SARUS

HUMANITARIAN

AEROSPACE

Sarus Humanitarian Aerospace is an initiative of the Sentinel Project, a Canadian non-profit using new technologies to address the most pressing humanitarian challenges of our time.

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SARUS
HUMANITARIAN AEROSPACE

UNMANNED AERIAL SYSTEMS FOR DEVELOPMENT AND HUMANITARIANISM IN THE GLOBAL SOUTH - SURVEY OF APPLICATIONS AND POLICIES

About This Report

The Sentinel Project is a Canadian non-profit organization dedicated to assisting communities threatened by mass atrocities worldwide and using new technologies to address core humanitarian and development challenges. The Sentinel Project currently has active field operations in Asia and Africa, including Kenya, the Democratic Republic of the Congo, and Myanmar.

The Sentinel Project has been an early advocate and adopter of unmanned aerial systems technology and has piloted small deployments in East Africa with a focus on community engagement and citizen perceptions.

Note: This report uses the term unmanned aerial system (UAS) rather than unmanned aerial vehicle (UAV) or the colloquial term "drone," though these terms are often used interchangeably. Due to the broad nature of the term UAS it is the preferred terminology for this project.

Acknowledgements

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List of Abbreviations and Definitions

UAS - Unmanned aerial system

UAV - Unmanned aerial vehicle

RPAS - Remotely piloted aircraft system

NGO - Non-governmental organization

GIS - Geographic information system

SAR - Search and rescue

UN - United Nations

Drone - Colloquial term referring to unmanned aerial systems / vehicles or - in certain regulatory circumstances - remotely piloted aircraft systems.

Global South - A term referring to countries traditionally considered "underdeveloped" or "developing." The term is not universally defined so for the purposes of this report it is based on the United Nations M49 standard for statistical use. Refer to *Annex 2* for a full list of included countries.

Regulatory status - This report utilizes a six-point scale for categorizing the regulatory status of unmanned aerial systems in different countries, broken down as follows.

Unregulated - No discernable regulations and no enforcement

Open - Basic regulation in place and little to no enforcement

Cautious - Detailed regulations, operations classified by operator and purpose, consistent enforcement

Restricted - Onerous regulations, permissions required before operations, strict enforcement

Prohibited - Explicit or de facto prohibition through law or regulatoryobstinance

Unknown - No reliable information available

Practitioner - An operator or potential operator of unmanned aerial systems, whether individual and self-directed or as part of an organizational initiative.

INTRODUCTION

1. INTRODUCTION

The increasingly accessible technology known as unmanned aerial systems (UAS, commonly called drones) has gained a great deal of recognition for its potential to support development and humanitarian work in the Global South. However, one of the major challenges holding back the employment of UAS for such applications is the lack of clear policy and regulatory frameworks in the majority of countries worldwide, a situation which is particularly salient in developing countries. While some actors in countries with more supportive governments have conducted effective proof-of-concept projects, wider adoption by responsible actors is hindered by government authorities which continue to make poorly-informed decisions based primarily upon fear and misconceptions. The Sentinel Project has experienced this situation directly in Kenya, where the organization has previously taken steps to conduct unique action research on employing UAS for civilian protection in conflict situations. While citizens and local authorities in the potential project areas responded very positively, this work highlighted the vague and ineffective policy guidance which the relevant authorities, particularly the Kenya Civil Aviation Authority (KCAA), has issued for prospective UAS users. Such lack of clarity has effectively stopped all work on using this technology in a country which is otherwise well known for its friendliness to technology and innovation. This situation stands in stark contrast to countries like Rwanda, Tanzania, and South Africa, which have adopted much more open UAS policies in order to encourage increasingly valuable innovation and have already started to see the benefits of this work for both commercial and social benefit applications.

Furthermore, public and organizational perceptions of UAS often see it as either a technology which is detached from the realities of the problems it is intended to solve or military-associated equipment with negative associations. These perceptions have permeated the notion of humanitarian aerospace without being examined in depth. It is necessary to analyze how deeply held these beliefs actually are and to what extent they are incorporated into policy considerations.

The divergence in UAS policy and regulation across Africa, Asia, and Latin America highlights how different governments are having drastically different reactions to this technology across the Global South, a set of regions poised to benefit most from the advance of UAS technology. This diversity of reactions is sometimes driven by well-founded concerns related to local circumstances but in other cases it is due to government authorities acting with an incomplete understanding of the real risks and opportunities before them.

1.1 Methodology and research questions

This study seeks to answer the following questions:

1 - What applications of UAS (both current and potential) are most relevant to development in the Global South?

2 - What policy and regulatory challenges present obstacles to UAS deployment for development and humanitarian applications in Global South countries?

3 - What factors (security, public perception, etc.) most influence policy makers in Global South countries when forming UAS policy?

4 - What practical and theoretical concerns exist regarding UAS and how do they impact policy and regulation?

The research questions have been addressed by analyzing publicly-available policy and regulatory documents combined with interviews conducted with relevant actors in selected countries including government officials (e.g. civilian aviation authorities), UAS experts (e.g. researchers, technology developers), and organizations currently employing this technology (or attempting to do so), as well as staff responsible for innovation at large development and humanitarian organizations (e.g. NGOs, UN agencies, donor country government agencies). Due to the nature of the proposed project's examination of government and organizational UAS policies, the analysis is necessarily qualitative in nature. While the interviews conducted included standardized questions, they were flexible in order to capture a greater diversity of perspectives on the topic, thus meaning that they will not be used to identify statistically significant trends but rather logical associations between a variety of factors and interviewee responses (which is also more suited to the proposed sample size). Of most interest is the correlation between a respondent's proximity to policy decision making and perceptions of UAS activities or opportunities. Also significant are current applications of UAS assets when compared to regional or global legislation and policy as a measure of permissiveness and practical application.

1.2 Literature review

The academic and policy literature on the use of UAS for development and humanitarian work is currently quite minimal and has focused primarily on the ethical aspects of using the technology for remote sensing in environments experiencing insecurity or conflict, such as in the case of detecting and documenting mass atrocities. Less attention has been given to broader development and humanitarian applications. While most of the material that does exist tends to be published in non-academic sources, such as by NGOs and practitioners in the field, some researchers have published journal articles on the topic of UAS. However, these are typically not informed by broad-based research. The publications that do regularly touch upon UAS tend to be generally more technical in nature and focused on topics such as robotics, aeronautics, and remote sensing (e.g. Journal of Unmanned Vehicle Systems). The following is a selected list of examples of relevant literature.

- The Swiss Foundation for Mine Action (FSD). "Drones in Humanitarian Action: A Guide to the Use of Airborne Systems in Humanitarian Crises," (December 2016)
- Meier, Patrick. "Aerial Robotics and Agriculture: Opportunities for the Majority World," *iRevolutions* (7 November 2016)
- Lichtman, Amos and Mohit Nair. "Humanitarian Uses of Drones and Satellite Imagery Analysis: The Promises and Perils," *Journal of Ethics*, October 2015, Volume 17, Number 10, pp 931-937
- Chow, Jack C. "The Case for Humanitarian Drones," *Open Canada* (12 December 2012)
- Raymond, Nathaniel A., Brittany Card, and Ziad Al Achkar. "The Case Against Humanitarian Drones," *Open Canada* (12 December 2012)

Though not strictly related to the literature, it is worth noting that there is currently a lack of research organizations and events related to the topic of UAS, particularly in connection with development and humanitarian applications. While there are numerous UAS-focused conferences around the world each year, these tend to be commercially focused with little participation by academics, researchers, government policymakers, or development and humanitarian actors.

RESEARCH FINDINGS

2. RESEARCH FINDINGS

There are three primary outcomes that the findings from this survey will impact. First, the conclusions reached will help to guide the discussion between government bodies, practitioners, and industry leaders such that future decision making about UAS policy development and regulation can be supported with a wide breadth of data. Secondly, findings will contribute to increased understanding by practitioners within this field of broad trends in government and organizational UAS policies as they relate to development and humanitarian efforts. Such information will help them to identify opportunities and risks in their operations. Third, the findings will help to better inform advocates who are working towards UAS policy improvements at the governmental and organizational levels in the Global South, thus contributing to better informed, regulated, and responsible UAS deployments in development and humanitarian contexts.

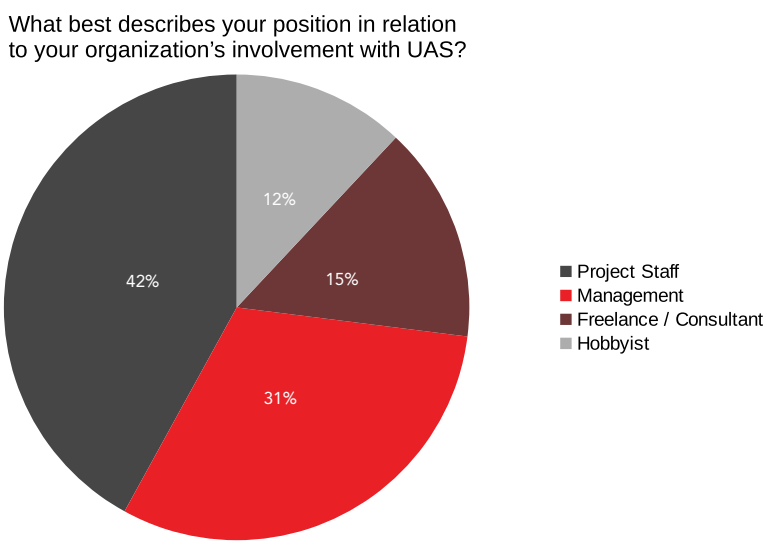
2.1 Respondent field and industry

The project team's objective was to consult with a broad spectrum of individuals, with an emphasis on responses from non-profit, for profit, and governmental actors. Though there have been other industry-wide assessments on the applications of UAS,[1] this project's approach was to obtain a more granular view of the confluences that shape policy and regulatory development, as well as the dynamic of non-governmental organizations working in this sphere. As a result, our sample size is smaller and more focused on these elements.

The respondents include individual practitioners, established non-profit or for-profit organizations, and representatives of international organizations or national government bodies. Where possible, respondents and their opinions will be publicly identified in this report if permission has been granted. Other respondents have elected to remain anonymous for the purposes of the report.
The largest portion (35 percent) of respondents were from non-profit backgrounds in addition to 31 percent who identified themselves as individual practitioners.

Governmental respondents (23 percent) represented the third largest respondent group and in the survey received additional questions intended to gather further data on government perspectives in contrast to non-governmental respondents. Finally, for-profit respondents represented 12 percent, which aligns with the active role that UAS manufacturers, consultants, and industry professionals have taken within the field.

1. Swiss Foundation for Mine Action (FSD). "Drones in Humanitarian Action: A Guide to the Use of Airborne Systems in Humanitarian Crises," (December 2016)



2.2 Organizational position

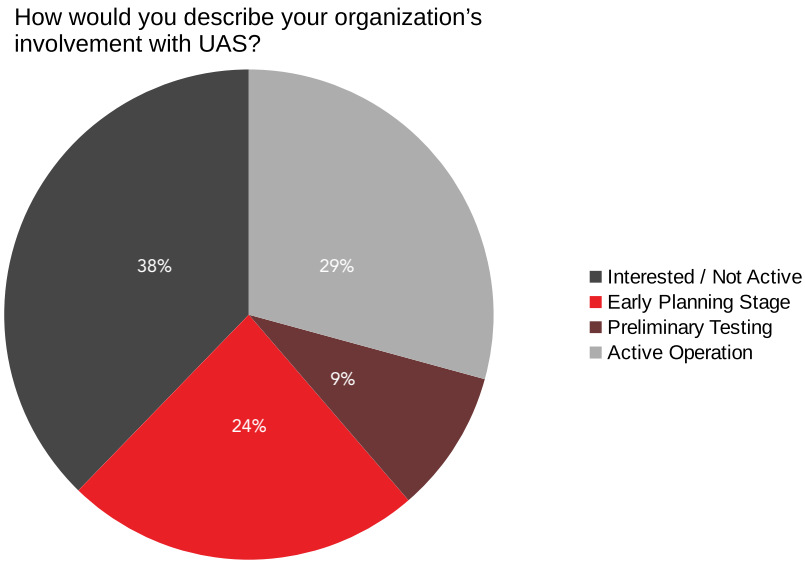
Another important element to determine is the position within the industry or individual organization each respondent held. It is important that this research registered the views not only of management staff but also of field operators and technical staff.

Project staff accounted for 42 percent of respondents (defined as working on daily operations of a project actively utilizing UAS or otherwise exploring the option), while management staff represented 31 percent of respondents. This separation of positions within the dataset allows for better assessment of views and opinions in contrast to relative distance from actual operating conditions. For example, government respondents were more likely to list themselves as management staff while non-governmental respondents identified themselves more often as project staff. This disparity helps to clarify some larger trends within the dataset that will be discussed later in the report.

Finally, freelance professionals and consultants amounted to 15 percent of respondents while hobbyists came in at 12 percent. The distinction between freelance or consultant and hobbyist is based on whether they make their services available for a fee in the case of the former, or whether they are operating a UAS project privately or for personal use in the case of the latter.

2.3 Organizational involvement with UAS

Crucially, it was important to look at the degree to which organizations of all types are attempting to engage in UAS operations. The survey indicates that 40 percent of respondents were interested in UAS but not actively pursuing UAS deployments. However, 25 percent were in early planning stages, another 10 percent in preliminary testing, and 25 percent had active UAS operations in effect.



Based on the limited sample size it is challenging to draw broad conclusions so there are two ways to read these findings. The first is to note the degree to which UAS operations are already underway (60 percent in planning, testing, or operations), but to be cognizant of the fact that these are respondents largely from within the UAS community or people who contacted the project team through an intermediary involved with the UAS community. This leads to an alternative reading, which is that even within the UAS community, a full 40 percent of respondents expressed interest but had not initiated actual testing or programs. The project team concludes that, even when taking statistical deviation into account, such a large proportion of respondents not currently active with UAS initiatives despite their close relationship to the field highlights the impact of larger unresolved security and regulatory factors which impede the formation of coherent program strategies upon which active operations can be launched.

PRIORITY UAS APPLICATIONS IN THE GLOBAL SOUTH

3. PRIORITY UAS APPLICATIONS IN THE GLOBAL SOUTH

3.1 Broad overview of UAS applications

Before further consideration of UAS regulations and respondent input on these, it is important to have a general understanding of the various applications for which this technology is being proposed in the development and humanitarian fields. Broadly speaking, the vast majority of proposed or actual UAS deployments fall into one of two categories. First is remote sensing, the use of UAS to gather a variety of data for a wide range of applications. Second is cargo delivery, primarily of small payloads of critical supplies to inaccessible areas or across difficult terrain. The following example use cases are categorized this way. In both categories, the majority of use cases represent innovations on activities which are already carried out using conventional manned aircraft or (in the case of remote sensing) satellites but which present considerable advantages of cost, efficiency, accessibility, and local control when conducted using UAS.

Remote sensing

- **Land use mapping -** A major hindrance to development in many Global South countries is the inability to effectively plan land use due to a lack of up-to-date aerial maps. The imagery which can be gathered quickly and inexpensively using UAS gives planners for projects both large and small the ability to get a real-time understanding of the conditions of land which would otherwise not be possible. A small-scale example of this comes from the Practical Permaculture Institute in Zanzibar, which has proposed using small UAS to more effectively set up sustainable permaculture facilities.[2]

- **Post-disaster damage assessment -** Rapidly and accurately understanding the scale and nature of damage caused by a disaster is critical for enabling appropriate responses by humanitarian agencies. Reliance upon manned aircraft may mean that aerial assessments are significantly delayed due to availability or cost. UAS, on the other hand, are relatively inexpensive and require less skill and infrastructure to operate. It is even possible for them to be operated by local actors in the immediate aftermath of a disaster, provided that the appropriate capacity has been built. This removes reliance on large humanitarian agencies and enables local responders to identify needs and act more rapidly. The work of UAViators in the Pacific region and Mexico presents a good example of this type of work.[3]

- **Search and rescue -** Finding missing people is a critical function for responders in post-disaster scenarios and other situations. Reliance upon manned aircraft significantly limits the options available for this kind of work in most parts of the world for reasons related to cost and skill sets, as explained above. The relative inexpensiveness and ease of use which UAS provide means that even local communities can carry out such operations for their own benefit, especially if they have benefited from dedicated capacity building.[4] In many cases to date, UAS-enabled SAR activities have been carried out by private individuals using hardware developed for recreational use.[5]

- **Deforestation monitoring -** In many parts of the world, particularly in South America and Africa, illegal deforestation presents not only a serious threat to environmental sustainability but also national economies and the habitats upon which local communities depend for their survival. There have been examples of such communities using UAS in order to document illegal deforestation in order to attempt holding the perpetrators accountable with the help of human rights groups.

2. This example is based on project team site visit and interviews.
3. "Case Study No. 10: Using Drones for Disaster Damage Assessments in Vanuatu," Europa (1 September 2016); https://europa.eu/capacity4dev/innov-aid/blog/case-study-no-10-using-drones-disaster-damage-assessments-vanuatu
4. "DroneSAR wants to turn drones into search-and-rescue heroes," Silicon Republic (12 June 2017)
5. "Here's How Many Lives Drones Have Saved Since 2013," Fortune (14 March 2017)

A notable example is Digital Democracy's work with the Wapichana indigenous group in Guyana, which saw them collaboratively build UAS mostly out of locally available materials and train participants on UAS maintenance and usage for the purpose of monitoring deforestation on their land.[6] The UN Food and Agricultural Organization has also supported similar work with indigenous groups in Panama.[7]

- **Counter-poaching operations -** In many parts of Africa and Asia conservationists have seen the potential for using UAS in surveillance and reconnaissance roles to protect populations of endangered species from poachers. In many such cases, ground-based information sources are used to determine the possible presence of poachers, which is then verified using imagery from UAS and, if confirmed, then communicated to park rangers and conservation officers on the ground so that they can intervene. This model has been tested in places such as South Africa's Kruger National Park[8] and Kenya's Lewa Wildlife Conservancy.[9]

- **Civilian protection -** Similar to how UAS are being used to protect endangered humans in some places, there have also been proposals to use this technology for the protection of threatened human populations in conflict zones. Specific potential applications include using UAS to conduct perimeter patrols around villages in threatened areas, thus warning the inhabitants of incoming threats, and conducting reconnaissance to verify ground-based reports of threats and determine whether certain routes are safe for the movement of displaced persons. In cases where atrocities are committed UAS may be able to help document these incidents and identify perpetrators in order to support later prosecutions of war crimes and crimes against humanity. The Sentinel Project itself has long advocated for such initiatives and has conducted some community-based research on this topic in Kenya, though the regulatory environment there has been very challenging.

Cargo delivery

- **Humanitarian aid delivery -** The rapid delivery of supplies during humanitarian crises is often critical for the survival of impacted populations. However, this is difficult to do in many cases due to severely damaged infrastructure or insecurity, especially in the case of conflict zones. There have been several proposals to use UAS for the rapid delivery of humanitarian supplies into such inaccessible areas. While there are clear limitations to the amount of cargo which can be delivered in comparison to manned cargo aircraft, most proposals focus on using large numbers of UAS devices to delivery numerous small payloads of critical supplies, such as medication. A notable example of this kind of work was the now-inactive Syria Airlift Project proposed by Uplift Aeronautics, which aimed to use a swarm of fixed-wing UAS to deliver supplies to otherwise inaccessible civilians in Syria.[10] Unfortunately, the project encountered too many obstacles on the ground and never become operational.

- **Medical supplies -** Outside of humanitarian crises, more routine cases of cargo delivery can help to significantly improve medical services in the Global South, particularly in terms of reaching undeveloped communities which live in remote areas or beyond insufficient infrastructure. In such cases, UAS can be used for rapid, on-demand delivery of critical supplies such as medications and blood for transfusion from a centralized storage point when these are otherwise not available to local healthcare providers. The company Zipline operates a notable example of such a service in Rwanda (see case study in section 7 "Survey of Regulatory and Policy Development Across Global South" below for more details).

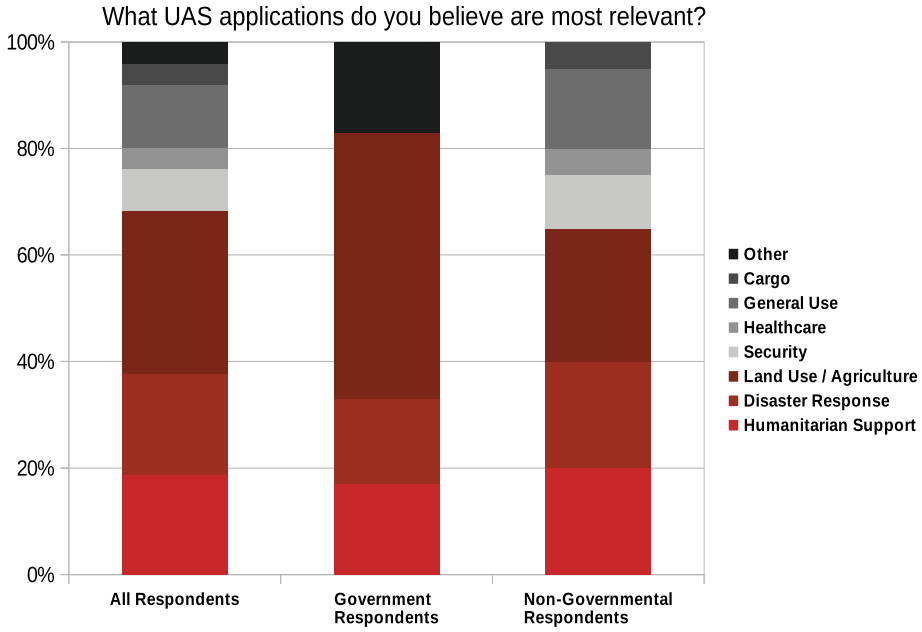
6. MacLennan, Gregor. "We Built A Drone," Digital Democracy (19 December 2014)
7. "Indigenous peoples in Panama learn the use of drones for forest healthcare," FAO (3 June 2016)
8. Masinga, Lindi. "Kruger Park tests anti-poaching drones," IOL News (7 March 2016)
9. Ekstein, Nikki. "Paul Allen's High-Tech Quest to Save the World's Most Endangered Animals," Bloomberg (9 May 2017)
10. Nye, Catrin. "Getting aid to a war zone in a swarm of drones," BBC News (25 April 2015)

3.2 Survey responses on UAS applications

Land use and agriculture represent some of the most commonly cited UAS applications across the spectrum of respondents, encompassing a broad range of tasks including land surveying, crop monitoring, environmental protection, and integration into geographic information systems (GIS) for data gathering and analysis. This application also represents one of the most practical and common applications of unmanned aerial systems currently deployed.[7]

Disaster response, defined as providing immediate assistance to populations impacted by natural or human-made disasters, includes a variety of UAS roles including the addition of remote search and rescue (SAR) capabilities to emergency response and recovery teams, ranks almost equally with non-emergency humanitarian and development support as a cited application.

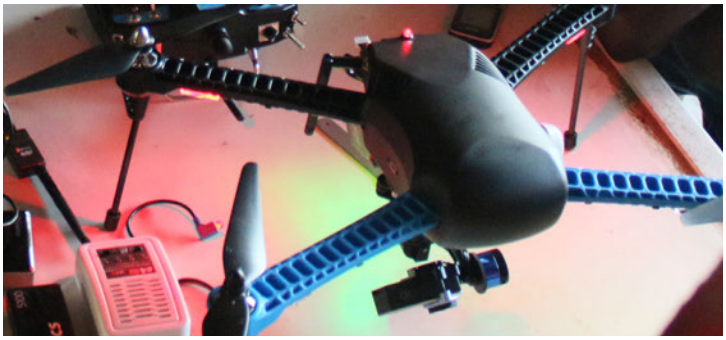
Interestingly, there are disparities between governmental and non-governmental opinions of other applications



beyond this.

Non-governmental respondents cited a range of applications, including security, cargo, disaster response, and operations in support of humanitarian efforts. Governmental respondents limited their support to only humanitarian support and disaster response, de-emphasizing other potentially persistent applications beyond land use and agriculture.

Though further study is required to fully understand the reasons for this division, one concept explored later in this report suggests that the top-down nature of government policy development and the bottom-up aspect of practitioner deployments result in fundamentally different approaches to the application of new processes in relation to UAS.



Mahima Taneja	
Country	India
Affiliation	NGO project staff
"UAVs can accord visibility by feeding into GIS information about otherwise invisible spaces, visualizing policy performance and exclusions where applicable, and aid in expediting evidence-based public policy making and monitoring."	

7. WeRobotics has been on the leading edge of a variety of UAS use-cases. "Using Drones to Map Property Rights in Senegal," (24 May 2017) explores the applications for GIS integration.

POLICY AND REGULATORY CHALLENGES FACING UAS DEPLOYMENTS

4.POLICY AND REGULATORY CHALLENGES FACING UAS DEPLOYMENTS

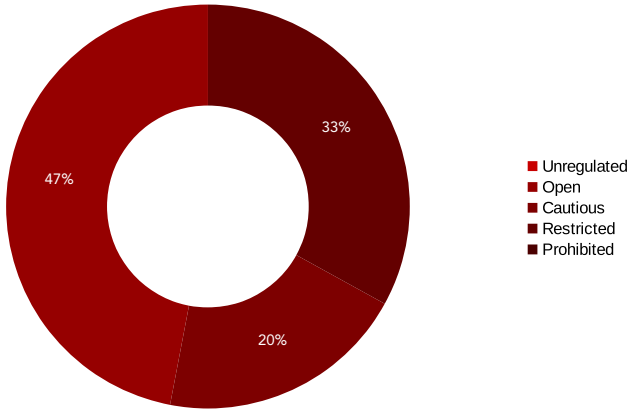
One important facet of the dataset is the contrast between governmental and non-governmental respondents. The following sections attempt to highlight the larger disparities of opinion and provide some context and analysis for these differences.

4.1 Government perception of regulatory status

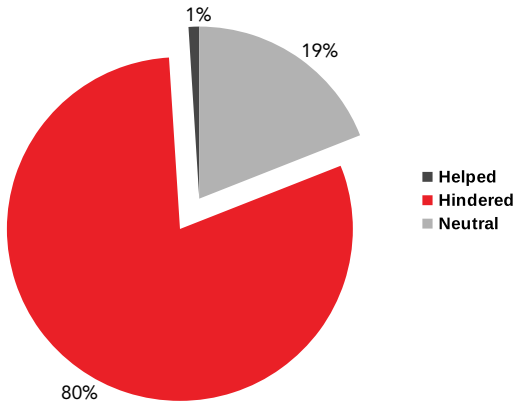
Government respondents were asked how they would categorize the regulatory status of UAS in their country. The majority of respondents (47 percent) deemed regulations to be open, only 33 percent deemed the regulations in their country to be restricted, and another 20 percent characterized regulations as being cautious. No respondents believed that UAS use was completely unregulated or entirely prohibited.

This suggests that, despite reservations about the implementation of UAS, those working within government administrations feel that the current regulations are not overly onerous.

How would you characterize your country's attitude towards UAS?



Have government policies helped or hindered your willingness or ability to operate UAS?



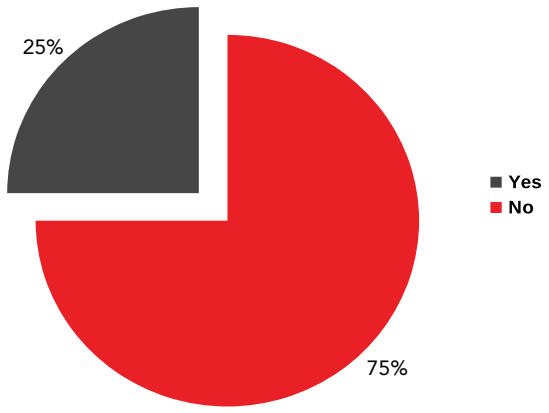
4.2 Inaction or inability of public users to influence policy / regulation

Our study has indicated that one major identifiable barrier to progress and cooperation between practitioners and government is inaction or inability to influence policy or regulatory developments. Fully 80 percent of respondents said that government regulations or policies hindered their organization's willingness or ability to use UAS in the countries and regions in which they operate. The remaining 20 percent said that such policies or regulations had no meaningful positive or negative impact while no respondents indicated that they had helped their efforts in any way.

However, the survey also attempted to understand what proactive measures practitioners have taken to influence government policies or regulations either towards UAS in general or for humanitarian and development work in particular.

Only one quarter of respondents had made an effort to influence policy, which highlight several possible factors: (a) practitioners are not actively engaging with regulatory and policy processes, (b) government and regulatory bodies are undertaking policy development with insufficient public and professional input, or (c) no meaningful regulatory development is taking place in many countries and regions.

Have you taken steps as an organization to influence government policy toward UAS usage for developmer



4.3 Lack of practitioner engagement

Most small to intermediate UAS practitioners do not see engaging in fruitful cooperation with government agencies as their main objective. Rather, deployment and programming take priority, often to the detriment of larger structural efforts which can develop more meaningful interactions between practitioners and regulatory or policy bodies.

For this reason, the work of industry-specific networks such as UAViators[8] can help practitioners and relevant organizations wield enough power and distributed access to successfully influence policy and regulation development on a united front rather than through individual, piecemeal efforts.

4.4 Closed-door policy development

Industry networks can also help to overcome the tendency of government bodies (whether intentional or unintentional) to engage in policy development with insufficient public and industry input. Many government agencies in the Global South undertake such policy development without external consultation simply because they believe that this is a purely governmental function. In many cases these closed-door processes are undertaken in countries with restrictive domestic security laws and such policy development is only meant to arrive at the determination that UAS should be prohibited or severely restricted.[9]

Shazia Haris	
Country	Pakistan
Affiliation	Consultant to government agency

"Currently the perceptions of drones has a severely negative connotation along with a resistance to drones as we have had drones killing people around this region. I may say the idea of using drones for development would not only be a novel idea but at the same time implementation would depend on who is advocating it, as drones are viewed as a security concern at the moment."

However, far more commonly, government regulatory development lacks sufficient external consultation due to a lack of resources or experience with public input, or weak outreach efforts which result in no meaningful community response because citizens are unaware of the opportunity to contribute or do not know how to do so.[10] Regardless of the case, industry networks can leverage the combined membership and expertise to successfully lobby for more inclusive and public feedback on UAS policy development.

8. UAViators is a humanitarian UAV network which works to collaboratively establish industry standards, best practices, and to coordinate humanitarian UAV deployments in response to disasters.
9. "Cuba Drone Laws," UAV Systems International (1 February 2016)
10. Andae, G. "Longer wait for Kenyans to fly drones," Daily Nation (21 June 2017)

4.5 No regulatory discussion

When no practical discussion on UAS policy and regulation takes place it forces governments and practitioners to fall back on existing - and only tangentially related - rules put in place for the most closely related industries and technologies.[11]

This results in many users and regulators applying principles of commercial aviation law to UAS applications, which may at first seem sensible, until it becomes apparent that class, weight, airworthiness, licensing, training, and communications requirements are incredibly burdensome and often present an insurmountable obstacle for the vast majority of UAS operators (or potential operators). The primary value of UAS is their ease of use and low cost compared to conventional manned aircraft.

Therefore, if a country needlessly implements even a single measure that was originally designed for conventional aviation, such as demanding that UAS operators possess a commercial pilot's licence, this negates those benefits and almost completely destroys UAS innovation within the country.

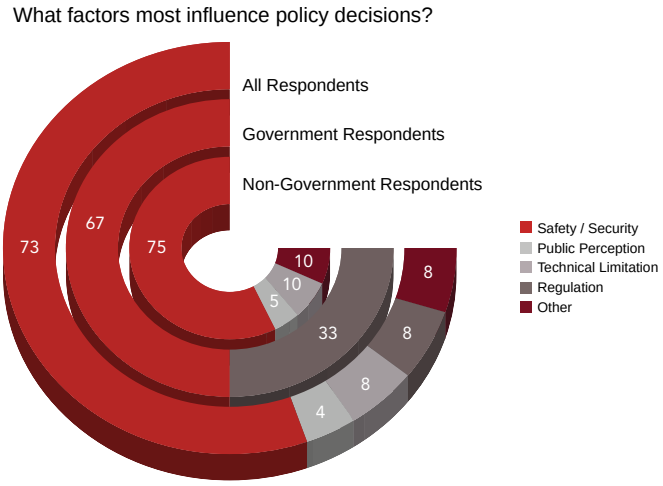
14. Zirulnick, A. "Kenya was set to be a perfect lab for commercial drones until regulators struck," Quartz Africa (31 May 2015)

INFLUENTIAL FACTORS VERSUS PRACTICAL CONCERNS

5. INFLUENTIAL FACTORS VERSUS PRACTICAL CONCERNS

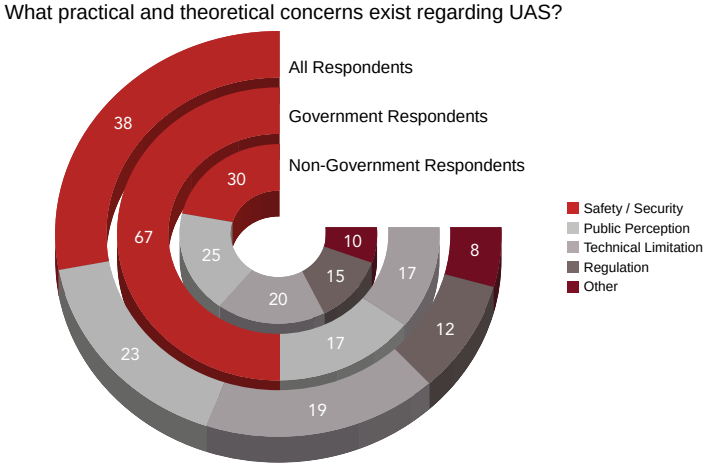
Our research has identified a trend in which factors which influence policymakers are different in scope and content than identified practical and theoretical concerns. Understanding this tendency will help to comprehend the varying dynamics which shape policy development in UAS deployment and the subsequent regulatory environments which coalesce around these policies.

5.1 Factors most influencing UAS policy



Seventy-three percent of all respondents said they thought safety and security considerations had the largest influence on policymakers and regulatory developments surrounding UAS. It is therefore clear that safety and security play a primary role in shaping policy development in Global South countries. However, even within this data there are revealing differences between governmental and non-governmental respondents. Non-governmental respondents cited a variety of factors which they believe influence policy, including the aforementioned safety and security considerations, technical limitations, public perceptions, and existing regulations. In contrast, the government respondent group cited only two significant factors - that of safety and security taken together as well as existing regulations. This hints at governmental policy having a narrower focus, relying on existing regulatory frameworks to guide policy on safety and security matters arising from the use of UAS. Additional layers of complexity are found when contrasting respondent views on what shapes policy with their views on which practical and theoretical concerns exist.

5.2 Practical and theoretical concerns



Despite the fact that among all respondents, a total of 73 percent stated that safety and security was the largest influencing factor on UAS policy and regulation, when asked what they viewed as the actual greatest practical or theoretical concern, only 38 percent of all respondents cited security and safety as their primary concern. Other concerns included the role of public perception, technical limitations, and even the burden of overbearing or unnecessary regulation. Once again, these opinions varied sharply along governmental and non-governmental lines. The majority of governmental respondents (67 percent) cited security and safety as their primary concerns while only 30 percent of non-governmental respondents believed this to be the case. Indeed, non-governmental respondents cited public perception (25 percent), technical limitations (20 percent), and regulations (15 percent) as other clear concerns.

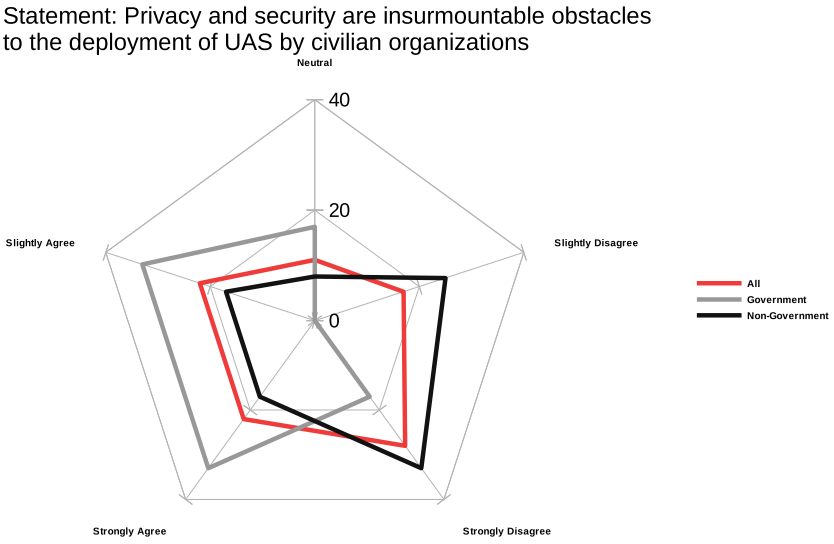
Government bodies possess an outsized concern for safety and security in the development of UAS policy and regulation compared to practitioners. This can be explained best by placing the roles of each group into context. Governmental elements operate in order to define limits in relation to regulations, which frames the conversation about the development of policy. Practitioners, on the other hand, operate more in terms of opportunities and innovation rather than the confines in which something must be done. This healthy tension between opportunity and regulation can be a highly conducive environment if all efforts can be directed towards a mutually agreed upon standard of operations for UAS moving forward.

PERCEPTIONS OF UAS, THEIR PRACTICALITY, AND IMPACT

6. PERCEPTIONS OF UAS, THEIR PRACTICALITY, AND IMPACT

6.1 Privacy and security as insurmountable obstacles

When measured across all respondents, nearly equal numbers agreed and disagreed about whether privacy and security were insurmountable obstacles to UAS deployments in a broader development and humanitarian context. This highlights a predominant trend in the development of UAS operations, and particularly connected to the roots of the technology as a military tool used for surveillance and as a weapon, which for many observers implicitly calls into question the benevolent uses of the technology.[12] These concerns are well founded, and the validity of the tools or the sincerity of its operators pose one of the most significant challenges moving forward, but what role does perspective play when assessing these elements? Such concerns are often also very much geographically dependent and rooted in local culture, general technological exposure, and collective experiences. For example, in countries such as Pakistan or Yemen it is likely that the most common associations with UAS will be negative due to frequent lethal American drone strikes against militant targets. However, in other countries such as Kenya, the lack of such past experiences means that perceptions of UAS are often much friendlier and open minded in relation to the potential applications of the technology.

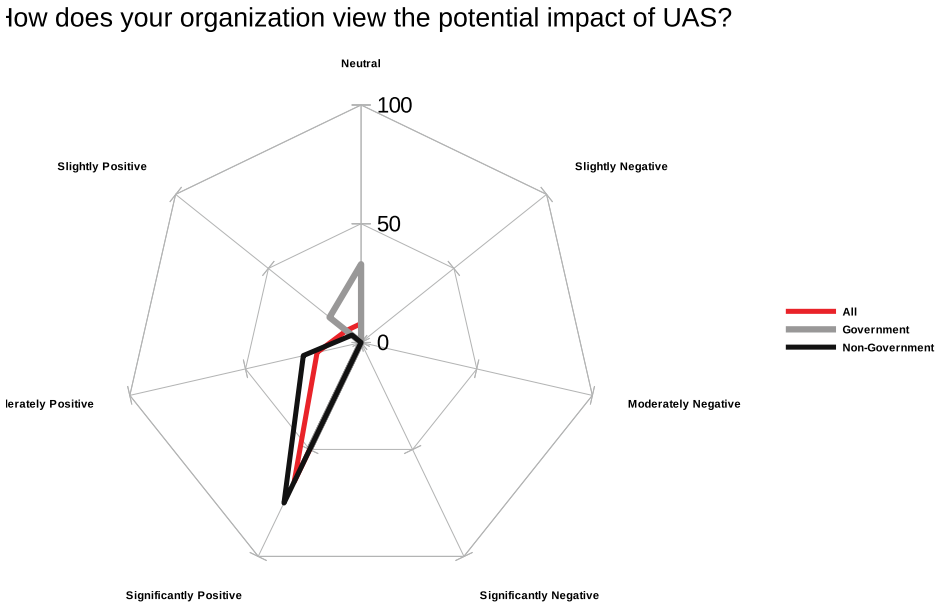


When delving deeper into the survey data, one finds that the equilibrium between negative and positive responses is the balance between government respondents on one end of the spectrum and non-governmental respondents on the other end. A full 66 percent of governmental respondents said they slightly or strongly agreed that privacy and security were insurmountable obstacles, while 58 percent of non-governmental respondents slightly or strongly disagreed with that sentiment. A modest minority of governmental and non-governmental respondents, 17 percent and 8 percent respectively, were neutral in their responses. Based on this data we can observe that government respondents tended to take more cautious views of potential concerns.

12. Reece A. Clothier, Dominique A. Greer, Duncan G. Greer, and Amisha M. Mehta. "Risk Perceptions and the Public Acceptance of Drones," Risk Analysis (February 2015)

6.2 UAS destabilization of conflict and humanitarian zones

When asked about whether they thought UAS destabilize conflict zones or humanitarian operations, 72 percent of all respondents disagreed or were neutral in their response. Once again, a more granular assessment of the data shows larger cleavages between governmental and non-governmental perspectives. Nearly 50 percent of governmental respondents stated that they slightly or strongly agreed that UAS have a destabilizing influence, compared to only 17 percent percent of non-governmental respondents.



Owing to the original military nature of UAS and the continued use of armed aerial systems by many militaries and non-state actors, the perception of these devices is far from neutral. It is therefore unsurprising that UAS continue to be viewed with suspicion and as potential grounds for conflict escalation. Because the utilization of UAS thus far lacks sufficient protocols for identification of humanitarian rather than military means, and even if such identification exists there is still an overarching perception that UAS have military applications, sightings can easily strike fear or sow confusion among communities and individuals who may not be aware of the benevolent objectives of the system operators.

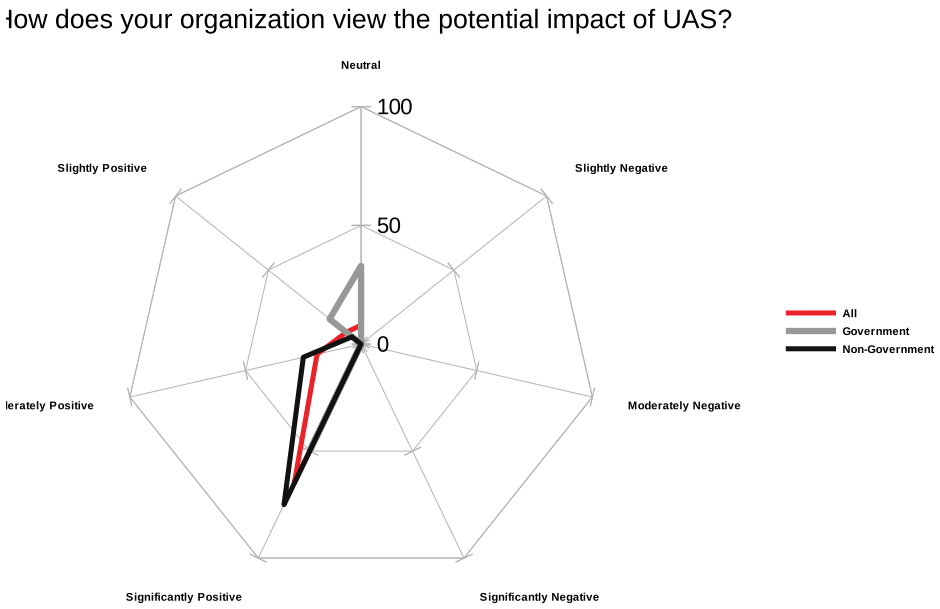
Tossah Aime	
Country	Togo
Affiliation	Freelance practitioner
"UAVs are perceived [by authorities] as a dangerous technology and instruments that can affect the safety and privacy of citizens. I have been arrested once while collecting data."	

Additionally, due to the fact that the technology is still new in the humanitarian and development field, and that the aerial system by definition can operate far beyond the physical location of the operators, it is entirely possible that observers will not have been informed in any manner the nature of the device and will be left to ascribe their own meanings and motivations to the sighting. This allows for an uncontrolled hypothesizing which can develop harmful or counter-productive narratives. For these reasons, it is important that UAS deployments in conflict zones and humanitarian crisis zones also carefully take into account local dynamics, being certain to gauge public perceptions of UAS as early as possible, and ensuring open communication and active communication with local communities. Such measures help to minimize the possibility of destabilizing misunderstandings around UAS usage and ensure that implementers are aware of host community concerns as they arise.

6.3 View of potential impact of UAS

Of all respondents, 65 percent believed that UAS will have significant positive impact on the humanitarian and development fields. However, governmental respondents were less enthusiastic about the impact, with 50 percent showing significant positive impact and the remainder showing only slightly positive or entirely neutral positions. On the other hand, 70 percent of non-governmental respondents believed that UAS present a significantly positive impact while the remainder felt they were only slightly or moderately positive in impact.

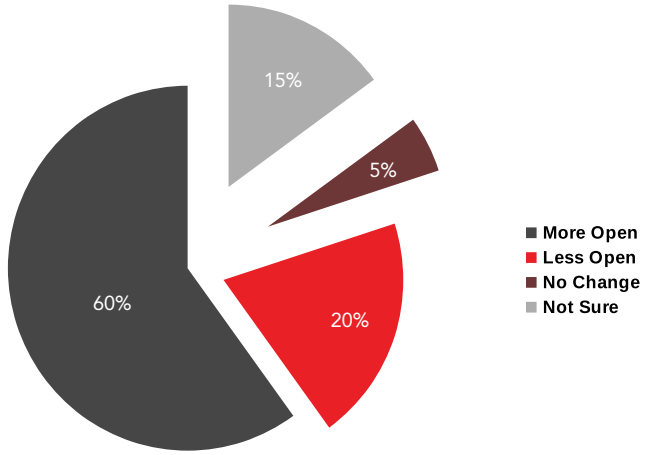
Generally speaking, this appears to indicate a consistent belief in the positive value of UAS despite some variance between respondent groups. It also arguably demonstrates the increased support for UAS in relation to the proximity of respondents, where practitioners who interact with such systems regularly grow to appreciate the value of aerial systems. Conversely, it may also indicate that these same proximities (or lack thereof) can generate disparity of opinion severe enough to cause schisms within this emergent field.



6.4 Unified understanding of the role of security, privacy, and safety

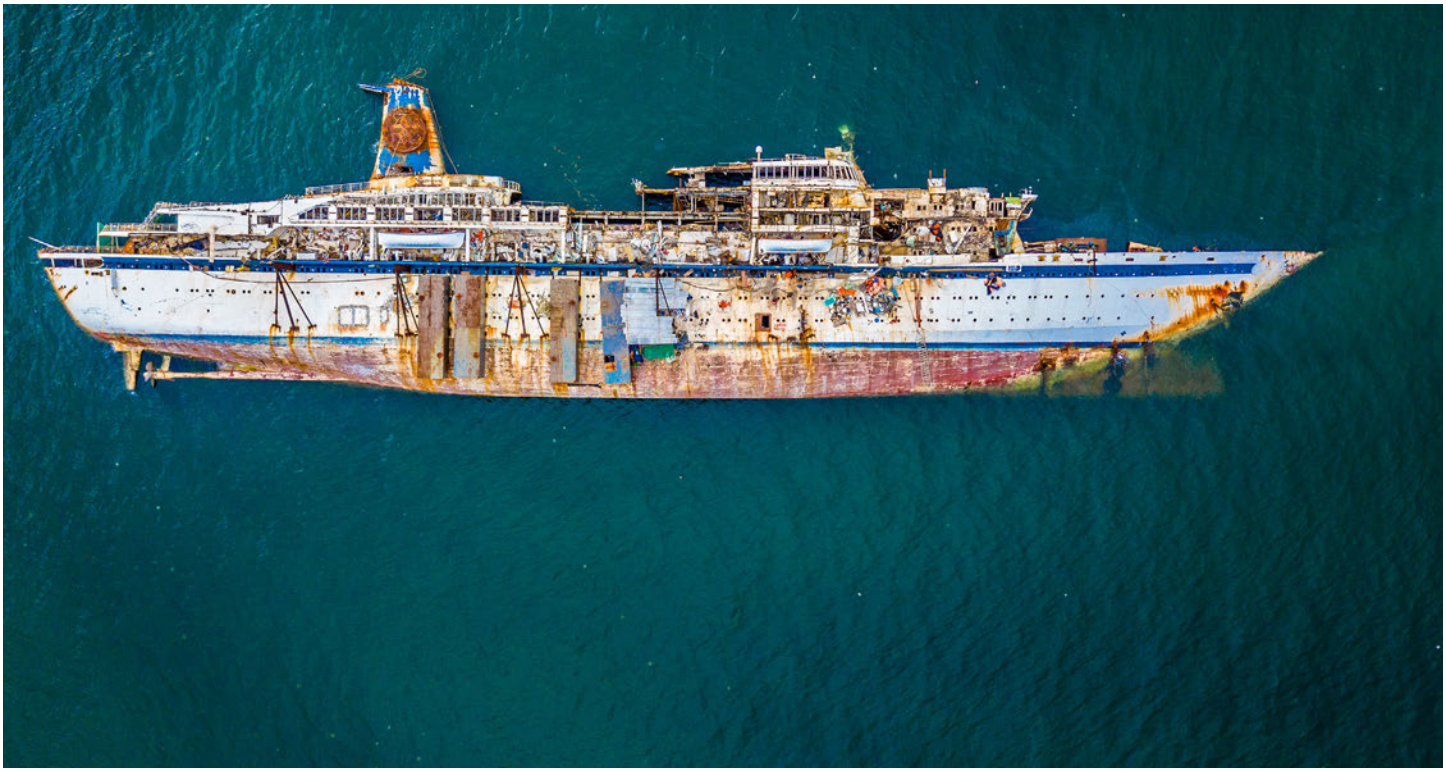
Though much can be made of the vastly differing perceptions of UAS between practitioners and government bodies, at least one element demonstrates a unified view between the two groups - the role of security, privacy, and safety. This research suggests that, despite differences in other aspects of UAS implementation, the understanding that this technology has inherent implications within vital regulatory sectors is shared across all fields. This highlights a more complex interplay between drones and security; one which understands that there are legitimate concerns but there also remains a broad-spectrum comprehension of their peaceful and useful applications in the development and humanitarian fields.

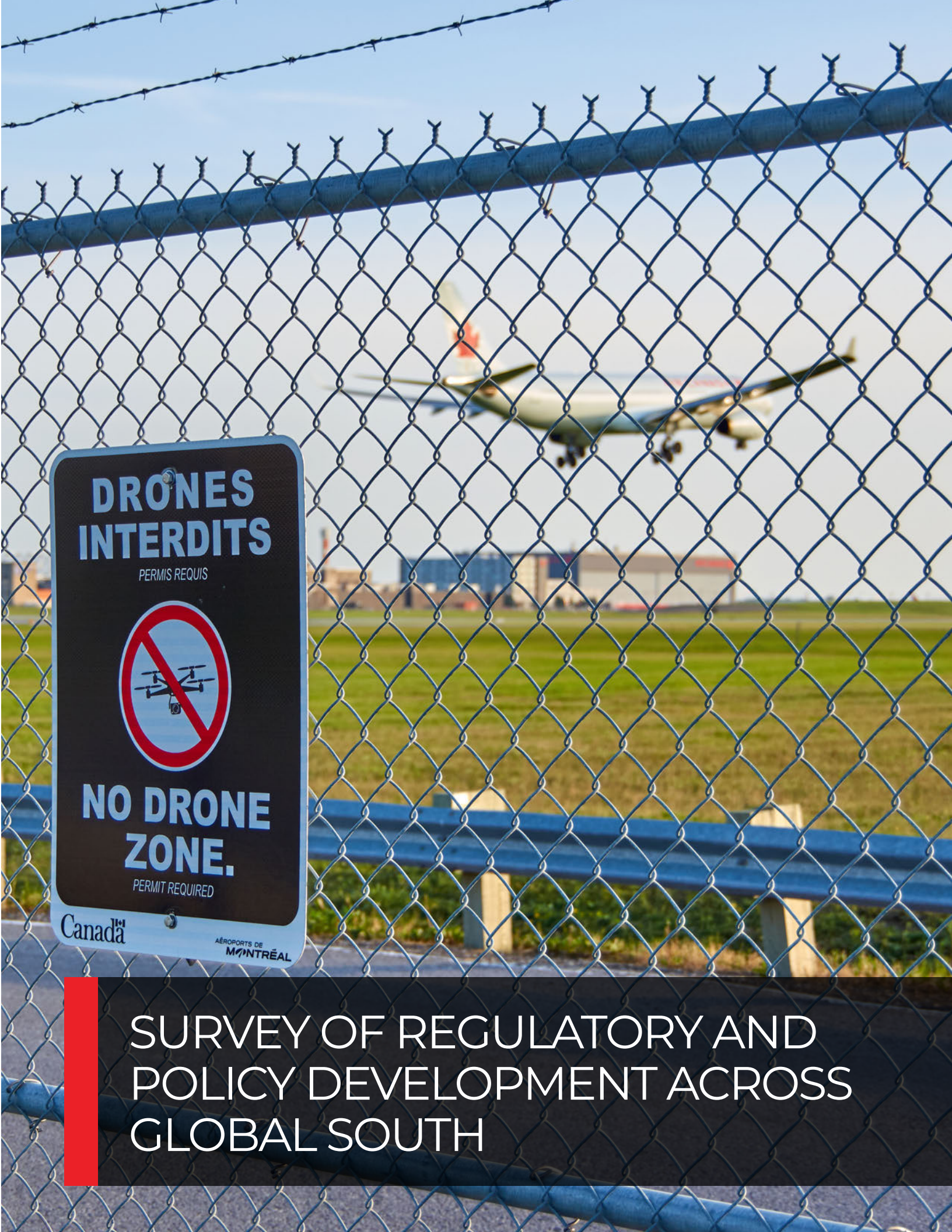
What do you expect in terms of future reception of UAS development in your country?



This tension between security and deployment appears to be slowly working through the process of clarification with a general sense among policymakers and practitioners that UAS will have a place.
The majority of respondents (60 percent) said that they expect future UAS developments - in terms of policy and regulation - to be more open, compared to 20 percent who expected less openness, 5 percent predicting no change, and 15 percent being unsure.

These findings make it possible to frame the discussion about UAS and security, privacy, and safety. Starting from the assumption that this component is a primary issue while also recognizing the general interest in the proliferation of UAS platforms into the humanitarian and development fields to some degree, it is possible to shape the path forward, including the best practices which must be established, if this technology ever hopes to become a standardized toolset.

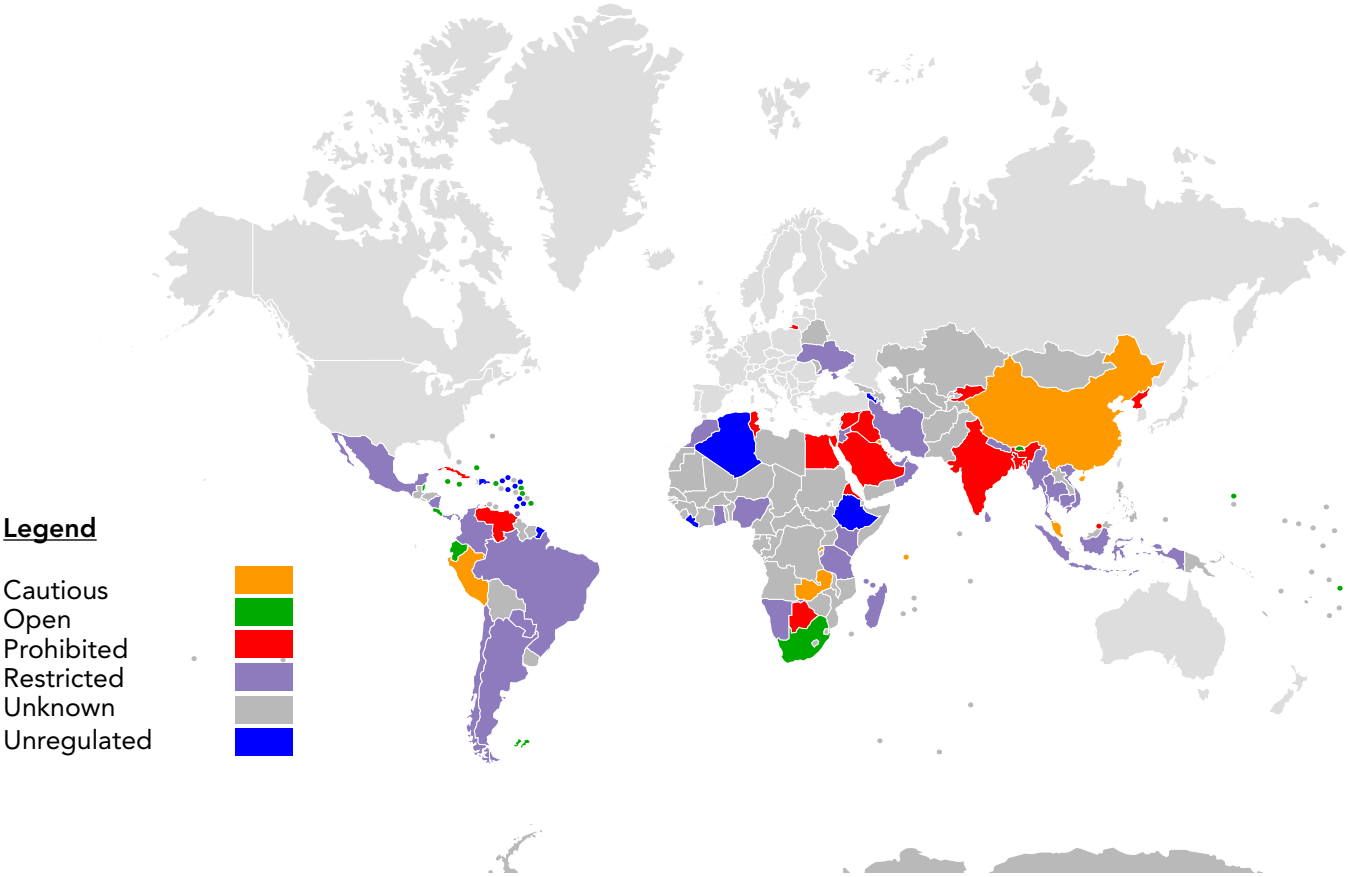




SURVEY OF REGULATORY AND POLICY DEVELOPMENT ACROSS GLOBAL SOUTH

7. SURVEY OF REGULATORY AND POLICY DEVELOPMENT ACROSS GLOBAL SOUTH

Another integral issue is the overall lack of clear regulatory conditions or formal policies for the use of UAS in many Global South countries. The map below indicates the regulatory status of UAS in Global South countries as of the publication date of this report.[13] Though it will inevitably change, large swaths of West Africa, Central Africa, and Central Asia have either highly inaccessible regulatory or policy documentation or, more likely, lack any coherent protocols or guidelines whatsoever.



Though reasons for the dearth of UAS regulation are many, the stability of government and its ability to act as a centralized authority are likely explanations. Where functions of government or indeed the existence of persistent government are in flux it is unreasonable to expect consistent policy or regulatory work on niche issues such as UAS. For example, it would be surprising at this point in time to find UAS regulations in place - let alone enforced - in a country like Somalia. In other countries with high levels of state control and exaggerated concerns about security, such as Eritrea and North Korea, it is unsurprising to find high levels of restrictions on UAS considering that the technology may still be perceived more in line with its military origins, a capability that these governments would be very reluctant to see in the hands of civilians.

13. Data gathered from direct inquiry with civil aviation authorities and compendium sources, including https://droneregulations.info, an extension of the FSD report on drones in humanitarian action. Learn more at http://sarus-aero.org

7.1 Case Study: Rwanda and Tanzania

These two countries are regularly cited as examples of places with forward thinking and ambitious objectives in the field of humanitarian and development UAS applications. Both Rwanda and Tanzania have recognized their opportunities to act as testing grounds for new technologies but also that their geographic environments, development needs, and regulatory settings can permit them to capitalize on several variables which play to their favour.

Rwanda hosts several UAS innovation projects including Zipline[14] which aims to deliver urgent medical supplies such as blood, and which created the first droneport in the world.[15] This kind of application is especially advantageous in Rwanda since the country's very hilly terrain makes road transport typically slow over even short distances as they appear on a map. UAS-based delivery of critical supplies which can be packaged into compact payloads represents a much faster, more efficient, and more responsive alternatives to conventional methods of transportation. Tanzania has similarly provided an accommodating atmosphere including a Zipline expansion and regulatory freedom for the testing and development of UAS tools and practices. Tanzania is also home to ambitious mapping initiatives, such as the Tanzania Flying Labs[16] effort to map all of Zanzibar using UAS. This aerial map will then be made openly accessible to anyone who wants to use it, with proposed potential applications including land use planning, improved tax collection, and improved disaster preparedness.

Rwanda and Tanzania demonstrate the value of countries facilitating UAS development within their own borders as the results of preliminary projects attract further investment, impact communities directly, and contribute to national reputation by putting them on the global map as innovators.

7.2 Case Study: Kenya

Despite the advances in neighbouring Tanzania, Kenya has taken contradictory steps in its handling of UAS operations. Once considered a contender for UAS project development due to its reputation as a hotbed of technological innovation, Kenya's unclear regulations, long periods of legislative paralysis, poorly communicated policy aims, and inconsistent enforcement have left the UAS industry wary of Kenyan airspace.

In some respects the Kenyan challenge can be explained by increasing concerns about terrorism, particularly the threat of al-Shabaab militants based out of Somalia but regularly operating within Kenyan territory. However, internal politics and the tendency for all regulation and legislation to be delayed also contribute to the current state of affairs regarding UAS operations in Kenya.

Finally, the government and relevant regulatory agencies - particularly the Kenya Civil Aviation Authority (KCAA) - regularly communicate a formal policy while actual implementation is vastly different. On any given day, professional UAS applications may require formal permission which involves a convoluted (and very likely unproductive) approval process involving both the KCAA and the Ministry of Defence while Nairobi residents fly small UAS in public parks. At the same time, customs agents are likely to impound UAS being carried by travelers coming from outside the country while it is possible to easily purchase recreational models in grocery stores. This kind of chaos and inconsistency in UAS regulation and enforcement has shut down almost all potential UAS-enabled development and humanitarian projects in Kenya for the foreseeable future.

It is clear from these two case studies that a formalized standard would assist in creating clear and functional policy and regulatory environments for UAS development. The following section summarizes this project's recommendations for how best to achieve this goal.

> *"Rwanda and Tanzania demonstrate the value of countries facilitating UAS development within their own borders."*

14. http://www.flyzipline.com
15. "Proposals for Droneport project launched to save lives and build economies," Foster+Partners (16 September 2015)
16. http://tanzania.werobotics.org

RECOMMENDATIONS

8. RECOMMENDATIONS

8.1 Drones as a toolset, not as a panacea

One element of UAS utilization which is often misunderstood is precisely how such systems fit into the humanitarian and development ecosystem. New technologies frequently follow a familiar implementation process involving four essential stages:

1) Revolution 2) Evangelism 3) Pragmatism 4) Convention

Revolution is the stage where a technology shifts from being a prohibitively expensive or exotic field into a more accessible phase through industry advances. The concept of small, unmanned aerial systems gained traction in the early 1990s and unmanned aerial systems in general had been around in some manner since the First World War. During most of this time, the primary users and drivers of innovation in this space were the military forces, military contractors, and other security agencies of a small number of developed countries. However, advances in science and engineering created smaller electronic components which could be produced at a lower cost, thus enabling the development of a market for small, consumer grade aerial platforms for entertainment and videography. Primarily marketed as expensive toys, users began to see how such systems could be used in a variety of new applications, which in turn inspired ideas for commercial and social benefit applications of UAS.

Evangelism is the stage at which optimism about a new technology results in rapid proliferation of the concept and potential but lacking proper context, awareness of limitations, or understanding of the technology in its entirety. In the mania that follows, the new technology is proposed for nearly any application. The frenzy demands mere mention of the concept rather than a sober assessment of its practical uses or whether existing and traditional methods already provide better capabilities than the proposed replacement. During such a time it is often financial factors, including the apparent abundance of venture capital looking for innovative investment opportunities, which tend to inspire the pursuit of any and all proposed uses of the new technology. This same process likely spurred the creation of several fantastical plans for UAS uses in recent years, even in cases when this was not the most appropriate technology to accomplish a given task.

Some examples, ranging from probable publicity efforts to advanced consumer proposals include UAS that deliver food,[17] last mile package delivery services, automated dry cleaning returns,[18] personal photography platforms, window cleaning, biodegradable cargo delivery systems,[19] and "manned" unmanned aerial systems for human transportation.[20]

This is not to suggest that experimentation is not a vital component in the development of any new technology, even if some of those experiments are ultimately unsuccessful. Indeed, experimentation is the core of the concept of technological advancement. However, within the evangelism stage the excitement frequently results in fringe applications being highlighted and promoted due to their novelty over more compelling use cases.

Pragmatism is the natural reaction to the evangelism stage and expresses cautious optimism about implementation while also understanding the practical limits of a given technology. This represents a change in understanding of a new technology from being a panacea to a toolset, and this is where we find the present state of UAS development. The mania in which any and all tasks might one day somehow involve UAS has subsided, replaced with a more sober assessment of the useful but not fanciful application of unmanned aerial systems. However, there are still many unanswered questions within this stage and much effort is required to answer the serious practical questions about how this technology will shape our world.

Convention marks the final stage for the purposes of this explanation, whereby a new technology comes to be implemented in the niche areas where it is best suited, where new use cases are still attempted but realistic estimations of capability limit new applications to where they are best utilized and more extraneous uses fall out of favour.

17. Moon, M. "Alphabet brings burritos-by-drone delivery to Australia," Engadget (17 October 2017)
18. "Someday, Your Dry Cleaning Might Be Delivered To Your House By A Quadrocopter Drone," Fast Company (7 October 2013)
19. Glaser, A. "These paper-airplane drones may one day save your life," Recode (12 January 2017)
20. Clemence, S. "The flying car is here: Dubai is testing its drone taxi service," The National Post (28 September 2017)

The current situation appears to be in transition between the pragmatism and convention stages, slowed if only temporarily by the process of clarification and edification of regulations and policies to adequately integrate UAS into sustained use as a tool among many in the humanitarian and development fields.

8.2 Sector-specific targets

- Primary stakeholder task

- Support task

Actor	Action	
Government / Regulatory Bodies / Security Bodies	Transparent regulatory and policy development	Public announcement of open policy meetings
		Requests for industry input process
	Engagement with industry and practitioner stakeholders	Participate in industry network efforts to expand private-public cooperation
		Communicate new circulars and developments
Funding Institutions / Donor Countries	Encourage further research	Engage practitioners undertaking research projects
	Facilitate development of the humanitarian aerospace field	Implement impact-research elements into programming
		Support inter-organizational cooperation activities
Non-Profit Organizations	Industry collaboration for policy development	Participation in calls for public input
		Cooperation efforts to influence policy and regulatory development
	Outreach to regulatory and policy development bodies	Demands for participation in policy discussions
		Provide research and documentation on existing programming and project findings
	Planning and deployment of beneficial UAS applications	Continued work on existing programming frameworks
		Monitoring and evaluation of active UAS applications
		Dissemination of research and project findings
For-Profit Organizations	Participation in industry networks	Involvement in cooperative industry efforts to shape policy and regulation
		Advocacy within industry for establishment of standards and practices
	Support for humanitarian and development programming	Material, technical, and logistical support
		Cooperative support on private-public UAS efforts
Individual Practitioners	Sustained UAS applications and research	Application of industry standards and practices[1]
		Efforts to disseminate findings of individual projects and research

24. UAViators has established a collection of best practices, case studies, directory of UAS regulations and a code of conduct for practitioners and policymakers alike.

8.3 Practitioner perceptions versus government perceptions

The findings of this research indicate that there are notable differences in core perceptions over the role of UAS, their validity in application, the nature of ideal applications, and their role in future deployments. These findings highlight an industry disparity whereby government and practitioners view the role of UAS and the relevant security and regulatory impacts of this technology on fundamentally different levels. From the interviews conducted it is possible to clarify what mechanisms shape respondent perceptions based on industry position.

Government and regulatory positions are approaching the subject from a top-down perspective where individual cases are not the priority and broad understandings of new technologies and their capabilities must therefore be weighed against the responsibilities of the relevant agency. As a result, there is a systemic reckoning which must aim to estimate large trends and the variables which span these trends. These governmental obligations in combination with the necessity of factoring in expansive circumstances leads to an opportunity aversion that errs on the side of an abundance of caution.

Practitioners are looking at the industry from their individual perspective and use case, which leads to a focus on implementation and positive impact from a bottom-up perspective. Those interviewed for this study almost universally acknowledged the importance of adequate regulation but did not have an organizational responsibility to oversee this and therefore emphasized the potential benefits of UAS rather than their potential risks.

Moving forward, it will be vital that this gulf is better understood and overcome such that equally oriented collaboration between governmental bodies and UAS practitioners will facilitate the sensible development of regulatory environments which will enable the proliferation of invaluable UAS assets for humanitarian and development endeavors.

“Government and regulatory positions are approaching the subject from a top-down perspective where individual cases are not the priority and broad understandings of new technologies and their capabilities must therefore be weighed against the responsibilities of the relevant agency.”

CONCLUSIONS

9. CONCLUSIONS

As with any relatively new technology, there is a diversity of opinions on whether UAS is more likely to provide positive or negative impacts in the development and humanitarian fields. While there are extreme positions at both ends of the spectrum - those who exaggerate the likely benefits as well as those who exaggerate the possible harms - most informed opinions to date seem to centre around realistic optimism which recognizes the potential of UAS to substantially support many areas of effort while also recognizing that risks do exist and need to be addressed in the context of specific applications. In short, there seems to be widespread acceptance that UAS technology is likely to become increasingly common in many areas of activity but that this does not mean it is always the best or most appropriate tool to use.

It follows that, like any technology-enabled development or humanitarian effort, UAS-supported work must be sensitive and intelligent. However, government and organizational policy does not always reflect this view, which is more common among researchers, individual practitioners, and smaller organizations.

There are core disparities in the perceptions on which UAS policy and regulation is based, and those differences in perspective must be reconciled through cooperation between policymakers and practitioners. If the recommendations made in this report are adhered to then it will be possible to realize the seamless adoption of UAS in development and humanitarian contexts while building a strong community of practice and adequate guidelines.

John Otunga	
Country	Kenya
Affiliation	NGO project staff
"Just as in many countries around the world, the concept of the use of drones is relatively new in Kenya, with no clear regulations and guidelines on their use, which has hindered the development of this growing field. This is certainly a challenging pursuit, but our communities have much to gain from it in the long run."	

Governmental bodies involved in policy and regulatory development must be willing and able to accept public input from industry leaders and practitioners, engage in the collaborative establishment of standards and practices, and see the value of UAS deployments within their countries and regions. Practitioners of all sizes must be capable of cooperative advocacy for humanitarian aerospace applications through the development of industry networks. These networks must continue to establish a coherent and rigorous community of practice and adoption of standards which address the practical and theoretical concerns raised by all relevant stakeholders. Lastly, external parties such as funding organizations, donor country governments, and intra-national bodies can support the development of this burgeoning field through continued support for efforts to expand initiatives aimed at establishing UAS as a practical tool for humanitarian and development settings.

10. ANNEXES

10.1 Global South index

Middle East and North Africa	Sub-Saharan Africa
Algeria, Bahrain, Egypt, Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Palestinian Territory, Qatar, Saudi Arabia, Sudan, Syria, Tunisia, United Arab Emirates, Western Sahara, Yemen	Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo, Congo (Democratic Republic), Côte D'Ivoire, Djibouti, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mayotte, Mozambique, Namibia, Niger, Nigeria, Rwanda, Saint Helena, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Somalia, South Africa, South Sudan, Swaziland, Tanzania, Togo, Uganda, Zambia, Zimbabwe
East and Southeast Asia	**Commonwealth of Independent States**
Afghanistan, American Samoa, Bangladesh, Bhutan, British Indian Ocean Territory, Brunei, Cambodia, China, Christmas Island, Cocos (Keeling) Islands, Cook Islands, Fiji, French, Polynesia, French Southern Territories, Guam, Heard Island and McDonald Islands, India, Indonesia, Iran, Kiribati, Korea (Democratic People's Republic), Laos, Malaysia, Maldives, Marshall Islands, Micronesia, Mongolia, Myanmar, Nauru, Nepal, New Caledonia, Niue, Norfolk Island, Northern Mariana Islands, Pakistan, Palau, Papua New Guinea, Philippines, Pitcairn Islands, Reunion, Samoa, Solomon Islands, Sri Lanka, Thailand, Timor-Leste, Tokelau, Tonga, Tuvalu, United States Minor Outlying Islands, Vanuatu, Vietnam, Wallis and Futuna	Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Ukraine, Uzbekistan
Central America / Caribbean	**South America**
Anguilla, Antigua and Barbuda, Aruba, Bahamas, Barbados, Belize, Cayman Islands, Costa Rica, Cuba, Dominica, Dominican Republic, El Salvador, Grenada, Guadeloupe, Guatemala, Haiti, Honduras, Jamaica, Martinique, Mexico, Montserrat, Netherlands Antilles, Nicaragua, Panama, Puerto Rico, Saint Barthelemy, Saint Kitts and Nevis, Saint Lucia, Saint Martin, Saint Vincent and the Grenadines, Trinidad and Tobago, Turks and Caicos Islands, Virgin Islands (British), Virgin Islands (US)	Argentina, Bolivia, Bouvet Island, Brazil, Chile, Colombia, Ecuador, Falkland Islands (Malvinas), French Guiana, Guyana, Paraguay, Peru, South Georgia and the South Sandwich Islands, Suriname, Uruguay, Venezuela