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ASSESSING FEASIBILITY AND READINESS FOR CARGO DRONES IN HEALTH SUPPLY CHAINS

A Guide to Conducting Scoping Trips in Low- and Middle-Income Countries

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ABSTRACT

As drone projects for health delivery grow in number, duration, and maturity, documentation of processes and guidance--grounded in implementation experience--will be critical for continued work toward successful drone projects with maximum impact for global beneficiaries. The United States Agency for International Development (USAID) developed this guide to document and share knowledge gained through numerous scoping visits conducted in the exploration and planning phases of the USAID-funded drone activity conducted in Malawi (2019-2020). The sections of this guide provide guidance for assessing cargo drone project feasibility and readiness across the following areas of investigation:

-Validation of information gathered from desk research
-Stakeholder engagement and education
-Analysis of supply chain and distribution systems, including validation of bottlenecks and justification for a drone intervention
-Confirmation of regulatory approvals processes, requirements, and timeline
-Determination of health facility readiness, including sufficient infrastructure, resourcing availability, and validation of identified use cases

The guide is grounded in experience with public health supply chains in limited resource settings. It will not apply uniformly to all contexts but will serve as a helpful starting point for adaptation to specific contexts and use cases.

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INTRODUCTION

Unmanned Aerial Vehicles, or drones, have garnered an increasing amount of interest and investment within the international development and humanitarian spaces. Common applications in these contexts include mapping and imaging, monitoring, post-disaster relief, search and rescue, and health delivery. From floods and earthquakes to refugee camps, the imaging applications are numerous and widely deployed. Health delivery, in contrast, remains an underdeveloped area of work, as the technology for cargo drones is still rapidly evolving, often prohibitively expensive, and poses security and regulatory challenges that drones for imaging do not. Donor agencies have unique and at times competing objectives that tend to limit collaboration and options to pool funding in support of any singular activity. Moreover, the number of development and humanitarian organizations with on-the-ground drone experience is limited to less than a handful of implementers. However, this is changing.

As the technology is proven to have a beneficial impact on the lives of global beneficiaries, public and private sectors alike are increasingly willing to invest large sums of money in deploying cargo drones within existing health supply chains. Not only can drones leapfrog over challenging terrain and logistical obstacles, but also enable new forms of delivery, which were not possible previously. For example, while trucks and motorcycles may be the most efficient and cost-effective mode of delivery between hospitals and facilities connected by stretches of paved road, poorly maintained roads leading to rural health outposts may be impassable by large trucks at the best of times, and dangerous even to motorcycles throughout the rainy season. During the global COVID-19 response, many countries set up checkpoints to limit transportation between regions or provinces and stem the spread of the virus; drones would be able to surpass these checkpoints and roadblocks to access remote locations without endangering lives through person-to-person exposure. Additionally, when used to supplement existing transportation and distribution networks, drones create opportunities for targeted deliveries to avoid stockouts, respond to emergency medical requests, and dramatically speed up diagnostic sample delivery time to ultimately improve treatment. This last use case was demonstrated successfully through the USAID-funded drone activity in Malawi, which took place between July 2019 and February 2020.[1]

The United States Agency for International Development (USAID,) through its Global Health Supply Chain-Procurement and Supply Management project (GHSC-PSM), developed the Unmanned Aerial Vehicle Procurement Guide to contribute to the growing body of knowledge, which supports both donors and implementers in planning for and executing cargo drone activities.[2] As drone projects for health delivery grow in number, duration, and maturity, similar documentation of processes and guidance will provide a body of best practices from which to work.

In that spirit, the purpose of this guide is to share knowledge gained from numerous scoping visits the authors conducted while in the exploration and planning phases of the 2019-2020 Malawi drone activity.

These trips spanned several regions across four countries,[3] and had as their main objectives:

1. Validation of information gathered from desk research, through industry events and informational interviews, and via supply chain project field offices in the candidate countries

[1] Reference drone report - link

[2] https://www.ghsupplychain.org/index.php/unmanned-aerial-vehicle-procurement-guide

[3] Lesotho, Malawi, Rwanda, Zambia

2. Stakeholder engagement and education; gauging country readiness as indicated by stakeholder interest in and support for the activity
3. Analysis of the supply chain and distribution systems, including validation of bottlenecks and justification for a drone intervention
4. Confirmation of regulatory approvals processes, requirements, and timeline
5. Determination of health facility readiness, including sufficient infrastructure, resourcing availability, and validation of identified use cases

The information shared here will not be universally applicable to all organizations seeking to use drones for cargo movement, as the guide is based on experiences with public health supply chains and operationalization within limited resource settings. Nonetheless, the questions and guidance will serve as a helpful starting point for adaptation to specific contexts and use cases.

PART 1. VALIDATION OF INFORMATION

Validation of information gathered from desk research, through industry events and informational interviews, and via supply chain project field offices in the candidate countries

This section includes an overview of how and where to look for relevant information. Validation of desk research should be incorporated throughout all activities described within this guide.

INDUSTRY LANDSCAPE ANALYSIS

The first step toward a drone activity will be to reach an understanding of the current state of cargo drone operations. A broad industry analysis will help justify a business investment based on proven outcomes, as well as build a clear understanding of the current limitations of drone technology. A review of existing landscape analyses may be sufficient or may reveal focused areas for further investigation.

Areas of market research for inclusion in the industry landscape analysis:

- Types of drones and the unique characteristics of each (multi-rotor, fixed wing, hybrid)
- Options for fuel sources and the implications of each (fuel, battery)
- Technical specifications and maximums (range, weight)[4]
- Infrastructural needs for a hub of drone operations
- Any available cost and pricing data
- Information on a range of use cases for consideration
- An overview of regulatory concerns (e.g. VTOL approvals, differentiation of regulations by fuel source and weight)

[4] A comprehensive list of technical specifications to be collected in a Request for Proposals can be found in the Unmanned Aerial Vehicle Procurement Guide.

- Documented reports and outcomes for past operations with similar use cases to the one(s) under consideration
- Noted lessons learned from prior operations, including both successes and failures
- Contact information for implementers or industry actors consulted

Market research is critical to identifying the most appropriate use case(s), as well as to prioritize locations and key beneficiaries. Moreover, an understanding of the types of drones and their fuel sources, as well as their operational requirements and limitations, will point toward a limited selection of options capable of fulfilling the activity objectives. Understanding your requirements will save significant time and resources during the sourcing process for drone services.

Preparation for a scoping trip will include a variety of information gathering methods. Possible sources of information include but are not limited to:

- Internet-based desk research
- Industry events
- Conferences (virtual or in-person)
- Webinars
- Industry mailing lists
- Professional organizations, forums, and working groups
- Regulatory body websites
- Abstracts and published articles
- UAS regulations
- Prior drone activity reports
- Publicly available tools and guides
- Informational interviews with points of contact identified in the industry landscape analysis
    - flight engineers, remote pilots, prior drone project implementers, ministries of health, civil aviation bodies, drone manufacturers, governmental donors, etc.

The importance of informational interviews cannot be overstated and will likely occur before, during, and after the scoping trip in an iterative process. As the activity planning progresses, the focus of the interviews may shift from the state of the industry and globally applicable lessons learned, to the particularities and nuances of a specific place of performance, including local politics and culture. As cargo drones remain a relatively underdeveloped field of practice and readily available financial resources are limited, it is especially important to reference existing data, analyses, and other documentation where significant time and money has already been invested. Additional research can supplement gaps in the existing body of knowledge.

At a minimum, desk-based research should include preliminary investigations into the applicable aviation regulations, with special attention to the operation of any autonomous or remotely operated vehicle. The terms “drone,” “UAV,” and “UAS” may be used interchangeably, alongside references to autonomous aircrafts and autonomous aircraft systems. When reviewing news articles, formal reports, and other documentation of prior drone activities, identify the implementing organization, drone manufacturer or service provider used, targeted use cases, locations, outcomes, whether there is a

drone working group, and any mentions of government entities with a stake in the approvals process. It is important to pursue a point of contact from each identified entity.

If the researching organization has in-country resources which can be leveraged, these actors should begin brainstorming applications for cargo movement, as well as prioritization of sites for implementation. It is also highly recommended to have designated points of contact at the management level within each hospital, facility, and outpost prioritized for visiting. If international stakeholders are included in the scoping trip, an in-country office can also assist with transportation and lodging, setting up meetings, advising on whether and where to buy equipment in-country, addressing security concerns, and more.

VALIDATION OF RESEARCH

Information gathered prior to a scoping trip requires on-the-ground validation. Once in-country, discussions should be continued at each level of involvement, from the central government down to health facility workers. Additionally, this opportunity can be leveraged to gather intel with regards to operations data, cost drivers, community awareness, importation, and exportation.

Use your research to inform the development of a project concept note and set of objectives. Once these have been documented and agreed upon, compile a list of questions to be answered during the scoping trip. The more preparation occurs prior to the trip, the more efficiently you can utilize financial resources and make better, more focused use of government officials' or health workers' valuable time. This also provides you information to share with the stakeholders with whom you will interact.

The following list includes examples of questions which may arise during the desk research phase.

- Does a drone traffic management system exist?
- Who has successfully navigated the cargo drone application and authorization process?
- What reporting to civil aviation is required, and with what frequency?
- If there is any local drone manufacturer, what is their capacity for piloting support and for assisting with the maintenance of drones?
- Are there relevant training institutions, certifications, or university-level programs?
- What is the level of capacity and maturity for the aviation experience market?
- Can you collect names of individuals who can help to navigate the processes or who may be a good fit for later recruitment?
- What monitoring and evaluation indicators best support the measurement of the intended impact?
- What data is required, and is it available and accessible?

This list represents a sampling of the questions which may arise or be only partially answered in preparatory research. The process of preparation and planning for a drone activity is iterative, so that validation of information is also supported through each of the following sections of the guide and will almost certainly continue after the conclusion of the scoping trip, or trips.

PART 2. STAKEHOLDER ENGAGEMENT

Stakeholder engagement and education; gauging country readiness as indicated by stakeholder interest in and support for the activity

GOVERNMENT STAKEHOLDERS

An enabling regulatory environment and some degree of industry readiness are necessary but insufficient for a successful drone project. Active government support and commitment are also critical. Questions to guide your initial inquiries are listed below. These questions will help you to gain an understanding of institutional support and resources.

- What is the government's interest in drones, and what drives their interests?
- What is the government's history and experience with drones, and how does this impact their receptivity to future drone activity?
- If the government has never supported drones before, how can champions for the activity be identified and leveraged?
- Have specific points of contact been identified within each relevant government ministry?
- In which aspects of the scoping visit will the identified points of contact participate?
- What level of involvement has been expressed as desirable?
- Can the relevant ministries contribute resources or time?
- In addition to governmental authorities at the central level, who are the relevant regional, district, and local authorities?
- What is the role of the military?
- Are there ministries of information or communications technology who will want to be involved, and to what extent?

CIVIL AVIATION BODIES

Civil aviation and related bodies may show reluctance to support drone activities, especially if a national regulatory framework for drones is underdeveloped or nonexistent. Aviation representatives may rightfully worry about providing the highest standards of safety while lacking specialized drone training. No activity can proceed without a minimum level of civil aviation support, as their approvals are required for flights. However, operations will run more smoothly and effectively if civil aviation is an active and enthusiastic supporter of drone activities, with a desire and willingness to create dialogue between manned and unmanned aircraft operators.

Some countries, such as Malawi and Sierra Leone, have designated controlled airspace for testing and conducting demonstrations. Other countries may approve specific flight routes and times in lieu of the relatively flexible environment of the corridor, where operations are controlled and generally limited to unmanned aircraft. Either way, aviation authorities must be willing to agree to—and to document—several critical aspects of operations, including:

- The extent of civil aviation involvement in daily operations (Are regular site visits required?)
- Communications protocols between civil aviation, air traffic control, and the drone project

- Communications between national or private airlines and the drone project, as well as with any other existing in-country drone projects

As with the other topics presented in this guide, the above is a non-exhaustive list of subject matter relevant for gauging willingness to support drone operations.

PROVINCIAL, DISTRICT, AND FACILITY SUPPORT

When visiting facilities, come prepared to ask several questions to draw out how the facility and catchment area can best benefit from the drone, and do not expect that local authorities will immediately have an answer. Find out not only who is responsible for approvals at the local level, but also how they coordinate with the central level. At all levels, support and buy-in must come not only from leadership, but also from those assisting with implementation, such as health facility staff, government officials, and local and traditional leaders who are not connected to government.

The list of questions in the next section can help guide conversations at the facility level. These may be adapted to address regional, provincial, and district stakeholders.

PART 3. ANALYSIS OF DISTRIBUTION SYSTEMS

Analysis of the supply chain and distribution systems, including validation of bottlenecks and justification for a drone intervention

ANALYSIS OF DISTRIBUTION SYSTEMS

It is important to establish a baseline level of first-hand knowledge about the supply chain procedures and systems you seek to address. In the case of health supply chains, the creation of parallel or unnecessary supply chains may present new inefficiencies in the distribution of resources. A compelling and specific use case to supplement existing systems will often be better received, provide an anchor for conversations both internal and external to your organization, and create the highest chance for impact and sustainability. Conversations with the Ministry of Health (or appropriate government body), as well as health facility staff should aim to understand how deliveries/collections are currently made and the frequencies with which they are done. If the current frequency is not meeting the need as reported by health facility staff, this is a sign of a potential implementation case. It may also be the case that delivery sufficiency varies according to seasonality (e.g. the rainy season) or resource-related factors. Finding out when and why distributions are not working efficiently will be a critical objective of conversations at the facility level. An investigation of data flow is also necessary, as planned interventions should ideally not disrupt the upstream and downstream flow of both product and information. The goal should be to understand the entirety of the logistics ecosystem.

ROOT CAUSE ANALYSIS

The next stage of investigation is to take your distribution system analysis a step further and find the root issue of disruptions in timing or frequency to confirm that they are in fact transport related. If a root cause analysis is not conducted, you risk wasting scarce funding and resources in providing the

wrong solution (e.g. drones) to a problem rooted in staffing, storage, policy, laboratory processing, or other unrelated issues. And even worse, misdirecting limited resourcing could adversely affect another part of the system where funds might be put to use with greater impact.

> **Example A.** A health facility worker notes that it takes an average of 10 weeks for patients to receive test results after the collection of a diagnostic sample. They wonder if a drone can move the samples to the laboratory and return with the test results. Interviews with the laboratory reveal that lab staff are facing significant resource and personnel shortages, resulting in a significant backlog of samples for processing. The average processing time from arrival to testing of the sample is eight weeks. Under these circumstances, a drone cannot significantly reduce the time from sample collection to test result return, as the underlying problem is systemic to the laboratory setting.
>
> **Example B.** A health facility outpost reports stock outs of multiple types of medicines. They are reachable only by motorbike, which comes only once a quarter. They conclude that a drone can bring them needed medicines via off-cycle drone deliveries while waiting for the next quarterly distribution of medicines. Analysis of the stock environment, however, reveals that the stocked out products at the health outpost are also stocked out at the district and regional levels, and that frequency of delivery is not the primary underlying issue. The district hospital then asks if the drone can deliver the same stocked out product to that hospital before being repackaged and sent to the health outpost. Before continuing any discussions, the drone project managers must investigate: are the stock outs caused by limited transportation resources, poor data collection and visibility, under-forecasting of needs, or even international shipping challenges and global shortages of active pharmaceutical ingredients? Most of these problems should be addressed with targeted supply chain technical assistance.

A root cause analysis will improve the project design, increase potential for positive health impact, and strengthen the case for implementation.

PART 4. REGULATORY REQUIREMENTS

Confirmation of regulatory approvals processes, requirements, and timeline

DOCUMENTED REGULATIONS AND PROCEDURES

Beyond collecting as much information as possible on the drone and aviation landscape before a scoping trip, there are other questions which need to be verified in on-the-ground conversations. For example, internet research may reveal whether the national regulations for drones are generally enabling, prohibitive, lacking in specificity, or simply nonexistent. However, the mere existence of an enabling regulatory environment does not, by itself, demonstrate that civil aviation authorities have an approval process in place for sustained cargo drone activities. How does civil aviation intend to issue approvals? How many flight requests per day should they be expected to field? Will they need to be contacted directly for ad hoc approvals, or will they have an automated system in place for managing requests? Keep in mind that a civil aviation body may never have been through the process of approving a cargo drone project previously, or even have been asked to approve a project.

If there are known and documented procedures, has a drone company or donor successfully completed the approval process? A successful applicant can share whether there are expectations and challenges not specifically indicated in the written procedures. Moreover, the written procedures may lack indication of the appropriate point of contact within each relevant ministry (e.g. aviation, health, information). Without a named point of contact, it will be difficult to estimate a time frame for approvals, as well as whether a demonstration is needed. Regulations will also be unlikely to reveal a reasonable timeframe for approval, which may be affected by any number of factors. A reasonably short time frame indicates the ability to launch a project imminently after approval, while a prolonged time frame indicates the potential for significant added costs. Will the drone deployment team need to export their drone in order to wait for approval? If so, has the additional time and cost been accounted for? Personnel availability may be another issue. Staff—hired locally or otherwise—cannot be onboarded or re-allocated without tangible expectations of employment, which may in turn be contingent on approvals.

ADDITIONAL QUESTIONS FOR CIVIL AVIATION

- What are the requirements for a drone demonstration?
    - What must be demonstrated?
    - What are the specific criteria? Is this documented? If not, the criteria you are held to may change unpredictably and without dialogue or notice.
- What written checklists and manuals should be submitted?
- What is the timeline for approval of operations following the demonstration?
- What are the limitations and duration of the authorization, once provided?
- What additional waivers may be required?
    - E.g. carrying dangerous goods, night operations
- What licensing is required to operate a drone of the relevant weight and size?
    - Can a locally hired trainee operate the drone under the supervision of a Remote Pilot In Command (RPIC)?
- What licensing is required to communicate with manned aircraft pilots by radio, and when is this necessary?
- Does civil aviation uphold the validity of licensing issued from other countries?
- What are the importation requirements for the drone and drone batteries?
- Can civil aviation or the ministry of health assist with importation and customs clearance?
- What import and customs duties or other taxes will be levied?

PART 5. HEALTH FACILITY INFRASTRUCTURE AND NEEDS

Determination of health facility readiness, including sufficient infrastructure, resourcing availability, and validation of identified use cases

INFRASTRUCTURE FOR OPERATIONS

While not a primary goal for a scoping visit, such trips should also be used to examine the existing infrastructure and its suitability for drone operations. In each of the four countries assessed for the USAID-funded drone activity, GHSC-PSM was accompanied by an engineer or representative from the

drone manufacturer to assist with assessment of the ideal operational base location, suitability of landing sites, and preliminary flight route analysis.

There are numerous logistical and operational factors which can be investigated during the site-level visits, such as:

- Reliability of internet or 3G/LTE connectivity (depending on the drone communications platforms).
- Occurrence of power outages (important if the drone may require recharging or a change in batteries).
- Collection of GPS waypoints for accurately mapping locations and distances (critical to consider in relation to the drone's maximum range, as well as in relation to a more realistic range leaving 20-30% battery reserves).
- Location of suitable landing areas, assessing for size of space, possible obstructions to the flight path, proximity to crowds, and visibility in all directions.
- Determining where the base of operations is located. The locations for implementation may be limited not only by the drone's range, but also by the country's shape and borders. Placing operations near a border will prevent the utilization of the full capacity of the drone's range or may require complex negotiations with the neighboring country's aviation and military bodies.
- If the implementing organization has an office in the country, how will utilization of those office resources be impacted? Will new staff be recruited, or will it be acceptable to relocate existing staff? If the latter, what are the lodging conditions and options available at the place of performance?

NEEDS VALIDATION AT THE FACILITY LEVEL

Below is a sample list of questions to ask on a facility visit. It is recommended to ask these questions to personnel in a variety of positions at the facility, as this may reveal differing perspectives to the same question.

<u>Maintaining Inventory Levels</u>

- Do you experience stockouts of _____?
    - (ask questions about several types of commodities rather than relying on staff to know offhand the answer to "do you have stock outs?"
- When you are stocked out of a product, what is your procedure for getting more?
- When you are stocked out of a product, how long would it normally take for you to get restocked?
- Who would deliver more product? What would stop them from bringing more supplies immediately?
- What do your patients do when a needed product is stocked out?

Laboratory Challenges

- When do you collect samples?
- How do you store samples?
- What day(s) of the week do samples ship?
- What happens to the samples after they leave the facility?
- Where is sample processing done? Is there more than one delivery or collection point before reaching the processing center?
- How long is a typical sample turnaround time, from sample collection until results delivery?
- How are results received?

Indications of a Cold Chain Use Case

- What cold chain products are distributed in your administrative area (district, region, etc.)?
- Which cold chain products are used to respond to health emergencies, and which are used more routinely?
- How often are health emergencies requiring cold chain products reported? How are they reported?
- Where do you store vaccines and other cold chain products?
- How often do you have power outages?
- Do you have solar power?
- Do you have a functioning generator for backup power?

Information on Vehicles and Fleet

- Who owns the vehicles that bring medicine from the district (or provincial, or central) level?
- Who owns the vehicles that take samples from the clinic for processing?
- Does the health facility own a vehicle or are personal ones used?
- Are all vehicles in good working condition, and if not, how does this affect deliveries?

Patient Experience

- How many patients are in your catchment area?
- How far do your farthest away patients live (walk/drive time)?
- How do they get to the clinic?
- Do you ever ask patients to return on a different day to give a sample or to collect a specific medicine? If so, do they come back?
- Do samples spoil from delayed collection?

COMMUNITY SENSITIZATION NEEDS

Facility visits also serve the critical purpose of providing opportunities for direct interaction with community members. While community sensitization should always be planned for as a continuous activity occurring throughout the period of performance, community exposure to drones, along with existing preconceptions, fears, or beliefs will inform the types of sensitization and level of investment required.

SUMMARY

The components discussed above may be iterative in nature. They must all be approached concurrently, with several questions that should be answered at each of the central, regional/provincial, district, and facility levels. However, it is crucial that as much work as possible is done before arrival in-country to minimize the time demands of busy health and government staff during the site visit(s). It is strongly recommended that the drone manufacturer or service provider accompany the team conducting the site visits and that they are closely involved in the project planning process. The drone manufacturer will have the strongest understanding of how their specific platform functions within the given context and will know the regulatory points of interest based on their hardware, software, and written procedures. As drones become more capable and standardized, this step can be removed or undertaken by a local drone professional. Finally, the questions and indications noted within this guide are extensive but not exhaustive. They should provide a robust starting point by which to plan a successful scoping trip at the outset of any cargo drone activity.

ANNEX: ILLUSTRATIVE QUESTIONS LIBRARY

PRE-TRIP

- What can you find out about the aviation regulations?
- Are there references to autonomous or remotely operated vehicles?
- Can you find documentation of prior drone activities conducted in the country?
- If so, who was the implementer?
- What were the use cases explored?
- Where was the activity conducted?
- What are the known outcomes?
- Which government entities have a stake in the approvals process?
- Who will be your primary points of contact within each?
- Does a drone traffic management system exist?
- Who has successfully navigated the cargo drone application and authorization process?
- What reporting to civil aviation is required, and with what frequency?
- If there is any local drone manufacturer, what is their capacity for piloting support and for assisting with the maintenance of drones?
- Are there relevant training institutions, certifications, or university-level programs?
- What is the level of capacity and maturity for the aviation experience market?
- Can you collect names of individuals who can help to navigate the processes or who may be a good fit for later recruitment?

GOVERNMENT STAKEHOLDERS

- What is the government's interest in drones, and what drives their interests?
- If the government has never supported drones before, how can champions for the activity be identified and leveraged?
- Have specific points of contact been identified within each relevant government ministry?
- In which aspects of the scoping visit will the identified points of contact participate?
- What level of involvement has been expressed as desirable?
- Can the relevant ministries contribute resources or time?
- In addition to governmental authorities at the central level, who are the relevant regional, district, and local authorities?
- What is the role of the military?
- Are there ministries of information or communications technology who will want to be involved, and to what extent?

CIVIL AVIATION

- What are the requirements for a drone demonstration?

- What must be demonstrated?
- What are the specific criteria? Is this documented? If not, the criteria you are held to may change unpredictably and without dialogue or notice.
- What written checklists and manuals should be submitted?
- What is the timeline for approval of operations following the demonstration?
- What are the limitations and duration of the authorization, once provided?
- What additional waivers may be required?
- E.g. carrying dangerous goods, night operations
- What licensing is required to operate a drone in-country?
- Can a locally hired trainee operate the drone under the supervision of a Remote Pilot In Command (RPIC)?
- What licensing is required to communicate with manned aircraft pilots by radio, and when is this necessary?
- What are the importation requirements for the drone and drone batteries?

INVENTORY

- Do you experience stockouts of _____?
    - (ask questions about several types of commodities rather than relying on staff to know offhand the answer to "do you have stockouts?"
- When you are stocked out of a product, what is your procedure for getting more?
- When you are stocked out of a product, how long would it normally take for you to get restocked?
- Who would deliver more product? What would stop them from bringing more supplies immediately?
- What do your patients do when a needed product is stocked out?

LABORATORY

- When do you collect samples?
- How do you store samples?
- What day(s) of the week do samples ship?
- What happens to the samples after they leave the facility?
- Where is sample processing done? Is there more than one delivery or collection point before reaching the processing center?
- How long is a typical sample turnaround time?
- How are results received?

COLD CHAIN

- What cold chain products are distributed in your administrative area (district, region, etc.)?

- Which cold chain products are used to respond to health emergencies, and which are used more routinely?
- How often are health emergencies requiring cold chain products reported? How are they reported?
- Where do you store vaccines and other cold chain products?
- How often do you have power outages?
- Do you have solar power?
- Do you have a functioning generator for backup power?

VEHICLES AND FLEETS

- Who owns the vehicles that bring medicine from the district (or provincial, or central) level?
- Who owns the vehicles that take samples from the clinic for processing?
- Does the health facility own a vehicle or are personal ones used?
- Are all vehicles in good working condition, and if not, how does this affect deliveries?

PATIENT EXPERIENCE

- How many patients are in your catchment area?
- How far do your farthest away patients live (walk/drive time)?
- How do they get to the clinic?
- Do you ever ask patients to return on a different day to give a sample or to collect a specific medicine? If so, do they come back?
- Do samples spoil from delayed collection?

COMMUNITY PERCEPTIONS

- Where have drones been used in the country, for what purposes, and for how long?
- What do average community members know about drones?
- What are the connotations associated with drones?
- Are there any existing fears or superstitions associated with drones?

DATA

- What monitoring and evaluation indicators best support the measurement of the intended impact?
- What data is required, and is it available and accessible?
- Will any data sharing agreements be required?

OPERATIONAL ENVIRONMENT

- What tools can be sourced locally?
- What is the quality of tools and materials available?
- Which mission-critical items cannot be sourced locally?
- What is the cost of internet and cellular data packages?

- Are there safe, locking storage spaces for storing the drone at the hub of operations?
- Is there a strong data signal at the identified hub of drone operations, and at each of the drop-off and collection points where the drone will fly?
- If international remote pilots or trainers must be brought to the area for an extended period, what lodging options are available? What is the cost?