DRONES HAVE ARRIVED, WITH NEW OPPORTUNITIES AND CHALLENGES: A COMPARATIVE APPROACH TO REGULATIONS GOVERNING THE OPERATIONS OF UNMANNED AERIAL VEHICLES IN THE UNITED STATES, ITALY, COSTA RICA, UNITED ARAB EMIRATES, CANADA, NICARAGUA, SPAIN, AND SAUDI ARABIA.

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I. INTRODUCTION

During World War I, the United States conducted secret research and development of Unmanned Aerial Vehicles (UAV).[1] In 1918, Orville Wright and Charles F. Kettering supervised the secret project to develop UAVs for use during World War I.[2] Kettering developed the first self-flying aerial torpedo known as the "Kettering Bug," but World War I ended before it was cleared for military use.[3]

Following World War I, many conventionally piloted aircraft were converted into radio-controlled aircraft for use as targets or guided missiles.[4]

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1. KEVIN DESMOND, ELECTRIC AIRPLANES AND DRONES: A HISTORY 174 (McFarland & Company, Inc. ed., 2018).

2. *Id.*

3. *Id.*

4. RON BARTSCH, JAMES COYNE & KATHERINE GRAY, DRONES IN SOCIETY: EXPLORING THE STRANGE NEW WORLD OF UNMANNED AIRCRAFT 24 (Routledge ed., 2016).

In 1935, Geoffrey de Havilland invented the Queen Bee, which was a pilotless version of the famous Tiger Moth DH.82, but their noisy, slow and heavy flight rather made them look like male *drones* rather than queen bees.[5] The introduction of the Queen Bee became a game changer for the non-existent unmanned aircraft world as it was the first multi-use unmanned aircraft that was designed to be target practice for anti-aircraft gunners while they were in training, rather than being a missile style weapon.[6] The Queen Bee could fly at altitudes of 17,000 ft at speeds over 160 kph, and was capable of traveling distances of over 400km.[7] In December 1935, the United States began to use the name "drone" for any UAVs being researched and developed, in homage of the British pilotless aircraft, the Queen Bee.[8]

At the beginning of World War II, a British man by the name of Reginald Denny moved to the United States and became a renowned figure in the field of radio controlled research.[9] Mr. Denny opened Reginald Denny Industries, a company that specialized in model planes, that were displayed in stores called the Reginald Denny Hobby Shops.[10] Soon after, the company evolved into the Radio plane Company, and Mr. Denny began to sell his target drones to the military for target practice.[11] The company produced over 15,000 target drones for the military before and during WWII.[12] In the late 1930s, the US Navy deployed the Curtiss N2C-2, a pilotless aircraft.[13] While the US was entering World War II, research into UAS shifted from target practice to actual combat use.[14] This shift in research led to the development of the TDN-1 assault drone in 1940, which was capable of carrying a 1,000-pound bomb and was deemed fit for service.[15] The TDN-1 never saw combat because of its limited maneuverability and control difficulty.[16] Unmanned aircraft were given designations based on their

5. Desmond, *supra* note 1.

6. Bartsch, *supra* note 4, at 25.

7. *Id.*

8. Desmond, *supra* note 1, at 175.

9. Nikola Budanovic, *The Early Days of Drones — Unmanned Aircraft from WWI & WWII*, WAR HISTORY ONLINE, https://www.warhistoryonline.com/military-vehicle-news/short-history-drones-aircraft.html (May 12, 2018).

10. *Id.*

11. *Id.*

12. *Id.*

13. *Id.*

14. Budanovic, *supra* note 9.

15. *Id.*

16. *Id.*

design and function: "A" designated "Attack drones," "PQ" designated "full-sized" target drones, and "OQ" designated "small-scale" target drone.[17] During Operation Aphrodite in 1944, some modified B-17 Flying Fortress and B-24 Liberator heavy bombers were used as enormous aerial torpedoes, but they also failed to see wider service.[18]

On the other side of the war, the Germans produced the V-1 Flying Bomb, which used pulsejet engines for propulsion and became a fearsome guided missile.[19] Although the United States also produced pulsejet engines during the war, it was only introduced for target drones such as the Katydid TD2D/KDD/KDH, and not combat drones.[20] The real boom in the UAV industry was yet to come, during the troublesome years of the Cold War.[21]

During the Vietnam War, the United States deployed large scale reconnaissance with UASs on the field.[22] A new UAS, the AQM-34 Lighting Bug, flew 3435 sorties in support of the Vietnam War.[23] During the Cold War, the Central Intelligence Agency (CIA), developed other drones.[24] During the 1960s the CIA developed the Aquiline and Axillary UASs, which were successfully tested them at Area 51.[25] In the 1970's the Air Force funded Boeing and Teledyne Ryan to develop high-altitude, long endurance drones.[26]

By 1994 the Air Force had developed a UAS capable of live satellite reconnaissance which was fitted with a satellite data link in its nose, codenamed the Predator.[27] This new UAS was deployed during the Balkan conflicts of 1995, under Nomad Vigil and Operation Deliberate Force, and proved it was a formidable asset in the field and even went on to earn its service under the Eleventh Reconnaissance Squadron at Indian Springs

17. Bartsch, *supra* note 4, at 25.

18. Budanovic, *supra* note 9.

19. *Id.*

20. *Id.*

21. *Id.*

22. *A Brief History of Drones*, IMPERIAL WAR MUSEUMS, https://www.iwm.org.uk/history/a-brief-history-of-drones (Jan. 30, 2018).

23. LAURENCE R. NEWCOME, UNMANNED AVIATION: A BRIEF HISTORY OF UNMANNED AERIAL VEHICLES 86 (Am. Inst. of Aeronautics and Astronautics, Inc. ed., 2004).

24. IAN G. R. SHAW, PREDATOR EMPIRE: DRONE WARFARE AND FULL SPECTRUM DOMINANCE 131 (Univ. of Minn. Press ed., 2016).

25. *Id.*

26. *Id.* at 132.

27. *Id.* at 143.

Auxiliary Airfield in Nevada.[28] By the turn of the century, the Predator was one of two drones in the service with the United States.[29]

In October 2003, the Federal Aviation Administration (FAA) issued an order allowing applications of Certificate of Authorization (CoA) of UASs for non-military use, which until the time were limited for military operations based on an agreement between the FAA and the Department of Defense (DoD).[30] This order opened the door for research and development of drone technology for applications that were not military, mainly for proof-of-concept demonstrations, but the order made it clear that it did not apply to UASs intended for recreational purpose.[31]

By March 2006, the FAA established the Unmanned Aircraft Program Office to facilitate the UASs regulation process.[32] In 2007, it changed the definition of an Unmanned Aircraft to "a device that is used, or is intended to be used, for flight in the air with no onboard pilot."[33]

In 2012, the FAA exempted certain types of aircraft from a more rigorous CoA process in an attempt to streamline the process.[34] This new exemption allowed operators to use drones in limited ways, by providing a Blanket CoA with very basic restrictions that were beginning to seem like constant in the application process.[35] Due to the repetitive nature of these restrictions, the FAA provided airworthiness without a rigorous application process, for as long as the pilot followed the operational requirements, which in turn would decrease the risk of air safety when the aircraft is being flown.[36]

In 2018, the National Academy of Sciences (NAS) released a report on its findings related to the overly restrictive approach by the FAA when it

28. *Id.*

29. Shaw, *supra* note 24, at 145.

30. KONSTANTINOS DALAMAGKIDIS, LES PIEGL & KIMON P. VALAVANIS, ON INTEGRATING UNMANNED AIRCRAFT SYSTEMS INTO THE NATIONAL AIRSPACE SYSTEM: ISSUES, CHALLENGES, OPERATIONAL RESTRICTIONS, CERTIFICATION, AND RECOMMENDATIONS 45 (Springer ed., 2d ed. 2009).

31. *Id.*

32. *Id.*

33. *Id.*

34. HARRISON WOLF, DRONES: SAFETY RISK MANAGEMENT FOR THE NEXT EVOLUTION OF FLIGHT 74, 75 (Routledge ed., 2017).

35. *Id.*

36. *Id.* at 75.

comes to UAS.[37] The committee found that "fear of making a mistake" is what drives the culture at the FAA, which means that it is too often overly conservative, particularly with regard to UAS technologies.[38] The committee concluded that a better measure for the FAA to apply is to ask the question, "Can we make UAS as safe as other background risks that people experience daily?"[39] For example, planes are not grounded because birds fly on the sky, even though we know that a bird strike can easily bring down a plane.[40] Traditional view in manned aviation measures risk assessment based on the probability of human fatalities.[41] Given their very nature, this assessment does not correspond well when it comes to unmanned aircraft.[42] UAS are versatile in their applications and as such, it is difficult to ascertain a uniform measurement of the risks involved with the technology as a whole rather than what type of operation is being conducted.[43] As such, a point of concern for the drone industry arises when there are overly stringent certification requirements based on high risk assessments applied to low-risk operations, which place and unnecessary burden on some operations and hinder innovation.[44]

Development of regulations and infrastructure for the drone market have been outpaced and unable to keep up with the rapid growth the market has seen.[45] It is imperative that regulations clarifying the role of drones in the national airspace is updated as to remove the uncertainty that it currently weighs on innovation and commercial adoption.[46] The National Aeronautics and Science Administration (NASA) is a leading player for the development of a US airspace management system that will be able to provide the infrastructure drones need to safely operate, while the FAA to ease

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37. *See* NAT'L ACAD. OF SCI., ENG'G, AND MED., ASSESSING THE RISKS OF INTEGRATING UNMANNED AIRCRAFT SYSTEMS (UAS) INTO THE NATIONAL AIRSPACE SYSTEM (The National Academies Press ed., 2008) [hereinafter ASSESSING THE RISKS].

38. *Id.* at 2.

39. *Id.*

40. *Id.*

41. *Id.* at 3.

42. ASSESSING THE RISKS, *supra* note 37, at 3.

43. *Id.*

44. *Id.*

45. *Drones: Reporting for Work*, GOLDMAN SACHS, https://www.goldmansachs.com/insights/technology-driving-innovation/drones/ (last visited Sept. 14, 2019).

46. *Id.*

regulations that are hindering the development and operation of drone technology.[47]

Currently, the FAA uses the Low Altitude Authorization and Notification Capability (LAANC), which regulates UAS control over the national airspace.[48] LAANC also provides an automated "process for the approval of airspace authorizations."[49] "Through automated applications developed by an FAA Approved UAS Service Suppliers (USS) pilots apply for an airspace authorization."[50]

In order to prevent misunderstanding, the acronyms for Unmanned Aerial Vehicles (UAV), Unmanned Aerial Systems (UAS), Remotely Piloted Aircraft System (RPAS), and the word drone, in singular or plural, are used interchangeably depending on the source of the information.[51]

II. LAWS AND EVENTS IN DIFFERENT COUNTRIES.

Jurisdictions which have passed regulations governing the open use of drones in the private sector.

A. United States.

1. FAA Reauthorization Act of 2018.

"On October 5, 2018, the President of the United States signed the FAA Reauthorization Act of 2018, which establishes new conditions for recreational use of drones and immediately repeals the Special Rule for Model Aircraft."[52] The new legislation requires the FAA to adopt a more risk-based approach when it comes to the development of drone policies nationwide, which relaxes the regulations that are currently in place for UAS.[53] "The FAA Reauthorization allows the agency to expedite the review

47. *Id.*

48. *UAS Data Exchange (LAANC)*, FEDERAL AVIATION ADMINISTRATION, https://www.faa.gov/uas/programs_partnerships/data_exchange/ (last modified Aug. 9, 2019, 12:12 PM).

49. *Id.*

50. *Id.*

51. *Drone, UAV, UAS, RPA or RPAS*, ALTIGATOR, https://altigator.com/drone-uav-uas-rpa-or-rpas/ (last visited Sept. 14, 2019).

52. *FAA Reauthorization Bill Establishes New Conditions for Recreational Use of Drones*, FEDERAL AVIATION ADMINISTRATION, https://www.faa.gov/news/updates/?newsId=91844 (last modified Oct. 12. 2018, 12:32 PM).

53. Andrea O'Sullivan & Michael Kotrous, *The Good and the Bad of FAA Reauthorization: Drone Policy*, THE BRIDGE (Nov. 6, 2018), https://www.mercatus.org/bridge/commentary/good-and-bad-faa-reauthorization-drone-policy.

process for authorization and lifts some burdensome drone restrictions."[54] The begin with, the FAA has one year to update the current regulations and to allow drones to carry property by operators for compensation or hired within the United States.[55] "Further, FAA Reauthorization codifies an administrative directive that established the Integrated Pilots Program."[56] This program is designed to test "beyond-line-of-sight flights," detection and avoidance systems, *command and control links*, while also testing how *factors like weather conditions* and human error *affect safe operations*.[57]

2. Licensing and Registration Requirements for Certain UASs.

Under the FAA Reauthorization, Recreational pilots will now be required to carry proof that they have passed a basic aviation knowledge and safety exam.[58] Additionally, pilots will be required to register their UAS before flying, and label the UAS with the proper registration number.[59] The registration is valid for three years and costs $5 per UAV.[60] The pilot will be required to provide an email address, credit or debit card, physical address and mailing address, make and model of UAV.[61]

3. Safety Standards for UASs.

Section 345 of the FAA Reauthorization calls for the FAA to develop a process to develop safety standards related to design, production, and modifications of UAV and considering the risk associated with operations.[62] Needless to say it the FAA Reauthorization establishes a prohibition and

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54. *Id.*

55. *Id.*

56. *Id.*

57. *Id.*

58. O'Sullivan & Kotrous, *supra* note 53.

59. *Register Your Drone*, FEDERAL AVIATION ADMINISTRATION, https://www.faa.gov/uas/getting_started/register_drone/ (last modified July 11, 2019, 8:56 AM).

60. *Id.*

61. *Id.*

62. Jeff Davis, *Summary of Final Compromise FAA Reauthorization Act of 2018*, THE ENO CTR. FOR TRANSP. (Sep. 24, 2018), https://www.enotrans.org/article/summary-of-final-compromise-faa-reauthorization-act-of-2018.

penalty for false certifications.[63] This will allow private manufacturers to self-certify the UAS without input from the FAA.[64] The safety standards must consider the technologies employed with the UAV, such as geo-fencing, altitude limiters, sense and avoid, Return To Home (RTH), Remote ID and tempering control.[65] Homebuilt UAS may require different safety standards based on their risk assessment and the FAA must determine whether any type of UAS will be exempt from the safety standards established.[66] For example, the FAA Reauthorization states that the FAA may exempt UAS that are "not capable of navigating beyond visual line of sight of the operator through advanced flight systems and technology," but only if the exemption does not pose a risk to the national airspace.[67]

4. Prohibited Activities with UASs.

Recreational pilots are subject to criminal and civil liabilities if they violate any of the safety requirements enumerated in the FAA Reauthorization, such as not meeting the safety requirements or operating in a careless and reckless manner.[68] Fly UAS at or below 400 feet when in uncontrolled or "Class G" airspace and keep UAS within line of sight, or within the visual line-of-sight of a visual observer who is co-located and in direct communication.[69] Operating a UAV in a restricted or prohibited airspace is not allowed.[70] It is the drone pilot's responsibility to ensure that the operation complies with all airspace restrictions that they never fly near other aircraft, whether manned or unmanned.[71] UAV cannot be flown near airports, over large groups of people, at public events or stadiums, near emergencies, law enforcement, firefighters, or recovery efforts, or while the operator is under the influence of drugs and alcohol.[72]

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63. *Id.*

64. Kenji Sugahara, *Analysis of the 2018 FAA Reauthorization Act*, ARIASCEND (Dec. 13, 2018), https://www.ariascend.com/analysis-of-the-2018-faa-reauthorization-act/.

65. *Id.*

66. *Id.*

67. *Id.*

68. *Recreational Flyers & Modeler Community-Based Organizations*, FED. AVIATION ADMIN., https://www.faa.gov/uas/recreational_fliers/ (last modified Aug. 13, 2019).

69. *Id.*

70. *Id.*

71. *Id.*

72. *Id.*

5. Carriage of property by small UAS.

Although the FAA Reauthorization does not authorize delivery flights beyond the operator's line of sight, there is room for the drone delivery market to demonstrate safety and persuade the FAA to relax restrictions and potentially ease regulations on beyond-line-of-sight operations.[73] Alphabet Inc's Wing Aviation, the sister company of Google, got approval to start delivering goods via drones in Virginia, which makes this the first company to get such an approval in the U.S.[74] This certification will be valid for two years and the pilot can operate up to five UAV at once, but only during the daytime, the materials carried cannot be hazardous, and the UAV cannot hover over people.[75]

6. Use of UAS aircraft systems for Public Service.

The U.S. Forest Service has sought new opportunities with drone technologies, and affirms the potential that UAV can have in supporting the agency in a host of activities such as natural resource management, measuring the health of forests, wildfire suppression, and law enforcement to name a few.[76] The U.S. Forest Service believes that UAV can further the agency's goals and provide an asset to the National Forest System while in compliance with the FAA regulations governing UASs.[77]

B. Italy.

1. Regulation of Remotely Piloted Aerial Vehicles.

The Italian Civil Aviation Authority (ENAC) governs regulations pertaining to Remotely Piloted Aerial Vehicles.[78] On 24 March 2017, ENAC

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73. O'Sullivan, *supra* note 53.

74. David Shepardson, *FAA Paves Way for Alphabet Unit to Make First U.S. Drone Deliveries*, REUTERS (Apr. 23, 2019, 2:53 PM), https://www.reuters.com/article/us-usa-drone-alphabet/faa-paves-way-for-alphabet-unit-to-make-first-u-s-drone-deliveries-idUSKCN1RZ25N.

75. *Id.*

76. *Unmanned Aircraft Systems (UAS)*, U.S. FOREST SERV., https://www.fs.fed.us/managing-land/fire/aviation/uas (last visited Sep. 14, 2019).

77. *Id.*

78. Regolamento [Regulation] 22 dicembre 2016, n. 21/2016, art. 4, C.d.A. Dec. 16, 2013, n. 42/2013 (It.).

approved new amendments to the 2015 regulations governing UAVs.[79] The amendment provides modifications to article 29 and introduces a new safety framework that provides clarification on ENAC's response requirements in case of accidents.[80] Art. 29 is only applicable to commercial drone operations since drone operations for recreational purposes are not considered part of the framework according to existing Italian drone regulations, and are subject to ordinary courts.[81]

2. Licensing and Registration Requirements for Certain UASs.

In order to obtain a Permission for Aerial Work (PFAW) for flying in Italy all UAS Pilots have to apply to ENAC for a declaration: for non-critical and critical operations in standard scenarios; and authorization: for critical operations not included in standard scenarios.[82] Any foreign pilots seeking to fly in Italy need to convert their license under ENAC.[83] Pilots who already have an Italian license need to collect all the required documentation: Operations Manual, Flight Manual, Maintenance Manual, RPAS Configuration System Document, Risk Assessment, Flight trials document, Flight Logbook, Medical License, RPAS Serial Numbers and tags.[84] Once the pilot gathers all the documents, then the forms will be subject to non-critical & standard scenarios operations or the Authorization for critical operations.[85] The declaration and registration costs 600 € plus taxes ($682.05 usd.).[86] The pilot will receive a QR code that identifies that UAV once the registration is complete by ENAC and it is registered on the D-flight list.[87] Commercial drone operations are subject to regulation while recreational use

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79. *Italy Approves a New Amendment to the National Drone Regulation*, DRONERULES (May 18, 2017), http://dronerules.eu/pt/professional/news/italy-approves-a-new-amendment-to-the-national-drone-regulation.

80. *Id.*

81. *Id.*

82. *How to Apply to ENAC*, EUROUSC, https://www.eurousc-italia.it/applications/ (last visited on Sept. 14, 2019).

83. *Id.*

84. *Id.*

85. *Id.*

86. *Id*.

87. *How to Apply to ENAC*, *supra* note 82.

is not as complex or restrictive.[88] RPAS specialized operations with operating take-off mass of less than or equal to 2 kg (4.4 lbs.) are to be considered non critical in any operative scenario.[89] The RPAS must meet certain design and manufacturing criteria that do not hinder safety and the RPAS must be verified by ENAC or any agency authorized to do so before operation.[90]

3. Safety Standards for UASs.

More advanced and specialized operations can be done for as long as it does not hinder safety standards and the operations does not pose a risk to other manned or unmanned aircraft.[91] The safety level that applies is dependent on the RPAS itself, the pilot's skill and experience, the procedures employed during the flight, environmental conditions and any other element that may affect the safety of the RPAS such as proper implementation of maintenance programs.[92] The RPAS as a whole needs to be in compliance with the safety standards set forth by ENAC and must remain so throughout the operation of the aircraft.[93] All RPAS designed to carry out specialized operations shall be equipped with a flight termination system that can function automatically regardless of the primary command and control system.[94] There must be a minimum height level that is sufficient for the flight termination system to be effective.[95]

4. Prohibited Activities with UASs.

RPAS cannot be operated over large crowds, sport events, or public gatherings.[96] RPAS cannot be operated within the Aerodrome Traffic Zone (ATZ) and beneath take-off and landing paths or at a distance less than 5 km

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88. Woerndle & Partner, *Legal Regulation for the Use of Drones(UAS-RPAS) in Italy Comparison to Regulations in Other Alpine Countries Use of Drones in Conservation Areas*, ALPARC 1, 2, http://www.alparc.org/de/ressourcen/item/download/1246_81ec7e1aabbdf5b94da4932ac0d0f00c (last visit June 27, 2019).

89. *Id.* at 3.

90. R. n. 21/2016 art. 11 (It.).

91. *Id.* at art. 10.

92. *Id.*

93. *Id.*

94. *Id.*

95. R. n. 21/2016 art. 10 (It.).

96. *Id*. at art. 10.

[3.1 mi.] from the airport where ATZ is not established; within Controlled Traffic Region (CTR), within active restricted areas and prohibited areas.[97]

5. Carriage of property by small UAS.

Donatello Gianni, president of the temporary Joint Venture U-Avitalia, provided a presentation as to the future development of Cargo UAVs as sponsored by RTI U-Avitalia, Piaggio Aerospace, Bcube in partnership with at the Unmanned Cargo Aircraft Conference, on November 23, 2017, in Rivalta di Torino, Italy.[98] The Cargo UAV project was sponsored by ENAC and successfully completed its first test flight at the Trapani Birgi airport on the 10 and 11 of October [2017].[99] The Cargo UAV was designed by Piaggio Aerospace, in collaboration with Leonardo's avionics system division and with the support of the Italian Air Force.[100] The success of the first test flight provides a milestone for further development of regulations relating to commercial drone delivery systems for UAV above 150 kg, whilst creating an opportunity to enlarge the drone market even further and influencing the private and governmental sectors.[101]

This platform and the success of the first test flight will provide an opportunity to further develop, produce, operate, and support of unmanned cargo aircraft (UCA).[102] The members of this platform are manufacturers, knowledge institutes, consultancy bureaus and entrepreneurs in Belgium, China, France, Germany, Italy, Kenya, the Netherlands, the UK, the USA and other countries.[103] The activities involved include, but is not limited to, research, creating a communication platform for members, and participation in advisory groups.[104]

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97. *Id.* at art. 24.

98. W. Master, *First Flight and Real Project for Future Development of Cargo UAV by RTI U-Avitalia/ Piaggio Aerospace/Bcube in Partnership with ENAC – Presented by Donatello Gianni*, UNMANNED CARGO AIRCRAFT CONF. (July 11, 2017), https://unmannedcargoaircraftconference.com/speaker/first-flight-real-project-future-development-cargo-uav-donatello-gianni/.

99. *Id.*

100. *Id.*

101. *Id.*

102. Avio Aero, *5th Edition of the Unmanned Cargo Aircraft Conference*, UNMANNED CARGO AIRCRAFT CONF. (Nov. 23, 2017) http://www.jakajima.eu/wp-content/uploads/2017/07/Press-release_Puca_conference_in_Avio-Aero_november23-002.pdf.

103. *Id.*

104. *Id.*

6. Use of UAS aircraft systems for Public Service.

Search and rescue operations have found a new tool with the use of drones that provide a different point of view with quadcopters equipped with GPS capabilities and video cameras.[105] UAS have been used by the Italian National Fire Corps [Corpo Nazionale dei Vigili del Fuoco] (CNVVF) to provide a different point of view to rescue workers and international news organizations.[106] Similarly to rescuers who use helicopters to locate and retrieve survivors in areas that are blocked off by debris.[107] Italy has a notorious history of slow and inefficient natural disaster response, but drones have provided the speed and efficiency that is needed to scout an area for survivors, by this changing world's opinion regarding Italy's response methods.[108]

C. Costa Rica.

1. Operation of Remote Piloted Aircraft Systems of Costa Rica.

The General Office of Civil Aviation of Costa Rica governs regulations of UAV, RPAS and unmanned aircraft and the limitations in operations and restrictions of the national airspace.[109] The operational guidelines governing UASs became effective in Costa Rica on August 13, 2017.[110] These regulations provide guidelines regarding the use of drones for recreational, commercial and governmental purposes.[111]

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105. Tonya Riley, *Drones Get a Bad Rap: Drones have an Image Problem and that's Keeping them from Saving Lives*, INVERSE (Aug. 25, 2016), https://www.inverse.com/article/20210-humanitarian-aid-drones-italy-earthquake.

106. *Id.*

107. *Id.*

108. *Id.*

109. *See* Directiva Operacional, DO-001-OPS-RPAS, Operaciones con Sistema de Aeronave Piloteada a Distancia (RPAS) [Regulations Regarding the Operation of Remotely-Piloted Unmanned Aircraft], Dirección General de Aviación Civil Costa Rica. *See also, Drone Laws in Costa Riva,* UAV COACH, https://uavcoach.com/drone-laws-in-costa-rica/ (last visited Aug. 28, 2019).

110. Wendy Anders, *Drones in Costa Rica must be Registered Within 6 Months*, THE COSTA RICA STAR (Aug. 22, 2017), https://news.co.cr/drones-costa-rica-must-registered-within-6-months/64541/.

111. *Id.*

2. Licensing and Registration Requirements for Certain UASs.

The guidelines allow the General Civil Aviation Authority (DGAC) to keep track of drones by requiring registration of any UAV that weighs more than 25 kg [55 lbs.] and requiring an identification plate when its weight is less than the registration requirement.[112] The Executive Branch of Costa Rica will require DGAC to keep a digital registry in which all owners of commercial or non-commercial UAS must register.[113] The registry applies to all UAS regardless of weight and operation type.[114] To start the registration process, the drone operator must attend an informational meeting to review the regulations.[115] Once the meeting is completed, the operator must submit the required documents, which once reviewed and approved by DGAC, will allow the operator to take a practical drone flight test to demonstrate adequate and correct usage of the craft for which the permission is being sought.[116] If the operator successfully completes all the requirements, DGAC will provide an operating permit that will be valid from five to fifteen years.[117]

An additional note on the test, it requires a drone flight course consisting of 48 theoretical hours and 10 practical hours with the training provided by approved centers.[118] The DGAC application for a drone permit costs $1,874 USD and does not include the cost of the required training.[119]

3. Safety Standards for UASs.

RPAS owners are required to purchase liability insurance that covers damages caused during or on account of flying, and covers third parties as well.[120] A RPAS flight is considered a Visual Line of Sight Operation (VLSO) if the drone has a maximum takeoff mass below 25 kg, which means

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112. Gabriela Alfaro, *New Drone Guidelines in Costa Rica*, NASSAR ABOGADOS (June 8, 2017), http://en.nassarabogados.com/blog/nueva-directiva-de-drones-en-costa-rica.

113. *Id.*

114. *Id.*

115. Anders, *supra* note 104.

116. *Id.*

117. *Id.*

118. *Id.*

119. *Id.*

120. Alfaro, *supra* note 112.

the drone may operate in uncrowded zones, uncontrolled airspace, within the visual range of the pilot, and at a maximum distance of 500 meters and maximum height of 120 meters.[121] Beyond Visual Line of Sight Operations (BVLSO) are those beyond the visual range of the pilot that is still within radio broadcasting range and within the control station and that has a maximum height of 120 meters, as long as the position of the aircraft is able to be known.[122] "BLVSO operations required the issuance of a NOTAM (Notice to Airmen) from the Aeronautical Information Service (AIS) that must be requested by the operator."[123] Drone flights in the national airspace that are deemed special operations require further approval prior to being authorized to perform said operations.[124] Special operations are those that are beyond the radio line, at night, with a maximum take-off mass above 25 kg, and that fly within 30 meters of crowded or inhabited areas.[125] Drone pilots that operate within the national airspace to market products and services must obtain the appropriate operating license and operating certificate following RAC (Costa Rican Aeronautical Regulations).[126]

4. Prohibited Activities with UASs.

The use of UAS is prohibited in restricted areas designated by the General Civil Aviation Authority, except with proper permission.[127] UAS are not permitted to operate within a radius of 8 km around an aerodrome, except with permission and the conditions established by the DGAC.[128] The operation of an UAS cannot be done in such a way that it can constitute an obstacle to another approaching aircraft to an aerodrome.[129] No person can operate an UAS near another aircraft, so as to pose a danger of collision.[130] UAS cannot operate above 120 meters from ground level in an uncontrolled

121. *Id.*

122. *Id.*

123. *Id.*

124. *Id.*

125. Alfaro, *supra* note 112.

126. *Id.*

127. *See* Directiva Operacional, DO-001-OPS-RPAS, Operaciones con sistema de aeronave piloteada a distancia (RPAS) [Regulations Regarding the Operation of Remotely-Piloted Unmanned Aircraft], Dirección General de Aviación Civil Costa Rica.

128. *Id.*

129. *Id.*

130. *Id.*

airspace, except with the permission and conditions established by the DGAC.[131] Can use aerial activities with unmanned aircraft only during the day and in visual weather conditions, the performance of night flights is subject to the approval and conditions of the DGAC.[132] Unmanned aircraft can only operate in areas outside agglomerations of buildings in cities, towns or inhabited places, meetings of people outdoors, in uncontrolled airspace, except with the permission and conditions established by the DGAC.[133]

5. Carriage of property by small UAS.

Costa Rica allows for the use of UAS for cargo, and currently eight remote communities in Costa Rica receive drugs via UAS since 2017.[134] Costa Rican Social Security Fund (CCSS) links the health centers in remote communities with distribution points where drones can operate and deliver the medicine.[135] By using UAS to deliver much needed medicine and drugs, the waiting time has been reduced to 45 after an order has been placed.[136] Without the use of drones patients would have to wait anywhere from several hours to three days to receive their much needed medicine.[137] The program hopes to deliver every month anywhere from 13,200 medical packages with a cost close to $26.000 USD.[138] The drugs are controlled and administered by CCSS-affiliated doctors in these remote communities.[139] On the other end an employee will prepare the medical packet, and the 10 kg UAS will deliver it to its destination.[140] The CCSS is also taking steps to provide electronic prescriptions, as to improve the efficiency of drug requests, and allow health professionals to request medicines digitally.[141]

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131. *Id.*

132. Directiva Operacional, *supra* note 127.

133. *Id.*

134. Diego Arguedas Ortiz, *Drones to Deliver Drugs in Remote Costa Rica*, SCIDEV.NET (Oct. 19, 2016), https://www.scidev.net/global/technology/news/drones-drugs-costa-rica.html.

135. *Id.*

136. *Id.*

137. *Id.*

138. Ortiz, *supra* note 134.

139. *Id.*

140. *Id.*

141. *Id.*

6. Use of UAS aircraft systems for Public Service.

The Costa Rican Fire Department (CRFD) has incorporated drones into its emergency operations.[142] The use of UAS by the CRFD for emergency response requires further development for emergency protocols to improve the efficient application of the new technology to ensure human safety by aiding in emergency situations.[143] Drones can be deployed for forest and brush fires, structure fires, hazardous materials incidents, traffic incidents, and remote sensing.[144] These types of emergencies all have limited visibility, and drones provide an improved point of view to counteract the limitations that humans alone cannot surpass.[145] CRFD has common emergencies such as forest and brush fires, which can be aided by drones.[146] UAS can provide more precise data in emergency situations and are more efficient manner to save time and lives.[147] Drones can provide a perspective that is not available from the ground, which allows firefighters to use this point of view and take appropriate measures to combat the emergency situation.[148]

Drones have also been used to conduct aerial surveys off the coast of Ostional, Costa Rica, to study and research Olive Ridley sea turtles.[149] The use of drones to conduct research can provide robust, safe, and cost-effective population assessments of sea turtle populations in coastal marine ecosystems.[150] Recent studies have shown that drone technology is a strong tool that can be used to study marine wildlife at sea by providing new methods of gathering data.[151] The Olive Ridley sea turtle study has explored

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142. Joseph Alvarado, Tara Sharp, Oliver Simon & Samuel Sierra, *The Application of Drones in the Costa Rican Fire Department*, WORCESTER POLYTECHNIC INSTITUTE (May 2, 2016), https://web.wpi.edu/Pubs/E-project/Available/E-project-050216200226/unrestricted/CR16_Drone_Protocol.pdf.

143. *Id.*

144. *Id.*

145. *Id.*

146. Alvarado, *supra* note 142.

147. *Id.*

148. *Id.*

149. Seth T. Sykora-Bodie et al., *Quantifying Nearshore Sea Turtle Densities: Applications of Unmanned Aerial Systems for Population Assessments*, SCIENTIFIC REPORTS (Dec. 18, 2017), https://www.nature.com/articles/s41598-017-17719-x.

150. *Id.*

151. *Id.*

new methods for conducting population surveys and estimating sea turtle densities using a small, fixed wing UAS.[152]

D. United Arab Emirates.

1. General Civil Aviation Authority Regulation of Unmanned Aerial Systems.

> [T]he United Arab Emirates (UAE) General Civil Aviation Authority (GCAA) is the regulatory authority for the use of drones in the UAE, in as much as to establish procedures and instructions for the safe operation of UAS, and operators shall ensure that every flight is conducted in accordance with the provisions of this CAR and applicable laws (including the Civil Aviation Law of the UAE) this includes but not limited to the following requirements: Operators shall ensure that all UA are appropriately insured before commencement of any operation; operators shall not operate UA in a manner which may cause safety risks to other individuals/properties or aircraft; operators shall ensure that the UA Pilot gives way to other aircraft at all times and land the UA whenever hearing or sighting another aircraft in the vicinity of the UA operation; operators shall ensure that no flight contravenes intentionally or unintentionally the privacy of others; operators shall determine and maintain a defined Minimum Safety Distance for operation of any UAS from persons not directly involved in flying the UA and from fixed or mobile objects. The Minimum Safety Distance shall not be less than 50 meters unless prior authorization has been obtained from the GCAA; no UAS shall be used to carry persons; operators shall ensure that no flights is for recreational purposes; and operators shall ensure that no flights is for commercial activities unless authorized.[153]

Resolution No 2 of 2015 provides the GCAA with the foundations for drone regulations in the UAE.[154] Building on that foundation, the GCAA

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152. *Id.*

153. *Car-UAS Unmanned Aircraft System (UAS) and Operations*, UAE GENERAL CIVIL AVIATION AUTHORITY (Feb. 6, 2018), https://www.gcaa.gov.ae/en/GCAA%20ePublication%20Pdf/CARUAS%20%20UNMANNED%20AIRCRAFT%20SYSTEM%20(UAS)%20AND%20OPERATIONS-%20ISSUE%2001.pdf.

154. STA Law Firm, *United Arab Emirates: Overview: Drone Laws and Regulations in the UAE*, MONDAQ (Jan. 25, 2019), http://www.mondaq.com/x/775090/Aviation/Overview+Drone+Laws+and+ Regulations+in+the+UAE.

published the GCAA Civil Aviation Regulations which oversees the operations of drones in the UAE.[155]

2. Licensing and Registration Requirements for Certain UASs.

All pilots intending to operate a UAS within the national airspace my register with the GCAA before commencing operations.[156] If the operations is for commercial purposes, the pilot must register and obtain the Unmanned Aircraft Operator Authorization (UOA).[157] Any operators that intend to fly drones in the national airspace for commercial or special operations are required to get authorization from the GCAA by obtaining security clearance and filing a "UA operator registration letter."[158] The operator registration letter must be printed on the company letterhead and submit to the GCAA, subscribe to the GCAA E-Publications service and send the evidence of subscription thereafter.[159] It takes around 3 weeks to obtain the UOA and is subject to GCAA discretion.[160] However, the UOA does not in it of itself authorize the operator to fly the drone.[161] The operator must apply for an unmanned aircraft operation permission for each drone flying activity in any red zone.[162]

3. Safety Standards for UASs.

The operator must comply with any manufacturer's instructions and inspect the drone before commencement of flight.[163] The drone and the operator must always have direct radio control link during the flight while frequency band restrictions shall be maintained.[164] The effects UAS has on radio communication, such as interference, is of considerable concern as

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155. *Id.*

156. *Registration of Unmanned Aerial Vehicles*, GENERAL CIVIL AVIATION AUTHORITY, https://gcaa.gov.ae/en/pages/UASRegistration.aspx (last visited June 27, 2019).

157. *Id.*

158. *Id.*

159. *Id.*

160. *Id.*

161. *Registration of Unmanned Aerial Vehicles*, *supra* note 156.

162. *Id.*

163. *Id.*

164. *Id.*

well.[165] UAS may not be used in a hostile manner as to promote collisions with people, objects, and other aircraft.[166] Given their ability to reach places otherwise not accessible, UAS cannot be used to harass or endanger people or threaten to damage property.[167] The utility of the UAS rests on the operator, who has full responsibility of compliance with the regulations while operating.[168] GCAA also requires appropriate insurance prior to operating.[169] UAS may be used for a number of operations, as such, prior to any flight, it is imperative to provide proper maintenance and to ensure that the UAS is fit for the intended flight in order to ensure safe operations.[170] Pilots are also subject to enumerated requirements prior to operation of an UAS.[171]

4. Prohibited Activities with UASs.

Beyond safety requirements, there are additional prohibitions relating to the operations of UAS, mainly, no video or image capturing devices shall be used when flying.[172] The use of drop or release devices on an UAS is also prohibited.[173] Flying is limited to line of sight and to an altitude of less than 400 feet above ground level.[174] Flight is restricted to the daytime and only under good weather conditions.[175] The use of UAS cannot be for commercial purposes, and is restricted to recreational use only.[176] UAS may not be flown within 5 km of airports, and airfields or in controlled zones.[177]

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165. *Id.*

166. *Registration of Unmanned Aerial Vehicles*, *supra* note 156.

167. *Id.*

168. Paul Katsouris, *Droning on: New Drone Regulation in the UAE*, INCE (Apr. 4, 2018), https://www.incegd.com/en/knowledge-bank/droning-on-new-drone-regulation-in-the-uae?event=reloadPublications&currentPagePiD=58ef56d8c6fe1b0e9cddff00&assetType=PUBLICATION&orderBy=datedesc&take=8&skip=0&ajaxbranchid=58ef614fc6fe1b266450fe10.

169. *Id.*

170. *Id.*

171. *Id.*

172. *Registration of Unmanned Aerial Vehicles*, *supra* note 156.

173. *Id.*

174. *Id.*

175. *Id.*

176. *Id.*

177. *Registration of Unmanned Aerial Vehicles*, *supra* note 156.

5. Carriage of property by small UAS.

Eniverse Technologies, a delivery company that uses UAS systems, projects that the use of drones for deliveries can cut costs by 30-40 percent.[178] The use of drones for delivery clearly provides an economic benefit for Dubai, but it also has a more environmentally friendly impact than standard delivery methods.[179] The approval process for delivery drones can take 6 to 12 months.[180] It is expected that the project will start with five UAS deliveries in Emirates Hills, The Meadows, The Springs, The Greens, Jumeirah and Umm Suqeim.[181] The initial phase of the project will provide the stepping stone for Eniverse in order to expand their 5 kg-maximum deliveries of goods to more areas, while expecting an increase of the drone fleet to 100 vehicles.[182] The Roads and Transportation Authority (RTA) of Dubai, is planning on beginning trials for drone delivery.[183]

6. Use of UAS aircraft systems for Public Service.

There have been over 2,000 recorded traffic violations using UAS since March 2016.[184] These traffic control drones are equipped with infrared video cameras to catch reckless drivers and improve road safety.[185] The drones can also take video footage of accidents and relay information relating to traffic jams, which help patrol cars clear these areas and improve efficiency.[186] These drones can live-stream to patrol vehicles and senior officers at the central operations room which allows better management of emergency situations.[187]

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178. Marco Margaritoff, *Drone Delivery is Coming to Dubai by 2018*, THE DRIVE (Jul. 26, 2017), https://www.thedrive.com/aerial/12883/drone-delivery-is-coming-to-dubai-by-2018.

179. *Id.*

180. *Id.*

181. *Id.*

182. *Id.*

183. Margaritoff, *supra* note 178.

184. Arabian Business, *Ajman Police Use Drones to Keep Eye on Traffic Jams, Reckless Drivers*, ITP DIGITAL MEDIA (Dec. 4, 2016, 12:59 PM) https://www.arabianbusiness.com/ajman-police-use-drones-keep-eye-on-traffic-jams-reckless-drivers-655014.html.

185. *Id.*

186. *Id.*

187. *Id.*

Jurisdictions which have passed regulations restricting or banning the use of drone technology in the private sector.

E. Canada

1. Drone Safety Regulation.

Transport Canada regulates drone safety, drone registration, drone pilot certification, restrictions, and reporting of drone incidents.[188] On January 9, 2019, the Government of Canada published new rules for operating drones.[189] These rules are now applicable.[190] The new rules apply to drones that weigh between 250 grams to 25 kilograms (kg) and are operated within the pilot's sight.[191] Transport Canada applies the rules based on two categories of UAS operations: basic and advanced.[192] The categories are determined based on the distance from bystanders and the rules applicable to the airspace where the drones will be operated.[193]

2. Licensing and Registration Requirements for Certain UASs.

In order for a person to seek registration and certification to operate a drones must be a citizen or permanent resident of Canada, or a corporation incorporated under the laws of Canada, or a government entity.[194] The minimum age requirement for registering, seeking certification and operating a drone is 14.[195]

Pilots conducting basic operations need a Pilot Certificate for Basic Operations while Pilots conducting advanced operations need a Pilot

188. Transport Canada et al., *Drone Safety*, GOV'T OF CAN., http://www.tc.gc.ca/en/services/aviation/drone-safety.html (last modified Aug. 2, 2019).

189. Transport Canada, *New Rules for Drones in Canada*, GOV'T OF CAN., https://www.tc.gc.ca/en/services/aviation/drone-safety/new-rules-drones.html#overview (last modified May 31, 2019) [hereinafter *New Rules for Drones in Canada*].

190. *Id.*

191. *Id.*

192. *Id.*

193. *Id.*

194. Canadian Aviation Regulations, SOR/96-433, art 901.04 (1) (Can.).

195. *Id.* at art 901.04 (2).

Certificate for Advanced Operations.[196] Certification requires the passing of a Small Advanced Exam and an in-person flight review.[197] The in-person flight review is designed to assess a pilot's ability to safely operate their drone.[198] Any drone weighing between 250 grams and 25 kilograms must be registered with Transport Canada.[199] The drones must displayed the registration number while they fly.[200] Pilots cannot operate a UAS system without the registration being handy while flying.[201]

3. Prohibited Activities with UASs.

UAS are limited to flight below 120 meters or 30 meters above any building.[202] UAS cannot be flown in formation with other UAS unless the formation was arranged prior to flight.[203] No pilot shall operate a remotely piloted aircraft at or near an aerodrome that is listed in the Canada Flight Supplement or the Water Aerodrome Supplement in a manner that could interfere with an aircraft operating in the established traffic.[204] No pilot shall operate a remotely piloted aircraft while operating a moving vehicle, vessel or manned aircraft.[205] UAS may not be flown during the nighttime, or operate using night-vision goggles, unless the goggles are capable of detecting all light within the visual spectrum.[206]

196. *New Rules for Drones in Canada*, *supra* note 189.

197. *Id.*

198. *Id.*

199. *Id.*

200. *Id.*

201. *New Rules for Drones in Canada*, *supra* note 189.

202. Canadian Aviation Regulations, *supra* note 194, at art 901.25 (1).

203. *Id.* at art 901.36.

204. *Id.* at art 901.47 (1).

205. *Id.* at art 901.37.

206. *Id*. at art 901.39 (2).

4. Punishment and Oversight of UAS.

Penalties for violating UAS regulations includes fines and jail time.[207] Fines include, but is not limited to, $1,000 for flying without a drone pilot certificate; up to $1,000 for flying unregistered or unmarked drones; up to $1,000 for flying where you are not allowed; up to $3,000 for putting aircraft and people at risk; up to $5,000 for flying without a drone pilot certificate involving corporate operations; up to $5,000 for flying unregistered or unmarked drones; up to $5,000 for flying where not allowed; up to $15,000 for putting aircraft and people at risk.[208] All UAS operators are subject to the Canadian Criminal Code as well as any laws governing privacy and trespassing.[209] Endangering the safety of a manned aircraft could be subject the operator to additional fines of up to $25,000 or prison depending on the act.[210] All drones are subject to regulations prohibiting certain activities while operating UAS.[211]

F. Spain

1. Official Bulletin Regarding Remotely Piloted Aerial System.

Article 8 of the Chicago Convention establishes that no aircraft capable of flying without a pilot shall operate within the national airspace.[212] In December 30, 2017, Spain released Regulations Governing UAS, with revisions done on June 15, 2018.[213] No aircraft capable of flying without a pilot shall do so on the territory of Spain unless it has a special authorization from that State and in accordance with the terms of that authorization.[214] It

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207. Transport Canada, *Flying Your Drone Safely and Legally*, GOV'T OF CAN., https://www.tc.gc.ca/en/services/aviation/drone-safety/flying-drone-safely-legally.html (last modified May 30, 2019).

208. *Id.*

209. Transport Canada, *Minister Garneau Unveils Canada's New Drone Safety Regulations*, GOV'T OF CAN., https://www.canada.ca/en/transport-canada/news/2019/01/minister-garneau-unveils-canadas-new-drone-safety-regulations.html (last modified Jan. 9, 2019).

210. *Id.*

211. *Id.*

212. Operation of Remotely Piloted Unmanned Civil Aircrafts, Statement of Motives (B.O.E. 2017, 1036) (Spain).

213. *Id.*

214. *Id.*

is for the States to ensure that the flight of these pilotless aircraft in the regions opened for the flight of civil aircraft is regulated in such a way as to avoid any danger.[215]

2. Licensing and Registration Requirements for Certain UASs.

UAS with a maximum mass at take-off not exceeding 25 kg are exempt from the registration requirements in the Civil Aircraft Registration Register, and the obtaining of the intended airworthiness certificate, articles 29 and 36 of Law 48/1960 of 21 July on Air Navigation.[216] Current drone regulations only require people who are engaged in the operation of professional drones to be licensed as a pilot.[217] These persons will have to prove theoretical and practical knowledge, in addition to accrediting a LAPL-class medical certificate for < 25KG or Class II for drones >25KG.[218] There are many academies and training centers that issue these degrees.[219]

3. Prohibited Activities with UASs.

Users of UAS intended exclusively for recreational flights must comply with the following conditions: fly at a minimum distance of 8 km from any airport or aerodrome, fly outside of controlled airspace, do not exceed 120 meters above ground, or over the highest obstacle located within a radius of 150 meters from the aircraft; fly by day and in good weather conditions.[220] If the aircraft weighs less than 2 kilograms night flights are allowed as long as it does not exceed 50 meters in height.[221] Flights will always be within the visual range of the pilot.[222] Aircraft of less than 250 grams may fly in the city and on crowds of people and buildings as long as they are not at an

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215. *Id.*

216. *Id.*

217. *Normativa sobre drones en España [2019]*, [*Regulations of Drones in Spain [2019]*], AERIAL INSIGHTS, https://www.aerial-insights.co/blog/normativa-drones-espana/ (last updated June 2019) [hereinafter *Regulations of Drones in Spain*].

218. *Id.*

219. *Id.*

220. *Id.*

221. *Id.*

222. *Regulations of Drones in Spain*, *supra* note 217.

altitude above 20 meters.[223] Although it is not mandatory for recreational use, it is highly recommended to have liability insurance.[224]

For non-recreational, commercial and professional operation of UAS, it is forbidden to fly drones in urban areas and in crowds of people, i.e. beaches, concerts, parks, demonstrations, processions, etc.[225] UAS cannot be flown at night and it is forbidden to fly drones near airports, airfields or other controlled airspaces and endanger third parties.[226] The drone must be flown within the visual range of the pilot, at a distance of no more than 500 meters and at a height on the ground no more than 400 feet (i.e. maximum 120 meters high).[227]

For Recreational use of UAS that does not have a commercial purpose, the aircraft will be considered in this case as an "Aeromodel" and will not legally receive UAS treatment.[228] The use of a drone as recreational use or as a mere hobby does not require any special license.[229]

4. Punishment and Oversight of UAS.

The Agencia Estatal de Seguridad Aérea (AESA) oversees operations of drones and violations while operating same can be subject to criminal punishment and fines up € 225,000.[230]

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223. *Id.*

224. *Id.*

225. *Id.*

226. Elisa Muñoz & José María Mesa, *Restricciones de vuelo con drones en España* [*Drone Flight Restrictions in Spain*], MARISCAL & ABOGADOS, https://www.mariscal-abogados.es/restricciones-de-vuelo-con-drones-en-espana/ (last visited Sept. 14, 2019) .

227. *Id.*

228. *Id.*

229. *Id.*

230. *Government Approves Updated Legislation on Drone Rules in Tenerife*, JANET ANSCOMBE (Dec. 16, 2017), https://www.janetanscombe.com/notices/drone-rules-in-tenerife.html.

G. Nicaragua

1. Law 595 and the International Norms of Civil Aviation.

On November 28, 2014, the Government of Nicaragua issued a press release relating to the operation of UAS within their airspace.[231] The Nicaraguan Institute of Civil Aeronautics provides to civil, military and general authorities that the use of UAS in the national territory that operate at an elevation greater than 100 feet with 30 horizontal meters of displacement is prohibited, since they expose the danger to aviation by becoming an obstacle in airspace.[232] Do not use UAS in order to prevent accidents, given the operation of civilian, military and national and international civil aviation aircrafts throughout the national territory.[233]

The UAS ban is supported by the 1946 Chicago Convention, to which Nicaragua is a signatory, under which Article 8 states that no aircraft capable of flying without a pilot will be allowed to fly within the national airspace.[234]

2. Registration and Marking Requirements for Model Aircraft and Small Unmanned Aircraft.

UAS are not allowed into the country through customs, and are subject to confiscation.[235] Operation of an UAS is only allowed with prior special authorization from the government and strict adherence to the terms set forth therein.[236] Unless, the UAS cannot operate above 100 feet and more than 30

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231. *Restricción para uso de drones en Nicaragua* [*Restriction for Drone Use in Nicaragua*], INSTITUTO NICARAGÜENSE DE AERONÁUTICA CIVIL [NICARAGUAN INST. OF CIV. AVIATION] (Nov. 29, 2014), http://www.inac.gob.ni/2014/11/restriccion-para-uso-de-drones/ [hereinafter *Restrictions for Done in Nicaragua*]; Therese Jones, *International Commercial Drone Regulation and Drone Delivery Services*, RAND iii, 8 tbl.2.2 (2017).

232. *Restrictions for Drones in Nicaragua*, *supra* note 231.

233. *Id.*

234. Resolution 34-2014, Nov. 28, 2014, Resolución del Instituto Nicaragüense de Aeronáutica Civil bajo las facultades conferidas por los Artículos 17 y 29 de la Ley No. 595, Ley General de la Aeronáutica Civil [Resolution of the Nicaraguan Institute of Civil Aviation under its capacity conferred by Articles 17 and 29, Ley No. 595, General Law of Civil Aviation] Exposición de Motivos [Statement of Motives] http://www.inac.gob.ni/wp-content/uploads/2014/12/RESOLUCION_34-2014.pdf.

235. *Id.*

236. *Id.*

meters horizontally.[237] Any UAS capable of operating beyond those limitations is considered a threat to the national airspace.[238]

H. Saudi Arabia

1. Registration and Marking Requirements for Model Aircraft and Small Unmanned Aircraft.

General Authority of Civil Aviation's (GACA) Part 48 provides registration and identification requirements for model aircraft and small unmanned aircraft that are part of a small unmanned aircraft system.[239] GACA oversight of UAS involves registration and issuing licenses for drones, which is a pre-requisite to flying within Saudi Arabia.[240] Most of the process can be completed online through GACA's website in order to ease the process of being able to operate drones within the airspace.[241] GACA is subject to the framework by the government of Saudi Arabia called Kingdom's Vision 2030, which seeks to improve and regulate the work of drones.[242]

2. Licensing and Registration Requirements for Certain UASs.

A Certificate of Authorization, which is issued by the President of GACA, is needed in order to operate a UAS.[243] The Certificate of Authorization contains the official name and address of the operator; the name and address of the accountable person; list and identification of small unmanned aircraft systems used by the operator; any additional operating conditions and limitations set by the President of GACA.[244] No person may operate a UAS unless the owner has registered and marked the aircraft; the

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237. *Id. at* § First.

238. *Id.*

239. General Authority of Civil Aviation Regulations, March 1, 2016, § 48.1 (Saudi Arabia) https://gaca.gov.sa/web/en-gb/page/new-regulations.

240. *See Id.* at § 48.1.

241. *GACA Launches its Electronic Services for Drones Permits*, GEN. AUTHORITY OF CIV. AVIATION (Jan. 11, 2019) https://gaca.gov.sa/web/en-gb/news/gacanews-130119-hf01 [hereinafter *GACA Launches its Electronic Services for Drones Permits*].

242. *Id.*

243. General Authority of Civil Aviation Regulations, *supra* note 239, at § 107.17 (a).

244. *Id*. at § 107.17 (b).

aircraft weighs 250 grams or less on takeoff.[245] Uniquely, in Saudi Arabia, a UAS cannot be registered with GACA if the UAS is already registered in a foreign country and is owned by a citizen or permanent resident of the Kingdom of Saudi Arabia.[246] The intended operator of the UAS must register the aircraft under its name, unless the intended operator is less than 18 years of age.[247] If the intended operator is less than 18 years of age, then the UAS must be registered by a person who is at least 18 years of age.[248]

3. Prohibited Activities with UAS.

UAS must be operated under safe conditions only and for the intended purpose.[249] It is the responsibility of the operator to determine prior to flight that the conditions are prudent for the UAS.[250] If the UAS is not safe to fly and a reasonable person could make such determination, then it is the operator's to not fly the aircraft.[251]

Operation of a UAS un a careless or reckless manner is strictly prohibited, especially if it endangers the life or property of another; or the UAS is equipped with a drop mechanism that creates an unnecessary hazard to persons or property.[252]

Operating a UAS during the nighttime is prohibited, with some exceptions.[253] The operator can fly an UAS during the nighttime if the aircraft has lighted anti-collision lighting that is visible for at least three miles.[254] The lighting requirement during nighttime flight can be reduced if, the operator reasonably determines that the due to operating conditions it

245. *Id.* at § 48.3.

246. *Id.* at § 48.5.

247. *Id.* at § 48.7 (b).

248. General Authority of Civil Aviation Regulations, *supra* note 239, at § 48.7 (b).

249. *Id.* at § 107.19 (a).

250. *Id.*

251. *Id.* at § 107.19 (b).

252. *Id.* at § 107.27.

253. General Authority of Civil Aviation Regulations, *supra* note 239, at § 107.35.

254. *Id.*

would be safer to reduce the intensity of the lights.[255] UAS are not allowed to transport hazardous materials.[256]

The operator of a UAS cannot fly the aircraft over other persons unless the person is participating in the operation of the aircraft or the person is protected under a covered structure or vehicle as to provide reasonable protection from a falling aircraft.[257] UAS may not operate in prohibited or restricted areas unless the operator has permission from the agency controlling that airspace.[258]

4. Punishment and Oversight of UAS.

Under the cyber-crime law of the Kingdom of Saudi Arabia, it is strictly prohibited to take pictures of strangers in public, which can be punishable by imprisonment for up to one year and a 500,000 Saudi riyal fine.[259]

III. COMPARATIVE ANALYSIS OF LAW

I. Similarities

Due to a sharp increase in drone use internationally, countries are struggling to incorporate drones into their aviation regulatory frameworks.[260] Most countries that have created a favorable regulatory environment, there are similarities as to the requirements such as a pilot's license, restricted zones, some form of required or voluntary insurance, and enforcement based on the type of drone, how much it weighs at takeoff, altitude and the type of use of the drone.[261] Countries like the United States have seen pressure by the UAS market to ease regulations, and to establish a proper framework that does not burden the market.[262] This is spearheaded by the commercial usefulness of drones such as providing the opportunities to use them as

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255. *Id.*

256. *Id.*

257. *Id.*

258. *GACA Launches its Electronic Services for Drones Permits*, *supra* note 241, at 11.

259. Naser Al Wasmi, *Drones in Saudi Arabia: Laws and Regulations*, THE NATIONAL (Apr. 22, 2018), https://www.thenational.ae/world/gcc/drones-in-saudi-arabia-laws-and-regulations-1.723778.

260. Jones, *supra* note 231.

261. *Id.*

262. Thomas Black, *Fifty-Mile Drone Flights Beckon as Industry Pushes FAA on Rules*, BLOOMBERG NEWS TRANSP. TOPICS (May 8, 2018, 11:15 AM), https://www.ttnews.com/articles/fifty-mile-drone-flights-beckon-industry-pushes-faa-rules.

delivery robots, emergency responders, or ease of access to deliver goods to consumers.[263] As such, the private sector has been lobbying the FAA to loosen regulations that inhibit the use of drones for commercial purposes.[264] The balance that FAA must accomplish is exceptional however, given that the FAA's conservative nature has kept the national airspace safe, and there is a genuine fear that loosening UAS regulations will pose a danger to passenger and private aircraft, as well as military aircraft and other flying objects using the national airspace.[265] For example, the FAA has been reluctant to permit drones to fly beyond the line of sight of the operator.[266] The numbers provide evidence of the popularity of drones, as in 2018 175,000 UAS were registered with the FAA, and by doing so increasing the total number of UAS in the national airspace by 170%.[267] The original predictions were around a 44% increase in production of UAS, but that number was under projected as 277,000 units entered the commercial drone market that year.[268] In 2018, the FAA predicted there would be roughly 452,000 commercial drones in use by 2022, but now it expects the industry to hit that size around the beginning of next year.[269] It is expected that the commercial drone market will triple in size over the next five years, with an impressive 835,000 aircraft entering the market by 2023.[270]

Around the world, most countries that are accepting of UAS are doing so while balancing the interest of the market and the benefits UAS provide with safety concern of other aircraft that share the airways and civilians on the ground.[271] In Costa Rica drones have been used to counteract deforestation and measure the health of the rainforests in areas where it is

263. *Id.*

264. *Id.*

265. *Id.*

266. *Id.*

267. Jack Corrigan, *FAA Predicts the Commercial Drone Market Will Triple by 2023*, NEXTGOV (May 3, 2019), https://www.nextgov.com/emerging-tech/2019/05/faa-predicts-commercial-drone-market-will-triple-2023/156743/.

268. *Id.*

269. *Id.*

270. *Id.*

271. Jones, *supra* note 231, at 1.

difficult for humans to access.[272] In Italy, drones have been used to access damage caused by natural disasters and aid in finding victims of same.[273]

Virginia Tech School of Public and International Affairs Associate Professor Patrick Roberts research regarding stories about drones in the news, found that most of the drone use was for recreation, scientific research, environmental and wildlife conservation, and commerce.[274] Panelist Bruce Walker of Northrop Grumman described how the Global Hawk System, a type of UAS, assisted in disaster relief after the Haiti earthquake, and the Japan tsunami and nuclear disaster.[275] Drones are versatile machines with limitless applications from tracking storms to delivering an online order.[276]

J. Differences

With varying similarities, there are also differences that abound as to the regulations regarding UAS.[277] A striking one is the requirement for liability insurance.[278] Although most countries recommend liability insurance, some countries require it.[279] In Costa Rica, owners of UAS are required to purchase liability insurance in order to operate.[280] UAS insurance is required to cover liability for damage caused to third parties while operating the UAS.[281] The liability insurance policy must specify the characteristics of the UAS, the type of operations the UAS will be used for,

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272. Sebastian Rodriguez, *With Drones and Lasers, Costa Rica Seeks to Track its Forests*, REUTERS (Oct. 2, 2018), https://www.reuters.com/article/us-costa-rica-forest-carbon/with-drones-and-lasers-costa-rica-seeks-to-track-its-forests-idUSKCN1MC1DI.

273. Riley, *supra* note 105.

274. *How Will Drones Impact American Culture*, VA. TECH. SCH. OF PUB. AND INT'L AFF., https://www.spia.vt.edu/how-will-drones-impact-american-culture/ (last visited Jul. 10, 2019).

275. *Id.*

276. *Id.*

277. Jones, *supra* note 231, at 2.

278. *Id.*

279. Ruth Levush, *Regulation of Drones: Comparative Analysis*, LAW LIBR. OF CONGRESS (Apr. 2016), https://www.loc.gov/law/help/regulation-of-drones/comparative.php.

280. Alfaro, *supra* note 112.

281. Diego Bosque, *Propietarios de drones en Costa Rica deberán costear pólizas y certificados*, [*Drone Owners in Costa Rica Must Pay for Policies and Certifications*], LA NACIÓN (June 8, 2015), https://www.nacion.com/el-pais/propietarios-de-drones-en-costa-rica-deberan-costear-polizas-y-certificados/VR3G6L3PJBHQNEK75OCH4ME6TU/story/.

and who will operate the UAS.[282] Similarly, the United Arab Emirates requires liability insurance for the use of drones.[283] The policies have a minimum.[284] The United Arab Emirates announced in October 2017 mandatory minimum insurance for commercial UAS.[285] The minimum requirements impose liability coverage of roughly one million dollars.[286] Privately operated UAS will be subject to a liability insurance requirement starting 2018.[287]

Liability insurance for UAS will vary and is dependent on the type of drone and what it is being used for.[288] The risks the operator will take with the drone will influence the type of coverage that would be required.[289] For example, a typical drone quadcopter that is used for recreational purposes can be covered with a very inexpensive policy.[290] It is common for an umbrella liability policy to exclude all aviation, which includes drone usage.[291] Although liability insurance is not required in the United States and Canada, it is recommended when using a drone for recreational purposes.[292] Commercial use of drones will require liability insurance.[293]

Another point of contention that needs to be addressed is the reasoning given by different countries as to the restrictions or outright ban on the use of UAV.[294] Nicaragua cites to safety concerns for the other manned aircraft,

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282. *Id.*

283. Michael Nelson & Joseph Marrinan, *United Arab Emirates: Drones in the United Arab Emirates*, MONDAQ (Mar. 15, 2018), http://www.mondaq.com/x/683316/Aviation/Drones+in+the+United+Arab+Emirates.

284. *Id.*

285. *Id.*

286. *Id.*

287. *Id.*

288. *Drone Insurance Cost*, TRAVERS & ASSOCIATES AVIATION INS. AGENCY, https://www.traversaviation.com/drone-insurance-cost.html (last visited July 10, 2019).

289. *Id.*

290. *Id.*

291. *Id.*

292. *List of Drone Insurance Providers for USA and Canada*, DRONETRADER, https://blog.dronetrader.com/list-of-drone-insurance-providers-for-usa-canada/ (last visited Sept. 14, 2019).

293. *Id.*

294. *See* Jones, *supra* note 231.

and improvement on efficiency of the airways.[295] Additionally, Nicaragua cites to the Chicago Convention of 1946 which established that no UAS will be allowed to fly in its airways.[296]

On the other hand, Saudi Arabia cites to privacy and national security issues.[297] An obvious conflict occurs in the Kingdom of Saudi Arabia, where it is illegal to record with a video camera without prior authorization, but the use of a video camera is the primary method of operating a drone; which means that the use of drones present an issue of breach of privacy.[298] Saudi Arabia cyber-crime law makes it illegal to take pictures of people in public, with the punishment for breach of privacy of the home or capturing images of uncovered women being severe.[299] As to National Security, Saudi Arabia alleges numerous UAS attacks from Yemen due to their ongoing conflict.[300] Yemen's rebels have used armed drones equipped with military grade missiles to target Saudi Arabia, hindering the intervention of the international community to broker a peace deal.[301]

K. Cultural Influence on Regulations.

Varying cultural influences across the world have molded the way UAS are regulated for a particular country.[302] In the United States for example, the drone is synonymous with the historical Predator or Reaper, which elicits a more negative response assimilating drones to military technology.[303] However, since 2010 the assimilation of drones and the military has been shifting as popular culture brings new light into the drone market.[304] High volume media outlets effectively held a monopoly on the public's

295. Resolución No. 34-2014 [Resolution No. 34-2014], *supra* note 234.

296. *Id.*

297. Wasmi, *supra* note 259.

298. *Id.*

299. *Id.*

300. *Id.*

301. Sudarsan Raghavan, *Yemeni Drone Strikes Saudi Airport, Injuring 9*, THE WASH. POST (July 2, 2019), https://www.washingtonpost.com/world/middle_east/yemeni-drone-strikes-saudi-airport-injuring-9/2019/07/02/a9cf1c3e-9c9a-11e9-a1fc-7337aeb9179e_story.html?utm_term=.4c3aa54e2e95.

302. *See* Arthur Holland Michel, *Drones in Popular Culture*, CTR. FOR THE STUDY OF THE DRONE AT BARD C. (Sept. 4, 2015), https://dronecenter.bard.edu/drones-popular-culture/.

303. *Id.*

304. *Id.*

relationship with this technology.[305] The roles of drones is different in politics and how it is portrayed in popular culture.[306] The use of the word drone is psychologically related to autonomous, killing machines, which is an inaccurate portrayal of UAS.[307] However, drones are becoming more common in everyday life and in other aspects as well, which influence the way popular culture reacts to that market. [308]

Soon a distinction will be drawn between Predator drones and Amazon drones.[309] Companies like Amazon are researching ways to incorporate drones into their business model, such as delivering packages to consumers, which can later be improved and deployed to deliver lifesaving items like organs and medicine.[310] Amazon claims that about 86% of packages it delivers are under 5 pounds, which makes them lightweight enough to be delivered by drone.[311] Another company, Facebook, is researching ways to use drones as a method of beaming Internet connectivity to areas that would normally not have access to internet coverage; while the oil company Shell uses drones to keep its *offshore rigs running smoothly*.[312] Google's research facility, has also been testing the utility of drones in their business model since 2012.[313] Meanwhile, in the investment sector, hundreds of millions of dollars are being invested into drone technology development companies like Skycatch, and Skydio.[314] Even Domino's Pizza is already testing drones to deliver their pizzas in New Zealand, and Walmart is researching ways to use drones inside its warehouses catalog inventory.[315] However, across the Pacific is a dominant player of the drone industry, China.[316] DJI, a China

305. *Id.*

306. *Id.*

307. Michel, *supra* note 303.

308. *Id.*

309. *Id.*

310. Alex Fitzpatrick, *Drones Are Here to Stay. Get Used to It*, TIME (May 31, 2018), https://time.com/longform/time-the-drone-age/.

311. Tom Foster, *10 Ways Drones Are Changing Your World*, CONSUMER REP. (Dec. 14, 2016), https://www.consumerreports.org/robots-drones/10-ways-drones-are-changing-the-world/.

312. Fitzpatrick, *supra* note 310.

313. Foster, *supra* note 311.

314. Fitzpatrick, *supra* note 310.

315. Foster, *supra* note 311.

316. Fitzpatrick, *supra* note 310.

company housed in Shenzhen which often referred to as the Silicon Valley of China, controls 72% of the global drone market.[317]

The FAA unveiled the first set of regulations governing the commercial use of drones, generally confining them to daylight flights below 400 feet and within the pilot's field of vision.[318] In 2017, over 3 million drones were sold worldwide, with about a million of those registered in the U.S. with the FAA.[319]

Drones are also being used farmers as a farming equipment to monitor and spray crops, by using aerial imagery from a drone equipped with an NDVI (normalized difference vegetation index) camera, which could help farmers estimate what the yield of a crop would be in July, instead of waiting until harvest in October.[320] This special UAS allows farmers to analyze diseases, weeds, and flooding with enough time to fix the situation before losing the crop, and can also increase the efficiency of fertilizers.[321]

Drones have also been used to save lives like in California, were an estimated sixty-five people have been rescued with the aid of the technology.[322] Additionally, the point of view that drones provides keeps first responders in a safe distance from danger.[323] The Michigan State Police received FAA approval in February 2015 to fly a SkyRanger quadcopter made by Canada's Aeryon Labs for public safety efforts.[324] That same SkyRanger quadcopter was used to investigate a suspicious fire a week after approval.[325] UAS have also been used to conduct search and rescue, provide a different point of view for SWAT teams, and map scenes.[326]

Of course, drones are being flown by hundreds of thousands of amateurs, who use them for everything from taking vacation photos to buzzing around their local park.[327] "The soaring panoramas captured by

317. *Id.*

318. Foster, *supra* note 311.

319. Fitzpatrick, *supra* note 310.

320. Foster, *supra* note 311.

321. *Id.*

322. Fitzpatrick, *supra* note 310.

323. Foster, *supra* note 311.

324. *Id.*

325. *Id.*

326. *Id.*

327. Fitzpatrick, *supra* note 310.

drones are compelling enough to have made their way into movies such as "Captain America: Civil War," "Spectre," and "The Wolf of Wall Street," as well as CNN's coverage of the earthquakes in Italy and Ecuador in 2015."[328] Drones have been used as a tool for real-estate agents who can use the technology to provide a new perspective of the properties they are selling.[329] New advances in drone technology even allows drones to follow the operator without the need to control the flight, and take amazing footage of cyclists, skiers, surfers, hikers, and kayakers.[330]

IV. OPINION

As UAS become part of society, countries will have to face the reality of their existence and enact regulations that will provide the proper balance between the public use of UAS and the safety of the airways. When it comes to new technologies, history has shown that society takes a precautionary approach as it develops, but it nevertheless integrates at its pace.[331] The number of drones that have entered the private sector in the last decade has been staggering, and projections have that number growing at a substantial rate.[332] Safety concerns around UAS relate to their potential to go anywhere, and the probability that the technology will be used against society in some way or another. Whether that is weaponing them or using UAS as a means to monitor citizens while in public. These concerns are warranted, but with every technology there is an offset, UAS is no different. The benefits involved and the potential technological developments are grand. Companies like Amazon, Walmart, SkyCatch and others have exploited the use of UAS to further improve their companies and to provide services that do not currently exists.[333] The use of drones for public services is another major advantage.

Countries like the U.S. have been on the forefront of UAS regulations. While at the beginning of the UAS industry, the U.S. had lenient regulations, it quickly began to regulate the market to the point that private actors and companies demanded relief from such strict regulations. In 2018 and 2019

328. Foster, *supra* note 311.

329. *Id.*

330. *Id.*

331. Pablo Chamaso et al., *The Use of Drones in Spain: Towards a Platform for Controlling UAVs in Urban Environments*, 18 SENSORS, 1 (2018), https://pdfs.semanticscholar.org/0b91/943a15d1151bc6c8c37ab86ad7057cdea65f.pdf.

332. *Id.* at 2.

333. Shep Hyken, *Walmart to Use Drones in Stores to Provide Better Customer Service*, FORBES (June 17, 2019, 08:00 AM), https://www.forbes.com/sites/shephyken/2018/06/17/walmart-to-use-drones-in-stores-to-provide-better-customer-service/#1b788c7b4e84.

these regulations came, and the U.S. welcomed the market for innovation and beneficial use of the technology.[334] In Costa Rica, there has been eased regulations from the beginning. Since the country is known for its progressive movements, it is founded that the UAS technology would be welcomed with reasonable regulations, but not restrictive.[335] Italy has seen a substantial increase in the use of UAS for public service and has taken a liberal approach to the incorporation of the technology into the country's airways.[336] The United Arab Emirates recognized for its interest in innovation does not fall far behind when it comes to UAS technology. The country has even merged UAS technology with manned aircraft to develop vehicles for public service.

Other countries, like Canada, have taken a more conservative approach. Although Canada allows UAS operations in its airways, it is substantially restricted when compared to other countries. A more extreme case is Nicaragua, which has an all-out ban on the operations of UAS on its airways. This ban is to an extreme of custom enforcement confiscating drones at checkpoints and returning them after the individual departs the country. Across the pond, Spain has had a tumultuous history with UAS. At the national level, there was not a lot of discussion regarding UAS regulations.[337] However, many of its autonomous regions began enacting restrictive or ban regulations on UAS operations. Soon after, the national regulations followed the model. There is hope however, as the country begins to permit research of UAS to be conducted it is airways. Saudi Arabia is ahead of the game for restrictions, as it has eased its restrictive measures as to UAS. However, these easements are not in par with other countries that have more liberal regulations of UAS operations.

V. CONCLUSION

Historically, drone technology found its foothold for its military advantages, but drones have now been able to appeal to the corporate world and private research into the technology is well on its way.[338] Some companies are investigating the ability of drones to deliver goods to

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334. Colin Snow, *Seven Trends that Will Shape the Commercial Drone Industry in 2019*, FORBES (Jan. 7, 2019, 03:27 PM), https://www.forbes.com/sites/colinsnow/2019/01/07/seven-trends-that-will-shape-the-commercial-drone-industry-in-2019/#599871eb7494.

335. Jones, *supra* note 231, at viii.

336. *Id.* at 5–6.

337. Chamaso et al., *supra* note 331, at 1.

338. Pamela Cohn et al., *Commercial Drones are Here: The Future of Unmanned Aerial Systems*, MCKINSEY & COMPANY (Dec. 2017), https://www.mckinsey.com/industries/capital-projects-and-infrastructure/our-insights/commercial-drones-are-here-the-future-of-unmanned-aerial-systems.

consumer, or provide internet access to remote areas.[339] Because of their versatility, drones have a greater appeal to the private sector than does other types of technology, even more so when their commercial applications go beyond basic surveillance, photography, or videos, to transform the industries to which they are incorporated.[340] Insurance companies have used drones to capture footage of damage, while farmers have deployed drones to monitor crops and collect data to better improve their yields.[341] Further development of drone technology could see the use of the technology for air taxis, which consumers could use as a method of transport.[342] It is expected that by 2026, commercial drones will have an annual impact of $31 billion to $46 billion on the United States's Gross Domestic Product (GDP).[343] The United States is one of the leading countries in drone technology and is a signal as to how the market will develop in the upcoming years.[344] The drone market is not immune to fluctuations in the economy of course.[345] However, investment in the drone market is on the rise, with many companies investing in research of new applications for drones.[346] A good example, as explained above, is air taxis, which have drawn substantial attention from the press.[347] Public acceptance is hard to project, but drone technology is still in its early stages.[348] The obvious hurdle is regulations and building the infrastructure.[349] It is naive to assume that regulatory agencies will rubber-stamp an approve a proposal for automatic flights, nor will cities approve infrastructure development for drones.[350] Some of the most innovative drone applications may take years to develop.[351] While stakeholders, government officials, investors, regulators, members of the UAS industry, and corporate adopters need to predict how the drone market is evolving and use those predictions to refine strategies that will help the market grow and capture additional value.[352]

339. *Id.*
340. *Id.*
341. *Id.*
342. *Id.*
343. Cohn et al., *supra* note 338.
344. *Id.*
345. *Id.*
346. *Id.*
347. *Id.*
348. Cohn et al., *supra* note 338.
349. *Id.*
350. *Id.*
351. *Id.*
352. *Id.*

The regulatory issues are persistent with most agencies taking a cautionary approach, but it is no different with other technologies that have implications for public safety.[353] The United States has a Drone Advisory Committee that provides representation to the drone industry and includes regulators and members of the industry itself who are tasked with integrating drones into the national airspace.[354] Regulators are tasked with evaluation how new drones will affect the national airspace with potential safety issues, before they reach the market.[355] Because of the regulatory process, the timeline for new drone applications to become viable is dependent on how much time the process takes.[356] The regulations in the United States can be divided into three categories that cover UAS vehicles, operations, and operators.[357] For example, drones flying beyond the visual line of sight is not allowed under the current regulations, but a push to change that restriction could enable more uses of drone technology, such as delivery to consumers and delivery of medications to remote areas.[358] With new regulatory processes that analyze the safety of autonomous flight, weight and altitude limitations, new guidelines can be developed that will permit such operations without jeopardizing safety.[359]

Across the pond, the European Aviation Safety Agency (EASA) has developed new RPAS regulations since 2017.[360] The regulatory body can be divided into three categories of operations: "Open, Specific, and Certified."[361] "More specifically, EASA intends to implement a risk-based approach to the regulation of unmanned aircraft through a "Concept of Operation."[362] The concept will allow EASA to achieve two main goals: integration and acceptance of drones into the airspace without jeopardizing safety, and to invigorate the drone market to create new jobs and develop

353. Cohn et al., *supra* note 338, at 5.

354. *Id.*

355. *Id.*

356. *Id.*

357. *Id.*

358. Cohn et al., *supra* note 338, at 5.

359. *Id.*

360. Timothy Ravich, *A Comparative Global Analysis of Drone Laws: Best Practices and Policies*, in 27 THE FUTURE OF DRONE USE OPPORTUNITIES AND THREATS FROM ETHICAL AND LEGAL PERSPECTIVES 310 (Bart Custers ed., 2016).

361. *Id.*

362. *Id.*

new technology.[363] "In August 2016, EASA release a "Prototype" Commission Regulation on Unmanned Aircraft Operations."[364]

Ultimately the goal is to balance the interest of the drone industry by investing on the market and researching the possibilities of drone technology without increasing the threats that drones pose to the national airspace.[365] Various regulatory agencies have taken different approaches that are country-specific, which include creating policies for aviation law, privacy law, criminal law, cooperation between different regulatory agencies, enacting international regulations, and making rules independent of technology.[366] Further marketing of drone technology to desensitize stigmas by providing information campaigns, mainly targeted at non-professional users, could be a viable asset for shifting regulations.[367] All new technology poses risks and threats, drones are no different, but that can be mitigated by requiring additional specifications and mandatory certifications and training.[368]

363. *Id.*

364. *Id.*

365. Bart Custers, *Drones Here, There and Everywhere Introduction and Overview*, in 27 THE FUTURE OF DRONE USE OPPORTUNITIES AND THREATS FROM ETHICAL AND LEGAL PERSPECTIVES 18 (Bart Custers ed., 2016).

366. *Id.*

367. *Id.*

368. *Id.*