by Kenya is akin to the US' approach through the involvement of the Department of Homeland Security.

Analysis of the regimes shows that the two States take other pro-active security approaches to conduct background checks on operation and regulation of storage of UAS.[20] Lastly, both jurisdictions demand that UAS not in use be stored and prepared for flight in a secure manner.[21] It is noted that, a further step in the development of requirements for organizational arrangements requires operators to ensure security measures and programmes are both established and implemented.[22]

As regards security controls through registration requirements, background checks, and regulations of storage of UAS as well as the organizational tools, the States have domesticated ICAO guidance material on security such as ICAO Circular 328-AN/190. This commitment is evidence that South Africa and Kenya have not only ratified the Chicago Convention but also domesticated ICAO Annex 17, which is demonstration of the desire to ensure aviation security in the total chain of regulation of UAS through the national legislations and policies.

[20] Compare SA-CATS 101 r 101.04.8 discussed in chapter Five, section 6.2 of this thesis and the Kenya Aviation Policy, Kenya Civil Aviation (Remote Piloted Aircraft Systems) Regulations 2017, reg 6 (2) (now annulled) and Regulation 43 of the 2020 UAS Regulations discussed in chapter Six, section 5.2 of the thesis.

[21] See chapter Five, section 6.2 on discussion on the content of the General restrictions SA- CATS 101, section 101.05.3 in South Africa and chapter Six part 5.2.

[22] See chapter Six, section 5.2 on the description of Kenya's National Civil Aviation Security Programme section 4.3 on partnership with IATA through the latter's safety and security programmes. South Africa's programme functioning through analysis of SA-CATS 101, r 101.04.5 and part 4 on the role of Civil Aviation Security Department of SACAA and section 111 of the Civil Aviation Act 2009 on development of National Security programme under chapter Five, section 6.2 of this thesis.

2.3. Privacy Challenges

With respect to privacy challenges, the international framework provides comparatively less aviation-related privacy safeguards compared to other safety and security concerns.[23] This is reflected in the domestic frameworks of the States that consequently adopt differential levels of effective implementation index as evidenced in the differential levels of legislative steps and judicial activism in the United States, South Africa and Kenya.[24] The domestic frameworks are also heavily dependent on the national constitutional frameworks for protection and enforcement. The States' reliance on such protection in the international system is therefore, placed on the International Bill of Rights and several country's constitutions. Although constitutions are fundamental with safer protections against breach, they are too general for specific protections save for the US, which has proved to offer far better protection, at least from the analysis of jurisprudence.[25]

That notwithstanding, the legal frameworks of all the States considered in this thesis have tended to adopt domestic rules that complement the UAS-specific rules regarding privacy concerns.[26] In particular, they focus on distance as a tool to balance the freedom of UAS and respect for the privacy of others. In other words, all three legal systems, to varying degrees, regulate the distance from persons or property at which a UAS may be used or operated. The distances vary of course,[27] but appear to be integral in protecting the right of privacy under the UAS regulations.

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[23] See chapter Three on the analysis of International Bill of Rights instruments on assurance of piracy and tardiness of such provision on the Chicago Convention, 1944.

[24] US, South Africa and Kenya's frameworks on regulation of privacy is discussed under chapter Four, section 5.3, chapter Five, section 6.3 and chapter Six, section 5.3 respectively.

[25] The Fourth Amendment to the Constitution of the US discussed under chapter Four, section 5.3 and the Constitution of Kenya 2010 discussed under chapter Six, section 5.3 provide for general protections. Analysis of key highlights of the US jurisprudence is under sections 5.3.1-5.3.3.

[26] While South Africa has developed Civil Aviation Regulations of 2015, Kenya has developed UAS 2020 Regulations. The US on its part utilizes the Academy of Model Aeronautics Safety Code of 2018 as read with FAA Modernization Reform Act.

[27] In US, the Academy of Model Aeronautics Safety Code of 2018 generally prohibit flying the UAS closer than 25 feet to an individual. In South Africa, there is a limit the operation of UAS to a lateral distance of 50 metres from any structure or public road.

The analysis of the regulatory regimes also suggests a trend in favour of regulating the components of UAS as a means for achieving balance between integrating UAS and protecting privacy rights of the people on the ground and their properties, although it varies in degree. For example, while the US and Kenya have rules on the attachment of cameras, South Africa's rules are less clear and have to be inferred.[28]

Finally, with regard to the distance regulation and the component requirement, the regulatory frameworks in three States adopt by the principal legislative framework under the Chicago Convention, which places emphasis on prohibition of use of photographic apparatus in an aircraft over the territory of another State.[29]

3. Conclusion

The global regulation of the UAS is moving towards a non-restrictive approach. The approach is dictated by various factors including the legislative development levels of the States. As such, the developing States should not get stuck with the wait-and-see approach but consider regulation on an *ad hoc* basis. For developed countries, like the United States, the suggested way forward is to adopt legislation to cover for new emerging situations of possible use of UAS to transport cargo and hopefully people. Generally, however, the two categories of countries ought to monitor the general trajectory of development of the UAS technology and adopt the best approach, while embracing more flexibility to achieve better the goals of integration. Emphasis should be on approaches that do not compromise safety, security and violate the universal fundamental human right to privacy.

[28] For example, See chapter Six, section 5.3 on the analysis of 2020 UAS Regulations, Regulation 24(1)(e) and its provision on regulation of imaging devices. The SA-CATS do not have express provision on such.

[29] Chicago Convention Art 36

South Africa and Kenya have different legislative processes, made distinct steps in the development of the policies, and regional approach to aviation regulation, but they have in the last few years made phenomenal progress in integration of UAS into civil aviation. The two African countries, who are both signatories to the Chicago Convention, have strived to adopt the ICAO-based framework. Consequently, therefore, the States' regulatory frameworks recognize the general need to regulate UAS activities as a way of achieving integration of UAS into civil airspace, despite deviations such as extent of consensus in relevant regional economic communities. The more recent Kenya UAS 2020 Regulation offers evidence for similarity of approaches in ensuring safety and adoption of State safety programmes, effective licensing, and authorization, categorization of UAS, public participation frameworks, security standards and observance of people's privacy. Other similarities occur in the regulatory approaches and enforcement of UAS Regulations, such as criminal sanctions.

The jurisdictions face similar challenges caused by lack of unanimity in Sense and Avoid technology, and tardiness in having UAS-specificity in privacy provisions in the existing legislation. Others relate to concerns in environmental, enforcement, privacy, licensing and authorization. This chapter has further established long-standing involvement of the US in UAS, which presents a good example from which South Africa and Kenya can learn relevant UAS regulatory lessons. Key among them is the safe and pragmatist integration of UAS, integration, which targets safety as opposed to full integration. Other worthwhile lessons are flexibility in the regulation of safety and privacy concerns arising from use of UAS. The US' UAS regime presents the two African countries with an opportunity to learn lessons on use of community-based organizations as well as introduction of certificate of waiver framework. Kenya has a lot to learn regarding the need to embrace use of local authorities or counties in effective enforcement of UAS regulation as well as strengthening her public participation framework from a constitutional requirement to more specific regulation standard.

CHAPTER EIGHT

CONCLUSION, RECOMMENDATIONS AND WAY FORWARD

1. Introduction

This chapter provides a summary of findings of the research, as analysed in the preceding chapters of this thesis. The rationale of the study is absence of unified international UAS regulatory framework in hampering integration into civil aviation. The objective is developed against the backdrop of increased technological use of UAS without effective integration into the national airspace. To address this problem, the thesis made inquiry into how and to what extent the existing international regulatory framework of the Chicago Convention and ICAO address current UAS-related challenges of safety, security and privacy. The area of focus are how the US, South Africa and Kenya through institutional, policy and legal frameworks have responded to UAS regulation in addressing current needs and challenges in operation within their domestic frameworks.

The thesis further sought to investigate the rights and obligations of States in addressing UAS challenges under international and domestic laws, with a view to providing possible recommendations to aid faster and safer integration of UAS into civil aviation by the States under study. This chapter dutifully presents the findings in respect of these concerns. Finally, it utilizes the findings and the conclusion to offer practical recommendations and opportunities for improvement in operations of UAS to international, regional, sub-regional, domestic frameworks and stakeholders towards addressing safety, security and privacy challenges.

2. General Conclusions

The background and analysis of the research questions was made in the preceding seven chapters. Chapter One provides the background and overview of the study. It provides the background to the problem as well as the philosophical, conceptual and theoretical underpinnings of the study. Specifically, it provides expansion of use of UAS, and increased safety, security and privacy concerns and advancement in technology as the basis for an array of regulatory approaches regarding UAS. It provides the general implementation and enforcement challenges experienced by States that have opted to regulate UAS in their domestic frameworks and proceeds to offer a vivid description of the research methodology.

Chapter Two demonstrates that States are faced with circumstances that make regulation of UAS almost inevitable. It emphasizes that in so choosing to take up the challenge, States have to decisively deal with the unique safety, security and privacy concerns arising from the use of UAS.

Chapter Three traces the international law response to the three thematic areas of safety, security and privacy challenges. That the Chicago Convention has blended well with the creation of the ICAO framework and complemented by other international human rights instruments, international customary law and general principle of law to address the concerns in the three areas. It emerges that the concern for privacy is unevenly addressed compared to the other two thematic areas, that is, safety and security.

Chapter Four analyses the response to integration of UAS by the US, jurisdiction with a longer history with UAS regulation and thus highly advanced framework to address the three thematic areas through a more proactive regulatory agency, namely FAA. The challenge of unbalanced focus on privacy concerns as well as lack of sense and avoid technology in some UAS appears to takes a toll on enforcement and regulatory framework.

Chapter Five analyses the South African framework and its redress of concerns on the three thematic areas. It is established that the framework is cognizant of and addresses the areas, albeit with differential levels of focus, the lowest focus being on privacy. South Africa is lauded for her active participation in ICAO activities though the efforts are faced with institutional challenges due the absence of regional efforts at the SADC level to support her domestic integration of UAS into civil aviation.

Chapter Six analyses Kenya’s response to strides the concerns of the three thematic areas. Kenyan has made strides via legislative amendments in 2016, the development of UAS policy, and the 2017 RPAs Regulation that was annulled but re-enacted as 2020 UAS Regulations to address the challenges of safety, security and privacy among others. The frameworks have a laudable albeit little focus on privacy concerns. At its nascent stages, however, Kenya has challenges related to sense and avoid technologies, UTM, command and control, lack of involvement of county governments for effective enforcement and categorization of UAS regulation.

Chapter Seven provides a synthesis of findings. The three jurisdictions have certain common elements in their approach of regulation of UAS. Some challenges are common across the States. The States can learn from each other on matters of classification of UAS, training, authorizations, integration planning and regional efforts. The chapter establishes that pragmatism, flexibility, gradualism and classification of UAS stand out as areas of effective redress of the concerns of UAS regulation in the three thematic areas of safety security and privacy.

3. Recommendations

This part discusses recommendations based on the above general and specific conclusions of the problem statement and research questions. The recommendations are addressed to the ICAO, and the relevant structures, bodies and institutions within domestic jurisdictions of the US, South Africa, Kenya and, by limited extension, regional and continental agencies for implementation towards successful integration of UAS into civil aviation as they endeavour to address safety, security and privacy challenges associated to UAS operations.

3.1 ICAO

First, there is need to broaden the meaning of aircraft in the Chicago Convention. Enacted in 1944, the Chicago Convention was designed to specifically address international law for manned aircraft and by extension unmanned aircraft as provided for under Article 8 of the Convention. For States without UAS-specific laws, the treaty law can only be made by implication, which is not sustainable as it only promotes a wait and see approach in regulation of UAS at domestic level. Some authors too affirm the conundrum by suggesting that the implication of its application has not been without controversy.[1] Adoption and remodelling of the Chicago Convention on UAS, in the manner envisaged for amendment under Article 94 and having State parties, ratify it, has potential of boosting commitment of State parties such as South Africa and Kenya and others that are yet to develop UAS legislation. Alternatively, though not most ideal, ICAO State parties may consider adoption of a new convention or additional protocol tailored to address UAS, considering the ever-changing technological and operational landscapes.

[1] Marshall D "Unmanned Aerial Systems and International Civil Aviation Organization Regulations" 2009 *North Dakota Law Review* 693.

Secondly, Although, Annex 6 Part IV is under development for UAS operations. ICAO uses the term RPAs because its main focus is on large UAS that fall in that category as UAS encompasses both small and large UAS. Hence ICAO limits itself to above 25kg UAS. This means that there is need for ICAO to consider development of ICAO Annex 20 for UAS. The Annex should be binding to all member States so that UAS application is well regulated to address global emerging technological trends appearing as moving target, on uses, designs and capabilities of UAS. Alternatively, the conditions and standards set out under the ICAO Circular 328.AN/190 on UAS may be revised and adopted through an amendment then ratified as the Annex. The Annex will be prominent for parties who comply for purposes of international obligation, best practice, moral authority to external forces of international power politics or other reasons. It is envisaged that this recommendation to the ICAO is relevant in the short term, pending the complete execution of the first recommendation made above to ensure that UAS has equal prominence as that under Annex 6 that deals with Operation of Aircraft with a view to giving more emphasis on expected increase of UAS operation.

The thesis further recommends enhancement of security and safety mechanisms. In order to meet the security and safety standards provided for under ICAO Annexes 17 and 19 respectively, there is need for requirements that UAS to be enhanced with the help of modified global positioning system data to avoid possible manipulation by hackers who use such data for criminal activities such as, terrorism, cyber-attacks, navigation systems, among other acts of unlawful interference against civil aviation. Another viable requirement is that safety and security are enhanced by improving communication between UAS, other aircraft, control towers and ground crew. This can be done by way of sharing UAS operational frequencies, UTM, common data, and video links, through the development of counter-jamming technologies and providing background security and safety checks to the applicants to operate UAS.

Lastly, ICAO should ensure a robust framework for regulation of UAS-specific privacy concerns. In seeking to level the concern of privacy with that of safety and security, it is recommended that ICAO considers development of another Annex 20 as suggested above to make provision for privacy.

3.2 South Africa and Kenya

This thesis makes ten recommendations to both jurisdictions as follows: Firstly, South Africa and Kenya should strengthen aviation institutions to make them efficient and able to cope with technological advances regarding UAS. The efficiency of these institutions can be ensured through public participation, upholding of independence of regulators, and establishment of permanent regulatory units that deal with UAS. This would help to address existing challenges such as regulatory independence, capacity building and ability to issue policy statements in the dynamic civil aviation sector for sustainable development.

Secondly, the States should constantly review UAS regulations as work in progress through relevant departments of transport and infrastructure with a view to strengthening them, taking into consideration new technological advancements associated with UAS. The relevant departments may also consider when it is appropriate to collaborate with community-based organizations and to adopt the classification model that distinguishes model aircraft and regulated aircraft in respective national aviation systems. It is envisaged that such clarity in categorization shall aid the aviation regulators to determine the extent to which UAS is allowed to operate within the airspace, the information they are likely to collect about individuals, their uses and disclosure requirements, as well as possible impact on individual privacy. In addition, the States should emulate the US in development of efficient categorization of UAS for a more focused regulatory approach regarding the differential rates of safety, security and privacy risks that they pose.

Thirdly, the States should develop minimum standards for operator dynamic training with curriculum focus on proficiency and safety in UAS control and interaction with other aircraft in the national airspace. This will go a long way in ensuring safety of civil aviation, given that, as identified in chapter One of this study, the UAS sector continues to grow exponentially.

Fourthly, the executive and legislative authorities should either develop or maintain a delicate balance between protection of human rights including right to privacy and public security regarding use and operation of UAS to ensure that the former is not sacrificed at the altar of the latter. Countries, such as South Africa, can borrow from Kenya's annulled 2017 RPAs Regulations and the current Kenya 2020 UAS that has provisions devoted to provisions on privacy protection. This is a sure way of complementing the International Bill of Rights assurances on privacy protection. To further entrench these efforts, it is recommended that courts adopt judicial activism akin to the US' in order to bridge the *lacuna* in the provisions and implementation of the same across the African continent, regional, sub-regional and domestic jurisdictions.

Fifthly, both States should develop requirements that mandate individuals to mitigate potential impact on personal privacy, such as protecting UAS against unauthorized disclosure. The license should specify those who would be individually responsible for safe use of UAS and the information collected thereof.

Sixthly, the States should endeavour to expand opportunities for citizens to air their grievances or complaints through legally recognized fora. A statement of the UAS operators that is accessible online should accompany all licenses granted by State agencies with possible frameworks or timelines in handling such complaints.

Seventhly, South Africa and Kenya should adopt lessons of pragmatism, gradualism and flexibility from the US on integration of UAS into civil aviation. This will require formulation of effective UAS regulation enforcement mechanisms and development of implementation roadmaps with achievable deadlines. Priority should be placed on ensuring there is proper listing of all unmanned aircraft irrespective of size or use for data compilation and information sharing with relevant agencies or countries. Clear sanctions for violators of UAS regulations as established should be effectively enforced.

Eighthly, it befits to aver here that the importance of UAS should not be ignored with the rising globalization, coupled with rapidly changing technology, States should set aside more resources and funding for further progressive research in a discipline that is, without doubt, the future of civil aviation. UAS may impact on how people, work, live, move and associate with each other as technology advances.

Ninthly, the States should consider UAS traffic management (UTM), which has capacity to detect where command and control centre for the UAS in operation is located. The purpose is for the enforcement officers to ensure compliance through monitoring of UAS hovering in civil airspace for effective oversight. The implementation will support the regulation in addressing the safety and security challenge in the civil aviation industry.

Lastly, South Africa and Kenya should consider allocating resources for command and control system (CCS), which is essential for civil aviation to control UAS movement within their airspace. It is proposed that such improved system be available in at least every regional security or civil aviation office or at the county level. The technology, once established, will go a long way in providing countermeasures in dealing with emerging crimes, which keep evolving day by day.

3.3 Kenya

In respect of Kenya, this thesis makes the following five recommendations:

Firstly, Kenya should make regulatory requirements for UAS operators to mitigate, risk against other airspace users, ground property and people in general, although the 2020 UAS Regulation has provision and requirement to take up insurance before they are allowed to operate safely within the national airspace to mitigate civil liability issues and claims.[2] What is missing is the guidance on how insurance applied, the *lacuna* in the regulations is the assumption that the aircraft premium computation would work for UAS which may not be appropriate due to different sizes of UAS.

Second, Kenyan should consider developing a policy to co-ordinate and progressively harmonize matters relating to civil aviation, and UAS in particular, in line with the Chicago Convention. Of prime concern is an appeal to integrate UAS as emerging technology into the national airspace, complete with safety and security regulation of their operations. Other than complementing Kenya's National Security Policy and the National Security Strategy, provides, the Policy should address environmental management, disposal of ruined UAS, safety and security, air traffic management, training, research, innovation, policy direction on protection of privacy rights, involvement of county government structures, monitoring and evaluation of UAS systems.

Thirdly, the Government should provide the KCAA with sufficient funding to undertake major research in the field of UAS, which could help achieve Kenya's dream of full integration of unmanned aircraft system into civil aviation.

[2] Legal Notice No 42. KCAA UAS Regulation of 30 March 2020 r.40.

Fourthly, the East Africa School of Aviation (EASA) should be best utilized in addition, to offer training relating to UAS and certification to those who qualify. Moreover, it should evolve into Aviation University of East Africa and contribute effectively and immensely in the area of research and technology to achieve integration of UAS regulation into civil aviation, among other academic achievements.

Fifthly, the KCAA cannot oversight itself; it is high time the East Africa School of Aviation, as a service provider, is delinked from other directorate of KCAA to concentrate on providing learning and research for the aviation industry.

3.4 USA

The study has without doubt established that the US has a longer history of dealing with UAS operation than the two African countries. It is recommended, therefore, that such experience needs to be shared with other countries towards building capacity and for effective enforcement. UAS have capacity to transcend beyond domestic jurisdiction, which may have impact on the safety, security and privacy of American citizens either in the US, domiciled in Africa or visiting destinations in the continent, hence, there is urgent need for institutionalized partnership between the US and other countries to safeguard its airspace from unlawful intrusion from unregulated jurisdictions.

The thesis recommends to FAA to steer the sharing of experiences with aim of strengthening effective regulations in the Africa States. Such partnership can also increase international trade and sustainable development emanating from increased technology of UAS use.

3.5 Regional / Sub-Regional Economic Communities: EAC, SADC and AFCAC

Whereas the study is not meant for regional and sub-regional civil aviation entities in Africa, as it progressed, it was established that UAS have capability to fly across borders of several States, consequently establishing some shortcomings within SADC where South Africa is domiciled, and the East Africa Community for Kenya. The identified shortcomings mirrors what happens at the continental level, hence, the justification to include recommendations for EAC, SADC and AFCAC as per the findings of the study.

Regarding EAC, the Civil Aviation Safety and Security Oversight Agency (CASSOA) should, as a matter of priority, urgently consider a framework for establishment and creation of a specific office dealing with UAS, complete with qualified staff. Doing so will increase harmonization of regulation within the region and improve coordination of UAS integration in East Africa and domestic jurisdictions such as Kenya.

Regarding SADC, South Africa should actively support SADC members in the establishment of a regional civil aviation organization through to full ratification in order to preserve the remarkable regulatory and institutional frameworks that it has developed towards integration of UAS within the 15 SADC member States. Lesson learnt from the EAC's Civil Aviation Safety and Security Oversight Agency can be used to aid SADC in establishing such a model organization. This will help in overcoming the challenges of lack of implementation by the interim Southern Africa Safety Organization (iSASO), which is not yet fully in operational.

For both EAC and SADC, this thesis recommends that they consider harmonization of procedures and standards with like bodies within the African continent. This may mirror the FAA. Such a move would create the ideal ground for effective oversight and enforcement of UAS in several States. Kenya and South Africa stand to benefit by benchmarking from lessons of countries where UAS is long entrenched into regulation covering several States.

At the continental level, AFCAC, established under the AFCAC Constitution that was adopted on 16 December 2009, should consider establishing structures within its operations of UAS to progressively and incrementally complement interventions for addressing safety, security and privacy challenges at the continental level. This is in addition to amendment and revision of the AFCAC Constitution as provided for under Article 22 (of the Constitution) to strengthen the oversight role and provide regulations for general civil aviation. Lastly, an office dedicated specifically for UAS, modelled on the framework of the FAA, should be created by taking similar measures.

4. Areas for further Research

This study considered policy, institutional, legal and regulatory issues on UAS under international air law, the US, South Africa and Kenya, areas that are not so volatile. As such, there is a need for further research on the uniqueness of the regulation of UAS in volatile States. Such a study should focus on how best to integrate the UAS into civil aviation for unequalled success. In addition, further research needs to be undertaken in view of future prospects of UAS having capacity to carry people and cargo and the projected effects on current conventional civil aviation architecture. In addition, there is need to have further research for UAS use in marine operations.

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APPENDICES

Appendix A

The rationale to include this appendix is to appreciate the different types of UAS operating in civil aviation airspace and their capabilities, as discussed in this thesis. This enables the reader to have an idea of the UAS design and abilities.

Examples of UAS and RAPAS

Flying-Robots - Switzerland– Swan

Delft-Dynamics - Netherlands- RH2-Stern

LuxCopter - Luxembourg - LC-201

Schiebel - Austria-S-100

Clear-Flight-Solutions - Netherlands- Peregrine-Falcon

Advanced-UAV-Technology - UK- AT-200

Aermatica - Ital- Anteos-A2

Aurora-Imaging Belgium- Aurea-1800

AeroSystems – Portugal

Aerovision - Spain- Fulmar

Vision-du-Ciel - France– cyclvol2

Photos sourced from the UVS International Photo Database on 6 May 2016.