Emerging Technologies

UAVs for Improving Access to Reproductive Health Commodities
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Photo Credit: © Matternet (Malawi 2016)
UAV Use Cases for the Last Mile

Routine
- Integrated with existing transport systems
- Routine, predictable resupply
- Movement of diagnostics

On-Demand
- Daily service needs, forecasted on-demand
- Removes need for cold chain or other specialized equipment

Emergency
- Post partum hemorrhage
- Blood
- Rabies vaccine or other hard-to-manage prophylaxis
What is the state of the industry?

PAYLOAD
- > 100 kg
- 50 - 100kg
- 10 - 50 kg
- 2 - 10 kg
- 0.5 - 2 kg
- < 0.5 kg

Hybrid
Fixed wing
Rotary wing

RANGE
- Line-of-sight
- 1-5 km
- 5-50 km
- 50-500 km
- > 500 km

Commercial surveillance
DHL ParcelCopter
Raven
ATMOS (VTOL)
ScanEagle

Military surveillance

Amazon Prime Air
GoogleWing
Microdrones
MatterNet
Zipline
Vayu

Military
Reaper
Wings for Aid
Flying Donkey project

Modified from Wings for Aid slide
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HERMES Simulation used to Assess Potential UAVs Benefits for Vaccine Delivery

Results published in July 25th issue of journal *Vaccine*

**TMLTS for All Locations**

- District stores (12)
- Health Centers (123)

**Results:**
- 94% vaccine availability
- $0.41 per dose administered

**UAS for Selected Locations (and TMLTS for Remaining Locations)**

- District stores without hubs (3)
- Health Centers (123)
- District stores with hubs (3)

**Results:**
- 96% vaccine availability
- $0.33 per dose administered

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### What Factors Made the Most Difference in Cost?

<table>
<thead>
<tr>
<th>Factor</th>
<th>Savings Per Dose Administered (USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Geography: road speed</strong></td>
<td>$0.00</td>
</tr>
<tr>
<td>Baseline mean: 59 km/hr</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$0.10</td>
</tr>
<tr>
<td>100 km/hr (no effect)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$0.20</td>
</tr>
<tr>
<td>5 km/hr</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$0.30</td>
</tr>
<tr>
<td><strong>Throughput (population)</strong></td>
<td></td>
</tr>
<tr>
<td>Baseline mean: 360 newborns annually</td>
<td>$0.00</td>
</tr>
<tr>
<td>Mean: 720 newborns</td>
<td>$0.10</td>
</tr>
<tr>
<td>Mean: 180 newborns</td>
<td>$0.20</td>
</tr>
<tr>
<td><strong>Geography: road distance</strong></td>
<td></td>
</tr>
<tr>
<td>Baseline mean: 77 km</td>
<td>$0.00</td>
</tr>
<tr>
<td>Mean: 39 km</td>
<td>$0.10</td>
</tr>
<tr>
<td>Mean: 154 km</td>
<td>$0.20</td>
</tr>
<tr>
<td><strong>Population distribution</strong></td>
<td></td>
</tr>
<tr>
<td>Baseline: Current Gaza population distribution</td>
<td>$0.00</td>
</tr>
<tr>
<td>Evenly distributed (no effect)</td>
<td>$0.10</td>
</tr>
<tr>
<td>70% of population placed at 3 urban centers</td>
<td>$0.20</td>
</tr>
<tr>
<td><strong>Seasonality (impassable roads)</strong></td>
<td>$0.30</td>
</tr>
<tr>
<td>% of HCs unreachable for part of year</td>
<td>$0.00</td>
</tr>
<tr>
<td>75% increase (no effect)</td>
<td></td>
</tr>
<tr>
<td>80% HCs unreachable, 4 months annually</td>
<td>$0.10</td>
</tr>
<tr>
<td><strong>Vehicle lifetime</strong></td>
<td></td>
</tr>
<tr>
<td>Baseline mean: 10 yrs for land transport, 375,000 km for UAV</td>
<td>$0.00</td>
</tr>
<tr>
<td>75% reduction</td>
<td>$0.10</td>
</tr>
<tr>
<td><strong>Vaccine introductions</strong></td>
<td></td>
</tr>
<tr>
<td>Mid-2015 Mozambique EPI schedule</td>
<td>$0.20</td>
</tr>
<tr>
<td>Rota, IPV, MSD, &amp; HPV introductions</td>
<td>$0.30</td>
</tr>
</tbody>
</table>
Challenges UAVs Face

**Technology**
- Distance vs. Power
- Distance vs. Weight
- Transmission signal
- Battery charge & materials
- Collision avoidance automation

**Cargo**
- Fragile
- Sensitive to temp
- Expensive
- Limited space
- Limited weight
- Biological/biohazard

**Environment**
- Bad weather
- Terrain/topography
- Animals & Birds
- Human interference

**Economic**
- Cost of drone
- Infrastructure
- Pilot training
- Maintenance
- Additional system devices

**Political**
- Regulations
- Military connotations
- Security - national, personal data
- Public acceptance
- Growing local technical capacity

**Social/Community**
- Evolving perceptions (military → healthcare)
- Accidents - people & property
- Security - national, local
- Knowledge

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Relevance for RHSC SSWG

Are UAVs a good option for reproductive health commodities?
- Current system constraints
- Volumes, shelf-life, handling considerations
- Considerations around reliability vs cost

How could the SSWG help?
- Thought leadership of RH use cases
- Small scale studies (e.g., costing analysis)
- Join the UAV Payload Delivery Working Group (industry, implementers, and donors)
An optional slide, to be used for conclusions, quotes, etc.