

Review

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Posted Date: 26 November 2024

doi: 10.20944/preprints202411.1985.v1

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Review

Unmanned Aircraft Systems in Colombia: A Chronological and Sectoral Analysis

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Abstract: The Colombian Aeroclub licensed the first use of Unmanned Aircraft Systems (UAS) in Colombia in 2004. Initially, this technology was used for research and development purposes. In 2004, several UAS were obtained from the Aeroclub de Colombia, and this is considered the first recorded use of UAS in Colombia. In 2015, Aerocivil issued Circular 005 as an initial operational regulation for UAS in Colombia, a significant step towards the regulation of these aircraft. The establishment of the National UAS Commission in 2016 to foster responsible development within the UAS industry has marked another milestone. For 2023, Aerocivil brings to light Circular 008 that serves as a regulation that governs the operation of UAS specifically in urban landscapes, to which the National Development Plan (2022-2026) is later added. This plan adds a section dedicated to describing how drones can be used for economic and social growth; Two intertwined but distinct spheres. The use of unmanned aircraft systems (UAS) has revolutionized government decision-making, providing smart alternatives for information collection and processing, surveillance and monitoring are the two main components of security with many details. This helps stakeholders to take timely and effective action in different fields, including but not limited to medical situations that require emergency responses or natural calamities (where specific efforts can be concentrated based on identified needs), security to ensure peace among citizens, urban development through proper planning of resource allocation and use, etc. The use of drones in government has a far-reaching impact on many sectors that fall under scientific and technological research.

Keywords: UAVS; UAS; drones; chronology; government; sectoral; articles

Introduction

Chronology of UAS in Colombia

In 2004, the utilization of Unmanned Aircraft Systems (UAS) was first recorded in Colombia when Aeroclub de Colombia acquired a license to run a UAS in the nation. Back then, this technology was novel and largely restricted to just research and development undertakings.

In 2015, Aerocivil achieved a major breakthrough with the release of Circular 005 of 2015. It was the first ever set of requirements for the operation of UAS in Colombia. This circular can be seen as an event that created history by creating a foundation for the use of these aircrafts, legal and safe at the same time.

It was in 2016 that the central government established the National UAS Commission with the objective of fostering a responsible development of the UAS industry. The commission's mandate was to develop a national strategy for UAS deployment in different sectors — agriculture, mining, infrastructure and public safety — among others.

Colombia saw further developments in UAS regulation in subsequent years. In 2017, Resolution 101 of 2017 came into being— it brought forth an updated set of prerequisites for operating Unmanned Aircraft Systems. Among these was the establishment of various categories of operation based on the level of risk related to the activity (Aerocivil, 2017).

Last year — 2018 — stands out as a milestone year for the UAS industry in Colombia when the national government unveiled the National UAS Program with an aim that struck at the very core of

this South American nation's economic and social fabric. The initiative, as steered by the program, was to see drones employed in various sectors of the economy (not forgetting those social) so as to bring about development and, ultimately, ensure Colombians lead a quality life full of prosperity (Aerocivil, 2018).

As early as 2019, Aerocivil released Circular 007 of 2019, setting forth the conditions for operation of UAS beyond visual line of sight (BVLOS). This marked a significant milestone that unlocked novel opportunities in the realm of UAS usage— think inspecting vast infrastructures easily or surveilling isolated areas. Explore the beyond with drones like never before.

The year 2020 saw the publication of Resolution 120 of 2020 in Colombia which brought together the various regulations governing the operation of UAS. This resolution was an update, with significant changes including the establishment of a registration system for UAS operators and more stringent requirements on where UAS could be operated especially in populated areas. The pandemic drove changes in this area which had mixed implications on the development of this segment of the aeronautical industry as highlighted by Grant Thornton in their report for the year 2020.

The increased utilization of such planes for delivering drugs and food, along with aiding in public disinfection, led to positive changes in regulatory processes. This included operation control as well as the permissive nature of regulations regarding their use. Norms were also established towards their functionality sans stringent surveillance which helped streamline the monitoring of quarantines — avoiding elaborate exposure of personnel on streets — came into play with the introduction of these aircrafts. The technology was promoted at a national level, leading to an increased interest among individuals interested in unmanned vehicles; this further sparked curiosity among more people. Consequently, companies involved in designing these aircraft saw a boost in their sales volumes— although they had to upturn their price levels due in this sector. It was hit hard by supply chain disruption and reduced investment, as reported by Aerocivil in 2020.

The year 2021 saw the birth of the National Spectrum Agency (ANE), the body tasked with overseeing the radio spectrum within the nation's borders. The UAS operation greatly depended on proper allocation of spectrum, which ANE undertook to provide, thus marking a milestone for their effective functioning.

Resolution 001 of 2022 was published by the ANE for the year 2022. This resolution laid down the requirements for spectrum allocation for UAS, aiming at striking an efficient and fair utilization of radio spectrum that would facilitate operation of UAS across Colombia.

In the previous year (2023), Aerocivil came out with Circular 008 of 2023 that talks about what it takes to operate UAS in urban areas. This circular is designed to oversee the use of such planes reasonably and responsibly in consideration of the density of people inhabiting an area where they are intended to be used as well as the risks that may come about due to this kind of operation.

Something that was reinforced with the launch of the National Development Plan 2022- 2026, this year. Then it included a module on the use of drones for economic & social development of the country - acknowledging the multi-sectoral catalytic potential of these birds. (National Planning Department, 2022)

UAS Revolutionizing Government Decision-Making

Drones or Unmanned Aircraft Systems (UAS) have transformed multiple facets of government from a decision-making perspective. This tool offers all the power of an intelligent solution supporting the work of data collection and analysis, surveillance and monitoring, being instrumental for the administration of solutions, making the responsible team act more quickly, precisely and efficiently in the multiple fronts of the field. Therefore, under the conditions that make sense, while incorporating the latest developments in the technological environment surrounding UAS, it is imperative to institute top-covering rules for the ethical and beneficial utilization of this advancing aero-space system. (InfraStructure, n.d.)

Table 1. The frequency of use of UAVs in scientific publications, which help biometric recognition. Taken from Footage, L. D. [Table] (2019, 25 June). <https://ladronefootage.com/how-governments-can-use-drones-to-solve-public-safety-issues/>.

Terms	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	Marginal Row Totals	
																					No.	%
UAS	3	4	1	3	3	3	4	2	2	1											26	5.7
UAV	28	48	35	25	21	33	18	4	10	2	5	4	2	1	4	1	1	2	2		250	55.1
Drone	10	15	21	17	14	8	7	1	1												94	20.7
RPAS			2																		2	0.4
UAS and UAV			2	1	2	3	1		2		1										12	2.6
UAS and Drone		3		1	1	1															6	1.3
UAV and Drone	5	12	7	10	5	9	1	1													50	11.0
UAV and RPAS		2		2	2																6	1.3
UAS and UAV and Drone	2		3	1						1											7	1.5
UAS and UAV and Drone and RPAS								1													1	0.2
Marginal	Nr.	48	84	71	60	48	31	9	15	3	7	4	2	1	4	4	1	1	2	2	454	100
Columns Totals	%	10.6	18.5	15.6	13.2	10.6	6.8	2.0	3.3	0.7	1.5	0.9	0.4	0.2	0.9	0.9	0.2	0.2	0.4	0.4	100	

• Medical emergencies and natural disasters

In situations of natural disasters accompanied with the presence of any natural disasters, like earthquakes or floods, not only can drones fly over the affected areas quickly, but also produce looks such as videos and images of the disaster as it happens in real-time, or even just the aftermaths right after to occur helping rescue staff assess the situation and assess the damage to properly assess the importance responses team to the damage assessment and structuring the priority of areas most affected. Apart from these aircrafts also have thermal and high-resolution cameras on board, so it could perhaps recognise and map those that need rescuing, so the exchange could be more determined and faster. (Serafinelli, E; 2022)

• Improved Security

The Security sectors that have used drones have greatly benefited, as the potential that these UAVs generate information about drug trafficking, illegal immigration, among others; have shown a great improvement in their ability to act, since they have the capability to be more accessible, faster, move and offer a level proportionality of views that overarching any human eye in high-crime areas and rural locations reaching these hard spots generating an important source of information for the respective security forces. In urban settings, drones are used at large events to help keep law and order by monitoring the event from the air and providing rapid responses when an incident occurs. (Serafinelli, E; 2022)

• Urban development

UAS are equipped to generate precise topographic surveys and rich maps that are of great service to infrastructure planning and resource management. Plus: Tracking urban growth via drones gives officials insights into trends and infrastructure requirements, as well as ensuring by-law compliance. (Serafinelli, E; 2022)

• Infrastructure & Maintenance

Drones are one of the most important tools for the inspection and maintenance of all critical infrastructure. They make in-depth inspections of bridges, roads, power lines and pipelines, locating anomalies and damages without disrupting the services, which increases the efficiency of maintenance and reduces expenses. Drones enable real-time monitoring of construction projects that minimize compliance risk in terms of deadlines and quality levels. (Cook, K; 2024)

• Science & Technology

Drones have also enhanced scientific research, conducting telecommunications surveys to collect data on geology and meteorology, have access and are capable of collecting data from distant areas efficiently and less dangerous with basic sensors like GPS, imaging or ranging and specialized sensors such as thermal sensors. Using more and more advanced technologies like AI and ML by drones are making them more capable and application-ready which is fueling innovation in government's decision making (Cook, K; 2024)

Table 2. The number of articles in which the concept of UAV or associated terms appears. Taken from Medium [Table] (2021, 14 December) <https://eurecom-blog.medium.com/how-can-drones-play-an-essential-role-for-smart-cities-safety-a9e869901d82>.

Terms	Cultural Heritage Preservation	Forestry	Land Use Management	Geomorphology	Hydrography	Engineering	Medicine	Nature and Eco-Friendly Practices	Risk Management	Smart Cities	Tourism	Virtual Cinematography	Virtual Reality
e-Government													
e-Governance													
Governance								1					1
Digital Governance													
Digital era													
Digital era governance													
Digitisation	4		5	3	5	3		5	1				
Digitalisation	2	1	1		1	1							1
Digital transformation													
Big Data	3		1	2	1			2		2			
Artificial Intelligence			1	2	1	1		2	1				1
Digital Twin													1
Internet of Things			2								1		

These technologies and basic features of these tools, now its use with this kind of aircraft have been placed that fulfills to works many tasks for efficient and safe results together with everything they are still analyzing and studying the characteristics in order to provide better handling to them and adjust difficulties that present some challenges, being developed obtained like the versions of drones in the rescue plane. That would allow tackling large fires quicker, saving money, time, and hardware as well, since it can detect the sources of the fires independently from downdrafts, temperature changes and the like.

The system of unmanned aircraft is another tool that the government has implemented in different sectors such as agriculture, security, rescue and many more in its task of moving forward through technology; which allows him to work with greater efficiency and security as well as being a tool that provides significant information for decision-making as in the case of civil protection or military operations.

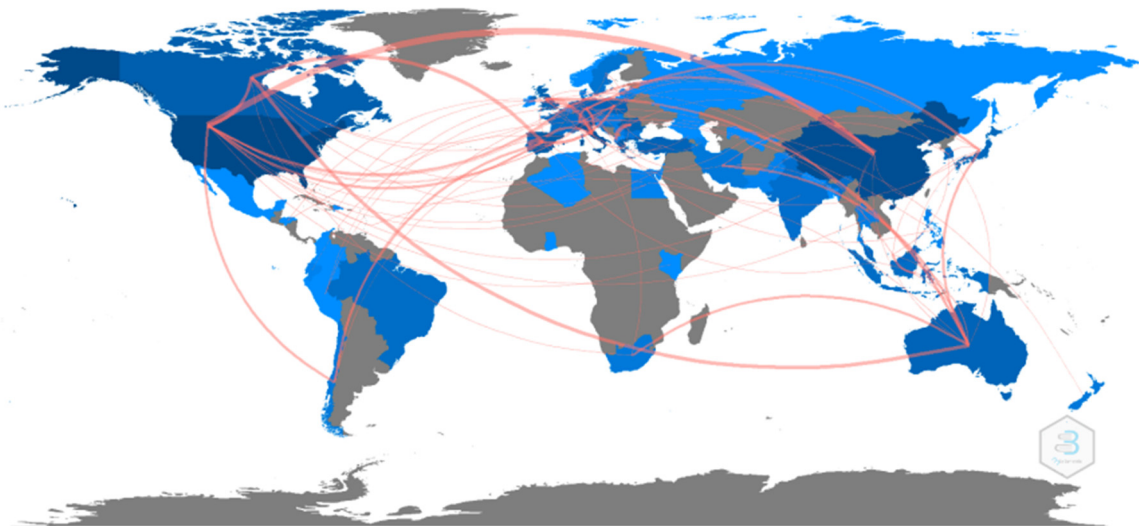


Figure 1. World map of interest due to the approach of UAV technologies. Taken from Hognogi G, Marian-Potra A, C, & Pop A, M; [Figure] (2021, October). https://www.researchgate.net/publication/355145384_The_role_of_UAS-GIS_in_digital_Era_governance_A_systematic_literature_review.

The journey from the start of the regulation of Unmanned Aircraft in the country to the development of a comprehensive regulatory framework is commendable as the first regulation was formulated in 2004 and the consolidated regulatory structure came about in the year 2020. What provides the fundamentals of a safe legal forest are many circulars and resolutions of Unmanned Aircraft.

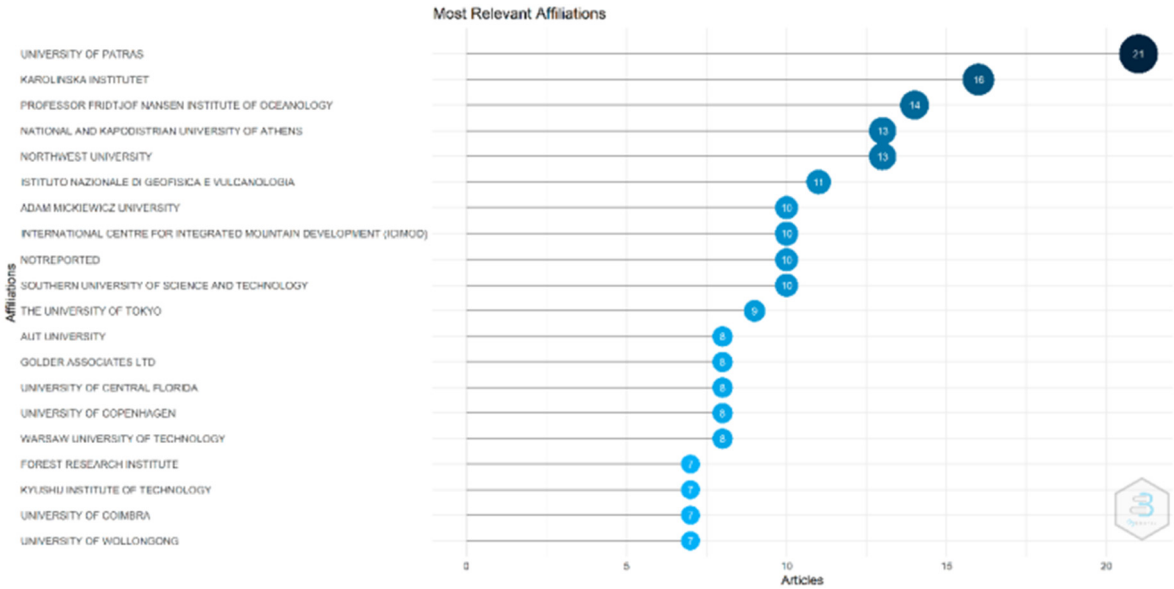


Figure 2. Map of the organizations with the largest number of researchers interested in or correlating UAVs in their articles. Taken from Hognogi G, Marian-Potra A, C, & Pop A, M; [Figure] (2021, October). https://www.researchgate.net/publication/355145384_The_role_of_UAS-GIS_in_digital_Era_governance_A_systematic_literature_review.

Discussion

After what we have already seen, we come to the following discussions:

1. The path of regulation of Unmanned Aircraft in the country shows great progress from its inception in 2004 to the creation of a consolidated regulatory framework in 2020. The different circulars and resolutions establish the basis for a safe and legal operation of Unmanned Aircraft
2. The launch of the National UAS Program in 2018 was a pivotal moment for the sector, helping in various economic and social areas. This program has benefited the union with other sectors such as agriculture, mining, infrastructure and public safety, and what challenges it has faced in its implementation.
3. The COVID-19 pandemic spurred great changes and advances, especially in the delivery of medicines and food, as well as in the disinfection of public areas. These uses have made it possible to accommodate regulations and promote the purchase and use of these aircraft, and the challenges faced due to supply chain disruption and reduced investments.
4. As they are managed remotely, they help in several complex tasks, such as topographic surveys and help in the creation of detailed maps, fundamental for urban planning and the study of land in the national territory. It also collaborates with data collection in the identification of urban growth trends and in the efficient management of resources and compliance with regulations.
5. The ability of these aircraft to collect data in geological and meteorological surveys has aided scientific research. It considers how the integration of advanced technologies, such as artificial

intelligence, is expanding the applications of UAS and fostering innovation in government decision-making.

6. These aircraft run into several problems such as continuous improvement of technology and management of privacy and security. It discusses the areas on which future technological and regulatory developments should be focused in order to maximize the potential of UAS in Colombia, also considering the ethical and safety implications.

Conclusions

The evolution of UAS legislation in Colombia, from the first licenses in 2004 to the consolidation of the regulatory framework in 2020, has been fundamental in the development and adoption of this technology. Progressive regulations such as 2015 notification no. 005 and 2017 resolution no. 101, provide a safe and legal environment that fosters innovation and growth in the drone field.

The launch of the National Drone Program in 2018 has had a significant impact on several economic and social sectors in Colombia. The program promotes the integration of unmanned aerial systems in critical operations such as agriculture, mining, infrastructure, and public safety, improving efficiency and effectiveness in these areas.

The Covid-19 pandemic has highlighted the flexibility and usefulness of drone systems, especially for the delivery of supplies and the disinfection of public spaces. Regulations were quickly adjusted to allow for more widespread use of these aircraft, proving their value in emergency situations and highlighting the need for further development of this technology.

Drone systems have become an important tool for dealing with emergencies and natural disasters. Its ability to provide instant data enables faster and more efficient responses, improves rescue operations and damage assessment, and saves lives and resources.

The adoption of drones in the realm of security has led to substantial enhancements in surveillance capabilities and response efficiency for security personnel— helping nip illegal activities in the bud and ensuring smooth order maintenance during group events, regardless of location.

Unmanned aerial vehicles can provide data with precision and details— both of which are the key elements in urban development as well as infrastructure planning and management. The use of these systems in continuous inspections and monitoring demonstrates high effectiveness levels, significantly slashing costs related to maintaining critical infrastructure.

Unmanned Aerial Systems (UAS) have revolutionized scientific research— particularly in geology and meteorology where data collection is typically challenging due to the location accessibility. The emergence of these advanced technologies, including artificial intelligence, fosters innovation in new applications that lead to more effective governance decision-making processes; however, while this sector has seen notable progress, it continues encountering challenges such as demand for better technology and privacy or security management, and adaptive regulation. Future development of UAS should focus on addressing these challenges to maximize their potential and benefit society.

References

1. EASA. (s. f.). EASA. <https://www.easa.europa.eu/en>
2. *Aerocivil-Covid19 documentos*. (s. f.). <https://www.aerocivil.gov.co/prensa/Pages/Aerocivil-Covid19-documentos.aspx>
3. *Agencia Nacional del Espectro | Resoluciones ANE*. (s. f.). <https://www.ane.gov.co/SitePages/ListaArchivosNormatividad.aspx?p=10gencia%20Nacional%20del%20Espectro%20%7C%20Resoluciones%20ANE>
4. AUVSI. (2001, 20 april). AUVSI. <https://www.auvsi.org/>
5. Beltran, M. (2024, 10 January). *Requisitos de diseño y producción de drones*. EU Drone Port eu. <https://eudroneport.com/es/blog/requisitos-diseno-produccion-drones/>
6. Byman, D. L. (2013, 17 june). Why Drones Work: The Case for Washington's Weapon of Choice. *Brookings*. <https://www.brookings.edu/articles/why-drones-work-the-case-for-washingtons-weapon-of-choice/>

7. CAMPUS RPAS. (2024, 25 January). *Autorización operacional - CAMPUS RPAS*. <https://campusrpas.com/autorizacion-operacional/>
8. Carnegie Mellon University. (s. f.). *About Integrated Innovation - Integrated Innovation Institute - Carnegie Mellon University*. <https://www.cmu.edu/iii/about/index.html>
9. Chehtman, A. (2017, 1 april). *Una evaluación normativa del uso de drones en conflictos armados asimétricos*. <https://www.redalyc.org/journal/3636/363652130003/html/>
10. Christiansen, M.P.; Laursen, M.; Jørgensen, R.N.; Skovsen, S.; Gislum, R. *Designing and Testing a UAV Mapping System for Agricultural Field Surveying*. *Sensors* 2017, 17, 2703, <https://doi.org/10.3390/s17122703>.
11. Communication, E. (2022, 4 January). How can drones play an essential role for smart cities' safety? *Medium*. <https://eurecom-blog.medium.com/how-can-drones-play-an-essential-role-for-smart-cities-safety-a9e869901d82>
12. CONCLUSIONES Y RECOMENDACIONES FORO IMPACTO DEL COVID – 19 EN EL TRANSPORTE AÉREO: Nuevos retos y oportunidades en la visión del Plan Estratégico Aeronáutico 2030. Noviembre 24 y 25 de 2020. (2020, 24-25 November). Unidad Administrativa Especial de Aeronáutica Civil. <https://www.aerocivil.gov.co/aerocivil/IMPACTO%20DEL%20COVID19%20EN%20EL%20TRANSPORT%20AREO/Conclusiones%20y%20Recomendaciones%20Foro%20Final.pdf>
13. Cook, K. (2024, 7 june). *Infrastructure Magazine - News, views and opinion from the Australian infrastructure industry*. *Infrastructure Magazine*. <https://infrastructuremagazine.com.au/2021/02/10/economy-wide-%20impact-of-drones/>
14. *Drone operations*. (2018, 24 may). U.S. GAO. <https://www.gao.gov/drone-operations>
15. *Drones*. (s. f.). GovTech. <https://www.govtech.com/tag/drones>
16. *Drones CAN navigate dynamic environments*. (2023, 22 december). College Of Engineering At Carnegie Mellon University. <https://engineering.cmu.edu/news-events/news/2023/12/22-drones.html>
17. *Drones: FAA Should Improve Its Approach to Integrating Drones into the National Airspace System*. (2023, 26 January). U.S. GAO. <https://www.gao.gov/products/gao-23-105189>
18. *Drones in Construction: A Comparative International Review of the Legal and Regulatory Landscape*. (2020, may). ResearchGate. https://www.researchgate.net/publication/341653403_Drones_in_Construction_A_Comparative_International_Review_of_the_Legal_and_Regulatory_Landscape
19. *El impacto del COVID-19 en la industria de la aviación*. (2020, 23 september). Grant Thornton Colombia. <https://www.granthornton.com.co/Perspectivas/coronavirus/el-impacto-del-covid-19-en-la-industria-de-la-aviacion/>
20. Footage, L. D. (2019, 25 june). *How Governments can use Drones to Solve Public Safety Issues*. LA Drone Footage. <https://ladronefootage.com/how-governments-can-use-drones-to-solve-public-safety-issues/>
21. Garrido, C. G. (2022, January). *Análisis sobre la utilización de drones en conflictos armados desde el Derecho internacional público*. *Anales de Derecho*, 39. <https://doi.org/10.6018/analesderecho.480101>
22. Hognogi G, Marian-Potra A, C, & Pop A, M; (2021, october). *The role of UAS–GIS in digital Era governance. A systematic literature review*. ResearchGate. https://www.researchgate.net/publication/355145384_The_role_of_UAS-GIS_in_digital_Era_governance_A_systematic_literature_review
23. Kabiri, K. *Mapping coastal ecosystems and features using a low-cost standard drone: Case study, Nayband Bay, Persian gulf, Iran*. *J. Coast Conserv.* 2020, 24, 62, <https://doi.org/10.1007/s11852-020-00780-6>
24. Laborator.Co. (s. f.). *Decretos*. <https://www.aerocivil.gov.co/normatividad/decretos>
25. Musso, R. G., Sebastián, M., Rabino, A., & Azzaro, F. (2017). *Uso de VANTs («Drones») como método de prospección de síntomas ocasionados por plagas en forestaciones*. ResearchGate. <https://doi.org/10.13140/RG.2.2.23155.63524>
26. OPERACIÓN y MANTENIMIENTO DE AERONAVES NO TRIPULADAS. (s. f.). Unidad Administrativa Especial de Servicios Públicos. <https://www.uaesp.gov.co/sig/documentos/gestionti/editables/GTI-MN-03-V1%20Operacion%20y%20mantenimiento%20de%20aeronaves%20no%20tripuladas%20UAS.pdf>
27. Parcero-Oubiña, C.; Fábrega-Álvarez, P.; Salazar, D.; Troncoso, A.; Hayashida, F.; Pino, M.; Borie, C.; Echenique, E. *Ground to air and back again: Archaeological prospect to characterize prehispanic agricultural practices in the high-altitude Atacama (Chile)*. *Quat. Int.* 2017, 435, 98–113, <https://doi.org/10.1016/j.quaint.2015.12.050>.
28. *Plan Nacional de Desarrollo 2022-2026*. (2022, January). Departamento Nacional de Planeación. <https://www.dnp.gov.co/plan-nacional-desarrollo/pnd-2022-2026>
29. Pulver, A.; Wei, R. *Optimizing the spatial location of medical drones*. *Appl. Geogr.* 2018, 90, 9–16, <https://doi.org/10.1016/j.apgeog.2017.11.009>.
30. *Research Knowledge Base - RA Fundamentals Job Aid - Orientation - Research*. (s. f.). https://support.ucsd.edu/research?id=kb_article_view&sysparm_article=KB0033588
31. *Resoluciones 2015 - all documents*. (2015). <https://www.aerocivil.gov.co/normatividad/resoluciones%202015/forms/allitems.aspx>

32. Serafinelli, E. (2022). *Imagining the social future of drones*. *Convergence*, 28(5), 1376-1391. <https://doi.org/10.1177/13548565211054904>
33. *Unmanned Aircraft Systems (UAS)*. (s. f.). Federal Aviation Administration. <https://www.faa.gov/uas>
34. Vargas-Ramírez, N. (2015). *Evaluación del potencial de uso de drones para el monitoreo ambiental y la defensa territorial indígena en México*. ResearchGate. <https://doi.org/10.13140/RG.2.1.1118.9845>
35. Waldo, O. B., Jorge, F. V., & Ronald, O. C. (2016). *Uso y manejo de drones con aplicaciones al sector hídrico*. <http://repositorio.imta.mx/handle/20.500.12013/2193>
36. World Economic Forum. (s. f.). *Strategic Intelligence | World Economic Forum*. Strategic Intelligence. <https://intelligence.weforum.org/topics/a1Gb0000002ZKplEAG>

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