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Building Partnerships, Transforming Lives

Deploying AAS for payload delivery

The role of geography, product, and AAV type in prioritizing public health use cases for delivery by AAV

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- Public health programs and supply chains face challenges that include high transport costs, chronic stock-outs, waste, and inefficiency

- AAVs may offer a last mile delivery system to address some of these challenges…but countries have many options to choose from

- Limited tools exist to help countries analyze and make informed decisions on how and when to integrate AAVs into public health programs and systems to maximize health and logistics objectives

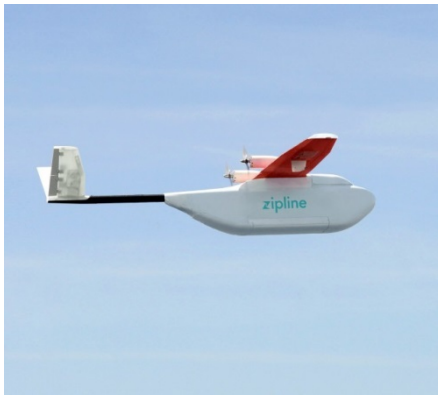
- JSI with support from the Bill & Melinda Gates Foundation and in partnership with LLamasoft and Kameko Nichols analyzed the cost-effectiveness of deploying AAVs for delivering commodities to health facilities and developed a tool that can help inform country decisions on deploying AAVs for public health

AAVs in Public Health Systems

- What exactly is their potential?
- Where exactly do they provide a compelling advantage?

- Decision is not - “drones or no drones”
- Rather: in what specific niches in public health systems can drones provide a benefit?

- Drones will be integrated into the public health system
- Operate in parallel with and complement other forms of transportation



Goals of our project

- Create a first-pass screening tool for individual countries to:
  - consider their unique situations
  - rapidly prioritize potential use cases for AAV delivery
  - approximately estimate relative costs and potential benefits

- Extract and share general insights into factors that point towards AAVs offering a logistics advantage, their thresholds and limits of applicability

AAV delivery should support health and logistics objectives

- Overall **Health Objectives** (e.g. saving lives, ensuring care) are supported by **Logistics Objectives**

- What are select situations that AAVs offer advantage on:
  - Multiple logistics objectives simultaneously
  - Large advantage on at least one of the logistics objectives – enough to be compelling in terms of achieving overarching health objectives

Logistics Objectives

- Cost
- Service Level: Availability of Product
- Service Time: Speed/Responsiveness
- Risk or Flexibility *(accommodate unplanned events or risk e.g. unplanned demand variation, unplanned disruption of access to HFs)*
- Quality

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Rules for Comparison

- Do AAVs offer advantage over **well-managed land transport** (not only to status quo)?
- Assess performance holistically - across the logistics objectives
- Consider not only direct transportation costs, but **wider system costs which may not be directly apparent** (e.g. inventory holding costs, capacity expansion costs)

To meaningfully assess and identify niches of potential AAV advantage, we need to look across three dimensions

Geography

- Health Facility Density
- Road network quality
  - *Circuity factor – road distance/straight-line distance between two points*
  - *Average travel speed*
- Health Facility Accessibility *(% of facilities inaccessible by road * % of year inaccessible by road) e.g. low in watery regions*

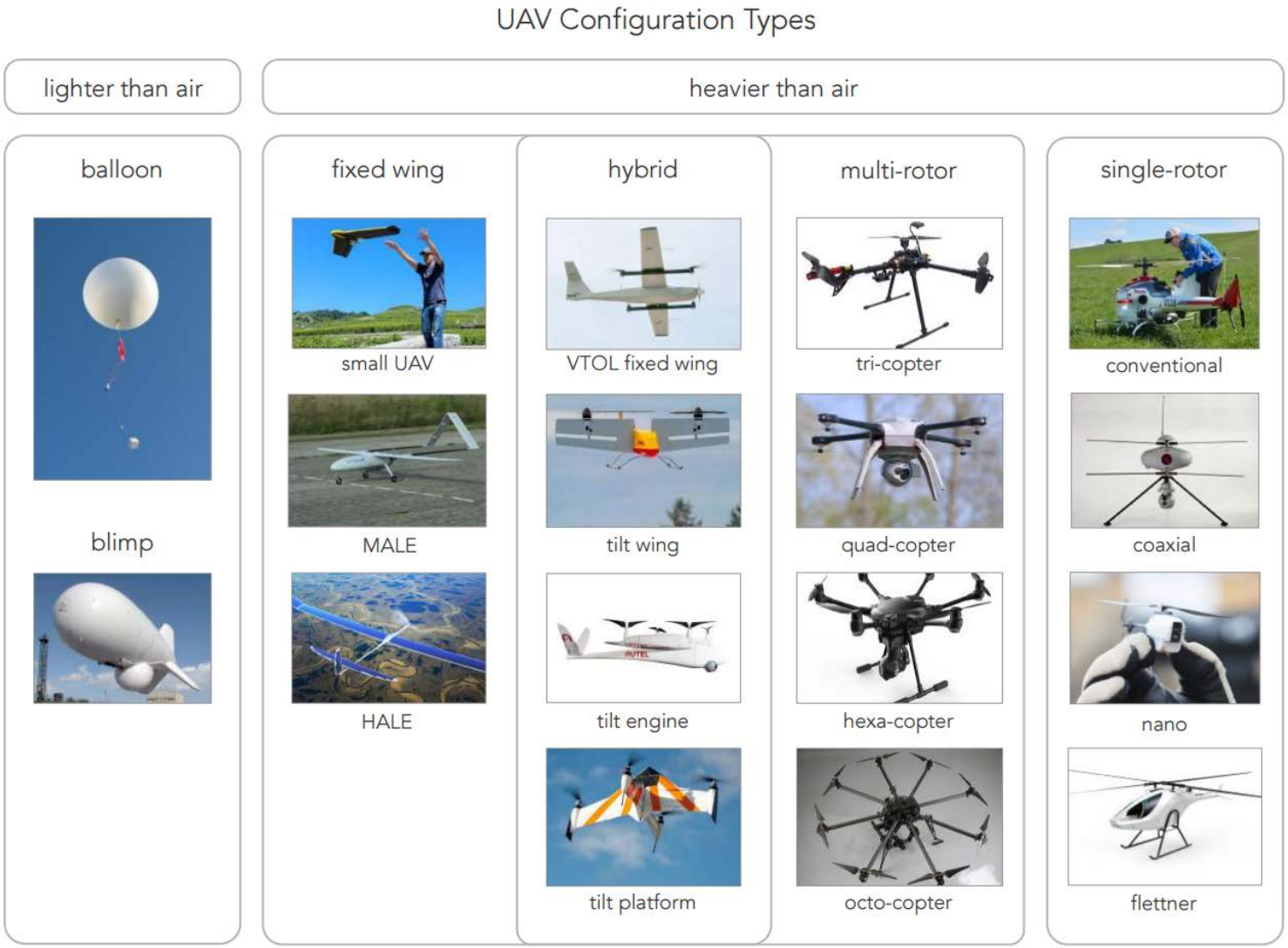
Product/Demand

- Weight
- Volume
- Financial Value
- Health Value
- Shelf-life/Difficulty to store
- Quantity of demand at individual facility
- Unpredictability of demand
- Current extent of stockouts

AAV Characteristics

- Payload Weight
- Payload Volume
- Range
- Reverse logistics capability
- Cost
  - *Fixed (minimum annual costs)*
  - *Variable (per-km or per-delivery)*

AAV Characteristics

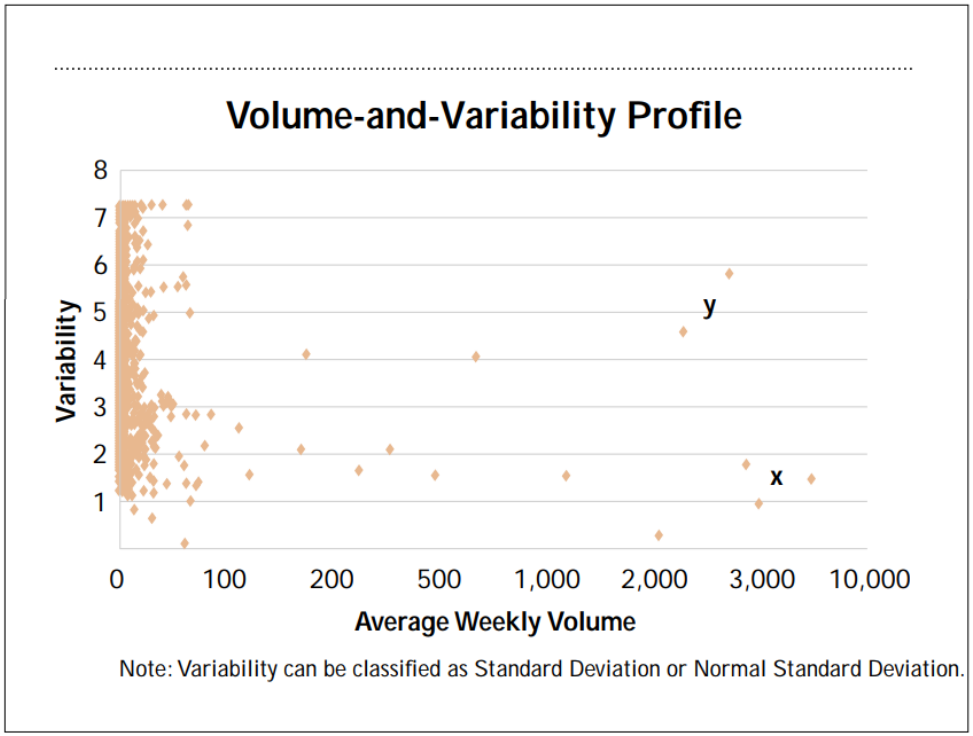


MALE: medium altitude long endurance (15.000 – 45.000 ft.), HALE: high altitude long endurance (>45.000 ft.)

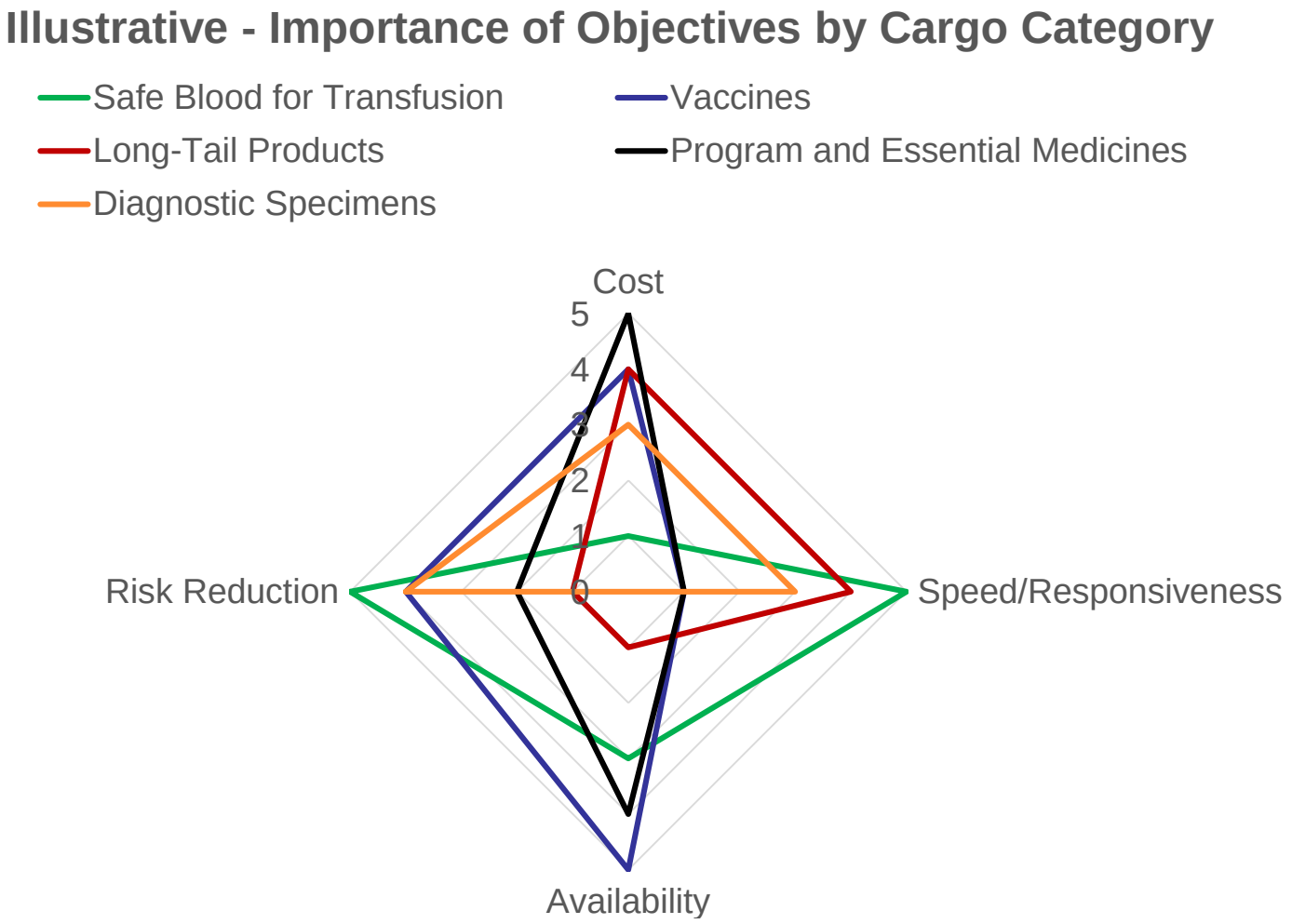
Source: Drone Industry Insights www.droneii.com, June 2016

Product/Demand

- Wide range of product categories considered
  - Safe blood for Transfusion
  - Vaccines
  - Long-tail Products
  - Program and Essential Medicines
  - Diagnostic Specimens
- Data for health facility level demand obtained from three SSA countries (supplemented by public data) and analyzed to obtain indicative demand quantities, variability, stockout rates etc.



Product/Demand - Cargo categories vary not only on product and demand characteristics, but also on importance of logistics objectives



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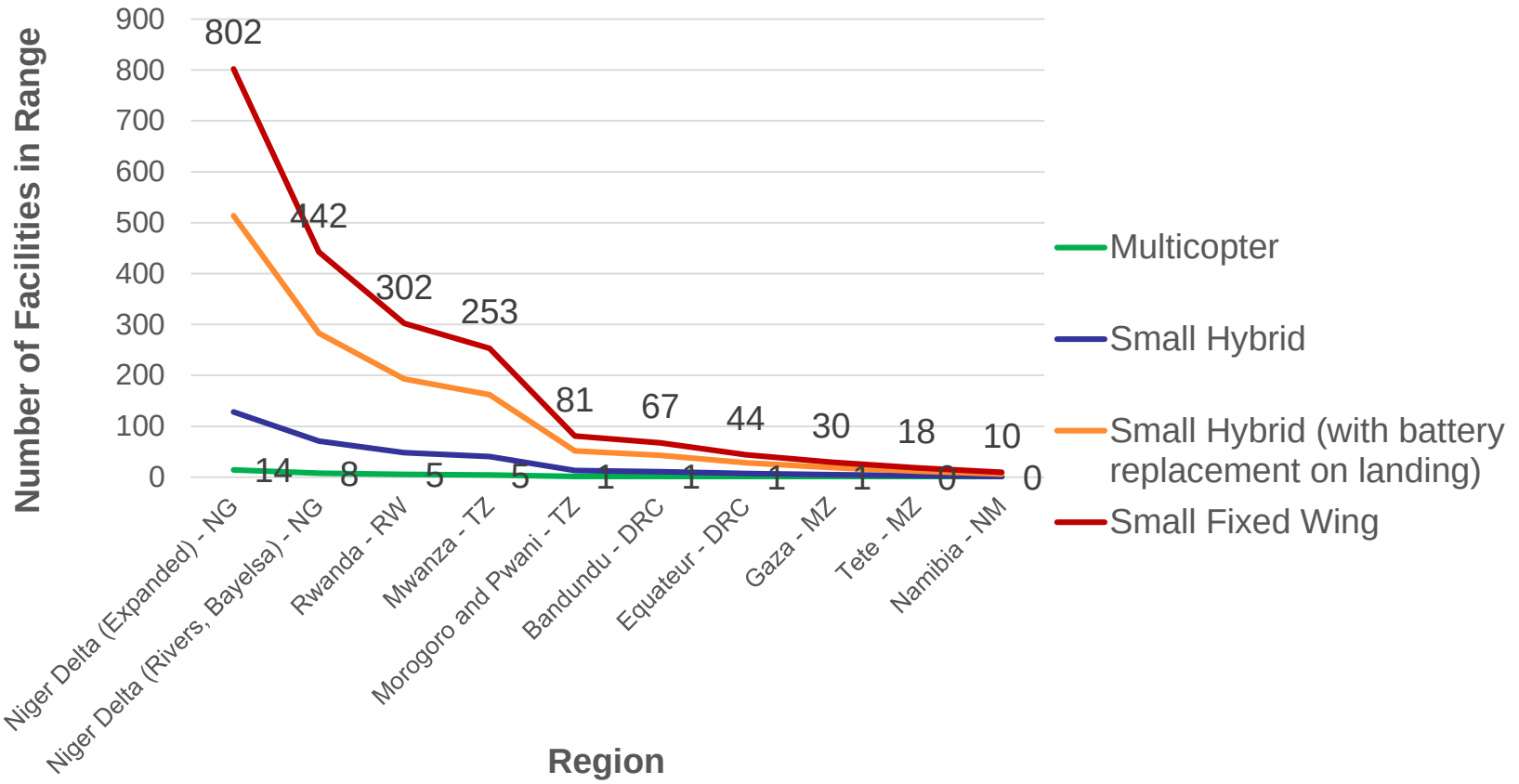
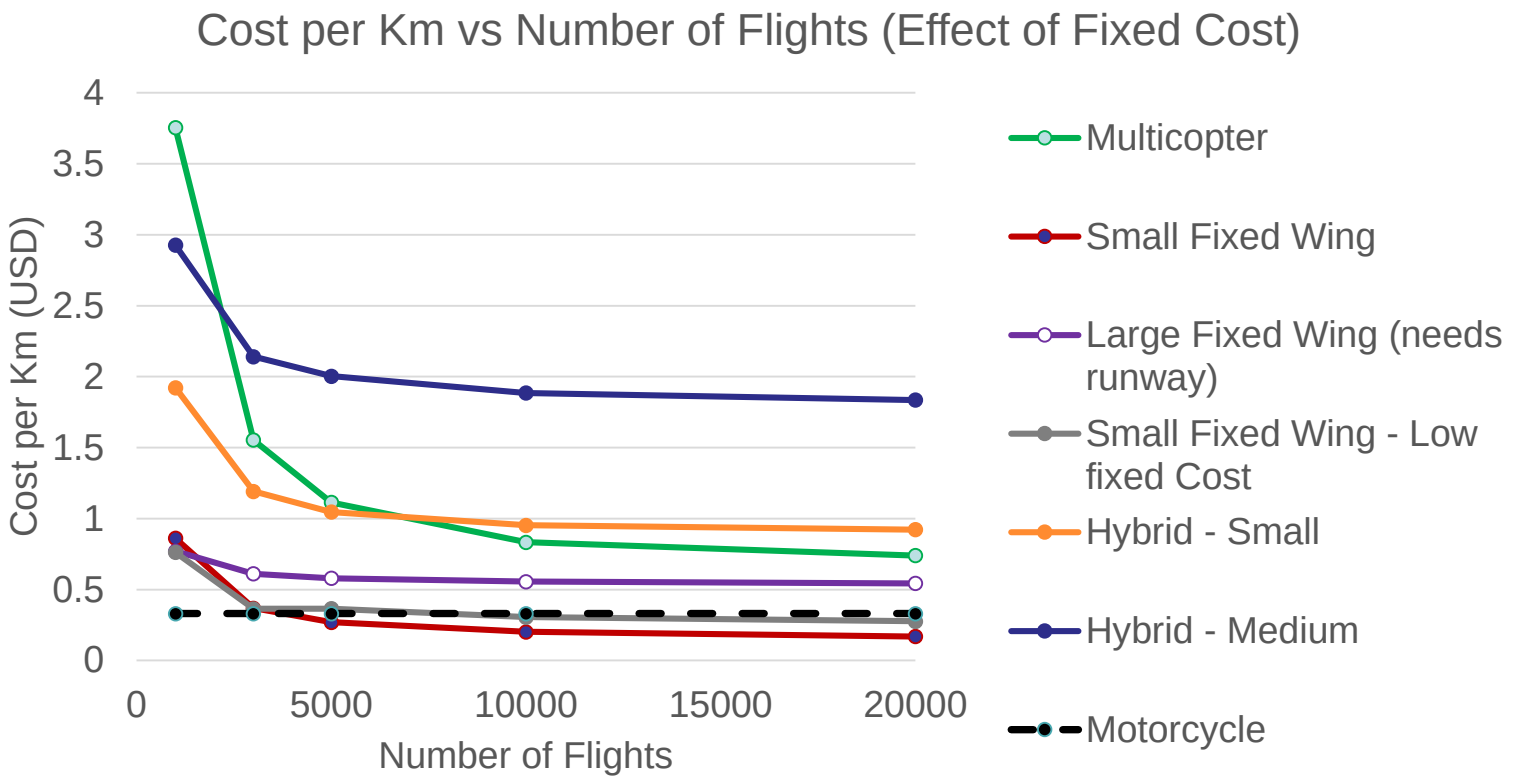
The number of facilities in range of delivery is an important driver of viability



- Can vary by a factor of 50+ by **AAV type (range)**
- Can vary by a factor 50+ by **facility density**

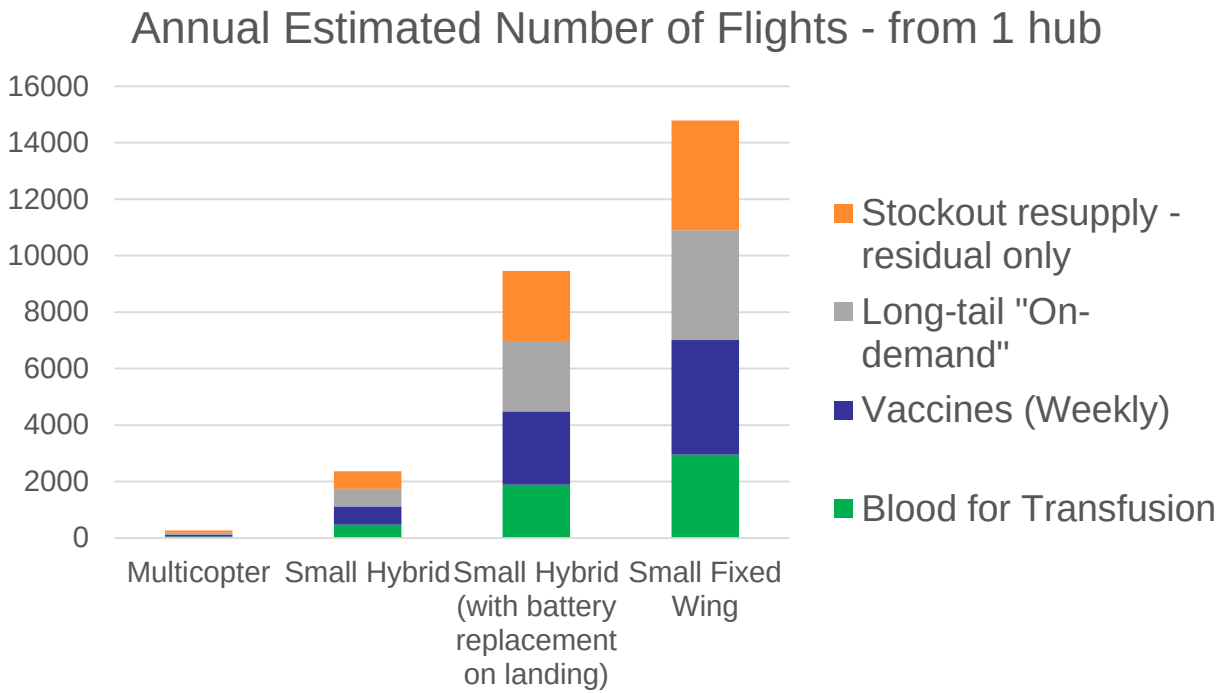
Fixed Costs need to be defrayed over a large number of flights for AAVs to cost competitive



If flight volumes are bound to be low, one should consider AAV systems that have low fixed costs, but closely examine their capabilities and overall cost-competitiveness

General Takeaway: To effectively use this new transport mode, need to consider layering use cases across programs to build flight numbers

- Roughly estimating the numbers of flights for different use cases in a region with the facility density of Morogoro and Pwani in Tanzania (not very dense, quite rural)



- We acknowledge difficulty of layering use cases. Land transport is having difficulty integrating across programs, so this is not trivial. But important to consider.

General Takeaway: Each of the three dimensions - Geography, AAV Characteristics, and Product/Demand - are essential to determine if a particular use case is value-adding

Changing any one of these dimensions, will change which alternative is cost-effective

- **Geography**: Facility density
- **AAV Characteristics**: AAV Cost per flight and range
- **Product/Demand Characteristics**: Variability Factor (Demand Unpredictability)

So the answer to the question "Should we be delivering Cargo Category X by AAV?" will depend on **the country specific combination** of**:**

- Geography
- Product/Demand
- AAV Characteristics

Broader Conclusions and Considerations

Cost-effectiveness can be determined by maximizing the number of flights per day, driven by any/all of the following:

- A large number of facilities in range
  - High facility density
  - Increased range of AAVs
- Use cases that cut across multiple health programs rather than one program-specific approach
- Potentially expanding the list of potential clients to include non-health use cases

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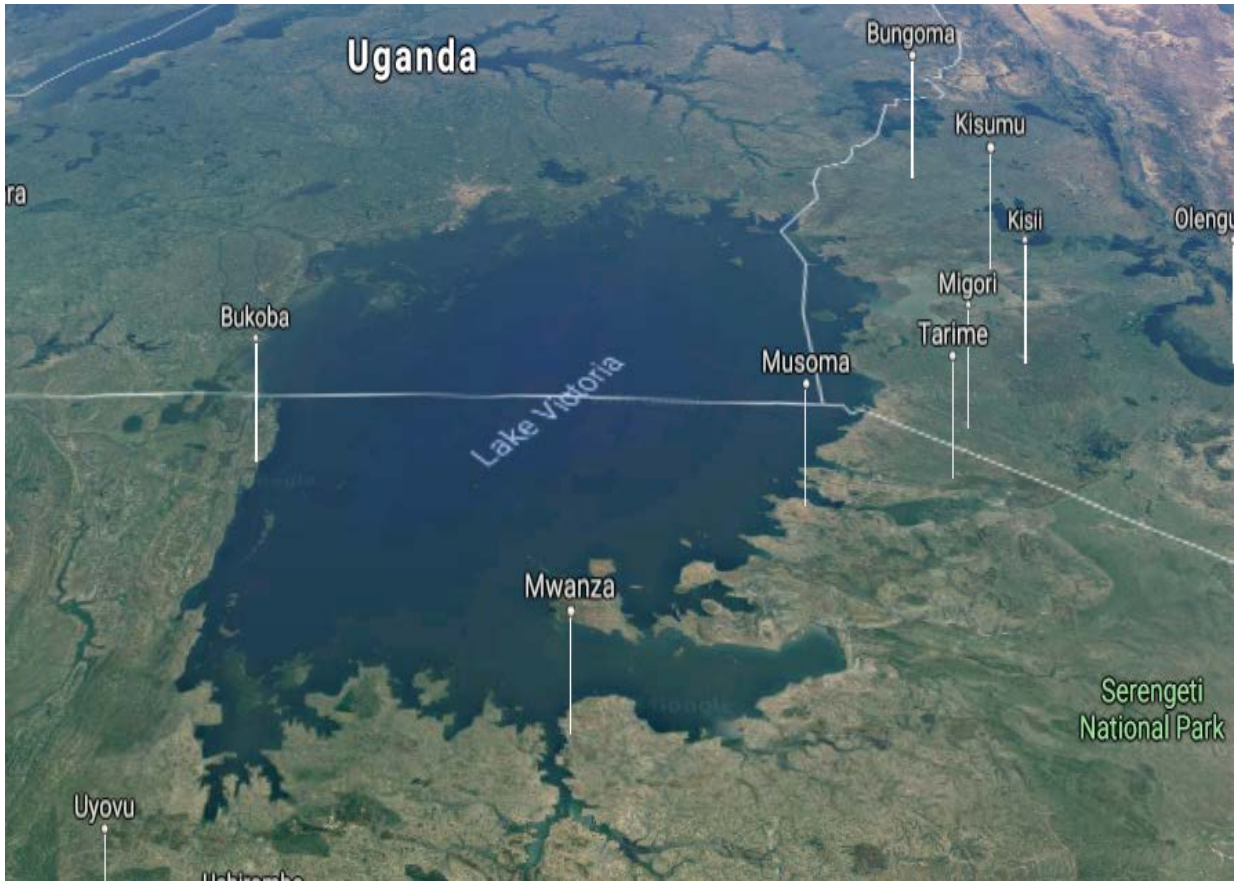
Health commodities delivery in the lake zone



IMPLEMENTATION EXAMPLE

Delivering Health Commodities in the Lake Zone, Tanzania: inSupply Support for AAV Phase 1 Pilot (January to June 2018)

- Engaging government and stakeholders early to ensure buy in, approvals
- Assisting with importing and custom clearance for the AAVs
- Identified take off and landing sites, set the communication towers
- Conducting community sensitization
- Identified use cases
- AAV test flights across Lake Victoria to Ukerewe islands conducted and flight data obtained

Delivering Health Commodities in the Lake Zone, Tanzania: inSupply Support for AAV Phase 2: (Aug. 2018)

- Phase II will begin with deliveries of commodities to facilities and collection of diagnostic samples, including:
  - Essential commodities ordered on emergency and life saving commodities e.g. Oxytocin, Adrenaline inj.
  - Blood and blood products for transfusion
  - Transfer of diagnostic samples from facilities to referral hospitals
- Collect more data to inform cost analysis study and AAV integration in health supply chain

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Next Steps

- Our goal is to work with a further 3-5 countries to test and validate the tool and develop user-friendly implementation guidelines that can be used by the broader community

- Exploring and open to partnerships with programs or partners that are considering introduction of AAVs and have funding to support our participation

- With screening excel tool, we can help a country look across programs, prioritize use cases, and estimate level of benefits, with ~ 2 weeks of effort

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THANK YOU!

Please reach out to us

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